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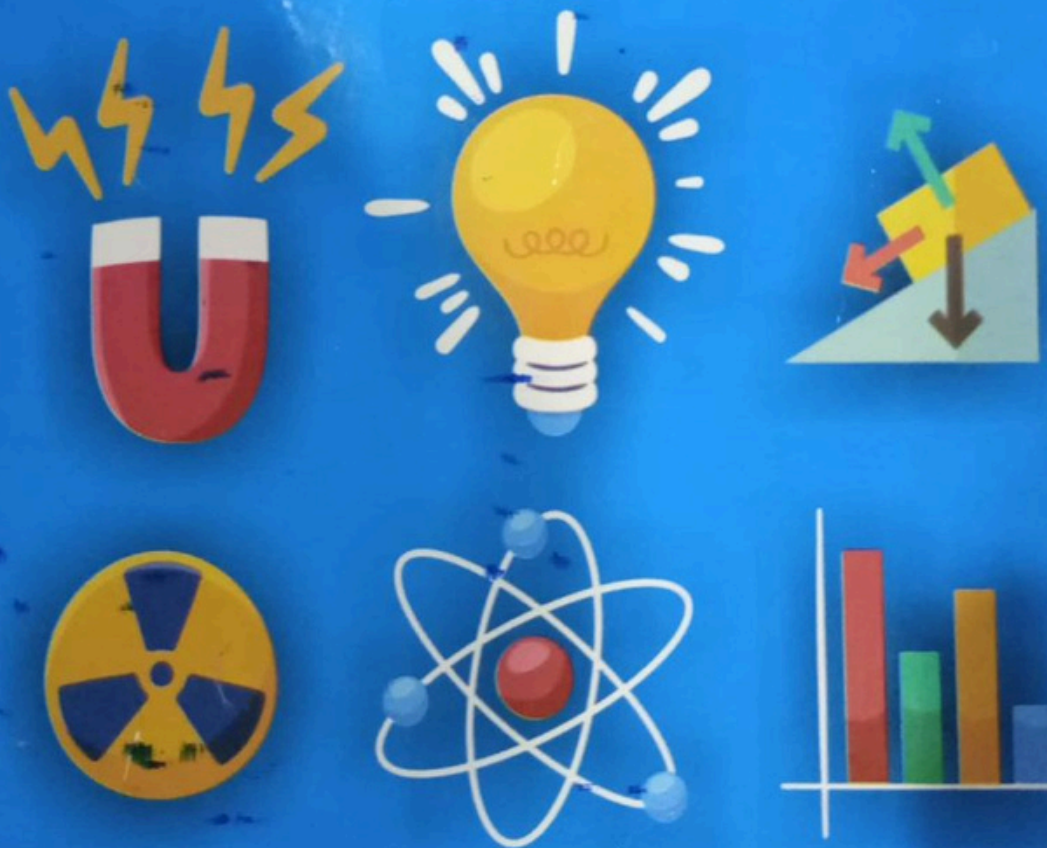

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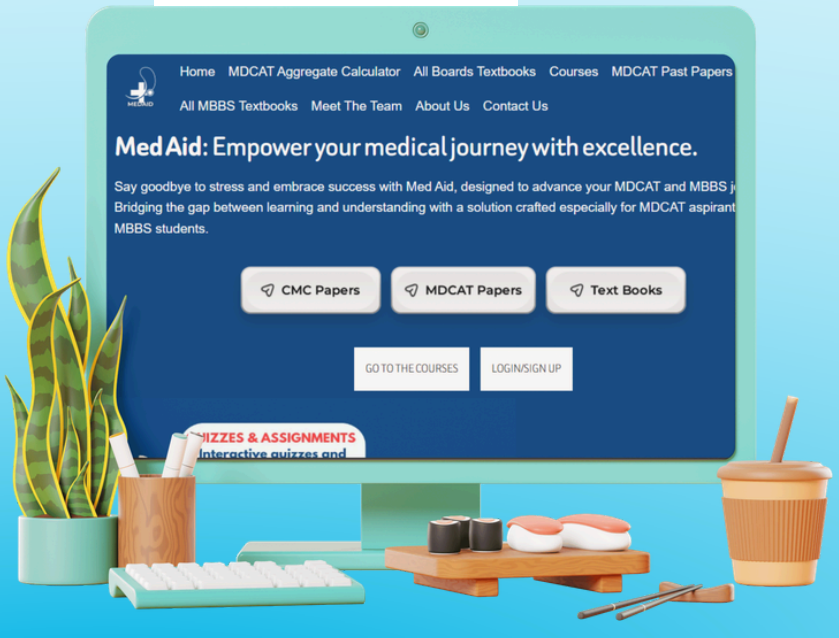

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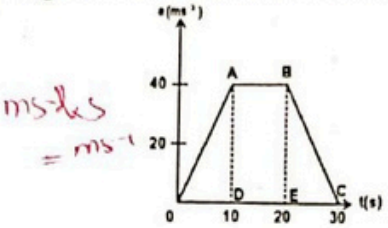
UNIT 1

PRACTICE EXERCISE

FORCE AND MOTION

1. A projectile is fired horizontally with an initial speed of 20 m/s. Its horizontal speed 3 s later will be
   A. 20 m/s
   B. 6.67 m/s
   C. 60 m/s
   D. 29.4 m/s

2. The acceleration time graph for a particle in rectilinear motion is shown in the figure given below. The average acceleration in first twenty seconds is:



   A. 45 ms^{-2}
   B. 40 ms^{-2}
   C. 30 ms^{-2}
   D. 20 ms^{-2}

3. The distance covered by a body with uniform acceleration in time "t" starting from rest is:
   A. $at^2/2$
   B. vt
   C. $a^2t/2$
   D. Both A. and B.

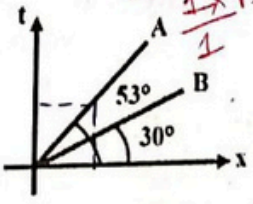
4. Time rate of change of momentum is equal to:
   A. force
   B. velocity
   C. impulse
   D. both "A" and "C"

5. A cricket ball is hit so that it travels straight up in air and it acquires 3 s to reach the maximum height. Its initial velocity is:
   A. 10 ms^{-1}
   B. 29.4 ms^{-1}
   C. 15 ms^{-1}
   D. 12.2 ms^{-1}

6. A racing car traveling with constant acceleration increases its speed from 10m/s to 50m/s over a distance of 60 m. How long does this take?
   A. 2.0 s
   B. 5.0 s
   C. 4.0 s
   D. 8.0 s

7. A car moving with an initial velocity of 25 m/s north has a constant acceleration of 3 m/s^2 south. After 6 s its velocity will be:
   A. 7 m/s north
   B. 43 m/s north
   C. 7 m/s south
   D. 20 m/s north

8. Time – displacement (t-x) graph of two objects A and B is shown in Fig. The ration of their speeds $\left(\frac{v_A}{v_B}\right)$ is $(\tan 37° = \frac{3}{4})$

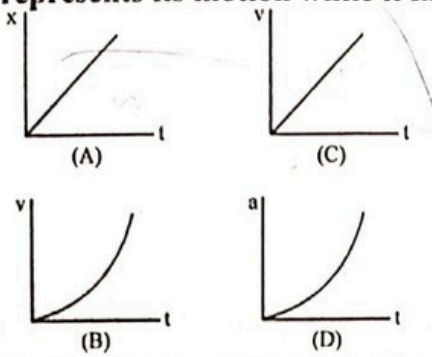


   A. $\frac{\sqrt{3}}{4}$
   B. $\frac{4}{\sqrt{3}}$
   C. $\frac{4}{3\sqrt{3}}$
   D. $\frac{3\sqrt{3}}{4}$

9. **A ball is in free fall. Its acceleration is:**
   A. downward during both ascent and descent
   B. downward during ascent and upward during descent
   C. upward during ascent and downward during descent
   D. upward during both ascent and descent

10. **Which one of the following statements is correct for an object released from rest?**
   A. The average velocity during the first second of time is 4.9m/s
   B. During each second the object falls 9.8m
   C. The acceleration changes by 9.8m/s^2 every second
   D. The object falls 9.8m during the first second of time

11. **A stone is dropped from a cliff. The graph (carefully note the axes) which best represents its motion while it falls is:**



12. **A 1.0 kg ball moving at 2.0m/s perpendicular to a wall rebounds from the wall at 1.5m/s. The change in the momentum of the ball is:**
   A. zero
   B. 0.5 N s toward wall
   C. 0.5 N s away from wall
   D. 3.5 N s away from wall

13. **A train is moving east at a speed of 5 ms^{-1}. A bullet fired westwards with a velocity of 10 ms^{-1} crosses the train in 8s. The length of the train is:**
   A. 120 m
   B. 60 m
   C. 30 m
   D. 15 m

14. **A baseball is thrown vertically into the air. The acceleration of the ball at its highest point is:**
   A. zero
   B. g, up
   C. g, down
   D. 2g, down

15. **For a freely falling body, the vertical velocity at the fifth second is:**
   A. 39.2 ms^{-1}
   B. 49 ms^{-1}
   C. 19.6 ms^{-1}
   D. 94.9 ms^{-1}

16. **Which shows the correct relation between time of flight T and maximum height H?**
   A. $H = \frac{gT^2}{8}$
   B. $H = \frac{8T^2}{g}$
   C. $H = \frac{8g}{T^2}$
   D. $H = \frac{8}{gT^2}$

17. **A car travels east at constant velocity. The net force on the car is:**
   A. east
   B. up
   C. west
   D. zero

18. **Which vehicle has an acceleration of 5 m/s^2?**
   A. a bicycle, when its speed changes from rest to 2.5 m/s in 2 s
   B. a car, when its speed changes from rest to 15 m/s in 5 s
   C. a lorry, when its speed changes from rest to 20 m/s in 15 s
   D. a motorbike, when its speed changes from rest to 50 m/s in 10 s

19. In projectile motion the acceleration in the vertical direction is:
A. Remains constant
B. Varies with time
C. zero
D. Is taken as positive

20. If a projectile is projected at an angle of 35°, It hits certain target. It will have the same range if it is projected at an angle of:
A. 45°
B. 55°
C. 65°
D. 70°

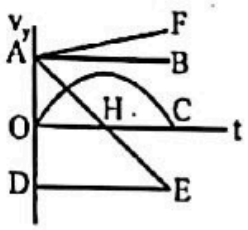
21. How large a force is required to accelerate a body of weight 5 N with 4 ms^{-2} (g = 10 ms^{-2}):
A. 10 N
B. 2 N
C. 5 N
D. 1 N

22. A body having uniform acceleration of 10 ms^{-2} has a velocity of 100 ms^{-1}. In what time its velocity will be doubled:
A. 8 s
B. 12 s
C. 10 s
D. 14 s

23. Velocity of an object dropped from a building at any instant "t" is given by:
A. $\frac{1}{2}gt^2$
B. at
C. $v_i t + \frac{1}{2}gt^2$
D. gt

24. A ball is thrown up with 20 ms^{-1} at an angle of 60° with x-axis. The horizontal velocity of the ball at the top position is:
A. 0 ms^{-1}
B. 20 ms^{-1}
C. 10 ms^{-1}
D. 16 ms^{-1}

25. Which of the curves on the graph below best represents the vertical component "v_y" of the velocity versus the time t for a projectile fired at an angle of 45° above the horizontal?



A. OC
B. AB
C. DE
D. AE

26. A projectile is fired from ground with an initial velocity that has a vertical component of 20m/s and a horizontal component of 30m/s. Using g = 10m/s^2, the distance from launching to landing points is:
A. 40m
B. 80m
C. 60m
D. 120m

27. A student's life was saved in an automobile accident because an airbag expanded in front of his head. If the car had not been equipped with an airbag, the windshield would have stopped the motion of his head in a much shorter time. Compared to the windshield, the airbag:
A. causes a much smaller change in momentum
B. exerts a much smaller impulse
C. causes a much smaller change in kinetic energy
D. exerts a much smaller force

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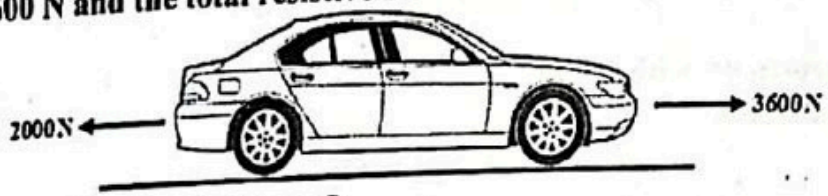
28. **Which of the following velocity-time graph represents infinite acceleration?**
A. Straight line normal to the time–axis
B. Straight line inclined to the time axis at an angle of 45°
C. Straight line parallel to the time axis
D. Straight line inclined to the time axis at an angle of 135°

29. **A train of length 150 m is going to north with a speed of $10ms^{-1}$. A parrot flies 5mr toward south parallel to the railway line. The time taken by parrot to cross the train i**
A. 8 s
B. 10 s
C. 12 s
D. 15 s

30. **A body covers one half of its journey at $40ms^{-1}$ and the next half at $50ms^{-1}$. Its average velocity is:**
A. 44.4 ms^{-1}
B. 45 ms^{-1}
C. 50 ms^{-1}
D. 40 ms^{-1}

31. **The rate of change of momentum for a freely falling object is always:**
A. = mg
B. > mg
C. < mg
D. zero

32. **A car of mass 800 kg is being driven along a level road. The engine supplies a forward force of 3600 N and the total resistive force is 2000 N.**



What is the acceleration of the car?
A. 2.0 ms^{-2}
B. 2.5 ms^{-2}
C. 4.5 ms^{-2}
D. 7.0 ms^{-2}

33. **A body is falling freely under gravity. How much distance it falls during an interval of time between 1st and 2nd seconds of its motion? (taking $g = 10ms^{-2}$)**
A. 15 m
B. 5 m
C. 20 m
D. 25 m

34. **If the speed of a particle at the end of four successive hours is 20, 25, 30, 35 km/hr, then the acceleration of the particle is:**
A. 5 m/sec^2
B. 5 m/hr^2
C. 5 km/hr^2
D. 5 km/sec^2

35. **A bomb is dropped from an aeroplane moving horizontally with a speed of 200 mph (miles per hour). If the air resistance is negligible, the bomb will reach the ground in 5 sec when the altitude is ($g = 10ms^{-2}$):**
A. 4 miles
B. 40 m
C. 125 m
D. 10 m

36. **A particle accelerates uniformly from 10 km/hr to 20 km/hr with acceleration of 2 km/hr^2. The total time it takes is:**
A. 20 hr
B. 10 min
C. 10 hr
D. 5 hr

37. **Two bodies of unequal mass, placed at rest on a frictionless surface, are acted on by equal horizontal forces for equal times. Just after these forces are removed, the body of greater mass will have:**
A. the smaller acceleration
B. the greater acceleration
C. the smaller momentum
D. the greater momentum

38. **A 0.2 kg rubber ball is dropped from the window of a building. It strikes the sidewalk below at 30m/s and rebounds up at 20m/s. The impulse on the ball during the collision is:**
A. 10 Ns upward
B. 2.0 Ns upward
C. 10 Ns downward
D. 2.0 Ns downward

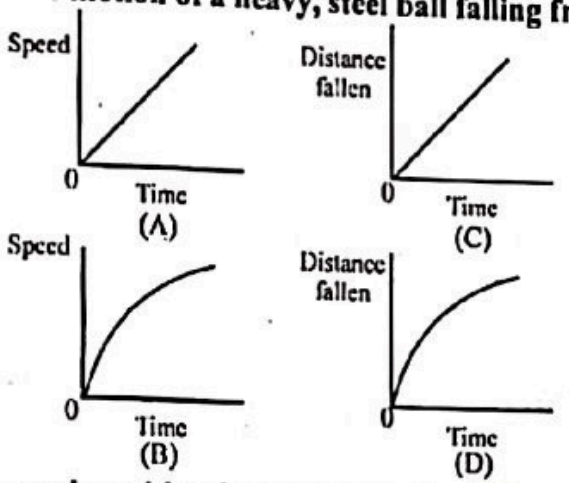
39. **A 10 kg block of ice is at rest on a frictionless horizontal surface. A 1.0 N force is applied in East direction for 1.0 s. During this time interval, the block:**
A. acquires a speed of 1m/s
B. acquires a momentum of 1.0 kg m/s
C. moves 10 cm
D. acquires a kinetic energy of 0.1J

40. **A mass of 20 kg moving with a speed of 10 m/s collides with another stationary mass of 5 kg. As a result of the collision, the two masses stick together. The kinetic energy of the composite mass will be:**
A. 600 J
B. 800 J
C. 1000 J
D. 1200 J

41. **Two projectiles "P" and "Q" are thrown with the same speed up at angles of 40^0 and $50^0$with the horizontal. Range of "P" will be:**
A. Equal to that of Q
B. Less than that of Q
C. Greater than that of Q
D. 3/7 times that of Q

42. **Newton's 2nd gives the measurement of:**
A. acceleration
B. momentum
C. force
D. inertia

43. **Which graph shows the motion of a heavy, steel ball falling from a height of 2 m?**



44. **A man is in a car is moving with velocity of 36 km/hr. His speed with respect to the car is:**
A. 10m/s
B. zero
C. 36m/s
D. infinite

45. **When velocity time graph is a straight line parallel to time axis then:**
A. acceleration is constant
B. acceleration is zero
C. acceleration is variable
D. velocity is zero

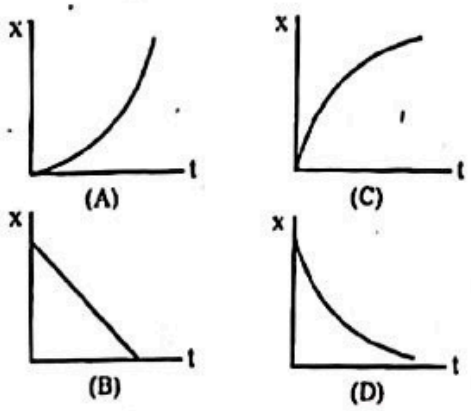
46. **Newton's laws do not hold good for particles:**
A. at rest
B. move with velocity comparable to velocity of Light
C. moving slowly
D. high velocity

47. **Motorcycle safety helmet extend the time of collision hence decreasing the:**
A. chance of collision
B. velocity
C. force acting
D. impulse

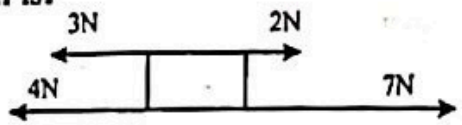
48. An object is thrown vertically upward with a certain initial velocity in a planet where the acceleration due to gravity is 19.6 m/s². The height to which it raises is _____ that to which the object would rise if thrown upward with the same initial velocity on the Earth. Neglect friction.

A. half
B. twice
C. $\sqrt{2}$ times
D. four times

49. Which of the following distance versus time graphs represents the motion of an object whose speed is increasing?



50. Net force in the diagram is:



A. Zero
B. 5 N to left
C. 2 N to right
D. 2 N to left

51. A constant force of 8.0 N is exerted for 4.0 s on a 16 kg object initially at rest. The change in speed of this object will be:

A. 0.5m/s
B. 4m/s
C. 2m/s
D. 8m/s

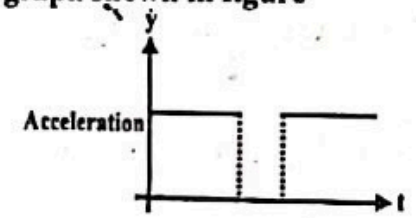
52. Two forces are applied to a 5.0 kg crate; one is 6.0N to the north and the other is 8.0N to the west. The magnitude of the acceleration of the crate is:

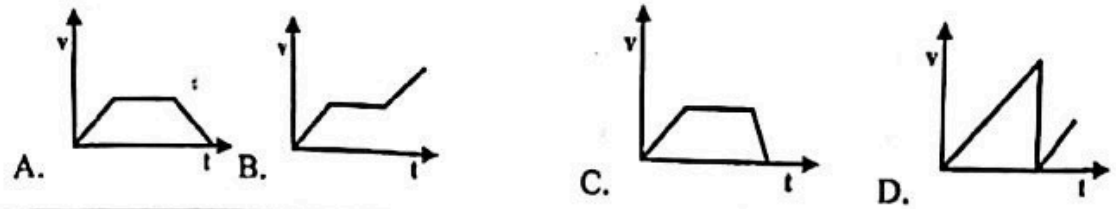
A. 0.50m/s²
B. 2.8m/s²
C. 2.0m/s²
D. 10m/s²

53. The "reaction" force does not cancel the "action" force because:

A. the action force is greater than the reaction force
B. they are on different bodies
C. they are in the same direction
D. the reaction force exists only after the action force is removed

54. Which of the following represents the velocity – time graph corresponding to the acceleration – time (a-t) graph shown in figure



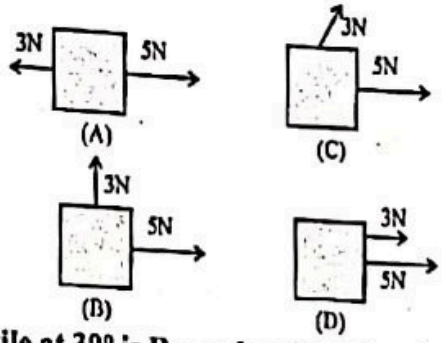


55. **If a body is moving with uniform velocity then its average velocity is equal to:**
A. its acceleration
B. Instantaneous velocity
C. variable velocity
D. zero velocity

56. **If the acceleration of a body is zero then the slope of its v–t graph:**
A. parallel to time axis
B. perpendicular to time axis
C. Straight line for the origin
D. Straight line inclined to the time axis at an angle of 45°

57. **In the case of a projectile fired at an angle equally inclined to the horizontal and vertical with velocity "u", the horizontal range is:**
A. $\frac{u^2}{g}$
B. $\frac{u^2}{3g}$
C. $\frac{u^2}{2g}$
D. $\frac{u^2}{4g}$

58. **Two forces, one with a magnitude of 3N and the other with a magnitude of 5N, are applied to an object. For which orientations of the forces shown in the diagrams is the magnitude of acceleration of object is least?**



59. **The range of a projectile at 30° is R_{30} and at 60° is R_{60} then:**
A. $R_{30} = R_{60}$
B. $2R_{30} = R_{60}$
C. $R_{30} = 2R_{60}$
D. $R_{30} = R_{60}$ if initial velocity are same

60. **If the body of mass 2 kg dropped from the height of 5 m find its momentum ($g = 10ms^{-2}$):**
A. 15 N s
B. 20 N s
C. 30 N s
D. 40 N s

61. **A 2.5 kg stone is released from rest and falls toward Earth. After 4.0 s, the magnitude of its momentum is ($g = 10ms^{-2}$):**
A. 100 kgm/s
B. 50 kgm/s
C. 98 kgm/s
D. 49 kgm/s

62. **Two objects moving along the opposite direction with different mass but same velocity. there relative velocity becomes:**
A. 2 times
B. 4 times
C. 0
D. Both A. and B.

63. **If instantaneous acceleration equal to average acceleration then body is moving with:**
A. variable acceleration
B. uniform acceleration
C. uniform velocity
D. increasing acceleration

64. **The momentum of an object is increased from 10 N s to 20 N s by the application of the force in 1s. What is the magnitude of applied force?**
A. 10N
B. 20N
C. 30N
D. 40N

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65. A bear can be knocked down by hitting one of the following bullets of same momentum:
A. lead
B. steel
C. gold
D. rubber

66. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The maximum height reached by the first object will be that of the other:
A. 10 times
B. 1000 times
C. 100 times
D. 10000 times

67. A stone released from the window of a moving train shall hit the ground following:
A. Straight path
B. Circular path
C. curved path
D. Elliptical path

68. What is the acceleration of a projectile at its highest point:
A. Maximum
B. Zero
C. Minimum
D. g

69. A wheel of radius 1-meter rolls forward half a revolution on a horizontal ground. The magnitude of the displacement of the point of the wheel initially in contact with the ground is
A. 2π
B. $\sqrt{2}\,\pi$
C. $\sqrt{\pi^2+4}$
D. π

70. To throw a stone horizontally from the vertical height of 10m as it covers the horizontal distance of 10m find the x–component of velocity ($g = 10\ ms^{-2}$):
A. 2.5 ms^{-1}
B. 5 ms^{-1}
C. 7.1 ms^{-1}
D. 10 ms^{-1}

71. Identical guns fire identical bullets horizontally at the same speed from the same height above level planes, one on the Earth and one on the Moon. Which of the following three statements is/are true?
I. The horizontal distance traveled by the bullet is greater for the Moon.
II. The flight time is less for the bullet on the Earth.
III. The velocity of the bullets at impact are the same.
A. III only
B. I and III only
C. I and II only
D. II and III only

72. A student drops a table–tennis ball in air. What happens to the velocity and to the acceleration of the ball during the first few seconds after release?

	Velocity	Acceleration
A.	decreases	decreases
B.	decreases	increases
C.	increases	constant
D.	increases	increases

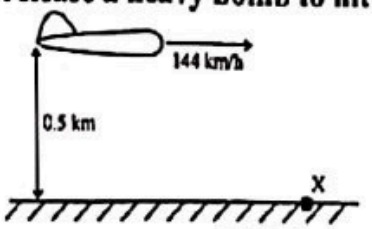
73. A car is brought to rest in 5 s from a speed of 10 m / s. What is the average deceleration of the car?
A. 0.5 m/s^2
B. 15 m/s^2
C. 2 m/s^2
D. 50 m/s^2

74. Which of the following is NOT an example of accelerated motion?
A. Vertical component of projectile motion
B. A swinging pendulum
C. Circular motion at constant speed
D. Horizontal component of projectile motion

75. **Two bodies are falling with negligible air resistance, side by side, above a horizontal plane. If one of the bodies is given an additional horizontal acceleration during its descent, it:**

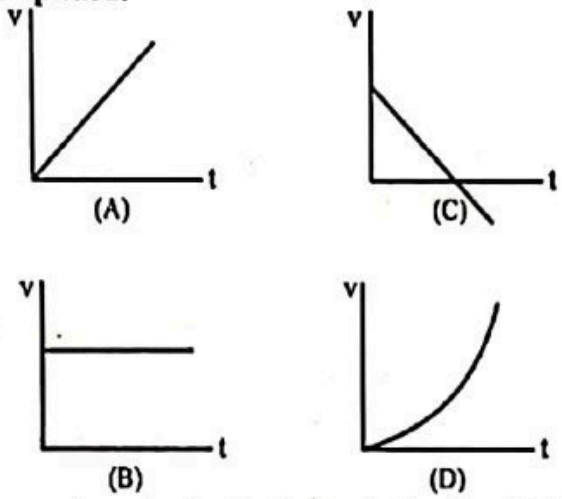
A. strikes the plane at the same time as the other body
B. strikes the plane earlier than the other body
C. has the vertical component of its velocity altered
D. has the vertical component of its acceleration altered

76. **The airplane shown is in level flight at an altitude of 0.50 km and a speed of 144 km/h. At what distance should it release a heavy bomb to hit the target X? (Take g = 10m/s^2)**



A. 150m
B. 400m
C. 305m
D. 2550m

77. **An object is thrown vertically into the air. Which of the following four graphs represents the velocity (v) of the object as a function of the time (t)? The positive direction is taken to be upward.**



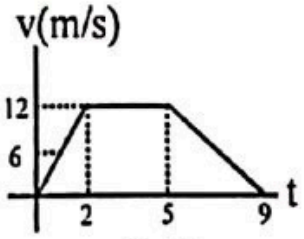
78. **A bullet shot straight up returns to its starting point in 10 s. Its initial speed was:**

A. 9.8 ms^{-1}
B. 49 ms^{-1}
C. 24.5 ms^{-1}
D. 98 ms^{-1}

79. **A force of 10 N acts on a body of mass 5 kg for one second, then its time rate of change of momentum will be:**

A. 10 kgms^{-2}
B. 5 kgms^{-2}
C. 50 kgms^{-2}
D. 2 kgms^{-2}

80. **The graph represents the straight line motion of a car. How far does the car travel between t = 2 s and t = 5 s?**



A. 4 m
B. 24 m
C. 12 m
D. 36 m

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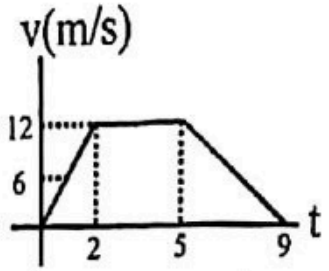
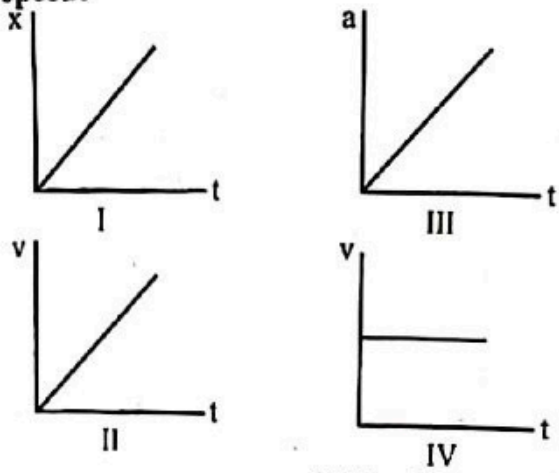
81. **The diagram represents the straight line motion of a car. Which of the following statements is true?**



A. The car accelerates, stops, and reverses
B. The car is moving for a total time of 12 s
C. The car accelerates at 6 m/s^2 for the first 2 s
D. The car decelerates at 12 m/s^2 for the last 4s

82. **Consider the following graphs (note the axes carefully). Which of these represents motion at constant speed?**



A. IV only
B. I, II, and III only
C. III only
D. I and IV only

83. **If a body of mass 2 kg moves with 15 m/s collides with stationary body of same mass, then after elastic collision second body will move with velocity of:**
A. 15 m/s
B. 2 m/s
C. 30 m/s
D. 0 m/s

84. **K.E is conserved in:**
A. inelastic collision
B. all collisions
C. elastic collision
D. none of these

85. **When a heavy particle collides with a light particle at rest, then after collision the target particle moves with:**
A. the same speed
B. double the velocity of incident particle
C. zero velocity
D. Bounce back with same velocity

86. **Sphere "A" has mass m and is moving with velocity "v". It makes a head-on elastic collision with a stationary sphere "B" of mass 2m. After the collision their speeds (v_A and v_B are:**
A. 0, v/2
B. − v, v
C. − v/3, 2v/3
D. −2v/3, v/3

87. **A body of mass "m" having an initial velocity "v" makes head on elastic collision with a stationary body of mass "M". After the collision, the body of mass "m" comes to rest and only the body having mass "M" moves. This will happen only when:**
A. m >> M
B. m = M
C. m << M
D. m = M/2

88. The velocities of two equal masses "A" and "B" are 13 m/s and – 14 m/s respectively. What will be their respective velocities after they suffer one dimensional elastic collision?

A. – 14 m/s and 13 m/s
B. – 13 m/s and 14 m/s
C. 0 and 13 m/s
D. 0 and 14 m/s

89. A body of mass "m_1" moving with uniform velocity of 40 m/s collides with another body of mass "m_2" at rest and then two together begin to move with uniform velocity of 30 m/s. the ratio of their masses $\frac{m1}{m2}$ is:

A. 0.75
B. 1.33
C. 3.0
D. 4.0

90. A man goes 10 towards North, then 20m towards east then displacement is

A. 22.5m
B. 25m
C. 25.5m
D. 30m

91. A particle moves along the sides AB, BC, CD of a square of side 25 m with a velocity of 15 m/s. Its average velocity is

A. 15 m/s
B. 10 m/s
C. 7.5 m/s
D. 5 m/s

92. An aeroplane 400 m north and 300 m south and then flies 1200 m upwards then net displacement is

A. 1200 m
B. 1300 m
C. 1400 m
D. 1500 m

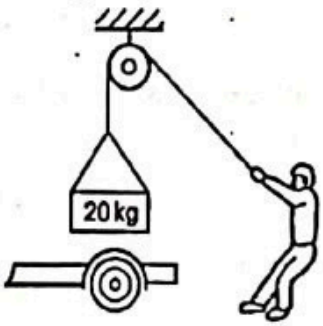
93. An athlete completes one round of a circular track of radius R in 40 sec. What will be his displacement at the end of 2 min. 20 sec

A. Zero
B. 2R
C. $2\pi R$
D. $7\pi R$

94. A person travels along a straight road for the first half time with a velocity v_1 and the second half time with a velocity v_2. Then the mean velocity v is given by

A. $v = \frac{v_1 + v_2}{2}$
B. $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$
C. $v = \sqrt{v_1 v_2}$
D. $v = \sqrt{\frac{v_2}{v_1}}$

95. A person just supports a mass of 20 kg suspended from a rope.



What is the resultant force acting on the mass?

A. 0N
B. 10N
C. 20N
D. 200N

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96. A particle is moving along a circular path of radius 6 m with a uniform speed of 8 ms^{-1}. The average acceleration when the particle completes one half of the revolution is

A. $\frac{16}{3\pi}$ ms^{-2}
B. $\frac{32}{3\pi}$ ms^{-2}
C. $\frac{64}{3\pi}$ ms^{-2}
D. None of these

97. A motor car can be stopped within a distance of S, when it moves with a speed v. If it moves with a speed 4v, it can be stopped within a distance (assuming constant braking force)

A. S
B. 4S
C. 2S
D. 16S

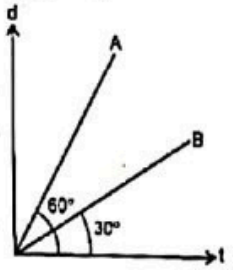
98. What is the angle of projection for which the range and maximum height become equal?

A. $\tan^{-1}\left(\frac{1}{4}\right)$
B. $\tan^{-1}(4)$
C. $\cos^{-1}\left(\frac{1}{4}\right)$
D. $\sin^{-1}\left(\frac{1}{4}\right)$

99. A bullet is fired with a gun from tower horizontally with a velocity 400 m/s. at the same time, a stone is dropped from the same tower.

A. The stone will reach the ground first
B. The bullet will reach the ground first
C. Both will reach the ground at the same time
D. None of these

100. Displacement time $(t-x)$ graph of two objects A and B is shown in the figure given below. The ratio of their speed (v_A / v_B) is

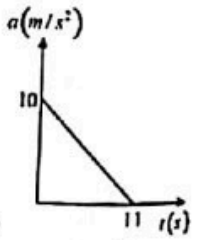


A. $\frac{\sqrt{3}}{4}$
B. $\frac{4}{\sqrt{3}}$
C. $\frac{4}{3\sqrt{3}}$
D. $\frac{3}{1}$

101. The engine of a car produces an acceleration of 6 m s^{-2} in the car. If this car pulls another car of the same mass, then the acceleration would be

A. 6 m s^{-2}
B. 12 m s^{-2}
C. 3 m s^{-2}
D. 1.5 m s^{-2}

102. A particle starting from rest undergoes a rectilinear motion with acceleration a. The variation of a with time t maximum velocity attained by the particle during the motion is:



A. 55 m/s
B. 550 m/s
C. 110 m/s
D. 650 m/s

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103. The instantaneous acceleration is the limit of average acceleration as $\Delta t \to 0$ is given by

A. $\bar{a}_{ins} = \lim_{\Delta t \to 0} \frac{\Delta \bar{d}}{\Delta t}$

C. $\bar{a}_{ins} = \lim_{\Delta t \to 0} \frac{\Delta t}{\Delta \bar{v}}$

B. $\bar{a}_{ins} = \lim_{\Delta t \to 0} \frac{\Delta \bar{v}}{\Delta t}$

D. $\bar{a}_{ins} = \lim_{\Delta t \to 0} \frac{\Delta \bar{a}}{\Delta t}$

104. If an object is moving with constant velocity of $20ms^{-1}$ towards north then its acceleration will be

A. 5 m s^{-2}
B. 9 m s^{-2}
C. 10 m s^{-2}
D. 0 m s^{-2}

105. The retardation is defined as

A. increase in velocity per unit time
B. decrease in speed per unit time
C. decrease in velocity per unit time
D. increase in speed per unit time

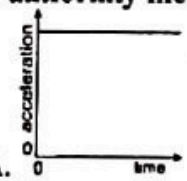
106. A sledge of mass 25 kg is pulled across level ground with a horizontal force of 60 N. The constant force of friction is 20 N. What is the acceleration of the sledge?

A. 0.5 m/s^2
B. 2 m/s^2
C. 1.6 m/s^2
D. 0.2 m/s^2

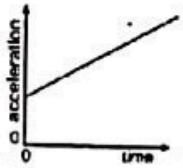
107. A swimmer of mass 60 kg dives into a deep pool from a high diving platform. She enters the water at high speed and then decelerates at a rate of 16 m/s^2 as she travels vertically downwards in the water. The gravitational field strength is 10 N/kg. What is the swimmer's weight and the size of the resultant force acting on her as she decelerates?

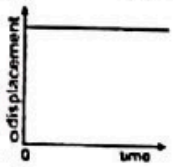
	Swimmer's weight	Resultant Force
A.	60 kg	960 N
B.	60 kg	9600 N
C.	600 N	960 N
D.	600 N	9600 N

108. Which graph represents the motion of a car that is travelling along a straight road with a uniformly increasing speed?

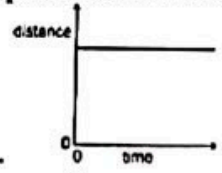
A. 

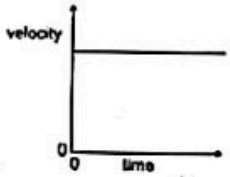
B. 

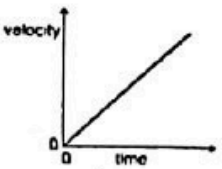
C. 

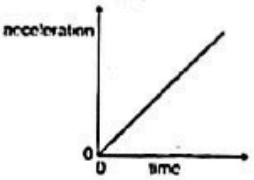
D. 

109. A particle is moving in a straight line with uniform acceleration. Which graph represents the motion of the particle?

A. 

B. 

C. 

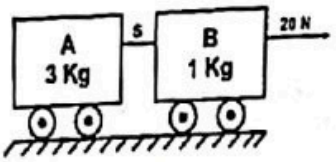
D. 

110. A body moves from rest with a constant acceleration of 5 m/s^2. Its instantaneous speed (in m/s at the end of 10 sec is
A. 50
B. 2
C. 5
D. 0.5

111. If a body starts from rest and travels 120 *cm* in the 6th second, then what is the acceleration
A. 0.20 m/s^2
B. 0.218 m/s^2
C. 0.027 m/s^2
D. 0.03 m/s^2

112. If a car at rest accelerates uniformly to a speed of 144 *km/h* in 20 *s*. Then it covers a distance of
A. 20 m
B. 1440 m
C. 400 m
D. 2880 m

113. A two-car train, with data as given in Fig. is pulled by a child on a horizontal frictionless surface. The strings are massless. The force exerted by car A on the string S is:



A. 10N
B. 20N
C. zero
D. 15 N

114. An object is projected upwards with a velocity of 100 m/s. It will strike the ground after (approximately)
A. 10 sec
B. 15 sec
C. 20 sec
D. 5 sec

115. If the force acting on a body is doubled, then acceleration becomes
A. Half
B. One fourth
C. Doubled
D. Constant

116. When force of 1 N is applied on a body of mass 100 g then the acceleration would be
A. 5 $m\ s^{-2}$
B. 10 $m\ s^{-2}$
C. 0.5 $m\ s^{-2}$
D. 0.1 $m\ s^{-2}$

117. A mass of 10 kg moves with an acceleration of 10 $m\ s^{-2}$, the force on it is
A. 5 N
B. 50 N
C. 100 N
D. 25 N

118. When a force of 4 N acts on a mass of 2 kg for a time of 2 sec, what is the rate of change of momentum?
A. 2 kg $m\ s^{-2}$
B. 8 kg $m\ s^{-2}$
C. 4 kg $m\ s^{-2}$
D. 16 kg $m\ s^{-2}$

119. A lead ball strikes a wall and falls down, a tennis ball having the same mass and velocity strikes the wall and bounces back. Check the correct statement.
A. The lead ball suffers a greater change in momentum compared with the tennis ball
B. The tennis ball suffers a greater change in momentum as compared with the lead ball
C. The momentum of the lead ball is greater than that of the tennis ball
D. Both suffer an equal change in momentum

120. **Which is a statement of the principle of conservation of momentum?**
A. A force is equal to the rate of change of momentum of the body upon which it acts.
B. In a perfectly elastic collision, the relative momentum of the bodies before impact is equal to their relative momentum after impact
C. The momentum of a body is the product of the mass of the body and its velocity
D. The total momentum of a system of interacting bodies remains constants, providing no external force acts

121. **The average force necessary to stop a hammer with 25 N s momentum in 0.05 s expressed in 'N' is**
A. 500
B. 50
C. 125
D. 25

122. **A projectile can have the same range R for two angles of projection. If t_1 and t_2 are the times of flights in the two cases, then product of the time of flights is proportional to:**
A. R^2
B. $\frac{1}{R^2}$
C. $\frac{1}{R}$
D. R

123. **A cricket ball of mass 0.5 kg strikes a bat normally with a velocity of 30 m s^{-1} and rebounds with a velocity of 20 m s^{-1} in the opposite direction. The impulse of the force exerted by the ball on the bat is**
A. 0.5 N s
B. 25 N s
C. 1.0 N s
D. 50 N s

124. **A force of 6 N acts on a mass of 1kg which acquire velocity of 30ms^{-1}. The time for which the force acts is**
A. 26 s
B. 5 s
C. 6 s
D. 2 s

125. **A small submarine of mass 1000 kg sinks in water with a uniform speed of 2 m/s. What is the resultant force exerted on the submarine as it sinks?**
A. 0 N
B. 500 N
C. 2000 N
D. 10000 N

126. **Two similar spheres, each of mass m and travelling with speed v, are moving towards each other.**



The spheres have a head on elastic collision. Which statement is correct?
A. The spheres stick together on impact
B. The total kinetic energy after impact is mv^2
C. The total kinetic energy before impact is zero
D. The total momentum before impact is 2 mv

127. **Two railway trucks of masses m and 3m move towards each other in opposite directions with speeds 2v and v respectively. These trucks collide and stick together. What is the speed of the trucks after the collision?**
A. $\frac{v}{4}$
B. $\frac{v}{2}$
C. v
D. $\frac{5v}{4}$

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128. A handball is tossed vertically upward with a velocity of 19.6 meters per second. Approximately how high will it rise?
A. 15 m
B. 25 m
C. 20 m
D. 30 m

129. A runner runs 100m in 10s, then turns around and jogs 50m back toward the starting point in 30s. What is his average speed and average velocity in ms^{-1}
A. 3, 1.25
B. 3.75, 1.25
C. 4.25, 1.25
D. 3, 1

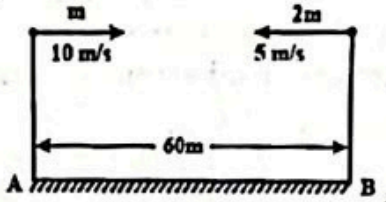
130. At maximum height on the trajectory which of projectile becomes zero
A. acceleration
B. velocity
C. vertical velocity
D. horizontal velocity

131. Time taken by a projectile to reach maximum height is t =
A. $\frac{v_i \sin\theta}{2g}$
B. $\frac{v_i \sin 2\theta}{g}$
C. $\frac{v_i \sin\theta}{g}$
D. $\frac{2v_i \sin\theta}{g}$

132. Two projectiles are projected at angle of 20^0 and 70^0 with same velocity which one have longer range
A. Which is fired at 20^0
B. Which is fired at 70^0
C. Both have same range
D. none of these

133. The path followed by a projectile is known as its
A. range
B. cycle
C. trajectory
D. height

134. Two particles one of mass m and the other of mass 2m are projected horizontally towards each other from the same level above the ground with velocities 10 m/s and 5 m/s respectively. They collide in air and stick to each other. The distance from A, where the combined mass finally land is:



A. 40 m
B. 20 m
C. 30 m
D. 45 m

135. A stone is dropped from the top of a cliff of height 30m. At the same instant another stone is projected vertically upwards from the ground with a speed of 30 m/s. The two stones will cross each other after a time:
A. 1s
B. 2s
C. 3s
D. 4s

136. Which of the following must always be true?
I. If an object's acceleration is constant, then it must move in a straight line.
II. If an object's acceleration is zero, then its speed must remain constant.
III. If an object's speed remains constant, then its acceleration must be zero.
A. I and II only
B. I and III only
C. II only
D. III only

137. A stone is thrown horizontally with an initial speed of 30 m/s from a bridge. Find the stone's total speed when it enters the water 4 seconds later. (Ignore air resistance.)
A. 30 m/s
B. 40 m/s
C. 50 m/s
D. 60 m/s

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138. **The cable of a crane is used to lift a load of mass 500 kg and weight 5000 N. The cable exerts a force of 7500 N on the load. What is the acceleration of the load?**
A. 5.0 m/s^2
B. 10 m/s^2
C. 15 m/s^2
D. 25 m/s^2

139. **A feather, initially at rest, is released in a vacuum 12 m above the surface of the earth. Which of the following statements is correct?**
A. The maximum velocity of the feather is 9.8 m/s
B. The acceleration of the feather remains constant during the fall
C. The acceleration of the feather increases during the fall
D. The acceleration of the feather decreases until terminal velocity is reached

140. **In which of the following is a force of friction necessary?**
A. when a ball is bouncing off a wall
B. when a car is accelerating
C. when a drum skin is vibrating
D. when a rocket is taking off

141. **A force $\vec{F} = 8\hat{i} - 6\hat{j} - 10\hat{k}$ newton produces acceleration of 1 m s^{-2} in a body. The mass of the body is:**
A. $10kg$
B. $10\sqrt{2}kg$
C. $10\sqrt{3}kg$
D. $200kg$

142. **In a game of tug of wars, a condition of equilibrium exists. Both the teams pull the rope with a force of 10^4 N. The tension in the rope is:**
A. 10^4 N
B. 10^8 N
C. 0 N
D. 2×10^4 N

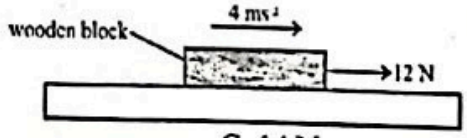
143. **A ball of mass 1 kg is accelerating at the rate of 1 m s^{-2}. The rate of change of momentum is:**
A. 1 kg m s^{-2}
B. 2 kg m s^{-2}
C. 3 kg m s^{-2}
D. 4 kg m s^{-2}

144. **Nine five-rupee coins are put on top of each other on a table. Each coin has mass in kg. The reaction of the 5th coin (counted from bottom) on 6th coin is:**
A. 0 mg
B. 2 mg
C. 4 mg
D. 5 mg

145. **When we jump out a boat standing in water, it moves**
A. backward
B. forward
C. sideways
D. none of these

146. **A force of 6 N acts on a mass of 1 kg which acquires a velocity 30 ms^{-1}. The time for which the force acts is**
A. 26 s
B. 6s
C. 5s
D. 2s

147. **A wooden block of mass 0.60 kg is on a rough horizontal surface. A force of 12 N is applied to the block and it accelerates at 4.0 ms^{-2}. What is the magnitude of the frictional force acting on the block?**



A. 2.4 N
B. 9.6 N
C. 14 N
D. 16 N

148. A force of 5 newton acts on a body of weight 9.80 newton. What is the acceleration produced in $m\ s^{-2}$?
A. 0.51
B. 1.96
C. 5.00
D. 49.00

149. A body moves from point P (3, 4) to Q (5, 7). Its displacement vector would be
A. $8\hat{i}+10\hat{j}$
B. $8\hat{i}+2\hat{j}$
C. $2\hat{i}-2\hat{j}$
D. $2\hat{i}+3\hat{j}$

150. Action and reaction forces act on
A. The same body
B. The different bodies
C. The horizontal surface
D. Nothing can be said

ANSWER KEY

1	A	16	A	31	A	46	B	61	A	76	B	91	D	106	C	121	A	136	C
2	C	17	D	32	A	47	C	62	A	77	C	92	A	107	C	122	D	137	C
3	A	18	D	33	A	48	A	63	B	78	B	93	B	108	A	123	B	138	A
4	A	19	A	34	C	49	A	64	A	79	A	94	A	109	C	124	B	139	B
5	B	20	B	35	C	50	C	65	D	80	D	95	A	110	A	125	A	140	B
6	A	21	B	36	D	51	C	66	C	81	C	96	C	111	B	126	B	141	B
7	A	22	C	37	A	52	C	67	C	82	D	97	D	112	C	127	A	142	A
8	A	23	D	38	A	53	B	68	D	83	A	98	B	113	D	128	C	143	A
9	A	24	C	39	B	54	B	69	C	84	C	99	C	114	C	129	B	144	C
10	A	25	D	40	B	55	B	70	C	85	B	100	D	115	C	130	C	145	A
11	C	26	D	41	A	56	A	71	C	86	C	101	C	116	B	131	C	146	C
12	D	27	D	42	C	57	A	72	C	87	B	102	A	117	C	132	C	147	B
13	A	28	A	43	A	58	A	73	C	88	A	103	B	118	C	133	C	148	C
14	C	29	B	44	B	59	D	74	D	89	C	104	D	119	B	134	A	149	D
15	B	30	A	45	B	60	B	75	A	90	A	105	C	120	D	135	A	150	B

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SOLUTIONS

1. No acceleration in horizontal direction.
So, horizontal speed remains same.

2. $\text{Average acceleration} = \dfrac{\text{Change in velocity}}{\text{Time taken}}$

$\therefore$ Change in velocity = Area of acceleration–time graph

$\therefore$ Average acceleration $= \dfrac{\text{Area OABE}}{20s} = \dfrac{600}{20} = 30 ms^{-2}$

3. $S = vit + \frac{1}{2}at^2 = 0 + \frac{1}{2}at^2 = \frac{1}{2}at^2$

4. $F = \dfrac{\Delta p}{\Delta t}$

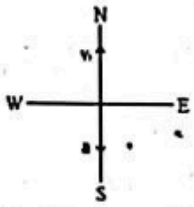
5. Time to reach maximum height is $t = \dfrac{v_i}{g} \Rightarrow v_i = gt = 9.8 \times 3 = 29.4 ms^{-1}$

6. $2aS = v_f^2 - v_i^2$

$2\,(a)\,60 = 50^2 - 10^2 \Rightarrow 120a = 2500 - 100 = 2400$

$a = \dfrac{2400}{120} = 20\ ms^{-2}$

$a = \dfrac{v_f - v_i}{\Delta t} \Rightarrow \Delta t = \dfrac{vf - vi}{a} = \dfrac{50 - 10}{20} = \dfrac{40}{20} = 2\ s$

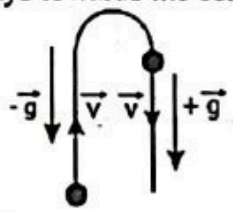
7. 

$v_f = v_i + at = 25 + (-3)(6) = 25 - 18 = 7$ m/s north

car is moving with decreasing velocity thus it has negative acceleration.

8. $\dfrac{v_A}{v_B} = \dfrac{1/\tan 53°}{1/\tan 30°} = \dfrac{3/4}{\sqrt{3}} = \dfrac{\sqrt{3}}{4}$

9. Gravitational acceleration is always towards the center of Earth (downward).



10. $v_f = v_i + gt = 0 + (9.8)(1) = 9.8$ m/s

$v_{av} = \dfrac{v_i + v_f}{2} = \dfrac{0 + 9.8}{2} = 4.9$ m/s

11. As stone is moving with constant acceleration (gravitational acceleration).
As the slope of graph (C) is constant. So, stone moves with constant acceleration.

12. $P_i = mv_i = (1)(2) \quad = 2$ N s

$P_f = mv_f = (1)(-1.5) \quad = -1.5$ N s

$\Delta P = mv_f - mv_i = -1.5 - 2 = -3.5$ N s

13. $S = v_t t = (10+5)(8) = (15)(8) = 120m$

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14. At highest point, velocity is momentarily zero but change in velocity is not zero. Acceleratio is equal to gravitational acceleration which is g and is always directed downwards.

15. $v_f = v_i + gt = 0 + (9.8)(5) = 49\ ms^{-1}$

16. $H = \frac{v_i^2 \sin^2\theta}{2g}$

$$T = \frac{2v_i \sin\theta}{g} \Rightarrow T^2 = \frac{4v_i^2 \sin^2\theta}{g^2}$$

$$\frac{H}{T^2} = \frac{\frac{v_i^2 \sin^2\theta}{2g}}{\frac{4v_i^2 \sin^2\theta}{g^2}} = \frac{g}{8} \Rightarrow H = \frac{gT^2}{8}$$

17. $v = \text{constant} \Rightarrow \Delta v = 0 \Rightarrow a = 0$

$F = ma = m(0) = 0$

18. $a = \frac{v_f - v_i}{\Delta t} = \frac{50 - 0}{10} = 5\ ms^{-2}$

19. Projectile motion is two dimensional motion under constant acceleration due to gravity.

20. If $\theta_1 + \theta_2 = 90°$

Then $R_{\theta_1} = R_{\theta_2}$

21. $W = mg \Rightarrow m = \frac{W}{g} = \frac{5}{10} = 0.5\ kg$

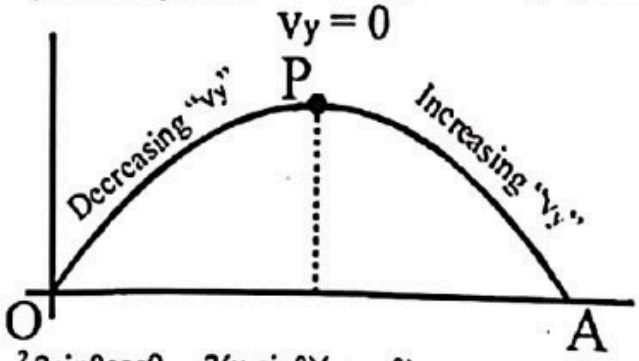
$F = ma = (0.5)(4) = 2N$

22. $a = \frac{v_f - v_i}{\Delta t} \Rightarrow \Delta t = \frac{v_f - v_i}{a} = \frac{200 - 100}{10} = \frac{100}{10} = 10\ s$

23. $v_f = v_i + at \Rightarrow v_f = 0 + gt = gt$

24. $v_x = v\cos\theta = (20)\cos 60° = (20)(0.5) = 10\ ms^{-1}$

25. In this figure "OP" portion represents the "AH" portion of graph and "PA" represents "HE



26. $R = \frac{v_i^2 \sin 2\theta}{g} = \frac{v_i^2\, 2\sin\theta\cos\theta}{g} = \frac{2(v_i \sin\theta)(v_i\cos\theta)}{g}$

$$= \frac{2(v_{ix})(v_{iy})}{g} = \frac{2(30)(20)}{10} = 120\ m$$

27. The average force generated in a collision is equal to the momentum change during th collision divided by the time interval in which collision is taken place.

$$\bar{F} = \frac{\Delta \bar{p}}{\Delta t}$$

The air bag extends the time interval over which the collision occurs and reduces the forc experienced by the student.

28. Acceleration = slope of velocity-time graph
Slope of line parallel to velocity axis is infinite.

29. $S = v_r t \Rightarrow t = \frac{S}{v_r} = \frac{150}{10+5} = \frac{150}{15} = 10s$

30. When body covers equal distance with different velocities, then the formula for the average velocity is

$$v_{av} = \frac{2v_1v_2}{v_1 + v_2} = \frac{2(40)(50)}{40 + 50} = \frac{4000}{90} = 44.4\ ms^{-1}$$

31. Time rate of change of momentum = Applied force

$$\frac{\vec{P}_f - \vec{P}_i}{t} = \frac{\Delta\vec{P}}{t} = \vec{F}$$

In freely falling motion
Force = Weight $\Rightarrow F = W = mg$

$$\frac{\Delta\vec{P}}{t} = \vec{W} = m\vec{g}$$

32. $$a = \frac{F-f}{m}$$

$$a = \frac{3600-2000}{800}$$

$$a = \frac{1600}{800} = 2ms^{-2}$$

33. Distance covered in 1st second, $h_1 = \frac{1}{2}gt^2$

$$= \frac{1}{2}(10)(1)^2 = 5\ m$$

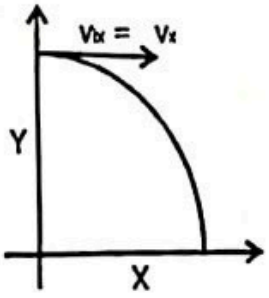
Distance covered in 2nd second, $h_2 = \frac{1}{2}gt^2$

$$= \frac{1}{2}(10)(2)^2 = 20\ m$$

Distance between 1st and 2nd second, $h = h_2 - h_1$
$= 20 - 5 = 15\ m$

34. $$a = \frac{v_f - v_i}{\Delta t} = \frac{25km/hr - 20km/hr}{1\ hr} = 5\ km/hr^2$$

35. $$Y = \frac{1}{2}gt^2 = \frac{1}{2}(10)(5)^2 = 125\ m$$



36. $$a = \frac{v_f - v_i}{\Delta t}$$

$$\Delta t = \frac{v_f - v_i}{a} = \frac{20\ km/hr - 10\ km/hr}{2\ km/hr^2} = \frac{10}{2} = 5\ hr$$

37. $F = ma$

$$a = \frac{F}{m}$$

For same force the body of greater mass has lesser acceleration.

38. $P_i = mv_i = (0.2)(-30) = -6$ Ns

$P_f = mv_f = (0.2)(20) = +4$ Ns

$\Delta P = mv_f - mv_i = +4 - (-6) = +10$ Ns

Taking downward velocity is –ve and upward is +ve.

39. $\Delta P = Ft = (1)(1) = 1$ kgm/s

40. By law of conservation of linear momentum

$(20)(10) + 0 = (20+5)v$

$$v = \frac{200}{25} = 8 \text{ m/s}$$

$$K.E = \frac{1}{2}mv^2 = \frac{1}{2}(20+5)(8)^2 = \frac{1}{2}(25)(64) = 800 \text{ J}$$

41. Ranges at angles $(45^\circ + 5^\circ)$ and $(45^\circ - 5^\circ)$ are equal. So, $R_P = R_Q$

42. Newton's 2nd law of motion gives the measurement of force.

$$F = ma = \frac{P_f - P_i}{t}$$

43. $v_f = v_i + at$

for freely falling body

$v_f = 0 + gt = gt \Rightarrow v_f \propto t$

44. Both man and car are in same speed. So, their relative speed will be zero.

45. Acceleration = slope velocity-time graph = $\tan 0^\circ = 0$

46. Newton's laws are adequate for speeds that are low compared with the speed of light. For very fast-moving objects relativistic mechanics developed by Einstein is applicable.

47. The average force generated in a collision is equal to the momentum change during the collision divided by the time interval in which collision is taken place.

$$F = \frac{\Delta P}{\Delta t}$$

The pad inside the helmet extends the time interval over which the collision occurs and reduces the force experienced by the brain during collisions. That is why the safety helmet of a motorcycle's is padded.

48. $\frac{2g_p h_p}{2g_e h_e} = \frac{v_i^2}{v_i^2} = 1$ (initial velocities are same)

$$\frac{h_p}{h_e} = \frac{g_e}{g_p} = \frac{9.8}{19.6} = \frac{1}{2} \Rightarrow h_p = \frac{h_e}{2}$$

49. Speed = slope of distance-time graph

The slope of graph (A) is increasing. So, the speed is increasing.

50. Total force in right side, $F_{right} = 7 + 2 = 9$N

Total force in left side, $F_{left} = 3 + 4 = 7$N

Net force on body = $F_{right} - F_{left} = 9 - 7 = 2$N (right side)

51. $$F = \frac{P_f - P_i}{\Delta t} = \frac{mv_f - mv_i}{\Delta t} = \frac{m(v_f - v_i)}{\Delta t} = \frac{m\Delta v}{\Delta t}$$

$$\Delta v = \frac{F\Delta t}{m} = \frac{(8)(4)}{16} = 2 \text{ m/s}$$

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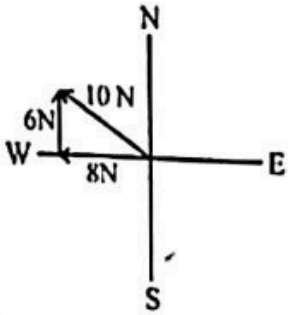
52. Resultant force, $F = \sqrt{8^2 + 6^2} = 10\ N$

$F = ma \Rightarrow a = \frac{F}{m} = \frac{10}{5} = 2\ m/s^2$

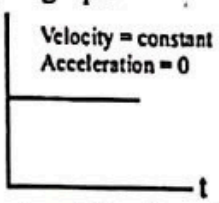


53. For every action there is a reaction. This action and reaction are equal magnitude but opposite in direction. Action and reaction never act on the same body; they act on the different bodies.

54. From acceleration time graph, acceleration is constant for first part of motion so, for this part velocity of body increases uniformly with time and as a = 0 then the velocity becomes constant. Then again increased because of constant acceleration.

55. Uniform velocity means that the velocity of body remains same at any instant. So, Instantaneous velocity = average velocity

56. Acceleration = slope of velocity-time graph



57. An angle equally inclined to the horizontal and vertical means $\theta = 45°$. so,

$R_{max} = \frac{u^2}{g}$

58. Net force, F = ma
In figure (A) net force is least. So, the acceleration is also least.

59. $R = \frac{v_i^2 \sin 2\theta}{g}$

$R_{30°} = \frac{v_i^2 \sin 2(30°)}{g}$

$R_{60°} = \frac{v_i^2 \sin 2(60°)}{g}$

$\sin 2(30°) = \sin 2(60°)$

$R_{30°} = R_{60°}$ (if initial velocities are same)

60. $2gh = v_f^2 - v_i^2 = v_f^2 - 0$

$v_f^2 = 2gh$

$v_f = \sqrt{2gh}$

$P = mv = m\sqrt{2gh} = 2[\sqrt{2(10)(5)}] = 2(10) = 20\ N\ s$

61. $v_f = v_i + gt = 0 + (10)(4) = 40\ ms^{-1}$

$P = mv = (2.5)(40) = 100\ kgms^{-1}$

62. Relative velocity of bodies moving in opposite direction is

$v_r = v_1 + v_2 = v + v = 2v$

Relative velocity does not depend upon the masses of bodies.

63. Uniform acceleration means that the acceleration of body remains same at any instant. So, Instantaneous acceleration = average acceleration

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64. $F = \frac{P_f - P_i}{t} = \frac{20-10}{1} = 10\ N$

65. The rubber bullet will be more effective as it will bounce back after hitting the bear. If initially the bullet was moving to the right with a velocity v, after bouncing off the bear it will move to the left with a velocity = -v. If m is the mass of the bullet its initial momentum is mv while the final momentum is - mv. So change in momentum is mv - (-mv) = 2mv. Since the force on the bear is proportional to the change in momentum, the rubber bullet will exert more force.

The lead bullet will pass through, as its direction is the same as before, it only slows down so the change in momentum is always less, even if it gets stuck in the bear in which case it has the max value of mv – 0 = mv.

However if we are looking at which can cause more damage it is obviously the lead bullet.

66. Maximum height attained by body thrown vertically upward is

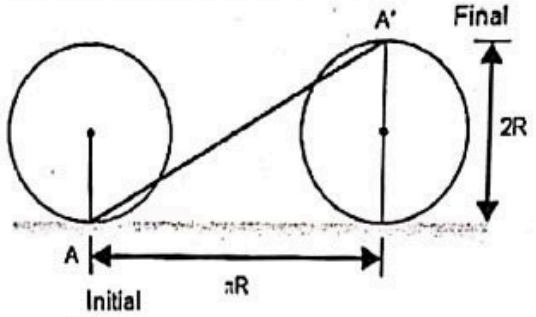
$$h = \frac{v_i^2}{2g}$$

$$\frac{h_1}{h_2} = \frac{v_1^2/2g}{v_2^2/2g} = \frac{(100)^2}{(10)^2} = 100 \Rightarrow h_1 = 100h_2$$

67. When a stone released from the window of a moving train, then its motion will be a projectile motion. So its path will be curved.

68. Projectile motion is the 2-dimensional motion under the action of gravity. So, acceleration during projectile motion will be gravitational acceleration (g).

69. Horizontal distance covered by the wheel in half revolution $= \pi R$



So, the displacement of the point which was initially in contact with ground

$= AA' = \sqrt{(\pi R)^2 + (2R)^2}$

$= R\sqrt{\pi^2 + 4} = \sqrt{\pi^2 + 4}$ (As R = 1m)

70. $y = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2(10)}{10}} = 1.4\ s$

$x = v_x \times t \Rightarrow v_x = \frac{x}{t} = \frac{10}{1.4} = 7.1\ m/s$

71. $g_{moon} = \frac{gEarth}{6}$

$y = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2y}{g}} \Rightarrow t \propto \frac{1}{\sqrt{g}}$

$t_{Moon} > t_{Earth}$

$x = v_x \times t \Rightarrow x \propto t \Rightarrow x_{Moon} > x_{Earth}$

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72. When student drops a table tennis ball in air, then its speed increases due to force of gravity but acceleration due to gravity remains same ($g = 9.8\ ms^{-2}$).

73. Acceleration, $a = \frac{v_f - v_i}{\Delta t} = \frac{0-10}{5} = -2\ ms^{-2}$

deceleration $= 2\ ms^{-2}$

74. According to Newton's first law of motion, there will be no acceleration in the horizontal direction ($a_x = 0$), unless a horizontal directed force acts on the body. In the absences of air friction only force acting on the body during flight is the force of gravity. As there is no horizontal force acting on the body so its horizontal velocity remains unchanged.

75. As

$$Y = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2Y}{g}}$$

As "Y" and "g" are constant in both cases. So, both are strike the plan with same time.

76. $$Y = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2Y}{g}} = \sqrt{\frac{2(500)}{10}} = \sqrt{100} = 10\ s$$

$x = v_x \times t = (40)(10) = 400\ m$

77. When an object is thrown vertically upward its velocity decreases to zero and then it moves downward its velocity increases in reverse direction.

78. Time to reach the highest point of its path $= \frac{10}{2} = 5\ s$

$v_f = v_i + at \Rightarrow 0 = v_i - gt$

$v_i = gt = (9.8)(5) = 49\ ms^{-1}$

79. $\frac{\Delta P}{\Delta t} = F = 10\ kgms^{-2}$

80. Distance covered by body = area under v-t graph with time axis
Distance covered by body from time 2s to 5 s = (12)(3) = 36 m

81. Acceleration = slope velocity-time graph

Acceleration in first 2s $= \frac{12-0}{2} = 6\ m/s^2$

82. Speed = slope of distance-time graph
The slope of graph (I) is constant. So, speed is constant.
Also in graph (IV) speed is constant.

83. $m_1 = m_2 = m$ and $v_2 = 0$

$$v'_2 = \left(\frac{2m_1v_1}{m_1+m_2}\right) + \left(\frac{m_2-m_1}{m_1+m_2}\right)v_2$$

$$v'_2 = \left(\frac{2mv_1}{m+m}\right) + \left(\frac{m-m}{m+m}\right)(0) = \left(\frac{2mv_1}{2m}\right) + 0 = v_1$$

$v'_2 = 15\ ms^{-1}$

84. The collision in which both linear momentum and kinetic energy of the system remains constant is called elastic collision.

85. $m_1 >> m_2$ so $m_2 \approx 0$ and $v_2 = 0$

$$v'_2 \approx \left(\frac{2m_1v_1}{m_1+0}\right) + \left(\frac{0-m_1}{m_1+0}\right)(0) = \left(\frac{2m_1v_1}{m_1}\right) + 0 = 2v_1$$

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86. $v'_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)v_1 + \left(\frac{2m_2v_2}{m_1 + m_2}\right)$

$v'_1 = \left(\frac{m - 2m}{m + 2m}\right)v + \left(\frac{2m(0)}{m + m}\right) = \left(\frac{-1}{3}\right)v = -\frac{v}{3}$

$v'_2 = \left(\frac{2m_1v_1}{m_1 + m_2}\right) + \left(\frac{m_2 - m_1}{m_1 + m_2}\right)v_2$

$v'_2 = \left(\frac{2mv}{m + 2m}\right) + \left(\frac{m - m}{m + m}\right)(0) = \left(\frac{2mv}{m + 2m}\right) = \frac{2v}{3}$

87. $v_M = 0$

$v'_m = 0$

$v'_M = \left(\frac{2mv_m}{m + M}\right) + \left(\frac{M - m}{m + M}\right)v_M$

If m=M

$v'_M = \left(\frac{2mv_1}{m + m}\right) + \frac{\left(\frac{m-m}{m+m}\right)}{(0)} = \left(\frac{2mv_m}{2m}\right) + 0 = v_m$

88. When masses of the two balls are equal.

$m_A = m_B = m$

$v'_A = v_B$

$v'_B = v_A$

The velocities of the balls are interchanged after collision.

$v'_A = v_B = -14$ m/s

$v'_B = v_A = 13$ m/s

89. By law of conservation of linear momentum

$(m_1)(40) + 0 = (m_1 + m_2)(30)$

$\frac{40}{30} = \frac{m_1 + m_2}{m_1} = 1 + \frac{m_2}{m_1}$

$\frac{m_2}{m_1} = \frac{4}{3} - 1 = \frac{1}{3}$

$\frac{m_1}{m_2} = 3$

90. $\vec{r} = 20\hat{i} + 10\hat{j} \quad \therefore r = \sqrt{20^2 + 10^2} = 22.5\text{m}$

91. $t = \frac{75}{15} = 5\text{s}, v_{avg} = \frac{AD}{t} = \frac{25}{5} = 5\text{m/s}$

92. An aeroplane flies 400 m north and 300 m south so the net displacement is 100 m towards north.

Then it flies 1200 m upward so $r = \sqrt{(100)^2 + (1200)^2}$

$= 1204 = 1200\text{m}$

The option should be 1204 m, because this value mislead one into thinking that net displacement is in upward direction only.

93. Total time of motion is 2 min 20 sec = 140 sec. As time period of circular motion is 40 sec so in 140 sec. athlete will complete 3.5 revolution i.e., He will be at diametrically opposite point i.e., Displacement = 2R

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94. Displacement in the 1st half time $= v_1 t$

Displacement in the 2nd half time $= v_2 t$

$\therefore$ Net displacement $= (v_1 + v_2)t$

$\therefore$ Average velocity $= \dfrac{(v_1 + v_2)t}{2t} = \dfrac{v_1 + v_2}{2}$

95. Using Newton's first Law, the 20 kg is at rest and there is no resultant force. The tension and the pulling force exerted by the man are both 200 N but this is not what the question is asking for.

96. Change in velocity $= \Delta v = 8 - (-8) = 16 m/s$

Time taken $\Delta t = \dfrac{\pi r}{v} = \dfrac{\pi \times 6}{8} = \dfrac{3\pi}{4}$

$\therefore$ Average acceleration $= \dfrac{\Delta v}{\Delta t} = \dfrac{16 \times 4}{3\pi} = \dfrac{64}{3\pi}$

97. The stopping distance $S \propto v^2$

98. $4H = R \tan\theta$

If $R = H$

$4H = H \tan\theta \Rightarrow \tan\theta = 4 \Rightarrow \theta = \tan^{-1}(4) = 76°$

99. For both particles time will be same.

100. $\dfrac{v_A}{v_B} = \dfrac{\tan 60°}{\tan 30°} = \dfrac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = \dfrac{3}{1}$

101. $a \propto \dfrac{1}{m}$

102. V_{max} = area of triangle

$= \dfrac{1}{2} \times 11 \times 10 = 55 m/s$

103. $\bar{a}_{in} = \lim_{\Delta t \to 0} \dfrac{\Delta \bar{v}}{\Delta t}$

104. Since velocity is constant so acceleration is zero.

105. Definition of retardation.

106. $F - f = ma$

$\dfrac{60 - 20}{25} = a \Rightarrow a = 1.6 \text{ m s}^2$

107. Weight of the swimmer = mg = (60) (10) = 600 N

Resultant force = ma (60) (16) = 960 N

108. As velocity of an object is increasing uniformly so it's acceleration is constant.

109. When velocity of an object changes equally in equal intervals of time then acceleration is said to be uniform.

110. $v = u + at \Rightarrow v = 0 + 5 \times 10 = 50 m/s$

111. $S_n = u + \dfrac{a}{2}(2n - 1) \Rightarrow 1.2 = 0 + \dfrac{a}{2}(2 \times 6 - 1)$

$\Rightarrow a = \dfrac{1.2 \times 2}{11} = 0.218 m/s^2$

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112. Here $v = 144\ km/h = 40 m/s$

$v = u + at \Rightarrow 40 = 0 + 20 \times a \Rightarrow a = 2\ m/s^2$

$\therefore s = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times (20)^2 = 400\ m$

113. $a = \frac{F}{m} = \frac{20}{4} = 5 ms^{-2}$ (Common acceleration)

$F = ma$

$F = 3 \times 5 = 15 N$

114. Time of flight $= \frac{2u}{g} = \frac{2 \times 100}{10} = 20$ sec

115. $F = ma \Rightarrow a \propto F$

$a = \frac{F}{m} = \frac{1}{0.1} = 10\ m\ s^{-2}$

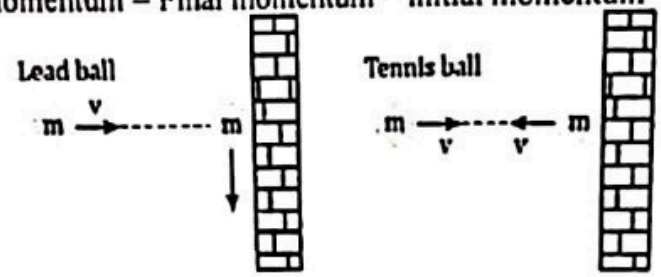
116.

117. $F = ma = 10 \times 10 = 100\ N$

118. Rate of change of momentum is equal to applied force

So, $F = \frac{\Delta p}{\Delta t}$

119. The tennis ball suffers a greater change in momentum as compared with the lead ball.
Change in the momentum = Final momentum – initial momentum



For lead ball, $\Delta\vec{p}_{lead} = 0 - m\vec{v} = -m\vec{v}$

For tennis ball, $\Delta\vec{p}_{tennis} = -m\vec{v} - m\vec{v} = -2m\vec{v}$

i.e. tennis ball, suffers a greater change in momentum.

120. Statement of law of conservation of momentum.

121. $\Delta p = F \times t$

$F = \frac{\Delta p}{t} = \frac{25}{0.05} = 500\ N$

122. $t_1 = \frac{2u\sin\theta}{g}, t_2 = \frac{2u\cos\theta}{g}$

$t_1 t_2 = \frac{2u^2 \sin 2\theta}{g^2} = \frac{2R}{g}$

123. Impulse=change in momentum

$I = mu - m(-v)$

$= m(u+v) = 0.5 \times (30+20) = 25\ N\ s$

124. $F = \frac{\Delta p}{t}$

$t = \frac{mv}{F} = \frac{1 \times 30}{6}$

$t = 5s$

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125. For an object with zero acceleration, or moving at uniform speed, the different forces acting on it add up to zero. When the resultant force is zero, this does not mean there are no forces acting on the object.

126. Kinetic energy is conserved for elastic collision.

$$\frac{1}{2}mv^2+\frac{1}{2}mv^2=mv^2$$

127. $$u=\frac{m_1v_1+m_2v_2}{m_1+m_2}$$

$$u=\frac{2mv+3m(-v)}{m+3m}$$

$$u=\frac{2mv-3mv}{4m}=\frac{-mv}{4m}$$

$$u=\frac{-v}{4}$$

128. $$h=\frac{v_i^2}{2g}$$

129. $$v_{av}=\frac{S}{t}=\frac{150}{40}=3.75ms^{-1}$$

$$\left|\overrightarrow{v_{av}}\right|=\frac{|\vec{d}|}{t}=\frac{50}{40}=1.25ms^{-1}$$

130. At maximum height projectile have minimum velocity as $v_y=0$

131. $T=\frac{v_i\sin\theta}{g}$ is the time taken to reach maximum height

132. For complementary angles ranges are same.

$$\theta_1+\theta_2=90°$$

133. Path followed by projectile is known as its trajectory.

134. Relative velocity of A with respect B $V_{AB}=V_A-V_B=10-(-5)=15$ m/s

Time required to cover distance A to B, $t=\frac{S}{V_{AB}}=\frac{60}{15}=4sec$

Hence, at 4 sec they both collide and stick together
In 4 sec, distance covered by A $S=V_A t=10\times4=40$ m
They both collide at 40m from A

135. $$S_1=\frac{1}{2}gt^2$$

$$S_2=v_it-\frac{1}{2}gt^2$$

$$S_1+S_2=v_it$$

$$30=(30)t$$

$$t=1sec$$

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136. According to statement of 2nd law of motion.

137. $v=\sqrt{v_{ix}^2+g^2t^2}$

$=\sqrt{30^2+10^2\times4^2}=50$

138. $F_{net}=ma$

Force due to cable – weight = ma

$7500-5000=500a$

$a=5.0\ m/s^2$

139. In vacuum air resistance is zero. So, A freely falling body has constant acceleration ($a=g$).

140. The force causing a car to accelerate comes from the frictional force between the wheels and the road.

141. $m=\frac{F}{a}=\frac{10\sqrt{2}}{1}=10\sqrt{2}kg$

142. Newton's third law of motion

143. $F=\frac{\Delta p}{\Delta t}=\frac{m\Delta v}{\Delta t}=1\ kgms^{-2}$

144. According to Newton's third law of motion the reaction of the 5th coin (counted from bottom) on 6th coin is 4 mg

145. Newton's third law of motion

146. $t=\frac{mv}{F}=\frac{1\times30}{6}=5sec$

147. $F_{net}=ma=0.6\times4=2.4\ N$

Friction = $12-2.4=9.6\ N$

148. $a=\frac{F}{m}=\frac{Fg}{w}=\frac{5\times9.8}{9.8}=5ms^{-2}$

149. $\vec{r}_1=3\hat{i}+4\hat{j}$

$\vec{r}_2=5\hat{i}+7\hat{j}$

$\vec{d}=\vec{r}_2-\vec{r}_1$

$\vec{d}=2\hat{i}+3\hat{j}$

150. Action and reaction never act on the same body.

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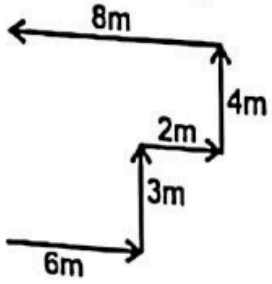
BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **What is the displacement of the moving body, shown in the following figure?**

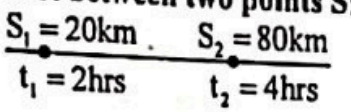


A. 6 m
B. 7 m
C. 8 m
D. 23 m

2. **Acceleration due to uniform velocity of a body is:**
A. positive
B. negative
C. maximum
D. zero

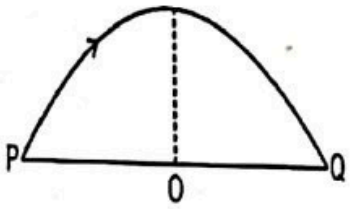
3. **Third equation of motion is independent of:**
A. Time
B. Displacement
C. Velocity
D. Acceleration

4. **What is the speed of the cyclist between two points S_1 and S_2 as shown in figure?**



A. 10 km h^{-1}
B. 20 km h^{-1}
C. 30 km h^{-1}
D. 50 km h^{-1}

5. **What is the velocity of an object when it reaches from point P to point Q in 2 s along a semicircle of radius 2m?**

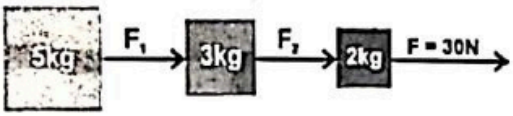


A. Zero
B. 1 ms^{-1}
C. 2 ms^{-1}
D. 4 ms^{-1}

6. **The SI unit of weight is:**
A. Gram
B. Kilogram
C. Pound
D. Newton

7. **What is the acceleration produced by a force of 0.5 N applied on a body of mass 0.1 kg?**
A. 0.1 ms^{-2}
B. 0.5 ms^{-2}
C. 1 ms^{-2}
D. 5 ms^{-2}

8. **Three masses which are connected by a massless spring are shown in the figure. What will be the value of force F_2?**



A. 15 N
B. 18 N
C. 24 N
D. 30 N

9. **Rate of change of momentum is:**
   A. Impulse
   B. Force
   C. Torque
   D. Velocity

10. **Impulse has always changed.**
   A. Energy
   B. Momentum
   C. Velocity
   D. Acceleration

11. **In one dimensional elastic collision of two bodies of same masses, what will happen if the moving body collides with the mass which is initially at rest?**
   A. Their velocities will be interchanged
   B. Velocities of both bodies will be zero
   C. Moving body will continue its motion
   D. Moving body will come at rest and the mass at rest will start its motion

12. **In projectile motion, the horizontal component of acceleration of a body is:**
   A. Zero
   B. Accelerated
   C. Decelerated
   D. Maximum

13. **At what angle a projectile gains its maximum height.**
   A. 0°
   B. 45°
   C. 60°
   D. 90°

14. **A rocket works on basis of:**
   A. Newton's 1st law
   B. Newton's 2nd law
   C. Newton's 3rd law
   D. Newton's gravitational law

15. **The vertical and horizontal distances of the projectile will be equal if angle of projection is:**
   A. 45°
   B. 56°
   C. 66°
   D. 76°

16. **The quantitative measure of inertia of a body is its:**
   A. Mass
   B. Weight
   C. Velocity
   D. Momentum

ANSWER KEY

1	B	6	D	11	A	16	A
2	D	7	D	12	A		
3	A	8	C	13	D		
4	C	9	B	14	C		
5	C	10	B	15	D		

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KPK TEXT BOOK EXERCISE MCQs

1. A ball is thrown vertically upwards at 19.6 m/s. for its complete trip (up and back down to the starting position), its average speed is:
   A. 19.6 m/s
   B. 9.8 m/s
   C. 6.5 m/s
   D. 4.9 m/s

2. If you throw a ball downward, then its acceleration immediately after leaving your hand, assuming no air resistance, is:
   A. 9.8 m/s^2
   B. less than 9.8 m/s^2
   C. more than 9.8 m/s^2
   D. speed of throw is required for answer

3. The time rate of change of momentum gives:
   A. Force
   B. Impulse
   C. Acceleration
   D. Power

4. The area between the velocity-time graph is numerically equal to:
   A. Velocity
   B. Displacement
   C. Acceleration
   D. Time

5. If the slope of velocity-time graph gradually decreases, then the body is said to be moving with:
   A. Positive acceleration
   B. Negative acceleration
   C. Uniform velocity
   D. Zero acceleration

6. A 7.0 kg bowling ball experiences a net force of 5.0 N. what will be its acceleration.
   A. 35 m/s^2
   B. 7.0 m/s^2
   C. 5.0 m/s^2
   D. 0.71 m/s^2

7. SI unit of impulse is:
   A. kg ms^{-2}
   B. Ns
   C. N s^{-1}
   D. Nm

8. A ball with original momentum +4.0 kg×m/s hits a wall and bounces straight back without losing any kinetic energy. The change in momentum of the ball is:
   A. +4Ns
   B. -4 Ns
   C. +8 Ns
   D. -8Ns

9. A body is traveling with a constant acceleration of 10 ms^{-2}. If S_1 is the distance traveled in 1st second and S_2 is the distance traveled in 2nd second, which of the following shows a correct relation between S_1 and S_2.
   A. $S_1 = S_2$
   B. $S_1 = 3S_2$
   C. $S_2 = 3S_1$
   D. $2S_2 = 3S_1$

10. During projectile motion, the horizontal component of velocity:
    A. Changes with time
    B. Becomes zero
    C. Remains constant
    D. Increase with time

11. A projectile is thrown horizontally from a 490m high cliff with a velocity of 100 ms^{-1}. The time taken by projectile to reach the ground is:
    A. 2.5 s
    B. 5.0 s
    C. 7.5 s
    D. 10 s

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12. **A projectile is launched at 45° to the horizontal with an initial kinetic energy Assuming air resistance to be negligible what will be the kinetic energy of the project when it reaches its highest point?**

A. 0.50 E
B. 0.71 E
C. 0.70 E
D. E

13. **To improve the jumping record, the long jumper should jump at an angle of:**

A. 30°
B. 45°
C. 60°
D. 90°

14. **Range of a projectile on a horizontal plane is same for the following pair of angles:**

A. 15° and 18°
B. 43° and 47°
C. 20° and 80°
D. 52° and 62°

ANSWER KEY

1	B	6	D	11	D
2	A	7	B	12	A
3	A	8	D	13	B
4	B	9	C	14	B
5	A	10	C		

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PAST PAPERS 2008-2020

1. **Force in terms of base units is expressed as:** (UHS 2008)
   A. kg ms^{-2}
   B. kg m^2s^{-2}
   C. kg m^2s^{-3}
   D. kg ms^{-3}

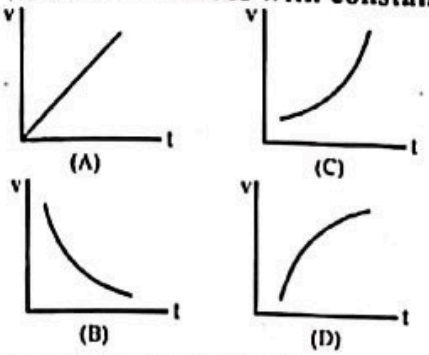
2. **An _____ missile is called a ballistic missile.** (UHS 2008)
   A. un-powered and guided
   B. un-guided and powered
   C. Powered and guided
   D. Un-powered and un-guided

3. **If the force of magnitude 8 N acts on a body in direction making an angle 30°, its "x" and "y" components will be:** (UHS 2009)
   A. $F_x = 3\sqrt{3}$ N, $F_y = 4$ N
   B. $F_x = 4\sqrt{3}$ N, $F_y = 4$ N
   C. $F_x = 4\sqrt{3}$ N, $F_y = 8$ N
   D. $F_x = 8$ N, $F_y = 4\sqrt{3}$ N

4. **If the body is rotating with uniform angular velocity, then its torque is:** (UHS 2009)
   A. zero
   B. Clockwise
   C. Maximum
   D. Remains the same

5. **A body is moving with an initial velocity of 2 kms^{-1}. After a time of 50 s its velocity becomes 1.5 kms^{-1}. Its acceleration will be:** (UHS 2009)
   A. 30 ms^{-2}
   B. 40 ms^{-2}
   C. – 20 ms^{-2}
   D. – 10 ms^{-2}

6. **When a car moves with constant acceleration, the velocity-time graph is:** (UHS 2009)



7. **In elastic collision, when a massive body collides with light body at conditions $m_1 >> m_2$ and $v_2 = 0$ ms^{-1}, then the change in velocity will be written as:** (UHS 2009)
   A. $v_1' \approx -v_1$; $v_2' \approx v_1$
   B. $v_1' \approx v_1$; $v_2' \approx 0$
   C. $v_1' \approx v_1$; $v_2' \approx 2v_1$
   D. $v_1' \approx -v_1$; $v_2' \approx 0$

8. **The horizontal range of a projectile, at a certain place, is completely determined by:** (UHS 2010)
   A. The angle of projection
   B. The initial velocity of projection
   C. The mass of the projectile
   D. Speed and mass of the projectile

9. **For a body to be in complete equilibrium:** (UHS 2010)
   A. Linear acceleration is zero
   B. Angular acceleration is zero
   C. Linear acceleration is zero but angular acceleration is not zero
   D. Linear acceleration and angular acceleration both should be zero

10. **Time of projectile's flight is:** (UHS 2010)
    A. $\frac{v_i^2 \sin^2\theta}{g}$
    B. $\frac{2v_i \sin\theta}{g}$
    C. $\frac{v_i^2 \sin\theta}{g}$
    D. $\frac{v_i^2}{g}\sin 2\theta$

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11. If the velocity of the body changes by equal amount in equal intervals of time, the body is said to have: (UHS 2010)
A. variable velocity
B. uniform velocity
C. Uniform acceleration
D. Negative acceleration

12. For finding the height of projectile, the equation used is: (UHS 2010)
A. $2S = a(v_f^2 - v_i^2)$
B. $S = 2a(v_f^2 - v_i^2)$
C. $2aS = v_f^2 - v_i^2$
D. $a = 2S(v_f^2 - v_i^2)$

13. If a force of 12N is applied on a body and its momentum is changed from 60 $kgms^{-1}$ to 36 kg ms^{-1}, then find the time during, which this force acts: (UHS 2010)
A. 1 second
B. 2 seconds
C. 12 seconds
D. 24 seconds

14. The ratio of displacement along diameter and total distance along circle: (UHS 2017)
A. $1 : \pi$
B. $\pi : 1$
C. $2 : \pi$
D. $\pi : 2$

15. Arshad is driving down 7th street. He drives 150 meter in 18 seconds. Assume he does not speed up or slow down. What is his speed? (UHS 2017)
A. 0.38m/s
B. 126m/s
C. 8.33m/s
D. 58.33m/s

16. The distance travelled by a moving car with velocity 15 m/s in 2 seconds, decelerates at $2m/s^2$ is equal to: (UHS 2017)
A. 30m
B. 34m
C. 16m
D. 26m

17. If slope of velocity time graph is not constant at different points then body is moving with: (UHS 2018)
A. constant acceleration
B. Average acceleration
C. Increasing acceleration
D. uniform velocity

18. Newton first law of motion is also known as: (UHS 2018)
A. Law of conservation of momentum
B. Law of inertia
C. Law of electromagnetism
D. Law of universal gravity

19. A cyclist is travelling at 15 ms^{-1}. She applies brakes so that she doesn't collide with the wall in front of her at a distance of 18 m. Calculate the magnitude of deceleration: (UHS 2018)
A. 6.3 ms^{-2}
B. 12.5 ms^{-2}
C. 5.3 ms^{-2}
D. 13 ms^{-2}

20. For projectile motion in the absence of air resistance: (UHS 2019)
A. vertical speed is constant
B. horizontal force is constant
C. horizontal acceleration is zero
D. vertical acceleration is zero

21. The range of the projectile depends upon the velocity of the projection and angle of the projection i.e 45°. For a fixed velocity, when the angle of projection is larger than 45°, which of the following is correct? (UHS 2019)
A. Both the height and the range attained by the projectile will be less
B. Both the height and the range attained by the projectile will be more
C. The height attained by the projectile will be less but the range is more
D. The height attained by the projectile will be more but the range is less

22. If two objects of equal masses "m" are moving towards each other with the same speeds "v" then what will be the total final momentum after elastic head-on collision: (UHS 2019)

A. –mv kg/s
B. mv kg m/s
C. 2mv kg/s
D. 0 kg m/s

23. Under what condition an object will have zero displacement but non zero distance? (PMC 2020)

A. linear motion
B. circular motion
C. random motion
D. oscillation

24. The slope of distance – time graph will always be: (PMC 2020)

A. negative
B. positive
C. zero
D. maximum

25. At what angle of projection of a projectile the range becomes half of its maximum value? (PMC 2020)

A. 15°
B. 30°
C. 20°
D. 40°

26. If we drop an object, its initial velocity is zero. How far will it fall in time't'? (PMC 2020)

A. $9.8t^2$
B. $4.9\ t^2$
C. $0.49t^2$
D. $98\ t^2$

27. The newton – second is unit of: (PMC 2020)

A. work
B. power
C. impulse
D. momentum

ANSWER KEY

1	A	11	B	21	D
2	D	12	C	22	D
3	B	13	B	23	B
4	A	14	A	24	B
5	D	15	C	25	A
6	A	16	D	26	B
7	C	17	C	27	C
8	A	18	B		
9	D	19	A		
10	B	20	C		

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SOLUTIONS

1. $F = ma$

Units of "F" = $kg\ ms^{-2}$

2. An un-powered and un-guided missile is called a ballistic missile.

3. $F_x = F\cos\theta = (8)\cos 30^\circ = (4)(2)\left(\frac{\sqrt{3}}{2}\right) = 4\sqrt{3}\ N$

$F_y = F\sin\theta = (8)\sin 30^\circ = (4)(2)\left(\frac{1}{2}\right) = 4\ N$

4. $\tau = I\alpha$

$\omega = \text{constant} \Rightarrow \Delta\omega = 0 \Rightarrow \alpha = 0$

$\tau = I(0) = 0$

5. $a = \frac{v_f - v_i}{\Delta t} = \frac{1500 - 2000}{50} = \frac{-500}{50} = -10\ ms^{-2}$

6. Slope of v-t graph = Acceleration

As body moves with constant acceleration, so v-t graph will be a straight line (slope = constant)

7. $v'1 \approx \left(\frac{m1 - 0}{m1 + 0}\right)v1 + \left(\frac{2m2(0)}{0 + m2}\right)$

$v'1 \approx \left(\frac{m1}{m1}\right)v1 + 0$

$v'1 \approx v1 + 0$

$v'1 \approx v1$

$v'2 \approx \left(\frac{2m1v1}{m1 + 0}\right) + \left(\frac{0 - m1}{m1 + 0}\right)(0)$

$v'2 \approx \left(\frac{2m1v1}{m1}\right) + 0$

$v'2 \approx 2v1$

8. $R = \frac{v_i^2}{g}\sin 2\theta$

The most important parameter in the range of projectile is angle of projection as compared to initial velocity of projectile.

9. For a body to be in complete equilibrium both 1st and 2nd conditions of equilibrium must be satisfied.

i. $\Sigma \vec{F} = \vec{0}$ (Linear acceleration = 0)

ii. $\Sigma \vec{\alpha} = \vec{0}$ (Angular acceleration = 0)

10. Time of flight $= \frac{2v_i\sin\theta}{g}$

11. Definition of uniform velocity.

12. $2aS = v_f^2 - v_i^2$

$2a_y y = v_{fy}^2 - v_{iy}^2$

$2(-g)h = (0)^2 - (v_i\sin\theta)^2$

$-2gh = -v_i^2\sin^2\theta$

$2gh = v_i^2\sin^2\theta$

$h = \frac{v_i^2\sin^2\theta}{2g}$

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13. $F = \frac{\Delta P}{\Delta t} \Rightarrow \Delta t = \frac{P_f - P_i}{F} = \frac{36-60}{12} = \frac{-24}{12} = -2\,s$

Time can never be negative.

14. $\frac{\text{Displacement}}{\text{Total distance of circle}} = \frac{2r}{2\pi r} = \frac{1}{\pi} = 1:\pi$

15. $v = \frac{S}{t} = \frac{150}{18} = 8.33\ m/s$

16. $S = v_i t + \frac{1}{2}at^2 = (15)(2) + \frac{1}{2}(-2)(2)^2$

$S = 30 - 4 = 26\ m$

17. Slope of v-t graph = Acceleration

In case of increasing acceleration, slope will be different at different points of graph.

18. Newton first law of motion is also known as Law of inertia.

19. $2aS = vf2 - vi2 \Rightarrow 2(a)(18) = 0 - 152$

$a = \frac{-225}{36} = -6.3\ m/s2$

20. $F_x = ma_x$

As there is no net force along the horizontal direction. So, horizontal acceleration (a_x) is zero.

21. $R = \frac{v_i^2}{g}\sin 2\theta \Rightarrow R \propto \sin 2\theta$

$H = \frac{v_i^2}{g}\sin^2\theta \Rightarrow H \propto \sin^2\theta$

If angle of projection is larger than 45°, then value $\sin^2 0$ is more than $\sin 2\theta$.

22. Initial momentum = mv + (−mv) = 0

In elastic collision momentum remains constant. So, Final momentum = 0

23. For a body moving in a circular path displacement is zero but distance can never be zero.

24. Slope of distance time graph represents speed and speed for a moving object can never be negative because speed is scalar quantity.

25. $R = R_{max}\sin 2\theta$

$\frac{R_{max}}{2} = R_{max}\sin 2\theta$

$\sin 2\theta = \frac{1}{2}$

$2\theta = 30°$

$\theta = 15°$

26. $Y = \frac{1}{2}gt^2 = \frac{1}{2}9.8t^2 = 4.9t^2$

27. $F \times \Delta t = \Delta p = I \Rightarrow Ns = kgms^{-1}$

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Q.1 A car travels 30m towards east, the it takes turn and travel 40 m towards west, i average velocity after 60s

A. $10ms^{-1}$ B. $1/6\ ms^{-1}$
C. $7/6\ ms^{-1}$ D. $-5\ ms^{-1}$

Q.2 Displacement of sun with respect to earth is

A. r B. $2\pi r$
C. 2r D. r^2

Q.3 Instantaneous velocity is

A. Always positive B. Always negative
C. Positive and negative D. Not enough info

Q.4 If the displacement = 15m and time = 10seconds the average velocity is

A. 12.5m/s B. 1.5 m/s
C. 2.5m/s D. 3m/s

Q.5 Instantaneous velocity for a displacement function dt = 2 – 2t at any time is given by

A. -2t B. 2t
C. 2 D. -2

Q.6 Decrease in velocity per unit time is called

A. Acceleration B. deceleration
C. positive acceleration D. uniform acceleration

Q.7 An object is moving with constant speed, which of the following is always true?

A. Distance is greater than displacement B. distance is lesser than displacement
C. distance is equal to displacement D. we cannot answer

Q.8 Acceleration of moving car when brakes are applied

A. Positive B. negative
C. zero D. none of these

Q.9 If the velocity versus time graph of an object is a horizontal line, the object is

A. moving with zero acceleration.
B. moving with constant non-zero acceleration.
C. at rest.
D. moving with increasing speed

Q.10 The newton-second is unit of:

A. Work B. Impulse
C. Momentum D. Both 'B' and 'C'

Q.11 Accelerating frame of reference which has constant acceleration is

A. constant moving car B. moving train
C. free falling body on earth D. none of these

Q.12 Vertical velocity vs time graph for a projectile motion

A. varies linearly B. follow a parabolic path
C. is constant D. is linear

Q.13 Pseudo forces arises in

A. Inertial frame B. constant moving frame
C. rest frame of reference D. accelerating frame of reference

Q.14 The frame of reference could be

A. Fixed always B. not fixed always
C. at rest D. none of these

Q.15 The magnitude of displacement is
A. Size of object A
B. Straight line distance between initial and final position
C. Size of object B
D. Any distance between initial and final position

Q.16 The acceleration of a moving object can be found from
A. area under displacement-time graph
B. slope of displacement-time graph
C. area under velocity-time graph
D. slope of velocity-time graph

Q.17 The coefficient of restitution for a perfectly elastic collision is
A. 1
B. 0
C. ∞
D. -1

Q.18 Walking is possible on the account of
A. Newton's First Law of Motion
B. Newton's Second Law of Motion
C. Newton's Third Law of Motion
D. Newton's Law of Gravitation

Q.19 If force is doubled by keeping mass constant then acceleration will be
A. Doubled
B. Halved
C. Quadrupled
D. 3 times

Q.20 Newton's 3rd law is derived from
A. Newton's 1st law
B. Newton's 2nd law
C. both
D. none

Q.21 Force exerted by the wall on the water will be
A. F = mv/t
B. F= - mv/t
C. Both a and b
D. None

Q.22 If car and Truck move with same velocity and we Applied same force on other which body comes rest first
A. Car
B. Truck
C. Both
D. None

Q.23 If the maximum horizontal range is 400m then what will be the height attained by the projectile
A. 100m
B. 300m
C. 400m
D. 800m

Q.24 According to 2nd law of motion, which is correct?
A. acceleration is directly related to mass
B. acceleration is inversely related to force
C. acceleration is not related to mass
D. none of these

Q.25 Car weighing 1000kg has velocity 50 km per hour If mass of 250kg is placed in this then velocity become
A. 25 Km/h
B. 50 Km/h
C. 10 Km/h
D. 40 Km/h

Q.26 Dimension of momentum is same as
A. Impulse
B. Power
C. Planks constant
D. All

Q.27 In which situation, distance is three times than its displacement?
A. object moves and come back to its initial position
B. object moves 20 m towards east and 10 m towards west
C. object moves 20 m towards east and 10 m towards south
D. object moves 20 m towards north and 10 m towards west

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Q.28 SI unit of acceleration is:_____
A. m
B. m^2
C. m/s
D. m/s^2

Q.29 Horizontal velocity vs time graph for a projectile motion is
A. varies linearly
B. follows a parabolic path
C. is a straight line at certain angle
D. is a straight line parallel to time axis

Q.30 Acceleration of object which starts from rest to reach 20 m/s in 10 sec is
A. $2m/s^2$
B. $10m/s^2$
C. $1 m/s^2$
D. $2m/s^2$

Q.31 If a projectile is launched with 3m/s velocity at 60-degree angle, then at highest point its horizontal velocity is
A. 3 m/s
B. 2m/s
C. 1.5 m/s
D. 1.8 m/s

Q.32 If velocity varies with time in quadratic manner, then acceleration
A. Constant
B. Zero
C. linearly varying
D. varies as t^3

Q.33 The magnitude of the displacement is: _____
A. size of object A
B. straight line distance between the initial position and the final position of the body
C. size of object B
D. any distance between the initial position and the final position of the body

Q.34 The net force acting in an inertial frame is
A. positive
B. negative
C. zero
D. none of these

Q.35 An object moves 20 m in 5 sec. What is the gradient of the displacement-time graph?
A. 25
B. 15
C. 4
D. 1/4

Q.36 Circular motion of a particle while attached to a string centripetal acceleration is provided by
A. Tension in string
B. gravitational force
C. Normal force
D. none of these

Q.37 Passengers sitting in a stationary car experience a jerk when the car suddenly starts. This is due to
A. inertia of motion
B. inertia of rest
C. inertia of turning
D. inertia of acceleration

Q.38 For a linear relationship between displacement and time we get d-t graph as
A. straight line passing through origin
B. straight line parallel to t- axis
C. quadratic relationship
D. cubic relationship

Q.39 At every point of trajectory of projectile which of the following quantities is always zero
A. horizontal velocity
B. total velocity
C. vertical acceleration
D. horizontal acceleration

Q.40 Acceleration of a moving car when brakes are applied is
A. negative
B. zero
C. positive
D. infinite

Q.41 A horizontal line in displacement-time graph represents:_____
A. uniform accelerated motion
B. motion with constant velocity
C. motion with constant speed
D. body at rest

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Q.42 A motion with uniform negative acceleration can be represented on displacement-time graph by:

A. a horizontal line
B. a curve line with decreasing gradient
C. a straight line with constant gradient
D. a curve line with increasing gradient

Q.43 Displacement is a:

A. tensor
B. vector
C. scalar
D. None of these

Q.44 Average speed of an object after completing a circle of 5 m radius in 5 seconds

A. 2π
B. π
C. zero
D. 10π

Q.45 Centripetal acceleration always acts_____ the center

A. away
B. towards
C. normally
D. tangentially

Q.46 Pseudo forces arises in:

A. inertial frames
B. constant moving frames
C. rest frame of reference
D. accelerating frame of reference

Q.47 An object moves 20 m towards east and then 10 m towards west, in 5 sec. What is its average velocity and average speed?

A. speed = 6 m/s velocity = 2 m/s
B. speed = 6 m/s velocity = 6 m/s
C. speed = 2 m/s velocity = 2 m/s
D. speed = 2 m/s velocity = 6 m/s

Q.48 The acceleration is a:

A. vector quantity
B. scalar quantity
C. dimensionless quantity
D. none of these

Q.49 If the velocity of an object is increasing with time, then acceleration is

A. negative
B. positive
C. zero
D. none of the above

Q.50 If displacement-time graph is a curve, which of the following is correct:

A. area under graph represent displacement
B. gradient of the graph is constant
C. gradient of the graph represents acceleration
D. gradient of the graph represents velocity

Q.51 Unit of instantaneous velocity is

A. m/s^2
B. m/s
C. m
D. 1/s

Q.52 If an object moves with constant speed, then its acceleration always is

A. zero
B. nonzero
C. infinite
D. none of these

Q.53 Accelerating frame of reference which has constant acceleration is

A. constant moving car
B. moving train
C. freely falling body on earth
D. none of these

Q.54 If a car moves from 15 m/s to 5 m/s in 10 sec then average acceleration is

A. 1 m/s2
B. 2m/s2
C. 5 m/s2
D. 10m/s2

Q.55 Rate of change of displacement with respect to time is

A. acceleration
B. velocity
C. speed
D. power

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Q.56 When an object moves on a circular path and come back to its initial position, then:
A. only its distance is zero
B. only its displacement is zero
C. neither distance nor displacement is zero
D. both distance and displacement is zero

Q.57 A bullet moving with a speed of 100 ms^{-1} can just penetrate two planks of equal thickness. Then, the number of such planks penetrated by the same bullet when the speed is doubled will be:
A. 6 B. 10
C. 4 D. 8

Q.58 Under what condition an object will have zero displacement but non-zero distance.
A. Linear motion B. Circular motion
C. Random motion D. Oscillation

Q.59 What is the acceleration of a projectile relative to another projectile?
A. 0 B. g
C. 2g D. –2g

Q.60 If the flock of birds is flying, total momentum will be zero if
A. Taking off from the ground B. Very tired and coming down to rest
C. Flying in opposite direction D. Flying in same direction

Q.61 The slope of distance – time graph will always be:
A. Negative B. Positive
C. Zero D. Maximum

Q.62 At what angle of projection of a projectile the range becomes half of its maximum value.
A. 14° B. 15°
C. 20° D. 40°

Q.63 If we drop an object, its initial velocity is zero. How far will it fall in time 't'?
A. $9.8\ t^2$ B. $4.9\ t^2$
C. $0.49\ t^2$ D. $98\ t^2$

Q.64 The slope of velocity-time graph represents
A. displacement B. acceleration
C. force D. Momentum

Q.65 An object is accelerating
A. only when its speed changes. B. only when its direction changes.
C. when its speed or direction changes. D. if its velocity is large

Q.66 What is the slope of a straight line graph of position vs time?
A. Velocity B. Displacement
C. Distance D. Acceleration

Q.67 The coefficient of restitution e for a perfectly inelastic collision is
A. 1 B. 0
C. Infinity D. -1

Q.68 When two bodies stick together after the collision, the collision is said to be
A. Partially elastic collision B. Totally elastic collision
C. Totally inelastic collision D. None of the above

Q.69 What is the accelerating force on the Diwali rocket if it ejects 0.05 kg of gases per second at a velocity of 400 m/s?
A. 20 N B. 20 dynes
C. 1000 N D. 22 dynes

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Q.70 If mass is 2 kg and velocity is 35 m/s, then momentum is
A. 70 kg m/s B. 90 kg m/s
C. 17.5 kg m/s D. 105 kg m/s

Q.71 The momentum of particle changes when
A. Energy is changed B. Force is applied
C. both D. None

Q.72 The speed of object in particular direction is called
A. Velocity B. acceleration
C. force D. momentum

Q.73 The acceleration time graph for projectile motion will be
A. Parabola B. Nonlinear
C. Straight line D. inclined

Q.74 A mass accelerate uniformly when resultant force acting on it is
A. Zero B. Constant but not zero
C. Increasing uniformly with respect to time D. Both a & b

Q.75 Which law of motion define force?
A. 1st Law B. 2nd Law
C. 3rd Law D. All of these

Q.76 Displacement time graph slope gives us unit of
A. m/sec B. m/sec^2
C. sec D. m

Q.77 Kg m/s^2 is unit of
A. Force B. Momentum
C. Both D. None

Q.78 Instantaneous velocity is defined as
A. dx/dt B. $\Delta x/\Delta t$
C. $\Delta x.\Delta t$ D. $\Delta v/\Delta t$

Q.79 Which of the given motion is a type of 2D motion?
A. Circular B. Pendulum motion
C. Projectile motion D. All of these

Q.80 If an object moves with constant velocity, then its acceleration is:
A. zero B. nonzero
C. infinite D. none of these

Q.81 When a stone is thrown horizontally with 2m/s from a building of height 5 m then just before hitting ground its acceleration is:
A. 12 m/s^2 B. 13 m/s^2
C. 9.8 m/s^2 D. 7.6 m/s^2

Q.82 The displacement between A and B is defined as:
A. change in position of an object from a to b
B. any distance between two points
C. longest distance from a to b
D. longest distance between two points

Q.83 If a car starts from rest and reaches 20 m/s velocity in 10 m distance, then acceleration is:
A. 20 m/s^2 B. 10 m/s^2
C. 5 m/s^2 D. 2m/s^2

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Q.84 The distance and displacement can be equal if:
A. an object moves on a circular path
B. an object oscillates
C. an object moves in a straight line
D. an object moves on a parabolic path

Q.85 Instantaneous velocity is defined at
A. particular displacement
B. instant acceleration
C. instant time
D. average time

Q.86 Acceleration of a moving train when it start its motion is:
A. negative
B. zero
C. positive
D. infinite

Q.87 If the velocity of particle is varying linearly with time then shape of d-t curve would be:
A. linear
B. quadratic
C. cubic
D. decreasing linearly

Q.88 If a car is travelling eastward and slowing down, what is the direction of acceleration?
A. eastward
B. westward
C. neither eastward nor westward
D. we cannot answer with this data

Q.89 The displacement has:
A. magnitude only
B. direction only
C. magnitude and direction
D. no unit

Q.90 Projectile motion of object on earth is always:
A. linear
B. parabolic
C. cubic
D. inverse

Q.91 When an object moves on a circular path, then:
A. its displacement is constant
B. its displacement changes due to change in distance
C. its displacement changes due to change in direction of motion
D. its displacement is always zero

Q.92 1 light year distance is:
A. distance travelled by earth in one year
B. distance travelled by star in one year
C. distance travelled by light in one year
D. distance travelled by light in one galactic year

Q.93 If we are moving with constant velocity frame then the inertial state is same as:
A. rest frame
B. accelerating frame
C. non-inertial frame
D. All of these

Q.94 A car travels 30 m toward east, then it takes turn and travels 40 m towards north. It takes 50 seconds. Its average velocity is:
A. 7/5 m/s
B. 1 m/s
C. 1/5 m/s
D. 5 m/s

Q.95 Average velocity of a object after a completing a circle of 5 m radius in 5 seconds:
A. 2π
B. π
C. zero
D. 10π

Q.96 In which case, the object is speeding up:
A. velocity is positive acceleration is negative
B. velocity is negative acceleration is negative
C. velocity is negative acceleration is zero
D. velocity is negative acceleration is positive

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Q.97 Acceleration describes how:
A. speed is changing
B. the speed and force are changing
C. the speed and direction of motion are changing
D. the direction of motion are changing

Q.98 If we apply 100 N force on 10 kg box then its acceleration is:
A. 20 m/s2
B. 5 m/s2
C. 10 m/s2
D. 40 m/s2

Q.99 Consider a displacement-time graph of an object moving along x-axis. Then negative gradient of the graph represents:
A. velocity in x-direction
B. velocity in negative x-direction
C. acceleration in x-direction
D. acceleration in negative x-direction

Q.100 Speed is a
A. tensor
B. vector
C. scalar
D. None of these

Q.101 Displacement of an object in moving around a complete circle is
A. $2\pi r$
B. $2r$
C. πr
D. zero

Q.102 Velocity is a
A. tensor
B. vector
C. scalar
D. None of these

Q.103 A straight moving bus takes a sharp right turn. What will happen to the passengers sitting inside the bus?
A. They will tilt rightwards
B. They will tilt leftwards
C. They will stay the way they were
D. They will start jumping

Q.104 People sitting in a moving bus experience a jerk when the bus stops. This is due to:
A. inertia of motion
B. inertia of rest
C. inertia of turning
D. inertia of acceleration

Q.105 We can calculate velocity of an object from displacement-time graph by:
A. calculating area under the graph
B. finding gradient of displacement-time graph
C. calculating area above the graph
D. finding the length of the graph

Q.106 A motion with increasing velocity can be represented on displacement-time graph by:
A. a horizontal line
B. a curve line with decreasing gradient
C. a straight line with constant gradient
D. a curve line with increasing gradient

Q.107 The acceleration of a moving object can be defined as:
A. rate of change in speed
B. rate of change in velocity
C. rate of change in distance
D. rate of change in displacement

Q.108 Acceleration of an object is defined as the rate of change of
A. displacement
B. time
C. velocity
D. distance

Q.109 At the highest point of trajectory which of the following quantities is zero
A. horizontal velocity
B. total velocity
C. vertical velocity
D. none of these

Q.110 Rockets use thrust forces which produces
A. constant acceleration
B. variable acceleration
C. constant velocity
D. linearly varying velocity

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Q.111 Which of the following vector is perpendicular to the vector $A = 2i + 3j + 4k$

A. $i + j + k$
B. $4i + 3j - 2k$
C. $i - 3j + k$
D. $i + 2j - 2k$

Q.112 Rate of change in displacement is known as:

A. speed
B. velocity
C. acceleration
D. momentum

Q.113 Acceleration is always _____ for a freely falling body

A. positive
B. negative
C. zero
D. none of these

Q.114 The value of acceleration due to gravity on moon is _____ of earth

A. 1/4 th
B. 1/10th
C. 2/3rd
D. 1/6th

Q.115 Inertia refers to tendency of object to:

A. beat rest
B. be at constant motion
C. remain in the same state as previous
D. be at accelerating motion

Q.116 Displacement and distance moved by an object in a straight path is

A. zero
B. same
C. different
D. not enough info

Q.117 Acceleration of a particle at any moment from a-t graph we calculate is called _____ acceleration

A. average
B. instantaneous
C. periodic
D. linear

Q.118 average velocity is defined as

A. displacement/time
B. distance/time
C. distance*time
D. displacement*time

Q.119 Acceleration of rolling object is zero at point of hill:

A. highest
B. lowest
C. middle
D. none of these

Q.120 Acceleration due to gravity near earth is

A. non-uniform
B. uniform
C. decreasing with distance
D. increasing with time

Q.121 Newton's first law applicable only in

A. accelerating frames
B. inertial frame
C. both A and B
D. non-inertial frames

Q.122 The value of acceleration due to gravity on earth is

A. 5 m/s^2
B. 6m/s^2
C. 15m/s^2
D. 9.8 m/s^2

Q.123 Projectile motion is not dependent on the of particle

A. initial velocity
B. mass
C. launch angle
D. acceleration

Q.124 Acceleration of earth around sun in its orbit is always

A. tangential
B. radial
C. zero
D. none of these

Q.125 If a squash ball comes back to its starting point after bouncing off the wall several times, then:

A. its total displacement is zero but its average velocity is non-zero
B. its total displacement is non-zero but its average velocity is zero
C. both its total displacement and its average velocity is non-zero
D. its total displacement is zero and so also is its average velocity

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Q.126 In elastic collision which of the following is constant

A. Momentum
B. Velocity
C. Force
D. All

In elastic collision, momentum, KE and total energy remain constant.

Q.127 Kinetic friction always than static friction

A. More
B. Less
C. Equal
D. None

Kinetic friction is always less than static friction.

Q.128 Momentum is the product of

A. Mass and velocity
B. Mass and force
C. Velocity and force
D. Force and displacement

Q.129 If Velocity time graph shape is parallel to Y-axis the acceleration

A. maximum
B. 0
C. infinity
D. minimum

Q.130 Body moves from rest with a constant acceleration of $5ms^{-2}$. Its instantaneous speed at the end of 10 seconds is:

A. 0.5 m/s
B. 2 m/s
C. 50 m/s
D. 5 m/s

Q.131 A train of length 200m is crossing a bridge 400m length at speed of 36kmh what is the totally time by train cross the bridge

A. 60s
B. 45s
C. 120s
D. 36s

Q.132 If one body is at rest then if we try to move it then it will resist by

A. inertia of motion
B. inertia of rest
C. inertia of turning
D. inertia of acceleration

Q.133 If the velocity varies linearly with time then acceleration is called

A. non-uniform
B. discrete
C. instantaneous
D. uniform

Q.134 Mass m1 has a velocity of 0m/s and mass m2 has a velocity of 5 m/s. Mass m1 >m2. Which one has larger inertia?

A. m2
B. m1
C. both m1 and m2
D. not enough information

Q.135 Consider a car is travelling for one hour. In which of the following cases the average velocity is zero?

A. car travels 20 km due east
B. car travels 60 km due east, then turns around and travels 40 km due west
C. car travels 70 km due east
D. car travels 30 km due west, then turns around and travels 30 km due east

Q.136 Newton's second law states that the rate of change of _____ is equal to external force

A. velocity
B. Mass
C. momentum
D. position

Q.137 Velocity of an object changes from 20 m/s to 50 m/s in 5 sec. What is the acceleration of the object?

A. 6 m/s
B. $6\ m/s^2$
C. 10 m/s
D. $10\ m/s^2$

Q.138 For a car which applies brakes from 10 m/s to stop the car in 10 sec its acceleration is

A. $1\ m/s^2$
B. $2m/s^2$
C. $-1\ m/s^2$
D. $-2\ m/s^2$

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Q.139 What is the FPS unit of displacement

A. kilometer
B. meter
C. Foot
D. pound

Q.140 A hunter aiming a bird in a tree should aim

A. a little below the bird
B. a little above the bird
C. exactly at the bird
D. very high

Q.141 Horizontal component of velocity of a bouncing ball is

A. affected by gravity
B. unaffected by gravity
C. affected by weight
D. affected by contact force

Q.142 A ball is dropped from a height 10m. The ball is embedded in sand 1m and stops, then

A. Only momentum remains conserved
B. Only kinetic energy remains conserved
C. Both momentum and K.E are conserved
D. Neither K.E nor momentum is conserved

Q.143 Which of the following is momentum closely related to?

A. Impulse
B. Power
C. Force
D. Kinetic energy

Q.144 An object will possess uniform motion as long as the

A. resultant force acting on it is zero
B. resultant force acting on it begins to decrease
C. resultant force is right angles to its rotation
D. resultant force on acting on it increases continuously

Q.145 In an elastic collision of two particles the following is conserved

A. Speed of each particle
B. Kinetic energy of each particle
C. Total kinetic energy of both the particles
D. Momentum of each particle

Q.146 The displacement is a:_____

A. Vector quantity
B. Scalar quantity
C. Neither vector nor scalar quantity
D. Dimensionless quantity

Q.147 Projectile motion has _____ acceleration at each point of trajectory

A. Variable
B. Constant
C. zero
D. None of these

Q.148 A projectile is launched with vertical Kinetic energy K at angle 0 then its variation with vertical displacement Y

A. Parabolic
B. periodic
C. hyperbolic trajectory
D. linear

Q.149 Projectile when launched at 90 degrees with respect to horizontal then its trajectory is

A. Parabolic
B. Periodic
C. hyperbolic trajectory
D. linear

Q.150 When an object moves in a straight line then:____

A. its displacement is equal to distance
B. its displacement is greater than distance
C. its displacement is less than distance
D. we cannot measure displacement

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ANSWER KEY

1	B	16	D	31	C	46	D	61	B	76	A	91	B	106	D	121	B	136	C
2	A	17	A	32	C	47	A	62	B	77	A	92	C	107	B	122	D	137	B
3	C	18	C	33	B	48	A	63	B	78	A	93	A	108	C	123	B	138	C
4	B	19	A	34	C	49	B	64	B	79	D	94	B	109	C	124	B	139	C
5	D	20	D	35	C	50	D	65	C	80	A	95	A	110	B	125	D	140	B
6	B	21	B	36	A	51	B	66	A	81	C	96	B	111	D	126	A	141	B
7	A	22	A	37	B	52	D	67	B	82	A	97	B	112	B	127	B	142	A
8	B	23	A	38	A	53	C	68	C	83	D	98	C	113	A	128	A	143	A
9	A	24	D	39	D	54	A	69	A	84	C	99	B	114	D	129	C	144	A
10	D	25	D	40	A	55	B	70	A	85	C	100	C	115	C	130	C	145	C
11	C	26	A	41	D	56	B	71	C	86	C	101	D	116	B	131	A	146	A
12	A	27	B	42	B	57	D	72	A	87	B	102	B	117	B	132	B	147	B
13	D	28	D	43	B	58	B	73	C	88	B	103	B	118	A	133	D	148	B
14	D	29	D	44	A	59	A	74	B	89	C	104	B	119	A	134	B	149	D
15	B	30	D	45	B	60	B	75	A	90	B	105	B	120	B	135	D	150	A

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UNIT 2 PRACTICE EXERCISE

WORK AND ENERGY

1. When the velocity of the body is doubled and the mass is halved the K.E will be:
   A. unchanged
   B. doubled
   C. halved
   D. four times

2. A mass of 10 g moving with velocity of 100 cm/s strikes a pendulum bob of mass 10 g. The two masses stick together. The maximum height reached by the system now is ($g = 10\ m/s^2$):
   A. zero
   B. 2.5 cm
   C. 5 cm
   D. 1.25 cm

3. A car moving with a speed of 50 km/h can be stopped by brakes after at least 6 m. If the same car is moving at a speed of 100 km/h the minimum stopping distance is:
   A. 6 m
   B. 12 m
   C. 18 m
   D. 24 m

4. As we move up a body, above the surface of Earth, the change in potential energy will always be:
   A. negative
   B. zero
   C. positive
   D. infinity

5. A body is moved along a straight line by a machine delivering a constant power. The distance moved by the body in time "t" is proportional to:
   A. $t^{1/2}$
   B. $t^{3/4}$
   C. $t^{3/2}$
   D. $t^{1/4}$

6. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60m tall building. After a fall of 30 m each towards Earth, their respective kinetic energies will be in the ratio of:
   A. 1 : 4
   B. 1 : 2
   C. $1 : \sqrt{2}$
   D. $\sqrt{2} : 1$

7. K.E is defined as dot product of:
   A. momentum and force
   B. average momentum and velocity
   C. force and velocity
   D. all of these

8. Absolute gravitational P.E. of an object at infinite height w.r.t Earth is taken as:
   A. negative
   B. minimum
   C. zero
   D. Positive

9. Work done by the frictional force can be:
   A. positive
   B. zero
   C. negative
   D. both A. and C.

10. A particle of mass "m_1" is moving with a velocity "v_1" and another particle of mass "m_2" is moving with a velocity "v_2". Both of them have the same momentum but their different kinetic energies are "E_1" and "E_2" respectively. If $m_1 > m_2$ then:
    A. $\frac{E_1}{E_2} = \frac{m_1}{m_2}$
    B. $E_1 > E_2$
    C. $E_1 = E_2$
    D. $E_1 < E_2$

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11. A stone is thrown up from the surface of the Earth when it reaches at maximum height, its K.E. is equal to:

A. mgh
B. zero
C. $\frac{1}{2}mv^2$
D. 2mgh

12. A body of mass 2kg moving having momentum and velocity 8 Ns and 4ms^{-1} respectively. Its K.E. equal to:

A. 16 J
B. 32 J
C. 8 J
D. 2 J

13. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain thrice as much as water from the same pipe in the same time, power of the motor has been increased:

A. 3 times
B. 9 times
C. 27 times
D. 81 times

14. Work done in moving a body along a closed path in a conservative field is:

A. Fd
B. zero
C. −mgh
D. mgh

15. A 2m tall man standing at the top of 30m tall tower raises a 1kg mass 0.5 m above his head. The P.E. of the raise mass will be (taking head as reference point): ($g = 10m/s^2$)

A. 5 J
B. 320 J
C. 25 J
D. All of these

16. A bomb of mass 12 kg at rest explodes into two pieces of masses 4 kg and 8 kg, the velocity of mass 8kg is 5 m/s. the kinetic energy of mass 4 kg is:

A. 100 J
B. 150 J
C. 200 J
D. 192 J

17. If mass of moving body is doubled its K.E. becomes:

A. 2 times
B. 5 times
C. 4 times
D. 16 times

18. If momentum of body decreased by 20%, then the percentage decrease in kinetic energy is:

A. 19 %
B. 21 %
C. 36 %
D. 42 %

19. 3 joules of work is done in 3 seconds, then power is:

A. 6 watt
B. 18 watt
C. 3 watt
D. 1 watt

20. Potential energy per unit volume is given by:

A. mgh
B. $\frac{mgh}{\rho}$
C. gh
D. ρgh

21. The K.E. of bullet of mass 500g moving at a speed of 200 ms^{-1} is:

A. 250 J
B. 2500 J
C. 125 J
D. 10000 J

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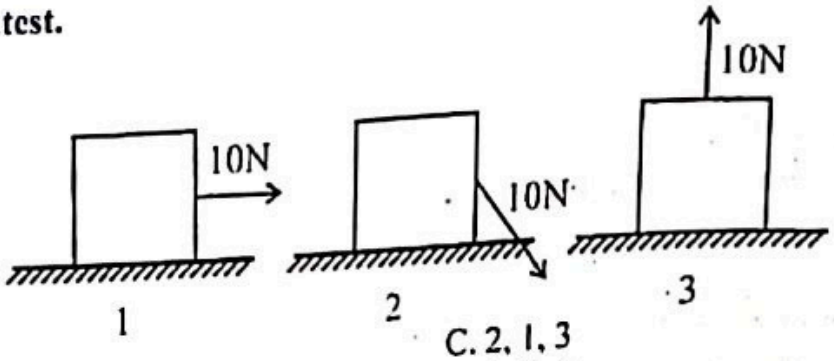
22. A crate moves 10m to the right on a horizontal surface as a woman pulls on it with a 10 N force. Rank the situations shown below according to the work done by her force least to greatest.



A. 3, 2, 1
B. 2, 3, 1
C. 2, 1, 3
D. 1, 3, 2

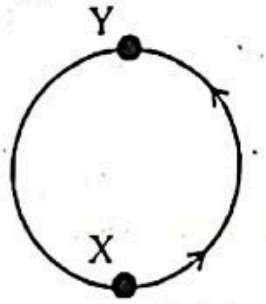
23. The work done by gravity during the descent of a projectile:
A. is positive
B. is negative
C. is zero
D. depends for its sign on the direction of the y axis

24. Kinetic energy of a body on Earth moving with speed "v" to that of the same body moving with speed "v" on the moon is:
A. 6:1
B. 1:1
C. 36:1
D. 1:6

25. The amount of work required to stop a moving object is equal to:
A. the velocity of the object
B. the kinetic energy of the object
C. the mass of the object times its acceleration
D. the mass of the object times its velocity

26. 5.0 kg cart is moving horizontally at 6.0m/s. In order to change its speed to 10.0m/s, the net work done on the cart must be:
A. 40 J
B. 160 J
C. 90 J
D. 400 J

27. 4 kg cart starts up an incline with a speed of 3m/s and comes to rest 2m up the incline. The total work done on the car is:

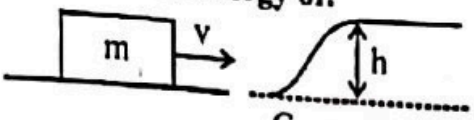


A. 6 J
B. 12 J
C. 8 J
D. 18 J

28. A man moves the 10 g object shown in a vertical plane from position "X" to position "Y" along a circular track of radius 20 m. The process takes 0.75 min. The work done by the man is about: ($g = 10m/s^2$)
A. 1 J
B. 4 J
C. 2 J
D. 6 J

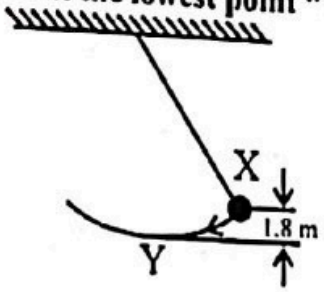
29. Which one of the following quantities CANNOT be used as a unit of potential energy?
A. watt second
B. kg m^2/s^2
C. g cm/s^2
D. ft lb

30. For a block of mass "m" to slide without friction up the rise of height "h" shown, it must have a minimum initial kinetic energy of:



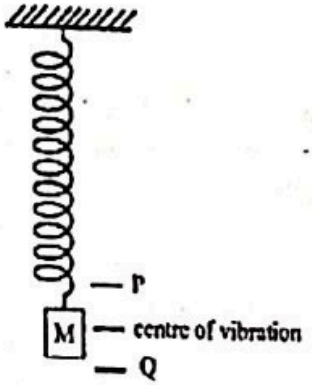
A. mgh
B. $\frac{mgh}{2}$
C. zero
D. 2mgh

31. A simple pendulum consists of a 2.0 kg mass attached to a string. It is released from rest at "X" as shown. Its speed at the lowest point "Y" is about:



A. 0.90 m/s
B. 3.6 m/s
C. 36 m/s
D. 6.0 m/s

32. A mass M is hung from a spring. It is then pulled down slightly and allowed to vibrate vertically between P and Q.



Which row is correct?

	Energy at point P	Energy at point Q
A.	Kinetic	Kinetic
B.	Kinetic	Potential
C.	Potential	Kinetic
D.	Potential	Potential

33. A car of mass "m" has an engine which can deliver power "P". what is the minimum time in which the car can be accelerated from rest to a speed "v":

A. $\frac{mv}{P}$
B. $\frac{mv^2}{2P}$
C. $\frac{P}{mv}$
D. $\frac{2P}{mv^2}$

34. An electric motor is required to haul a cage of mass 400 kg up a mine shaft through a vertical height of 1200 m in 2 minutes. What will be the electrical power required if the overall efficiency is 80%? ($g = 10ms^{-2}$)

A. 3.2 kW
B. 32 kW
C. 5 kW
D. 50 kW

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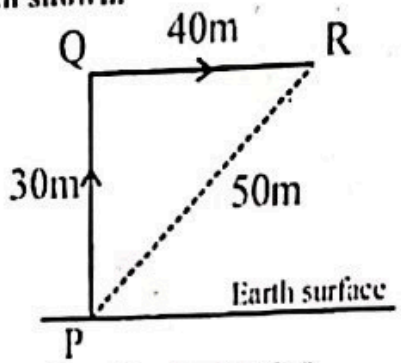
35. **Slope of work time graph is equal to:**
A. displacement
B. power
C. acceleration
D. energy

36. **Work done on the body equals to the:**
A. change in its K.E always
B. change in it K.E and change in its P.E
C. change in its P.E always
D. neither change in K.E nor change in its P.E

37. **A stone of weight 4 N in the Earth's gravitational field is moved from "P" to "Q" and then to "R" along the path shown.**



How much potential energy does the stone gain?
A. 120 J
B. 280 J
C. 200 J
D. 1200 J

38. **If velocity is double, then.**
A. momentum increase 4 times and K.E increases 2 times
B. momentum and K.E remain same
C. momentum increases 2 times and K.E increase constant
D. momentum increases 2 times and K.E increases 4 times

39. **One mega watt hour is equal to.**
A. 36×10^6 J
B. 36×10^9 J
C. 36×10^{12} J
D. 36×10^8 J

40. **Which of the following is not conservative force:**
A. Friction
B. gravitational
C. electric
D. elastic spring force

41. **When arrow is released from its bow, its energy is transformed from:**
A. heat energy to K.E
B. chemical energy to elastic P.E
C. elastic P.E to K.E
D. K.E to elastic P.E

42. **A man lifts, vertically, a weight of 40 kg through 1m in 10s: while a child lifts, vertically, a weight of 10 kg through a distance of 1m in 1s. What will be correct inference? ($g = 10\ m/s^2$)**
A. man has more power than child
B. both have same power
C. child has more power than man
D. it is a foolish question.

43. **A man carries a 1 kg suitcase 10 m horizontally across the corridor and then goes up the stairs of total height 10 m. The work done by the man due to force of gravity is:**
A. 0 J
B. 196 J
C. 4.9 J
D. 98 J

44. **A 100 kg car starting from rest runs down a 30° slope. If the total length of the slope is 20 m, the speed of the car at the bottom, ignoring friction, is:**
A. $14000\sqrt{3}$ m/sec
B. 20 sin 30° m/sec
C. 1.4 m/sec
D. 14 m/sec

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45. A body is falling freely under gravity from point "A" to point "B". The energy of the body at the point "C" (ground level) is:
A. is less than its energy at A
B. is greater than its energy at A
C. is equal to its energy at A
D. Zero

46. If you weigh 500 N and in 5 seconds you can run up a flight of stairs consisting of 40 steps, each 15 cm high, what is your power?
A. 3000 J
B. 600 watt
C. 3000 J sec^{-1}
D. 60 kilowatt

47. To pump up 2400 kg of water up 74.6 m in 5 minutes, the required in horse power is:
A. 8 hp
B. 15 hp
B. 25 hp
D. 16 hp

48. An object of mass 1 g is whirled in a horizontal circle of radius 0.5m at a constant speed of 2m/s. The work done on the object during one revolution is:
A. 0 J
B. 2 J
C. 1 J
D. 4 J

49. The F-d graph for an object is a straight line with positive slope. If the height and width of the graph are 4 units and 2 units respectively, the work done on the object is:
A. zero
B. 4 units
C. 8 units
D. 2 units

50. A field is said to be conservative if:
A. work done inside that field is independent of the path followed
B. work done in closed path inside that field is zero
C. both A. and B.
D. work done is always negative

51. If the linear momentum changes by 10%, the kinetic energy will change by
A. 10%
B. 50%
C. 100%
D. 20%

52. A particle of mass "m" accelerates uniformly from rest to a speed "v" in "t" seconds. What is the average power delivered?
A. $\frac{mv^2}{t}$
B. $\frac{4mv^2}{t}$
C. $\frac{mv^2}{2t}$
D. $\frac{t}{mv^2}$

53. A body of mass 40 kg, is acted upon by a constant force equal to 4 N over a distance of 2 m. What is the kinetic energy of acquired by the body?
A. 8 J
B. 80 J
C. 160 J
D. 4 J

54. A 10 kg bomb explodes into two pieces of masses 6 kg and 4 kg. The velocity of 4 kg mass is 12 m/s. What is the kinetic energy of the other mass?
A. 72 J
B. 48 J
C. 120 J
D. 192 J

55. Two bodies of masses 1kg and 2kg have same momenta. The ratio of their K.E is:
A. 1:1
B. 1:2
C. 2:1
D. 4:1

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56. A body builder lifts a 250 kg weight from the ground to a height of 2 m in 2.5 s. The average power generated is (Take g=10 m/s²):
A. 500 watt
B. 1000 watt
C. 1250 watt
D. 2000 watt

57. Two spherical bodies of identical diameter weighing 2 kg and 5 kg respectively are allowed to fall freely from the top of a tower at the same time. When they are 1.5 m above the ground, they will have the same value of:
A. Kinetic energy
B. Momentum
C. acceleration
D. potential energy

58. A 1 kg ball changes its velocity from 6 m/s to 2 m/s. What are the changes in kinetic energy of the ball?
A. 2 J
B. 4 J
C. 8 J
D. 16 J

59. A ball of mass m is dropped from a height "h" above the ground. What is the velocity of the ball when it loses half of its initial potential energy?
A. $\sqrt{2gh}$
B. $\sqrt{gh/2}$
C. $\sqrt{gh}$
D. $2\sqrt{gh}$

60. If a power of 1kW is maintained for 1 sec then work done is equal to:
A. 10^3J
B. 10^5J
C. 3.6×10^5J
D. 3.5×10^6J

61. A ball whose kinetic energy is "E", is thrown at an angle of 45° with the horizontal, its kinetic energy at the highest point of its trajectory will be:
A. E
B. E/2
C. $E/\sqrt{2}$
D. zero

62. A force "F" acts a body at an angle of 60° to the horizontal and moves it 10 m. The effective component of the force which performs work is:
A. 0.5 F
B. 0.866F
C. Fcos30°
D. 0.707 F

63. Proton, electron, neutron and α-particle have same momentum. Which of them have highest K.E?
A. Proton
B. Electron
C. Neutron
D. α-particle

64. Work is independent of:
A. Force
B. Displacement
C. Time
D. All of these

65. A 40 newton object is released from a height of 10 m. Just before it hits the ground, its kinetic energy, in joules is (ignoring air friction):
A. 400 J
B. 3920 J
C. 2800 J
D. 4000 J

66. A man of mass 50 kg jumps to a height of 1 m. His potential energy at the highest point is (g = 10 m/s²):
A. 50 J
B. 60 J
C. 500J
D. 600 J

67. In 10 second, elevator picks a weight of 1000 N over a distance of 10 m at constant velocity, its power is:
A. 10 Watt
B. 100 Watt
C. 1000 Watt
D. 10,000 Watt

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68. **An object of 5 kg is pulled horizontally by a force of 50 N through a displacement of 10m, the work done by gravity is:**
A. 250 J
B. 500 J
C. Zero
D. 5 kJ

69. **Which of the following type of force cannot do work on which it acts?**
A. frictional force
B. centripetal force
C. gravitational force
D. restoring force

70. **If a body of mass 2 kg is raised vertically through 2m, then the work will be:**
A. 38.2 J
B. 39.2 J
C. 392.1 J
D. 40 J

71. **The average power and instantaneous power become equal if work is done at:**
A. any rate
B. uniform rate
C. variable rate
D. high rate

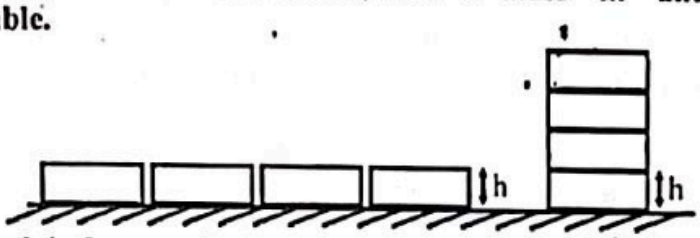
72. **The power is one kilo watt if work is done at the rate of:**
A. 1000 Js^{-1}
B. 1000 J min^{-1}
C. 100 Js^{-1}
D. 1000 J h^{-1}

73. **Power can be defined as the dot product of:**
A. Force and displacement
B. force and time
C. force and velocity
D. force and mass

74. **kilowatt hour is the unit of:**
A. power
B. Force
C. momentum
D. energy

75. **Which is the biggest unit of energy:**
A. erg
B. joule
C. watt hour
D. kilowatt hour

76. **Initially, four identical uniform blocks, each of mass "m" and thickness "h", are spread on a table.**



How much work is done on the blocks in stacking them on top of one another?
A. 2mgh
B. 3mgh
C. 4mgh
D. 6mgh

77. **Object "A" has half the mass of object "B". If the two objects have equal momentum, then K.E. of object "A" in terms of K.E. of object "B" will be:**
A. $K.E_A = K.E_B$
B. $K.E_A = \frac{1}{2} K.E_B$
C. $K.E_A = 2K.E_B$
D. $K.E_A = 4K.E_B$

78. **A child is revolving a tiny 10g stone, tied at one end of a string, in a vertical loop of 2m diameter. If the stone completes 100 revolutions in 1 second, the work done on it will be:**
A. zero
B. 19.8 J
C. 4.9 J
D. 9.8 J

79. **A body of mass 1.0 kg drops from the top of a tower of height 50 m. What will be its K.E. 10 m below the top?**
A. 490 J
B. 98 J
C. 49 J
D. 980 J

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80. Which of the following bodies has the largest kinetic energy?
A. Mass 3M and speed v
B. Mass 2M and speed 3v
C. Mass 3M and speed 2v
D. Mass M and speed 4V

81. A 2 kg block is thrown upward from a point 20m above Earth's surface. At what height above Earth's surface will the gravitational potential energy of the Earth-block system have increased by 500 J? ($g = 10\ m/s^2$)
A. 5m
B. 45m
C. 25m
D. 70m

82. A person carries a load of 15 kg of bricks to the top of building 10 m high. The work done is: ($g = 10\ m/s^2$)
A. 150 J
B. 100 J
C. 1500 J
D. 750 J

83. The amount of work done is pumping out water of a cubicle vessel of height 1 m is: ($g = 10\ m/s^2$)
A. 1000 J
B. 5000 J
C. 10,000 J
D. 100 J

84. A force $\rightarrow F = 6\hat{i} + 2\hat{j} - 3k$ acts on a particle and produces a displacement $\rightarrow S = 2\hat{i} - 3\hat{j} + xk$, what is the value of "x". If work done is zero?
A. 2
B. –2
C. $\frac{1}{2}$
D. d

85. A body constrained to move along $(-2\hat{i} + 15\hat{j} + 6\hat{k})N$. The work done by this force in moving this body through a distance equal to 10 m along the yaxis w ill be:
A. 50 J
B. 100 J
C. 150 J
D. 160 J

86. A toy box is pushed along a horizontal floor through 2 m by means of a force equal to 10 N directed at an angle of 30° to the vertical. Total work done is:
A. 6 J
B. 10 J
C. 12 J
D. 8 J

87. A crane can raise a body of mass 100 kg vertically upward with a speed of 5 m/s. The power of its engine is ($g = 10\ m/s^2$):
A. 2 kW
B. 10 kW
C. 5 kW
D. 4 kW

88. A person with mass 60 kg climbs the stairs to the first floor 10 m above the ground in 20 s. The power developed by him is: ($g = 10\ m/s^2$)
A. 120 W
B. 60 W
C. 300 W
D. 294 W

89. Work done against gravity in lifting a 5 kg box through a distance of 1.5 m is ($g=10\ ms^{-2}$)
A. – 75 J
B. –73.5 J
C. 73.5 J
D. 75 J

90. A 50 kg body is accelerated from rest to 20 m/s in 10 s. What is the amount of work done?
A. 1000 J
B. 2000 J
C. 10,000 J
D. 20,000 J

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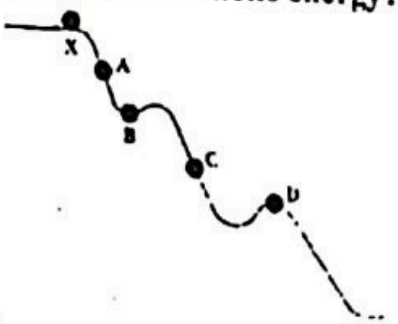
91. A ball, starting at point X, rolls down the hill shown in the diagram. At which point does the ball have half of its maximum kinetic energy? (Ignore friction)



A. A B. B C. C D. D

92. During rainfall, a certain drop of radius "r" falls through a height "h" above the ground. The work done by the gravitational force is proportional to the:

A. r^3 C. r
B. r^2 D. r^4

93. A body is allowed to fall freely under gravity from a height of 12 m. It loses of 25% of its energy when it first hits the ground. To what height will it rise after the first impact with the ground?

A. 3 m C. 9 m
B. 6 m D. 10 m

94. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to the gravity is not known. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of:

A. $\frac{16}{25}$ C. $\frac{3}{5}$
B. $\frac{2}{5}$ D. $\frac{9}{2}$

95. A 5 kg block is moved from the rest through a distance of 4 m along the x–direction. A force equal to 20 N acts on it. If the block acquires a K.E. equal to 40 J, what is the angle the force makes with x–axis?

A. 0° C. 45°
B. 30° D. 60°

96. An electric motor car has a rating of 500 watt. How much energy per minute is delivered by it?

A. 500 J C. 5 kJ
B. 3 kJ D. 30 kJ

97. The height of the dam is 20 m at a hydroelectric power plant. How many of kg of water must fall per second on the blades of a turbine to generate one mega watt of electrical power? ($g=10\ m/s^2$)

A. 1000 kg/s C. 4000 kg/s
B. 2000 kg/s D. 5000 kg/s

98. A bullet of mass "m" is fired from horizontally with a velocity "v" on to a wooden block of mass "m" and gets embedded in it. The kinetic energy of the bullet + block system is:

A. $\frac{1}{2}(M+m)v^2$ C. $\frac{1}{2}\left(\frac{mMv^2}{M+m}\right)$
B. $\frac{1}{2}mv^2$ D. $\frac{1}{2}\left(\frac{m^2v^2}{M+m}\right)$

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99. A person "X" of 75 kg walks up a staircase in 15 s. Another person "Y" of mass 60 kg walks up the same staircase in 12s. The ratio of the power generated by "X" to that by "Y" is:
A. 4/5
B. 5/4
C. 5/6
D. 1

100. A body with a mass 100 g has a velocity $\rightarrow v = \left(2\hat{i} + 4\hat{j}\right)$ m/s at a certain instant of time. Its kinetic energy is:
A. 0.5 J
B. 1.0 J
C. 2.0 J
D. 3 J

101. At what angle the work done will be half of its maximum value
A. 0°
B. 45°
C. 30°
D. 60°

102. A man pushes a wall with 50 (N) and it displaces it zero (m), his work is
A. Negative
B. Positive
C. no work
D. may all possible

103. If a mass of 5 Kg is lifted upto 5m height, what will be the work done against the gravitational field
A. 245 J
B. 49 J
C. 25 J
D. 98 J

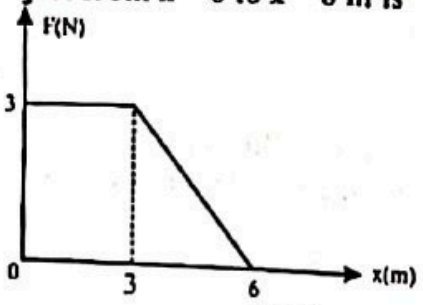
104. A person walks 2 m with an acceleration of 5 m s^{-2}, holding an object of mass 2 kg. The net work done on the object is
A. 20 J
B. 5 J
C. 10 J
D. 0 J

105. A force of $3\hat{i}+2\hat{j}+4\hat{k}$ N gives displacement of 10 $\hat{j}$m. The work done is
A. 20 J
B. 32 J
C. 26 J
D. zero

106. A body travels displacement of 10 m by force of 5 N If work done is 25 J then angle between $\vec{F}$ and $\vec{d}$ is
A. 0°
B. 30°
C. 45°
D. 60°

107. A person holds a bucket of weight 60 N. He walks 7 m along the horizontal path and then climbs up a vertical distance of 5 m. The work done by the gravity is:
A. 300 N-m
B. 420 N-m
C. 720 N-m
D. none of these

108. A force F acting on an object varies with distance x as shown in fig. The work done by the force in moving the object from x = 0 to x = 6 m is



A. 18 J
B. 13.5 J
C. 9 J
D. 4.5 J

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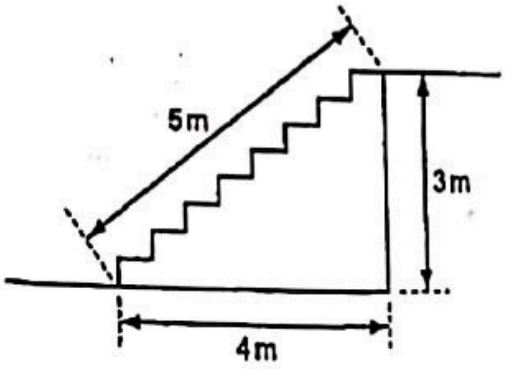
109. If force and displacement of particle in direction of force are doubled. Work would be
A. double
B. half
C. 1/4 times
D. 4 times

110. The diagram shows a flight of stairs



How much useful work is done by a person weighing 600 N when climbing the stairs?
A. 120 J B. 1800 J C. 2400 J D. 3000 J

111. A person is holding a bucket by applying a force of 10N. He moves a horizontal distance of 5m and then climbs up a vertical distance of 10m. Find the total work done by him?
A. 50J
B. 150J
C. 100J
D. 200J

112. A tennis ball is dropped on to a horizontal surface. As the ball bounces up and down, the height of each bounce gradually decreases.
During the motion of the ball.
A. the kinetic energy of the ball is constant
B. the potential energy of the ball is constant
C. the sum of the kinetic and potential energies of the ball is constant
D. the total energy of the ball, ground and air is constant

113. What will be the ratio of kinetic energies of alpha particle and proton if their linear momentum will be same
A. 18 : 1
B. 1 : 4
C. 4 : 1
D. 10^4 : 1

114. One erg is equal to
A. 10^{-5} dynes
B. 10^{-7} watt
C. 10^{-7} joules
D. 10^{-5} newton

115. The Bodies of one kg and four kg have same kinetic energy. The ratio in their momenta will be
A. 1 : 2
B. 1 : 16
C. 1 : 4
D. 1 : 1

116. The velocity and momentum of a moving body are 10,000 cm s^{-1} and 10,000 g cm s^{-1} respectively. The K.E will be
A. 5×10^7 J
B. 5×10^{-2} J
C. 5×10^8 J
D. 5×10^0 J

117. If momentum of a moving object is doubled then its kinetic energy will be
A. doubled
B. halved
C. four times
D. same

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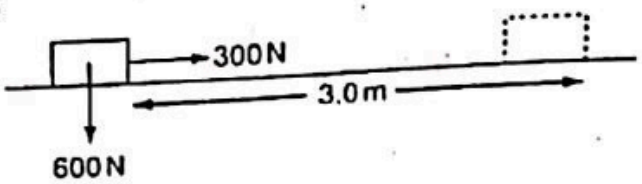
118. When a 300 N force is applied to a box weighing 600 N, the box moves 3.0 m horizontally in 20 s.



What is the average power?

A. 45 W B. 90 W C. 900 W D. 1800 W

119. Kinetic energy of a body moving with speed of 10 m s^{-1} is 30 J. If its speed becomes 30 m/s its K.E will be

A. 10 J C. 90 J
B. 180 J D. 270 J

120. Car X is traveling at half the speed of car Y. Car X has twice mass of car Y. Which statement is correct?

A. Car X has half the kinetic energy of car Y
B. Car X has one quarter of the kinetic energy of car Y
C. Car X has twice the kinetic energy of car Y
D. The tow cars have the same kinetic energy

121. The amount of work required to stop a moving object is equal to:

A. The velocity of the object
B. The mass of the object times its velocity
C. The kinetic energy of the object
D. The mass of the object times its acceleration

122. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of:

A. $\sqrt{2}:1$ C. 1 : 2
B. 1 : 4 D. $1:\sqrt{2}$

123. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 m s^{-1}. The K.E of other mass is

A. 324 J C. 256 J
B. 486 J D. 524 J

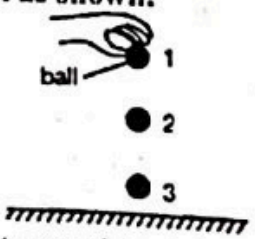
124. Kinetic energy of a body moving with speed of 10 ms^{-1} is 30 J. If its speed becomes 30 ms^{-1} then its K.E becomes

A. 10 J C. 270 J
B. 90 J D. 180 J

125. The kinetic energy acquired by a body of mass m is travelling some distance s, starting from rest under the actions of a constant force, is directly proportional to

A. m^0 C. m
B. m^2 D. $m^{1/2}$

126. A ball is dropped from a height as shown.



Ignoring the effects of air resistance, the total energy is:

A. greatest at point 1 C. greatest at point 3
B. greatest at point 2 D. the same at all points

127. **When force and displacement are in the same direction, the kinetic energy of the body**
A. Increases
B. Decreases
C. Remains constant
D. Becomes zero

128. **A truck and a car are moving with equal velocity. On applying brakes, both will stop after a certain distance, then?**
A. Truck will cover less distance before stopping
B. Car will cover less distance before stopping
C. Both will cover equal distance
D. None of the mentioned

129. **Potential energy per unit volume is given by**
A. mgh
B. $\frac{mgh}{\rho}$
C. gh
D. ρgh

130. **A body is dropped from 1000m height, if its potential energy is 8×10^8 J. What will be its velocity on reaching the ground?**
A. 1410 m s^{-1}
B. 141 m s^{-1}
C. 1.41 m s^{-1}
D. 9800 m s^{-1}

131. **A body is falling from a height h. After it has fallen a height h/2 , it will possess**
A. Only potential energy
B. Only kinetic energy
C. Half potential and half kinetic energy
D. More kinetic and less potential energy

132. **Energy stored in the spring of watch is**
A. Electrical energy
B. Kinetic energy
C. potential energy
D. Elastic potential energy

133. **Then bricks, each 6.0 cm thick and mass 1.5 kg, lie flat on a table. How much work is required to stack them one on the top of another?**
A. 10 J
B. 15 J
C. 40 J
D. 150 J

134. **A ball is thrown vertically upwards. Neglecting air resistance, which statement is correct?**
A. The kinetic energy of the ball is greatest at the greatest height attained
B. The potential energy of the ball increase uniformly with time during the ascent.
C. By the principle of conservation of momentum, the momentum of the ball is constant throughout its motion
D. By the principle of conservation of energy, the total energy of the ball is constant throughout its motion

135. **A stone is thrown up from the surface of earth when it reaches at maximum height. Its total energy is equal to**
A. mgh
B. zero
C. $\frac{1}{2}mv^2$
D. 2 mgh

136. **You lift a suit case from the floor and keep it on a table. The work done by you on the suitcase does not depend on.**
A. the path taken by the suitcase
B. initial and final position
C. weight of the suitcase
D. None

137. **If 10 kg mass is dropped from a certain height, hits the ground with speed 10 ms^{-1}. The height will be**
A. 100 m
B. 10 m
C. 50 m
D. 5 m

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138. In freely falling system, if potential energy is equal to kinetic energy. Then force of friction of air will
A. be negligible
B. be maximum
C. be zero
D. not be predicted

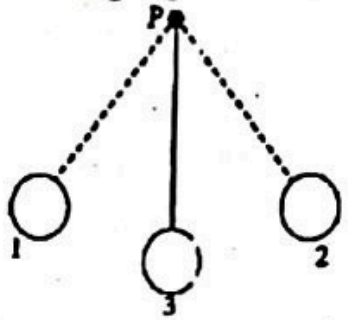
139. In the presence of air friction, the relation for free falling body is
A. $mgh = \frac{1}{2}mv^2 - fh$
B. $mgh = fh - \frac{1}{2}mv^2$
C. $mgh = \frac{1}{2}mv^2 + fh$
D. $mgh = fg + \frac{1}{2}mv^2$

140. A 500N force is applied on an object and it moves with velocity $10ms^{-1}$. If value of power is 2500 watt. Then what will be the angle between force and displacement
A. 0°
B. 60°
C. 90°
D. 23°

141. The time taken by an engine of power 10 kW to lift a mass of 200 kg to the height of 40 m is
A. 2 s
B. 4 s
C. 8 s
D. 16 s

142. To travel at a constant speed, a car engine provides 24 kW of useful power. The driving force on the car is 600 N. At what speed does it travel?
A. 25 ms^{-1}
B. 4.0 ms^{-1}
C. 2.5 ms^{-1}
D. 40 ms^{-1}

143. A mass hangs on a string fixed at point P. It starts from position 1 and swings to the furthest position on the opposite side, position 2. It then oscillates several times with decreasing amplitude before ending at position.



Where does the ball have the most kinetic energy?
A. at position 1
B. at position 2
C. the first time at position 3
D. the last time at position 3

144. The power output of a lamp is 6W. How much energy does the lamp give out in 2 minutes?
A. 3 J
B. 120 J
C. 720 J
D. 430 J

145. A man M_1 of mass 80 kg runs up a staircase in 15 s. Another man M_2 also of mass 80 kg runs up the same staircase in 20 s. The ratio of the power developed by them will be:
A. 1
B. 4/3
C. 16/9
D. none of these

146. An engine pumps up 100 kg of water through a height of 10 m in 5s. Given that the efficiency of the engine is 60%, what is the power of the engine? (Take $g = 10\ m\ s^{-2}$)
A. 33 kW
B. 3.3 kW
C. 0.33 kW
D. 0.033 kW

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147. An engine pumps out 40 kg of water in one second. The water comes out vertically upwards with a velocity of 3 m s^{-1}. What is the power of engine in kilowatt?
A. 1.2 kW
B. 12 kW
C. 120 kW
D. 1200 Kw

148. An elevator's motor produces 3000 W power. The speed with which it can lift a 1000 kg load is:
A. 30.6 m s^{-1}
B. 3.06 m s^{-1}
C. 0.306 m s^{-1}
D. 300.6 m s^{-1}

149. The power needed to lift a mass of 5000g to height of 1 m in 2 second is
A. 2.45 watt
B. 245 watt
C. 24.5 watt
D. 2.45 k watt

150. An engine pulls a car of mass 1500 kg on a level road at a constant speed of 5 ms^{-1}. If the frictional force is 500 N, what power does the engine generate?
A. 5.0 kW
B. 2.5 kW
C. 10 kW
D. 12.5 kW

ANSWER KEY

1	B	16	C	31	D	46	B	61	B	76	D	91	C	106	D	121	C	136	A
2	B	17	A	32	D	47	A	62	A	77	C	92	A	107	A	122	C	137	D
3	D	18	C	33	B	48	A	63	B	78	A	93	C	108	B	123	B	138	C
4	A	19	D	34	D	49	B	64	C	79	B	94	B	109	D	124	C	139	C
5	C	20	D	35	B	50	C	65	A	80	B	95	D	110	B	125	A	140	B
6	B	21	D	36	B	51	D	66	C	81	C	96	D	111	C	126	D	141	C
7	B	22	A	37	A	52	A	67	C	82	C	97	D	112	D	127	A	142	D
8	C	23	A	38	D	53	A	68	C	83	C	98	D	113	B	128	B	143	C
9	D	24	B	39	D	54	D	69	B	84	A	99	D	114	C	129	D	144	C
10	D	25	B	40	A	55	C	70	B	85	C	100	B	115	A	130	B	145	B
11	B	26	B	41	C	56	D	71	B	86	B	101	D	116	D	131	C	146	B
12	A	27	D	42	C	57	C	72	A	87	C	102	C	117	C	132	D	147	A
13	A	28	B	43	D	58	D	73	C	88	C	103	A	118	A	133	C	148	C
14	B	29	C	44	D	59	C	74	D	89	A	104	A	119	D	134	D	149	C
15	A	30	A	45	C	60	A	75	D	90	C	105	A	120	A	135	A	150	B

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1. $K.E = \frac{1}{2}mv^2$

$(K.E)' = \frac{1}{2}\left(\frac{m}{2}\right)(2v)^2 = \frac{1}{2}\left(\frac{m}{2}\right)4v^2 = 2\left(\frac{1}{2}mv^2\right) = 2\,(K.E)$

2. Gain in P.E = Loss in K.E

$(2m)gh = \frac{1}{2}mv^2$ $(m + m = 2m)$

$h = \frac{v^2}{4g} = \frac{1^2}{4(10)} = 0.025\ m = 2.5\ cm$

3. $Fd = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = \frac{1}{2}m\,(v_f^2 - v_i^2)$

$Fd = -\frac{1}{2}mv_i^2$ $(v_f = 0)$

$d = -\frac{mvi^2}{2F}$

for same car

$d \propto v_i^2$

$\frac{d_2}{d_1} = \frac{v_2^2}{v_1^2} = \frac{100^2}{50^2} = 4 \Rightarrow d_2 = 4d_1 = 4(6) = 24m$

4. $U_g = -G\frac{Mm}{R}$

– ve sign indicates that the earth's gravitational field for mass "m" is attractive. When distance from the centre of earth increases the gravitational force does –ve work, potential energy increases. (becomes less – ve).

5. $P = Fv = mav = (m)\left(\frac{v}{t}\right)(v) = \frac{mv^2}{t} = \frac{m}{t}\left(\frac{d}{t}\right)^2 = \frac{md^2}{t^3}$

$d^2 = \frac{Pt^3}{m}$

$d^2 \propto t^3 \Rightarrow d \propto t^{3/2}$

6. By law of conservation of energy

Gain in K.E = Loss in P.E

K.E = mgh

$\frac{(K.E)_1}{(K.E)_2} = \frac{m_1g(h_1 - h_2)}{m_2g(h_1 - h_2)} = \frac{m_1}{m_2} = \frac{2}{4} = \frac{1}{2} = 1:2$

7. $K.E = \frac{1}{2}mv^2 = \frac{1}{2}m\vec{v}.\vec{v} = \left(\frac{0 + m\vec{v}}{2}\right).\vec{v} = P_{av}.\vec{v}$

8. $U_g = -G\frac{Mm}{R}$

At infinite height from center of Earth

$R = \infty$

$U_g = -G\frac{Mm}{\infty} = 0$

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9. Friction force sometimes opposes the direction of motion. So, angle between frictional force and displacement is 180^0.
$W = fd\cos 180^0 = -fd$
When we walk frictional force is in the direction of motion. So, in this case work done by frictional force is positive.

10. $E = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m} = \frac{P^2}{2m}$
For same momentum
$E \propto \frac{1}{m}$
As
$m_1 > m_2$
so. $E_1 < E_2$

11. At maximum height the velocity is zero. So, its kinetic energy will be zero.

12. $K.E = \frac{1}{2}mv^2 = \frac{1}{2}(mv)(v) = \frac{1}{2}Pv = \frac{1}{2}(8)(4) = 16\ J$

13. $P = \frac{mgh}{t}$
$P \propto m$ (for same height and time)
$P' = \frac{3mgh}{t} = 3P$ ($m' = 3m$)

14. "The field in which work done on a body does not depend on the path followed by the body is called conservative field".
OR
"The field in which work done in a closed path is zero is called conservative field".

15. $P.E = mgh = (1)(10)(0.5) = 5\ J$

16. By conservation of linear momentum
Total initial momentum = Total final momentum
$0 = m_1v_1 + m_2v_2$
$0 = (4)v_1 + (8)(5)$
$v_1 = -\frac{(8)(5)}{4} = -10\ m/s$
$K.E. = \frac{1}{2}m_1v_1^2 = \frac{1}{2}(4)(-10)^2 = 200\ J$

17. $K.E = \frac{1}{2}mv^2$
$K.E \propto m$

18. %age decrease in $K.E = 2(\%age\ increase\ in\ p) - n^2$
$= 2(20\%) - 2^2$
$= 40\% - 4 = 36\%$

19. $P = \frac{W}{t} = \frac{3}{3} = 1\ W$

20. $\frac{P.E}{V} = \frac{mgh}{V} = \rho gh$

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21. $K.E = \frac{1}{2}mv^2$

$= \frac{1}{2}(0.5)(200)^2 = \frac{1}{2}(0.5)(40000)$

$= \frac{1}{2}(20000) = 10000\ J$

22. 1. Force and displacement are parallel to each other. So, $0 = 0°$, $\cos 0° = 1$ hence $W_1 = F$

2. Force and displacement are making some angle "0"

$W_2 = Fd\cos\theta$

3. Force and displacement are perpendicular to each other. So, $0 = 90°$, $\cos 90° = 0$ so W

.0

$W_3 < W_2 < W_1$

23. During descent (downward motion) force of gravity and displacement are in the same direction.

So, $\theta = 0°$, $\cos 0° = 1$

$W = F_g d$ (+ve)

24. $\frac{(K.E)_E}{(K.E)_M} = \frac{\frac{1}{2}mv^2}{\frac{1}{2}mv^2} = 1:1$

(For same mass and speed)

25. By work energy prinpciple

Work done = $\Delta K.E$

26. By work energy principle

$Work = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = \frac{1}{2}m(v_f^2 - v_i^2)$

$= \frac{1}{2}(5)(10^2 - 6^2) = \frac{1}{2}(5)(64) = 160\ J$

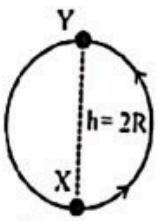
27. By work energy principle

$Work = \frac{1}{2}m(v_f^2 - v_i^2)$

$= \frac{1}{2}(4)(0^2 - 3^2) = (2)(-9) = -18\ J$

–ve sign indicates that the loss in K.E which is converted into P.E.

28.



From "X" to "Y" the displacement = 2(radius)

$= 2(20m) = 40m$

$W = mgh = (0.01)(10)(40) = 4\ J$

29. All are the unit of energy except "$gcms^{-2}$. It is the unit of force in CGS system.

30. In upward motion

Loss in K.E = Gain in P.E

Initial K.E = mgh

31. Gain in K.E = Loss in P.E

$$\frac{1}{2}mv^2 = mgh$$

$$v^2 = 2gh \Rightarrow v = \sqrt{2gh} = \sqrt{2(10)(1.8)} = \sqrt{36} = 6 \text{ m/s}$$

32. At the extreme points, P and Q, the spring is not moving. So there is no kinetic energy at both points. At P, there is maximum elastic potential energy of the spring

33. Gain in K.E = Work done

$$\frac{1}{2}mv^2 = W$$

$$\frac{1}{2}mv^2 = Pt \Rightarrow t = \frac{mv^2}{2P} (W = Pt)$$

34. Energy of motor = Gain in gravitational P.E

$$80\%W = mgh$$

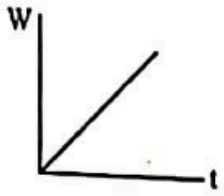
$$0.8(Pt) = mgh$$

$$0.8P(120) = (400)(10)(1200)$$

$$P = \frac{(400)(10)(1200)}{(0.8)(120)}$$

$$= \frac{40000}{0.8} = 50000 \text{ J} = 50 \text{ kJ}$$

35.



Slope of W-t graph $= \frac{W}{t}$ = Power

36. By work energy principle:
"Work done on a body equals the change in its kinetic energy and change in potential energy of the body."
Work done = ΔK.E. + ΔP.E.

37. P.E = mgh = 4 × 30 = 120 J

38. $P = mv \Rightarrow P \propto v$

$K.E = \frac{1}{2}mv^2 \Rightarrow K.E. \propto v^2$

39. $1MWh = 10^6 \times 3600$ watt s
$1MWh = 36 \times 10^8$ J

40. Frictional force is a non conservative force.

41. When an arrow is thrown from its bow, the elastic P.E. of the bow is transferred to arrow as its K.E.

42. $W_{man} = mgh = (40)(10)(1) = 400$ J

$$P = \frac{W_{man}}{t} = \frac{400}{10} = 40 \text{ watt}$$

$W_{child} = mgh = (10)(10)(1) = 100$ J

$$P = \frac{W_{child}}{t} = \frac{100}{1} = 100 \text{ watt}$$

43. $W_{horizontal} = mgh\cos 90° = 0$
$W_{vertical} = mgh = (1)(9.8)(10) = 98$ J

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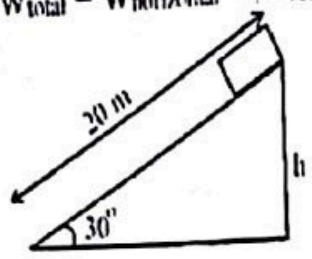
$W_{total} = W_{horizontal} + W_{vertical} = 0 + 98 = 98$ J

44.



$\frac{h}{20} = \sin 30° \Rightarrow h = 20 \sin 30° = 20(0.5) = 10$ m

By law of conservation of energy

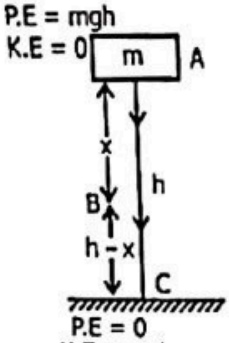
Gain in K.E = loss in Gravitational P.E

$\frac{1}{2}mv^2 = mgh$

$v^2 = 2gh$

$v = \sqrt{2gh} = \sqrt{2(10)(10)} = 10\sqrt{2} = 10\,(1.4) = 14$ m/s

45.



$E_A = E_B = E_C = mgh$ (by conservation of energy)

46. $h = (15)(40)$ cm $= 600$ cm $= 6$m

$P = \frac{mgh}{t} = \frac{(500)(6)}{5} = 600$ watt

$(W = mg = 500N)$

47. $P = \frac{(2400)(10)(74.6)}{300}$ watt $= \frac{(2400)(10)(74.6)}{(300)(746)}$ hp

$= 8$ hp $(1hp = 746$ watt$)$

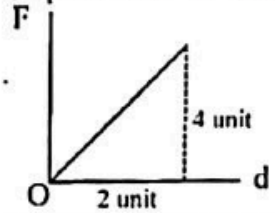
48. $W = F.d$

$W = Fd \cos 0 = Fd \cos 90° = Fd\,(0) = 0$

Due to centripetal force the object will move in a circular path. In the circular path, the centripetal force "F_c" is perpendicular to velocity "v".

As the displacement "d" is parallel to the velocity "v". So the angle between the displacement "d" and the centripetal force "F_c" is 90°.

49.



Work done = area under F-d graph

$= \frac{1}{2}(2)(4) = 4$ units

50. i. The field in which work done on a body does not depend on the path followed by the body is called conservative field.
i. The field in which work done in a closed path is zero is called conservative field.

51. $K.E \propto p^2$
%age change in K.E $= 2$(%age change in p)
$= 2(10\%) = 20\%$

52. $P = Fv = mav = m\frac{v}{t}v = \frac{mv^2}{t}$

53. According to work energy principle
Acquired K.E = Work done = Fd = (4)(2) = 8 J

54. By conservation of linear momentum
Total initial momentum = Total final momentum
$0 = m_1v_1 + m_2v_2$
$0 = (6)v_1 + (4)(12)$
$v_1 = -\frac{48}{6} = -8$ m/s
$K.E. = \frac{1}{2}m_1v_1^2 = \frac{1}{2}(6)(-8)^2 = 192$ J

55. $K.E. = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m} = \frac{P^2}{2m}$
For same momentum
$K.E. \propto \frac{1}{m}$
$\frac{K.E_1}{K.E_2} = \frac{m_2}{m_1} = \frac{2}{1} = 2:1$

56. $P = \frac{mgh}{t} = \frac{(250)(10)(2)}{2.5} = 500(4) = 2000$ watt

57. In freely falling motion, objects of different mass move with same gravitational acceleration ($g = 9.8$ m/s^{-2})

58. $\Delta K.E = \frac{1}{2}m(v_f^2 - v_i^2)$
$= \frac{1}{2}(1)(2^2 - 6^2) = 0.5(-32) = -16$J
(–ve sign indicates that K.E will reduce)

59. By law of conservation of energy
Gain in K.E = loss in P.E
$\frac{1}{2}mv^2 = \frac{mgh}{2}$
$v^2 = gh$
$v = \sqrt{gh}$

60. $P = \frac{W}{t}$
$W = Pt = (1000\ W)(1s) = 10^3$ J (Ws = J)

61. The velocity at highest point is
$v = v_x = v\cos 0$

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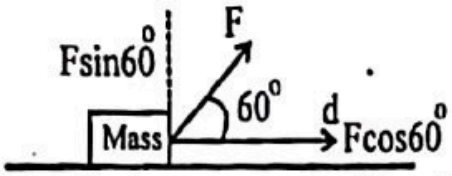
$$K.E = \frac{1}{2}mv_x^2 = \frac{1}{2}mv^2\cos^2\theta = E(\cos 45^\circ)^2$$

$$= E(1/2) = E/2 \quad (E = \tfrac{1}{2}mv^2)$$

62.



The effective component of force is that which is in the direction of displacement.
Effective component = $F\cos 60^\circ = 0.5\ F$

63. $K.E. = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m} = \frac{P^2}{2m}$

For same momentum

$$K.E. \propto \frac{1}{m}$$

$m_e < m_p < m_n < m_\alpha$

$K.E_e > K.E_p > K.E_n > K.E_\alpha$

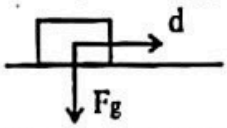
64. $W = Fd\cos\theta$
So, Work is independent of time.

65. By law of conservation of energy
Gain in K.E = Loss in P.E
$K.E = mgh = (40)(10) = 400\ J$ (F=mg)

66. $P.E = mgh = (50)(10)(1) = 500\ J$

67. $P = \frac{mgh}{t} = \frac{(1000)(10)}{10} = 1000\ W$

68.



$W = F_g d\cos 90^\circ = 0\ J$

69. $W = F.d$
$W = F_c d\cos\theta = F_c d\cos 90^\circ = Fd(0) = 0$
Due to centripetal force the object will move in a circular path. In the circular path, the centripetal force "F_c" is perpendicular to displacement "d".

70. $W = P.E. = mgh = (2)(9.8)(2) = 39.2\ J$

71. If a body do equal work in equal interval of time, then its work done is said to be in uniform rate. So,
$P_{avg} = P_{Ins}$

72. Work done by a body in one second is known as power.
$P = 1kW = 1000\ W = 1000\ Js^{-1}$
$= 1000$ J work in one second

73. $P = \frac{\Delta W}{\Delta t} = \frac{\vec{F}.\Delta\vec{d}}{\Delta t} = \vec{F}.\frac{\Delta\vec{d}}{\Delta t} = \vec{F}.\vec{v}$

74. One kilowatt hour is the work done (energy) in one hour by an agency whose power is one kilowatt.
$1kWh = (1000\ watt) \times (3600\ s)$
$1kWh = 3600000\ watt\ s = 3.6 \times 10^6\ J = 3.6\ MJ$

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75. $1\,kWh = 3.6 \times 10^6\ J$
$1erg = 10^{-7}\ J$
$1\,Wh = 3.6 \times 10^3\ J$
$1kWh > 1Wh > 1J > 1erg$

76. $W = 0 + mgh + mg(2h) + mg(3h) = 6mgh$
Shortcut:
$$\frac{n(n-1)}{2}mgh = \frac{4(4-1)}{2}mgh = 6mgh$$
n = No.of bricks

77. $K.E. = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m} = \frac{p^2}{2m} \Rightarrow K.E \propto \frac{1}{m}$ (For same momentum)
$$\frac{K.E_A}{K.E_B} = \frac{m_B}{m_A} = \frac{m_B}{m_B/2} = 2 \Rightarrow K.E_A = 2K.E_B\ (m_A = m_B/2)$$

78. $W = \vec{F}.\vec{d}$
$W = F_c d\cos\theta = F_c d\cos 90^\circ = Fd\,(0) = 0$
Due to centripetal force the stone will move in a circular path. In the circular path, the centripetal force "F_c" is perpendicular to velocity "v".
As the displacement "d" is parallel to the velocity "v". So the angle between the displacement "d" and the centripetal force "F_c" is 90°.

79. Gain in K.E = Loss in Gravitational P.E
$K.E = mg(h_1 - h_2)$
$= (1)(9.8)(50 - 40) = 9.8(10) = 98\ J$

80. $K.E = \frac{1}{2}Mv^2$
The K.E will be maximum when the product of "M" and "v^2" is maximum. In (B) the product has maximum value.

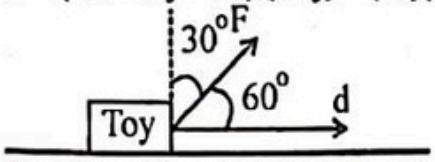
81. $P.E = mgh$
$$500 = (2)(10)h \Rightarrow h = \frac{500}{20} = 25\ m$$

82. $P.E = mgh$
$P.E = (15)(10)(10) = 1500\ J$

83. $\rho = \frac{m}{V} \Rightarrow m = \rho V = (1000)(1\times1\times1) = 1000\ kg$
$W = P.E. = mgh = (1000)(10)(1) = 10000\ J$

84. $W = \vec{F}.\vec{S}$
$0 = (6\hat{i} + 2\hat{j} - 3\hat{k}).(2\hat{i} - 3\hat{j} + x\hat{k})$
$0 = 12 - 6 - 3x$
$3x = 6$
$x = 2$

85. $W = \vec{F}.\vec{S}$
$W = (-2\hat{i} + 15\hat{j} + 6\hat{k}).(10\hat{j}) = (15)(10) = 150\ J$

86.


$W = Fd\cos 60^\circ = (10)(2)(0.5) = 10\ J$

87. $P = Fv = mgv = (100)(10)(5) = 5000\ watt = 5\ kW$

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88. $P = \frac{P.E.}{t} = \frac{mgh}{t} = \frac{(60)(10)(10)}{20} = 300$ watt

89. $W = F_g d\cos 180^\circ = -mgh = -(5)(10)(1.5) = -75$ J

90. Work done $= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}(50)(20^2 - 0^2) = 25(400)$ 10000 J

91. Gain in kinetic energy = loss in gravitational potential energy. The ball will have maximum kinetic energy at the bottom of the hill. At point C, the ball is about midway to the bottom of hill. Hence at C, the ball will have half of its maximum kinetic energy.

92. Work done by gravitational force, $W = mgh$

$= (\rho V)\, g\, h = \left(\frac{4}{3}\pi r^3\right)\rho\, g\, h \Rightarrow W \propto r^3$

93. After the impact the 25% of energy is lost while 75% of its initial energy is left behind.

$P.E_2 = 0.75P.E_1$

$mgh_2 = 0.75mgh_1$

$h_2 = 0.75h_1 = 0.75(12) = 9$ m

94. By law of conservation of energy

$\frac{1}{2}mv^2 = mgh$

$v^2 = 2gh$

$v = \sqrt{2gh} \Rightarrow v \propto \sqrt{h}$

$\frac{v_1}{v_2} = \sqrt{\frac{h_1}{h_2}} = \sqrt{\frac{5}{1.8}} = \sqrt{\frac{100}{36}} = \frac{10}{6} = \frac{5}{3}$

$v_1 = \frac{3}{5}v_2$

Loss in velocity on bouncing $= 1 - \frac{3}{5} = \frac{2}{5}$

95. By work energy principle

Work = K.E

$Fd\cos 0 = K.E$

$\cos 0 = \frac{K.E}{Fd} = \frac{40}{(20)(4)} = \frac{1}{2}$

$0 = \cos^{-1}(1/2) = 60^\circ$

96. 500 watt $= \frac{500J}{s} = \frac{500 \times 60J}{min} = 30000$ J min^{-1} = 30 kJ

97. $P = \frac{mgh}{t} = \left(\frac{m}{t}\right)gh$

$\frac{m}{t} = \frac{P}{gh} = \frac{10^6}{(10)(20)} = 5000$ kg/s

98. By law of conservation of linear momentum

Total initial momentum = Total final momentum

$mv = mv' + Mv'$

$mv = (m + M)v'$

$v' = \frac{mv}{M + m}$

$$K.E. = \frac{1}{2}(M+m)\left(\frac{mv}{M+m}\right)^2$$

$$K.E. = \frac{1}{2}\left(\frac{m^2v^2}{M+m}\right)$$

99. $$\frac{P_X}{P_Y} = \frac{\frac{mxgh}{t_X}}{\frac{mygh}{t_Y}} = \frac{m_X}{m_Y} \times \frac{t_Y}{t_X} = \frac{75}{60} \times \frac{12}{15} = 1$$

100. $$K.E = \frac{1}{2}mv.v = \frac{1}{2}(0.1)(2\hat{i}+4\hat{j}).(2\hat{i}+4\hat{j})$$

$$= \frac{1}{2}(0.1)(4+16) = \frac{1}{2}(0.1)(20) = 1\ J$$

101. $$W = \frac{W_{max}}{2}$$

$$W = Fd\cos\theta$$

$$W = W_{max}\cos\theta$$

$$\frac{W_{max}}{2} = W_{max}\cos\theta$$

$$\theta = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ$$

102. $W = F\,d\cos\theta$

Since $d = 0 \Rightarrow W = 0$

103. $W = F\,d\cos\theta$

$\theta = 0^\circ$

$W = mgh$

$W = 245J$

$W = Fd$

$W = (ma)d$

$W = 2\times5\times2 = 20J$

104.

105. $W = \vec{F}.\vec{d}$

$$= \left(3\hat{i}+2\hat{j}+4\hat{k}\right).\left(10\hat{j}\right)$$

$W = 20J$

106. $W = F\,d\cos\theta$

$$\theta = \cos^{-1}\left(\frac{W}{Fd}\right)$$

$$= \cos^{-1}\left(\frac{25}{10\times5}\right)$$

$$= \cos^{-1}\left(\frac{1}{2}\right)$$

$\theta = 60^\circ$

107. $W_T = W_{horizontal} + W_{vertical}$

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$W_T = 0 + 60 \times 5$

$W_T = 300\,Nm$

108. W = Area under $F - x$ graph

$W = \frac{1}{2}$ (Sum of parallel sides) (Perpendicular distance between parallel sides)

$= \frac{1}{2}(6+3)(3) = 13.5J$

109. Work = Force × Displacement If force and displacement both are doubled then work would be four times.

110. By conservation of energy, useful work done = gain in gravitational potential energy
$= mgh = (600\ N)\ (3\ m) = 1800\ J$

111. $F = 10N$, $s = 5m$, $\theta = 90°$
Work done, $W_1 = Fs\cos\theta = 10 \times 5 \times \cos 90° = 0$
For vertical motion, the angle between force and displacement is 0°.
Here, $F = 10N$, $s = 10m$, $\theta = 0°$
Work done, $W_2 = 10 \times 10 \times \cos 0 = 100J$
Total work done = $W_1 + W_2 = 100J$.

112. The principle of conservation of energy states that the total energy of a system remains constant. The total energy includes the internal energy. The total of KE and PE at the end is 0

113. Mass of α-paricle $= 6.644 \times 10^{-27}\,kg$
mass of proton $= 1.672 \times 10^{-27}\,kg$

$p_\alpha = p_p$

$K.E = \frac{p^2}{2m}$, $K.E \propto \frac{1}{m}$

$\frac{K.E_\alpha}{K.E_p} = \frac{m_p}{m_\alpha} = \frac{1.672 \times 10^{-27}}{4(1.672 \times 10^{-27})} = \frac{1}{4}$

114. $1J = 10^7\,erg \Rightarrow 1\,erg = 10^{-7}J$

115. $K.E_1 = K.E_2$

$p_1^2 \propto m$

$\frac{p_1^2}{p_2^2} = \frac{m_1}{m_2} \Rightarrow \frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}} \Rightarrow \frac{p_1}{p_2} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

116. $K.E = \frac{1}{2}pv \Rightarrow K.E = \frac{1}{2}\left(\frac{10{,}000 \times 10^{-2}}{1000}\right)(10{,}000 \times 10^{-2})$

$= \frac{1}{2}\left(\frac{10000}{1000}\right) = 5J$

$K.E = 5 \times 10^0\,J$

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117. $K.E=\frac{p^2}{2m}$

if $p'=2p$

$K.E=\frac{(2p)^2}{2m}=\frac{4p^2}{2m}=4K.E$

$K.E'=4K.E$

118. $\text{Average power}=\frac{\text{work done}}{\text{time}}=\frac{F\times d}{t}=\frac{300\times 3.0}{20}W$

119. $\frac{K.E_1}{K.E_2}=\frac{v_1^2}{v_2^2}$

$K.E_2=K.E_1\frac{v_2^2}{v_1^2}$

$K.E_2=30\times\frac{900}{100}=270J$

120. $v_x=\frac{v_y}{2}, m_x=2m_y$

$K.E_x=\frac{1}{2}m_x v_x^2=\frac{1}{2}(2m_y)\left(\frac{v_y}{2}\right)^2$

$=\frac{1}{2}(2m_y)\left(\frac{v_y^2}{4}\right)=\left(\frac{1}{2}m_y v_y^2\right)\frac{1}{2}=\frac{K.E_y}{2}$

121. $W=\Delta K.E$

122. As both balls falling from same height so speed is same $v=\sqrt{2g(h_1-h_2)}$

$\frac{K.E_1}{K.E_2}=\frac{\frac{1}{2}m_1v^2}{\frac{1}{2}m_2v^2}=\frac{2}{4}=\frac{1}{2}$

123. $m_1v_1=m_2v_2 \therefore v_2=\frac{18\times 6}{12}=9ms^{-1}$

$KE=\frac{1}{2}\times 12(9)^2=486J$

124. $K.E=\frac{1}{2}mv^2$

$K.E\propto v^2$ (m=constant)

if $v'=3v$, then $K.E'=9K.E$

$K.E'=9K.E$

$=9(30)$

$K.E=270J$

125. $K.E=\frac{1}{2}mv^2 \Rightarrow K.E\propto v^2$ $\therefore$ does not depend upon mass for a single body (As mass is constant)

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126. Using principle of conservation of energy, the loss in gravitational potential energy = gain in kinetic energy at all times. Hence, total energy = GPE + KE = constant at all times.

127. When force and displacement are in the same direction, the kinetic energy of the body increases. The increase in kinetic energy is equal to the work done on the body.

128. Being lighter than a truck, the car has less kinetic energy. On applying brakes with the same force, the car will cover less distance before coming to rest.

129. $\frac{P.E}{V} = \frac{mgh}{V} = \rho gh$

130. $v = \sqrt{2gh}$

$v = \sqrt{2 \times 10 \times 1000} = \sqrt{20000} = 141 \, m/s$

131. $P.E = mgh$

$P.E' = \frac{mgh}{2} \quad \left(\because h' = \frac{h}{2}\right)$

$P.E' = \frac{P.E}{2}$

So at h/2, body has half P.E and half K.E.

132. Spring has elastic potential energy.

133. $W = \frac{n(n-1)}{2} mgh = \frac{10(10-1)}{2} mgh = 45mgh$

$W = 40 \, J$

134. T.E remains same through the motion

135. At maximum height:

$T.E = K.E + P.E$

$= 0 + mgh$

$= mgh$

136. A. and B. gravitational force is conservative; work done is independent of path and time.

137. Loss in P.E = Gain in K.E

$mgh = \frac{1}{2}mv^2 \Rightarrow h = \frac{v^2}{2g} = \frac{(10)^2}{2 \times 10} = \frac{100}{20} = 5m$

138. $mgh = \frac{1}{2}mv^2 + fh$

if, $mgh = \frac{1}{2}mv^2$

then, $fh = 0$

$f = 0$

139. $mgh = \frac{1}{2}mv^2 + fh$ (In the presence of friction)

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140. $P = \vec{F}.\vec{v}$

$P = Fv\cos\theta$

$\theta = \cos^{-1}\left(\frac{P}{Fv}\right)$

$= \cos^{-1}\left(\frac{2500}{500\times10}\right)$

$= \cos^{-1}\left(\frac{1}{2}\right) = 60°$

141. $P = \frac{W}{t} = \frac{mgh}{t}$

$t = \frac{200\times9.8\times40}{10\times10^3} = 7.84s$

$t = 8s$

142. $P = \vec{F}.\vec{v}$

$P = Fv\cos\theta$

$\theta = 0°$

$P = Fv$

$v = \frac{P}{F} = \frac{24000}{600} = 40\ ms^{-1}$

143. At positions 1, 2 and finally (last time) coming to rest at 3, the speed of the ball is zero. The ball will undergo a few oscillations before coming to rest and so the speed of the ball when it is the first time at 3 will not be zero.

144. $t = 2\times60 = 120s$

$P = \frac{E}{t}$

$E = Pt = 6\times120$

$E = 720J$

145. $P = \frac{mgh}{t}$

As, $M_1 = M_2 = m$

h = same

$\frac{P_1}{P_2} = \frac{t_2}{t_1}$

$= \frac{20}{15}$

$= \frac{4}{3}$

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146. $(P)=\frac{mgh}{t}$

$P=\frac{100\times10\times10}{5\times0.6}$

$P=3333.3\,W$

$P=3.3kW$

147. $P=\frac{mgh}{t}$

$P=mgv$

$=40\times10\times3$

$=1200\,W$

$=1.2\times10^{3}\,W=1.2KW$

148. $P=Fv$

$P=mgv\Rightarrow v=\frac{P}{mg}=\frac{3000}{1000\times10}=0.306ms^{-1}$

149. $P=\frac{mgh}{t}=\frac{\frac{5000}{1000}\times10\times1}{2}=\frac{50}{2}=24.5W$

150. $P=Fv=500\times5=2500=2.5kW$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. When the applied force and covered displacement are parallel to each other than work done of the body is:
   A. Zero
   B. Negative
   C. Maximum
   D. Minimum

2. A man pulling a bag with force of 15 N at angle 60° with horizontal plane. If bag convers a distance of 10 m, then work done by the man is:
   A. 50 J
   B. 75 J
   C. 100 J
   D. 150 J

3. The area under a curved in a force and displacement graph shows that:
   A. Work under a constant force
   B. Work under a variable force
   C. Work under a maximum force
   D. Work under a minimum force

4. If the velocity is doubled then the K.E of the body will be:
   A. remain same
   B. double
   C. three times
   D. four times

5. A bullet of mass 20 g is fired with velocity of 2000 ms^{-1}, the K.E of the bullet is:
   A. 2000 J
   B. 4000 J
   C. 20000 J
   D. 40000 J

6. A body of mass 100 g is raised vertically from surface of Earth in a gravitational field. The P.E of the body at height 100 m is:
   A. 0.98 J
   B. 9.8 J
   C. 98 J
   D. 980 J

7. What is the power of an electric motor when it consumes energy of 9×10^3 J in 3 s?
   A. 1 hp
   B. 2 hp
   C. 3 hp
   D. 4 hp

8. Absolute potential energy of a body at the surface of the earth is:
   A. Gm/R
   B. Gm/R^2
   C. GmM/R
   D. GmM/R^2

9. What is the value of potential energy of a body at the height where the value of 'g' is zero?
   A. Zero
   B. Negative
   C. Maximum
   D. mgh

10. When velocity of body of mass 10 kg is increased from 2 ms^{-1} to 8 ms^{-1} then the work done of the body is:
    A. 100 J
    B. 200 J
    C. 300 J
    D. 400 J

11. Which force is a non-conservative?
    A. Gravitational force
    B. Friction force
    C. Electrostatic force
    D. Magnetic force

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12. **Which the following source of energy is not a fossil fuel?**

A. Coal
B. Uranium
C. Oil
D. Gas

13. **Conventional method of energy extracted is:**

A. Hydro power
B. Wind power
C. Tidal power
D. Biomass power

14. **One megawatt hour is equal to:**

A. 3.6×10^{7}J
B. 3.6×10^{9}J
C. 3.6×10^{12}J
D. 3.6×10^{18}J

15. **If the speed of an object is tripled, its kinetic energy is increased by:**

A. $\frac{1}{9}$times
B. $\frac{1}{3}$times
C. 6 times
D. 9 times

ANSWER KEY

1	C	6	C	11	B
2	B	7	D	12	B
3	A	8	C	13	B
4	D	9	A	14	B
5	D	10	C	15	D

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KPK TEXT BOOK EXERCISE MCQs

1. You push a heavy crate down a ramp at a constant velocity. Only four forces act on the crate. Which force does the greatest magnitude of work on the crate?
   A. The force of friction
   B. The force of gravity
   C. The normal force
   D. The force you pushing

2. The force constant of a wire is k and that of the another wire is 3k when both the wires are stretched through same distance, if work done are W_1 and W_2, then
   A. $W_2 = W_1$
   B. $W = 9W_1$
   C. $W_1 = 3\ W_2$
   D. $W_2 = 3W_1$

3. Escape velocity on the surface of the earth is 11.2 kms^{-1}. If the mass of the earth increases to twice its value and the radius of the earth become half the escape velocity is:
   A. 5.6 kms^{-1}
   B. 11.2 kms^{-1}
   C. 22.4 kms^{-1}
   D. 33.6 kms^{-1}

4. An example of non-conservation force is:
   A. Electric force
   B. Gravitational force
   C. Frictional force
   D. Magnetic force

5. When the speed of your car is doubled, by what factor does its kinetic energy increased?
   A. $\sqrt{2}$
   B. 2
   C. 4
   D. 8

6. One horse power is given by:
   A. 746 W
   B. 746 KW
   C. 746 MW
   D. 746 GW

7. Work is said to be negative when $\bar{F}$ and $\bar{d}$ are:
   A. Parallel
   B. Anti-parallel
   C. Perpendicular
   D. at 45°

8. Two bodies of masses m_1 and m_2 have equal momentum their kinetic energies E_1 and E_2 are in the ratio:
   A. $\sqrt{m_1} : \sqrt{m_2}$
   B. $m_1 : m_2$
   C. $m_2 : m_1$
   D. $\sqrt{m_1^i} : \sqrt{m_2^i}$

9. The atmosphere is held to the earth by:
   A. Winds
   B. Gravity
   C. Clouds
   D. The rotation of earth

10. If momentum is increased by 20% then K. E increase by:
    A. 44%
    B. 55%
    C. 66%
    D. 77%

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11. **If the K.E of a body becomes four time of the initial value, then new momentum will:**

A. Become twice its initial value
B. Become three time, its initial value
C. Become four time, its initial value
D. Remains constant

12. **Two bodes with kinetic energies in the ratio of 4 : 1 are moving with equal linear momentum. The ration of their masses is:**

A. 1 : 2
B. 1 : 1
C. 4 : 1
D. 1 : 4

13. **A body of mass 5 kg is moving with a momentum of 10 kgms^{-1}. A force of 0.2 N acts on it in the direction of motion of the body for 10s. the increase in its kinetic energy is:**

A. 2.8 J
B. 3.2 J
C. 3.8 J
D. 4.4 J

14. **If force and displacement of particle in the direction of force are doubled. Work would be:**

A. Double
B. 4 times
C. Half
D. ¼ times

ANSWER KEY

1	A	6	A	11	A
2	D	7	B	12	D
3	C	8	C	13	D
4	C	9	B	14	B
5	C	10	A		

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1. 100 joules work has been done by an agency in 10 seconds. What is power of agency? (UHS 2008)

A. 1000 watts
B. 100 watts
C. 10 watts
D. 0.10 watts

2. Work done on a body equal to change in its _____ energy? (UHS 2008)

A. Total
B. Potential
C. Kinetic
D. All of these

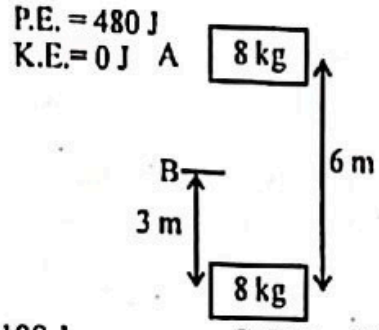
3. The escape velocity corresponds to _____ energy gained by body, which carries it to an infinite distance from the surface of Earth? (UHS 2008)

A. Total
B. Potential
C. Initial kinetic
D. None of these

4. If a certain force acts on an object and changes its kinetic energy from 65 J to 130 J, then work done by the force will be? (UHS 2009)

A. 92.5 J
B. 97.5 J
C. 65 J
D. 130 J

5. A body of mass 6 kg falls under action of gravity. At initial position "A" its P.E. is 480 J and K.E. is 0 J. During its downward journey at point "B" its energies will be ($g = 10\ ms^{-2}$): (UHS 2009)



A. P.E. = 300 J and K.E. = 180 J
B. P.E. = 180 J and K.E. = 300 J
C. P.E. = 240 J and K.E. = 240 J
D. P.E. = 250 J and K.E. = 230 J

6. If velocity is doubled, then: (UHS 2010)

A. momentum increases 4 times and K.E. increases 2 times
B. momentum and K.E. remain same
C. momentum increases 2 times and K.E. remains constant
D. momentum increases 2 times and K.E. increases 4 times

7. The consumption of energy by 60 watt bulb in 2 seconds is: (UHS 2010)

A. 20 J
B. 120 J
C. 30 J
D. 0.02 J

8. Which of the following is non-conservative force? (UHS 2010)

A. Gravitational force
B. Elastic spring force
C. Frictional force
D. Electric force

9. Value of escape velocity for the surface of the Earth is 11 km/s. its value for surface of Moon is: (UHS 2010)

A. 11 km/s
B. 10.4 km/s
C. 2.4 km/s
D. 4.3 km/s

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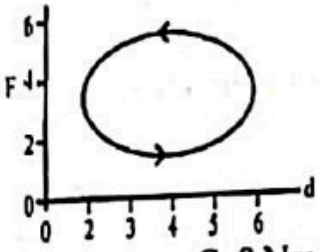
10. **Total work done in figure:** (UHS 201



A. 24 Nm
B. 16 Nm
C. 8 Nm
D. Zero Nm

$W = F.d$

11. **Work done will be zero if angle between Force and displacement is:** (UHS 201
A. 0°
B. 60°
C. 270°
D. 360°

12. **If mass 'm' is dropped from height "h" vertically, "f" is the force of friction durin downward motion and "v" is the velocity at bottom, following equation will be hol (UHS 2017)**
A. $\frac{1}{2}mv^2 = mgh + fh$
B. $fh = mgh + \frac{1}{2}mv^2$
C. $mgh = \frac{1}{2}mv^2 - fh$
D. $mgh = \frac{1}{2}mv^2 + fh$

13. **The rate at which work is being done is called:** (UHS 2018
A. Power
B. Energy
C. Density
D. Force

14. **Energy consumed by 60-watt bulb in 2 minutes is equal to:** (UHS 2019
A. 120 joules
B. 72000 joules
C. 720 joules
D. 7.2 kJ

15. **A stone of mass 2.0 kg is dropped from a rest position 5.0 m above the ground. Wha is its velocity at a height of 3.0 m above the ground:** (UHS 2019)
A. 16.0 m/s
B. 12.5 m/s
C. 6.3 m/s
D. 9.3 m/s

16. **Which of the following is statement shows that no work is done:** (UHS 2020)
A. Pushing a car to start it moving
B. Writing an essay on a page
C. Lifting the weight
D. The Moon orbiting the Earth

17. **An automobile is moving forwards with uniform velocity due to the force exerted by its engine. If that force is double with the velocity remaining constant that happens to its total power?** (UHS 2020)
A. it does not change
B. It is squared
C. It is halved
D. It is doubled

18. **A 1.75 m heighted weight-lifter raises weights with a mass of 50 kg to a height of .5m above his head. How much work is being done by him? ($g=10ms^{-2}$)** (PMC 2020)
A. 2125J
B. 2500 J
C. 50J
D. 1225 J

19. **What is the speed of 2.0 kg metallic bob at mean position of a simple pendulum, when released from its extreme position 0.5m high? ($g=10ms^{-2}$)** (PMC 2020)
A. $3.16ms^{-1}$
B. $10\ ms^{-1}$
C. $100ms^{-1}$
D. $50\ ms^{-1}$

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20. When the speed of your car is halved, by what factor does its kinetic energy decreases? (PMC 2020)

A. 1/2
B. 1/4
C. 1/8
D. 1/6

21. Which of the following force is non-conservative force? (PMC 2020)

A. fractional force
B. gravitation force
C. electric force
D. elastic spring force

22. One kilowatt-hour is commonly termed as one commercial unit of electric energy which is equal to: (PMC 2020)

A. 3.6×10^5 J
B. 3.6×10^6 J
C. 3.6×10^4 J
D. 3.6×10^3 J

ANSWER KEY

1	C	11	C	21	A
2	D	12	D	22	B
3	C	13	A		
4	C	14	D		
5	C	15	C		
6	D	16	D		
7	B	17	D		
8	C	18	D		
9	C	19	A		
10	D	20	B		

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SOLUTIONS

1. $P = \frac{W}{t} = \frac{100}{10} = 10$ watts

2. By work energy principle

   Work done = $\Delta K.E + \Delta P.E$ = total energy

3. If we want to lift a body of mass "m" from the surface of earth to infinity, the kinetic energy must be supplied to the body which is equal to increase in its P.E.

   Initial K.E = Increase in P.E

4. Work done = $(K.E)_f - (K.E)_i = 130 - 65 = 65$ J

5. At point "B"

   $P.E = mgh = (8)(3)(10) = 240$ J

   $K.E = 480 - 240 = 240$ J

6. $P = mv \Rightarrow P \propto v$

   $K.E = \frac{1}{2}mv^2 \Rightarrow K.E \propto v^2$

7. $P = \frac{W}{t} \Rightarrow W = Pt = (60)(2) = 120$ J

8. Frictional force is a non–conservative force. Work done against the frictional force depends upon the path followed.

9. The value of escape velocity for the surface of Moon is 2.4 km/s.

10. In closed path the displacement is zero. So, $W = 0$

11. $W = \vec{F}.\vec{d} = Fd\cos\theta$

    $W = \vec{F}.\vec{d} = Fd\cos270^\circ = 0$ $(\cos270^\circ = 0)$.

12. If the frictional force is present during the downward motion, a part of P.E. is used in doing work against frictional force and is equal to "f h". The remaining P.E (mgh – f h) is converted into the K.E.

    $mgh - fh = \frac{1}{2}mv^2$

    $mgh = \frac{1}{2}mv^2 + fh$

13. The time rate at which work is being done is called power.

    $P = \frac{W}{t}$

14. $P = \frac{W}{t} \Rightarrow W = Pt = (60)(120) = 7200$ J

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15. Gain in K.E = Loss in P.E

$$\frac{1}{2}m(v_2^2 - v_1^2) = mg(h_1 - h_2)$$

$$v_2^2 - 0 = 2g(h_1 - h_2) \Rightarrow v = \sqrt{2g(h_1 - h_2)}$$

$$v = \sqrt{2(10)(2)} = 6.3 \text{ m/s}$$

16. $W = \vec{F}.\vec{d}$

In closed path (circular motion) the displacement is zero. So,

$W = 0$

17. $P = \vec{F}.\vec{v} = Fv\cos 0 \Rightarrow P \propto v$

18. $W = mgh$

19. $v = \sqrt{2gh}$

20. $K.E = \frac{1}{2}mv^2$

$K.E \propto v^2$

21. Frictional force, Air resistance, Tension in a string, Normal force, Propulsion force of a rocket and propulsion force of a motor are all non-conservative forces.

22. $1kWh = 3.6MJ = 3.6 \times 10^6 J$

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PMC PAST PAPER 2022 (WORK & ENERGY)

Q.1 If momentum is increased by 13% than K.E increase by
A. 37% B. 2.27%
C. 3.47% D. None

Q.2 The slope of the work time graph is equal to
A. Displacement B. Acceleration
C. Power D. Energy

Q.3 If the velocity is doubled then
A. Momentum increases 4 times and K.E increases 2 times
B. Momentum and K.E. remain same
C. Momentum increases 2 times and K.E increases constant
D. Momentum increases 2 times and K.E increases 4 time

Q.4 What is the average power (in watts) required to lift a mass of 100kg to a height of 50m in 50 seconds?
A. 980 B. 50
C. 100 D. 5000

Q.5 In case of negative work, the angle between the force and displacement is
A. 180° B. 90°
C. 45° D. 0°

Q.6 A car travels with a constant speed of 15 m/s. The car's engine produces a 4000N pushing force in order to keep the speed constant. How much power is developed by the engine?
A. 60000 W B. 600 W
C. 6000 W D. 60 W

Q.7 If a pump can lift 200 kg of water through a height of 6 m in 10 seconds, then its power is
A. 1200 watts B. 1300 watts
C. 1000 watts D. 1100 watts

Q.8 As the rain falls, the potential energy changes to
A. kinetic energy B. chemical energy
C. thermal energy D. nuclear energy

Q.9 If the linear momentum of the object is increased by 0.1%, then the kinetic energy is increased by
A. 0.1 % B. 0.2%
C. 0.4% D. 0.01%

Q.10 Kinetic energy of a body is 1000J its momentum decreases by 50% then kinetic energy of that body becomes
A. 500J B. 750J
C. 1250J D. 250J

Q.11 Which of the following is not a conservative force?
A. friction B. electric
C. magnetic D. gravitational

Q.12 A field in which work done in a moving a body along the close path is zero called:
A. Electric field B. conservative field
C. magnetic field D. none of these

Q.13 Work done by conservative force is
A. Reversible B. Non reversible
C. Can be both D. None of them

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Q.14 A particle of mass 2 kg is in circular motion with velocity 5 m/s ^{2}, radius of path is 2 m what will be the work done by the centrifugal force in half cycle
A. 100 J
B. -100 J
C. 0
D. 50 J

Q.15 A force F = (0.5x +10) N acts on a particle, calculate the work done by the force in displacing particle from x=0 to x=2 m
A. 20 J
B. 21 J
C. 22 J
D. 23 J

Q.16 A constant force of F= (i- 2j – 3k) causes a displacement d = (2i – 5j + k), what will be the net work done if F in N and displacement is in meter
A. 15 J
B. 9 J
C. 8 J
D. 18 J

Q.17 A gardener moves a lawn roller through a distance of 50 m. Applied force is 50 N inclined at 60 degrees of direction of motion what will be the work done by the gardener
A. 1250 J
B. 2500 J
C. -1250 J
D. -2500 J

Q.18 The K.E. of a body of mass 2kg and momentum of 2Ns is :
A. 1J
B. 2J
C. 3J
D. 4J

Q.19 Two masses 1 g and 4 g are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is
A. 4 : 1
B. 1 : 2
C. 0 : 1
D. 1 : 6

Q.20 Work is a
A. vector quantity
B. scalar quantity
C. sometime scalar some time vector
D. none of these

Q.21 Work done is said to be negative if force and displacement are
A. parallel
B. perpendicular
C. anti parallel
D. none of these

Q.22 A constant force of 10N is applied in horizontal direction and distance travelled in the direction of force is 2m,then work done is
A. 50 J
B. 20 J
C. 22 J
D. 10 J

Q.23 Work is said to be done when a body move through certain distance by the action of
A. energy
B. force
C. momentum
D. power

Q.24 Work is said to be done when a body move through certain distance by the action of
A. energy
B. force
C. momentum
D. power

Q.25 A force of F = (1 + y) N is acting in y direction, work done by this force to move the particle from y= 0 to y = 1m
A. 0.5 J
B. 1 J
C. 2 J
D. 1.5 J

Q.26 An object is displaced from point A (2,3,4) m to point B (1,2,3) m under a constant force F=(2i+3j+4k). find the work done by this force in this process
A. 9 J
B. 0
C. -9 J
D. 20 J

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Q.27 If a horse pulls a cart, work done by horse is
A. negative
B. zero
C. positive
D. none of these

Q.28 A particle moves from point P(1,2,3) to Q(2,1,4) under the action of a constant force F= (2i + j + k), work done by force is:
A. 2 J
B. 4 J
C. 16 J
D. 8 J

Q.29 If momentum is increased by 20% then K.E. increase by: =
A. 0.44
B. 0.55
C. 0.66
D. 0.77

Q.30 1 joule is equal to
A. 104 erg
B. 105 erg
C. 106 erg
D. 107 erg

Q.31 A 4kg eagle picks up a 75g snake and raises it 2.5 m from the ground to a branch. What is the work done by the eagle on the snake? (Assume g = 10 m/s2)
A.100 J
B.1.875 J
C.18.75 J
D.187.5 J

Q.32 A stone of 1 kg is thrown upward it reaches a max height of 5 m , work done by the gravity is:
A. 50 J
B. 49 J
C. -49 J
D. 55 J

Q.33 The atmosphere around the earth is held by
A. clouds
B. winds
C. gravity
D. none of these

Q.34 A disc of radius 2 m and mass 100 kg roll on a horizontal surface, its center of mass has speed of 2cm/s, how much work is needed to stop it
A. .1 J
B. 0.02 J
C. 30 J
D. 2 J

Q.35 Work done can be calculated by taking
A. dot product of force and displacement
B. cross product of force and displacement
C. both cross and dot product
D. none of these

Q.36 A force of F = 20 + 10y N is acting in y direction, work done by this force to move the particle from y= 0 to y = 1m
A. 20 J
B. 15 J
C. 5 j
D. 25 J

Q.37 Work done by the centripetal force on a body moving in circle is zero because
A. the body moves parallel to F
C. the body move right angle to F
B. the body move opposite to F
D. centripetal and centrifugal balance each other

Q.38 For a particular displacement how is the work done related to time
A. depend on time
B. independent of time
C. both of these
D. none of these

Q.39 At which angle work done is maximum
A. 45 degree
B. 90 degree
C. 0 degree
D. 180 degree

Q.40 When the direction of the force and displacement are opposite, work done is
A. negative
B. positive
C. zero
D. none of these

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Q.41 When momentum of body increased by 200 %, its kinetic energy increases by
A. 200 %
B. 300 %
C. 400 %
D. 800 %

Q.42 When a force is parallel to the direction of motion of body, the work done is
A. Zero
B. minimum
C. infinity
D. maximum

Q.43 Effect of work is equal to
A. Change in total energy
B. change in kinetic energy
C. change in power
D. none of these

Q.44 If two point charges of charge q_1 and q_2 are placed at distance D. The force between them is proportional to:
A. d
B. d^2
C. 1/d
D. $1/d^2$

Q.45 A ball is released from the top of the tower, the ratio of work done by the gravity in first, second and third second of the motion
A. 1 : 2 :3
B. 1 : 4 : 9
C. 1 : 3 : 5
D. 1 : 5 : 3

Q.46 At which angle work done is minimum
A. 45 degree
B. 90 degree
C. 0 degree
D. 180 degree

Q.47 The slope of the work time graph is equal to
A. Displacement
B. Acceleration
C. Power
D. Energy

Q.48 The consumption of energy by a 60-watt bulb in 2 sec is
A. 120 J
B. 60 J
C. 30 J
D. 0.02 J

Q.49 A man lifts vertically a weight of 40kg through 1m in 10s; while a child lifts vertically a weight of 10kg through a distance of 1m in 1s. What will be correct inference?
A. Man does more work than a child
B. A child does more work than a man
C. Both do the same amount of work
D. None is correct

Q.50 The area under the force displacement graph represents
A. Area
B. Work done
C. Power
D. None of these

Q.51 When can one say that work is done on the body
A. When the body experiences force
B. When there is an increase in energy because of mechanical influence
C. When the body moves a certain distance
D. None of the above

Q.52 The work done on an object does not depend upon the
A. displacement
B. force applied
C. angle between force and displacement
D. initial velocity of the object

Q.53 A machine does 2500 J of work in 1 min. What is the power developed by the machine?
A. 21 W
B. 42 W
C. 150 W
D. 2500 W

Q.54 A moving car possesses
A. sound energy
B. mechanical energy
C. heat energy
D. chemical energy

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Q.55 The interconversion of matter and energy is predicted by
A. Newton B. Einstein
C. Jobst Burgi D. Abu Jafar

Q.56 A bus weighing 12kN has speed of 20 ms^{-1}. Its kinetic energy is
A. 210 kJ B. 230 kJ
C. 240 kJ D. 250 kJ

Q.57 Work done will be maximum. If the angle between the force F and displacement is
A. 45° B. 90°
C. 150° D. 0°

Q.58 Which of the following have same dimension?
A. Work and Torque B. Energy and Work
C. Power and Force D. Power and Torque

Q.59 What is kinetic energy of body 5kg and momentum 15 kg.m/sec
A. 30 J B. 55 J
C. 50 J D. 22.5 J

Q.60 Work done by non-conservative force is
A. Reversible B. Non-Reversible
C. can be both D. none of them

Q.61 Two forces of F1 =5 N and F2= 15 N are working on a body in opposite direction. If body displaced by 5 m in direction of net force, what will be the work done by F1
A. 25 J B. -25 J
C. 50 J D. 75 J

Q.62 When a spring is stretched, work done by stretching force is
A. positive B. negative
C. zero D. none of these

Q.63 KE of body is increased by 44 %, what is the percentage increase in the momentum
A. 10 % B. 20 %
C. 30 % D. 44 %

Q.64 A constant force F= 2i + 3j +4k is applied on a body what will be the work done to move a body 5m in z- direction
A. 0 B. 10 J
C. 45 J D. 20 J

Q.65 1 joule is equal to
A. 10^4 erg B. 10^5 erg
C. 10^6 erg D. 10^7 erg

Q.66 Unit of Energy
A. joule B. kilo joule
C. calorie D. All of these

Q.67 Work done will be maximum if the angle between the force F and displacement d is
A. 45° B. 90°
C. 180° D. 0°

Q.68 A field in which the work is done in a moving a body along a closed path is zero is called
A. Electric field B. Conservative field
C. Electromagnetic field D. Gravitational field

Q.69 When a force is parallel to the direction of motion of the body, then work done on the body is
A. Zero B. Minimum
C. Infinity D. Maximum

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Q.70 If a body a mass of 2 kg is raised vertically through 2m, then the work done will be
A. 38.2 J
B. 392.1 J
C. 39.2 J
D. 3.92 J

Q.71 The relation between horsepower and watt is
A. 1 hp = 546 watts
B. 1 hp = 746 watts
C. 1 hp = 1000 watts
D. 1 hp = 946 watts

Q.72 Work done on a ceiling fan by gravity is
A. maximum
B. zero
C. minimum
D. Infinity

Q.73 A body of mass 10 kg is travelling with uniform speed of 5 m/s. Its kinetic energy is
A. 125 J
B. 250 J
C. 500 J
D. 255 J

Q.74 When a body moves vertically upward, the work done will be
A. positive
B. zero
C. negative
D. none of these.

Q.75 A body moves a distance of 10 m along a straight line under the action of 5 N force. If work done is 25 J, then angle between the force and direction of motion of the body will be:
A. 75°
B. 60°
C. 45°
D. 30°

Q.76 According to the law of conservation of energy
A. Energy can't be destroyed
B. Energy can't be created
C. Energy can be transformed from one from to another
D. All of the above

Q.77 kWh is the unit of
A. Force
B. Power
C. Time
D. Energy

Q.78 An object that has potential energy has this energy because of its
A. Speed
B. Acceleration.
C. Momentum
D. Location

Q.79 Power delivered by the water pump up lifting
A. P=mgh/t
B. P=gh/t
C. P=mh/t
D. None

Q.80 2kg mass is uplifted by the machine through the height of 200m for 10 sec calculate power deliver to the load. ($g = 10m/s^2$)
A. 40W
B. 400W
C. 440W
D. 200W

Q.81 Light body A and heavy body B have equal K.E of translation, Then
A. A has lager momentum than B
B. B has larger momentum Than A
C. A and B have same
D. None

Q.82 Energy required to accelerate a car from 10ms to 20m/s compared with that required to accelerate is from 0 to 10 is
A. Twice
B. four times
C. three time
D. same

Q.83 A spring having spring constant of 10 N/m^2 is stretched to 5 m, what will be the work done:
A. 250 J
B. 50 J
C. -250 J
D. 125 J

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Q.84 An object is displaced from point A (0,1,1) m to point B (1,4,3) m under a constant force F=(i+2j+3k). find the work done by this force in this process
A. 13 J
B. 15 J
C. 0
D. -13 J

Q.85 A man hold a bucket by applying force 10 N, then moves a horizontal distance of 5 m and vertical distance of 10 m, find out the net work done
A. 100 J
B. 150 J
C. 50 J
D. 200 J

Q.86 A force $F = 7 - 2x+3x^2$ is applied on 2kg body, work done to displace the body from x =0 to x=5 m
A. 70 J
B. 200 J
C. 35 J
D. 135 J

Q.87 Work done by friction force is always
A. Negative
B. positive
C. zero
D. maybe positive, maybe negative

Q.88 When a man walks on a surface horizontally with constant velocity, work done by
A. friction is zero
B. contact force is zero
C. gravity is zero
D. all of these

Q.89 When brakes are applied to moving vehicle, the work done by the braking system is
A. positive
B. negative
C. zero
D. none of these

Q.90 A horse is pulling a cart of mass 50kg in the horizontal direction, if the distance travelled is 20m then what will be the work done by normal force
A. 1000 J
B. –1000 J
C. 0
D. 500 J.

Q.91 Work done by a conservative force in a complete cycle is
A. Zero
B. more than zero
C. less than zero
D. none of these

Q.92 Two forces of F_1 =5 N and F_2= 15 N are working on a body in opposite direction. If body displaced by 5 m in direction of net force, what will be the work done by F_{net}
A. 25 J
B. -75 J
C. 75 J
D. 50 J

Q.93 A 4kg eagle picks up a 75g snake and raises it 2.5 m from the ground to a branch. What is the work done to raise the bird's own Centre of mass to the branch? (Assume $g = 10\ m/s^2$)
A. 100 J
B. 1.875 J
C. 18.75 J
D. 187.5 J

Q.94 If force is $F = 4i - 2j$ and displacement is $d= 3i + 4j$, the work done will be
A. 4 J
B. 8 J
C. 2 J
D. 12 J

Q.95 A man pushes a wall and failed to displace it, he does
A. Negative work
B. positive work but not maximum
C. No work at all
D. maximum work

Q.96 When work done by force of gravity is negative (only gravity is acting)
A. KE decreases
B. PE increases
C. both (A) and (B)
D. none of these

Q.97 If the speed of the body is doubled, then
A. KE doubled
B. PE doubled
C. momentum doubled
D. acceleration is doubled

Q.98 work on arbitrary system means a transfer of energy to the system
A. Positive B. negative
C. Can be positive or negative D. None of the above

Q.99 A stone of mass 1 kg dropped from a height of 10m with the speed of 14 m/s, approximate kinetic energy is
A. 10 J B. 0 J
C. 100 J D. 1000 J

Q.100 A man standing in a bus and pushing the wall of the bus in direction of motion work done by the man is
A. positive B. zero
C. negative D. none of these

Q.101 Kinetic energy of the body is increased by the 21 %. what is the percentage change in the linear momentum of the body?
A.0.21 B. 0.22
C. 0.11 D. 10

Q.102 Work done can be calculated by taking:
A. dot product of force and displacement B. cross product of force and displacement
C. both cross and dot product D. none of these

Q.103 A body of mass 10 kg is moved parallel to the ground, through a distance of 2 m. The work done against gravitational force is:
A. zero B. 196 J
C. -196 J D. 48 J

Q.104 A constant force of 10 N is applied on a body which causes displacement of 12 cm what will be the work done:
A. 120 J B. 12 J
C. 1.2 J D. 18 J

Q.105 Work done by friction
A. can be zero B. can be positive
C. can be negative D. all of these

Q.106 If a porter is carrying a load and waiting for arrival of train then work done by the porter is:
A. positive B. zero
C. negative D. none of these

Q.107 A cyclist come to skidding stop in 10 m, the force on the cycle due to the road is 200 N and opposite to the motion. how much work does the road do on the cycle:
A. 2000 J B. -2000 J
C. 0 D. 200 J

Q.108 Moon is revolving around the earth, work done by the earth on the moon is:
A. positive B. zero
C. negative D. none of these

Q.109 A constant force of 20N is applied in horizontal direction and distance travelled in the direction of force is 5m, then work done is:
A. 200 J B. 50 J
C. 20 J D. 100 J

Q.110 A variable force F = x is applied what will be the work done in moving the particle from X= 0 to 1

A. 2 J
B. I J
C. 0.5 J
D. 5 J

Q.111 A bullet of mass 10 g leaves a rifle at an initial velocity of 1000 m/s and strikes earth at the same level with a velocity of 500 m/s. the work in overcoming the resistance of air will be:

A. 500J
B. 5000J
C. 3750J
D. 475J

Q.112 A bullet fired from gun can pierce to a target due to:

A. heat energy
B. mechanical energy
C. acceleration
D. kinetic energy

Q.113 A man move a roller through a distance of 20 m. 10 N of applied force is inclined at 60 degree of direction of motion what will be the work done by the man:

A. 100 J
B. 50 J
C. -100 J
D. -50 J

Q.114 Work is done by the applying force when

A. applied force is variable
B. applied force is perpendicular to the motion
C. applied force generated motion
D. applied force is constant

Q.115 What is the SI unit of work

A. joule
B. newton
C. watt
D. none of these

Q.116 In case of harmonic oscillator total energy remains:

A. variable
B. infinity
C. constant
D. zero

Q.117 In case of simple pendulum total energy remains:

A. variable
B. constant
C. infinity
D. zero

Q.118 A bullet of mass 5x10-5 has the velocity of 200 m/s, kinetic energy of the bullet is:

A. 100 J
B. I J
C. 10 J
D. none of these

Q.119 A constant force F= 2i + 3j +4k is applied on a body what will be the work done to move a body 5m in z- direction

A. 0
B. 10 J
C. 45 J
D. 20 J

Q.120 Unit of Energy

A. joule
B. kilo joule
C. calorie
D. All of these

Q.121 Work done will be maximum if the angle between the force F and displacement d is

A. 45°
B. 90°
C. 180°
D. 0°

Q.122 A field in which the work is done in a moving a body along a closed path is zero is called

A. Electric field
B. Conservative field
C. Electromagnetic field
D. Gravitational field

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Q123 When a force is parallel to the direction of motion of the body, then work done on the body is
A. Zero
B. Minimum
C. Infinity
D. Maximum

Q124 If a body a mass of 2 kg is raised vertically through 2m, then the work done will be
A. 38.2 J
B. 392.1 J
C. 39.2 J
D. 3.92 J

Q125 The relation between horsepower and watt is
A. 1 hp = 546 watts
B. 1 hp = 746 watts
C. 1 hp = 1000 watts
D. 1 hp = 946 watts

ANSWER KEY

1	D	16	B	31	B	46	B	61	A	76	D	91	A	106	B	121	D
2	C	17	A	32	B	47	C	62	A	77	D	92	A	107	B	122	B
3	D	18	A	33	C	48	A	63	B	78	D	93	A	108	B	123	D
4	A	19	B	34	B	49	A	64	D	79	A	94	A	109	D	124	C
5	A	20	B	35	A	50	B	65	D	80	B	95	C	110	C	125	B
6	A	21	C	36	D	51	B	66	D	81	B	96	B	111	C		
7	A	22	B	37	C	52	D	67	D	82	C	97	C	112	D		
8	A	23	B	38	B	53	B	68	B	83	D	98	A	113	A		
9	B	24	B	39	C	54	B	69	D	84	A	99	C	114	D		
10	D	25	D	40	A	55	B	70	C	85	A	100	B	115	A		
11	A	26	C	41	D	56	C	71	B	86	D	101	D	116	C		
12	B	27	A	42	D	57	D	72	B	87	A	102	A	117	B		
13	A	28	A	43	B	58	A	73	A	88	C	103	A	118	B		
14	C	29	A	44	D	59	D	74	C	89	B	104	C	119	D		
15	B	30	D	45	C	60	B	75	B	90	C	105	C	120	D		

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UNIT 3

PRACTICE EXERCISE

ROTATIONAL AND CIRCULAR MOTION

1. An electric motor of 12 horse power generates an angular velocity of 22 rad/s. What will be the frequency of rotation?
   A. $\frac{20}{\pi}$ C. $\frac{10}{\pi}$
   B. 7/2 D. 7/44
2. The ratio of angular speeds of seconds hand and hour hand of a watch is:
   A. 1 : 720 C. 1 : 60
   B. 60 : 1 D. 720 : 1
3. A body moves with constant angular velocity on a circle. Magnitude of angular acceleration is:
   A. $r\omega^2$ C. zero
   B. constant D. $r\omega$
4. A wheel having a diameter of 3 m starts from rest and accelerates uniformly to an angular velocity of 210 r.p.m. in 5 seconds. Angular acceleration of the wheel is:
   A. 4.4 rad s^{-2} C. 2.2 rad s^{-2}
   B. 3.3 rad s^{-2} D. 1.1 rad s^{-2}
5. If a particle moves in a circle describing equal angles in equal intervals of time, the velocity vector:
   A. remains constant. C. changes in direction only
   B. changes in magnitude only. D. changes both in magnitude and direction
6. Which of the following is an axial vector?
   A. Torque C. Angular Velocity
   B. Angular Displacement D. All of these
7. A particle of mass 1 kg is revolved in a horizontal \circle of radius 1 m with the help of a string. If the maximum tension the string can withstand is $16\pi^2$ N, then the maximum frequency with which the particle can revolve is:
   A. 3 Hz C. 4 Hz
   B. 2 Hz D. 5 Hz
8. Angle between radius vector and centripetal acceleration is:
   A. 0° C. 180°
   B. 90° D. 45°
9. A tachometer is a device to measure
   A. Gravitational pull B. Speed of rotation
   C. Surface tension D. Tension in a spring
10. A flywheel rotates at a constant speed of 3000 r.p.m. The angle described by the shaft in one second is:
    A. 3π rad C. 100π rad
    B. 30π rad D. 3000π rad
11. What is the angular speed of the seconds hand of a watch?
    A. 60 rad/s C. $\pi/30$ rad/s
    B. π rad/s D. 2 rad/s
12. A body of mass 100 g is revolving in a horizontal circle. If its frequency of rotation is 3.5 rps and radius of circular path is 0.5 m, the angular speed of the body is:
    A. 18 rad/s C. 22 rad/s
    B. 20 rad/s D. 24 rad/s

13. **A wheel has circumference C. If it makes "f" r.p.s., the linear speed of a point on the circumference is:**
A. $2\pi fC$ C. $fC/2\pi$
B. fC D. $fC/60$

14. **A body is whirled in a horizontal circle of radius 20 cm. It has angular velocity of 10 rad/s. What is its linear velocity at any point on circular path?**
A. 10 m/s C. 20 m/s
B. 2 m/s D. 2 m/s

15. **A particle moves along a circular orbit with constant angular velocity. This necessarily means:**
A. its motion is confined to a single plane
B. its motion is not confined to a single plane
C. nothing can be said regarding the plane of motion.
D. its motion is one–dimensional



2 Axes ↓ Single Plane.

16. **A mass of 5 kg is tied to a string of length 1.0 m and is rotated in vertical circle with a uniform speed of 4 m/s. The tension in the string will be 130 N when the mass is at ($g = 10\ m/s^2$)**
A. highest point C. bottom
B. mid way D. cannot be justified

$T = \frac{mv^2}{r} + mg$

17. **A cane filled with water is revolved in a vertical circle of radius 4 m and water does not fall down. The time period of revolution will be:**
A. 2 s C. 6 s
B. 4 s D. 8 s

$T = m$ $T = \frac{(5)(16)}{1} + (5)(10)$ $T = 80 + 50$ $T = 130$.

18. **A body travelling in a circular path at constant speed:**
A. Has a constant velocity C. has an inward acceleration
B. is not accelerated D. has transverse acceleration

$v = \frac{d}{t}$

19. **A satellite is revolving around the Earth in a circular orbit of radius R. Its period of revolution varies as:**
A. R^2 C. R
B. $R^{3/2}$ D. $R^{1/2}$

$T = \frac{2\pi R}{v}$ $T = \frac{2\pi R}{\sqrt{gR}}$

20. **Which of the following is not directed along the axis of rotation?**
A. angular displacement C. angular momentum
B. centripetal acceleration D. Angular acceleration

21. **The direction of _____ can be found by right hand rule.**
A. angular displacement C. angular velocity
B. angular acceleration D. all of these

$L = I\omega$

22. **A pedestal fan is rotating anticlockwise. When the electric power is cut off, its speed steadily decreases to zero. Its angular acceleration will be directed:**
A. upward C. away from us
B. downward D. towards us

23. **The angular velocity of the minute's hand of the watch is:**
A. $2\pi\ rads^{-1}$ C. $\pi/30\ rads^{-1}$
B. $\pi/1800\ rads^{-1}$ D. $3600\pi\ rads^{-1}$

Then, its direction will not change

24. **The angular velocity of a body moving along a circular path can be manipulated as a scalar if:**
A. angular speed is slow C. mass of body is very light
B. axis of rotation is fixed D. Both "A" and "B"

25. **The time rate of change of angular displacement is called:**
A. linear velocity
B. angular velocity
C. linear speed
D. angular speed

26. **In which case angular work is being done:**
A. if angular velocity is increased
B. if angular velocity is decreased
C. if radius is decreased
D. Both "A" and "B"

27. **Angular velocity has same dimensions as that of:**
A. angular displacement
B. linear acceleration
C. frequency
D. linear velocity

28. **Equations of angular motion are useful only when the axis of rotation is:**
A. constantly varying
B. fixed
C. along the x–axis
D. not stable

29. **For very small values of $\Delta\theta$, the angular displacement is:**
A. base quantity
B. supplementary quantity
C. vector quantity
D. scalar quantity

30. **A particle moves in a circle of radius "r". After half revolution, its displacement and distance are:**
A. "πr" and "2r" respectively
B. equal to each other
C. "0" and "πr" respectively
D. "2r" and "πr" respectively

31. **A flywheel at rest is to reach an angular velocity of 36 $rads^{-1}$ in 6 second, with a constant angular acceleration. The total angle turned through during this interval is:**
A. 216 rad
B. 108 rad
C. 144 rad
D. 72 rad

32. **Identify the increasing order of the angular velocities of the following:**
(I) Earth rotating about its own axis
(II) hour's hand of a clock
(III) second's hand of a clock
A. I, II, III
B. III, I, II
C. II, III, I
D. III, II, I

33. **The angle between angular acceleration and centripetal acceleration is:**
A. 0^0
B. 90^0
C. 180^0
D. 360^0

34. **A body of mass 2kg is moving in a circle of radius 3m with velocity 6ms^{-1}. Its centripetal acceleration is:**
A. 24 ms^{-2}
B. 36 ms^{-2}
C. 12 ms^{-2}
D. 18 ms^{-2}

35. **An electric fan rotating with 3 $revs^{-1}$ is switched off. It comes to rest in 2 seconds having a constant deceleration of 1 $revs^{-2}$. How many revolutions did it turn before coming to rest?**
A. 6 revolutions
B. 8 revolutions
C. 2 revolutions
D. 10 revolutions

36. **Conventionally the angular velocity is directed at an angle of:**
A. 90° to the axis of rotation
B. 30° to the axis of rotation
C. 0° to the axis of rotation
D. Along the radius

37. **The satellites are held in orbits:**
A. by rockets
B. due to gravitational pull of Earth
C. due to their high mass
D. due to inertia

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38. **The acceleration of a low flying Earth satellite is:**
A. 1.62 m/s^2 C. very high
B. 9.8 m/s^2 D. zero

39. **An object of mass 1 g is whirled in a horizontal circle of radius 0.5m at a constant speed of 2m/s. The work done on the object during one revolution is:**
A. 0 C. 1 J
B. 2 J D. 4 J

40. **A child is revolving a tiny 10g stone, tied at one end of a string, in a vertical loop of 2m diameter. If the stone completes 100 revolutions in 1 second, the work done on it will be:**
A. zero C. 4.9 J
B. 19.8 J D. 9.8 J

41. **The angle between the minute and hour hands of a watch at 4'O clock is:**
A. 3π/2 radians C. 2π/3 radians
B. π/2 radians D. 5π/2 radians

42. **For satellite telecommunication _____signals are used.**
A. micro waves C. infrared waves
B. radio waves D. light waves

43. **Angular velocity of a body is 4 rev/min. Its angular velocity in rad/s will be:**
A. 2π rad/s C. π rad/s
B. 2π/15 rad/s D. 4π rad/s

44. **An athlete completes one round (θ = 2π radian) of a circular track of 40m radius in 40 sec. How much linear displacement will he cover in 2 minutes and 20 seconds?**
A. 240π meters C. 80π meters
B. 2π meters D. 80 meters

45. **When a body moves in a circle, the angle between its linear velocity $\vec{v}$ and angular velocity $\vec{\omega}$ is:**
A. 180° C. 90°
B. 0° D. 45°

46. **A body rotating at 10 rad/s in a circle of radius 2m has the tangential velocity:**
A. 5 ms^{-1} C. 100 ms^{-1}
B. 20 ms^{-1} D. 0.5 ms^{-1}

47. **A body is moving in a circle under centripetal force "F_c". If its linear velocity and radius both are made twice, the centripetal force will be:**
A. F_c C. $F_c/2$
B. $2F_c$ D. $4F_c$

48. **Two isosceles triangles are similar, if the angle between their:**
A. unequal arms are equal C. unequal arms are unequal
B. equal arms are equal D. equal arms are unequal

49. **When a body is whirled in a horizontal circle by means of a string, the centripetal force is supplied by:**
A. mass of a body C. velocity of a body
B. tension in the string D. centripetal acceleration

50. **For a body moving in a circle, its linear _____is equal to radius times angular _____.**
A. displacement C. acceleration
B. velocity D. all of these

51. **What is wrong about centripetal and centrifugal forces?**
A. they act on the same body
B. their magnitudes are same
C. their directions are opposite
D. Both perform work done

52. **Doubling which of the following quantities will increase the centripetal force eight times?**
(i) mass (ii) radius (iii) velocity
A. (i) and (ii) only
B. (ii) and (iii) only
C. (i) and (iii) only
D. (i), (ii) and (iii)

53. **A 1000kg car is turning around a corner at 10 ms^{-1} as the radius of circle is 10m. Find the centripetal force:**
A. 2×10^3 N
B. 1×10^4 N
C. 2×10^4 N
D. 0.5×10^4 N

54. **The angle between the centripetal force and tangential velocity is:**
A. 0°
B. 90°
C. 180°
D. 60°

55. **The ratio of the angular speed of minute hand of a clock to the second hand of clock for one complete rotation is:**
A. 1 : 15
B. 15 : 1
C. 1 : 60
D. 60 : 1

56. **If mass, velocity and radius becomes double then the centripetal force will be:**
A. Two times
B. Four times
C. Eight times
D. ¼ times

57. **If body moving with angular speed of 2π rad/s and radius is 1m the centripetal acceleration becomes:**
A. $4\pi\ ms^{-2}$
B. $4\pi^2\ ms^{-2}$
C. $2\pi\ ms^{-2}$
D. $2\pi^2\ ms^{-2}$

58. **The ratio of frequency to angular frequency is:**
A. $\frac{1}{\pi}$
B. π
C. $\frac{1}{2\pi}$
D. 2π

59. **The direction of centrifugal force is directed ____ the center.**
A. towards
B. away
C. at
D. Perpendicular to the plane

60. **An object of mass "m" and another object of mass "2m" are each forced to move along a circle of radius 1.0m at a constant speed of 1.0m/s. The magnitudes of their accelerations are:**
A. equal
B. in the ratio of 2 : 1
C. in the ratio of $\sqrt{2}$: 1
D. in the ratio of 4 : 1

61. **An object moves in a circle. If the mass is tripled, the speed halved, and the radius unchanged, then the magnitude of the centripetal force must be multiplied by a factor of:**
A. 3/2
B. 9/4
C. 3/4
D. 6

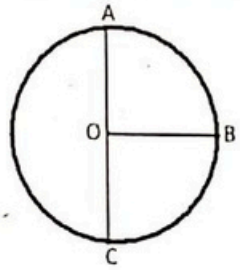
62. **The driver of a 1000 kg car tries to turn through a circle of radius 100m on an unbanked curve at a speed of 10 m/s. The actual frictional force between the tyres and slippery road has a magnitude of 900 N. The car:**
A. slides into the inside of the curve
B. slides off to the outside of the curve
C. makes the turn
D. makes the turn only if it goes faster

63. **One end of a 1.0 m string is fixed, the other end is attached to a 2.0 kg stone. The stone swings in a vertical circle, passing the top point at 4.0m/s. The tension force of the string (in newtons) at this point is about:**
A. 0 C. 12
B. 20 D. 32

64. **A flywheel rotating at 12 rev/s is brought to rest in 6 s. The magnitude of the average angular acceleration in rad/s^2 of the wheel during this process is:**
A. $1/\pi$ C. 2
B. 4 D. 4π

65. **A wheel initially has an angular velocity of 18 rad/s but it is slowing at a rate of 2.0 rad/s^2. By the time it stops it will have turned through:**
A. 81 rad C. 160 rad
B. 245 rad D. 330 rad

66. **The ratio of velocities at points A, B and C in vertical circular motion is**



A. 1:9:25 C. 1:3:5
B. 1:2:3 D. $1:\sqrt{3}:\sqrt{5}$

67. **If a car moves with a uniform speed of 400 cms^{-1} in a circle of radius 0.4m. Its angular speed is:**
A. 4 rads^{-1} C. 5 rads^{-1}
B. 10 rad s^{-1} D. 2.8 rad s^{-1}

68. **When a wheel, 1 m in diameter makes 30 rev min^{-1}, the linear speed of point on its rim in ms^{-1} is:**
A. 2π C. $\pi/2$
B. π D. 20π

69. **A cyclist cycling around a circular racing track, skids because:**
A. the centripetal force upon him is less than limiting friction
B. the centripetal force upon him is greater than limiting friction
C. the centripetal force upon him is equal to the limiting friction
D. the friction between the tyres of the cycle and road vanishes

70. **In angular motion, Newton's second law of motion is:**
A. $F = ma$ C. $F = \Delta P/\Delta t$
B. $\tau = I\alpha$ D. all of above

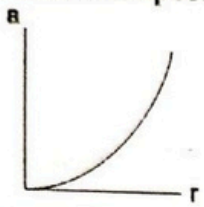
71. **If we whirl a stone at the end of a string in the vertical circle, it is likely to break when the stone is:**
A. at the highest point C. at the lowest point
B. at any point during motion D. at the point where gravity is not acting

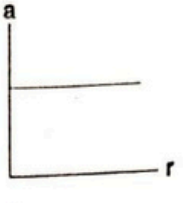
72. **Uniform circular motion is the direct consequence of:**
A. a force that is always tangent to the path
B. an acceleration tangent to the path
C. a force of constant magnitude that is always directed away from the same fixed point
D. a force of constant magnitude that is always directed toward the same fixed point

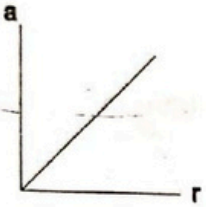
73. **The magnitude of the force required to cause a 0.04 kg object to move at 0.6m/s in a circle of radius 1.0 m is:**

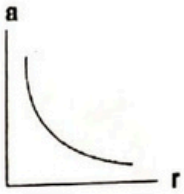
A. 2.4×10^{-2} N
B. $1.4\pi \times 10^{-2}$ N
C. 1.4×10^{-2} N
D. $2.4\pi^2 \times 10^{-2}$ N

74. **Which of the following graphs is correct for a particle moving in a circle of radius "r" at a constant speed?**

A.


C.


B.


D.


75. **An object moves around a circle. If the radius is doubled keeping the speed the same then the magnitude of the centripetal force must be:**

A. twice
B. four times
C. half
D. one fourth

76. **If a satellite moves above Earth's atmosphere in a circular orbit with constant speed, then:**

A. its acceleration and velocity are always in the same direction
B. its acceleration is toward the Earth
C. its velocity is constant
D. it will fall back to Earth when its fuel is used up

77. **If a certain car, going with speed V_1, rounds a level curve with a radius R_1, it is just on the verge of skidding. If its speed is now doubled, the radius of the tightest curve on the same road that it can round without skidding is:**

A. $2R_1$
B. $R_1/2$
C. $4R_1$
D. $R_1/4$

78. **A car is moving with speed 30 m/s on a circular path of radius 500 m. its speed is increasing at the rate of $2m/s^2$. The acceleration of car is**

A. $9.8\ m/s^2$
B. $1.8\ m/s^2$
C. $2\ m/s^2$
D. $2.7\ m/s^2$

79. **If a wheel turns with constant angular speed then:**

A. each point on its rim moves with constant velocity
B. each point on its rim moves with constant acceleration
C. the wheel turns through equal angles in equal times
D. the angle through which the wheel turns in each second increases as time goes on

80. **The angular velocity of a rotating wheel increases by 2 rev/s every minute. The angular acceleration in rad/s^2 of this wheel is:**

A. $4\pi^2$
B. 1/30
C. 2π
D. $\pi/15$

81. **A particle is under the action of force of constant magnitude. The direction of the force is such that it is always normal to the velocity of the particle. If the motion of the particle is confined to a plane, then:**

A. The particle has a linear motion
B. The particle has a circular motion
C. The acceleration of the particle is constant
D. The velocity of the particle constant

82. **If the angular velocity vector of a spinning body points out of the page then, when viewed from above the page, the body is spinning:**
A. clockwise about an axis that is perpendicular to the page
B. counterclockwise about an axis that is perpendicular to the page
C. about an axis that is parallel to the page
D. about an axis that is changing orientation

83. **A child, riding on a large merry–go–round, travels a distance of 3000m in a circle of diameter 40 m. The total angle through which she revolves is:**
A. 50 rad
B. 150 rad
C. 75 rad
D. 314 rad

84. **A particle moves in a circular path of radius 0.10m with a constant angular speed of 5 rev/s. The acceleration of the particle is:**
A. 10π m/s^2
B. 500π m/s^2
C. 0.50m/s^2
D. $10\pi^2$ m/s^2

85. **For a wheel spinning on an axis through its center, the ratio of the tangential acceleration of a point on the rim to the tangential acceleration of a point halfway between the center and the rim is:**
A. 1
B. ½
C. 2
D. 4

86. **Two wheels are identical but wheel "B" is spinning with twice the angular speed of wheel "A". The ratio of the magnitude of the radial acceleration of a point on the rim of "B" to the magnitude of the radial acceleration of a point on the rim of "A" is:**
A. 1
B. ½
C. 2
D. 4

87. **A disk is free to rotate on a fixed axis. A force of given magnitude F, in the plane of the disk, is to be applied. Of the following alternatives the greatest angular acceleration is obtained if the force is:**
A. applied tangentially halfway between the axis and the rim
B. applied tangentially at the rim
C. applied radially halfway between the axis and the rim
D. applied radially at the rim

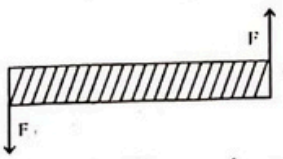
$F_{1c} = \frac{mv^2}{r}$ $F_{2c} = \frac{m4}{R}$

88. **A thin circular hoop of mass 1.0 kg and radius 2.0 m is rotating about an axis through its center and perpendicular to its plane. It is slowing down at the rate of 7.0 rad/s^2. The net torque acting on it is:**
A. 7.0 N m
B. 28.0 N m
C. 14.0 N m
D. 44.0 N m

$\frac{F_1}{F_2} = \frac{mv_1^2}{R_1} \times \frac{R_2}{m(2v_1)^2}$

89. **Two wheels roll side-by-side without sliding, at the same speed. The radius of wheel 2 is twice the radius of wheel 1. The angular velocity of wheel 2 is:**
A. twice the angular velocity of wheel 1
B. the same as the angular velocity of wheel 1
C. half the angular velocity of wheel 1
D. more than twice the angular velocity of wheel 1

90. **A rod rests on frictionless ice. Forces that are equal in magnitude and opposite in direction are then simultaneously applied to its ends as shown. The quantity that vanishes is its:**



A. angular momentum
B. total linear momentum
C. angular acceleration
D. kinetic energy

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91. When are length and radius of the circle become equal then the angle subtended at the centre of the circle will be:
A. 1 rad
B. π rad
C. 53.7°
D. All of these

92. The ratio of circumference of a circle to its diameter is equal to:
A. 2π rad
B. π /2 rad
C. π rad
D. 1 sr

93. The weight of the body at the center of Earth is:
A. slightly less
B. zero
C. slightly greater
D. maximum

94. One radian is equal to:
A. 2π rev
B. π/4 rev
C. π/2 rev
D. 1/2π rev

95. Angular acceleration is:
A. "r" times linear acceleration
B. "1/r" times linear acceleration
C. "1/r" times angular velocity
D. "r" times angular velocity

96. A wheel of radius 50 cm having angular speed of 5 rad s^{-1} will have linear speed in ms^{-1}:
A. 1.5
B. 3.5
C. 2.5
D. 4

97. A body of mass 8 kg moves along a circle of radius 4m with a constant speed of $8ms^{-1}$. The centripetal force on the body is:
A. 48 N
B. 128 N
C. 8 N
D. 72 N

98. The centripetal acceleration is also called:
A. Tangential acceleration
B. Angular acceleration
C. Radial acceleration
D. Rotational acceleration

99. 1 rev min^{-1} is equal to:
A. π/6 rad s^{-1}
B. π/20 rad s^{-1}
C. π/15 rad s^{-1}
D. π/30 rad s^{-1}

100. A wheel of radius 2 m turns through an angle of 57.3°. it lays out a tangential distance:
A. 2 m
B. 57.3 m
C. 4 m
D. 114.6 m

101. The linear and angular velocities of a particle moving about the centre of a circle of radius r, are related by
A. $\vec{V} = \vec{\omega} \times \vec{r}$
B. $\vec{V} \times \vec{\omega} = \vec{r}$
C. $\vec{V} = \vec{r} \times \vec{\omega}$
D. $\vec{\omega} \times \vec{V} = \vec{r}$

102. If a car moves with a uniform speed of 2 m s^{-1} in a circle of radius 0.4 m. Its angular speed is
A. 4 rad s^{-1}
B. 5 rad s^{-1}
C. 1.6 rad s^{-1}
D. 2.8 m s^{-1}

103. What could be the reason a car moving on a horizontal road gets thrown out of the road while taking a turn
A. Due to the reaction of the ground
B. Due to rolling frictional force between tyre and road
C. By the gravitational force
D. Due to lack of sufficient centripetal force

104. **An object of mass of 2 kg rotates at constant speed in a horizontal circle of radius 5m. The time for one complete revolution is 3s. What is the magnitude of the resultant force acting on the object?**

A. $\frac{4\pi^2}{9}$ N
B. $\frac{40\pi^2}{9}$ N
C. $\frac{100\pi^2}{9}$ N
D. $\frac{400\pi^2}{9}$ N

105. **For a body moving with constant speed in a horizontal circle, which of the following remains constant?**

A. Velocity
B. Acceleration
C. Centripetal force
D. Kinetic energy

106. **The length of the second hand of a watch is 1 cm. The velocity vector of the tip of the second hand in cm per second is**

A. 2π
B. $\frac{2\pi}{12\times60}$
C. $\frac{2\pi}{60}$
D. $\frac{2\pi}{24\times60}$

107. **The ratio of angular frequency and linear frequency is**

A. 2π
B. $\frac{1}{2\pi}$
C. π
D. $\frac{\pi}{2}$

108. **A small body of mass m, tied to a string and revolved in a vertical circle is just able to reach to the top of the path and complete the circle. The tension in the string at the lowest point of the path is**

A. mg
B. 2mg
C. 4 mg
D. 6 mg

109. **The angular momentum changes form 2 units to 6 units in 4 s. the torque is**

A. 1 unit
B. $\frac{1}{2}$unit
C. $\frac{3}{2}$unit
D. 4 unit

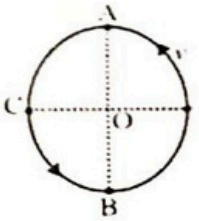
110. **In uniform circular motion, the factor that remains constant is**

A. Linear velocity
B. Acceleration
C. Centripetal force
D. Speed

111. **A flywheel gains a speed of 540 rpm in 6 second. Its angular acceleration is**

A. 3π rad s^{-2}
B. 9π rad s^{-2}
C. 6π rad s^{-2}
D. 12π rad s^{-2}

112. **One end of the string of length 1.0 m is tied to a body of mass 0.5 kg. It is whirled in a vertical circle as shown in figure below. If the angular frequency of the body is 4 rad s^{-1}, what is the tension in the string when the body is at the topmost point A? Take g = 10 m s^{-2}.**



A. 3 N
B. 13 N
C. 15 N
D. 18 N

113. **A particle is moving with constant speed by keeping itself at constant distance from a fixed point in a given plane. Its motion is**

A. Circular motion
B. Uniform circular motion
C. Uniform circular motion with fixed axis of rotation
D. Uniform circular motion with axis of rotation not defined

114. For a particle in uniform circular motion the relation $a = r\alpha$ of accelerations hold. The acceleration 'a'

A. Is centripetal acceleration
B. Is radial acceleration
C. Is tangential acceleration
D. both A and B

115. A point on the rim of a wheel 4 m in diameter has a velocity of 1600 cm s^{-1}. The angular velocity of the wheel is

A. 2 rad s^{-1}
B. 6 rad s^{-1}
C. 4 rad s^{-1}
D. 8 rad s^{-1}

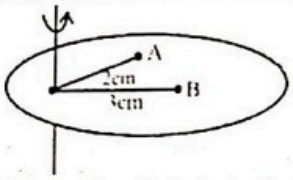
116. The angular speed of a fly wheel making 120 revolutions/minute is

A. 2π rad/s
B. $4\pi^2$rad/s
C. 4π rad/s
D. π rad/s

117. If a body is moving in a circular path with constant speed, then the

A. Velocity and acceleration are perpendicular to each other
B. Velocity and acceleration are parallel to each other
C. Velocity and acceleration are anti-parallel
D. Both have zero magnitude

118. A rigid body is rotating about an axis of rotation as shown.



The ratio of angular accelerations of point A to that of B.

A. 1 : 1
B. 2 : 3
C. 3 : 2
D. 1 : 6

119. A wheel rotates about an axis passing through the centre and perpendicular to the plane with slowly increasing angular speed. Thus it has:

A. radial velocity and radial acceleration
B. tangential velocity and radial acceleration
C. tangential velocity and tangential acceleration
D. tangential velocity but acceleration having both components

120. For positive angular displacement the rotation would be

A. clockwise
B. parallel
C. anti-clockwise
D. perpendicular

121. The acceleration of a motor car is 8 m/s^2. If the diameter of its wheel be 2m. It's angular acceleration will be

A. 8 rad/s^2
B. 16 rad/s^2
C. 10 m/s^2
D. 10 rad/s^2

122. When a wheel 1m in diameter makes 30 rev/min, the linear speed of point on it's rim in m s^{-1} is

A. 2π
B. 3π
C. $\frac{\pi}{2}$
D. 4π

123. Ten seconds after an electric fan is turned on, the fan rotates at 300rev/min. Its average angular acceleration is

A. 30 rad/s^2
B. 3.14 rad/s^2
C. 30 rev/s^2
D. 500 rev/s^2

124. The angular speed in radian/hour for daily rotation of the earth is
A. 2π C. 4π
B. $\frac{\pi}{6}$ D. $\frac{\pi}{12}$

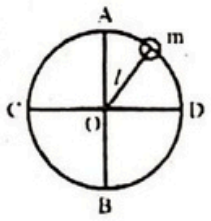
125. The shaft of a motor rotates at a constant angular speed of 360rev/min. Angle turned through in 1 sec in radian is
A. π C. 6π
B. 3π D. 12π

126. The angular velocity of the minute hand of a clock is
A. $\frac{2\pi}{60}\,rad\,s^{-1}$ C. $\frac{\pi}{24}\,rad\,s^{-1}$
B. $\frac{2\pi}{3600}\,rad\,s^{-1}$ D. $\frac{\pi}{3600}\,rad\,s^{-1}$

127. Work done due to centripetal force for circular motion will be:
A. reduced C. half
B. maximum D. zero

128. An object is travelling in a circle of radius r with angular velocity ω and speed v. Which expression gives the centripetal acceleration?
A. rω C. $\frac{v}{r}$
B. vω D. $\frac{v}{r^2}$

129. The force which provides the necessary centripetal force to keep the mud in circular path is called
A. cohesive force C. adhesive force
B. frictional force D. gravitational force

130. A small sphere is attached to a cord and rotates in a vertical circle about a point O. If the average speed of the sphere is increased, the cord is most likely to break at the orientation when the mass is at the


A. bottom point B C. point D
B. point C D. top point A

131. A stone of mass m tied to a string of length *l* is rotat ed in a circle with the other end of the string as the centre. The speed of the stone is v. If the string breaks, the stone will move
A. Toward the centre of circle C. Away from centre of circle
B. Along the tangent D. All of these

132. The mud flies off the tyre of a fast moving car in the direction
A. parallel to the moving tyre C. anti parallel to the moving tyre
B. tangent to the moving tyre D. none of these

133. Two bodies of mass 10 kg and 5 kg moving in concentric orbits of radii R and r such that their periods are the same. Then the ratio between their centripetal acceleration is
A. R/r C. R^2/r^2
B. r/R D. r^2/R^2

134. A car of 1000 kg traveling at 20m/sec rounds a curve of radius 100 m. Find the necessary centripetal force
A. 4×10^3 kgm/s^2 C. 5×10^3 kgm/s^2
B. 3×10^3 kgm/s^2 D. 4.5×10^3 kgm/s^2

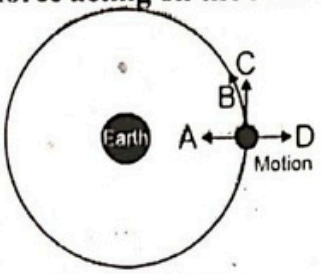
135. Particle is moving in a circle of radius r with constant angular speed ω. Its acceleration, directed towards the centre of the circle is

A. $\frac{\omega}{r}$
C. $\omega^2 r$
B. $\frac{\omega^2}{r}$
D. ωr^2

136. Two particle of equal masses are revolving in circular paths of radius r_1 and r_2, respectively with the same speed. The ratio of their centripetal force is

A. $\left(\frac{r_2}{r_1}\right)$
C. $\sqrt{\left(\frac{r_2}{r_1}\right)}$
B. $\left(\frac{r_2}{r_1}\right)^2$
D. $\left(\frac{r_1}{r_2}\right)^2$

137. The diagram represents the Moon in its orbit around the Earth. Which arrow represents the direction of the resultant force acting on the Moon at the instant shown?



A. B
C. A
B. D
D. C

138. A particle moves in a circle of radius 25 cm at two revolutions per second. The acceleration of the particle in m/s^2 is

A. π^2
C. $4\pi^2$
B. $8\pi^2$
D. $2\pi^2$

139. A stone of mass 250 g is tied to the end of a string of length 1.0 m. It is whirled in a horizontal circle with a frequency of 30 rev/min. What is the tension in a string?

A. $\frac{\pi^2}{4}$ N
C. π^2 N
B. $\frac{\pi^2}{2}$ N
D. $2\pi^2$ N

140. The centripetal force acting on a body of mass m in a circle of radius r is

A. $\frac{mv^2}{r}$
C. $mr^2\omega$
B. $mr\omega^2$
D. both A and B

141. A part in an engine is rotating in a circle of radius 8.0 cm at 3000 revolutions per minute. What is its centripetal acceleration?

A. 25 ms^{-2}
C. 3.1×10^4 ms^{-2}
B. 7900 ms^{-2}
D. 7.2×10^7 ms^{-2}

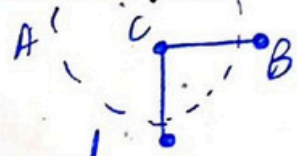
142. An engine flywheel of diameter 1m rotates with an angular velocity of 600 r.p.m. The linear velocity of a particle on the periphery of the wheel will be

A. 40πm/sec
C. 20πm/sec
B. 30πm/sec
D. 10πm/sec

143. **The driver of a car travelling at velocity v suddenly sees a broad wall in front of him at a distance a. The should:**
A. Brake sharply
B. Turn sharply
C. A and B both
D. None of the above

144. **A particle P is moving in a circle of radius a with a uniform speed v, C is the centre of the circle and AB is a diameter. The angular velocity of P about A and C are in the ratio:**
A. 1:1
B. 1:2
C. 2:1
D. 4:1

145. **A sphere is suspended by a thread of length L. What minimum horizontal velocity has to be imparted to the ball for it to reach he height of the suspension?**
A. gL
B. 2gL
C. $\sqrt{gL}$
D. $\sqrt{2gL}$



146. $1\frac{rev}{min}$ **is equal to:**
A. $\frac{\pi}{6}$ rad s^{-1}
B. $\frac{\pi}{15}$ rad s^{-1}
C. $\frac{\pi}{20}$ rad s^{-1}
D. $\frac{\pi}{30}$ rad s^{-1}

147. **Which of the following vector relation is incorrect where the symbols have their usual meaning:**
A. $\vec{V} = \vec{r} \times \vec{\omega}$
B. $\vec{V} = \vec{\omega} \times \vec{r}$
C. $\vec{\tau} = \vec{r} \times \vec{F}$
D. $\vec{L} = \vec{r} \times \vec{\omega}$

148. **A stone of mass 250 g is tied to the end of a string of length 1.0 m. It is whirled in a horizontal circle with a frequency of 30 rev./min. What is the tension in the string?**
A. $\frac{\pi^2}{4}$ N
B. $\frac{\pi^2}{2}$ N
C. π^2 N
D. $2\pi^2$ N

149. **A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is**
A. Quadrupled
B. Halved
C. Unchanged
D. Doubled

150. **A particle of mass m is rotating by means of a string in a vertical circle. The difference in the tensions at the bottom and the top would be:**
A. 6mg
B. 4mg
C. 2mg
D. Zero

ANSWER KEY

1	B	16	C	31	B	46	B	61	C	76	B	91	B	106	C	121	A	136	A
2	D	17	B	32	A	47	B	62	B	77	C	92	B	107	A	122	C	137	C
3	C	18	C	33	B	48	B	63	C	78	D	93	B	108	D	123	B	138	C
4	A	19	C	34	C	49	B	64	D	79	C	94	D	109	A	124	D	139	A
5	C	20	B	35	B	50	D	65	A	80	D	95	B	110	D	125	D	140	D
6	D	21	D	36	C	51	D	66	D	81	B	96	C	111	A	126	B	141	B
7	B	22	C	37	B	52	B	67	B	82	B	97	B	112	A	127	D	142	D
8	C	23	B	38	B	53	B	68	C	83	B	98	C	113	C	128	B	143	A
9	B	24	B	39	A	54	B	69	B	84	D	99	D	114	C	129	C	144	B
10	C	25	B	40	A	55	C	70	B	85	C	100	A	115	D	130	A	145	D
11	C	26	D	41	C	56	B	71	C	86	D	101	A	116	C	131	B	146	D
12	C	27	C	42	A	57	B	72	D	87	B	102	B	117	A	132	B	147	D
13	B	28	B	43	B	58	C	73	C	88	B	103	D	118	A	133	A	148	A
14	B	29	C	44	D	59	B	74	D	89	C	104	B	119	D	134	A	149	A
15	A	30	D	45	C	60	A	75	C	90	B	105	D	120	C	135	C	150	A

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SOLUTIONS

1. $\omega = 2\pi f$

$f = \frac{\omega}{2\pi} = \frac{22}{2\pi} = \frac{22}{2} \times \frac{7}{22} = \frac{7}{2} \left(\pi = \frac{22}{7}\right)$

2. $\omega_S = \frac{2\pi}{60}$

$\omega_H = \frac{2\pi}{12 \times 3600}$

(hour hand complete 1 revolution in 12 hours)

$\frac{\omega_S}{\omega_H} = \frac{\frac{2\pi}{60}}{\frac{2\pi}{12\times3600}} = \frac{12\times3600}{60} = 12\times60 = 720:1$

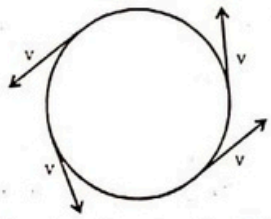
3. $\alpha = \frac{\Delta\omega}{\Delta t}$

ω = constant $\Rightarrow \Delta\omega = 0$

$\alpha = 0$

4. $\omega_f = 210 \times \frac{2\pi}{60} = 210 \times \frac{2}{60} \times \frac{22}{7} = 22 \text{ rad/s} \left(\pi = \frac{22}{7}\right), \left(1\text{rpm} = \frac{2\pi}{60} \text{ rad/s}\right)$

$\alpha = \frac{\omega_f - \omega_i}{\Delta t} = \frac{22-0}{5} = \frac{22}{5} = 4.4 \text{ rads}^{-2}$



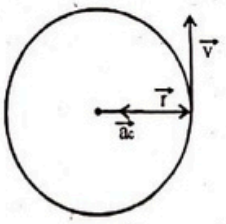
5. In circular motion the direction of velocity changes at every point and it is along the tangent.

6. Angular displacement, angular velocity, angular acceleration, angular momentum and torque all have direction along the axis of rotation. They can be determined by right hand rule.

7. $F_c = mr\omega^2 = mr(2\pi f)^2 = 4\pi^2 mrf^2$

$4\pi^2 mrf^2 = 16\pi^2 \Rightarrow (1)(1)f^2 = 4 \Rightarrow f = 2$ Hz

8. $\vec{F}_e = -m\omega^2 r$



9. A tachometer is an instrument that measures the working speed of an engine, typically in revolutions per minute (RPM). It is commonly used in cars, boats, planes, and other vehicles. Most tachometer gauges have either an analog (dial) or digital (LCD or LED screen) display

10. $3000 \text{ rpm} = 3000 \times \frac{2\pi}{60} \text{ rad/s} = 100\pi \text{ rad/s} \left(1 \text{rpm} = \frac{2\pi}{60} \text{ rad/s}\right)$

11. $\omega_S = \frac{2\pi}{60} \text{ rad/s} = \frac{\pi}{30} \text{ rad/s}$

(second hand complete 1 revolution in 1 minute)

12. $3.5 \text{ rps} = 3.5 \times 2\pi \text{ rad/s} = 22 \text{ rad/s}$ $(1\text{rps} = 2\pi \text{ rad/s})$

13. $C = 2\pi r \Rightarrow r = \frac{C}{2\pi}$

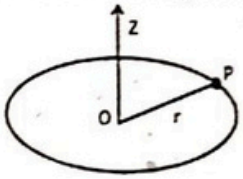
$\omega = f \text{ rps} = 2\pi f \text{ rad/s}$

$v = r\omega$

$v = \left(\frac{C}{2\pi}\right)2\pi f = fC$

14. $v = r\omega = (0.2)(10) = 2 \text{ m/s}$

15. Angular velocity is a vector quantity and its direction is along the axis of rotation and axis of rotation is perpendicular to plane of rotation. So, motion is confined in a single plane.



16. Tension at bottom:

$T - W = F_C \Rightarrow T = W + F_C = mg + \frac{mv^2}{r} = m\left(g + \frac{v^2}{r}\right)$

$= 5\left(10 + \frac{4^2}{1}\right) = 5(26) = 130 \text{ N}$

17. $T = \frac{2\pi R}{v} = \frac{2\pi R}{\sqrt{gR}} = \frac{2\pi(4)}{\sqrt{(9.8)(4)}} = \frac{\pi(4)}{\sqrt{9.8}} \approx 4 \text{ s} \left(\frac{\pi}{\sqrt{9.8}} \approx 1\right)$

18. The instantaneous acceleration of an object travelling with uniform speed in a circle is directed towards the centre of circle (inward) is called centripetal acceleration.

19. $T = \frac{2\pi R}{v} \Rightarrow T \propto R$

20. Centripetal acceleration is directed towards the center of circle. It is not directed along the axis of rotation.

21. Angular displacement, angular velocity, angular acceleration, angular momentum and torque all have direction along the axis of rotation. They can be determined by right hand rule.

22. When the pedestal fan is switched off, then its angular velocity and acceleration are anti parallel to each other. By right hand rule the angular velocity towards us while angular acceleration away from us.

23. $\omega_m = \frac{2\pi}{3600} \text{ rad/s} = \frac{\pi}{1800} \text{ rad/s}$

(minute hand complete 1 revolution in 1 hour)

24. When axis of rotation is fixed then all angular vectors have the same direction. Hence they can be manipulated as scalars.

25. The time rate of change of angular displacement is called angular velocity. It is given by

$\omega = \frac{\Delta\theta}{\Delta t}$

26. Angular work done = $\tau\theta = I\alpha\theta \left(\alpha = \frac{\omega_f - \omega_i}{\Delta t}\right)$ ✯ Note.

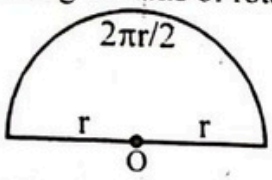
Angular work is being done when external torque acts on the body that changes the angular velocity (either increase or decrease).

27. $[\omega] = \frac{[\Delta\theta]}{[\Delta t]} = [T^{-1}] = [f]$

28. The angular equations holds true only in the case when axis of rotation is fixed. So, that all angular vectors have the same direction. Hence they can be manipulated as scalars.

29. For very small values of "$\Delta\theta$", the angular displacement is a vector quantity, its direction is along the axis of rotation and it is given by right hand rule.

30.



Displacement = 2r Distance = πr

31. $\alpha = \frac{\omega_f - \omega_i}{\Delta t} = \frac{36 - 0}{6} = 6 \text{ rad/s}^2$

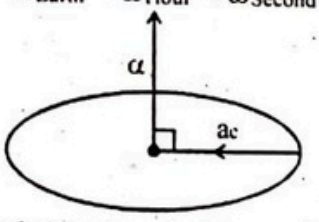
$\theta = \omega_i t + \frac{1}{2}\alpha t^2 = 0 + \frac{1}{2}(6)(6)^2 = 108 \text{ rad}$

32. $\omega = \frac{\theta}{t} \Rightarrow \omega \propto \frac{1}{t}$ (in one rotation "θ" remains same)

Earth completes one rotation in 24 hours
Hour hand completes one rotation in 12 hours
Second hand completes one rotation in 1 minute

$\omega_{Earth} < \omega_{Hour} < \omega_{Second}$

33.

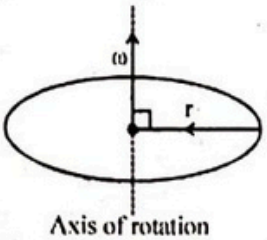


"a_c" is directed towards the center of circle while "α" is directed along the axis of rotation.

34. $a_c = \frac{v^2}{r} = \frac{6^2}{3} = \frac{36}{3} = 12 \text{ m/s}^2$

35. $\theta = \omega_i t + \frac{1}{2}\alpha t^2 = (3)(2) + \frac{1}{2}(1)(2)^2 = 6 + 2 = 8 \text{ rev}$

36.



37. Satellites are the objects which are orbiting around the earth at different heights from the surface of Earth. Artificial satellites are put into their orbits by rockets and are held in orbits by the gravitational pull of the Earth.

38. The low flying earth satellites have acceleration 9.8 ms^{-2} towards the center of Earth. If they do not have any acceleration, they would fly off in a straight line tangent to the Earth. When the satellite is moving in a circle, it has an acceleration

$a_c = \frac{v^2}{r}$

In circular orbit around the earth, the centripetal force is supplied by gravity and we have

$g = \frac{v^2}{R}$

39. $W = \vec{F}_c.\vec{d}$

$W = F_c d \cos\theta = F_c d \cos 90^\circ = Fd\,(0) = 0$

Due to centripetal force the object will move in a circular path. In the circular path, the centripetal forc "F_c" is perpendicular to velocity "v".As the displacement "d" is parallel to the velocity "v". So the angle between the displacement "d" and the centripetal force "F_c" is 90°.

40. No work done in circular motion due to centripetal force.

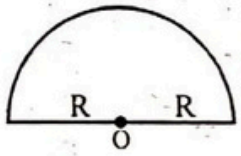
41. The angle between hour and minute hand at 1'O clock $= \frac{2\pi}{12}$ rad

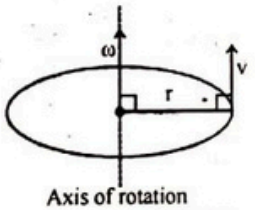
The angle between hour and minute hand at 4'O clock $= 4 \times \frac{2\pi}{12}$ rad $= \frac{2\pi}{3}$ rad

42. Microwaves are used for the communication because they travel in a narrow beam in a straight line and pass though the atmosphere of the Earth.

43. 4 rev/min $= 4 \times \frac{2\pi}{60} = \frac{2\pi}{15}$ rad/s

44. An athlete complete 1 round in 40 s. it means that 3 rounds complete 120s (2 minutes). So total displacement is zero in 120 s. The displacement of athlete in next 20 s (semi circle) is R+R =2R = (40)(2) = 80m.





45. Axis of rotation

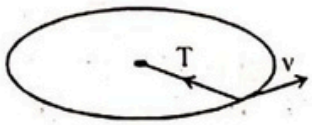
46. $v_t = r\omega = (2)(10) = 20$ m/s

47. $F_c = \frac{mv^2}{r}$

$F_c' = \frac{m(2v)^2}{2r} = \frac{4}{2}\left(\frac{mv^2}{r}\right) = 2F_c$

48. Two isosceles triangles are similar if the angle between their equal arms are equal.

49. $T = F_c = \frac{mv^2}{r}$



50. $S = r\theta$

$v = r\omega$

$a = r\alpha$

51. $W = \vec{F}.\vec{d}$

$W = Fd\cos\theta = Fd\cos 90^\circ = Fd\,(0) = 0$

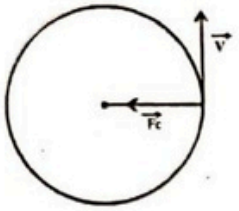
The centripetal and centrifugal forces are perpendicular to velocity. As the displacement is parallel to the velocity. So the angle between the displacement and the forces is 90°.

52. $F_c = \frac{mv^2}{r}$

$F_c' = \frac{2m(2v)^2}{r} = 8\left(\frac{mv^2}{r}\right) = 8F_c$

53. $F_c = \frac{mv^2}{r} = \frac{(1000)(10)^2}{10} = 1 \times 10^4\ N$

54.



55. $\omega_S = \frac{2\pi}{60}$

$\omega_M = \frac{2\pi}{3600}$

(minute hand complete 1 revolution in 1 hour)

$\frac{\omega_M}{\omega_S} = \frac{\frac{2\pi}{3600}}{\frac{2\pi}{60}} = \frac{60}{3600} = \frac{1}{60} = 1:60$

56. $F_c = \frac{mv^2}{r}$

$F_c' = \frac{2m(2v)^2}{2r} = 4\left(\frac{mv^2}{r}\right) = 4F_c$

57. $a_c = \frac{v^2}{r} = r\omega^2 = (1)(2\pi)^2 = 4\pi^2\ m/s^2$

58. $\omega = 2\pi f$

$\frac{f}{\omega} = \frac{1}{2\pi}$

59. Centrifugal force is equal in magnitude and opposite to the centripetal force. So, it is away from the center of circle.

60. $a_c = \frac{v^2}{r} = r\omega^2$

As centripetal acceleration does not depend upon the mass of object. So, at same speed and radius both have same centripetal acceleration?

61. $F_c = \frac{mv^2}{r}$

$F_c' = \frac{3m(v/2)^2}{r} = \frac{3}{4}\left(\frac{mv^2}{r}\right) = \frac{3}{4}F_c$

62. $F_c = \frac{mv^2}{r} = \frac{(1000)(10)2}{100} = 1000\ N$

To move in the circular path the required centripetal force must be provided by any source. But in this case the source of centripetal force is the force friction between road and tyres. In this case frictional force does not provide necessary centripetal force. So, the car slides off to the outside of the curve.

63. $T + W = F_C \Rightarrow T = F_C - W = \frac{mv^2}{r} - mg = m\left(\frac{v^2}{r} - g\right)$

$= 2\left(\frac{4^2}{1} - 10\right) = 2(6) = 12\ N$

64. $\alpha = \frac{\omega_f - \omega_i}{\Delta t} = \frac{0 - (12 \times 2\pi)}{6} = -4\pi\ rads^{-2}$ ($1rev = 2\pi$ rad)

65. $2\alpha\theta = \omega_f^2 - \omega_i^2$

$2(-2)\theta = (0)^2 - (18)^2$

$-4\theta = -324$

$\theta = \frac{324}{4} = 81$ rad

66. $v_A : v_B : v_C$

$\sqrt{gr} : \sqrt{3gr} : \sqrt{5gr}$

$1 : \sqrt{3} : \sqrt{5}$

67. $v = r\omega \Rightarrow \omega = \frac{v}{r} = \frac{4}{0.4} = 10$ rad/s

68. $v = r\omega = \left(\frac{1}{2}\right)\left(\frac{30 \times 2\pi}{60}\right) = \frac{\pi}{2}$ m/s ($r = d/2 = 1/2$ m)

69. To move in the circular path the required centripetal force must be provided by any source. But in this case the source of centripetal force is the force friction between road and tyres. Cyclist required more centripetal force to overcome skidding.

70. The analogous of Newton's 2nd law in angular motion is

$\tau = I\alpha$

71. $T - W = F_C \Rightarrow T = W + F_C = mg + \frac{mv^2}{r}$

The probability to break the string at lowest point is maximum. Because the tension at that point is maximum.

72. The force which is needed to move a body in a circular path and it is always directed towards the centre of the circle, is called centripetal force.

73. $F_c = \frac{mv^2}{r} = \frac{(0.04)(0.6)^2}{1} = \frac{144}{10000} = 1.4 \times 10^{-2}\ N$

74. $a_c = \frac{v^2}{r}$

$a_c \propto \frac{1}{r}$ (v = constant)

75. $F_c = \frac{mv^2}{r}$

$F_c' = \frac{mv^2}{2r} = \frac{1}{2}\left(\frac{mv^2}{r}\right) = \frac{1}{2}F_c$

76. Artificial satellites are put into their orbits by rockets and are held in orbits by the gravitational pull of the Earth. The low flying earth satellites have acceleration 9.8 ms^{-2} towards the center of Earth.

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77. $F_1 = F_2$

$$\frac{mv_1^2}{R_1} = \frac{mv_2^2}{R_2}$$

$$\frac{v_1^2}{R_1} = \frac{(2v_1)^2}{R_2}$$

$$\frac{v_1^2}{R_1} = \frac{4v_1^2}{R_2}$$

$$R_2 = 4R_1$$

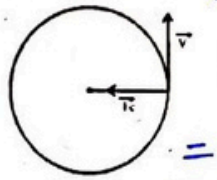
78. $a_c = \frac{v^2}{r}$

$$a_{net} = \sqrt{a_c^2 + a_t^2}$$

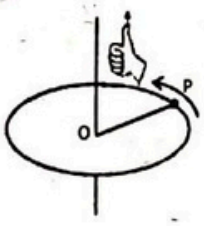
79. If a body covers equal angular displacement in equal time intervals, then it is said to be in uniform angular velocity.

80. $\alpha = \frac{\Delta\omega}{\Delta t} = \frac{2 \times 2\pi}{60} = \frac{\pi}{15}$ rad/s²

81.



82. If we grapes the axis of rotation in our right hand such that the fingers are curled in the direction of rotation.

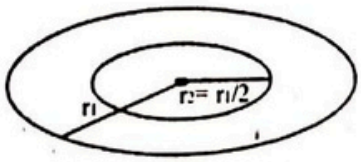


83. $\theta = \frac{S}{r} = \frac{3000}{20} = 150$ rad

84. $a = r\omega^2 = (0.1)(5 \times 2\pi)^2 = (0.1)(100\pi^2) = 10\pi^2$ m/s²

85. $a_t = r\alpha$

$$\frac{a_{t1}}{a_{t2}} = \frac{r_1\alpha}{r_2\alpha} = \frac{r_1}{r_1/2} = 2$$



86. $a = r\omega^2$

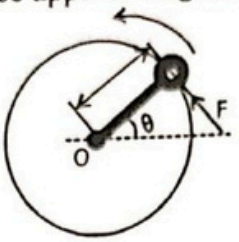
$$\frac{a_B}{a_A} = \frac{r\omega_B^2}{r\omega_A^2} = \frac{(2\omega_A)^2}{\omega_A^2} = 4 \ (\omega_B = 2\omega_A)$$

87. $\tau = I\alpha$

$rF = I\alpha$

$$\alpha = \frac{rF}{I}$$

Torque produces the angular acceleration in the body. The torque will be maximum if the force acted at larger distance from the fixed axis. In the given case the greatest angular acceleration is obtained if the force applied tangentially at the rim.



88. $\tau = I\alpha = mr^2\alpha = (1)(2)^2(7) = 28 \text{ N m}$

89. As two wheels roll side-by-side only if

$v_1 = v_2$

$r_1\omega_1 = r_2\omega_2$

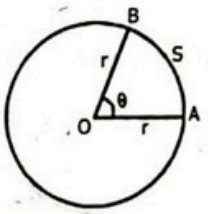
$r_1\omega_1 = (2r_1)\omega_2$

$\omega_2 = \frac{\omega_1}{2}$

90. Two equal but opposite forces at different line of action form a couple. Couple produces the all angular quantities given in the question except linear momentum.

91. The angular displacement traced by the body is said to be one radian when the arc length is equal to the radius of the circle.

$< AOB = 1 \text{radian}$



92. $\frac{\text{Circumfrence of circle}}{\text{Diameter}} = \frac{2\pi r}{2r} = \pi \text{ rad}$

93. At center of Earth

$g = 0$

$w = mg = m\,(0) = 0$

94. $2\pi \text{ rad} = 1 \text{rev}$

$1 \text{ rad} = \frac{1}{2\pi} \text{ rev}$

95. $a = r\alpha \Rightarrow \alpha = \frac{1}{r}(a)$

96. $v = r\omega = (0.5)(5) = 2.5 \text{ m/s}$

97. $F_c = \frac{mv^2}{r} = \frac{(8)(8)^2}{4} = 128 \text{ N}$

98. This acceleration is directed along the radius towards the centre of circle. So it is also known as radial acceleration.

99. $1 \text{ rev /min} = 1 \times \frac{2\pi}{60} \text{ rad/s} = \frac{\pi}{30} \text{ rad/s}$

100. $\theta = 57.3^\circ = 1 \text{ rad}$

$S = r\theta = (2)(1) = 2\text{m}$

101. Relation between linear and angular velocity in vector form is $\vec{v} = \vec{\omega} \times \vec{r}$

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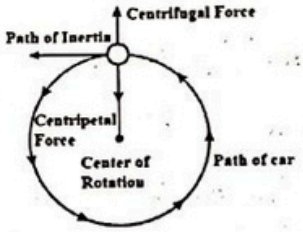
102. $\omega = \frac{v}{r} = \frac{2}{0.4} = 5\,rads^{-1}$

103. **Fact:**
When an object takes a turn two forces come to act.
- Centripetal force
- Centrifugal force

Centripetal force acts inward (towards the centre of the circular turn). This is provided by the frictional force. When the speed is large, required centripetal force to stay in the circular path increases. But friction is unable to provide large centripetal force and hence the body is thrown outwards.



104. Resultant force, $F = mr\omega^2$

$= mr\left(\frac{2\pi}{T}\right)^2$

$= 2\times5\times\left(\frac{2\pi}{3}\right)^2$

$= \frac{40\pi^2}{9}N$

105. As K.E depends upon magnitude of velocity i.e. speed. In a horizontal circle as speed is constant so K.E remains constant.

106. $v = r\omega$

$\because \omega = \frac{2\pi}{60}\,rad\,s^{-1}$

$v = 1cm\times\frac{2\pi}{60} = \frac{2\pi}{60}\,cm\,s^{-1}$

107. $\frac{\omega}{f} = \frac{2\pi f}{f} = 2\pi$

108. $T = \frac{mv^2}{r} + mg$

$T = \frac{m5gr}{r} + mg$

$T = 6mg$

109. $\tau = \frac{\Delta L}{\Delta t} = \frac{4}{4} = 1$ unit

110. As motion is uniform so magnitude velocity remains same i.e. speed

111. $\alpha = \frac{\Delta\omega}{\Delta t} = \frac{540\times2\pi}{60\times6} = \frac{540\times2\pi}{360} = 3\pi\ rad/s$

112. Speed of body $= v = R\omega = 1.0 \times 4 = 4\,ms^{-1}$. Referring to figure, we find that, when the body is at the topmost point A, the tension in the string is

$$T_A = \frac{mv^2}{R} - mg$$

$$= \frac{0.5x(4)^2}{1.0} - 0.5x10 \text{ OR } T_A = 8-5 = 3N$$

113. Only in circular motion, body remains at constant distance from a fixed point and this constant distance is called radius.

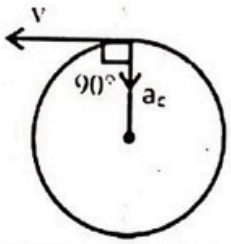
114. $a_t = r\alpha$

Here **a_t is tangential acceleration**

115. $\omega = \frac{v}{r} = \frac{16}{2} = 8\,rad\,s^{-1}$

116. $120\,rev/min = 120 \times \frac{2\pi}{60}\,rad/sec = 4\pi\ rad/sec$

117.



118. All the points on rotating body have same angular acceleration.

119. A wheel rotates about an axis with slowly increasing angular speed so $\Delta\omega \neq 0$ & $\Delta v \neq 0$ so, it has tangential velocity but acceleration having both components.

120. According to convention in anti-clock wise rotation angular displacement is taken as positive.

121. $a = r\alpha \quad \because r = \frac{d}{2} = \frac{2}{2} = 1m$

$$\alpha = \frac{a}{r} = \frac{8}{1}$$

$$\alpha = \frac{rad}{sec} = 8\,rad/sec^2$$

122. $v = r\omega$

$$v = \frac{1}{2} \times \frac{30 \times 2\pi}{60}$$

$$v = \frac{\pi}{2}\,ms^{-1}$$

123. $\omega_i = 0\ rads^{-1}$

$$\omega_f = 300\,rev/min = 10\pi\,rads^{-1}$$

$$\alpha = \frac{\omega_f - \omega_i}{t} = \frac{10\pi}{10}$$

$$\alpha = 3.14\,rads^{-2}$$

124. $\omega = \frac{\theta}{t} = \frac{2\pi}{24} = \frac{\pi}{12}$

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125. $\theta = \omega t = \frac{360 \times 2\pi}{60} \times 1$

$\theta = 12\pi$ radian

126. $\theta = \frac{2\pi}{T} = \frac{2\pi}{60 \times 60}$

$\theta = \frac{2\pi}{3600}\ rads^{-1}$

127. $W = Fd\cos\theta$

$\theta = 90^\circ$

$W = Fd\cos 90^\circ = 0$

128. Centripetal acceleration, $a = r\omega^2$

$= \frac{v^2}{r}$

$= v\omega$

129. Adhesion is clinging of unlike molecules.

130. At bottom 'T' is maximum because $T = W + F_c$

131. When centripetal force vanishes objects moves along straight path i.e along tangent to circle.

132. The mud's flies off the tyre of a fast moving car in the direction tangent to the moving car.

133. $\frac{a_R}{a_r} = \frac{\omega_R^2 \times R}{\omega_r^2 \times r} = \frac{T_r^2}{T_R^2} \times \frac{R}{r} = \frac{R}{r}\ [\text{As } T_r = T_R]$

134. $F_c = \frac{mv^2}{r}$

$= \frac{1000 \times 20^2}{100}$

$= 4.0 \times 10^3\ kg\,m\,s^{-2}$

135. $a = \frac{v^2}{r} = \frac{r^2v^2}{r}$

$a = r\omega^2$

136. $\frac{F_1}{F_2} = \frac{\frac{mv^2}{r_1}}{\frac{mv^2}{r_2}} = \frac{r_2}{r_1}$

137. Centripetal force is always directed towards the centre of the circle.

138. $a_c = r\omega^2$

$= 0.25 \times (2 \times 2\pi)^2$

$a_c = 4\pi^2\ rad\,s^{-2}$

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139. $T = \frac{mv^2}{r}$

$\because v = r\omega = \frac{1 \times 30 \times 2\pi}{60} = \pi$

$= \frac{0.25 \times \pi^2}{1}$

$T = \frac{1}{4}\pi^2 N$

140. $F_c = \frac{mv^2}{r}$

$\because v = r\omega$

$F_c = \frac{mr^2\omega^2}{r} = mr\omega^2$

141. Acceleration $= r\omega^2$

$= \left(8.0 \times 10^{-2}\right)\left[\frac{3000 \times 2\pi}{60}\right]^2$

$= 7900\ ms^{-2}$

142. $v = r\omega$

$v = \frac{d}{2}\omega = \frac{1 \times 600 \times 2\pi}{2 \times 60} = 10\pi\ ms^{-1}$

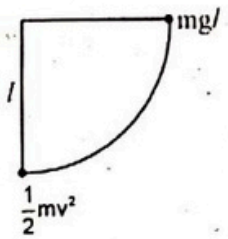
143. The driver should not take a turn because the centrifugal force will throw the car towards the wall and the possibility of collision will be more.

144. $v = r\omega \qquad \omega = \frac{v}{r},\ a = r$

$\frac{\omega_1}{\omega_2} = \frac{\frac{v}{2a}}{\frac{v}{a}} = \frac{v}{2a} \times \frac{a}{v} = \frac{1}{2}$

mgh

145. $mgl = \frac{1}{2}mv^2$ or $v = \sqrt{2gl}$



146. $1\frac{rev}{min} = \frac{2\pi}{60} = \frac{\pi}{30}\ rads^{-1}$

147. The correct form of angular momentum is

$\vec{L} = \vec{r} \times \vec{p}$

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148: $T = F_c = \frac{mv^2}{r} = \frac{\pi^2}{4}$ N

149: $F_c \propto v^2$

150: Tensions at the lowest point = 6 mg

$$T_{bottom} = \frac{mv^2}{r} + mg$$

$$T_{bottom} = \frac{5mgr}{r} + mg$$

$$T_{bottom} = 5mg + mg \equiv 6mg$$

Tensions at the highest point = zero

$$T_{top} = \frac{mv^2}{r} - mg$$

$$T_{top} = \frac{mgr}{r} - mg = 0$$

∴ Difference in tension = 6 mg

$a_c = \frac{v^2}{r}$

$a_c = \frac{v^2}{r^2} \cdot r$

$v = r\omega$

$\omega = \frac{v}{r}$

$a_c = \omega^2 r$

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BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **85.95° degree in terms of radian is:**
   A. $\frac{1}{2}$ radian
   B. 1 radian
   C. $1\frac{1}{2}$ radian
   D. 2 radian

2. **What is the circumference of a circle, having radius of 50 cm?**
   A. 3.12 m
   B. 3.14 m
   C. 3.16 m
   D. 3.18 m

3. **What is the angular velocity of a particle when its frequency is 50 Hz?**
   A. 312 rad s^{-1}
   B. 313 rad s^{-1}
   C. 314 rad s^{-1}
   D. 315 rad s^{-1}

4. **The direction of angular velocity is along:**
   A. Tangent the circular path
   B. Axis of rotation
   C. Inward the radius
   D. Outward the radius

5. **Angular speed for annual rotation of Earth in radian per day:**
   A. $\frac{\pi}{2}$ radian / day
   B. π radian / day
   C. $\frac{2\pi}{365}$ radian / day
   D. 365 radian / day

6. **A body moves with constant angular velocity in a circle. Magnitude of angular acceleration is:**
   A. $r\omega^2$
   B. Constant
   C. Zero
   D. $r\omega$

7. **Banking angle does not depend upon:**
   A. Mass
   B. Speed
   C. Radius
   D. Gravitational acceleration

8. **What will happen if the height of an orbit of a satellite from surface of earth is increased?**
   A. Speed increases
   B. Angular velocity increases
   C. Time period increases
   D. Gravitational acceleration increases

9. **What is the ratio of translational and rotational kinetic energies of a sphere?**
   A. $\frac{1}{2}$
   B. $\frac{2}{3}$
   C. $\frac{5}{2}$
   D. $\frac{2}{5}$

10. **Angular momentum in terms of moment of inertia is:**
A. $I\omega$ C. $I^2\omega$
B. $I\omega^2$ D. $\frac{I}{\omega^2}$

11. **Which one of the following rolling body has 50% translational K.E and 50% rotational K.E.**
A. Disc C. Rod
B. Ring D. Sphere

12. **A solid cylinder of mass 20 kg rotates about its axis with angular velocity 10 ms^{-1} radius 0.2m. The moment of inertia of the cylinder is:**
A. 0.2 kg m^2 C. 0.6 kg m^2
B. 0.4 kg m^2 D. 0.8 kg m^2

13. **The condition of weightlessness is (N = Normal Reaction and W is weight)**
A. N > W C. N = W
B. N < W D. N = 0

14. **A sphere is rolling without slipping on a horizontal plane. The ratio of in rotational kinetic energy and translational kinetic energy is:**
A. 2:3 C. 2:7
B. 2:5 D. 2:9

15. **The frequency of artificial gravity is:**
A. $2\pi\sqrt{\frac{g}{R}}$ C. $\frac{1}{2\pi}\sqrt{\frac{R}{g}}$
B. $2\pi\sqrt{\frac{R}{g}}$ D. $\frac{1}{2\pi}\sqrt{\frac{g}{R}}$

16. **A particle of mass 100g starts its motion from rest along a circular path of radius 10 cm. If its velocity becomes 10 ms^{-1} then its centripetal force is:**
A. 0.1 N C. 10 N
B. 1 N D. 100 N

17. **Which one of the following is conserved when the torque acting on a system is zero?**
A. K.E C. Rotational K.E
B. Angular momentum D. Linear momentum

18. **Orbital velocity of earth's satellite near the surface is 7 km/s. If the radius of the orbit is 4 times than that of Earth's radius, what will be the orbital velocity in the orbit?**
A. 3.5 kms^{-1} C. $7\sqrt{2} kms^{-1}$
B. 7 kms^{-1} D. 14 kms^{-1}

19. **When a parachutist is moving downward with uniform motion then its weight is:**

A. Decreasing
B. Increasing
C. Remain same
D. Zero

20. **An object of mass 1.5 kg is suspended by a string having tension T = 5 N in a lift. When the lift is moving upward with acceleration a = 2 ms^{-2} then its apparent weight is:**

A. 8 N
B. 5 N
C. 2 N
D. 1.5 N

ANSWER KEY

1	C	6	C	11	B	16	D
2	B	7	A	12	D	17	B
3	C	8	C	13	D	18	A
4	B	9	C	14	B	19	C
5	C	10	A	15	A	20	A

$F/T = 5N$

$W = mg = \frac{15 \times 16}{10} = 15kg$

$m = 1.5kg$

$a = 2ms^{-1}$

$mg = \frac{GMm}{R^2}$

$T = W - ma$

$T = 15 - (\frac{15}{10})(\frac{1}{2})$

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KPK TEXT BOOK EXERCISE MCQs

1. **The angular speed in radians/hours for daily rotation of our earth is:**
   A. 2π C. $\pi/6$
   B. 4π D. $\pi/12$

2. **Linear acceleration $a = r\alpha$ when 'θ' is:**
   A. $0°$ C. $360°$
   B. $180°$ D. $90°$

3. **What is momentum of inertia of a sphere:**
   A. MR^2 C. $\frac{2}{5}MR^2$
   B. $\frac{1}{2}MR^2$ D. $\frac{1}{2}M^2R$

4. **A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of particle. The motion of the particle takes place in a horizontal plane. It follows.**
   A. Linear momentum is constant C. It moves in a circular path
   B. Velocity is constant D. Particle moves in a straight line

5. **A body moving in a circular path with constant speed has:**
   A. Constant acceleration C. Constant retardation
   B. Variable acceleration D. Variable speed and constant velocity

6. **Astronauts appear weightless in space because:**
   A. There is no gravity in space
   B. There is no floor pushing upwards on the
   C. Satellite is freely falling
   D. There is no air in space

7. **Which one is constant for a satellite in orbit?**
   A. Velocity C. Angular momentum
   B. K.E D. Potential Energy

8. **If the earth suddenly stops rotating the value of 'g' at equator would:**
   A. Decrease C. Increase
   B. Remain changed D. Become zero

9. **In solid sphere and solid cylinder of same mass and density rotate about their own axis, the moment of inertia will be greater for:**
   A. Solid sphere
   B. Solid cylinder
   C. The one that has the largest mass arrives first
   D. The one that has the largest radius arrives first

10. **The gravitational force exerted on an astronaut on Earth's surface is 650 N down. When she is in the international space Station, the gravitational force on her is:**

A. Larger
B. Exactly the same
C. Smaller
D. Nearly but not exactly zero

11. **A solid cylinder of mass M and Radius R rolls down an incline without slipping. Its moment of inertia about an axis through its center of mass is $MR^2/2$. At any instant while in motion, its rotational kinetic energy about its center of mass is what fraction of its total kinetic energy?**

A. ½
B. ¼
C. 1/3
D. 2/5

ANSWER KEY

1	D	6	C	11	C
2	D	7	C		
3	C	8	C		
4	C	9	B		
5	B	10	C		

$2\theta\alpha = \omega f^2$

$(2)(2)\theta = 36$

$\theta = \frac{36}{4}$ 18 9 2 1

$\theta = \omega i t + \frac{1}{2}\alpha t^2$

$\theta = \frac{1}{2}(2)t^2$

$r = ?$

$t = 6 sec$

$\omega = 27 \times 2 ads^{-1}$

$v = \frac{81}{100} ms^{-1}$

$2\overline{)7}$ 3 6

$r = 4m$

$\theta = ?$

$\theta = \frac{S}{r} = \frac{14}{4}$ 7 2

$S = 14m$

$S = r\theta$

$v = 16$

$S = r\theta$

$S = 1 \times 180 \times \frac{\pi}{180}$

$v = r\omega$

$r = \frac{v}{\omega}$

$r = \frac{81}{100 \times 27}$ 9 3 3 1 $= 3$

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PAST PAPERS 2008-2020

1. The force required to bend the normally straight path of a particle into a circular path is called _____ force. (UHS 2008)

A. Traveling
B. Bending
C. Centrifugal
D. Centripetal

2. Two cylinders of equal mass are made from same material. The one with the larger diameter accelerates _____ the other under the action of same torque. (UHS 2008)

A. Faster than
B. Slower than
C. Equal to
D. None of these

3. If the body is rotating with uniform angular velocity, then its torque is: (UHS 2009)

A. Zero
B. Clockwise
C. Maximum
D. Remains same

4. Linear velocity or tangential velocity of any particle moving in a circular path of radius 2 m with angular velocity 8 rads^{-1} will be: (UHS 2009)

A. 16 ms^{-1}
B. 4 ms^{-1}
C. 10 ms^{-1}
D. 6 ms^{-1}

5. What is torque "τ" in a circular motion: (UHS 2009)

A. $\tau = mr^2\pi$
B. $\tau = mr^2\alpha$
C. $\tau = mr\alpha$
D. $\tau = mr^2/\alpha$

6. A wheel of radius 1 m covers an angular displacement of 180°. Its linear distance is: (UHS 2010)

A. 3.14 m
B. π rad
C. 6.28 m
D. 0.157 m

7. A body moves in a circle with increasing angular velocity. At time t= 6sec, the angular velocity is 27 rad/s. What is the radius of circle made by the body where linear velocity is 81cm/s? (UHS 2017)

A. 6cm
B. 3cm
C. 9cm
D. 7cm

8. A wheel starts rotating from rest with angular acceleration of 2 rad s^{-2} till its angular speed becomes 6 rad/s. the angular displacement of the wheel will be equal to: (UHS 2018)

A. 9 rad
B. 12 rad
C. 7 rad
D. 4 rad

9. Which of the following gives the relationship between linear velocity and angular velocity? (UHS 2018)

A. $v = r\omega$
B. $S = r\theta$
C. $v = s\omega$
D. $v = r\theta$

10. An object is moving along a circular path of radius 4m. What will be its angular displacement if it moves 14 m on this circular path? (UHS 2019)

A. 5.5 radians
B. 3.5 radians
C. 5.0 radians
D. 4.5 radians

11. **Work done due to centripetal force for circular motion will be:** (UHS 2019)
A. Reduced
B. Maximum
C. Half
D. Zero

12. **If during circular motion, tangential velocity of a body becomes double, then centripetal force becomes:** (PMC 2020)
A. double
B. one half
C. four times
D. one fourth

13. **The earth rotates on its axis once a day. Suppose, by some process the earth contracts so that its radius is only half as large as at present, then how long earth will take to complete its rotation?** (PMC 2020)
A. 24 hours
B. 18 hours
C. 6 hours
D. 12 hours

14. **1 radian is equal to** (PMC 2020)
A. 57.1°
B. 57.2° m
C. 57.3°
D. 57.4°

$p = mv$ $L = mr^2w$

$L = Iw$

$L_1 = L_2$

ANSWER KEY

1	D	11	D
2	B	12	C
3	A	13	C
4	A	14	C
5	B		
6	A		
7	B		
8	A		
9	A		
10	B		

$\frac{2}{5} mr^2 w_i = \frac{2}{5} m \left(\frac{r}{4}\right)^2 w_f$

$w_i \, r^2 = \frac{r^2}{4} w_f$

$w_f = 4w_i$

$w = \frac{2\pi}{T}$ $w_i = \frac{2\pi}{T_1}$ $w_f = \frac{2\pi}{T_2}$

$\frac{w_f}{w_i} = \frac{2\pi}{4w_i} \times \frac{Tw_i}{2\pi} = \frac{24}{4} = 6$

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SOLUTION

1. Definition of centripetal force.

2. $\tau = I\alpha = mr^2\alpha = \frac{md^2\alpha}{4} \Rightarrow \alpha = \frac{4\tau}{md^2} \Rightarrow \alpha \propto \frac{1}{d^2}$

   This shows that the cylinder having larger diameter will accelerate slower than others.

3. $\tau = I\alpha$

   As the body is rotating with uniform velocity. So, $\alpha = 0$

   $\tau = I(0) = 0$

4. $v = r\omega = (2)(8) = 16$ m/s

5. $\tau = I\alpha = mr^2\alpha$ $(I = mr^2)$

6. $\theta = 180^\circ = \pi$ rad

   $S = r\theta = (1)(\pi) = \pi$ m $= 3.14$ m

7. $v = r\omega \Rightarrow r = \frac{v}{\omega} = \frac{81}{27} = 3$ cm

8. $2\alpha\theta = \omega_f^2 - \omega_i^2 = \Rightarrow (2)(2)\theta = 6^2 - 0$

   $\theta = \frac{36}{4} = 9$ rad

9. $v = r\omega$

10. $S = r\theta \Rightarrow \theta = \frac{S}{r} = \frac{14}{4} = 3.5$ radian

11. $W = F_c d\cos 90^\circ = 0$

    The angle between centripetal force and displacement is 90°.

12. $F_c = \frac{mv^2}{r} \Rightarrow F_c \propto v^2$

13. $T \propto r^2$

    $\frac{T}{4} \propto \left(\frac{r}{2}\right)^2 \Rightarrow T' = \frac{T}{4} = \frac{24 \text{ hours}}{4} = 6$ hours

14. 1 rad $= 57.3^\circ$

$\omega = \frac{2\pi}{T}$

$v = r\omega$

$\omega = \frac{2\pi}{T}$

$T = \frac{2\pi}{\omega}$

$T = 2\pi$

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PMC PAST PAPER 2022 (ROTATIONAL AND CIRCULAR MOTION)

Q.1 Number of revolutions in 720 degrees.
A. 4 revolutions
B. 3 revolutions
C. 2 revolutions
D. 9 revolutions

Q.2 Centripetal acceleration's direction?
A. towards the center.
B. Away from the center
C. towards the tangent
D. None

Q.3 Angular displacement is equal to linear displacement and arc is
A. circular
B. curved
C. straight line
D. None

Q.4 Car move in circular path due to
A. Centripetal force
B. frictional force
C. gravitational force
D. None

Q.5 Radian is used to measure
A. Small angles
B. large angles
C. Both
D. None

Q.6 When particles move circle acceleration is always
A. Directed towards center
B. Away from center
C. Perpendicular
D. along the tangent

Q.7 Area of circle is represented by
A. Radius
B. Velocity
C. Theta
D. None

Q.8 If earth covers 360 degrees in 24 hours, then how many degrees are in two hours
A. 15°
B. 30°
C. 45°
D. 60°

Q.9 Circumference of circle is
A. πr
B. 2πr
C. 3πr
D. 4πr

Q.10 Earth completes one revolution in
A. 24 hours
B. 6 months
C. 12 months
D. None

Q.11 Direction of centripetal force is always
A. Parallel
B. Perpendicular
C. Towards the center
D. A way from center

Q.12 Turning effect produced in a car is due to
A. Gravity
B. Friction
C. Both
D. None

Q.13 The earth rotates 360° in 24hr find its angle in 2 hours
A. 30°
B. 40°
C. 60°
D. 90°

Q.14 If wheel of aero plane rotates in clockwise direction then the direction of angular acceleration will be?
A. north side
B. south side
C. West side
D. East side

Q.15 What will be the velocity vector of a particle moving in a circle describing equal angles in equal times

A. Changes in direction
B. Remains constant
C. Changes in magnitude
D. Changes both in direction and magnitude

Q.16 The angular velocity of a body moving with a constant speed v in a circle of radius r is given by

A. v^2/r
B. v^2/r
C. v/r
D. r/v

Q.17 A stone tied to a string is rotated in a circle. If the string is cut, the stone flies away from the circle because

A. A centrifugal force acts on the stone
B. Of its inertia
C. A centripetal force acts on the stone
D. The reaction of the centripetal force

Q.18 A tachometer is a device to measure

A. Gravitational pull
B. Speed of rotation
C. Surface tension
D. Tension in a spring

Q.19 One radian is equal to

A. 67.3°
B. 57.3°
C. 87.3°
D. 60°

Q.20 The period of a circular motion is given by

A. $T = \pi v$
B. $T = \pi w$
C. $T = 2\pi r$
D. $T = 2\pi r/v$

Q.21 The circumference subtends an angle

A. π radian
B. 2π radian
C. $\pi/2$ radian
D. 4π radian

Q.22 Centripetal force performs

A. Maximum work
B. Minimum work
C. Negative work
D. No work

Q.23 When a wheel 1 m in diameter makes 30 rev min the linear speed of the point on its rim in ms-1 is

A. 2π
B. $\pi/2$
C. π
D. 20π

Q.24 If a wheel of radius r turns through an angle of 30° then the distance through which any point on its rim moves is

A. $\pi/3 \times r$
B. $\pi/6 \times r$
C. $V/30 \times r$
D. $\pi / 180 \times r$

Q.25 The angular speed of seconds hand of a watch in $rads^{-1}$ is

A. π
B. $\pi/2$
C. $\pi/30$
D. $\pi/180$

Q.26 The ratio of the angular speed of the minute hand of a clock to that of its hour hand is

A. 3600 : 1
B. 60 : 1
C. 24 : 1
D. 12 : 1

Q.27 When a body moves with a constant speed along a circle,

A. Its linear velocity remains constant
B. No force acts on it
C. No work is done on it
D. No acceleration is produced is in it

Q.28 In circular motion, the radius vector

A. Changes in magnitude as well as direction
B. Changes in magnitude only
C. Changes in direction but has a fixed magnitude
D. Has constant magnitude and direction

Q.29 Which of these quantities is constant in uniform circular motion?
A. Speed
B. Velocity
C. Acceleration
D. Displacement

Q.30 The angular acceleration is produced by:
A. Momentum
B. Torque
C. Pressure
D. Power

Q.31 A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is
A. Doubled
B. Quadrupled
C. Halved
D. Unchanged

Q.32 What will be the velocity vector of a particle moving in a circle describing equal angles in equal times?
A. Changes in direction
B. Remains constant
C. Changes in magnitude
D. Changes both in direction and magnitude

Q.33 A body is moving in a circular path with constant speed. It has
A. Acceleration of constant magnitude
B. Constant velocity
C. Constant acceleration
D. An acceleration which varies with time

Q.34 A motorcyclist going with a constant speed in a circular track has
A. Linear velocity is constant
B. Constant acceleration
C. Angular velocity is constant
D. Constant force

Q.35 When a body moves in a circle, the angle between its linear velocity and angular velocity is always?
A. 180.
B. 0
C. 90
D. 45

Q.36 The angular speed of the wheels of a bicycle is 8π radian/sec their period of rotation is:
A. 25 sec
B. 4 sec
C. $\pi/4$ sec
D. 1/4 sec

Q.37 Determine the angular displacement in radians of 6.5 revolutions.
A. 40.8 radians
B. 4 radians
C. 3 radians
D. 36 radians

Q.38 A body is moving in a circle at constant speed. Which statement is true?
A. The resultant force acts towards the centre of the circle
B. There is no resultant force
C. The resultant force acts away from the centre of the circle
D. none of these

Q.39 For anti-clockwise rotations direction of angular velocity is
A. positive
B. negative
C. zero
D. infinite

Q.40 Centripetal force acts
A. Outwards
B. Inwards
C. Both of them
D. None of them

Q.41 A body moving along the circumference of a circle completes two revolutions. If the radius of the circular path is R, the total angular displacement covered is?
A. πr
B. $2\pi r$
C. zero
D. 4π

Q.42 The relation between linear and angular acceleration is:
A. $a = \alpha \times r$
B. $\alpha = a \times rv$
C. $v = a \times r$
D. $r = \alpha \times v$

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Q.43 A car of mass 2000 kg moving in a circular path of radius 10 m at a constant speed of 30m/sec. Find the centripetal force required for this purpose.
A. 1800N B. 18N
C. 180 kN D. 18 kN

Q.44 What is 30 degrees in radians?
A. π/3 B. π/6
✓ C. π/2 D. π/4

Q.45 Find angular acceleration when Δω is 250 rpm and Δt is 5.00 s.
A. 5.24 rad/sec ^{2} B. 6 rad/sec ^{2}
C. 10 rad/sec ^{2} D. none of these

Q.46 For an object moving in a circle, the angle between linear velocity and the position vector is:
A. 0 degrees B. 30 degrees
C. 90 degrees D. 60 degrees

Q.47 For angular acceleration anti-clockwise rotations means torque is
A. positive B. negative
C. zero D. infinite

Q.48 The SI unit of angular acceleration is:
A. rad/s ^{2} B. rad/s
C. rad.s D. rad.s ^{2}

Q.49 The number of revolutions in 3π radians is
A. 2 B. 3/2
C. 6 D. 1/6

Q.50 The angular acceleration has units
A. rad/sec^2 B. sec/rad
C. sec ^{2} D. none of these

Q.51 The angle subtended at the center of a circle by an arc equal to the radius of the circle is
A. One degree B. One rotation
C. One radian D. None of these

Q.52 The dimensions of angular velocity are
A. [LT $^{-1}$] B. [LT]
✓ C. [LT $^{-2}$] D. [T $^{-1}$]

Q.53 A stone is whirled in a vertical circle at the end of the string. When the stone is at the highest position the tension in the string is?
A. Max B. Zero
C. Equal to the weight of the stone D. Less than the weight of the stone

Q.54 A body is moving in a circle at constant speed. Which statement is true?
A. It accelerates away from the centre of the circle
B. It accelerates towards the centre of the circle
C. It does not accelerate
D. none of these

Q.55 Angular displacement becomes zero when
A. velocity is zero B. radial distance is zero
C. any of a or b D. it can never be zero

Q.56 The units of angular velocity are similar to
A. angular displacement B. angular acceleration
C. angular frequency D. none of these

Q.57 What is the measure in radians of the angle A = 330°?
A. $11\pi/3$ B. $7\pi/4$
C. $7\pi/6$ D. $11\pi/6$

Q.58 Which of the following as a spin motion :
A. The motion of the planets round the sun
B. The moment of electron around the nucleus
C. The motion of the moon round the Earth
D. The daily rotation of Earth causing day and night

Q.59 A string 2m long is used to whirl a 200g stone in horizontal circle at a speed of 2m/s. Find tension in string.
A. 0.4 N B. 1.4 N
C. 2.4 N D. 3.4 N

Q.60 An object is travelling in a circle at constant speed. Its angular velocity is:
A. changing B. the same
C. increasing D. decreasing

Q.61 The value of quantity G in the law of gravitation
A. depend on mass of Earth only B. depends on radius of Earth only
C. depends on both D. it independent of mass and radius of Earth

Q.62 What is 1 radian in degrees approximately
A. 57.3 degrees B. 360 degrees
C. π degrees D. π^2 degrees

Q.63 Revolution/minute^2 is the unit for
A. Angular displacement B. Angular momentum
C. Angular acceleration D. Torque

Q.64 A wheel whose radius is 50 cm rotates at an angular velocity of 6 rad/sec. The linear velocity of the rim of the wheel is closest to
A. 1.5 m/s B. 4.5 m/s
C. 3.0 m/s D. 7.5 m/s

Q.65 If angular velocity increases the _____ also increases
A. time period B. frequency
C. vibration D. none of these

Q.66 The angular acceleration is similar to
A. Centripetal acceleration B. Centrifugal acceleration
C. Both a or b. D. None of these

Q.67 One radian means
A. arc length of unit radius is half B. arc length of unit radius is unity
C. one degree D. all of these

Q.68 An arc of length equal to the circumference of a circle subtends an angle?
A. π radian B. 2π radian
C. $\pi/2$ radian D. 4π radian

Q.69 The angular displacement is taken to be positive when the rotation is:
A. linear B. non-linear
C. clockwise D. anti-clockwise

Q.70 The angle between linear and angular velocity can never be:
A. zero B. 90
C. 270 D. all of these

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Q.71 The SI unit of angular momentum is Js. It can also be expressed as:
A. kg ms^{-1} B. kgm^2s^{-1}
C. kgm^2s^{-2} D. kgm^2s^{-1}

Q.72 The shaft of a motor rotates at a constant angular speed of 360rev/min. Angle turned through in 1 sec in radian is?
A. π B. 3π
C. 6π D. 12π

Q.73 Determine the linear velocity of a point rotating at an angular velocity of 12 π radians per second at a distance of 8 centimeters from the center of the rotating object.
A. 31.6 cm/s B. 301.6 cm/s
C. 30.6 cm/s D. 3016 cm/s

Q.74 If angular frequency is doubled, centripetal force is:
A. twice B. four times
C. reight times D. remain same

Q.75 A particle is performing uniform circular motion has constant:
A. velocity B. magnitude of acceleration
C. position D. momentum

Q.76 The force that keeps the body moving in circular motion is:
A. centripetal force B. centrifugal force
C. force of gravity D. none of these

Q.77 A car is moving in a circular track of radius 20m at a constant speed of 20m/sec. Find the centripetal acceleration?
A. 20 m/s^2 B. 40 m/s^2
C. 30 m/s^2 D. 10 m/s^2

Q.78 The angular speed for the daily rotation of Earth in rad/s-1 is?
A. 2π B. π
C. 4π D. 7.3×10^{-5} rad/s^{-1}

Q.79 A body is travelling in a circle of radius r at a speed v. Its centripetal acceleration will be:
A. $a = r^2 / v$ B. $a = r / v$
C. $a = v^2 / r$ D. $a = v / r$

Q.80 A point on a wheel has a constant angular velocity of 3 rad/s. The angle turned through in 15 seconds is:
A. 45 rad B. 10π rad
C. 90π rad D. 5 rad

Q.81 For clockwise rotations direction of angular velocity is:
A. positive B. negative
C. zero D. infinite

Q.82 The frequency of a particle performing circular motion changes from 60 rpm to 180 rpm in 20s, then the angular acceleration is:
A. 0.1π rad/s^2 B. 0.2π rad/s^2
C. 0.3π rad/s^2 D. 0.4π rad/s^2

Q.83 If radius of object is doubled the centripetal force acting on same object becomes:
A. double B. half
C. eight times D. Remain same

Q.84 The direction associated with angular displacement is given by:
A. Left hand rule B. Head to tail rule
C. Right hand rule D. none of these

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Q.85 A car is moving in a circular track of diameter 100m at a constant speed of 40m/sec. Find the centripetal acceleration?
A. 42 m/s^2 B. 52 m/s^2
C. 32 m/s^2 D. 30 m/s^2

Q.86 The rate of change of angular velocity is called:
A. angular displacement B. angular acceleration
C. angular velocity D. acceleration

Q.87 If radial distance is 2 m and linear acceleration is 2 m/s^2 the angular acceleration becomes
A. 4 $rads^{-2}$ B. 1/4 $rads^{-2}$
C. 6 $rads^{-2}$ D. 1 $rads^{-2}$

Q.88 The velocity along tangent is
A. escape velocity B. angular velocity
C. linear velocity D. all of these

Q.89 A body is travelling in a circle of radius r at a constant angular velocity w. Its centripetal acceleration will be:
A. $a = rw$ B. $a = r/w$
C. $a = wr^2$ D. $a = rw^2$

Q.90 What force provides the centripetal force to planets moving around the sun?
A. coulomb force B. gravitational force
C. magnetic force D. none of these

Q.91 The angular velocity at a particular instant is called:
A. instantaneous angular speed B. instantaneous angular velocity
C. angular speed D. none of these

Q.92 If a car moves with a uniform speed of $2ms^{-1}$ in a circle of radius 0.4, its angular speed is?
A. 4 $rads^{-1}$ B. 5 $rads^{-1}$
C. 1.6 $rads^{-1}$ D. 2.8 $rads^{-1}$

Q.93 A belt passes over a wheel of radius 25 cm. if a point on the belt has a speed of 5 m/s, the belt is moving with an angular velocity of
A. 3.2 rad/s B. 0.32 rad/s
C. 20 rad/s D. 0.032 rad/s

$V = rw$
$V \propto w$

Q.94 The direction of linear velocity of a body moving in a circle is?
A. Along radius away from center B. Along radius towards center
C. changing with motion D. Along the tangent

Q.95 A body performing circular motion with a constant speed has a constant:
A. momentum B. angular velocity
C. acceleration D. radius vector

Q.96 What is angular velocity?
A. Change in angular rotation / change in time B. Change in displacement / change in time
C. Change in speed / change in time D. Change in acceleration / change in time

Q.97 If radius becomes four times, angular velocity becomes two times then linear velocity becomes
A. 4 B. 6
C. 8 D. none of these

Q.98 Rockets use thrust forces which produces
A. constant acceleration B. variable acceleration
C. constant velocity D. linearly varying velocity

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Q.99 The minute hand of a large clock is 3.0 m long. What is its mean angular speed
A. 1.4 x 10-4 rads^{-1}
B. 1.0 x 10-3 rad s^{-1}
C. 5.2 x 10-3 rad s^{-1}
D. 1.7 x 10-3 rad s^{-1}

Q.100 Find the radius of the circular path if a car is moving with a velocity of 25 m/s and has a centripetal acceleration of 10 m/s^2?
A. 72.3 m/s
B. 30 m/s
C. 62.5 m/s
D. 52.5 m/s

Q.101 Angle between radius vector and centripetal acceleration is
A. 0°
B. π
C. 2π
D. none of these



Q.102 The SI unit of angular acceleration is:
A. rad/s^2
B. rad/s
C. rad.s
D. rad.s^2

Q.103 The SI Unit of electric charge is?
A. Coulomb
B. Ampere
C. Hertz
D. Volt

Q.104 Radian is equal to ____ degree approximately
A. 57.3°
B. 53.7°
C. 0.017°
D. 0.17°

Q.105 What is the measure in degrees of the angle A = 7π/6?
A. 150°
B. 210°
C. 100°
D. 120°

Q.106 A car accelerates from 0 to 72 km/h in 5 seconds. If it has wheels of diameter 50cm. the angular acceleration of its wheels is:
A. 1.6 rad/s^2
B. 8 rad/s^2
C. 16 rad/s^2
D. 160 rad/s^2

Q.107 When brakes of a car are applied, angular velocity of a flywheel reduces from 900 cycles/min to 720 cycle/min in 6 sec. Angular retardation is:
A. π rads^{-2}
B. 9π rad/s2
C. 8π rad/s2
D. none of these

Q.108 The angular frequency is related to linear frequency by relation
A. inversely
B. directly
C. equally
D. none of these

Q.109 For an object moving in a circle, the angle between linear velocity and the position vector is:
A. 0 degrees
B. 30 degrees
C. 90 degrees
D. 60 degrees

Q.110 If a wheel of radius r turns through an angle of 30°, then the distance through which any point on its rim moves is?
A. π/3r
B. πr/6
C. π/30r
D. π/180r

Q.111 If r=1m and θ= 1° then what is the value of s
A. 0.01745m
B. 1m
C. 2m
D. None

Q.112 The ratio of angular speed of the minute hand of clock to that of its hour hand is:
A. 3600:1
B. 60:1
C. 24:1
D. 12:1

Q.113 The angle through which a body moves is called:
A. Angular displacement
B. Angular velocity
C. Angular acceleration
D. None of these

Q.114 The value of angular momentum is maximum when θ is
A. 60 degrees
B. 45 degrees
C. 0-degree
D. 90 degrees

Q.115 Determine the angular velocity if 4.8 revolutions are completed in 4 seconds
A. 9.6 radians/sec
B. 7.5 radians/sec
C. 8 radians/sec
D. 0.96 radians/sec

Q.116 The angular velocity of a minute hand of a clock is?
A. $2\pi/60$ rads^{-1}
B. $\pi/24$ rads^{-1}
C. $2\pi/3600$ rads^{-1}
D. $\pi/3600$ rads^{-1}

Q.117 The angular displacement of an object after one complete revolution is:
A. 0 radian
B. π radian
C. 2π radian
D. $(\pi/3)$ radian

Q.118 The angular velocity will become equal to linear velocity when r becomes
A. zero
B. negative
C. unity
D. they can never be equal

Q.119 One radian equals to_____ degree
A. 30
B. 60
C. 90
D. none of these

Q.120 An angular velocity of 60 revolutions per minute is the same as:
A. $1/2\pi$ rad/s
B. 120π rad/s
C. $30/\pi$ rad/s
D. 2π rad/s

Q.121 What is the formula for centripetal acceleration?
A. $a = v/t$
B. $a = v/r$
C. $a = v^2/r$
D. none of these

Q.122 The relation between linear and angular velocity is:
A. $v = r \times \omega$
B. $v = \omega \times r$
C. $\omega = v \times r$
D. $r = v \times \omega$

Q.123 An electric fan rotating at 3 rev s^{-1} is switched off. It comes to rest in 18.0 s. Assuming deceleration to be uniform. How many revolutions did it turn before coming to rest?
A. 30 rev
B. 27 rev
C. 40 rev
D. 10 rev

Q.124 Angular velocity is also called as
A. Instantaneous velocity
B. Rotational velocity
C. Tangential velocity
D. Linear velocity

Q.125 Angular velocity cannot be
A. zero
B. negative
C. infinite
D. linear

Q.126 A mixer grinder rotates clockwise it's angular velocity will be:
A. zero
B. negative
C. uniform but not zero
D. positive

Q.127 Angular velocity of hour arm of a clock in radian/ sec is
A. $\pi/43200$
B. $\pi/21600$
C. $\pi/30$
D. $\pi/1800$

Q.128 A body is travelling in a circle of radius r at a constant angular velocity w. Its centripetal acceleration will be:

A. $a = rw$ B. $a = r/w$

C. $a = wr^2$ D. $a = rw^2$

Q.129 The velocity along tangent is

A. escape velocity B. angular velocity

C. linear velocity D. all of these

Q.130 The force that keeps the body moving in circular motion is:

A. centripetal force B. centrifugal force

C. force of gravity D. none of these

ANSWER KEY

1	C	16	C	31	B	46	C	61	D	76	A	91	B	106	B	121	C
2	A	17	B	32	A	47	A	62	A	77	A	92	B	107	A	122	B
3	A	18	B	33	A	48	A	63	C	78	D	93	C	108	B	123	B
4	A	19	B	34	C	49	B	64	C	79	C	94	D	109	C	124	B
5	B	20	D	35	C	50	A	65	B	80	A	95	B	110	B	125	C
6	A	21	B	36	D	51	C	66	D	81	B	96	A	111	A	126	B
7	A	22	D	37	A	52	D	67	B	82	B	97	C	112	D	127	B
8	B	23	B	38	A	53	D	68	B	83	B	98	B	113	A	128	D
9	B	24	B	39	A	54	B	69	D	84	C	99	D	114	D	129	C
10	A	25	C	40	B	55	C	70	A	85	C	100	C	115	B	130	A
11	C	26	D	41	D	56	C	71	D	86	B	101	D	116	A		
12	B	27	C	42	A	57	D	72	D	87	D	102	A	117	C		
13	A	28	C	43	C	58	D	73	B	88	C	103	A	118	C		
14	A	29	A	44	B	59	A	74	B	89	D	104	A	119	D		
15	A	30	B	45	A	60	B	75	B	90	B	105	B	120	D		

UNIT 4 PRACTICE EXERCISE

WAVES

1. **Doppler's Effect is applicable to:**
   A. transverse waves
   B. longitudinal waves
   C. mechanical waves
   D. mechanical and electromagnetic waves

2. **The points in a wave separated by the displacement "x" have the phase difference of:**
   A. λ
   B. $\frac{\lambda x}{\pi}$
   C. $\frac{2\pi x}{\lambda}$
   D. $\frac{2\pi\lambda}{x}$

3. **A plane produces the sonic boom when:**
   A. its speed is greater than sound
   B. its sound is much louder
   C. it produces sound of high energy
   D. it produces sound of high amplitude

4. **If the distant star is receding from us, the spectral lines from such astar when examined on Earth will show:**
   A. No shift in frequency
   B. A shift in frequency towards the red end
   C. A shift in frequency towards the violet end
   D. shift in frequency towards ultraviolet

5. **A person moves with a speed 1/3 the speed of sound waves towards the stationary source of sound. Then the frequency of sound waves heard by the person will:**
   A. $\frac{2}{3}f$
   B. $\frac{3}{2}f$
   C. $\frac{4}{3}f$
   D. $\frac{3}{4}f$

6. **Due to overlapping of two identical waves the speed of resultant wave:**
   A. Decrease
   B. Increase
   C. Becomes velocity
   D. Remains same

7. **In the following properties of a wave, the one that is independent of the others in its:**
   A. Velocity
   B. Amplitude
   C. Frequency
   D. Wavelength

   $v = f\lambda$

8. **A progressive wave of frequency 500 Hz is traveling with a speed of 350 m/s. A compression maximum appear, at a place at a given instant. The minimum time interval after which a rarefaction maximum occur, at the same place is:**
   A. $\frac{1}{250}$s
   B. $\frac{1}{500}$s
   C. $\frac{1}{1000}$s
   D. $\frac{1}{350}$s

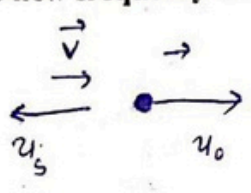
   $f = 500Hz$
   $v = 350ms^{-1}$

9. **Longitudinal waves are also known as:**
   A. Transverse waves
   B. Pressure waves
   C. Particle waves
   D. Electromagnetic waves

10. **When source and observe moving away from each other then the new frequency will be:**
    A. $f' = \left(\frac{v-u_o}{v+u_o}\right)f$
    B. $f' = \left(\frac{v+u_o}{v-u_o}\right)f$
    C. $f' = \left(\frac{v-u_o}{v+u_s}\right)f$
    D. $f' = \left(\frac{v}{v+u_s}\right)f$

    $f' = \left(\frac{v \pm u_o}{v \pm u_s}\right)f$

    $f' = \left(\frac{v-u_o}{v+u_s}\right)f$



11. **Longitudinal and transverse waves can be distinguished by the property of:**
A. interference C. reflection
B. diffraction D. polarization

12. **With what speed should an observer move towards a stationary source of sound so that frequency of sound emitted by source may appear double of its actual frequency as listen by the observer. Take speed of sound "v" and that of observer as "u":**
A. $u = v$ C. $u = 2v$
B. $u = v/2$ D. $u = 3v$

13. **A star is moving towards Earth shows:**
A. blue shift C. green shift
B. red shift D. All of these

14. **Which of the following cannot be used in RADAR system?** Electromagnetic wave.
A. infrared rays C. microwaves
B. X-Rays D. radio waves

15. **The frequency of sound appears 10% less to a moving observer. What is the speed of observer? (take speed of sound 350 m/s)** $v_s = 0$
A. 10 m/s C. 35 m/s
B. 20 m/s D. 40 m/s

$f' = \left(\frac{v \pm v_o}{v - v_s}\right) f$

16. **A stretched string fixed at both ends vibrates in "n" loop. Its length in terms of wavelength is:**
A. $(n+1)\frac{\lambda}{2}$ C. $\left(n+\frac{1}{2}\right)\lambda$
B. $(n-1)\frac{\lambda}{2}$ D. $n\frac{\lambda}{2}$

$l = n\frac{\lambda}{2}$

$f' = \left(\frac{v - v_o}{v}\right) f$

17. **The speed of the waves in the string in terms of the tension F and mass per unit length (m) of the string is given by:**
A. $v = \sqrt{\frac{F \times l}{m}}$ C. $v = \sqrt{\frac{m}{F}}$
B. $v = \sqrt{\frac{F}{m}}$ D. $v = \sqrt{\frac{F}{lm}}$

$\frac{16}{100} = \left(\frac{v}{v} - \frac{v_o}{v}\right) f$

18. **Electric and magnetic fields constitute:**
A. Electromagnetic wave C. Longitudinal waves
B. Transverse waves D. Stationary Waves

$\frac{1}{10} = \left(1 - \frac{v_o}{v}\right) f$

19. **Distance between any two consecutive crests or troughs is called:**
A. Frequency C. Wavelength
B. Period D. Phase difference

$\frac{350}{10} = (v - v_o) f$

20. **If 20 waves pass through the medium in 1 sec with speed of 20ms^{-1} then wavelength is:**
A. 20m C. 400m
B. 2m D. 1m

21. **Progressive wave of frequency 300 Hz are superimposed to produce a system of stationary waves in which adjacent nodes are 1.5 m apart. What is the speed of progressive waves?**
A. 100 m/sec C. 450 m/sec
B. 200 m/sec D. 900 m/sec

22. **In stationary wave, the velocity of particle at node is:**
A. Maximum C. Zero
B. Minimum D. Constant

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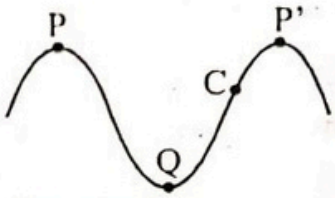
23. **Which of the following is not the case of Doppler's effect:**

A. $\left(\frac{v-u_o}{v}\right)f$ C. $\left(\frac{v+u_o}{v}\right)f$

B. $\left(\frac{v-u_s}{\lambda}\right)f$ D. $\left(\frac{v}{v+u_s}\right)f$

24. **When the wave propagates, what is true about points "P" and "C" in the below figure?**



A. They are always in-phase with each other
B. Sometimes in-phase but sometimes out-of-phase
C. They are always out-of-phase with each other
D. neither in-phase nor out-of-phase

25. **The frequency of sound is f and velocity is v, if frequency increases to 4f velocity will be:**

A. v C. v/4
B. 4v D. 2v

26. **Transverse mechanical waves can propagate:**

A. both is gas and metal C. in metal but not in gas
B. in gas but not in metal D. neither in gas not in metal

27. **A source emits sound with a frequency of 1000 Hz. It and an observer are moving in the same direction with the same speed, 100m/s. If the speed of sound is 340m/s, the observer hears sound with a frequency of:**

A. 294 Hz C. 545 Hz
B. 1000 Hz D. 1830 Hz

28. **If stretching force in a stretched wired is increased then its frequency of oscillation:**

A. decreases C. remains same
B. increases D. none of these

29. **The frequency of stationary waves in an organ pipe for third overtone when both ends are open is given by:**

A. $f_4 = v/2L$ C. $f_4 = 3v/(2L)$
B. $f_4 = 4/2L$ D. $f_4 = 4v/(2L)$

30. **A 100 cm long string fixed at its two end is plucked from the middle. The wave length of stationary waves generated is:**

A. 0.5m C. 2m
B. 1m D. 3m

31. **In standing wave if $\lambda = \ell/2$ in case of string when the number of loops are:**

A. one C. three
B. two D. four

32. **In stretched string, the speed of wave is independent of:**

A. tension
B. length
C. total mass of string
D. the point from where the string is plucked

33. **A stationary source emits a sound wave of frequency "f". If it were possible for a man to travel toward the source at the speed of sound, he would observe the emitted sound to have a frequency of:**
A. zero C. f/2
B. 2f/3 D. 2f

34. **The distance between node and anti-node is 85cm the velocity of sound is 340 ms^{-1} the frequency of waves is:**
A. 100Hz C. 200Hz
B. 250Hz D. 340 Hz

35. **The frequency of the fundamental node of open ends organ pipe is 400 Hz. If one end of pipe is closed the fundamental frequency will be:**
A. 800 Hz C. 400 Hz
B. 600 Hz D. 200 Hz

36. **When a wave moves through 10m, a point changes from crest to trough and time taken is 1s. then the wavelength of the wave and its frequency are:**
A. 20m, 0.5 Hz C. 10m, 1 Hz
B. 0.5m, 20 Hz D. 1m, 10 Hz

37. **Set of frequencies which are multiples of fundamental frequency is called:**
A. amplitude C. beat frequency
B. speed D. harmonics

38. **Which one is correct relation for fundamental frequency of open and close pipe:**
A. $f_{open} = 2f_{closed}$ C. $f_{open} = f_{closed}$
B. $f_{closed} = 2f_{open}$ D. $f_{open} = 1/f_{closed}$

39. **A phase angle of 180° is equivalent to the path difference of:**
A. λ/4 C. λ
B. λ/2 D. 2λ

40. **A piano wire has length L and mass M. If its fundamental frequency is f, its tension is:**
A. 2Lf/m C. $4LMf^2$
B. $2Mf^2/L$ D. $4f^2L^3/M$

41. **An observer is moving with ¼ of the speed of wave, away from the source its actual frequency is 100 Hz find it's apparent frequency:**
A. 300 Hz C. 125 Hz
B. 175 Hz D. 75 Hz

42. **The ratio of the nodes and antinodes in a closed pipe system (open at one end is always):**
A. less than one C. equal to one
B. greater than one D. less than or equal to one

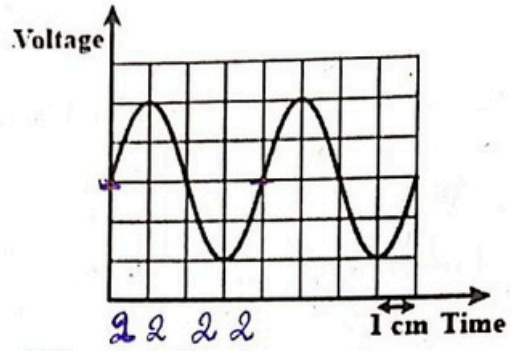
43. **Oscillating charge produces:**
A. mechanical wave C. matter waves
B. electromagnetic wave D. longitudinal wave

44. **A source of frequency "f" sends waves of wavelength "λ" traveling with speed "v" in some medium. If the frequency is changed from f to "2f", then the new wavelength and new speed are (respectively):**
A. 2λ, v C. λ/2, v
B. λ, 2v D. λ, v/2

45. **When a certain string is clamped at both ends, the lowest four resonant frequencies are measured to be 100, 150, 200, and 250 Hz. One of the resonant frequencies (below 200 Hz) is missing. What is it?**
A. 25 Hz C. 50 Hz
B. 75 Hz D. 125 Hz

46. A stationary source generates 5.0Hz water waves whose speed is 2.0 m/s. A boat is approaching the source at 10m/s. The frequency of these waves, as observed by a person in the boat, is:
A. 15 Hz
B. 25 Hz
C. 20 Hz
D. 30 Hz

47. The trace shown appears on a cathode-ray oscilloscope screen with the time base set to 2 ms/cm.



What is the frequency of the signal?
A. 40 Hz
B. 125 Hz
C. 250 Hz
D. 500 Hz

48. An observer hears a clap of thunder 2.0 s after seeing the flash of lightening. The speed of sound in air is 320 m/s.
How far from the observer was the lightening?
A. 160 m
B. 320 m
C. 640 m
D. 1280 m

49. Which of the following correctly describes the natures of sound, light and radio waves?

	Sound	Light	Radio
A.	Longitudinal	Transverse	Longitudinal
B.	Longitudinal	Transverse	Transverse
C.	Transverse	Longitudinal	Longitudinal
D.	Transverse	Longitudinal	Transverse

50. In transverse waves the particle of the medium vibrate:
A. along the direction of the motion
B. perpendicular to the direction of wave motion
C. opposite to the direction of motion of wave
D. do not vibrate

51. Which one of the following media can transmit both transverse and longitudinal waves:
A. Solid
B. Liquid
C. Gas
D. Plasma

52. An organ pipe with both ends open is 0.85 m long. Assuming that the speed of sound is 340m/s, the frequency of the third harmonic of this pipe is:
A. 200 Hz
B. 400 Hz
C. 300 Hz
D. 600 Hz

53. The sounds of the frequency greater than 20000 Hz are called:
A. supersonics
B. ultrasonic
C. infrasonic
D. all of these

54. The louder the sound the greater will be its:
A. Amplitude
B. wavelength
C. speed
D. frequency

55. **Pitch of sound depends upon:**
A. Intensity of sound
B. Wavelength of sound
C. Loudness of sound
D. Frequency of sound

56. **If 30 waves per second pass through a medium at speed of 30 ms^{-1}, the wavelength is:**
A. 30 m
B. 1 m
C. 15 m
D. 900 m

$v = f\lambda$

$\lambda = \frac{30}{30} = 1m$

57. **The waves associated with particles in motion are called:**
A. Light waves
B. Matter waves
C. Electromagnetic waves
D. Both "A" and "B"

58. **When a transverse wave is reflected on going from a denser to rarer medium, then:**
A. there is 180°phase shift
B. a crest is converted into trough
C. there is no change in phase shift
D. a trough is converted into crest

59. **The distance between two consecutive nodes or anti nodes is:**
A. $\lambda/4$
B. λ
C. $\lambda/2$
D. 2λ



60. **A 200 cm organ pipe with one end open is in resonance with a sound wave of wavelength 270 cm. The pipe is operating in its:**
A. fundamental frequency
B. third harmonic
C. second harmonic
D. fourth harmonic

$l = \frac{200}{100} = 2m$

61. **Sonar is the technique used for detecting the object:**
A. In air
B. under water
C. underground
D. on earth

$\lambda_n = \frac{4l}{n}$

$\lambda = \frac{270}{100} = 2.7m$

62. **Stationary waves are generated on a string of length "ℓ". Its fundamental frequency is given by:**
A. $f_1 = 2\ell/v$
B. $f_1 = v/\ell$
C. $f_1 = v/2\ell$
D. $f_1 = 2v/\ell$

$f = \frac{1v}{2l} = 1v$

63. **The distance between the node and the next anti node is:**
A. $\lambda/4$
B. λ
C. $\lambda/2$
D. 2λ

64. **A string of length "ℓ" can be maintaining the stationary waves of wavelength "λ" given by:**
A. $\lambda_n = \frac{2l}{n}$
B. $\lambda_n = 2\ell n$
C. $\lambda_n = \frac{2n}{l}$
D. $\lambda_n = \ell/2n$

$f = \frac{nv}{2l}$

λ_n

$\lambda = \frac{2l}{n}$

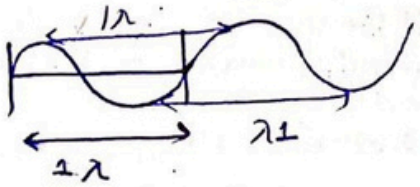
65. **The phase angle of 90° is equivalent to a path difference of:**
A. $\lambda/4$
B. λ
C. $\lambda/2$
D. 2λ

66. **Which one is the correct relation for one end closed pipe:**
A. $\lambda_n = 2\ell/n$
B. $\lambda_n = nv/\ell$
C. $\lambda_n = 4\ell/n$
D. $\lambda_n = nv/4\ell$

$\lambda_n = \frac{4l}{n}$

67. **During a time interval of exactly one period of vibration of a tuning fork, the emitted sound travels a distance:**
A. equal to the length of the tuning fork
B. of about 330m
C. equal to twice the length of the tuning fork
D. of one wavelength in air

$T = 1s$



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68. **Car "A" has a siren sounding a note of 540 Hz. A listener in car "B" hears a note of 544 Hz. Both move in same direction. One concludes that :**
A. "B" leads "A" and move faster
B. "B" is behind and moves slower
C. Both move with same speed
D. "B" leads "A" and moves slower

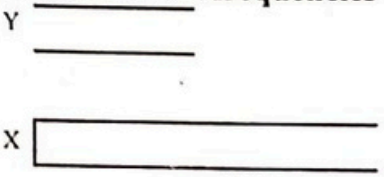
69. **For same mass and length, if tension of a vibrating string is increased by four times, the speed of wave increases by:**
A. 2 times
B. 6 times
C. 4 times
D. $\sqrt{2}$ times

70. **The string of length "ℓ" fixed at both ends is vibrating in two segments, the wavelength of wave is:**
A. ℓ / 2
B. 2ℓ
C. ℓ
D. 4ℓ

71. **When two identical waves move in the same direction, they give rise to:**
A. Stationary waves
B. beats
C. Interference
D. Doppler's Effect

72. **At open end of an organ pipe:**
A. Nodes are formed
B. Nodes and antinodes may be formed
C. Antinodes are formed
D. Neither node nor anti–node is be formed

73. **Organ pipe "Y" (open at both ends) is half as long as organ pipe "X" (open at one end as shown. The ratio of their fundamental frequencies fx:fy is:**



A. 1:1
B. 2:1
C. 1:2
D. 1:4

74. **A stretched string 4m long and it has 4 loops of stationary waves, then the wavelength is:**
A. 1 m
B. 3 m
C. 2 m
D. 4 m

75. **A stationary wave is established in a string which vibrates in four segments at a frequency of 120Hz. Its fundamental frequency is:**
A. 15 Hz
B. 60 Hz
C. 30 Hz
D. 480 Hz

76. **If the speed of sound is 340 m/s, the length of the shortest closed pipe that resonates at 100 Hz is:**
A. 170 cm
B. 42.5 cm
C. 17 cm
D. 85 cm

77. **The lowest tone produced by a certain organ comes from a 3.0 m pipe with both ends open. If the speed of sound is 340 m/s, the frequency of this tone is approximately:**
A. 7 Hz
B. 28 Hz
C. 14 Hz
D. 57 Hz

78. **If the speed of sound is 340m/s, the two lowest frequencies of an 0.5-m organ pipe, closed at one end, are approximately:**
A. 170 and 340 Hz
B. 340 and 680 Hz
C. 170 and 510 Hz
D. 340 and 1020 Hz

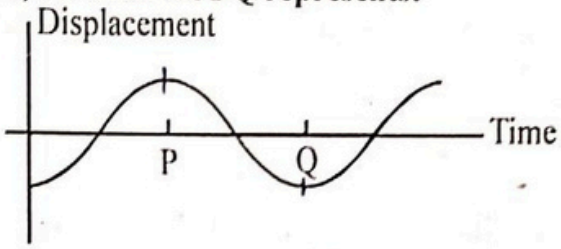
79. **The waves used in "Sonar" are:**
A. Electromagnetic waves
B. Sound waves
C. Matter waves
D. Water waves

80. **An organ pipe with one end closed and the other open has length "L". Its fundamental frequency is proportional to:**
A. L
B. $1/L^2$
C. $1/L$
D. L^2

81. **Four organ pipes are described below. Which one has the highest frequency fundamental?**
A. A 2.3 m pipe with one end open and the other closed
B. A 3.3 m pipe with one end open and the other closed
C. A 1.6 m pipe with both ends open
D. A 3.0 m pipe with both ends open

82. **The speed of stars and galaxies can be calculated by:**
A. Compton effect
B. Doppler's effect
C. Stefan's law
D. Pascal's law

83. **In the diagram below, the interval PQ represents:**



A. wavelength/2
B. 2 × amplitude
C. wavelength
D. period/2

84. **Sinusoidal water waves are generated in a large ripple tank. The waves travel at 20 cm/s and their adjacent crests are 5.0 cm apart. The time required for each new whole cycle to be generated is:**
A. 100 s
B. 2.0 s
C. 4.0 s
D. 0.25 s

85. **A transverse traveling sinusoidal wave on a string has a frequency of 100 Hz, a wavelength of 0.040 m, and an amplitude of 2.0 mm. The maximum acceleration in m/s^2 of any point on the string is:**
A. 0
B. 395
C. 130
D. 790

86. **The speed of a sinusoidal wave on a string depends on:**
A. the frequency of the wave
B. the amplitude of the wave
C. the wavelength of the wave
D. the tension in the string

87. **Distance covered during one vibration of an oscillating body in terms of amplitude "A" is:**
A. Zero
B. A
C. 2A
D. 4A

88. **Which of the following becomes maximum at mean position?**
A. P.E
B. Acceleration
C. Displacement
D. K.E

89. **At what temperature velocity of sound is double than that of at 0°C**
A. 819 K
B. 600°C
C. 819°C
D. 600 K

90. If a particle is rotating uniformly along a circular path, its projection would execute _____ along diameter.
A. vibratory motion
B. rotatory motion
C. SHM
D. Translational motion

91. The displacement of particle executing SHM is given by $x = 0.01 \sin(100\pi t)$. The time period is:
A. 0.01sec
B. 0.2 sec
C. 0.02 sec
D. 0.1 sec

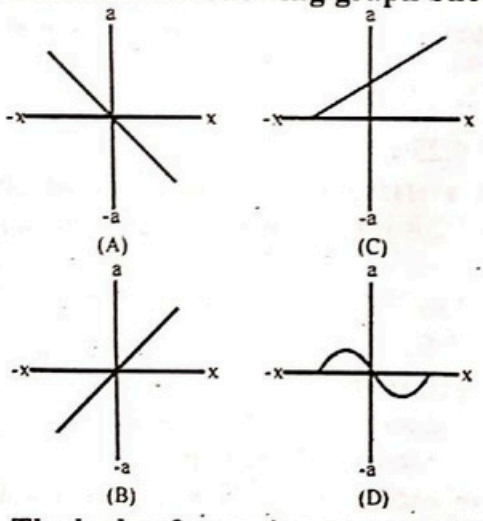
92. The SI unit of spring constant is same as that of:
A. force
B. surface tension
C. pressure
D. intensity

93. A simple harmonic oscillator consists of an particle of mass "m" and an ideal spring with spring constant "k". If the spring is cut in half and used with the same particle, the period will be:
A. 2T
B. $T/\sqrt{2}$
C. $\sqrt{2}\,T$
D. T

94. The mean position of an SHM oscillator is also called equilibrium position because:
A. it is the middle position between two extremes
B. acceleration is zero at this position
C. displacement is zero at this position
D. both "B" and "C"

95. Motion of an SHM oscillator is given by $x=0.25 \cos(\pi/4)t$. What is its time period?
A. 0.125 seconds
B. 8 seconds
C. 0.25 seconds
D. 4 seconds

96. Which of the following graph Shows SHM?



97. The body of a car is supported by four springs each of constant 2000 Nm^{-1}. What will be the value of spring constant for this combination of springs?
A. 2000 Nm^{-1}
B. 8000 Nm^{-1}
C. 500 Nm^{-1}
D. 4000 Nm^{-1}

98. The wave form of SHM is:
A. Sine wave
B. Square wave
C. Pulsed wave
D. tangent curve

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99. **The angular frequency "ω" and frequency "f" of SHM are related are:**

A. $f = 2\pi\omega$

B. $\omega = 2\pi f$

C. $f = \frac{1}{2\pi\omega}$

D. $f = \frac{1}{\omega}$

100. **A mass attached to an elastic spring is executing SHM with frequency of 5Hz, its angular velocity is:**

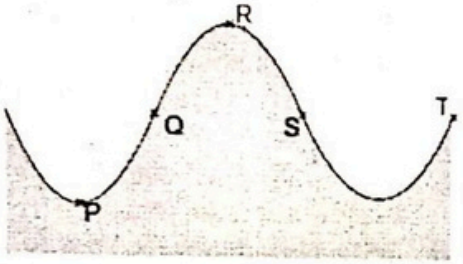
A. 10π rad s^{-1}

B. $\pi/10$ rad s^{-1}

C. 20π rad s^{-1}

D. 2π rad s^{-1}

101. **The diagram shows waves travelling on the sea.**



Which points are one wavelength apart?

A. P and R B. Q and S C. Q and T D. S and T

102. **In a transverse wave the distance between a crest and a trough is equal to**

A. $\frac{\lambda}{2}$

B. λ

C. $\frac{\lambda}{4}$

D. 2λ

103. **If a wave travelling at a speed of 130 m/s and has a wavelength of 5m. Then find out the frequency of the wave?**

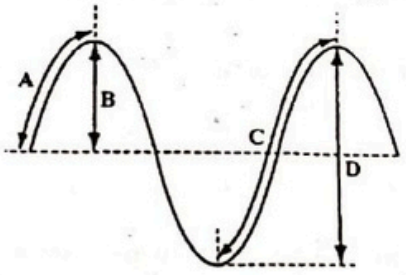
A. 650 Hz

B. 20 Hz

C. 3.8×10^2 Hz

D. 26 Hz

104. **What is the amplitude of the wave shown in the diagram?**



A. A B. B C. C D. D

105. **The sound of lightning flash is heard 3 second after the flash is seen. The distance of the lightning is 1020 metre. The speed of sound is:**

A. 340 m/s

B. 332 m/s

C. 1400 m/s

D. none of these

106. **When water waves pass from deep water into shallow water how do the frequency, wave length and speed change**

Frequency	Wavelength	Speed
A. Increases	Decreases	No change
B. No change	Decreases	Decreases
C. No change	Increases	Increases
D. None of these		

107. Which of the following waves can be transmitted through solids, liquids and gases?

A. Transverse waves
B. Electromagnetic waves
C. Mechanical waves
D. Longitudinal waves

108. If two sound waves having a phase difference of 60°, then they will have a path difference of

A. $\frac{\lambda}{6}$
B. $\lambda/3$
C. λ
D. 3λ

109. For beats to be produced

A. Frequency of sources should be different and amplitude should be the same
B. Frequency of sources should be same and amplitude should be different
C. Frequency of sources should be same and amplitude should be different
D. Frequency of sources should be same and amplitude should be the same

110. The frequency of the first harmonic of a string stretched between two points is 100 Hz. The frequency of the third overtone is

A. 200 Hz
B. 300 Hz
C. 400 Hz
D. 600 Hz

111. The fundamental frequency of a closed organ pipe is 50 Hz. The frequency of the second overtone is

A. 100 Hz
B. 150 Hz
C. 200 Hz
D. 250 Hz

112. With the increase in temperature, the frequency of the sound from an organ pipe

A. decreases
B. increases
C. remains unchanged
D. none of these

113. The frequency of the fundamental mode of vibration of an open organ pipe is 400 Hz. If one end of the pipe is closed, the fundamental frequency will be

A. 200 Hz
B. 400 Hz
C. 600 Hz
D. 800 Hz

114. An organ pipe, open at both ends and another organ pipe, closed at one end, will resonate with each other, if their lengths are in ratio of

A. 1 : 1
B. 1 : 4
C. 2 : 1
D. 1 : 2

115. "Stationary waves" are so called because in them

A. the particles of the medium are not disturbed,
B. the particles of the medium do not execute SHM
C. there occurs no flow of energy along the wave
D. the interference effect can't be observed

116. The frequency of the nth mode of vibration of a string stretched by a tension T and having mass m and length is given by

A. $f_n = \frac{n}{2}\sqrt{\frac{T}{m\ell}}$
B. $f_n = \frac{n}{2}\sqrt{\frac{\ell T}{m}}$
C. $f_n = \frac{n}{2\ell}\sqrt{\frac{T}{m}}$
D. $f_n = \frac{n}{2}\sqrt{\frac{T}{m}}$

117. If the string vibrates in 'n' loops, the wavelength is given by

A. $\lambda_n = \frac{2}{nl}$
B. $\lambda_n = \frac{2l}{n}$
C. $\lambda_n = \frac{l}{2n}$
D. none of these

118. A cylindrical tube, open at both ends has a fundamental frequency *f* in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of air column is now:

A. f/2 C. f

B. 3f/4 D. 2f

119. If the successive overtones of a vibrating string clamped at its ends are 280 Hz and 350 Hz, the frequency of fundamental is:

A. 350 Hz C. 140 Hz

B. 280 Hz D. 70 Hz

120. If the number of loops of a stationary wave are increasing, then

A. λ increases C. λ remains same

B. λ decreases D. λ may increase or decrease

121. A string of length 2m fixed between two supports vibrates in two loops. The distance between node and antinode is:

A. 50 cm C. 100 cm

B. 200 cm D. 10 cm

122. The distance between two particles in a wave motion in the same phase is

A. $\frac{\lambda}{4}$ C. $\frac{\lambda}{2}$

B. $\frac{3\lambda}{4}$ D. λ

123. The phase between two consecutive antinodes is:

A. $\frac{\pi}{4}$ C. $\frac{\pi}{2}$

B. π D. 2π

124. When the string vibrates in three loops then the length '*l*' of the string is expressed as

A. $l = \frac{3\lambda}{4}$ C. $l = \frac{3\lambda}{2}$

B. $l = \frac{\lambda}{2}$ D. $l = \frac{2\lambda}{3}$

125. When a source of sound is in motion towards a stationary observer then change in wave?

A. Increase in the velocity of sound

B. Decrease in the velocity of sound

C. Increase in frequency of sound

D. Increase in both velocity and frequency of sound

126. Overtones produced by a closed-end organ pipe are

A. f, 3f, 5f, ... C. 2f, 3f, 4f, ...

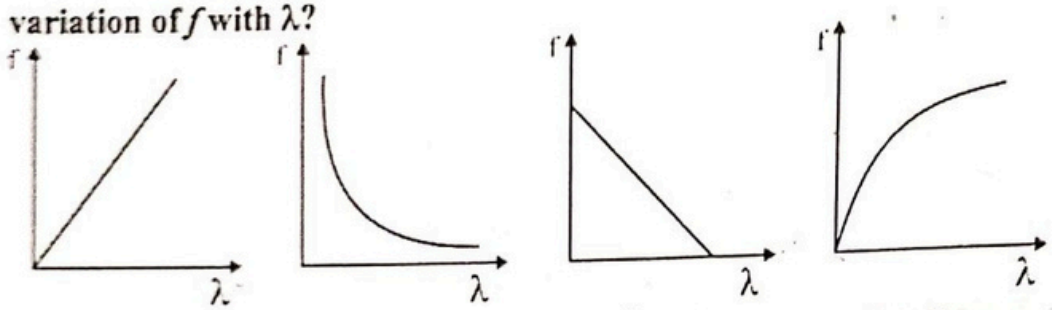
B. 3f, 5f, 7f, ... D. f, 2f, 3f, ...

127. The first resonance length in a closed pipe is 20 cm then second resonance occurs at

A. 60 cm C. 120 cm

B. 90 cm D. 80 cm

128. A sound wave of frequency f and wavelength λ travels through air. It may be assumed that its speed is independent of the frequency. Which graph correctly shows the variation of f with λ?



A. B. C. D.

129. The stationary longitudinal waves in a pipe closed at one end, only _____ harmonics are present.

A. even
B. just multiple of 5
C. odd
D. all of these

130. Consider a stretched string under tension and fixed at both ends. If the tension is doubled and the cross-sectional area halved, then the frequency becomes

A. Twice
B. Four times
C. Half
D. Eight times

131. When the antinodes are all at their extreme displacements, the energy stored is

A. K.E
B. thermal energy
C. P.E
D. all of these

132. The organ pipe which is open at both ends is

A. weaker in harmonics
B. no harmonics produce
C. richer in harmonics
D. none of these

133. Progressive waves of frequency 300 Hz are superimposed to produce a system of stationary waves in which adjacent nodes are 1.5 m apart. What is the speed of the progressive waves?

A. 100 m s^{-1}
B. 900 m s^{-1}
C. 450 m s^{-1}
D. 200 m s^{-1}

134. A tube closed at one end and containing air produces, when excited, the fundamental note of frequency 512Hz. If the tube is open at both ends, the fundamental frequency that can be excited is (in Hz).

A. 1024
B. 512
C. 256
D. 128

135. When an observer moves towards source with a velocity u_o, then the modified frequency 'f_A' becomes

A. $f_A = f(v - u_o)$
B. $f_A = \left(\frac{v + u_o}{2}\right) f$
C. $f_A = f\left(\frac{v + u_o}{v}\right)$
D. $f_A = \left(\frac{v - u_o}{V}\right) f$

136. Doppler's effect is not applicable for:

A. Microwaves
B. Electromagnetic waves
C. Ultrasonic
D. Standing waves

137. **Doppler shift in frequency does not depend upon**
A. The actual frequency of the wave
B. The distance of the source from the listener
C. The velocity of the source
D. The velocity of the observer

138. **The source is moving towards a stationary observer then the pitch of the sound will**
A. Sometimes increases and sometimes decreases
B. Remains constant
C. Decrease
D. Increase

139. **An observer standing at the sea coast observes 54 waves reaching the coast per minute. If the wavelength of the waves is 10 m, find the velocity.**
A. 3 m/s
B. 4 m/s
C. 9 m/s
D. 5 m/s

140. **The apparent frequency of the whistle of an engine changes in the ratio 6:5 as engine passes a stationary observer. If the speed of sound is 352 m/s. Then the speed of engine will be**
A. 22 m/s
B. 32 m/s
C. 27 m/s
D. 36 m/s

141. **A source of sound moves towards a stationary observer with a speed one third that of sound. If the frequency of the sound from the source is 100 Hz, the apparent frequency of the sound heard by the observer is**
A. 67 Hz
B. 150 Hz
C. 100 Hz
D. 75 Hz

142. **If a Radar system designed in accordance with the Doppler's effect, if an airplane is moving away from a Radar, the wavelength of the reflected wave from the air plane would be:**
A. Smaller than the transmitting wave
B. Larger than the transmitting wave
C. Same as that of the transmitting wave
D. Either smaller or larger than the transmitting wave

143. **Stars moving towards earth shows**
A. blue shift
C. red shift
B. no shift
D. may be 'A' may be 'B' depending upon speed of stars

144. **Bats navigate and find food by**
A. ultrasonic
B. amplitude
C. echo location
D. refraction

145. **Which one of the following explains that all the galaxies are receding from us?**
A. White shift
B. Neutrons stars
C. Black holes
D. Red shift

146. A whistle giving out 450Hz approaches a stationary observer at a speed of 33m/s. The frequency heard by the observer in Hz is (speed of sound = 330m/s).
A. 409
B. 429
C. 517
D. 500

147. The source of sound generating of a frequency of 3 kHz reaches an observer with a speed of 0.5 times the velocity of sound in air. The frequency heard by the observer is?
A. 1 kHz
B. 3 kHz
C. 4 kHz
D. 6 kHz

148. A whistle producing sound waves of frequencies 9500 Hz and it is approaching a stationary person with speed v ms^{-1}. The velocity of sound in air is 300 ms^{-1}. If the person can hear frequencies up-to a maximum of 10,000 Hz, the maximum value of v up-to which he can hear the whistle is
A. 30 m s^{-1}
B. 15 m s^{-1}
C. 10 m s^{-1}
D. 20 m s^{-1}

149. Velocity of sound is maximum in
A. Air
B. Water
C. Vacuum
D. Steel

150. If velocity of sound in a gas is 360 m/s and the distance between a compression and the nearest rarefaction is 1m, then the frequency of sound is
A. 90 Hz
B. 180 Hz
C. 360 Hz
D. 720 Hz

ANSWER KEY

1	D	16	D	31	D	46	D	61	B	76	D	91	C	106	B	121	A	136	D
2	C	17	A	32	D	47	B	62	C	77	D	92	B	107	D	122	D	137	B
3	A	18	A	33	D	48	B	63	A	78	C	93	B	108	A	123	B	138	D
4	B	19	C	34	A	49	B	64	A	79	B	94	D	109	A	124	C	139	C
5	C	20	D	35	C	50	B	65	A	80	C	95	B	110	C	125	C	140	C
6	D	21	D	36	A	51	A	66	C	81	C	96	A	111	D	126	B	141	B
7	B	22	C	37	D	52	D	67	D	82	B	97	B	112	B	127	A	142	B
8	C	23	B	38	A	53	B	68	D	83	D	98	A	113	A	128	B	143	A
9	B	24	C	39	B	54	A	69	A	84	D	99	B	114	C	129	C	144	C
10	C	25	A	40	C	55	D	70	C	85	D	100	A	115	C	130	A	145	D
11	D	26	C	41	D	56	B	71	C	86	D	101	C	116	C	131	C	146	D
12	A	27	B	42	C	57	B	72	C	87	D	102	A	117	B	132	C	147	D
13	A	28	B	43	B	58	C	73	D	88	D	103	D	118	C	133	B	148	B
14	B	29	D	44	C	59	C	74	C	89	C	104	B	119	D	134	A	149	D
15	C	30	C	45	C	60	B	75	C	90	C	105	A	120	B	135	C	150	B

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SOLUTIONS

1. Doppler's effect is applicable on both sound (mechanical) and light (electromagnetic) waves equally.

2. $\frac{\text{Phase differnce}}{2\pi} = \frac{\text{Displacement}}{\lambda}$

$$\text{Phase difference} = \frac{2\pi}{\lambda}(\text{Displacement})$$

$$\text{Phase difference} = \frac{2\pi x}{\lambda}$$

3. When plane moves faster than the speed of sound a conical surface of concentrated sound energy sweeps over the ground as a supersonic plane passes overhead. It is known as sonic bomb.

4. When a star is moving away from Earth show a red shift. The emitted waves have a longer wavelength than if the star had been at rest. So, the spectrum is shifted towards longer wavelength, i.e., towards the red end of the spectrum.

5. $f' = \left(\frac{v + u_o}{v}\right) f$

$$f' = \left(\frac{v + v/3}{v}\right) f = \frac{4}{3} f$$

$$\phi = \frac{2\pi \Delta x}{\lambda}$$

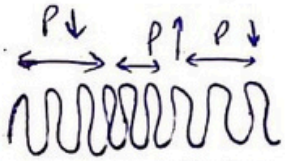
6. Due to the overlapping of waves the amplitude of wave may change but the speed of wave does not change. Speed of wave depends upon the nature of medium.

7. Speed, frequency and wavelength of a wave are related with each other but not amplitude. $v = f\lambda$

8. $T = \frac{1}{f} = \frac{1}{500}\,s$

For half wavelength (rarefaction)

$$t = \frac{1}{2}\left(\frac{1}{500}\right)s = \frac{1}{1000}\,s$$



9. Longitudinal waves are basically produced due to the pressure applied on the medium. From which compressions are produced, which further make rarefactions. That is why longitudinal waves are also called as pressure waves.

10. $f' = f\left(\frac{v - u_o}{v + u_s}\right)$

11. Only transverse waves can be polarized.

12. $f' = \left(\frac{v + u}{v}\right) f$

if $u = v$

$$f' = \left(\frac{v + v}{v}\right) f = 2f$$

13. When a star is moving towards the Earth show a blue shift. The emitted waves have a shorter wavelength than if the star had been at rest. So, the spectrum is shifted towards shorter wavelength, i.e., towards the blue end of the spectrum.

14. X-rays are very high energy electromagnetic waves. It is harmful to use for communication purposes.

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15. As apparent frequency decreases. So, observer is moving away from the stationary source.

$$f' = \left(\frac{v - u_o}{v}\right)f$$

$$0.9f = \left(\frac{v - u_o}{v}\right)f$$

$$0.9v = v - u_o$$

$$u_o = v - 0.9v = (0.1)v = (0.1)(350) = 35 \text{ m/s}$$

16. Length of 1 loop in terms of wave length $= \frac{\lambda}{2}$

Length of n loops in terms of wave length $= n\frac{\lambda}{2}$

17. The speed "v" of the waves in the string depends upon the tension "F" and mass per unit length of the string "m". the speed "v" of the wave is given by:

$$v = \sqrt{\frac{F}{m/\ell}} = \sqrt{\frac{F \times \ell}{m}}$$

18. Waves that do not require any medium for their propagation are called electromagnetic waves. These waves propagate due to the oscillations of electric and magnetic fields.

19. The distance between any two consecutive crests or troughs, is called wavelength.

20. The number of waves passing through a point per second in known as frequency. So,
$f = 20\text{Hz}$

$$v = f\lambda \Rightarrow \lambda = \frac{v}{f} = \frac{20}{20} = 1\text{m}$$

21. $\lambda/2 = 1.5 \Rightarrow \lambda = 3$ m

$v = f\lambda = (300)(3) = 900$ m/s

22. The points on stationary wave which are permanently at rest are known as nodes.

23. All are the cases of Doppler's effect except (B).

24. The points separated from one another through distances of λ, 2λ, 3λ, ... are all in phase with each other. The distance between "P" and "C" is not in integral multiple of wavelength. So. These are always in out of phase.

25. Speed of sound in any medium depends upon the properties of the medium. In a certain medium if frequency increases then its wavelength decreases with same rate. So, speed remains constant.

26. Transverse and longitudinal waves can be set up in solids. In gases transverse waves die out very quickly and usually cannot be produced at all.

27. As there is no relative motion between source and observer. So, apparent change in frequency will not be observed.

28. $$f = \frac{1}{2\ell}\sqrt{\frac{F}{m}}$$

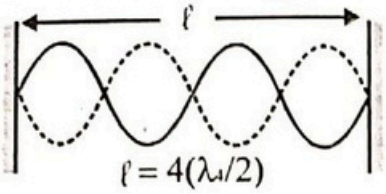
$$f \propto \sqrt{F}$$

29. $$f_1 = \frac{v}{2L}$$

for 3rd overtone means 4th harmonic

$$f_4 = 4\left(\frac{v}{2L}\right)$$

30. $\lambda/2 = \ell \Rightarrow \lambda = 2\ell = 2(1) = 2m$



31. $\ell = 4(\lambda_4/2)$

$\ell = 2\lambda_4 \Rightarrow \lambda_4 = \ell/2$

32. $v = \sqrt{\frac{F}{m/\ell}} = \sqrt{\frac{F \times \ell}{m}}$

33. $f' = \left(\frac{v + u_o}{v}\right) f = \left(\frac{v + v}{v}\right) f = 2f$

34. $\lambda/4 = 0.85 \Rightarrow \lambda = 4(0.85) = 3.4$ m

$f = \frac{v}{\lambda} = \frac{340}{3.4} = 100$ Hz

35. $f_o = \frac{v}{2\ell}$

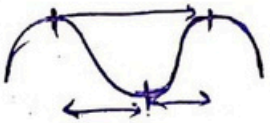
$f_c = \frac{v}{4\ell} = \frac{1}{2}\left(\frac{v}{2\ell}\right) \Rightarrow f_c = \frac{1}{2} f_o = \frac{1}{2}(400) = 200$ Hz

36. Time for half wave (crest to trough), T = 1 s

Time for 1 wave (crest to crest), T = 2 s

$f = \frac{1}{T} = \frac{1}{2} = 0.5$ Hz

Wavelength (crest to crest) = 2(10) = 20 m



37. The frequencies which are integral multiples of the fundamental frequency are called harmonics or overtones.

Stationary waves can be set up in the string only with discrete set of frequencies ($f_1, 2f_1, 3f_1, 4f_1, \ldots\ldots, nf_1$) is called harmonic series.

38. $f_{open} = \frac{v}{2\ell}$

$f_{closed} = \frac{v}{4\ell} = \frac{1}{2}\left(\frac{v}{2\ell}\right) \Rightarrow f_{closed} = \frac{1}{2} f_{open} \Rightarrow f_{open} = 2f_{closed}$

39. $\frac{\text{Phase differnce}}{2\pi} = \frac{\text{Path differnce}}{\lambda}$

$\frac{\pi}{2\pi} = \frac{\text{Path differnce}}{\lambda} \Rightarrow$ path difference $= \frac{\lambda}{2}$

40. $f = \frac{1}{2L}\sqrt{\frac{FL}{M}} \Rightarrow 4f^2L^2 = \frac{FL}{M}$

$F = 4Mf^2L$

41. $f' = \left(\frac{v - u_o}{v}\right) f$

$f' = \left(\frac{v - v/4}{v}\right) f = \frac{3}{4} f = \frac{3}{4}(100) = 75$ Hz

42. In closed pipe

No. of nodes = No. of antinodes

$\frac{\text{No. of nodes}}{\text{No. of antinodes}} = 1$

43. Waves that do not require any medium for their propagation are called electromagnetic waves. These waves are produced by the oscillations of charge particles that produce changing electric and magnetic fields.

44. Speed of sound in any medium depends upon the properties of the medium. In a certain medium if frequency increases then its wavelength decreases with same rate. So, speed remains constant.

45. Stationary waves can be set up in the string only with discrete set of frequencies ($f_1, 2f_1, 3f_1, 4f_1, \ldots\ldots, nf_1$) is called harmonic series.
If first harmonic (f_1) is 50 Hz then next harmonics will be 100 Hz, 150 Hz, 200 Hz and 250 Hz.

46. $f' = \left(\frac{v + u_o}{v}\right) f = \left(\frac{2 + 10}{2}\right)(5) = 30 \text{ Hz}$

47. The period of the oscilloscope T is:
4 division × 2 ms/cm = 8 ms.
$\therefore$ Frequency, $f = \frac{1}{T} = \frac{1}{8 \times 10^{-3}} \text{ Hz}$

48. Light travels almost instantaneously (3.0×10^8 m/s) from the lightening to the eye of the observer.
Sound travels at a slower speed of 320 m/s.
Distance from lightening is approximately equal to the product of speed of sound and time difference between the flash of lightening and the clap of thunder.
Distance = 320 × 2 = 640 m

49. Light and radio are examples of electromagnetic waves which are all transverse waves. Sound is an example of longitudinal wave.

50. The waves, in which particles of the medium vibrate in a line perpendicular to the direction of propagation of waves, are known as transverse waves.

51. Both types of waves can be set up in solids. In fluids transverse waves die out very quickly and usually cannot be produced at all.

52. $f_3 = 3\left(\frac{v}{2L}\right) = 3\left(\frac{340}{2(0.85)}\right) = 3\left(\frac{340}{1.7}\right) = 3(200) = 600 \text{ Hz}$

53. Sound waves having frequency greater than 20000 Hz are called ultrasonic and less than 20 Hz are called infrasonic.

54. Loudness of sound depends upon the amplitude.

55. Pitch of sound depends upon the frequency of sound.

56. The number of waves passing through a point per second in known as frequency. So, f = 30Hz

$v = f\lambda \Rightarrow \lambda = \frac{v}{f} = \frac{30}{30} = 1 \text{m}$

57. Waves associated with microscopic particles moving with very high speed are called matter waves.

58. If a transverse wave travelling in a denser medium is incident on a rarer medium then it is reflected such that there is no phase change.

59. The distance between two consecutive nodes = The distance between two consecutive antinodes = $\lambda/2$

60. $\lambda_n = \frac{4L}{n} \Rightarrow n = \frac{4L}{\lambda_n} = \frac{4(200)}{270} = 3$

For closed end pipe harmonics are $f_1, 3f_1, 5f_1, \ldots$..

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61. Sonar is derived from sound navigation and ranging. It is a technique which is used to detect and locate the objects like submarine, antisubmarine weapons, mine hunting under water and depth measurement of sea.

62. $f_1 = \frac{v}{2\ell}$

63. The distance between node and next antinode = The distance between antinode and next node = $\lambda/4$

64. The general formula for wavelength of stationary wave in string is: $\lambda_n = \frac{2\ell}{n}$

65. $\frac{\text{Phase differnce}}{2\pi} = \frac{\text{Path differnce}}{\lambda}$

$\frac{\pi/2}{2\pi} = \frac{\text{Path differnce}}{\lambda} \Rightarrow$ path difference $= \frac{\lambda}{4}$

66. The general formula for wavelength of stationary wave closed end organ pipe: $\lambda_n = \frac{4\ell}{n}$

67. One time period is the interval in which one wavelength is completed.

68. As Car "A" is source and car "B" observer.
As
$f_B > f_A$
So, (D) is correct.

69. $v = \sqrt{\frac{F}{m/\ell}} = \sqrt{\frac{F \times \ell}{m}}$ $f_n \Rightarrow \frac{nv}{4\ell} \Rightarrow \frac{v}{4\ell} \times \frac{\ell}{v}$

$v \propto \sqrt{F}$

70. 

$\ell = \lambda/2 + \lambda/2 = \lambda$

$f_y = \frac{nv}{2\ell} = \frac{nv}{\ell}$

71. Two waves having same frequencies and travelling in the same direction, when they superposed interference is produced.

72. If the reflecting end is open, the air molecules have complete freedom of motion and this behave as an antinode.

73. $f_x = \frac{v}{4L}$

$f_y = \frac{v}{2L/2} = \frac{v}{L}$

$\frac{f_x}{f_y} = \frac{v/4L}{v/L} = \frac{1}{4} = 1:4$

$\Rightarrow \frac{v}{4\ell} \Rightarrow \frac{v}{4\ell} \times \frac{2\ell}{v}$ (2)

74. $\lambda_n = \frac{2\ell}{n} = \frac{2(4)}{4} = 2m$

75. $f_4 = 4f_1 \Rightarrow f_1 = f_4/4 = 120/4 = 30$ Hz

$1m = 100cm$

76. $f = \frac{v}{4L} \Rightarrow L = \frac{v}{4f} = \frac{340}{4(100)} = 0.85$ m $= 85$ cm

77. $f = \frac{v}{2L} = \frac{340}{2(3)} = 57$ Hz

78. $f_1 = \frac{v}{4L} = \frac{340}{4(0.5)} = 170$ Hz

$f_3 = 3f_1 = 3(170) = 510$ Hz

79. Sonar is derived from sound navigation and ranging. It is a technique which is used to detect and locate the objects like submarine, antisubmarine weapons, mine hunting under water and depth measurement of sea.

80. $f = \frac{v}{4L} \Rightarrow f \propto \frac{1}{L}$

81. For open pipe:

$$f_1 = \frac{v}{2L} = \frac{v}{2(1.6)} = \frac{v}{3.2}$$

$$f_1 = \frac{v}{2L} = \frac{v}{2(3)} = \frac{v}{6}$$

For closed ended pipe:

$$f_1 = \frac{v}{4L} = \frac{v}{4(2.3)} = \frac{v}{9.2}$$

$$f_1 = \frac{v}{4L} = \frac{v}{2(3.3)} = \frac{v}{6.6}$$

1.6 m pipe with both ends open have highest fundamental frequency.

82. Astronomers use the Doppler Effect to determine the speed of stars and galaxies by comparing the spectrum of light from stars with light from a laboratory source.

83. The interval PQ = time to complete the half wavelength = Period/2

84. $v = \frac{\lambda}{T} \Rightarrow T = \frac{\lambda}{v} = \frac{5}{20} = 0.25 \text{ s}$

85. $a = \omega^2 x_o = 4\pi^2 f^2 x_o = 4\pi^2(10^4)(2\times10^{-3}) = 80\pi^2$
$= 80(9.8) \approx 790 \text{ m/}^2 \text{ because } (\pi^2 \approx g)$

86. $v = \sqrt{\frac{F}{m/\ell}} = \sqrt{\frac{F \times \ell}{m}}$

87. Distance covered during 1 vibration
$= 4(\text{amplitude}) = 4A$

88. $K.E. = \frac{1}{2}k(x_o^2 - x^2)$

At mean position $x = 0$

$K.E. = \frac{1}{2}kx_o^2$ (maximum)

89. $T_f = n^2 T_i$
$= 4 \times 273$
$= 1092K$
$= 819°C$

$v = r\omega$

90. When a body is moving along the circumference of circle with constant angular velocity, then its projection performs SHM along the diameter of circle.

91. $x = 0.01\sin(100\pi t)$
$x = x_o \sin(\omega t)$
by comparing.

$$\omega = 100\pi \Rightarrow \frac{2\pi}{T} = 100\pi \Rightarrow T = \frac{1}{50} = 0.02 \text{ sec}$$

92. The unit if surface tension and spring constant is N/m.

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93. $T = 2\pi\sqrt{\frac{m}{k}}$

If a spring is cut into two halves then the spring constant of each half will be doubled.

$k' = 2k$

$$T' = 2\pi\sqrt{\frac{m}{k'}} = 2\pi\sqrt{\frac{m}{2k}} = \frac{1}{\sqrt{2}}\left(2\pi\sqrt{\frac{m}{k}}\right) = \frac{1}{\sqrt{2}}T$$

94. A body is in equilibrium position during SHM if it has zero acceleration and acceleration will be zero if displacement is also zero.

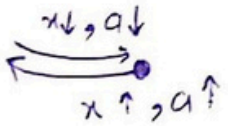
$$\vec{a} = -\frac{k}{m}\vec{x}$$

95. $x = 0.25\sin(\pi/4)t$

$x = x_o\sin(\omega t)$

by comparing

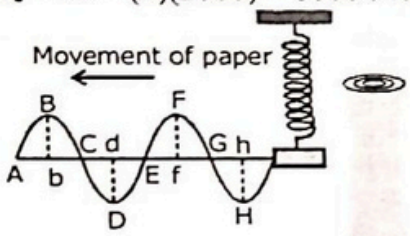
$$\omega = \pi/4 \Rightarrow \frac{2\pi}{T} = \frac{\pi}{4} \Rightarrow T = 8\ s$$



96. $\vec{a} \propto -\vec{x}$

When a body moves from mean to extreme position then displacement increases, magnitude of acceleration increases but in opposite to displacement.

97. $k_e = nk = (4)(2000) = 8000\ N/m$



98.

This is sine curve.

99. $\omega = \frac{\theta}{T}$

For one revolution

$\theta = 2\pi$ rad

So, $\omega = 2\pi\left(\frac{1}{T}\right) = 2\pi f$

100. $\omega = 2\pi f = (2)(\pi)(5) = 10\pi$ rad/s

101. The wavelength of the transverse water wave is the distance between two successive points which are moving in phase.

102. Distance between two consecutive crests = π

Distance between consecutive crests and trough = $\frac{\lambda}{2}$

103. $v = f\lambda \Rightarrow f = \frac{v}{\lambda} = \frac{130}{5} = 26Hz$

104. The maximum displacement or distance moved by a point on a vibrating body or wave measured from its equilibrium position.

105. $\text{Speed} = \frac{\text{distance}}{\text{time}}$

$$= \frac{1020}{3} = 340\,m\,s^{-1}$$

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106. Frequency does not depend upon nature of material.

107. Longitudinal waves involve changes in the volume and density of the medium. Since all media can sustain compressive stress, longitudinal waves can be transmitted through all the three types of media

108. $\Delta\varphi = 60° = \pi/3$

$\Delta x = \lambda/2\pi \times \Delta\varphi = \lambda/2\pi \times \pi/3 = \lambda/6$

109. For beats formation, frequency of sources should be slightly different and amplitude should be the same.

110. Third over tone mean fourth harmonic $f_4 = 4f_1$

111. In closed organ pipe 2nd over tone mean fifth harmonic

$f_3 = 5f_1 = 5 \times 50 = 250\text{Hz}$

112. $f_1 = \frac{v}{2\ell}, \quad v \propto \sqrt{T}$

113. $[f_1]_{closed} = \frac{1}{2}[f_1]_{open}$

114. $f_1 = f_2$

$$\frac{v}{2\ell_1} = \frac{v}{4\ell_2}$$

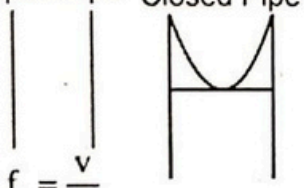
$$\ell_1 : \ell_2 = 2:1$$

115. Energy is a wave moves because of the motion of particle of the medium. The node always remains at rest so energy cannot flow past these point.

116. $f_n = \frac{n}{2\ell}\sqrt{\frac{T}{m}}$

117. $\lambda_n = \frac{2\ell}{n}$

Open Pipe Closed Pipe



118. $f_1 = \frac{v}{2l}$

Here, $\ell' = \frac{\ell}{2}$

Now it is closed end pipe

$$f' = \frac{v}{4\ell'} = \frac{v}{4\,\ell/2} = \frac{v}{2\ell} = f_1$$

119. $f' = f_2 - f_1$

120. $\lambda_n = \frac{2\ell}{n}$

$$\lambda_n \propto \frac{1}{n}$$

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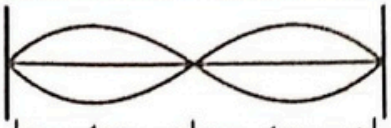


121. $\frac{\lambda}{2} = 1$

$\lambda = 2$ metre

Distance between nearest node and antinode is

$\frac{\lambda}{4} = \frac{2}{4} = 0.5\,m = 50\,cm$

122. Phase difference between two in phase points is $\lambda, 2\lambda, 3\lambda, ...$

123. Distance between two consecutive antinodes is $\frac{\lambda}{2} = x$ and phase different

$= \frac{2\pi x}{\lambda} = \frac{2\pi}{\lambda}.\frac{\lambda}{2} = \pi$

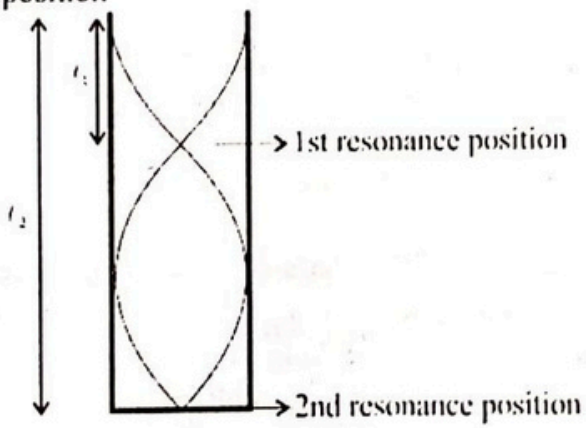
124. $\lambda_n = \frac{2\ell}{n}$

$n = 3$

125. $f_A = \left(\frac{v}{v - u_s}\right) f,\ f_A > f$

126. For a closed end organ pipe, only odd harmonics are produced (i.e. f, 3f, 5f.....) so in closed end organ pipe the 1st overtone is 3f and 2nd overtone is 5f and so on

127. From figure, the length of 2nd resonance position is 3 times of the length of 1st resonance position



128. $f \propto \frac{1}{\lambda}$

129. In closed pipe, only odd harmonics are present.

130. $f = \frac{1}{2l}\sqrt{\frac{T}{m}}$ where $m = \frac{\rho V}{l} = \frac{\rho(Al)}{l} = \rho A$

So, $f \propto \sqrt{\frac{T}{A}}$ and $f' \propto \sqrt{\frac{2T}{\frac{A}{2}}} \Rightarrow \frac{f'}{f} = 2$ OR $f' = 2f$

131. At extreme point energy stored is P.E.

132. Open pipe is richer in harmonics because both odd and even harmonics are present in open pipe.

133. $v = f\lambda = (300)(3) = 900\,ms^{-1}$

134. Fundamental frequency of a closed pipe, $f = v/4L = 512Hz$

Fundamental frequency of open pipe $f' = \frac{v}{4L} = 2f = 2 \times 512 = 1024Hz$

135. $f_A = \left(\frac{v + u_o}{v}\right) f$

136. Doppler's effect is applicable on light and sound waves.

137. $\Delta\lambda = \frac{u_s}{f}$

From formula Doppler shift in frequency does not depend upon distance of the source from listener.

138. As source is moving towards stationary observe.

$\because f' = \frac{v}{v - v_s} f \Rightarrow f' > f$ so pitch will increase.

139. $f = \frac{54}{60} = 0.9Hz$

$v = f\lambda = (0.9)(10) = 9\,ms^{-1}$

140. $\frac{f'}{f''} = \frac{v + u}{v - u} = \frac{352 + u}{352 - u} = \frac{6}{5}$

141. $f_A = \left(\frac{v}{v - u_s}\right) f$

$f_A = \left(\frac{v}{v - \frac{v}{3}}\right) 100 \Rightarrow f_A = \frac{3}{2} \times 100 = 150\,Hz$

142. Source is moving away from observer so apparent frequency decreases and wavelength increases.

143. When star is moving towards earth, according to Doppler's shift wavelength decreases, as blue light has smaller wavelength so blue shift appears.

144. Bats use echolocation to navigate and find food in the dark. To echolocate, bats send out sound waves from their mouth or nose. When sound waves hit an object, they produce echoes. Bats use this, to avoid flying into objects.

145. When galaxies or stars are receding from us its emitted light wavelength increase. So last colour of spectrum is red.

146. $v' = v/(v - v_s) \times v$

$v' = 330/(330 - 33) \times 450 = 500Hz$

147. $f' = v/(v - v_s) \times f = v/(v - 0.5v) \times 3kHz = 6kHz$

148. $f_A = \left(\frac{v}{v-u_s}\right) f$

$10,000 = \left(\frac{300}{300-v}\right) 9500 \Rightarrow v = 15 m s^{-1}$

149. Velocity of sound in steel is maximum out of the given materials water and air. In vacuum sound cannot travel, it's speed is zero.

150. Distance between a compression and the nearest rarefaction is $\frac{\lambda}{2} = 1m$. Hence $f = \frac{v}{\lambda} = \frac{360}{2} = 180Hz$

ALOCHISTAN TEXT BOOK EXERCISE MCQs

1. Wave is a mechanism which transmits:
A. Wavelength C. Mass
B. Amplitude D. Energy

2. The wave which requires a medium for its propagation is known as:
A. Mechanical waves C. Radio waves
B. Electromagnetic waves D. Light waves

3. Longitudinal wave consists of:
A. Crests and troughs C. Crests and compressions
B. Compression and rarefactions D. Troughs and rarefactions

4. Transverse wave is different from longitudinal wave, because it possesses a property of:
A. Reflection C. Diffraction
B. Interference D. Polarization

5. Due to high elasticity, the speed of sound is maximum in:
A. Solids C. Gases
B. Liquids D. Plazma

6. The speed of sound does not depend upon:
A. Density C. Temperature
B. Elasticity D. Pressure

7. Which of the following phenomenon is based on superposition principle?
A. Interference C. Beats
B. Standing waves D. All of these

8. When two waves of same frequency and travelling in the same direction are superimposed than we have?
A. Interference C. Standing wave
B. Beats D. Stationary wave

9. Which one of the following change can be observed in the resultant interference wave?
A. Amplitude C. Wavelength
B. Time period D. Frequency

10. **How many beats can be observed when the difference in frequencies of two waves is two:**
A. 1 C. 3
B. 2 D. 4

11. **The length between node and antinodes is:**
A. $\frac{\lambda}{4}$ C. λ
B. $\frac{\lambda}{2}$ D. 2λ

12. **Which one of the following wave does not transmit energy?**
A. Mechanical wave C. Matter wave
B. Standing wave D. Electromagnetic wave

13. **The ratio of the fundamental frequency of an open ended pipe to a pipe whose one end is closed is:**
A. 1:1 C. 2:1
B. 1:2 D. 1:4

14. **The number of quantization frequency of stationary wave in pipe when its one end is closed is:**
A. The whole number C. Even number
B. Natural number D. Odd number

15. **When wave is reflected from denser medium to rare medium then there is phase change of:**
A. $\frac{\pi}{4}$ C. π
B. $\frac{\pi}{2}$ D. $\pi 2$

16. **The sound which stimulates our ear is known as:**
A. Sonic C. Ultrasonic
B. Infrasonic D. Tidal

17. **Which one of the following parameter of a wave does not change when it transmits through two different media:**
A. Amplitude C. Frequency
B. Velocity D. Wavelength

18. **The acceleration of a body executing simple harmonic motion is:**
A. Zero at each point C. Maximum at mean position
B. Remain same at each point D. Minimum at extreme position

19. **What is the value of a spring constant when a 100g mass is attached to a spring and it is accelerated 0.5 ms^{-2} through a displacement of 5cm?**
A. 0.1 Nm^{-1} C. 1 Nm^{-1}
B. 0.5 Nm^{-1} D. 5 Nm^{-1}

20. If a spring of forced constant K is cut into two equal parts, then the spring constant of each half is:

A. $\frac{K}{2}$ C. K

B. 2K D. $\frac{K}{\sqrt{2}}$

21. When a body is performing S.H.M then at its extreme position?

A. Displacement is zero C. Velocity is a zero

B. Amplitude is zero D. P.E is zero

22. A particle is executing S.H.M along a straight line with amplitude A, its kinetic energy is maximum when its displacement is:

A. ±A C. Zero

B. $\pm\frac{A}{2}$ D. $\pm\frac{A}{\sqrt{2}}$

23. The time period of a body attached to a spring depends upon.

A. Amplitude C. Length

B. Mass D. Displacement

24. When the length of the pendulum is increased four times then its time period is increased?

A. One time C. Three time

B. Two time D. Four time

25. What is the frequency of the body when its time period is 2 seconds?

A. 1 Hz C. 0.2 Hz

B. 2 Hz D. 0.5 Hz

26. A second's pendulum is one who has a time period of:

A. 1s C. $\frac{1}{2}$s

B. 2s D. 0.2 s

27. In S.H.M., at what distance from mean position in terms of amplitude x_o K.E. and P.E. both will have equal value?

A. 0.51 x_o C. 0.71 x_o

B. 0.61 x_o D. 0.81 x_o

28. The instantaneous K.E of a mass attached to the end of an elastic spring is:

A. $\frac{1}{2}k(x_o^2 - x^2)$ C. $\frac{1}{2}k(x^2 - x_o^2)$

B. $\frac{1}{2}k(x_o^2 + x^2)$ D. $\frac{1}{2}k(x - x_o)$

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29. **In S.H.M., we have the conservation of:**
A. Kinetic energy C. Total energy
B. Potential energy D. Mechanical energy

30. **A free oscillation has constant:**
A. Energy C. Frequency
B. Amplitude D. All of these

31. **A resonance occurs when driving frequency is:**
A. Less than the natural frequency C. Equal to the natural frequency
B. Greater than natural frequency D. Equal to zero

32. **In the absence of damping force, when driving frequency is equal to the oscillating frequency then the amplitude of the oscillation will become:**
A. Zero C. Maximum
B. Minimum D. Infinity

33. **Food is cooked in a microwave oven by the effect of:**
A. Interference C. Magnetic resonance
B. Mechanical resonance D. Electric resonance

ANSWER KEY

1	D	6	D	11	A	16	A	21	C	26	B	31	C
2	A	7	D	12	B	17	C	22	C	27	C	32	C
3	B	8	A	13	C	18	C	23	B	28	A	33	C
4	D	9	A	14	D	19	C	24	B	29	C		
5	A	10	B	15	C	20	B	25	D	30	D		

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KPK TEXT BOOK EXERCISE MCQs

1. When a wave goes from one medium to another medium, which one of the following characteristics of the wave remains constant?
   A. Velocity
   B. Frequency
   C. Wavelength
   D. Phase

2. When a transverse wave is reflected from the boundary of a denser to a rarer medium, it under goes a phase change of:
   A. 0
   B. $\frac{\pi}{2}$
   C. π
   D. 2π

3. If the tension in the string is doubled and its mass per unit length is reduced to half. Then the speed of transverse wave on it is:
   A. Doubled
   B. Halved
   C. Constant
   D. One fourth

4. Which one of the following properties is not exhibited by the longitudinal waves?
   A. Reflection
   B. Interference
   C. Diffraction
   D. Polarization

5. A sounding source and a listener are both at rest relative to each other. If wind blows from the listener towards the source, then which one of the following of sound will change?
   A. Frequency
   B. Speed
   C. Phase
   D. Wavelength

6. Which one of the following factors has no effect on the speed of sound in a gas?
   A. Humidity
   B. Pressure
   C. Temperature
   D. Density

7. There is no net transfer of energy by particles of medium in:
   A. Longitudinal wave
   B. Progressive wave
   C. Transverse wave
   D. Stationary wave

8. Which one of the following could be the frequency of ultraviolet radiation?
   A. $1.0 \times 10^{6} H_z$
   B. $1.0 \times 10^{9} H_z$
   C. $1.0 \times 10^{12} H_z$
   D. $1.0 \times 10^{15} H_z$

9. When a stationary wave is formed then its frequency is:
   A. Same as that of the individual waves
   B. Twice that of the individual waves
   C. Half that of the individual waves
   D. Triple that of the individual waves

10. The fundamental frequency of a closed organ pipe is f. if both the ends are opened then its fundamental frequency will be:
   A. f
   B. $0.5f$
   C. $2f$
   D. $4f$

11. If the amplitude of a wave is doubled, then its intensity is:

A. Doubled
B. Halved
C. Quadrupled
D. One fourth

12. A sound source is moving towards stationary listener with $1/10^{th}$ of the speed of sound. The ratio of apparent to real frequency is:

A. $\frac{11}{10}$
B. $\left[\frac{11}{10}\right]^2$
C. $\left[\frac{9}{10}\right]^2$
D. $\frac{10}{9}$

13. Tuning of a radio set is an example of:

A. Mechanical resonance
B. Electrical resonance
C. Musical resonance
D. Free vibration

14. The heating and cooking of food evenly by microwave oven is an example of:

A. S. H. M
B. Damped Oscillation
C. Resonance
D. Free oscillation

15. The time period of the same pendulum at Karachi and Murree are related as:

A. $T_k = T_M$
B. $T_k > T_M$
C. $T_k < T_M$
D. $2T_k = 3T_M$

16. In an isolated system the total energy of vibrating mass and spring is:

A. Variable
B. Low
C. High
D. Constant

17. While deriving the equation of time period for simple pendulum which quantity should be kept small:

A. Length of simple pendulum
B. Amplitude
C. Mass of simple pendulum
D. Gravitational accelerating

18. If the period of oscillation of mass (M)suspended from a spring is 2s, then the period of mass $4M$ will be:

A. 1s
B. 2s
C. 3s
D. 4s

19. The time period of a simple pendulum is 2 seconds. If its length is increased by 4 times, then its period becomes.

A. 16s
B. 12s
C. 8s
D. 4s

20. To make the frequency double of a spring oscillation, we have to:

A. Reduce the mass to one fourth
B. Quadruple the mass
C. Double the mass
D. Half the mass

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21. The restoring force of SHM is maximum when particle:

A. Displacement is maximum
B. Half way between them
C. Crossing mean position
D. At rest

22. Two springs of spring constants K_1 and K_2 are joined in series. The effective spring constant of the combination is given by:

A. $(k_1+k_2)/2$
B. k_1+k_2
C. $k_1k_2/(k_1+k_2)$
D. $\sqrt{k_1k_2}$

ANSWER KEY

1	B	6	B	11	C	16	D	21	A
2	C	7	D	12	D	17	B	22	C
3	A	8	D	13	B	18	D		
4	D	9	A	14	C	19	D		
5	B	10	C	15	C	20	A		

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PAST PAPERS 2008-2020

1. **A standing wave pattern is formed when the length of string is an integral multiple of _____ wavelength.** (UHS 2008)
   A. Triple
   B. Full
   C. Half
   D. Double

2. **Two waves of slightly different frequencies and travelling in same direction produces_____.** (UHS 2008, 2009)
   A. Interference
   B. Polarization
   C. Stationary waves
   D. Beats

3. **Transverse wave cannot be setup in _____.** (UHS 2008)
   A. Metals
   B. Solids
   C. Fluids
   D. Soil

4. **A 2 m long pipe is open at both ends. What is its harmonic frequency? (Speed of sound is 340 m/s)** (UHS 2008)
   A. 42.5 Hz
   B. 85 Hz
   C. 220 Hz
   D. None of these

5. **What is it that we use to calculate the speeds of distant stars and galaxies?** (UHS 2009)
   A. Doppler Effect
   B. Interference
   C. Beats
   D. All of these

6. **Speed of waves is equal to:** (UHS 2009)
   A. $f\lambda$
   B. $\frac{\lambda}{T}$
   C. Both A. and B.
   D. λT

7. **Two waves of same amplitude are traveling in the same direction and are out of phase, their resultant wave is:** (UHS 2010)
   A. Zero amplitude
   B. The sum of amplitudes of two waves
   C. Difference of the amplitudes of two waves
   D. Double the amplitude of either wave

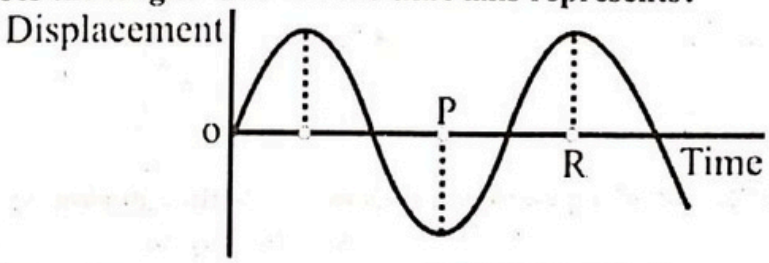
8. **An organ pipe closed at one end has a length of 25 cm. wavelength of the fundamental note is:** (UHS 2010)
   A. 25cm
   B. 50cm
   C. 100cm
   D. 75 cm

9. **A source "Y" of known frequency produces 4 beats with a source of 240 Hz and 8 beats with a sound of 252 Hz. Frequency of the source "Y" is:** (UHS 2010)
   A. 244 Hz
   B. 236 Hz
   C. 248 Hz
   D. 246 Hz

10. **A source of sound wave emits waves of frequency "f". If "v" is the speed of sound waves, then what will be the wavelength of waves:** (UHS 2011)
    A. $\frac{v}{f}$
    B. vf
    C. $\frac{v - u_o}{f}$
    D. $(v - u_o)f$

11. **The spectrum of a star's light is measured and the wavelength of one of the line as the sodium's line is found to be 589 nm. The same line has the wavelength of 497 nm when observed in laboratory. This means the star is:** (UHS 2011)
    A. Moving away from the Earth
    B. Moving towards the Earth
    C. Stationary
    D. Revolving around the planet

12. **In the diagram below, the displacement of an oscillating particle is plotted against time. What does the length "PR" on the time axis represents? (UHS 2012)**



A. Twice the frequency
B. Half the frequency
C. Half the period
D. Twice the period

13. **When the source of sound moves towards the stationary observer, the value of apparent frequency "f_o" is: (UHS 2012)**

A. $f_o = \left(\frac{v + u_s}{v}\right) f$
B. $f_o = \left(\frac{v}{v - u_s}\right) f$
C. $f_o = \left(\frac{v}{v + u_s}\right) f$
D. $f_o = \left(\frac{v - u_s}{v}\right) f$

14. **An observer moves with velocity "v_o" towards a stationary source, then the number of waves received in one second is: (UHS 2015)**

A. $f' = f\left(\frac{v}{v + v_o}\right)$
B. $f' = f\left(\frac{v}{v - v_o}\right)$
C. $f' = f\left(\frac{v + v_o}{v}\right)$
D. $f' = f\left(\frac{v - v_o}{v}\right)$

15. **The red shift measurement of Doppler effect of galaxies indicate that the universe is: (UHS 2016)**

A. Expanding
B. Contracting
C. Stationary
D. Oscillating

16. **A wave traveling with speed of 130 m/s having wavelength of 5 m. what is its frequency? (UHS 2017)**

A. 650 Hz
B. 20 Hz
C. 26 Hz
D. 3.8×10^2 Hz

17. **A metallic wire of length 2 m hooked between two points has tension 10 N. if mass per unit length is 0.004 kg/m, its fundamental frequency emitted by wire on vibration is? (UHS 2017)**

A. 48 Hz
B. 24 Hz
C. 12.5 Hz
D. 6.25 Hz

18. **A shock wave is produced due to an earthquake which makes the buildings move in the direction of shock wave. Which progressive wave would this be? (UHS 2018)**

A. Transverse wave
B. Longitudinal wave
C. Material wave
D. Particle wave

19. **The wavelength of the electromagnetic wave having frequency of 3 kHz will be: (UHS 2019)**

A. 80 km
B. 140 km
C. 100 km
D. 120 km

20. What will be the expression for the observed frequency, if the source is moving towards the observer: (UHS 2019)

A. $f_o = \left(\frac{v}{v - u_s}\right)f$

B. $f_o = \left(\frac{v}{v \pm u_s}\right)f$

C. $f_o = \left(\frac{v}{v + u_s}\right)f$

D. $f_o = \left(\frac{v}{v - u_s}\right)f$

21. If the mass of the bob of a pendulum is doubled its time period is: (UHS 2008)

A. Halved
B. Doubled
C. Unchanged
D. Increases four times

22. The angular frequency of simple pendulum is directly proportional to: (UHS 2008)

A. ℓ
B. $1/\ell$
C. $\sqrt{\ell}$
D. $1/\sqrt{\ell}$

23. The acceleration is proportional to the displacement and is directed towards mean position in _____ motion. (UHS 2008)

A. Gravity
B. Simple harmonic
C. Uniform
D. Projectile

24. If the mass attached with a spring becomes four times, the time period of vibration becomes: (UHS 2009)

A. One fourth
B. 3/4
C. Half
D. Double

25. In a microwave oven, the wave produced has a wavelength of 12 cm at a frequency of: (UHS 2009)

A. 2452 MHz
B. 2456 MHz
C. 2455 MHz
D. 2450 MHz

26. At t = 0 a body performing simple harmonic motion is at mean position; when t = T/4, it will be: (UHS 2010)

A. Between mean and extreme position
B. Again at mean position
C. Beyond extreme position
D. At extreme position

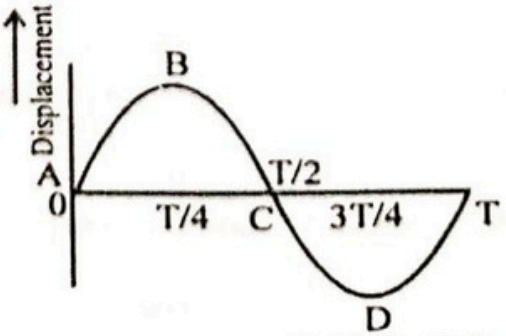
27. In a simple pendulum, the tension in the string is: (UHS 2010)

A. $mg \sin\theta$
B. $mg \cos\theta$
C. $g \cos\theta$
D. $g\theta$

28. What is the period of mass spring system during SHM if the ratio of mass to spring constant is ¼? (UHS 2011)

A. π s
B. 2π s
C. $1/\pi$ s
D. $1/2\pi$ s

29. Waveform of SHM is given in figure. At what time/times displacement is equal to zero? (UHS 2011)



A. T/4 only
B. 3T/4 only
C. 0,T/4, 3T/4 and T
D. 0, T/2 and T

30. **A simple harmonic oscillator has a time period of 10 seconds. Which equation relates its acceleration "a" and displacement "x"? (UHS 2012)**

A. $a = -10x$
C. $a = -\left(\frac{2\pi}{10}\right)^2 x$
B. $a = -(20\pi)x$
D. $a = -(20\pi)^2 x$

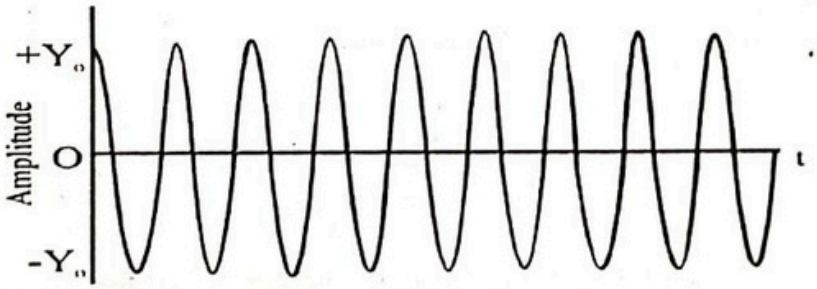
31. **When the length of a simple pendulum is doubled, find the ratio of the new frequency to the old frequency? (UHS 2012)**

A. $\frac{1}{4}$
C. $\sqrt{2}$
B. $\frac{1}{2}$
D. $\frac{1}{\sqrt{2}}$

32. **For vibrating mass-spring system, the expression of kinetic energy at any displacement "x" is given by? (UHS 2013)**

A. $\frac{1}{2}kx_o^2\left(1-\frac{x^2}{x_o^2}\right)$
C. $\frac{1}{2}m\omega\left(1-\frac{x^2}{x_o^2}\right)$
B. $\frac{1}{2}kx_o^2$
D. $\frac{1}{2}m\omega^2 x_o$

33. **Variation of amplitude with respect to time for an oscillating object is shown in figure. Identify the oscillation: (UHS 2013)**



A. Damped
C. Un-damped
B. Critical
D. Heavily damped

34. **In a simple Harmonic Motion with a radius "x_o", the velocity of the particle at any point is: (UHS 2013)**

A. $v = \omega\sqrt{x_o^2 - x^2}$
C. $v = \omega\sqrt{x_o - x}$
B. $v = \omega(x^2 - x_o^2)$
D. $v = \omega\sqrt{x - x_o}$

35. **Frequency of simple pendulum of length 9.8 m will be: (UHS 2014)**

A. 2π hertz
C. $\frac{1}{2\pi}$ hertz
B. $\frac{\pi}{2}$ hertz
D. $\frac{\pi}{4}$ hertz

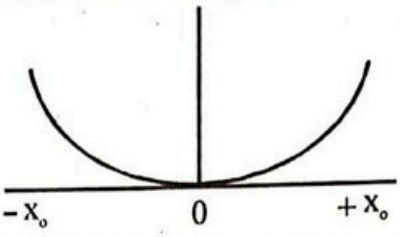
36. **A body performs simple harmonic motion with a period of 0.063 s. the maximum speed of the body is 3.0 ms^{-1}. What are the values of the amplitude x_0 (m) and angular frequency ω ($rads^{-1}$)? (UHS 2014)**

A. $x_o = 0.03, \omega = 100$
C. $x_o = 5.3, \omega = 16$
B. $x_o = 0.19, \omega = 16$
D. $x_o = 3.3, \omega = 100$

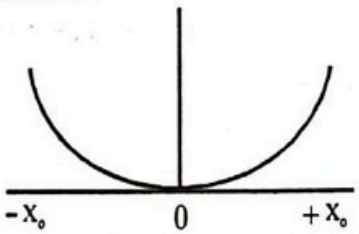
37. **Food being cooked in microwave oven is an example of:** **(UHS 2014)**

A. Beats
B. Overtones
C. Resonance
D. Stationary waves

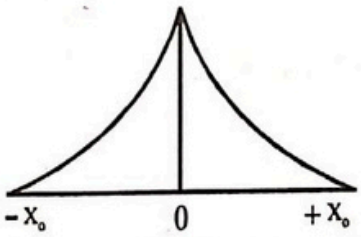
38. **Potential energy of a mass spring system with respect to displacement in simple harmonic motions (SHM) is shown in the figure.**



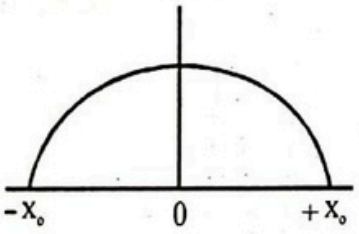
Which of the following represents the total energy of mass spring system during SHM? **(UHS 2014)**



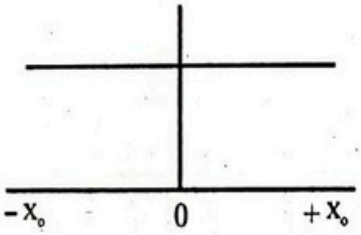
(A)



(C)



(B)



(D)

39. **Mathematical formula of maximum velocity (v_o) for a body executing simple harmonic motion is:** **(UHS 2015)**

A. $v_o = x_o\omega$
B. $v_o = \frac{k}{m}\sqrt{x_o^2 - x^2}$
C. $v_o = v\left(1 - \frac{x^2}{x_o^2}\right)$
D. $v_o = m\sqrt{x_o^2 - x^2}$

40. **What should be the length of a simple pendulum whose period is 6.28 second at a place where $g = 10\ ms^{-2}$.** **(UHS 2015)**

A. 9.8 m
B. 10.8 m
C. 6.28 m
D. 10 m

41. **What should be the ratio of kinetic energy to total energy for simple harmonic oscillator?** **(UHS 2015)**

A. $\left(1 - \frac{x^2}{x_o^2}\right)$
B. 1
C. $(x_o^2 - x^2)$
D. $\frac{1}{2}x^2$

42. **Resonance occurs when the driving frequency is:** **(UHS 2016)**

A. Greater than natural frequency
B. Less than natural frequency
C. Unequal the natural frequency
D. Equal to the natural frequency

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43. **Tuning a radio is an example:** **(UHS 2016)**
A. Natural resonance
B. Mechanical resonance
C. Free resonance
D. Electrical resonance

44. **In mass spring system, mass "m" is attached with spring of constant "k" with time period "T_1" then mass is replaced by "2m" with the same spring. What will be the time period "T_2"?** **(UHS 2017)**
A. $T_2 = \sqrt{2}\, T_1$
B. $T_2 = T_1$
C. $T_2 = 2T_1$
D. $T_2 = T_1/\sqrt{2}$

45. **A body performing SHM with displacement $x = x_o \sin(\omega t + \phi)$ when $t = 0$, $x = x_o$. What is the value of phase angle "ϕ"?** **(UHS 2017)**
A. π
B. $\pi/4$
C. $-\pi$
D. $\pi/2$

46. **Angular displacement of a point moving in a circle of radius 10 cm when displacement of projection of this point along vertical diameter of circle is 8.66 cm will be:** **(UHS 2017)**
A. 30°
B. 45°
C. 60°
D. 75°

47. **In SHM the kinetic energy of the body is maximum when:** **(UHS 2018)**
A. The body is at extreme position
B. The body is exactly half way down between mean and extreme position
C. The body is at mean position
D. The body is somewhere between mean and extreme position

48. **If the time period of oscillations is 20 micro-sec, then what will be the frequency of that oscillating body:** **(UHS 2018)**
A. 5000 Hz
B. 1000 Hz
C. 50000 Hz
D. 20000 Hz

49. **Simple harmonic motion of a body is described by which statement mentioned below:** **(UHS 2018)**
K : K.E is maximum when displacement $x = 0$
L : P.E is maximum when $x = 0$
M : P.E is maximum when $x = \pm x_o$
$x_o = x_o \sin\theta + \phi$
A. K, L and M
B. K and L
C. L and M
D. K and M

50. **When the frequency of the applied force becomes equal to one of natural frequencies of body then the body oscillates with maximum displacement this phenomenon is called:** **(UHS 2019)**
A. Damping
B. Reverberation
C. Heating
D. Resonance

51. **Which one of the following properties is not exhibited by the longitudinal waves?** **(PMC 2020)**
A. Interference
B. Reflection
C. Diffraction
D. Polarization

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52. The speed of sound in air is 332 m/s. The speed of sound at 22 °C will be: (PMC 2020)

A. 345.2m/s
B. 340 m/s
C. 350 m/s
D. 330 m/s

53. Astronomers calculate speed of distant stars and galaxies using which of the following phenomena? (PMC 2020)

A. Beats
B. Interference
C. Superposition Principle
D. Doppler Effect

54. In a ripple tank, 40 waves pass through a certain point in 1 second. If the wavelength of the wave is 5cm. then speed of the wave is: (PMC 2020)

A. 0.5 ms^{-1}
B. 1 ms^{-1}
C. 1.5 ms^{-1}
D. 2 ms^{-1}

ANSWER KEY

1	C	11	A	21	C	31	D	41	A	51	D
2	D	12	C	22	D	32	A	42	D	52	A
3	C	13	B	23	B	33	C	43	D	53	D
4	B	14	C	24	D	34	A	44	A	54	D
5	A	15	A	25	D	35	C	45	D		
6	B	16	C	26	D	36	A	46	C		
7	A	17	C	27	B	37	B	47	C		
8	C	18	B	28	A	38	D	48	C		
9	A	19	C	29	D	39	A	49	D		
10	A	20	D	30	C	40	D	50	D		

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SOLUTION

1. $\lambda_n = \frac{2\ell}{n}$

   $\ell = n \times \frac{\lambda_n}{2}$ = Integral multiple of half of wavelength

2. Definition of beats.

3. Transverse waves are also called surface waves. They cannot propagate within the fluids.

4. $f_1 = \frac{v}{2\ell} = \frac{340}{2(2)} = 85$ Hz

5. Doppler Effect can be used to calculate the speed of distant stars and galaxies.

6. Speed of waves $= \frac{\text{Distance}}{\text{Time}} = \frac{\lambda}{T}$

7. The superposition of two waves of same amplitude and are out of phase, then the displacement of resultant wave will be zero (According to principle of super position).

8. $\lambda_n = \frac{4\ell}{n}$ where n = 1, 3, 5, ...

   For fundamental mode of vibration

   $\lambda_1 = \frac{4\ell}{1} = 4\ell = 4(25 \text{ cm}) = 100 \text{ cm}$

9. "Y" produces 4 beats with source of 240 Hz. This shows that the frequency of "Y" will be either 236 Hz or 244 Hz.
   If the frequency of "Y" is 236 Hz then it produces 16 beats with 252 Hz source while the source "Y" produces 8 beats with 252 Hz. So, the frequency of "Y" is 244 Hz.

10. $v = f\lambda \Rightarrow \lambda = \frac{v}{f}$

11. $\lambda_{real} = 497$ nm
    $\lambda_{apparent} = 589$ nm
    As
    $\lambda_{apparent} > \lambda_{real}$
    This shows that star is moving away from Earth.

12. Length of "PR" = Half of wavelength = $\lambda/2$
    Time for half wavelength = T/2 = half the period

13. $f_o = \left(\frac{v}{v - u_s}\right) f$

14. $f' = f\left(\frac{v + v_o}{v}\right)$

15. Red shift in Doppler Effect means that galaxies are moving away from Earth (universe is expanding).

16. $f = \frac{v}{\lambda} = \frac{130}{5} = 26$ Hz

17. $f_1 = \frac{1}{2\ell}\sqrt{\frac{F}{m/\ell}} = \frac{1}{2(2)}\sqrt{\frac{10}{0.004}} = \frac{1}{4}\sqrt{\frac{10}{0.004}}$
    $= 12.5$ Hz

18. Shock waves are longitudinal in nature (Like sound wave)

19. $\lambda = \frac{c}{f} = \frac{3 \times 10^8}{3 \times 10^3} = 100 \times 10^3 \text{ m} = 100 \text{ km}$

20. $f_o' = \left(\frac{v}{v - u_s}\right) f$

21. $T = 2\pi\sqrt{\frac{\ell}{g}}$

Time period of simple pendulum is independent of mass of bob.

22. $\omega = \sqrt{\frac{g}{\ell}} \Rightarrow \omega \propto \frac{1}{\sqrt{\ell}}$

23. In SHM

$\vec{a} = -\frac{k}{m}\vec{x} \Rightarrow \vec{a} \propto -\vec{x}$

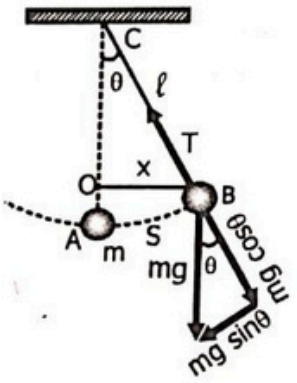
24. $T = 2\pi\sqrt{\frac{m}{k}} \Rightarrow T \propto \sqrt{m}$

25. The frequency of waves produced in microwave oven is 2450 MHz

26. $x = x_o \sin(\omega t) \Rightarrow x = x_o \sin\left(\frac{2\pi}{T} \times t\right) = x_o \sin\left(\frac{2\pi}{T} \times \frac{T}{4}\right)$

$x = x_o \sin\left(\frac{\pi}{2}\right) = + x_o$ (extreme position)

27.



$T = mg\cos\theta$

28. $T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{1}{4}} = \pi$ s

29. At the time t = 0, T/2 and T the body is at mean position. So, the displacement is zero.

30. In SHM

$a = -\omega^2 x$

$a = -\left(\frac{2\pi}{T}\right)^2 x = -\left(\frac{2\pi}{10}\right)^2 x$

31. $f = \frac{1}{2\pi}\sqrt{\frac{g}{\ell}} \Rightarrow f \propto \frac{1}{\sqrt{\ell}}$

$\frac{f'}{f} = \sqrt{\frac{\ell}{\ell'}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$

32. The K.E of mass- spring system at any displacement "x" is given by: $K.E = \frac{1}{2}kx_o^2\left(1 - \frac{x^2}{x_o^2}\right)$

33. As the amplitude of vibrating body remains same with the passage of time. So, the oscillation is un-damped.

34. The velocity of particle performing SHM at any displacement "x" is given by: $v = \omega\sqrt{x_o^2 - x^2}$

35. $f = \frac{1}{2\pi}\sqrt{\frac{g}{\ell}} = \frac{1}{2\pi}\sqrt{\frac{9.8}{9.8}} = \frac{1}{2\pi}$

36. $v_o = x_o\omega = (0.03)(100) = 3$ m/s

37. Microwave oven is an example of electrical resonance.

38. Total energy remains constant during SHM. So, the graph will be straight line and parallel to amplitude axis.

39. The maximum velocity at mean position of body performing SHM is $v_o = x_o\omega$

40. $T = 2\pi\sqrt{\frac{\ell}{g}}$

$6.28 = 2\pi\sqrt{\frac{\ell}{10}} \Rightarrow \sqrt{\frac{\ell}{10}} = 1 \Rightarrow \ell = 10$ m

41. $K.E = \frac{1}{2}kx_o^2\left(1 - \frac{x^2}{x_o^2}\right) = T.E.\left(1 - \frac{x^2}{x_o^2}\right)$

$\frac{K.E.}{T.E.} = \left(1 - \frac{x^2}{x_o^2}\right)$

42. By definition of resonance.

43. Tuning of radio is an example of electrical resonance.

44. $T = 2\pi\sqrt{\frac{m}{k}} \Rightarrow T \propto \sqrt{m}$

$\frac{T_2}{T_1} = \sqrt{\frac{m_2}{m_1}} = \sqrt{\frac{2m}{m}} = \sqrt{2} \Rightarrow T_2 = \sqrt{2}T_1$

45. $x = x_o \sin(\omega t + \phi)$

put $t = 0$ and $\phi = \pi/2$

$x = x_o \sin(0 + \pi/2) = x_o$

46. $x = x_o\sin\theta \Rightarrow \sin\theta = \frac{x}{x_o} = \frac{8.66}{10} = 0.866$

$\theta = \sin^{-1}(0.866) = 60^\circ$

47. $K.E = \frac{1}{2}kx_o^2\left(1 - \frac{x^2}{x_o^2}\right)$

At mean position $x = 0$

$K.E = \frac{1}{2}kx_o^2$ (maximum)

48. $f = \frac{1}{T} = \frac{1}{20 \times 10^{-6}} = \frac{100 \times 10^4}{20} = 50000$ Hz

49. At mean position $x = 0$, $\Rightarrow$ K.E = maximum

At extreme position $x = x_o$, $\Rightarrow$ P.E = maximum

50. At resonance the amplitude of vibrating body is maximum.

51. Sound waves are longitudinal waves in nature and they cannot be polarized because in such waves the vibratory motion of the particles of the medium is along the direction of propagation of the waves.

52. $v_t = v_0 + 0.61t$

53. Application of Doppler Effect.

54. $v = f\lambda = \frac{5}{100} \times 40 = 2\,ms^{-1}$

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PMC PAST PAPER 2022 (WAVES)

Q.1 Waves which requires medium, for their propagation
A. Mechanical wave
B. Electromagnetic wave
C. Matter wave
D. All of these

Q.2 Doppler's effect shows?
A. Change in frequency due to relative motion between source and observer.
B. Change in amplitude due to relative motion between source and observer.
C. Change in frequency due to motion of source only.
D. Change in frequency due to motion of observer only.

Q.3 Which wave doesn't travel in vacuum?
A. Sound wave
B. Light wave
C. Transverse Wave
D. All of these

Q.4 Distance Between two Consecutive nodes is
A. Wave length
B. Wave length /2
C. Wave length by 4
D. twice of Wave length

Q.5 Sound waves are
A. Longitudinal
B. Transverse
C. Both
D. None

Q.6 Property related to loudness of sound
A. Frequency
B. Wave
C. Intensity
D. amplitude

Q.7 Stationary waves
A. Move forward
B. Move backwards
C. Don't Move
D. Move in both direction

Q.8 Crest and trough are found in?
A. Transvers wave
B. Longitudinal wave
C. Progressive wave
D. None

Q.9 Ratio of fundamental frequency of Open Organ pipe to closed organ pipe is
A. 1 : 2
B. 2 : 1
C. 1 : 4
D. 4 : 1

Q.10 Which one required no medium?
A. X-Rays
B. Gamma Rays
C. Beta Rays
D. All

Q.11 At Crest Amplitude is
A. Maximum
B. Minimum
C. Both
D. None

Q.12 Speed of sound is maximum in
A. solid
B. liquid
C. gas
D. none

Q.13 Which rays need medium to travel
A. x rays
B. gamma rays
C. beta rays
D. all don't need medium

Q.14 Waves produced in explosion are
A. Longitudinal
B. Transverse
C. Shock waves
D. All of them

Q.15 Water waves are
A. Longitudinal
B. Transverse
C. Both
D. Matter waves

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Q.16 In interference phenomenon energy is
A. lost B. gained
C. conserved and redistributed D. none

Q.17 Doppler effect is
A. change in frequency b/w source and observer
B. change in sound b/w source and observer
C. change in wavelength b/w source and observer
D. None

Q.18 Unit of Time period is
A. 1 B. Hz
C. sec D. cycle per sec

Q.19 Ripple tank is used to study features of
A. Particle B. Wave
C. Light D. Solid

Q.20 Waves which deal with fast moving elementary practical
A. Transverse Waves B. Longitudinal waves
C. Matter waves D. Periodic waves

Q.21 Which one of the following properties of light does not change with nature of medium
A. frequency of light B. wavelength
C. speed D. All of these

Q.22 In which wave the motion of particles is perpendicular to the direction of wave
A. longitude B. transverse
C. matter D. None

Q.23 X-ray are type of wave
A. Electromagnetic B. longitudinal
C. transverse D. both a and c

Q.24 Infrasonic wave has frequency
A. less than 20Hz B. Greater than 20Hz
C. 20Hz D. greater than 20khs

Q.25 The distance between two consecutive crests of a travelling wave is 10 cm. If the speed of the wave 50 cm/s, then its frequency would be:_____
A. 40 Hz B. 1/5 Hz
C. 5 Hz D. 500 Hz

Q.26 What is the unit of frequency?
A. 1/Hertz B. 1/ second^2
C. Second D. Hertz

Q.27 In a standing wave, the distance between a node and consecutive anti-node is:
A. Equal to one wavelength B. Equal to two wavelengths
C. Equal to half of wavelength D. Equal to quarter of wavelength

Q.28 The speed of sound, v, is not affected by a variation in the pressure of the gas, because:
A. Speed, v, does not depend on pressure B. Speed, v, does not depend on density
C. Density is proportional to pressure D. None of the above

Q.29 Wavelength of a sound wave in air is 10 cm, what is the frequency of the sound wave?
A. 33 Hz B. 330 Hz
C. 3300 Hz D. 33000 Hz

Q.30 If the wavelength of a wave is 20 cm and its time period is T. What is the distance travelled by a crest on the wave in 1.25T?
A. 30 cm B. 25 cm
C. 15 cm D. 40 cm

Q.31 Which of the following frequency of sound wave is audible?
A. 5 Hz
B. 5000 Hz
C. 2500 kHz
D. 50 kHz

Q.32 Which group consists of only electromagnetic waves:
A. microwaves, radio waves, infra-red
B. microwaves, radio waves, sound
C. microwaves, water waves, infra-red
D. n/a

Q.33 A stationary wave is formed in a pipe which is open at one end. If length of pipe is L, then what is the maximum possible wavelength of the wave?
A. L
B. 2 L
C. 3 L
D. 4 L

Q.34 The shortest distance between two points on a travelling wave that have a phase difference of (pi/3) is 5 cm. If the wave has frequency 500 Hz, what is the speed of the wave?
A. 300 m/s
B. 150 m/s
C. 300 cm/s
D. 150 cm/s

Q.35 One vibration can be defined as:
A. motion of the body from one extreme position to the other extreme position
B. motion of the body from one extreme position to the same extreme position
C. motion of the body from one extreme position to the mean position
D. motion of the body from mean position and back to the mean position

Q.36 A wave is produced by
A. Disturbance
B. Heating
C. Freezing
D. Clapping

Q.37 Time period of the wave is 1/4 sec. How long does it take to pass 20 complete waves from a point?
A. 5 sec
B. 80 sec
C. 1/80 sec
D. 1/5 sec

Q.38 A stationary wave is set up in a pipe of length L, which is open from both ends. There are three nodes. How many antinodes are there in the stationary wave?
A. 2
B. 3
C. 4
D. 6

Q.39 A stationary wave is formed in a pipe which is open at one end. If two complete loops are formed and the wavelength of the wave is 10 cm, what is the length of the pipe?
A. 10 cm
B. 15 cm
C. 12.5 cm
D. 7.5 cm

Q.40 As the wavelength of light used increases. the distance between bright fringes in the interference pattern:
A. increases
B. decreases
C. remains same
D. none of these

Q.41 In a travelling wave, five complete waves pass through a point in 10 seconds. Frequency of the wave is:
A. 0.5 Hz
B. 5 Hz
C. 50 Hz
D. 15 Hz

Q.42 A stationary wave setup in a pipe closed at one end, only odd harmonics are generated, which are given by the equation
A. $f_n = (nv) / (4l)$ where n = 1,3,5,...
B. $f_n = (n+v) / (4+l)$ where n = 1,3,5,...
C. $f_n = (nv) / (4+l)$ where n = 1,2,3,4,5,...
D. $f_n = (nv) / (4l)$ where n = 1,2,3,4,5,...

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Q.43 **A stationary wave is setup on a string which is fixed at both ends. The frequency of the wave is 400 Hz. If the speed of wave is 480 m/s, then what is the length of the string?**

A. 1.2 m
B. 0.84 m
C. 0.60 m
D. 0.42 m

Q.44 **If a pipe is closed at one end and open at the other, the closed end is a:**

A. antinode
B. node
C. rarefaction
D. crest

Q.45 **Frequency of a travelling wave is 2000 Hz. Its speed is 300m/s. What is its wavelength?**

A. 20/3 m
B. 20x3 m
C. 3/20 m
D. 2/3 m

Q.46 **The distance between two consecutive nodes in a stationary wave is equal to:**

A. one wavelength
B. 2.5 wavelength
C. 3 wavelength
D. half wavelength

Q.47 **A stationary wave is formed in a pipe which is open at both ends. If two complete loops are formed and the wavelength of the wave is 10 cm, what is the length of the pipe?**

A. 15 cm
B. 10 cm
C. 5 cm
D. 20 cm

Q.48 **A pipe is filled with a gas and open at one end. If the length of the pipe is 0.6 m and the speed of sound in the gas in 300 m/s. Then frequencies of the first two harmonics are:**

A. 125 Hz and 250 HzB
B. 250 Hz and 750 Hz
C. 250 Hz and 500 Hz
D. 125 Hz and 375 Hz

Q.49 **The frequency of a string on a musical instrument can be changed either by:**

A. varying the diameter or by changing the length
B. varying the tension or by changing the thickness
C. varying the tension or by changing the length
D. varying the thickness or by changing the length

Q.50 **A standing-wave pattern is formed when the length of the string is:**

A. an odd multiple of quarter wavelength
B. an integral multiple of quarter wavelength
C. an integral multiple of wavelength
D. an integral multiple of half wavelength

Q.51 **Wave speed per frequency is equivalent to:**

A. beats
B. Time period
C. wavelength
D. None of them

Q.52 **The maximum value of displacement from the mean position is led:**

A. height
B. amplitude
C. frequency
D. distance

Q.53 **The object oscillates due to:**

A. a restoring force
B. its weight
C. centripetal force
D. force of friction

Q.54 **A wave has the speed 0.50 m/s. If its wavelength is 1.5 m. What is the period of the wave?**

A. 0.33 s
B. 3 s
C. 1.5s
D. 6 s

Q.55 **An object is undergoing simple harmonic motion. It's time period is T and total energy is E. The amplitude of vibration is reduced to half. What is the new time period and total energy of the system?**

A. time period = T/2 total energy = E/4
B. time period = T total energy = E/4
C. time period = T/2 total energy = E/2
D. time period = T total energy = E/2

Q.56 Whenever a transverse wave travelling in a denser medium, is reflected from the boundary of the rarer medium...

A. An incident crest on reflection disappears
B. An incident trough on reflection becomes double
C. An incident crest on reflection becomes a trough
D. An incident crest on reflection remains crest

Q.57 The phase angle between two points is 3π. The distance between these points is 15 cm. What is the wavelength of the wave?

A. 30 cm B. 45 cm
C. 5 cm D. 10 cm

Q.58 In a stationary wave, the distance between a node and an adjacent antinode is equal to:

A. λ B. 2λ
C. λ/2 D. λ/4

Q.59 A stationary wave is formed in a pipe which is open at one end. If length of pipe is 5 cm, then what is the maximum possible wavelength of the wave.?

A. 5 cm B. 10 cm
C. 15 cm D. 20 cm

Q.60 Under the action of the restoring force:

A. the speed of the body always increases B. the body moves at constant speed
C. the body always slows down D. the body accelerates

Q.61 An oscillation is called simple harmonic motion when:

A. acceleration is directly proportional to –x B. acceleration is directly proportional to x
C. acceleration is directly proportional to v D. acceleration is inversely proportional to –x

Q.62 In SONAR we use:_____

A. water waves B. sound waves
C. microwaves D. ultraviolet rays

Q.63 An air pipe opens at both ends. A stationary wave is produced in second harmonic mode. What is the phase difference between the motion of the particles at the end of the pipe and at the Centre of the pipe?

A. 0 deg B. 90 deg
C. 180 deg D. 270 deg

Q.64 When a monochromatic light travels from glass into air, then...

A. its frequency and wavelength both stays same
B. its frequency stays same but wavelength increases
C. its frequency increases but wavelength stays same
D. its frequency decreases and wavelength increase

Q.65 What is the wavelength of the wave if the phase angle between two points of the medium is 3π/4 and they are separated through a distance of 3 cm?

A. 8 cm B. 9 cm
C. 1 cm D. 12 cm

Q.66 The direction of the restoring force is always towards:

A. right hand B. up ward
C. rest or mean position D. extreme position

Q.67 In a stationary wave, the distance between adjacent antinodes is equal to:

A. λ B. 2λ
C. λ/2 D. λ/4

Q.68 **A transverse wave on a string has an amplitude A. A tiny spot on the string is colored red. As one cycle of the wave passes by, what is the total distance traveled by the red spot?**

A. A
B. 2A
C. A/2
D. 4A

Q.69 **Whenever a transverse wave, travelling in a rarer medium, encounters a denser medium.**

A. An incident crest on reflection disappears
B. An incident trough on reflection remains trough
C. An incident crest on reflection becomes a trough
D. An incident crest on reflection remains crest

Q.70 **A sound wave has a wavelength λ. What is the minimum possible distance between two points with phase difference 90 deg?**

A. λ/2
B. 3λ/2
C. 5λ/2
D. λ/4

Q.71 **The negative sign in F = -kx, indicates that:**

A. F is directed opposite to x
B. F is directed along x
C. F is always equal to x
D. none of these

Q.72 **What is the echo of sound?**

A. When sound reflects back
B. When sound gets absorbed
C. When sound penetrates into objects
D. All of them

Q.73 **When a wave comes across the boundary of two media, a part of it is reflected back. Which statement is true about reflected wave:**

A. its wavelength changes depending on the nature of the boundary
B. its frequency changes depending on the nature of the boundary
C. its amplitude increases depending on the nature of the boundar
D. its phase may changes depending on the nature of the boundary

Q.74 **A first harmonic stationary sound wave is produced in the air of the cylinder, which is half filled with water. More water is added to the cylinder, now first harmonic stationary wave is produced with a different frequency. What is the change in frequency and the nature of displacement in air at the water surface?**

A. nature of displacement = antinode change in frequency = decrease
B. nature of displacement = antinode change in frequency = increase
C. nature of displacement = node change in frequency = increase
D. nature of displacement = node change in frequency = decrease

Q.75 **The density of oxygen is 16 times the density of hydrogen. If the speed of sound in oxygen is v, then what is the speed of sound in hydrogen?**

A. v/4
B. 4v
C. v/2
D. none of these

Q.76 **Wave speed per frequency is equivalent to:**

A. beats
B. Time period
C. wavelength
D. None of them

Q.77 **The maximum value of displacement from the mean position is called:**

A. height
B. amplitude
C. frequency
D. distance

Q.78 **A wave have the speed 0.50 m/s. If its wavelength is 1.5 m. What is the period of the wave?**

A. 0.33 m
B. 3 m
C. 1.5 m
D. 6 m

Q.79 What is the phase difference between the center of compression and the center of rarefaction in longitudinal wave?
A. 0 deg
B. 45 deg
C. 90 deg
D. 180 deg

Q.80 In a stationary wave, the distance between adjacent nodes is equal to:
A. λ
B. 2λ
C. $\lambda/2$
D. $\lambda/4$

Q.81 Radar system is an application of:
A. Doppler's effect
B. mechanical effect
C. electric effect
D. magnetic effect

Q.82 Superposition of two waves having same frequency, same amplitude and travelling in the opposite direction, is called:
A. interference
B. diffraction
C. beats
D. stationary waves

Q.83 A sound wave travels from a region of hot air into a region of cold air. How does frequency and wavelength of sound change?
A. frequency decreases wavelength decreases
B. frequency increases wavelength decreases
C. frequency does not change wavelength decreases
D. frequency does not change wavelength does not change

Q.84 An object undergoes simple harmonic motion. Its amplitude is xo. The speed of the object is v when its displacement is xo/3. What is the speed when its displacement is xo?
A. v/3
B. 2 v
C. 3/2 v
D. 0

Q.85 Whenever a transverse wave travelling in a denser medium, is reflected from the boundary of the rarer medium.
A. the direction of its displacement remains same
B. the direction of its displacement is reversed
C. the displacement disappears
D. the displacement becomes double

Q.86 A stationary wave is formed in a pipe which is open at both ends. If length of pipe is 10 cm, then what is the maximum possible wavelength of the wave.
A. 20 cm
B. 5 cm
C. 10 cm
D. 30 cm

Q.87 In simple harmonic motion, which two quantities are always in opposite direction?
A. kinetic energy and potential energy
B. kinetic energy and velocity
C. velocity and acceleration
D. acceleration and displacement

Q.88 A park has an outdoor organ. When the air temperature increases, the fundamental frequency of one of the organ pipes:
A. is impossible to determine
B. stays the same
C. decreases
D. increases

Q.89 In a periodic wave, the distance between two consecutive crests is known as:
A. wave length
B. amplitude
C. displacement
D. none of these

Q.90 The relation between speed frequency and wavelength of a wave is:
A. speed = frequency * wavelength
B. speed * frequency = wavelength
C. speed = frequency / wavelength
D. speed = frequency + wavelength

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Q.91 If a transverse wave travelling in a denser medium is incident on a rarer medium, it is:
A. reflected without any change in phase
B. reflected with phase change of 90 deg
C. reflected with phase change of 180 deg
D. reflected with phase change of 270 deg

Q.92 Which of the following statements about wave motion is true:
A. waves transport energy and matter
B. waves transport energy without transporting matter
C. waves transport matter but not energy
D. waves on a rope, radio waves, infra red

Q.93 When a wave comes across the boundary of two media, a part of it is reflected back. Which statement is true about reflected wave:
A. the reflected wave has larger wavelength and larger frequency.
B. the reflected wave has same wavelength and larger frequency.
C. the reflected wave has larger wavelength and same frequency.
D. the reflected wave has same wavelength and same frequency.

Q.94 A simple pendulum has mass M, length L and time period T. What is the period of oscillation of the pendulum with mass 4M and length 0.49L?
A. 0.7T
B. T
C. 2T
D. 3T

Q.95 A pipe is open at both ends. A stationary wave is formed in the air of the pipe. Which statement is true?
A. there is always a central antinode
B. there is always a central node
C. the sum of number of nodes and the number of antinodes is always an even number
D. the sum of number of nodes and the number of antinodes is always an odd number

Q.96 The oscillating object overshoots the rest position due to:
A. restoring force
B. inertia
C. gravitational potential energy
D. elastic potential energy

Q.97 A wave passes through a medium, each particle of the medium performs 100 complete vibrations in 5 seconds. What is the frequency of the wave:
A. 2 Hz
B. 20 Hz
C. 4 Hz
D. 40 Hz

Q.98 If displacements due to two individual waves are y1 and y2. Then the resultant displacement, y, of the particle of the medium is:
A. $y = y_1 \times y_2$
B. $y = y_1 / y_2$
C. $y = y_1 - y_2$
D. $y = y_1 + y_2$

Q.99 The waves which propagate by the oscillation of material particles are called:
A. matter waves
B. mechanical waves
C. electromagnetic waves
D. microwaves

Q.100 When path difference between two waves are integral multiple of wavelength, the resultant effect is called:
A. destructive interference
B. constructive interference
C. beats
D. diffraction

Q.101 The successive distance between two crests is called?
A. time period
B. wavelength
C. Wave speed
D. Frequency

Q.102 A stationary wave is setup on a string of length 10 cm. Four loops are formed. What is the distance between two consecutive crests?
A. 4.5 cm
B. 5 cm
C. 2.5 cm
D. 1.25 cm

Q.103 What is true about acceleration of an object undergoing simple harmonic motion?
A. acceleration is minimum when velocity is maximum
B. acceleration is proportional to the frequency of oscillation
C. acceleration is in opposite direction to its velocity
D. acceleration is minimum when potential energy is maximum

Q.104 When path difference between two waves are odd integral multiple of half the wavelength, the resultant effect is called
A. destructive interference
B. constructive interference
C. beats
D. diffraction

Q.105 The stationary waves can be set up on the string only with the frequencies of harmonic series determined by:
A. The tension, length and mass per unit length of the string
B. The tension and mass per unit length of the string only
C. The length and mass per unit length of the string only
D. The tension and length of the string only

Q.106 In a periodic wave, the distance between second and fifth crests is 15 cm, what is the wavelength of the wave?
A. 45 cm
B. 5 cm
C. 1/5 cm
D. 1/3 cm

Q.107 In a stationary waves, if the string is made to vibrate in n loops, the frequency of stationary waves set up on the string will be:
A. $f_n = n \times f_1$
B. $f_n = n + f_1$
C. $f_n = f_1 / n$
D. $n \times f_n = f_1$

Q.108 The speed of waves depends upon the:
A. tension of the string
B. tension and mass per unit length of the string
C. diameter of the string
D. mass per unit length of the string

Q.109 Laplace expression for the speed of the sound in a gas is:
A. $v = P/\rho$
B. $v = P x \rho$
C. $v^2 = P x \rho$
D. $v = \sqrt{\gamma P / \rho}$

Q.110 SI Unit of wavelength?
A. m
B. m^3
C. m/s
D. m/s^2

Q.111 The distance between two consecutive crests of a travelling wave is 10 cm. If the speed of the wave 50 m/s, then its frequency would be:
A. 40 Hz
B. 1/5 Hz
C. 5 Hz
D. 500 Hz

Q.112 The frequency of a wave is 60 Hz. How long does it take to pass 20 complete waves from a point?
A. 1200 sec
B. 12 sec
C. 3 sec
D. 1/3 sec

Q.113 The number of vibrations executed in one second is called:
A. Period
B. Frequency
C. amplitude
D. wavelength

Q.114 A stationary wave is set up in a pipe of length L, which is open from one end. There are three nodes. How many antinodes are there in the stationary wave?
A. 2
B. 3
C. 4
D. 6

Q.115 The phase angle between two points in a medium is 4pi/5. What is the separation between these two points if the wavelength of the wave is 5m.

A. 5/4 m
B. 4π m
C. 2 m
D. 10 m

Q.116 A longitudinal standing wave, in second harmonic mode, is established in a tube that is open at both ends. The length of the tube is 0.80 m. What is the wavelength of the waves that make up the standing wave?

A. 0.20 m
B. 0.40 m
C. 0.80 m
D. 1.60 m

Q.117 The phenomenon of polarization of light reveals that light waves are:....

A. transverse waves
B. longitudional waves
C. mechanical waves
D. none of these

Q.118 When the antinodes are all at their extreme displacements,

A. the energy stored is wholly kinetic
B. the energy stored is wholly potential
C. the energy stored is kinetic and potential
D. the energy stored is wholly chemical

Q.119 Whenever a transverse wave, travelling in a rarer medium, encounters a denser medium. It...

A. bounces back such that the direction of its displacement remains same
B. bounces back such that the direction of its displacement is reversed
C. Travels into second medium and the direction of its displacement is reversed
D. Travels into second medium and the direction of its displacement remains same

Q.120 A stationary source of sound produce wave of wavelength L and speed v. Now, the source moves away from the observer. What is the wavelength and speed of the sound as measured by the observer?

A. wavelength decreases speed does not change
B. wavelength increases speed does not change
C. wavelength increases speed increases
D. wavelength increases speed decreases

Q.121 When a standing wave is set up in a pipe which is open from one end, which of the following statements is true?

A. sum of the number of antinodes and the number of nodes is always even
B. wavelength = length string / number of nodes
C. The shape of the string at any instant shows a symmetry about the midpoint of the string
D. frequency = number of nodes * fundamental frequency

Q.122 In mass-spring system, which of the following does not depend on the initial displacement of the spring?

A. maximum kinetic energy of the mass
B. average speed of the mass
C. total energy of the mass
D. angular frequency of the oscillation

Q.123 A point source broadcasts sound into a uniform medium. If the distance from the source is tripled how does the intensity change?

A. It becomes one-ninth as large
B. It becomes one-third as large
C. It becomes three times larger
D. It becomes nine times larger

Q.124 The points which are in phase are separated from one another through a distance of:

A. 1 wavelength
B. 1.5 wavelength
C. 0.5 wavelength
D. 2.5 wavelength

Q.125 Which of the following statements about speed of sound v, and temperature is correct:

A. v is directly related to temperature
B. v is directly related to square root of temperature
C. v is directly related to absolute temperature
D. v is directly related to square root of absolute temperature

Q.126 An ambulance siren emits a sound of frequency 1800 Hz. The speed of sound in air is 330 m/s. The ambulance moves towards a stationary observer at a constant speed of 50 m/s. What is the frequency heard by the observer?

A. (1800 x 290)/ 330
B. (1800 x 330) / 370
C. (1800 x 330) / 280
D. (1800 x 330) / 380

Q.127 In a stationary wave, the distance between adjacent antinodes is equal to:

A. λ
B. 2λ
C. $\lambda/2$
D. $\lambda/4$

Q.128 Which of the following statement is correct about infrared radiation and X-rays?

A. Radio waves has frequency larger than X-rays but less than infrared waves
B. infrared radiation travels faster than X-rays in vacuum
C. infrared radiation has lower frequency than X-rays
D. infrared waves can not be diffracted like X-rays

Q.129 A stationary wave is formed in a pipe which is open at both ends. If length of pipe is L, then what is the maximum possible wavelength of the wave?

A. 2 L
B. 1/2 L
C. L
D. 3 L

Q.130 The speed of sound in air is approximately:

A. 1500 m/s
B. 5000 m/s
C. 330 m/s
D. 50 m/s

ANSWER KEY

1	A	16	C	31	B	46	D	61	A	76	C	91	A	106	B	121	A
2	A	17	A	32	A	47	A	62	B	77	B	92	B	107	A	122	D
3	A	18	C	33	D	48	D	63	C	78	B	93	D	108	B	123	A
4	B	19	B	34	B	49	C	64	B	79	B	94	A	109	D	124	A
5	A	20	C	35	B	50	D	65	A	80	C	95	B	110	C	125	B
6	D	21	A	36	A	51	C	66	C	81	A	96	B	111	D	126	C
7	C	22	B	37	A	52	B	67	C	82	D	97	B	112	D	127	C
8	A	23	A	38	C	53	A	68	D	83	C	98	D	113	B	128	C
9	B	24	A	39	C	54	B	69	C	84	D	99	B	114	B	129	A
10	D	25	C	40	A	55	B	70	D	85	A	100	B	115	C	130	C
11	A	26	D	41	A	56	D	71	A	86	A	101	B	116	C		
12	A	27	D	42	A	57	D	72	A	87	D	102	C	117	A		
13	D	28	A	43	C	58	D	73	D	88	D	103	A	118	B		
14	C	29	C	44	B	59	D	74	C	89	A	104	A	119	B		
15	C	30	B	45	C	60	D	75	B	90	A	105	A	120	B		

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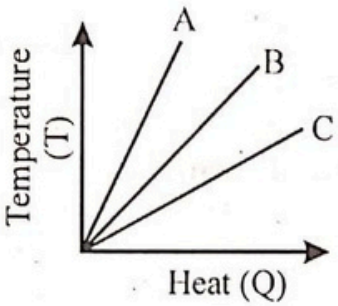
UNIT 5 PRACTICE EXERCISE

THERMODYNAMICS

1. **The specific heat of a gas in an isothermal process is:**
   A. infinity
   B. zero
   C. negative
   D. remain constant

2. **Which of the substances A, B or C has the highest specific heat? The temperature vs heat graph is:**



   A. A
   B. B
   C. C
   D. all have equal specific heats

3. **Consider the ratios of the heat capacities $\gamma = C_p/C_v$ for the three types of ideal gases: monatomic, diatomic, and polyatomic:**
   A. γ is the greatest for monatomic gases
   B. γ is the greatest for polyatomic gases
   C. γ is the same only for diatomic and polyatomic gases
   D. γ is the same only for monatomic and diatomic gases

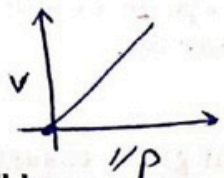
4. **Two gasses "A" and "B" having same number of molecules are at temperature 10^0C. A is heated at constant volume and "B" is heated at constant pressure and their temperature rises to 12°C.Increase in internal energy in:**
   A. A is greater
   B. B is greater
   C. both gasses are same
   D. A is slightly greater

5. **For an ideal gas force of attraction between molecules is:**
   A. very large
   B. infinite
   C. very small
   D. zero

6. **Which one is correct relation?**
   A. $C_P + C_V = \gamma$
   B. $\gamma = C_P/C_V$
   C. $C_P = 1 + R/C_v$
   D. $C_P = 1 - R/C_v$

7. **In free expansion of a gas, the internal energy of the system:**
   A. Increase
   B. Decreases
   C. is unchanged
   D. First increases then decreases

8. **At constant temperature, the graph between V and $\frac{1}{P}$ is:**



   A. Hyperbola
   B. Parabola
   C. Straight line
   D. Ellipse

9. **The K.E of the molecules of an ideal gas at absolute zero will be:**
   A. Infinite
   B. Zero
   C. Very high
   D. Below zero

10. **At constant temperature, if the volume of the given mass of gas is doubled, than the density of the gas becomes:**

A. Double
B. $\frac{1}{4}$ of the original value
C. $\frac{1}{2}$ of the original value
D. Remains constant

11. **At 30°C and atmospheric pressure, the volume of a given mass is 100 cm³. Pressure remaining same, the volume will be doubled if the temperature becomes:**

A. 15°C
B. 606°C
C. 60°C
D. 333°C

12. **In the equation PV = RT, 'V' stands for the volume of:**

A. One gram of gas
B. One liter of gas
C. Any amount of gas
D. One gram molecule of gas

13. **If a given mass of gas occupies a volume of 100 cm³at one atmospheric pressure and temperature of 100°C, what will be its volume at 4 atmospheric pressure, the temperature being the same?**

A. 25 cm³
B. 100 cm³
C. 104 cm³
D. 400 cm³

14. **When a car is drivers through some distance which of the following increases for the gas inside the tyres of car?**

A. K.E of the gas molecules
B. pressure of the gas
C. temperate of the gas
D. all of these

15. **The work done in an adiabatic change in a particular gas depends upon only:**

A. Change in volume
B. Change in temperature
C. Change in pressure
D. Change in specific heat

16. **The amount of heat required raising the temperature of 1 kg of a substance through 1 K is called:**

A. specific heat
B. calorie
C. heat capacity
D. Joule

17. **The ratio of the specific heat of an ideal gas at constant volume to its specific heat at constant pressure is:**

A. R
B. dependent on the temperature
C. dependent on the pressure
D. different for monatomic, diatomic, and polyatomic gases

18. **An ideal gas undergoes an isothermal process starting with a pressure of 2×10^5P a and a volume of 6 cm³. Which of the following might be the pressure and volume of the final state?**

A. 1×10^5 Pa and 10 cm³
B. 4×10^5 Pa and 4 cm³
C. 3×10^5 Pa and 6 cm³
D. 6×10^5 Pa and 2 cm³

19. **The ratio of the specific heat of a gas at constant volume to its specific heat at constant pressure is:**

A. 1
B. more than 1
C. less than 1
D. has units of pressure/volume

20. **A real gas is changed slowly from state 1 to state 2. During this process no work is done on or by the gas. This process must be:**

A. isothermal
B. iscoheric
C. adiabatic
D. isobaric

21. **Work done in expanding gas under adiabatic condition results in:**
A. Increase in temperature C. change in temperature
B. Decrease in temperature D. change in heat

22. **A given mass of gas is enclosed in a suitable container so that it may be maintained at constant volume. Under these conditions, there can be no change in what property of the gas?**
A. Pressure C. Density
B. Molecular kinetic energy D. Internal energy

23. **Heat energy added to a system under isothermal condition appears as:**
A. Work done by the system C. Increase in internal energy
B. Work done on the system D. Increase in temperature

24. **If 20 Jof work is done in compressing a gas adiabatically, thechange in internal energy is equal to:**
A. 20 J C. 10 J
B. –20 J D. 200 J

25. **A gas performs the most work when it expands:**
A. Isothermally C. Iso-barically
B. Adiabatically D. At non–uniform rate

26. **A system does 600 J of work and at the same time has its internal energy increased by 320 J, How much heat has been supplied?**
A. 280 J C. 600 J
B. 920 J D. 20 J

27. **The internal energy of an ideal gas depends on:**
A. the temperature only C. the pressure only
B. the volume only D. the temperature and pressure only

28. **The specific heat C_v at constant volume of am ono-atomic gas at low pressure is proportional to "T^n" where the exponent "n" is:**
A. −1 C. 0
B. 1 D. ½

29. **The SI unit of molar specific heat is:**
A. J mol K^{-1} C. J mol^{-1} K^{-1}
B. J mol^{-1} K D. J mol^{-1}

30. **In an adiabatic process the quantity which remains constant is:**
A. Internal energy C. temperature
B. volume D. Heat

31. **In an isothermal process, the internal energy of the system:**
A. Increases C. Remains constant
B. Decreases D. Becomes zero

32. **First law of thermodynamics when applied to an adiabatic process becomes:**
A. $W = \Delta U$ C. $Q = \Delta U$
B. $W = Q$ D. $W = -\Delta U$

33. **In which processes the pressure of the system remains constant:**
A. Isochoric process C. Adiabatic process
B. Isobaric process D. Isothermal process

34. **Given that $P = 10^4$ N m^{-2} , area of the piston is equal to 0.1 m^2 and distance moved by the piston is equal to 10^{-1} cm, then work done by the gas is:**
A. 1 J C. 104 J
B. 105 J D. 10 J

35. **Suppose volume of a gas in cylinder is 3 cm³. If the piston is kept fixed and gas is heated from 5°C to 12°C, then the work done is:**
A. 2.3 J
B. 21 J
C. 0 J
D. 2 J

36. **KMT is likely to break at:**
A. High pressure, low temperature
B. Low pressure, high temperature
C. High pressure, high temperature
D. Low pressure, low temperature

37. **A gas expands in three different ways isothermally, adiabatically and then isobarically. Work done is maximum in:**
A. Isothermal process
B. Adiabatic process
C. Isobaric process
D. Isochoric process

38. **If $C_v = \frac{5}{2}R$ then C_P in:**
A. $\frac{2}{5}R$
B. $\frac{7}{2}R$
C. $\frac{2}{7}R$
D. $\frac{5}{2}R$

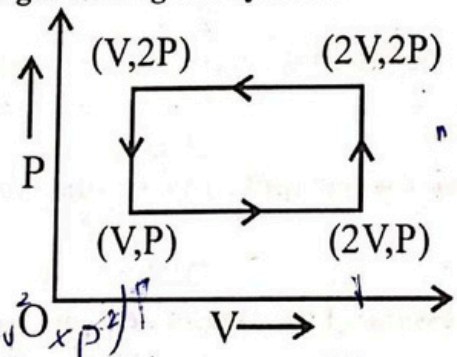
39. **Which one of the following is a correct relation?**
A. $C_p = C_v$
B. $C_v > C_p$
C. $C_v < C_p$
D. $C_v \geq C_P$

40. **Which of the following properties of molecules of gas is same for all gases at particular temperature?**
A. Momentum
B. Velocity
C. Mass
D. Kinetic energy

41. **Which one is not adiabatic process:**
A. Escape of air from burst tyre
B. Cloud formation
C. Slow expansion
D. Rapid expansion

42. **An ideal gas has molar specific heat "C_p" at constant pressure. When the temperature of "n" moles is increased by "ΔT" the increase in the internal energy is:**
A. $nC_p\,\Delta T$
B. $n(C_p - R)\,\Delta T$
C. $n(C_p + R)\,\Delta T$
D. $n(2C_p + R)\,\Delta T$

43. **The work done on ideal gas during the cycle is:**



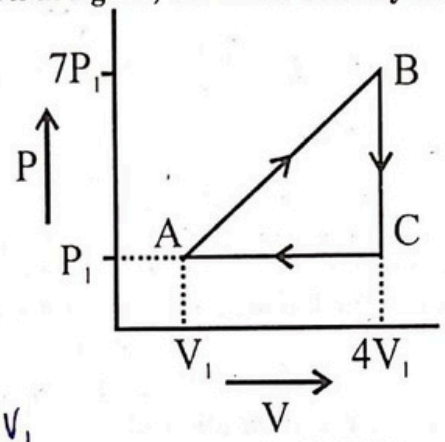
A. 1PV
B. 2PV
C. $\frac{PV}{2}$
D. 0

44. **If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cyclic process, then**
A. W = 0
B. E = 0
C. Q = W = 0
D. Q = 0

45. **An ideal gas is heated from 20°C to 40°C under constant pressure the change in internal energy is:**
A. Zero under constant pressure
B. Proportional to change in volume
C. Double the original value
D. Proportional to change in temperature

46. **Area under a P-V diagram represents:**
A. Work done
B. Heat supplied to system
C. A thermodynamic process
D. The state of a thermodynamic system

47. **In a cyclic process shown in figure, the work done by the gas in one cycle is:**

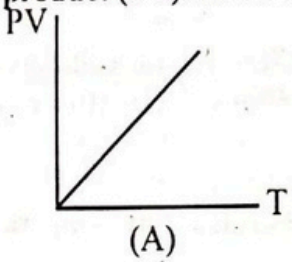


A. 28 P_1V_1
B. 18 P_1V_1
C. 14 P_1V_1
D. 9 P_1V_1

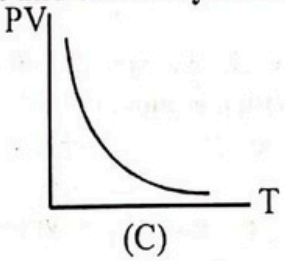
48. **For a gas obeying Boyle's law, if the pressure is doubled, the volume becomes:**
A. Double
B. Four time
C. One half
D. One fourth

49. **When a hot milk is shaken in a thermo flask whose lid is closed. The temperature of the milk will:**
A. Increase
B. Decrease
C. Is not affected
D. Cannot be predicted

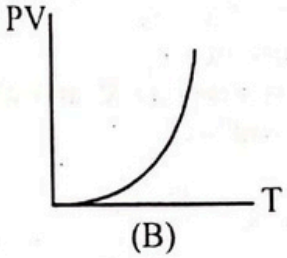
50. **Which one of the following graphs best illustrates the relationship between the product (PV) for an ideal gas and thermodynamics temperature:**



(A)



(C)



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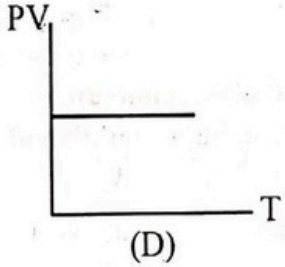


(D)

51. **One mole of a gas at STP in suddenly expanded to three times its initial volume. If $C_v = 2R$ the ratio of the initial and final pressure will be:**
A. 5 C. 3
B. 4 D. 2

52. **Which of the following remains constant in isochoric process:**
A. Pressure C. Volume
B. Temperature D. Entropy

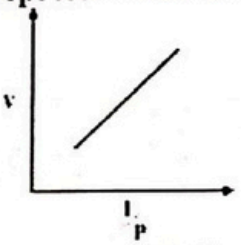
53. **The equation $W = P(V_2 - V_1)$ represents the work done by a gas in:**
A. A free expansion C. An adiabatic expansion
B. An isothermal expansion D. An expansion at constant pressure

54. **When piston is suddenly pushed in ward then:**
A. $Q = W$ C. $\Delta U = -W$
B. $-\Delta U = W$ D. $Q = \Delta U$

55. **The energy absorbed as heat by an ideal gas for an isothermal process equals:**
A. the work done by the gas
B. the work done on the gas
C. the change in the internal energy of the gas
D. the negative of the change in internal energy of the gas

56. **The pressure of an ideal gas is doubled during a process in which the energy given up as heat by the gas equals the work done on the gas. As a result, the volume is:**
A. doubled C. halved
B. unchanged D. need more information to answer

57. **The graph shown below is the representation of:**



A. Charles's law C. General gas law
B. Boyles law D. Stokes law

58. **When 20J of work was done on a gas, 40J heat energy was released. If the initial internal energy of the gas was 70J. What is the final energy?**
A. 50J C. 90J
B. 60J D. 110J

59. **A gas molecule "x" moving with the speed 100 m/s suffers elastic collision with a molecule "y" of the same gas which is moving with speed 150m/s. Then after collision:**
A. speed of both molecules will be 125 m/s C. speed of y only will be 125 m/s
B. speed of x will be 125 m/s D. speed of x will be 150 m/s

60. **What will be the density of the gas if its volume is doubled but temperature is constant?**
A. equal to original density C. quarter of original density
B. half of original density D. double of original density

61. **When a given quantity of an ideal monoatomic gas is at pressure P and absolute temperature T, then the adiabatic bulk modulus of the gas will be:**
A. P C. T
B. $\frac{5}{3}P$ D. $\frac{5T}{2}$

62. **If the pressure of a given gas is held constant its density is inversely proportional to its absolute temperature. We can refer it as another statement of:**
A. Boyle's law
B. Ideal gas law
C. Charles law
D. Avagadro's law

63. **Gas molecules of different masses in the same container have the same average transnational kinetic energy, which is directly proportional to:**
A. Volume
B. Absolute temperature
C. Pressure
D. Time

64. **Given: sample of 1 ml hydrogen and 1 ml of oxygen, both at S.T.P. which sample has higher number of molecules?**
A. Oxygen
B. Hydrogen
C. It depends upon their internal energies
D. Both will have the same number of molecules

65. **The work done in an adiabatic change in a particular gas depends upon only:**
A. Change in volume
B. Change in temperature
C. Change in pressure
D. Change in specific heat

66. **The ideal gas equation in terms of Boltzmann constant can be written as:**
A. $PV = N_A kT$
B. $\frac{PkT}{V} = N$
C. $T = \frac{nk}{PV}$
D. $\frac{P}{kT} = \frac{N}{V}$

67. **Two identical rooms in a housemare connected by an open door way. The temperatures in the two rooms are maintained at different values. Which room contains more air?**
A. the room with higher temperature
B. the room with higher pressure
C. the room with lower temperature
D. neither because both have the same pressure

68. **Work done in expanding gas under adiabatic condition results in:**
A. Increase in temperature
B. Decrease in temperature
C. change in temperature
D. Volume remains constant

69. **Heat energy added to a system under isothermal condition appears as:**
A. Work done by the system
B. Work done on the system
C. Increase in internal energy
D. Increase in temperature

70. **A water fall is 168 m high. Assuming that half the kinetic energy of the falling water gets converted into heat, the rise in the temperature of water is approximately:**
A. 0.1 °C
B. 0.2 °C
C. 0.3 °C
D. 0.4 °C

71. **If the volume of a gas is held constant and we increase its temperature then:**
A. its pressure is constant
B. its pressure falls
C. its pressure rises
D. any of above

72. **A 100 cm³ gas tank is filled with a certain amount of an ideal gas at 400K. If the gas is heated to 500K, the new volume of the gas will be:**
A. 100 cm³
B. 125 cm³
C. 150 cm³
D. 250 cm³

73. **Air enters a hot-air furnace at 7° C and leaves at 77° C. If the pressure does not change each entering cubic meter of air expands to:**
A. $0.80m^3$ C. $1.25m^3$
B. $1.9m^3$ D. $7.0m^3$

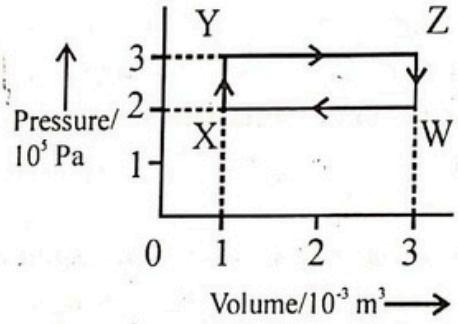
74. **If the pressure is doubled and kelvin temperature is halved, the volume of the gas will:**
A. become half C. become double
B. become quarter D. remain unchanged

75. **Heat Q is supplied to one mole of a gas which does an amount of work W. The rise in temperature of the gas is:**
A. Q/Cv C. (Q–W)/Cp
B. (Q–W)/Cv D. (Q–W)Cv

76. **In an adiabatic process:**
A. the energy absorbed as heat equals the work done by the system on its environment
B. the energy absorbed as heat equals the work done by the environment on the system
C. the absorbed as heat equals the change in internal energy
D. the work done by the environment on the system equals the change in internal energy

77. **The internal energy of a gas at 35°C is 100J. If the gas expands adiabatically and does an external work of 20J, its internal energy will be:**
A. 100 J C. 120 J
B. 80 J D. 115 J

78. **A gas undergoes the cycle of pressure and volume changes. W → X → Y → Z shown in the diagram:**



What is the net work done by the gas?
A. –600 J C. 200 J
B. 0 J D. –200 J

79. **A system undergoes an adiabatic process in which its internal energy increases by 20 J. Which of the following statements is true?**
A. 20 J of work was done on the system C. 20 J of work was done by the system
B. the system lost 20 J of energy as heat D. the system received 20 J of energy as heat

80. **Two different samples have the same mass and temperature. Equal quantities of energy are absorbed as heat by each. Their final temperatures may be different because the samples have different:**
A. heat capacities C. volumes
B. thermal conductivities D. coefficients of expansion

81. **The first law of thermodynamics may be expressed as shown.**
$\Delta U = Q + W$
Where ΔU is the change in internal energy, Q is the heating of the system, W is the work done on the system. A fixed mass of ideal gas at high pressure is contained in a balloon. The balloon suddenly bursts, causing the gas to expand and cool. In this situation, which row describes the values of ΔU, Q and W?

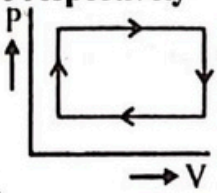
	ΔU	Q	W
A.	Negative	Negative	Positive
B.	Negative	Zero	Positive
C.	Positive	Zero	Negative
D.	Positive	negative	Positive

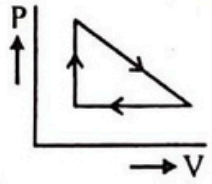
82. **Starting with same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1, if process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic. Then**
A. $W_1 > W_2 > W_3$
B. $W_2 > W_3 > W_1$
C. $W_2 > W_1 > W_3$
D. $W_1 > W_3 > W_2$

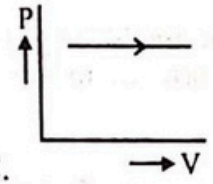
83. **A gas expands 0.25 m^3 at constant pressure 10^3 N/m^2. The work done is:**
A. 2.5 erg
B. 2500 J
C. 250 J
D. 2.5 J

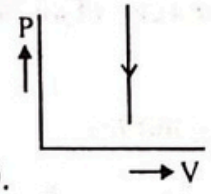
84. **Which of the following is not a thermodynamic function:**
A. Work
B. Internal Energy
C. Entropy
D. Temperature

85. **The indicator diagrams representing maximum and minimum amount of work done are respectively**

A. 

B. 

C. 

D. 

A. A and B
B. B and C
C. B and D
D. C and D

86. **An ideal gas undergoes an expansion in volume from 1.3×10^{-4} m^3 to 3.6×10^{-4} m^3 at a constant pressure of 1.3×10^5P a. During this expansion, 24 J of heat is supplied to the gas. What is the overall change in the internal energy of the gas?**
A. Decrease of 54 J
B. Decrease of 6 J
C. Increase of 6 J
D. Increase of 54 J

87. **A monochromatic gas is suddenly compressed to 1/8th of the initial volume adiabatically. The ratio of the final pressure to initial pressure is** $\left(\frac{C_p}{C_v} = \frac{5}{3}\right)$
A. 32
B. 24/3
C. 40/3
D. 8

88. **A graph between T and V of a gas at constant pressure is:**
A. Hyperbola
B. Straight line
C. Parabola
D. Exponential curve

89. **Two points on a same body having the same temperature will have no heat transfer between them. This is the condition of:**
A. Dynamic equilibrium
B. Hydrostatic equilibrium
C. Thermal equilibrium
D. Unstable equilibrium

90. **We consider a thermodynamic system. If ΔU represents the increase in internal energy and W the work done by the system, which of the following statements is true?**
A. ΔU = –W in an adiabatic process
B. ΔU = –W in an isothermal process
C. ΔU = W in an isothermal process
D. ΔU = W in an adiabatic process

91. **According to the first law of thermodynamics, applied to a gas, the increase in the internal energy during any process:**
A. equals the heat input minus the work done on the gas
B. equals the heat input plus the work done on the gas
C. equals the work done on the gas minus the heat input
D. is independent of the heat input

92. **If C_v is the molar specific heat at constant volume and ΔT is the temperature then $C_v\Delta T$ gives:**
A. Area
B. Volume
C. Energy
D. Density

93. **When one mole of monoatomic gas is mixed with one mole of a diatomic gas, Then the equivalent value of γ for the mixture will be (vibration mode neglected)**
A. 1.33
B. 1.40
C. 1.50
D. 1.6

94. **The initial volume of an ideal gas is 10cm³ at a pressure of 20Pa. Its volume and pressure in the final state might be:**
A. 5 cm³, and 10 Pa
B. 2.5 cm³, and 10 Pa
C. 20 cm³, and 40 Pa
D. 40 cm³, and 5 Pa

95. **The total sum of all energies of all the molecules in a system is called:**
A. potential energy
B. internal energy
C. kinetic energy
D. elastic P.E

96. **PV^{γ} = constant holds good for:**
A. Isothermal process
B. Isobaric process
C. Isochoric process
D. Adiabatic process

97. **The process in which no heat enters or leaves the system is called:**
A. Isothermal process
B. Isobaric process
C. Isochoric process
D. Adiabatic process

98. **Which is called internal energy of an ideal gas:**
A. Translational K.E.
B. Rotational K.E.
C. Vibrational K.E.
D. P.E.

99. **A system does 600 J of work and at the same time has its internal energy increased by 320 J. How much heat has been supplied?**
A. 280 J
B. 600 J
C. 920 J
D. 200 J

100. **Expression for isothermal process is:**
A. Q = ΔU
B. ΔU = W
C. Q = W
D. ΔU = – W

ANSWER KEY

1	A	16	A	31	C	46	A	61	B	76	D	91	B
2	C	17	D	32	D	47	D	62	C	77	B	92	C
3	A	18	D	33	B	48	C	63	B	78	C	93	C
4	C	19	C	34	A	49	A	64	D	79	A	94	D
5	D	20	B	35	C	50	A	65	B	80	A	95	B
6	B	21	B	36	B	51	A	66	D	81	B	96	D
7	B	22	C	37	C	52	C	67	C	82	C	97	D
8	C	23	A	38	B	53	D	68	B	83	B	98	A
9	B	24	A	39	C	54	C	69	B	84	A	99	C
10	C	25	C	40	D	55	A	70	B	85	C	100	C
11	D	26	B	41	C	56	C	71	C	86	B		
12	D	27	A	42	B	57	B	72	B	87	A		
13	A	28	A	43	A	58	A	73	C	88	C		
14	D	29	C	44	C	59	D	74	B	89	C		
15	B	30	D	45	D	60	B	75	B	90	A		

$\Delta U = Q - W$

SOLUTIONS

1. $\Delta T = 0$

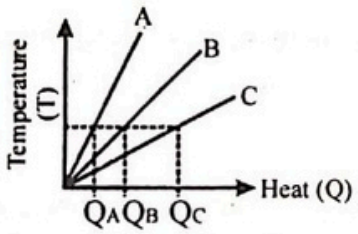
$$c = \frac{\Delta Q}{n\Delta T} = \frac{\Delta Q}{n(0)} = \infty$$

$Q = \Delta U + W$ ✓

$\Delta U = Q - W$

$\Delta U = Q + W$

2.



$Q = nC\Delta T \Rightarrow C \propto Q$

$Q_C > Q_B > Q_A$

3.

Values of constant	
Types of gas	**γ**
Mono-atomic	1.67
Diatomic	1.40
Polyatomic	1.29

4. As the temperature of system is defined as the average translational K.E. of its molecules, so for an ideal gas system the internal energy is directly proportional to its temperature. $Q \propto T$

5. The molecules of an ideal gas are mere mass points which exert no force on one another.

6. $\gamma = \frac{CP}{CV}$

7. As $\Delta U \propto \Delta T$

In free expansion the temperature of gas decreases, so its internal energy decreases.

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8. Adiabatic bulk modulus $= \gamma P = \frac{5}{3}P$

9. $K.E. = \frac{3}{2}kT = \frac{3}{2}k(0) = 0$

10. $\rho = \frac{m}{V} \Rightarrow \rho \propto \frac{1}{V}$

11. $T1 = 30^oC = 303\ K$

$$\frac{V2}{T2} = \frac{V1}{T1} \Rightarrow T2 = V2 \times \frac{T1}{V1}$$

$$= (200) \times \frac{303}{100} = 606\ K = 606 - 273 = 333^oC \qquad (V2 = 2V1 = 200\ cm3)$$

12. $PV = nRT$

n = number of mole

"V" is the volume of one mole or one gram molecule of gas.

13. $P_2V_2 = P_1V_1 \Rightarrow V_2 = \frac{P1V1}{P2} = \frac{(1)100}{4} = 25\ cm^3$

14. Friction between the tyre and the road heats up the gas in the tyre and its temperature increases. So, this increases the average K.E. of the gas molecules increases. $T \propto <K.E>$ & $P \propto <K.E>$

15. **Adiabatic Expansion:**

In adiabatic expansion of the system, the temperature decreases as the work is done in expanding the system at the cost of internal energy. $-\Delta U = +W$

Adiabatic Compression:

In adiabatic compression, the work has done on the system increases the temperature of the system.

$+\Delta U = -W$

$\Delta U \propto \Delta T$

16. The amount of heat required raising the temperature of 1 kg of a substance through 1 K is called specific heat.

17. $\gamma = \frac{CP}{CV} \Rightarrow \frac{1}{\gamma} = \frac{CV}{CP}$

Values of constant	
Types of gas	**γ**
Mono-atomic	1.67
Diatomic	1.40
Polyatomic	1.29

18. For isothermal process

PV = constant

P1V1 = P2V2

(2 × 105 Pa)(6 cm3) = (6 × 105 Pa)(2 cm3)

19. As we know that

$C_V < C_P$

$\frac{CV}{CP} < 1$

20. $W = P\Delta V$
In isochoric process (constant volume) $\Delta V = 0$
$W = P(0) = 0$

21. In adiabatic expansion
$+ W = - \Delta U$
+W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

22. As mass and volume of gas are constant. So, its density remains same.

23. By 1st law of thermodynamics
$Q = \Delta U + W = 0 + W = W$
This shows that the total energy supplied is used to do external work. To keep the temperature constant the compression and expansion must done very slowly.

24. In adiabatic compression, the work has done on the system increases the temperature of the system.
$- W = + \Delta U$
Work done on the gas = increase in its internal energy = + 20 J

25. $W_{isobaric} > W_{isothermal} > W_{adiabatic} >$ $W_{isocoheric}$

26. $Q = \Delta U + W$
$Q = 320 + 600 = 920$ J

27. For an ideal gas system the internal energy is directly proportional to its temperature.

28. It is the amount of heat required to raise the temperature of one mole of substance through 1 K at constant volume.
$$Q_v = C_v \Delta T \Rightarrow C_v = \frac{Q_v}{\Delta T} \Rightarrow C_v = Q_v \Delta T^{-1}$$

29. $$C = \frac{Q}{n\Delta T}$$
Its units are "J $mol^{-1}K^{-1}$".

30. Adiabatic is the process in which no heat enters or leaves the system. $Q = 0$

31. The temperature of system is defined as the average translational K.E. of its molecules, so for an ideal gas system the internal energy is directly proportional to its temperature.
$U \propto T$
As the temperature remains same in isothermal process. So, internal energy also remain same.

32. In adiabatic expansion
$+ W = - \Delta U$
+W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

33. The thermodynamic process in which pressure remains same is called isobaric process.

34. $W = P\Delta V = PA\Delta y = (10^4)(0.1)(10^{-3}) = 1$ J

35. $W = P\Delta V$
As the piston is fixed. So, $\Delta V = 0$ hence $W = 0$

36. Gases show ideal behaviour at high temperature and low pressure.

37. $W_{isobaric} > W_{isothermal} > W_{adiabatic} >$ $W_{isocoheri}$

38. For diatomic gases
$$C_V = \frac{5}{2}R \quad \text{and} \quad C_P = \frac{7}{2}R$$

39. As for every gas

$\gamma > 1 \Rightarrow \quad \frac{CP}{CV} > 1$

$C_P > C_V \quad \Rightarrow C_V < C_P$

40. $<K.E> = \frac{3}{2}kT$ ✓

T = constant

<K.E> = constant

41. All the sudden changes are adiabatic.

i. Rapid escape of air from a burst tire.

ii. The rapid expansion and compression of air when sound waves pass through it.

iii. Cloud formation in the atmosphere.

42. Using 1st law of thermodynamics

$Q_P = \Delta U + W$

$\Delta U = Q_P - W$

$\Delta U = C_P\Delta T - R\Delta T \quad (P\Delta V = R\Delta T)$

Internal energy for "n" moles = $n\Delta U$

$= n(C_P\Delta T - R\Delta T) = n(C_P - R)\Delta T$

43. Work done = Area of PV diagram (closed shape)

= (length)(width)

Work done = (P)(V) = PV

44. A process which brings the system back to its initial condition is called a cycle. In the reversible cycle all the changes are reversible. In cyclic the final and initial position of the system is same.

E = constant $\Rightarrow \Delta E = 0$

V = constant $\Rightarrow \Delta V = 0 \quad \Rightarrow W = 0$

By 1st law of thermodynamics

$Q = E + W = 0$

45. As

$U \propto T$

$\Delta U \propto \Delta T$

46. Work done = Area of PV diagram

47. Work done = Area of PV diagram (closed shape)

$= \text{Area of triangle} = \frac{1}{2}(3V_1)(6P_1) = 9P_1V_1$

48. $V \propto \frac{1}{P}$

49. When milk in the thermos flask is shaken rapidly, work is done in shaking it. This work is converted into K.E. of molecules of the milk.

As

$T \propto <K.E>$

So, temperature of the milk increases.

50. By ideal gas equation

$PV = nRT$

$PV \propto T \quad (n = \text{constant})$

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51. $P1V1\gamma = P2V2\gamma$

$$\frac{P1}{P2} = \left(\frac{V2}{V1}\right)\gamma$$

$$\frac{P1}{P2} = \left(\frac{(3V1)}{(V1)}\right)\gamma$$

$$\frac{P1}{P2} = 3\gamma$$

As

$CP - CV = R \Rightarrow CP - 2R = R \Rightarrow CP = 3R$

$$\gamma = \frac{CP}{CV} = \frac{3R}{2R} = 3/2$$

$$\frac{P1}{P2} = 33/2 \approx 5$$

52. The thermodynamic process in volume remains constant is called isochoric process.

53. The work done in thermodynamic process at constant pressure is

$W = P\Delta V = P\ (V_2 - V_1)$

54. In adiabatic compression

$-W = +\Delta U$

In adiabatic compression work done on the gas increases its internal energy and hence its temperature also increases.

55. By 1st law of thermodynamics

$Q = \Delta U + W = 0 + W = W$

This shows that the total energy supplied is used to do external work. To keep the temperature constant the compression and expansion must done very slowly.

56. In isothermal process

$Q = W$

As Boyle's law is applicable in isothermal process. So,

$$V \propto \frac{1}{P}$$

57. As Boyle's law is applicable in isothermal process. So,

$$P \propto \frac{1}{V}$$

$PV = \text{constant}$

58. $Q = \Delta U + W$

$Q = (Uf - Ui) + W$

$-40 = (Uf - 70) - 20$

$-40 = Uf - 90$

$Uf = -40 + 90 = 50J$

59. In elastic collision, the velocities of bodies having same masses are inter changed after collision. So, velocity of "x" = 150 m/s velocity of "y" = 100 m/s

60. $$\rho = \frac{m}{V} \Rightarrow \rho \propto \frac{1}{V}$$

61. $PV = nRT$

$PV = T$ (n, R are constant)

Option (C) gives the maximum product of PV this means it has maximum temperature.

62. $\rho = \frac{m}{V} \Rightarrow \rho \propto \frac{1}{V}$

$V \propto T$

$\rho \propto \frac{1}{T}$

63. The molecules of an ideal gas are mere mass points which exert no force on one another. So, the internal energy of an ideal gas system is generally the translational K.E. of the gas molecules.

64. At same condition (STP). If volume of two different gases is same, and then they have same number of molecules.

65. In adiabatic expansion

$+W = -\Delta U$

+W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

66. $PV = nRT$

$PV = \frac{N}{NA}RT \Rightarrow V = \frac{NRT}{NAP} = \frac{NkT}{P} \Rightarrow \frac{P}{kT} = \frac{N}{V}$

67. At same temperature, If volume of two different gases is same, then they have same number of molecules.

But in this case the temperatures of both rooms are maintained at different values, it means that both the rooms have different number of molecules of air. Which room contains more has less temperature and vice versa.

68. In adiabatic expansion

$+W = -\Delta U$

+W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

69. $Q = \Delta U + W$

At isothermal condition $\Delta U = 0$

70. $\frac{1}{2}mgh = mc\Delta T$

$OR \quad \Delta T = \frac{gh}{2c} = \frac{10\times168}{2\times4200} = 0.2°C$

71. At constant volume

$P \propto <K.E>$

And

$T \propto <K.E>$

72. At constant pressure

$V \propto T$

$\frac{V2}{V1} = \frac{T2}{T1} = \frac{500}{400}$

$V_2 = \frac{500}{400} \times V_1 = \frac{500}{400} \times (100) = 125\ cm^3$

73. At constant pressure

$V \propto T$

$\frac{V2}{V1} = \frac{T2}{T1} = \frac{350}{280}$

$V_2 = \frac{350}{280} \times V_1 = \frac{350}{280} \times (1) = 1.25\ m^3$

74. $PV = nRT$

$PV = T$ (n, R are constant)

$$\frac{P1V1}{T1} = \frac{P2V2}{T2} \Rightarrow V_2 = \frac{P1V1}{T1} \times \frac{T2}{P2} = \frac{P1V1}{T1} \times \frac{T1/2}{2P1} = \frac{V1}{4}$$

75. $Q = \Delta U + W$

$Q = C_V\Delta T + W$

$$\frac{Q-W}{CV} = \Delta T$$

76. In adiabatic compression work done on the gas increases its internal energy and hence its temperature also increases. $-W = +\Delta U$

77. $+W = -\Delta U$

+ W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

As 20 J of work is being done by using 20 J of internal energy. So, remaining internal energy will be 80 J.

78. Work done = Area of PV diagram (closed shape)

= Area of rectangle $= (2 \times 10^{-3})(1 \times 10^5) = 200$ J

79. $-W = +\Delta U$

In adiabatic compression work done on the gas increases its internal energy. So, 20 J of work was done by the system.

80. Two different samples have different heat capacities even their masses and temperatures are same

81. It is the process in which no heat enters or leaves the system. $Q = 0$

In Adiabatic expansion $+W = -\Delta U$

+W shows that work is done by the gas at the cost of its internal energy. Internal energy decreases and hence temperature also decreases.

82. $W_{isobaric} > W_{isothermal} > W_{adiabatic} > W_{isocoheric}$

$W_2 > W_1 > W_3$

83. $W = P\Delta V = (0.25)(10^3) = 250$ J

84. Work is the technique to transfer energy into the system. It is not a thermodynamics function.

85. Work done = Area of PV diagram

$W_D = 0$ ($\Delta V = 0$)

W_B = Maximum ($P\Delta V$ = max)

86. $W = P\Delta V = (1.3 \times 10^5)(2.3 \times 10^{-4}) \approx 30$ J

$Q = \Delta U + W$

$\Delta U = Q - W = 24 - 30 = -6$ J (Decrease)

87. $P_1V_1^{\gamma} = P_2V_2^{\gamma}$

$$\frac{P2}{P1} = \left(\frac{V1}{V2}\right)^{\gamma}$$

$$\frac{P2}{P1} = \left(\frac{V1}{V1/8}\right)^{\gamma}$$

$$\frac{P2}{P1} = 8^{\gamma} = 8^{5/3} = (2^3)^{5/3} = (2)^5 = 32 \quad (C_P/C_V = \gamma = 5/3)$$

88. $V \propto T$ straight line (P = constant)

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89. Two points on a same body having the same temperature will have no heat transfer between them. This is the condition of thermal equilibrium.

90. In adiabatic compression work done on the gas increases its internal energy and hence its temperature also increases.– $W = +\Delta U$

91. $Q = \Delta U + W$

$\Delta U = Q - W = Q + (-W)$ = heat input plus the work done on the gas

92. $C_V \Delta T = Q_V$ = Energy

93. **For monoatomic gases:**

$$C_v = \frac{3}{2}R, C_P = \frac{5}{2}R$$

For diatomic gases:

$$C_v = \frac{5}{2}R, C_P = \frac{7}{2}R$$

Then for the mixture of both gases

$$C_v = \frac{\frac{3}{2}RT + \frac{5}{2}RT}{2}$$

$$C_v = \frac{8}{4}RT$$

$$C_v = 2RT$$

$$C_P = \frac{\frac{5}{2}RT + \frac{7}{2}RT}{2}$$

$$C_P = \frac{12}{4}RT$$

$$C_P = 3RT$$

$$r = \frac{C_P}{C_V} = \frac{3RT}{2RT} = 1.5$$

94. $P_1V_1 = P_2V_2$

$(10 cm^3)(20\ Pa) = (5\ Pa)(40\ cm^3) = 200\ Pa\ cm^3$

95. The sum of all forms of molecular energies (K.E. and P.E.) of a substance is called internal energy.

96. For an adiabatic process

PV^γ = constant

97. Adiabatic process is the process in which no heat enters or leaves the system. $Q = 0$

98. The molecules of an ideal gas are mere mass points which exert no force on one another. So, the internal energy of an ideal gas system is generally the translational K.E. of the gas molecules.

99. $Q = \Delta U + W = 320 + 600 = 920\ J$

100. $Q = \Delta U + W$

In isothermal process $\Delta U = 0$

$Q = W$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **When two bodies are made at thermal contact having the same temperature then they are at:**
   A. Physical equilibrium
   B. Thermal equilibrium
   C. Mechanical equilibrium
   D. Chemical equilibrium

2. **Normal temperature of a human body is 98.6°F. What will be the temperature of the dead body in such atmosphere?**
   A. 84.6°F
   B. 98.6°F
   C. 92.5°F
   D. 185°F

3. **When the system is expanded by adding heat energy then the work done is:**
   A. positive and on the system
   B. negative and on the system
   C. positive and by the system
   D. negative and by the system

4. **Which substance possesses the largest internal energy at t°C?**
   A. Solid
   B. Liquid
   C. Gas
   D. All of these

5. **Internal energy of a substance is defined in terms of:**
   A. P and V
   B. P and T
   C. T and V
   D. P, V and T

6. **The ratio between work done and heat energy is equal to:**
   A. Adiabatic constant
   B. Joule's constant
   C. Specific heat constant
   D. Real gas constant

7. **A system which transfers neither mass not energy is called:**
   A. Open system
   B. Close system
   C. Isolated system
   D. Non-cyclic system

8. **First law of thermodynamics is based upon law of conservation of:**
   A. Mass
   B. Energy
   C. momentum
   D. charges

9. **A process in which all the heat energy is used for increasing internal energy of the system is known as:**
   A. Isobaric
   B. Isochoric
   C. Isothermal
   D. Adiabatic

10. **In which process the internal energy is used for doing work:**
    A. Isobaric
    B. Isochoric
    C. Isothermal
    D. Adiabatic

11. **Specific heat of a gas in an isothermal process is:**
    A. Zero
    B. remains constant
    C. Negative
    D. Infinite

12. **A process in which the system remains at thermal equilibrium is known as:**
    A. Isobaric
    B. Isochoric
    C. Isothermal
    D. Adiabatic

13. **The value of adiabatic constant for mono-atomic gas is:**
    A. 1.40
    B. 1.44
    C. 1.60
    D. 1.66

14. **The efficiency of a heat engine will be 100% when:**
    A. Engine takes huge amount of heat from source
    B. Engine exhaust a very small amount of heat from sink
    C. The temperature of cold reservoir is 0°C
    D. The temperature of cold reservoir is 0 K

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    C. The temperature of cold reservoir is 0°C
    D. The temperature of cold reservoir is 0 K

15. **Second law of thermodynamics provides the proper direction of:**
A. Temperature
B. Force
C. Pressure
D. Flow of heat

16. **A device which converts mechanical energy into heat energy is known as:**
A. Heat engine
B. Carnot Engine
C. Refrigerator
D. Turbine

17. **Entropy of a system in a reversible process:**
A. Decreases
B. Increases
C. Infinite
D. Zero

18. **Entropy remains constant in the process of:**
A. Isochoric
B. Isobaric
C. Isothermal
D. Adiabatic

ANSWER KEY

1	B	6	B	11	D	16	C
2	A	7	C	12	C	17	D
3	C	8	B	13	D	18	D
4	C	9	B	14	D		
5	D	10	D	15	D		

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KPK TEXT BOOK EXERCISE MCQs

1. **Assume we can change the equilibrium state of a system via two different process. Assume that the initial and the final state are the same. Which of the quantities ΔU, ΔQ, ΔW and ΔT must be the same for the two processes?**
   A. Only ΔQ and ΔW
   B. Only ΔU and ΔT
   C. Only ΔQ and ΔT
   D. Only ΔU and ΔW

2. **In any process the maximum amount of mechanical energy that can be converted to heat:**
   A. Depends upon the amount of friction
   B. Depends upon the intake and exhaust temperature
   C. Depends upon whether kinetic or potential energy is involved
   D. Is 100%

3. **In an isothermal change, internal energy:** ΔU=0
   A. Decreases
   B. Increases
   C. Becomes zero
   D. Remains constant

4. **A thermos bottle containing hot coffee is vigorously shaken. Consider coffee as the system, then its temperature:**
   A. Increases
   B. Decreases below then 0°C
   C. Remains same
   D. Decrease

5. **Maximum work can be obtained in the process called:**
   A. Cyclic
   B. Isothermal
   C. Adiabatic
   D. Isochoric

6. **A heat engine take in 800 J of heat at 1000 K and exhaust 600 J of heat at 400 K. what is the actual efficiency of this engine?**
   A. 25%
   B. 40%
   C. 50%
   D. 75%

7. **If the temperature of the heat source is increased, the efficiency of a Carnot's engine:**
   A. Increases
   B. Decreases
   C. Remains constant
   D. First increase and then constant

8. **Triple point of water is:**
   A. 273.16 °F
   B. 372.16 K
   C. 271.16 °F
   D. 273.16 K /0.01°C/32.01°F

9. **A real gas can be approximated to an ideal gas at:**
   A. Low density
   B. High pressure
   C. High density ↓ P ∝ 1/V ↑
   D. Low temperature

10. **If the volume of the gas is to be increased by 4 times, then:**
    A. Temperature and pressure must be double
    B. At constant P the temperature must be increased by 4 times
    C. At constant T the pressure must be increased by four times
    D. It cannot be increased

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11. In which of the systems listed below is the entropy decreasing?

A. A gas is cooled
B. A plate is shattered
C. An egg is scrambled
D. A drop of dye diffuses in a cup of water

12. If the temperature of source and sink of a Carnot engine having efficiency η are each decreased by 100 K, then the efficiency η

A. Remain constant
B. Become 1
C. Increases
D. Decreases

ANSWER KEY

1	B	6	A	11	A
2	A	7	A	12	C
3	D	8	D		
4	A	9	A		
5	B	10	B		

→ $\frac{W}{Q} = \frac{4.2\,J}{cal}$

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PAST PAPERS 2008-2020

1. **The pressure on the other sides and everywhere inside the vessel will be same according to the:** **(UHS 2009)**

A. Pascal's law
B. Hook's law
C. Boyle's law
D. Charles law

2. **The value of universal gas constant is:** **(UHS 2009,2010,2013)**

A. 8.314 J $mol^{-1}K^{-1}$
B. 8.32 J $mol^{-1}K^{-1}$
C. 100 J $mol^{-1}K^{-1}$
D. 1.38×10^{-23} J $mol^{-1}K^{-1}$

3. **For adiabatic process, the first law of thermodynamics is:** **(UHS 2009,2012)**

A. $W = \Delta U + Q$
B. $Q = -W$
C. $Q = W$
D. $W = -\Delta U$

4. **Which of the following is a postulate of kinetic theory of gases:** **(UHS 2010)**

A. A finite volume of a gas consists of a small number of molecules
B. The size of the molecules is much larger than the separating between them
C. Molecules do not exert force on each other except during a collision
D. The gas molecules are in no-random motion → Random motion, different velocities

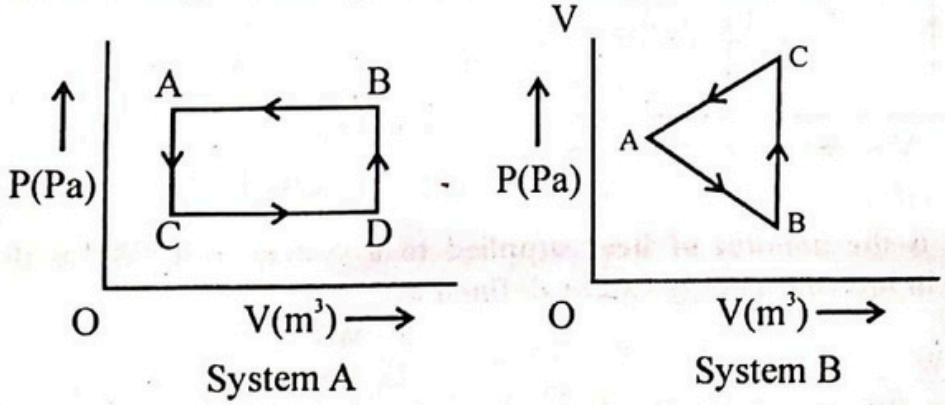
5. **Which one is not an irreversible process?** **(UHS 2010)**

A. Slow compression of a gas into a cylinder
B. Changes due to friction
C. Explosion
D. Dissipation of energy

6. **For a gas of volume "V" in its equilibrium state, if the pressure does changes with time then total kinetic energy of gas is constant because:** **(UHS 2011)**

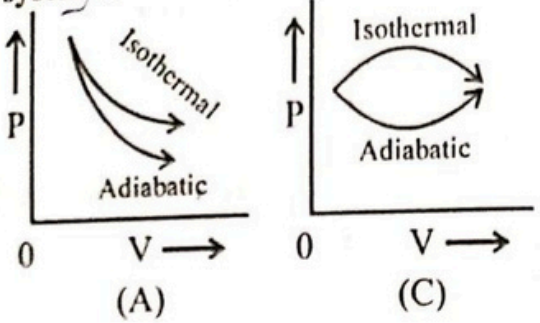
A. Collision between gas molecules occur
B. Collision between gas molecules occur linearly
C. Collision must be elastic
D. Collision must be inelastic

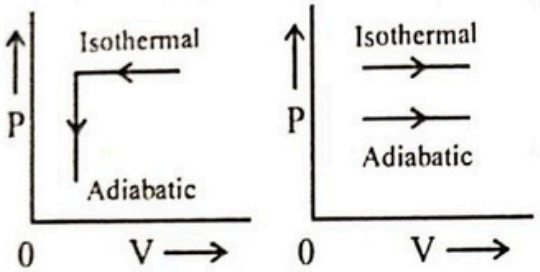
7. **In which of the following, the change in internal energy is more:** **(UHS 2011)**



A. In system A
B. In system B
C. Cannot be predicted
D. Change is zero in both

8. **Pressure-Volume graph of two systems "A" and "B" are plotted under isothermal and adiabatic conditions. Which of the following observation of graph represents the two systems?** (UHS 2011)

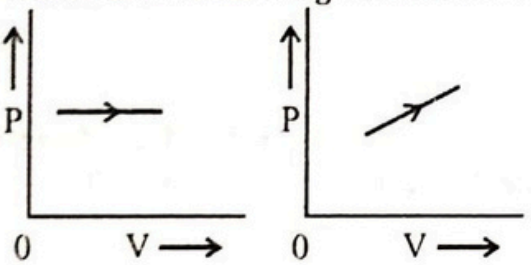


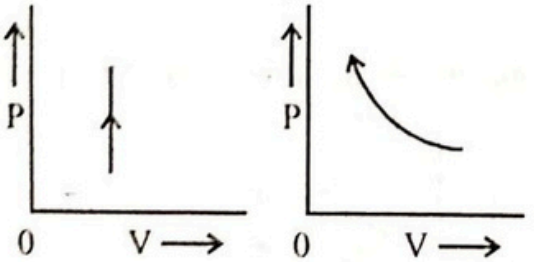


9. **The rabid escape of air from a burs tyre is an example of:** (UHS 2016)

A. Adiabatic processes
B. Isothermal process
C. cooling process
D. First law of thermodynamics

10. **Which of the following curve is an isotherm?** (UHS 2011)





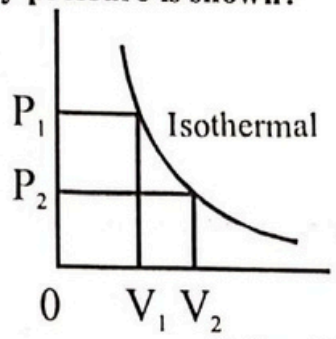
11. **If "Q" is the amount of heat supplied to a system and "W" is the work done then change in internal energy can be defined as:** (UHS 2012)

A. Q/W
B. Q – W
C. W/Q
D. 1 + Q/W

12. **What is the factor upon which change in internal energy and ideal gas depends?** (UHS 2013)

A. Change in volume
B. Changed in volume and temperature
C. Change in temperature
D. Path followed to change internal energy

13. **What will be the mathematical form of first law of thermodynamics for a system whose variation of volume by pressure is shown?** **(UHS 2013)**



A. Q = U
B. U = W
C. Q = U/W
D. Q = W

14. **In general gas equation PV = nRT, n represents the number of moles of gas. Which of the following represents the relation of "n"?** **(UHS 2014)**

A. $n = NN_A$
B. $n = N/N_A$
C. $n = N_A/N$
D. $n = N + N_A$

15. **The relation between Celsius and Fahrenheit scales is:**

$$\frac{C}{100} = \frac{F-32}{180}$$

At what temperature both scales give the same reading? **(UHS 2014)**

A. −100°
B. −40°
C. −180°
D. −173°

16. **Two samples of gasses "1" & "2" are taken at same temperature and pressure but the ratio of number their volume is $V_1:V_2$ = 2:3, what is the ratio of number of moles of the gas samples?** **(UHS 2015)**

A. 3 :2
B. $\sqrt{2} : \sqrt{3}$
C. 4:9
D. 2:3

17. **When the state of gas change without change in temperature, the gas is said to undergo:** **(UHS 2015)**

A. Isothermal process
B. Adiabatic process
C. Isochoric process
D. Isobaric Process

18. **The relation $\frac{R}{NA} = 1.38 \times 10^{-23}\ JK^{-1}$ in gas law is known as:** **(UHS 2016)**

A. Avogadro's law
B. Charles constant
C. Newton's constant
D. Boltzmann's constant

19. **The relation "PV=nRT" shows which law of physics?** **(UHS 2016)**

A. Charles' law
B. Avogadro's law
C. Newton's constant
D. Ideal gas law

20. **Which relation exactly described the isothermal process:** **(UHS 2016)**

A. Q = W
B. W = −ΔU
C. Q = − ΔU
D. Q = ΔU + W

21. **One mole of a gas occupies volume $1 \times 10^{-2}\ m^3$ in cylinder whose pressure is 2.5×10^5 Pa. The temperature of cylinder will be equal to:** **(UHS 2017)**

A. 300K
B. 227K
C. 370K
D. 390K

22. If $C_V = \frac{5}{2}R$, C_P will be: (UHS 2018)

A. $\frac{2}{7}R$
C. $\frac{2}{5}R$
B. $\frac{7}{2}R$
D. $\frac{5}{2}R$

23. If one mole of an ideal gas is heated at constant pressure, then the first law of thermodynamics can be written as: (UHS 2018)

A. $C_P\Delta T = C_V\Delta T + P\Delta V$
C. $C_P\Delta T = C_V\Delta T + \Delta PV$
B. $\Delta C_P T = \Delta C_V T + P\Delta V$
D. $C_V\Delta T = C_P\Delta T + P\Delta V$

24. Find the mean translational kinetic energy of ideal hydrogen gas at 17°C: (UHS 2018)

A. 5×10^{-21} J
C. 6.21×10^{-12} J
B. 6×10^{-21} J
D. 6.21×10^{-21} J

25. Molecules of a gas at constant pressure for a fixed amount of gas have average kinetic energy "X". increasing temperature from 27°C to 327°C, average K.E of molecules will become: (UHS 2019)

A. 200X
C. 300X
B. 20X
D. 2X

26. The sum of all forms of molecular energies (kinetic and potential) of a substances is termed as: (UHS 2019)

A. Internal energy
C. Heat energy
B. Elastic energy
D. Absolute energy

27. In which process the entire of heat supplied to the gas is converted to the internal energy of the gas? (PMC 2020)

A. isochoric process
C. isothermal process
B. isobaric process
D. adiabatic process

28. The internal energy of a system during an isothermal process: (PMC 2020)

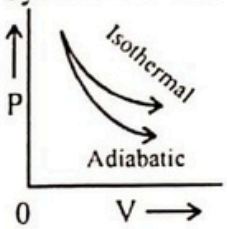
A. decreases
C. become zero
B. increases
D. remain constant

ANSWER KEY

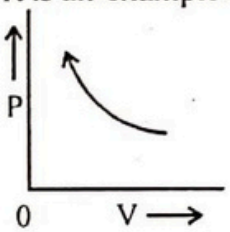
1	A	6	C	11	B	16	D	21	A	26	A
2	A	7	D	12	C	17	A	22	B	27	A
3	D	8	A	13	D	18	D	23	A	28	D
4	C	9	A	14	B	19	D	24	B		
5	C	10	D	15	B	20	A	25	D		

SOLUTION

1. By Pascal's law "Pressure on each side of the container and everywhere in the container is same provided the density of the gas is uniform."
2. $R = 8.314\ J\ mol^{-1}K^{-1}$
3. $Q = \Delta U + W$
   $0 = \Delta U + W \Rightarrow W = -\Delta U$
4. Only (C) is the postulate of KMT.
5. Explosion is an irreversible process.
6. In elastic collision the K.E remains constant.
7. System "A" and "B" both are cyclic process. In any cyclic process $\Delta U = 0$



8. Adiabat is steeper than isotherm.
9. It is an example of adiabatic process.



10. $V \propto \frac{1}{P}$ (T = constant)
11. $Q = \Delta U + W \Rightarrow \Delta U = Q - W$
12. For an ideal gas system the internal energy is directly proportional to its temperature.
    $U \propto T$
    $\Delta U \propto \Delta T$
13. $Q = \Delta U + W$
    In isothermal process
    $\Delta U = 0$
    $Q = 0 + W = W$
14. No. of moles, $n = \frac{N}{NA}$
15. $T_C = T_F$

$$T_C = \frac{9}{5}T_C + 32^o \Rightarrow T_C - \frac{9}{5}T_C = 32^o$$

$$\frac{5TC - 9TC}{5} = 32^o \Rightarrow -\frac{4}{5}T_C = 32^o$$

$$T_C = -\frac{32o \times 5}{4} = -40^oC$$

16. $PV = nRT \Rightarrow n = \frac{PV}{RT} \Rightarrow n \propto V$

$\frac{n1}{n2} = \frac{V1}{V2} \Rightarrow n_1 : n_2 = V_1 : V_2 = 2:3$

17. The process during which temperature remains same is called isothermal process.

18. $\frac{R}{NA} = k = 1.38 \times 10^{-23}\ JK^{-1}$ = Boltzmann's constant

19. "PV = nRT" is the Ideal gas law.

20. $Q = \Delta U + W$

In isothermal process

$\Delta U = 0$

$Q = 0 + W = W$

21. $PV = nRT$

$T = \frac{PV}{nR} = \frac{(2.5\times105)(1\times10-2)}{(8.314)(1)}\ K \approx 300\ K$

22. $C_P = C_V + R = \frac{5}{2}R + R = \frac{7}{2}R$

23. **At constant pressure:**

$Q_P = \Delta U + W$

$C_P\Delta T = \Delta U + P\Delta V$ .....(i)

At constant volume:

$Q_V = \Delta U + W = \Delta U + 0 = \Delta U$

$C_V\Delta T = \Delta U$

Put in (i)

$C_P\Delta T = C_V\Delta T + P\Delta V$

24. $<K.E> = \frac{3}{2}kT = \frac{3}{2}(1.38\times10^{-23})(290) = 6 \times 10^{-21}\ J$

25. $T_1 = 27°C = 300\ K$

$T_2 = 327°C = 600\ K = 2T_1$

$<K.E> = \frac{3}{2}kT$

$<K.E> \propto T$

As temperature double so, kinetic energy also double (2X).

26. Sum of all forms of molecular energies (K.E. and P.E.) of a substance is called internal energy.

27. $Q = \Delta U + W$

$Q = \Delta U + P\Delta V$

$Q = \Delta U + P(0)$

$Q = \Delta U$

28. $U \propto T$

T = constant, U = constant

PMC PAST PAPER 2022 (THERMODYNAMICS)

Q.1F irst law of Thermodynamics is related to

A. law of conversation of energy
B. law of conversation of mass
C. law of conversation of momentum
D. law of conversation of charge

Q.2C C_v/C_p is equals to

A. γ
B. γ^2
C. $1/\gamma$
D. R

Q.3 γ for poly atomic gas is

A. 1.66
B. 1.44
C. 1.29
D. 0.8

Q.4Whi ch one is True about C_v and C_p?

A. $C_p = C_v$
B. $C_p > C_v$
C. $C_v > C_p$
D. None

Q.5T hermodynamics does not consider

A. initial and final state
B. time factor
C. bulk of matter
D. energy change

Q.6A system which can neither exchange matter nor energy with the surroundings is called

A. Open system
B. Isolated system
C. Closed system
D. Ideal system

Q.7A bsolute zero temperature is taken as

A. – 273°C
B. 273°C
C. 237°C
D. – 373°C.

Q.8I n isothermal process

A. Pressure is constant
B. Volume is constant
C. Temperature is constant
D. Entropy is constant

Q.9I f the volume of a gas is held constant and we increase its temperature, then

A. Its pressure is constant
B. Its pressure rises
C. Its pressure falls
D. Any of above

Q.10 For a gas obeying Boyles law if the pressure is doubled the volume becomes

A. Double
B. One half
C. Four times
D. One fourth

Q.11 Find the value of $C_p - C_v$ =? If we have 3 moles of gas:

A. 3R
B. 2R
C. 5R
D. 7R

Q.12 A valid unit of specific heat capacity is

A. $Jkg^{-1}K^{-1}$
B. $Jkg^{-2}K^{-1}$
C. $Jkg^{-1}K$
D. $JkgK^{-1}$

Q.13 If 1 mole of mono atomic gas γ = 5/3 is mixed with 1 mole of diatomic gas γ = 7/5. What is the value of γ for the mixture

A. 1
B. 1.5
C. 2
D. 3.5

Q.14 A gas mixture consists of 2 moles of oxygen and 4 moles of Argon at temperature T. Neglecting all vibrational moles, the total internal energy of the system is

A. 9RT
B. 11 RT
C. 15 RT
D. 10 RT

Q.15 If energy required to raise the temperature of 10°C is 20 J at constant volume, then how much energy required to raise the same temperature at constant pressure.

A. 10 J B. 40 J
C. 20 J D. 12 J

Q.16 The internal energy of one gram of helium at 100 K and one atmospheric pressure is

A. 100 J B. 1200 J
C. 300 J D. 600 J

Q.17 310 J of heat is required to raise the temperature of 2 moles of an ideal gas at constant pressure from 25°C to 35°C. The amount of heat energy required to raise the temperature of gas through the same range at constant volume is.

A. 83 J B. 144 J
C. 115 J D. 105 J

Q.18 If $C_p = 34.4$ J /mol K and value of R is 8.314 then

A. $C_v = 26.1$ J/ mol K B. $C_v = 20.1$ J/ mol K
C. $C_v = 10.1$ J/ mol K D. $C_v = 120.1$ J/ mol K

Q.19 The difference between the principal specific heats of nitrogen is 300 J/kg-K and ratio of the two specific heats is 1.4 then

A. $C_P = 1050$ J/kg-K B. $C_P = 750$ J/kg-K
C. $C_P = 650$ J/kg-K D. $C_P = 150$ J/kg-K

Q.20 The equation of state corresponding to 8 g of O_2 is,

A. $PV = \frac{RT}{2}$ B. $PV = \frac{RT}{4}$
C. PV = RT D. PV = 8RT

Q.21 C_V of a gas is 8 $calK^{-1}mol^{-1}$. Find C_P/C_V. Assume R = 2 $calK^{-1}mol^{-1}$.

A. 1.4 B. 1.33
C. 1.25 D. 1.8

Q.22 100 g of water is heated from 30 °C to 50 °C. Ignoring the slight expansion of the water, the change in its internal energy is (specific heat of water is 4184 J kg^{-1} K^{-1})

A. 4.2 kJ B. 8.4 kJ
C. 84 kJ D. 2.1 kJ

Q.23 When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is

A. 2/5 B. 3/5
C. 3/7 D. 5/7

Q.24 How much heat (in Joules) does it take to raise the temperature 100 g of H_2O from 22°C to 98°C?

A. 0.4 kJ B. 60.0 kJ
C. 20.0 kJ D. 32 kJ

Q.25 A closed container contains an ideal gas. Which of the following changes will result in decrease in temperature?

A. Volume decrease temperature decrease B. Volume decrease temperature increase
C. Volume increase temperature decrease D. Volume increase temperature increase

Q.26 The efficiency of the heat engine can be defined as:

A. $1-\frac{Q_2}{Q_1}$ B. $1-\frac{Q_1}{Q_2}$
C. $1+\frac{Q_2}{Q_1}$ D. $\frac{Q_2}{Q_1}$

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Q.27 For an isothermal process, the first law of thermodynamics can be written as:

A. Heat absorbed = work done on the system
B. Heat absorbed = work done by the system
C. Heat released = work done by the system
D. Heat released = work done by the system + change in internal energy

Q.28 The Boltzmann's constant k, is defined as:

A. $N_A + R$ B. R / N_A
C. N_A / R D. $N_A \times R$

Q.29 A liquid has mass m and specific heat capacity C. The rate of change in temperature of liquid is R. What is the rate at which heat is transferred from the liquid?

A. Rmc B. R / mc
C. mc / R D. Rm / c

Q.30 100 W heater is used to heat 500 g of water from 20C to 50C. How long should the heater be switched on? Specific heat capacity of water is 4.2 J/gC.

A. 63 sec B. 63 min
C. 630 sec D. 6.3 min

Q.31 The energy input to an engine is 60 J, and the work it performs is 15 J. What is its thermal efficiency?

A. 4.00 B. 1.00
C. 0.25 D. Impossible to determine

Q.32 Which of the following is not a thermodynamic state function?

A. Enthalpy B. Work done
C. Gibbs free energy D. Internal Energy

Q.33 If N is the number of molecules of a gas in a container. Then number of moles can be calculated as:

A. $N + N_A$ B. $N_A \div N$
C. $N \div N_A$ D. $N \times N_A$

Q.34 The sum of all forms of molecular energies (kinetic and potential) of a substance is termed as its:

A. Absolute temperature B. Internal energy
C. Potential energy D. Kinetic energy

Q.35 When an ideal gas of constant mass is heated in a container of fixed volume. What is the reason for the increase in pressure of the gas?

A. Number of molecules per unit volume increases
B. Molecules occupy greater volume of the container
C. Average force per impact at the container wall increases
D. Molecules collide with each other with greater force

Q.36 Isothermal process can be defined as:

A. PV = constant B. PV = RT
C. P / V = constant D. P / V = nRT

Q.37 Which one of the following process is highly irreversible?

A. Slow compressions of an elastic spring
B. Slow evaporation of a substance in an isolated vessel
C. Slow compression of a gas
D. a chemical explosion

Q.38 During an adiabatic process the pressure of the gas is found to be proportional to fourth power of temperature. The ideal gas would be

A. H_2 B. He
C. CH_2 D. Mixture of H_2 and He

Q.39 Temperature is defined by

A. First law of thermodynamics B. Zeroth law of thermodynamics
C. Second law of thermodynamics D. Third law of thermodynamics

Q.40 Internal energy of the system depends on:

A. Initial and final states of the system and the path from initial to final state
B. Initial and final states of the system only
C. Initial state of the system and the path from initial to final state
D. The path from initial to final state

Q.41 Initial mass of water, at its boiling point, is 0.8 kg. 4 kW of heater is used to boil it completely. Assuming the specific latent heat of vaporization of water is 2MJ/kg, what is the time taken to vaporize all the water?

A. 400 s B. 4000 s
C. 250 s D. 2500 s

Q.42 Heater is used for 5 min to heat 500g of water from 30°C to 50°C. the specific heat capacity of water is 4.2 J/g/°C. The power of heater is

A. 4 W B. 210 W
C. 240 W D. 24 W

Q.43 A car of mass M is moving with speed v. The brake of mass m and specific heat capacity c, is used to stop the car. If half of the kinetic energy of the car is absorbed by the brake, then what is the increase in temperature of the brake?

A. $Mv^2/4mC$ B. $Mv^2/2mC$
C. $mv^2/4MC$ D. $mv^2/2MC$

Q.44 P-V diagram of a diatomic gas is a straight line passing through origin. What is the molar heat capacity of the gas in the process?

A. R B. 1.5R
C. 3R D. 4R/3

Q.45 What does the constant n represent in the equation of state for an ideal gas PV=nRT?

A. Number of atoms in the gas B. Number of moles of the gas
C. Number of nucleons D. Number of molecules of gas

Q.46 If $P = P_o$ and $V = V_o$ gas expands isothermally to $P = 3P_o$ then Volume is

A. $3V_o$ B. $2V_o$
C. $V_o/3$ D. $V_o/2$

Q.47 Which of the terms is related with thermodynamics?

A. System B. Surrounding
C. Boundary D. All of these

Q.48 Amount of heat supplied to 0.02 kg of nitrogen to raise its temperature by 45 degrees is

A. 936J B. 934J
C. 967J D. 954J

Q.49 What is the internal energy change in system that has absorbed 800J of heat and work done is 500J?

A. 200J B. 550J
C. 600J D. 300J

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Q.50 "The heat required to raise the temperature of one mole of the substance through 1 K" is called:

A. Specific latent heat
B. Molar heat capacity
C. Molar specific heat
D. Specific heat capacity

Q.51 Which of the following is not an assumption of the kinetic model of an ideal gas?

A. Collisions between molecules and walls of container are elastic
B. The duration of collision between molecules is very short
C. All particles of gas has same speed
D. All particles of gas have same mass

Q.52 Two identical gases expand i) isothermally ii) adiabatically. Work done is more in

A. Isothermal process
B. Adiabatic process
C. Neither of them
D. Equal in both cases

Q.53 In which of the following processes the heat is neither absorbed nor released by a system?

A. Isochoric
B. Isothermal
C. Adiabatic
D. Isobaric

Q.54 In Boyle's law, which quantity is constant

A. P
B. T
C.V
D. R

Q.55 A gas expands from V_1 to V_2. The amount of work done is greatest in

A. Adiabatic
B. Isobaric
C. Isochoric
D. Isothermal

Q.56 If heat given is 6 kcal and work done is 6 kJ, then internal energy is

A. 19.1 kJ
B. 25.2 kJ
C. 25kJ
D. Zero
A. Pressure conservation
B. Entropy conservation
C. Temperature conservation
D. Energy Conservation

Q.57 In the VT diagram slope of curve is

A. R
B. nR/P
C. P
D. R/P

Q.58 In Thermodynamics zeroth law is related with:

A. Work
B. Energy
C. Thermal equilibrium
D. Entropy

Q.59 The value of universal gas, R, constant is:

A. 8.314 J/molK
B. 1.38×10^{-23} J/K
C. 6.63×10^{-11} Nm^2/kg^2
D. 1.6×10^{-19} C

Q.60 Which of this is constant in adiabatic process:

A. Total heat
B. Work done
C. Entropy
D. Both 'A' and 'C'

Q.61 A cycle tyre bursts suddenly is an example of:

A. Isothermal process
B. Isochoric process
C. Adiabatic process
D. Isobaric process

Q.62 The efficiency of diesel engine is:

A. 10% to 20%
B. 20% to 35%
C. 35% to 40%
D. 40% to 50%

Q.63 One kcal =

A. 4.18 J
B. 4180 J
C. 2.09 J
D. 2090 J

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Q.64 **If 1 mole of an ideal gas is heated at constant volume so that its temperature rises by ΔT, then first law of thermodynamics can be written as:**

A. $\Delta U + Cv = \Delta T$
B. $\Delta U = Cv - \Delta T$
C. $\Delta U = Cv\,\Delta T$
D. $\Delta U = Cv + \Delta T$

Q.65 **A gas expands 0.25 m3 at constant pressure 103N/m2 then work done is:**

A. 0.25 ergs
B. 25ergs
C. 250 joules
D. 250W

Q.66 **All changes which occur suddenly or which involve friction or dissipation of energy through conduction, convection or radiation are:**

A. Irreversible changes
B. Chemical changes
C. Cyclic changes
D. Reversible changes

Q.67 **Which of the following is equivalent to a temperature –15°C?**

A. 123K
B. –123 K
C. 258 K
D. –423 K

Q.68 **Which of the following is equivalent to a temperature 150K?**

A. 123 °C
B. –123 °C
C. 423 °C
D. –423 °C

Q.69 **A monatomic ideal gas is thermally insulated, so no heat can flow between it and its surroundings. Is it possible for the temperature of the gas to rise?**

A. Yes. The temperature can rise if work is done by the gas
B. No. The only way that the temperature can rise is if heat is added to the gas
C. Yes. The temperature can rise if work is done on the gas
D. No. The only way that the temperature can rise is by adding more molecules in container

Q.70 **Some ice, at its melting point, is added to m kg of water at initial temperature 290 K. If c is the specific heat capacity of water and L is latent heat of fusion of ice. Ice melts completely. Final temperature of the water is 273 K. What is the minimum mass of ice that is required?**

A. 17mC / L
B. L / 17mC
C. 17m / LC
D. 290m / LC

Q.71 **Under what conditions of temperature and pressure does a real gas approximate to an ideal gas?**

A. Pressure low temperature low
B. Pressure low temperature high
C. Pressure high temperature low
D. Pressure high temperature high

Q.72 **In which process the net work done is zero?**

A. Cyclic
B. Free expansion
C. Isochoric
D. Adiabatic

Q.73 **Internal energy remains same throughout the process in**

A. Adiabatic process
B. Isothermal process
C. Cyclic process
D. Both A. and B.

Q.74 **An ideal gas is compressed to half of its initial volume. Which of this process would result in maximum work done?**

A. Adiabatic
B. Isobaric
C. Isochoric
D. Isothermal

Q.75 **If system changes from a state P_1 V_1 to P_2V_2 by two paths, then quantity which remains unchanged is**

A. dQ
B. dW
C. dQ-dW
D. dQ+Dw

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Q.76 An ideal reversible heat engine is 1 efficient only if:
A. Hot reservoir is at 0K
B. Hot reservoir is at °C
C. Cold reservoir is at 0C
D. Cold reservoir is at 0K

Q.77 Efficiency of heat engine in Terms of Temperature of reservoir and sink is defined as
A. T_1/T_2
B. $1+T_1/T_2$
C. $1-T_2/T_1$
D. T_2/T_1

Q.78 According to First law of thermodynamics,
A. $dQ=dW-dU$
B. $dQ=dU$
C. $dQ=dU+dW$
D. $dQ=dW$

Q.79 Which statement is incorrect?
A. In an isobaric process $\Delta P=0$
B. In an isochoric process $\Delta W=0$
C. In an isothermal process $\Delta T=0$
D. In an isothermal process $\Delta Q=0$

Q.80 The value of triple point of water is:
A. 1 K
B. 100 K
C. 273.16 K
D. 0 K

Q.81 Under a cyclic path, internal energy after complete cycle is same as
A. 2(initial)
B. Initial heat
C. Initial internal energy
D. Initial work

Q.82 Initial pressure and volume are P and V respectively. First it expanded isothermally to 4V then compressed adiabatically to Volume V, the final pressure is:
A. 2P
B. 1P
C. 3P
D. 4P

Q.83 Two objects, with different sizes, masses, and temperatures, are placed in thermal contact. In which direction does the energy travel?
A. Energy travels from the larger object to the smaller object
B. Energy travels from the object with more mass to the one with less mass
C. Energy travels from the object at higher temperature to the object at lower temperature
D. Energy does not travel

Q.84 Area of PV diagram gives
A. Internal energy
B. Work done
C. Entropy
D. Heat

Q.85 Work done in an adiabatic process in a gas depends on:
A. Change in pressure
B. Change in temperature
C. Change in Volume
D. All of these

Q.86 When the amount of work done is 33 cal and change in internal energy is 167 cal then heat supplied is:
A. 167 cal
B. 200 cal
C. 500 cal
D. 600 cal

Q.87 If the heat absorbed is 10J and Work done is 5 J, then change in internal energy is: A. –A. 5J
B. 10J
C. 15J
D. 5J

Q.88 A monatomic gas at pressure P and Volume V expands isothermally to volume 2V and then adiabatically to volume 16V. The final pressure is:
A. 16P
B. 64P
C. 32P
D. P/64

Q.89 When temperature of the system does not change, it is called:

A. Isothermal B. Adiabatic
C. Isovolumetric D. Isobaric

Q.90 For an adiabatic process, the first law of thermodynamics can be written as:

A. Work done by the system = decrease in internal energy of system
B. Work done by the system = increase in internal energy of system
C. Work done on the system = decrease in internal energy of system
D. Work done on the system = decrease in internal energy of system + heat released

Q.91 Adiabatic process can be defined as:

A. PV^{γ} = constant B. $PV = \gamma RT$
C. P/V^{γ} = constant D. $PV_{\gamma} = nRT$

Q.92 During an adiabatic process pressure of gas is found to be proportional to the cube of its temperature. The ratio of C_p/C_v is

A. $\frac{4}{3}$ B. 2
C. $\frac{3}{2}$ D. $\frac{5}{3}$

Q.93 Which one of the following is not the unit of heat?

A. calorie B. joule
C. watt sec D. watt

Q.94 For a certain process, pressure of diatomic gas varies according to the relation $P=aV^2$, where a is constant. What is the molar heat capacity of the gas for

A. 17R/6 B. 6R/16
C. 6R/17 D. 7R/16

Q.95 Specific heat in term of heat capacity can be written as

A. mC B. C^2m
C. C/m D. m/C

Q.96 At 0 k which of the following properties of a gas will be zero.

A. K.E B. P.E
C. Vibrational energy D. Density

Q.97 What will be change in internal energy when work done by the system is 50KJ heat absorbed is 40 kJ

A. 90 kJ B. –10 kJ
C. 190 kJ D. –190 kJ

Q.98 Gas laws are applicable to

A. Gases as well as vapours B. Gases alone and not to vapours
C. Gases and steam D. Gases and vapours under certain conditions

Q.99 An ideal gas as compared to a real gas at very high pressure occupies

A. More volume B. Less volume
C. Same volume D. None of the above

Q.100 The unit of pressure in S.I. unit is

A. Kg/cm^2 B. mm of water column
C. Pascal D. Bars

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ANSWER KEY

1	A	16	C	31	C	46	C	61	C	76	D	91	A
2	C	17	B	32	B	47	D	62	C	77	C	92	C
3	C	18	A	33	C	48	B	63	B	78	C	93	D
4	B	19	A	34	B	49	D	64	C	79	D	94	A
5	B	20	B	35	C	50	C	65	C	80	C	95	A
6	B	21	C	36	A	51	B	66	A	81	C	96	A
7	A	22	C	37	D	52	A	67	C	82	A	97	B
8	C	23	D	38	B	53	C	68	B	83	C	98	B
9	B	24	D	39	B	54	B	69	C	84	B	99	A
10	B	25	C	40	B	55	B	70	A	85	B	100	C
11	A	26	A	41	A	56	A	71	B	86	B		
12	A	27	B	42	B	57	B	72	C	87	D		
13	B	28	B	43	A	58	C	73	B	88	D		
14	B	29	A	44	C	59	A	74	A	89	A		
15	B	30	C	45	B	60	D	75	C	90	A		

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UNIT 6 PRACTICE EXERCISE

ELECTROSTATICS

1. **The unit of ε_r:**
   A. $Nm^{-1}A^{-1}$ B. Nm^2C^2
   C. $N^{-1}m^1C^2$ D. No unit

2. **An electric field can deflect:**
   A. neutrons B. X–rays
   C. γ–rays D. α–particle

3. **The minimum charge on any object cannot be less than:**
   A. $1.6\times10^{-19}C$ B. $9.1\times10^{9}C$
   C. $3.2\times10^{-19}C$ D. no definite value exis

4. **There are two charges 1 μc and 6 μc, the ratio of forces acting on them will be:**
   A. 1:25 B. 1:1
   C. 1:6 D. 6:1

5. **The no. of electrons is one coulomb charge is equal to:**
   A. 6.02×10^{18} B. 1.6×10^{-19}
   C. 6.2×10^{18} D. 6.2×10^{21}

6. **The electric intensity at infinite distance from the point charge is:**
   A. Infinite B. Positive
   C. Zero D. $k\frac{q}{r}$

7. **Charges of +2μc and –2 μc are placed at points (P) and (Q) respectively. Tell the location at which electric potential is zero:**
   A. Right from Q B. Left from P
   C. Both "A" & "B" D. Mid way b/w (P) and (Q)

8. **When two charges are equal "q" each, force they exert on each other is "F". When one of charge is double, the 2q charge exerts a force 2F on charge q. the force exerted by q on 2q is?**
   A. F B. F / 4
   C. F / 2 D. 2F

9. **A particle carrying a charge of 2e falls through potential difference of 3.0V. Calculate the energy acquired by it:**
   A. $9.6\times10^{-16}J$ B. $9.6\times10^{-15}J$
   C. $9.6\times10^{-20}J$ D. $9.6\times10^{-19}J$

10. **Three charges q,Q and 4q are placed in a straight line of length "ℓ" at a points distance 0, ℓ/2 and ℓ respectively from one end. In order to make the net force on "q" zero, the charge "Q" must be equal to:**
    A. $-q$ B. $-\frac{q}{2}$
    C. $-2q$ D. q

11. **The electric intensity is expressed in unit of N/C or:**
A. Volts B. Joules
C. Walt D. V/m

12. **S.I unit of permittivity of free space is:**
A. farad B. $C^2/N\,m^2$
C. Weber D. C^2/Nm

13. **The potential at a point, where a charge of 1×10^{-3} C is placed at a distance of 10m is:**
A. 1mV B. 1.6kV
C. 900 kV D. 0.15kV

14. **An alpha particle has twice the charge of a proton. Two protons separated by a distance "d" exert a force "F" on each other. What must be the separation between the alpha particles so that they also exert a force "F" on each other?**
A. 2d B. d/2
C. $\sqrt{2}$ d D. $d/\sqrt{2}$

15. **The ratio of the force between two small spheres with constant charges A. in air, B. in a medium of dielectric constant K is:**
A. $K^2 : 1$ B. K : 1
C. 1 : K D. $1 : K^2$

16. **The force of proton in electric field of magnitude 10^6 N/C is:**
A. 1.6×10^{-15}N B. 1.6×10^{13}N
C. 1.6×10^{9}N D. 1.6×10^{-13}N

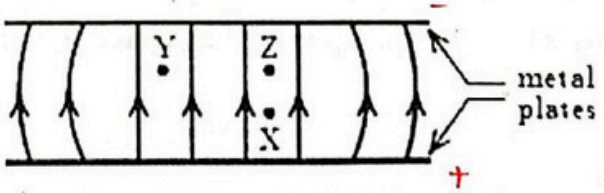
17. **Potential gradient is defined as:**
A. $\frac{\Delta E}{\Delta V}$ B. $-\frac{\Delta V}{\Delta r}$
C. $-\frac{\Delta V}{\Delta E}$ D. $\frac{\Delta V}{\Delta r}$

18. **The force between two point charges separated by air is 4N. When separated by a medium of relative permittivity 2, the force between them becomes:**
A. ½ N B. 4N
C. 2N D. 8N

19. **A 5MΩ resistor is connected with a 2μF capacitor. The time constant of the circuit is:**
A. 0.1 s B. 2.5 s
C. 1 s D. 10 s

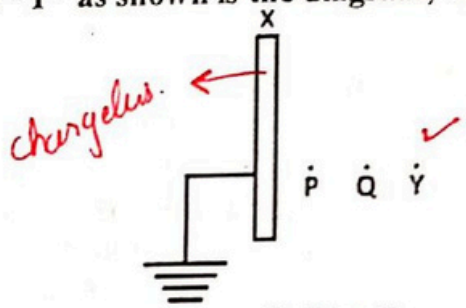
20. **In the time constant "RC" circuit, how much charge is stored, out of maximum charge q_o:**
A. $0.37q_o$ B. $0.63q_o$
C. $0.51q_o$ D. $0.90q_o$

21. **The diagram shows the electric field lines due to two charged parallel metal plates. We conclude that:**



A. the upper plate is positive and the lower plate is negative
B. a proton at X would experience the same force if it were placed at Y
C. a proton at X experiences a greater force than if it were placed at Z
D. a proton at X experiences less force than if it were placed at Z

22. **A point charge is placed at (Y) in front of an earthed metal sheet (X). "P" and "Q" are two points b/w "X" and "Y" as shown is the diagram, then relation:**



A. $E_P=0$
B. $E_P > E_Q$
C. $E_Q = 0$
D. $E_Q > E_P$

23. **The force between two similar unit charges placed one meter apart in air in newton is:**
A. Zero
B. 9×10^9
C. 1
D. 9×10^{-9}

24. **Two capacitors are identical one is filled with air and the other with oil. Both capacitors carry the same charge. The ratio of the electric fields E_{air}/E_{oil} is:**
A. between 0 and 1
B. 1
C. 0
D. between 1 and infinity

25. **One of materials listed below is to be placed between two identical metal sheets, with no air gap, to form a parallel-plate capacitor. Which produces the greatest capacitance?**
A. material of thickness 0.1mm and dielectric constant 2
B. material of thickness 0.2mm and dielectric constant 3
C. material of thickness 0.4mm and dielectric constant 8
D. material of thickness 0.5mm and dielectric constant 11

26. **The potential difference between the pair of similar conducting plates is known. What additional information is needed in order to find the electric field intensity?**
A. Permittivity of the medium
B. Separation between the plates
C. Dielectric constant
D. Separation and area of the plates

27. **A parallel plate capacitor has a plate area of $0.2m^2$ and a plate separation of 0.1 mm. If the charge on each plate has a magnitude of 4×10^{-6} C the potential difference across the plates is approximately:**
A. 0
B. 1×10^2 V
C. 4×10^{-2} V
D. 2×10^2 V

28. **A capacitor of 1.0 F will:**
A. Store 1.0C charge at the potential difference of 1.0 V
B. Discharge in 1 second when connected across resistor of 1.0 Ω
C. Be fully charged in 1 second by a current of 1 A
D. Block the alternating current

29. **The separation between the parallel plates of a capacitor is doubled then its capacitance "C" will be:**
A. 2C
B. 4C
C. C/2
D. C/4

30. **A parallel plate capacitor has a plate area of $0.2m^2$ and a plate separation of 0.1mm. To obtain an electric field of 2.0×10^6 V/m between the plates, the magnitude of the charge on each plate should be:**
A. 8.9×10^{-7} C
B. 3.5×10^{-6} C
C. 1.8×10^{-6} C
D. 7.1×10^{-6} C

31. **Two particles, X and Y, are 4m apart. X has a charge of 2Q and Y has a charge of Q. The force of X on Y:**
A. has twice the magnitude of the force of Y on X
B. has half the magnitude of the force of Y on X
C. has the same magnitude as the force of Y on X
D. has one-fourth the magnitude of the force of Y on X

32. **A 5.0 C charge is 10m from a -2.0 C charge. The electrostatic force on the positive charge is:**
A. 9.0×10^8 N toward the negative charge
B. 9.0×10^8 N away from the negative charge
C. 9.0×10^9 N toward the negative charge
D. 9.0×10^9 N away from the negative charge

33. **Charge "Q" is spread uniformly along the circumference of a circle of radius "R". A point particle with charge "q" is placed at the center of this circle. The total force exerted on the particle can be calculated by Coulomb's law:**
A. just use R for the distance
B. just use $2\pi R$ for the distance
C. just use 2R for the distance
D. the result of the calculation is zero

34. **The electric field at a distance of 10 cm from an isolated point particle with a charge of 2×10^{-9} C is:**
A. 1.8N/C
B. 18N/C
C. 180N/C
D. 1800N/C

35. **An isolated charged particle produces an electric field with magnitude "E" at a point 2m away from the charge. A point at which the field magnitude is E/4 is:**
A. 1m away from the particle
B. 2m away from the particle
C. 0.5m away from the particle
D. 4m away from the particle

36. **If 500 J of work are required to carry a charged particle between two points with a potential difference of 20V, the magnitude of the charge on the particle is:**
A. 0.040 C
B. 20 C
C. 12.5C
D. 25 C

37. **Two large parallel conducting plates are separated by a distance d, placed in a vacuum, and connected to a source of potential difference "V". An oxygen ion, with charge "2e", starts from rest on the surface of one plate and accelerates to the other. If "e" denotes the magnitude of the electron charge, the final kinetic energy of this ion is:**
A. eV/2
B. eV d
C. eV/d`
D. 2eV

38. **The equi-potential surfaces associated with a charged point particle are:**
A. radially outward from the particle
B. vertical planes
C. horizontal planes
D. concentric spheres

39. **A capacitor "C" has a charge "Q". The actual charges on its plates are:**
A. Q, Q
B. Q, −Q
C. Q/2, Q/2
D. Q/2, −Q/2

40. **A conducting sphere has charge "Q" and its electric potential is "V", relative to the potential far away. If the charge is doubled to 2Q, the potential is:**
A. V
B. 4V
C. 2V
D. V/2

41. **The number of electrons removed from an object to create a charge of one Coulomb are:**
A. 6.2×10^{-23}
B. 6.2×10^{18}
C. 1.6×10^{-19}
D. 6.2×10^{-18}

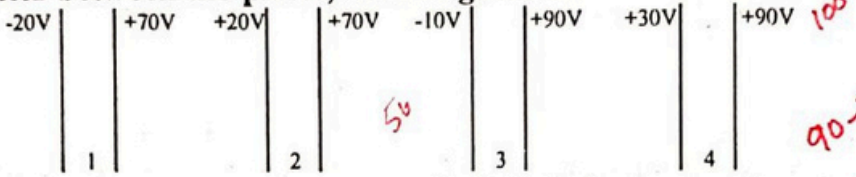
42. **A charge produces an electric field "E" at a point. If the charge on the particle is double then electric field at that point is:**
A. Half
B. Double
C. Unchanged
D. one fourth

43. **If force between point charges of 10μC and 40μC is 9000N, then distance between them is:**
A. 2cm
B. 20cm
C. 20m
D. 400cm

44. **There are four point charges A, B, C and D, if A and B repel each other and C and D also repel each other but A and C attract each other, then charges B and D will:**
A. Repel each other
B. Attract each other
C. exert no force
D. Have no effect

45. **If both the plate area and the plate separation of a parallel plate capacitor are doubled, the capacitance is:**
A. doubled
B. unchanged
C. halved
D. tripled

46. **The diagram shows four pairs of large parallel conducting plates. The value of the electric potential is given for each plate. Rank the pairs according to the magnitude of the electric field between the plates, least to greatest.**



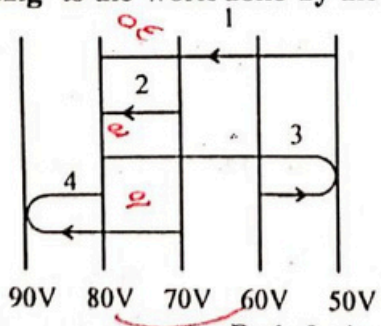
A. 1, 2, 3, 4
B. 2, 3, 1, 4
C. 4, 3, 2, 1
D. 2, 4, 1, 3

47. **The work required to carry a particle with a charge of 6.0C from a 5.0V equi–potential surface to a 6.0 V equi–potential surface and back again to the 5.0 V surface is:**
A. 0
B. 3.0×10^{-5} J
C. 1.2×10^{-5} J
D. 6.0×10^{-5} J

48. **The electrostatic force between two point charges kept at a distance "d" apart, in a medium $\varepsilon_r = 6$, is 0.3 N. The force between them at the same separation in vacuum is:**
A. 20 N
B. 0.5 N
C. 1.8 N
D. 2 N

49. **Electric field intensity is 400 V m^{-1} at a distance of 2 m from a point charge. It will be 100 V m^{-1} at a distance?**
A. 50 cm
B. 4 cm
C. 4 m
D. 1.5 m

50. **An electron goes from one equi–potential surface to another along one of the four paths shown below. Rank the paths according to the work done by the electric field, from least to greatest:**



A. 1, 2, 3, 4
B. 1, 3, 4 and 2 tie
C. 4, 3, 2, 1
D. 4 and 2 tie, then 3, then 1

51. **A glass rod rubbed with silk acquires a charge of $+8 \times 10^{-12}$C. The number of electrons it has gained or lost:**
A. 5×10^{-7} (gained)
B. 2×10^{-8} (lost)
C. 5×10^{7} (lost)
D. 8×10^{-12} (lost)

52. **Two point charges "+4q" and "+q" are placed 30 cm apart. At what point on the line joining them the electric field is zero?**
A. 15 cm from the charge q
B. 20 cm from the charge 4q
C. 7.5 cm from the charge q
D. 5 cm from the charge q

53. **+2 C and +6 C two charges are repelling each other with a force of 12 N. If each charge is given –2 C of charge, then the value of the force will be:**
A. 4 N (Attractive)
B. 4 N (Repulsive)
C. 8 N (Repulsive)
D. Zero

54. **The capacitance unit of convenient size is:**
A. farad
B. microfarad
C. kilofarad
D. magafarad

55. **The automobiles wind shield wipers works on:**
A. Electricity
B. Cell
C. Charging and discharging of capacitor
D. Charging and discharging of inductor

56. **The area of plates of 1 farad capacitor separated 8.85mm placed in the air is:**
A. $10^9 m^2$
B. $10^5 m^2$
C. $10^{-9} m^2$
D. $10^{-15} m^2$

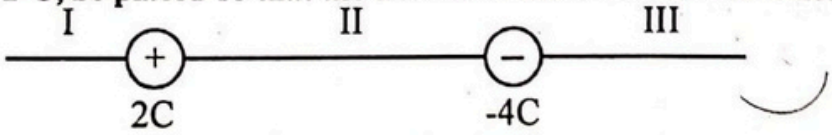
57. **A conducting sphere of radius 0.01m has a charge of 1.0×10^{-9} C deposited on it. The magnitude of the electric field in N/C just outside the surface of the sphere is:**
A. 0
B. 900
C. 90000
D. 4500

58. **10C of charge are placed on a spherical conducting shell. A particle with a charge of –3C is placed at the center of the cavity. The net charge on the inner surface of the shell is:**
A. –7C
B. 0C
C. –3C
D. +3C

59. **The capacitance of parallel plate capacitor is $A\varepsilon_o/d$ can also be written as:**
A. $A/4\pi kd$
B. $A/4\pi d$
C. $kA/4\pi d$
D. $4\pi\varepsilon_o A/d$

60. **The capacitance of a parallel plate capacitor increases from 5 μf to 60 μf when a dielectric is filled between the plates. The dielectric constant of the dielectric is:**
A. 65
B. 55
C. 12
D. 10

61. **Two charged particles are arranged as shown. In which region could a third particle, with charge +1 C, be placed so that the net electrostatic force on it is zero?**



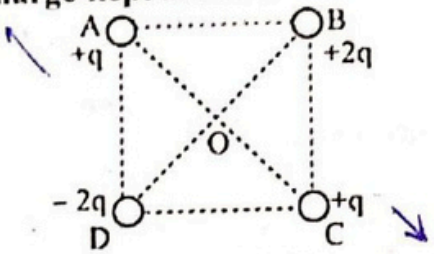
A. I only
B. III only
C. I and II only
D. I and III only

62. **Two positive point charges are 3 m apart and their combined charge is 20 μC. If the force between them is 0.075 N, then the charges are:**
A. 10 μC, 10 μC
B. 15 μC, 5 μC
C. 12 μC, 8 μC
D. 14 μC, 6 μC

63. **Three equal charges are placed on the three corners of a square. If the force between q_1 and q_2 is F_{12} and that between q_1 and q_3 is F_{13}, the ratio of magnitudes $\frac{F12}{F13}$ is:**
A. 1/2
B. 2
C. $1/\sqrt{2}$
D. $\sqrt{2}$

64. **1 joule =**
A. 1.6×10^{-19} eV
B. 1.6×10^{19} eV
C. 6.25×10^{18} eV
D. 6.25×10^{-18} eV

65. **Four charges are arranged at the corners of a square ABCD, as shown in the adjoining figure. The force on the charge kept at the center O is:**



A. zero.
B. along the diagonal BD
C. along the diagonal AC.
D. perpendicular to side AB

66. **A charged particle is placed in an electric field that varies with location. No force is exerted on this charge:**
A. at locations where the electric field is zero
B. at locations where the electric field strength is $1/(1.6 \times 10^{-19})$N/C
C. if the particle is moving along a field line
D. if the particle is moving perpendicularly to a field line

67. **The magnitude of the force of a 400 N/C electric field on a 0.02 C point charge is:**
A. 8.0N
B. 8×10^{-3} N
C. 8×10^{-5} N
D. 0.08N

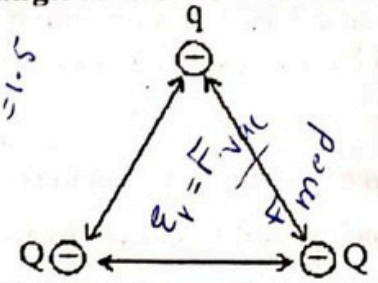
68. **The capacitance of a parallel plate condenser does not depend on:**
A. area of the plates
B. metal of the plates
C. medium between the plates
D. distance between the plates

69. **Two point particles, one with charge $+8 \times 10^{-9}$ C and the other with charge -2×10^{-9} C, are separated by 4m. The electric field in N/C midway between them is:**
A. 9×10^{9}
B. 135, 000
C. 13, 500
D. 22.5

70. **A charged capacitor stores 10C at 40V. Its stored energy is:**
A. 400 J
B. 4 J
C. 0.2J
D. 200J

71. **An air–filled parallel plate capacitor has a capacitance of 1 pF. The plate separation is then doubled and a wax dielectric is inserted, completely filling the space between the plates. As result, the capacitance becomes 2 pF. The dielectric constant of the wax is:**
A. 0.25
B. 0.5
C. 2.0
D. 4.0

72. **Two particles, each with charge Q, and a third particle, with charge q, are placed at the vertices of an equilateral triangle as shown. The total force on the particle with charge q is:**



A. parallel to the left side of the triangle
B. parallel to the bottom side of the triangle
C. parallel to the right side of the triangle
D. perpendicular to the bottom side of the triangle

73. **Two particles A and B have identical charge Q. For a net force of zero to be exerted on a third charged particle it must be placed:**
A. midway between A and B
B. on the perpendicular bisector of the line joining A and B but away from the line
C. on the line joining A and B, not between the particles
D. on the line joining A and B, closer to one of them than the other

74. **Charge is distributed uniformly on the surface of a spherical balloon (an insulator). A point particle with charge q is inside. The electrical force on the particle is greatest when:**
A. it is at the center of the balloon
B. it is halfway between the balloon center and the inside surface
C. it is anywhere inside (the force is same everywhere and is not zero)
D. it is anywhere inside (the force is zero everywhere)

75. **During a lightning discharge, 30 C of charge moves through a potential difference of 1.0×10^8 V in 2.0×10^{-2} s. The energy released by this lightning bolt is:**
A. 1.5×10^{11} J
B. 3.0×10^9 J
C. 6.0×10^7 J
D. 3.3×10^6 J

76. **A 20 μF capacitor is charged to 200V. Its stored energy is:**
A. 4000 J
B. 4 J
C. 0.4J
D. 2000 J

77. **Two small charged objects attract each other with a force F when separated by a distance d. If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to d/2 the force becomes:**
A. F/16
B. F/4
C. F/8
D. F/2

78. **A small object has charge Q. Charge q is removed from it and placed on a second small object. The two objects are placed 1m apart. For the force that each object exerts on the other to be a maximum. q should be:**
A. 2Q
B. Q/2
C. Q
D. Q/4

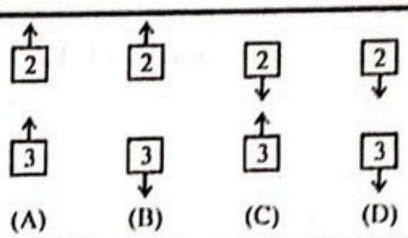
79. **A capacitor is a perfect insulator for:**
A. direct current
B. alternating current
C. both for the direct and alternating current
D. rapidly fluctuating current

80. **In a charged capacitor the energy resides in:**
A. electric field surrounding the capacitor
B. electric field inside the capacitor
C. both "A" and "B"
D. gravitational field

81. **Two metallic spheres of radius 3cm and 6cm get equal quantity of charge. Which has greater surface charge density?**
A. 1st sphere
B. 2nd sphere
C. Both get equal surface
D. Both "A" and "B"

82. **If the distance between the plates of parallel plates capacitor is increased, its potential will:**
A. Remain same
B. decrease
C. increase
D. decreases exponentially

83. **The diagram shows two pairs of heavily charged plastic cubes. Cubes 1 and 2 attract each other and cubes 1 and 3 repel each other:**
Which of the following illustrates the forces of cube 2 on cube 3 and cube 3 on cube 2?



84. **A charge of 0.10C accelerated through a potential difference of 1000V acquires kinetic energy:**
A. 200 J
B. 100 J
C. 10 J
D. 100 eV

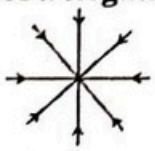
85. **A battery is disconnected after charging the capacitor and then placed a dielectric between the capacitor plates, which of the following quantity will not change:**
A. charge on plates
C. energy stored between plates
B. electric intensity between plates
D. capacitance

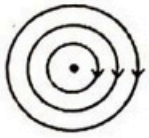
86. **After charging a capacitor, battery is disconnected and a dielectric slab is placed between capacitor plates. Then energy stored in it:**
A. Increases
B. decreases
C. unchanged
D. Both "A" and "B"

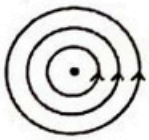
87. **When capacitor is being charged through resistance R, charge on it grows:**
A. Linearly
B. exponentially
C. sinusoidally
D. Both "A" and "B"

88. **Which diagram represents the electric fields of a negative point charge, shown by:**

A. 

B. 

C. 

D. 

89. **A 5 μF capacitor has a potential difference across its plates of 200 volts. The charge on the capacitor is:**
*A. 2.5×10^{-8} C
B. 10^{3} C
C. 10^{-3} C
D. 4×10^{3} C

90. **1kJ work is required to traverse a charged particle through a potential difference of 20V. The magnitude of charge on the particle is:**
A. 20 C
B. 50 C
C. 2000 C
D. 0.2 C

91. **The air between the plates of charged parallel plate capacitor is replaced by a medium of dielectric constant "K". The potential difference between the plate of capacitor becomes:**
A. K times
B. $\frac{1}{K}$ times
C. $\sqrt{K}$ times
D. $\frac{1}{\sqrt{K}}$ times

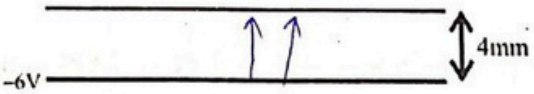
92. **The force experienced by a 10nC charge between parallel plates of a capacitor is 0.001N. If the plates are 1mm apart, the value of potential difference between them is:**
A. 10^{0} V
B. 10^{1} V
C. 10^{2} V
D. 10^{3} V

93. **The rate of change of electric potential with respect to distance is known as:**
A. Electric potential difference
B. Electric potential acceleration
C. Electric potential gradient
D. Electric potential variance

94. **A capacitor of capacitance C has charge Q and stored energy is E. If the charge is increase to 2Q. The stored energy will be:**
A. E/4
B. 2E
C. E/2
D. 4E

95. **A gold nucleus (radius r) is represented by the symbol $^{197}_{79}Au$. Taking e as the elementary charge and ε_o as the permittivity of free space, what is the electric field strength at the surface of an isolated gold nucleus?**
A. Zero
B. $\frac{79e}{4\pi\varepsilon or2}$
C. $\frac{197e}{4\pi\varepsilon or2}$
D. $\frac{79e2}{4\pi\varepsilon or2}$

96. **The large horizontal metal plates are separated by 4 mm. The lower plate is at a potential of –6V:**



What potential should be applied to the upper plate to create an electric field of strength 4000 Vm^{-1} Upwards in the space between the plates?
A. +22 V
B. +10 V
C. –10 V
D. –22 V

97. **The electric potential, at a distance 2 m from a 16 C charge will be:**
A. $\frac{1}{4\pi\varepsilon_o}$ (volts)
B. $\frac{2}{\pi\varepsilon_o}$ (volts)
C. $\frac{4\pi}{\varepsilon_o}$ (volts)
D. Both "A" and "B"

98. **A point charge q produces an absolute potential of 5V at a distance of 1 meter. What will be the absolute potential due to q at a distance of 3 meters?**
A. 15 V
B. 5/9 V
C. 3/5 V
D. 5/3 V

99. **An electron, a proton and an α-particle are displaced through a p.d. of 1V when placed b/w plates of a capacitor. The gain in K.E. will be highest for:**
A. electron
B. proton
C. α-particle
D. equal for all particles

100. **An electron is accelerated from rest through a potential difference of V volts. The gain in its velocity is proportional to:**
A. V
B. $\sqrt{V}$
C. V^2
D. 1/V

101. **A cube of side b has a charge q at each of its vertices. The electric field due to this charge distribution at the centre of the cube is:**
A. $\frac{q}{b^2}$
B. $\frac{q}{2b^2}$
C. $\frac{32q}{b^2}$
D. Zero

102. If the distance between two-point charges to becomes double then the coulomb's force will be

A. $\frac{F}{2}$ B. 2F

C. 4F D. $\frac{F}{4}$

103. The force between two point charges placed in air is F. if air is replaced by a medium of relative permittivity ε_r, the force is reduced to

A. $\varepsilon_r F$ B. $\frac{F}{\varepsilon_r}$

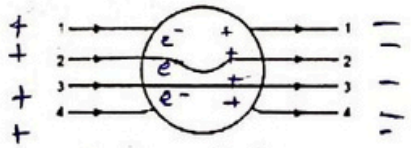
C. $\frac{\varepsilon_r}{F}$ D. ε_r

104. Two point charges are separated by a distance of 4 m. The force between them is 4 N. What is the force between the charges, when the distance between them is 1 m

A. 16 N B. 1 N

C. 64 N D. 32 N

105. A metallic sphere is placed in a uniform electric field. The lines of force follow the path (s) shown in the figure as:



A. 1 B. 2

C. 3 D. 4

106. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is (coulomb)

A. 10^{+19} B. +1.6

C. –1.6 D. 10^{-19}

107. Two point charges +3μC and +8μC repel each other with a force of 40N. If a charge of -5μC is added to each of the, then the force between them will become:

A. –10 N B. +10 N

C. +20 N D. –20 N

108. Two point charges +2 C and +6 C repel each other with a force of 12 N. If a charge of -2 C is given to each of these charges, the force will now be

A. zero B. 8 N (attractive)

C. 8 N (repulsive) D. 16 N (attractive)

109. Relative permittivity of a material is 10, It's absolute or actual permittivity is

A. 8.85×10^{-12} F/m B. 8.85×10^{-11} F/m

C. 9×10^{9} F/m D. 10 F/m

110. Two electrons are removed from a conductor the charge on it is

A. 1.6×10^{-19} C B. 3.2×10^{-19} C

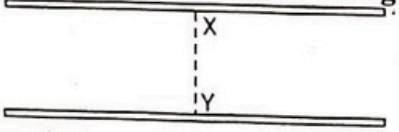
C. -3.2×10^{-19} C D. neutral

111. The magnitude of electric intensity E is such that an electron placed in it would experience an electrical force equal to its weight. E is given by

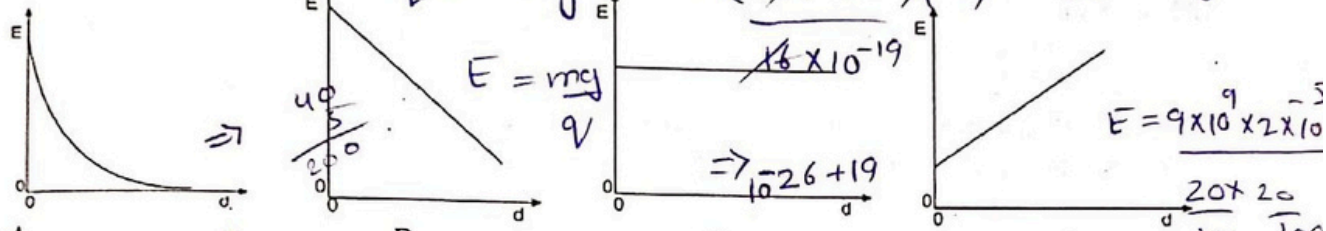
A. mge B. $\frac{e}{mg}$

C. $\frac{mg}{e}$ D. $\frac{e^2 g}{m^2}$

112. An electric field exists in the space between two charged metal plates.



Which graph shows the variation of electric field strength *E* with distance *d* from X along the line XY?



A. B. C. D.

113. The electric field intensity at a point 20 cm away from a charge of $2\times10^{-5}C$ is

A. $4.5\times10^{6}N/C$ B. $3.5\times10^{6}N/C$

C. $3.5\times10^{5}N/C$ D. $4.5\times10^{5}N/C$

114. The weight of proton (mass = 1.67×10^{-27} kg) on entering in a vertical electric field E is balanced by electric force. Then the electric field strength is

A. 10^{-9} V m^{-1} B. 10^{+7} V m^{-1}

C. 10^{-7} V m^{-1} D. 10^{-8} V m^{-1}

115. A hollow sphere of copper is positively charged. Then the electric field inside the sphere is

A. the same as the field at the surface B. less then the field at the surface but not zero

C. greater than the field at the surface D. zero

116. Two metal plates have potential difference of 300 V and are 0.01 m apart. A charged particle of mass 1.96×10^{-15} kg is held in equilibrium between the plates of the capacitor. Then the electric field is

A. 3×10^{2} V m^{-1} B. 3 V m^{-1}

C. 3×10^{4} V m^{-1} D. 3×10^{-4} V m^{-1}

117. The electric field strength between a pair of parallel plates is E. The separation of the plates is doubled and the potential difference between the plates is increased by a factor of four. What is the new electric field strength?

A. *E* B. 2 *E*

C. 4 *E* D. 8 *E*

118. Two plates are 2cm apart. If a potential difference of 10 volt s is applied between the plates. The electric field between the plates will be

A. 20 N/C B. 250 N/C

C. 500 N/C D. 250 N/C

119. Two plates are 1 cm apart and the potential difference between them is 10 volts. The electric field between the plates is

A. 10 N C^{-1} B. 500 N C^{-1}

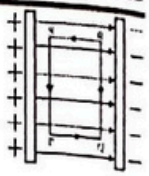
C. 1000 N C^{-1} D. 250 N C^{-1}

120. Electric field strength at a point between oppositely charge plates is E. If the distance between plates is reduced to half, what will be the new value of electric intensity?

A. 4E B. E/2

C. E/4 D. 2E

121. **The amount of work done in joule in carrying a charge +q along the closed path PQRSP between the oppositely charged metal plates is (where E is electric field between the plates)**

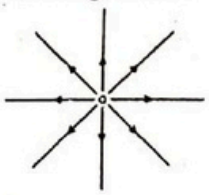


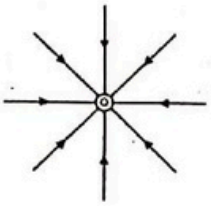
A. Zero
B. $qE(PQ+QR+SR+SP)$
C. q
D. $\frac{q}{\varepsilon_0}$

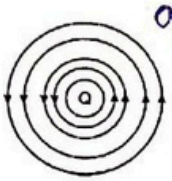
122. **A charged conductor has charge on its**
A. Outside surface
B. Surrounding
C. Middle point
D. Inner surface

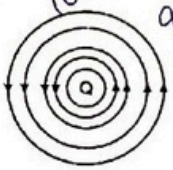
123. **Neutral zone in electric field of two similar charges is region where**
A. Both positive and negative charges are present
B. Equal quantity of both positive and negative charges are present
C. An electric dipole exists
D. No electric field line passes

124. **Which diagram represents the electric field in the vicinity of a positive electric charge of magnitude Q?**

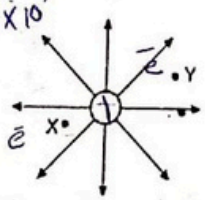

A.


B.


C.


D.

125. **The diagram shows the electric field near a point charge and two electrons X and Y.**
Which row describe the forces acting on X and Y?



	direction of force	magnitude of force on X
A.	radially inwards	less than force on Y
B.	radially inwards	greater than force on Y
C.	radially outwards	less than force on Y
D.	radially outwards	greater than force on Y

126. **A charged particle of mass 0.003 gm is held stationary in space by placing it in a downward direction of electric field of 6×10^4 N/C. Then the magnitude of the charge is**
A. 5×10^{-4}C
B. 5×10^{-10}C
C. -18×10^{-6}C
D. -5×10^{-9}C

127. **Two charged spheres of radii 10 cm and 15 cm are connected by a thin wire. No current will flow, if they have:**
A. The same charge on each
C. The same energy
B. The same potential
D. The same field on their surface

128. **12 J of work is to be done against an existing electric field to take a charge of 0.01 C from A to B. Find The potential difference between B and A.**
A. 120 V
B. 1200 V
C. 1.2 V
D. 12 V

129. **A and B are two points in an electric field. If the work done in carrying 4.0 coulomb of electric charge from A to B is 16.0 joule the potential difference between A and B is**
A. zero
B. 2.0 V
C. 4 V
D. 16V

130. **Potential due to charge q at distance 1m is 5V, at distance 3m will be**

A. $\frac{5}{3}$V B. $\frac{3}{5}$V

C. $\frac{7}{3}$V D. $\frac{3}{7}$V

131. **The electric potential at the surface of an atomic nucleus (Z = 50) of radius 9.0×10^{-15} m is**

A. 9 V B. 9×10^5 V

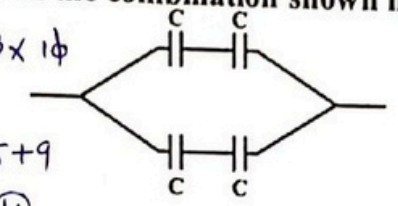
C. 8×10^6 V D. 80 V

132. **A capacitor with air as the dielectric is charged to a potential of 100 volt. If the space between the plate is now filled with a dielectric of dielectric constant 10, the potential difference between the plates will be**

A. 1000 V B. 100 V

C. 10 V D. 0 V

133. **The equation capacitance of the combination shown in the figure is:**



A. $\frac{C}{2}$ B. C

C. 2C D. 4C

134. **Value of potential at a point due to a point charge is**

A. A Inversely proportional to square of the distance

B. Directly proportional to square of the distance

C. Inversely proportional to the distance

D Directly proportional to the distance

135. **When one electron is taken towards the other electron, then the electric potential energy of the system**

A. Decreases B. Increases

C. Remains unchanged D. Becomes zero

136. **Electrostatic force is a _____ force**

A. attractive C. repulsive force

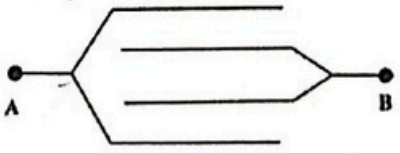
B. may be attractive or repulsive D. none of these

137. **Electrostatic force as compared to the gravitational force is**

A. Very weak B. equal

C. very strong D. half of the gravitational field

138. **Four metallic plates, each having area A, are placed as shown. The distance between the consecutive plates is d. Alternate plates are connected to points A and B. The equivalent capacitance of the system is:**



A. $\varepsilon_o \frac{A}{d}$ B. $2\varepsilon_o \frac{A}{d}$

C. $3\varepsilon_o \frac{A}{d}$ D. $4\varepsilon_o \frac{A}{d}$

139. The capacity of a condenser in which a dielectric of dielectric constant 5 has been used, is C. If the dielectric is replaced by another with dielectric constant 20, the capacity will become

A. $\frac{C}{4}$ B. $4C$

C. $\frac{C}{2}$ D. $2C$

140. A capacitor of capacitance C is connected to battery of emf V_0. Without removing the battery, a dielectric of strength ε_r is inserted between the parallel plates of the capacitor C, then the charge on the capacitor is

A. CV_0 B. $\varepsilon_r CV_0$

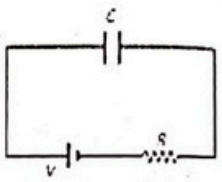
C. $\frac{CV_0}{\varepsilon_r}$ D. none of these

141. The space between the plates of a capacitor is filled by a dielectric constant k. The capacitance of the capacitor

A. increases by a factor k B. increases by a factor k^2

C. decreases by a factor k D. decrease by a factor k^2

142. As in figure shown, if a capacitor C is charged by connecting it with resistance R, then energy is given by the battery will be



A. $\frac{1}{2}CV^2$ B. More than $\frac{1}{2}CV^2$

C. Less than $\frac{1}{2}CV^2$ D. Zero

143. A capacitor of capacitance 2μF is connected with a battery of 12 volt, the charge stored is equal to:

A. 2.5×10^{-5} C B. 2.4×10^{-5} C

C. 2.4×10^{-6} C D. 2.5×10^{5} C

144. If an insulating material called dielectric is introduced between the plates, the capacitance of capacitor is:

A. $\frac{A\varepsilon_o\varepsilon_r}{2d}$ B. $\frac{Ad}{\varepsilon_o\varepsilon_r}$

C. $\frac{A\varepsilon_o\varepsilon_r}{d}$ D. $\frac{2Ad\varepsilon_o\varepsilon_r}{d}$

$C = Q/V$

145. If a 2 μF capacitor has a charge of 20 μC, the potential difference between the plates is:

A. 10 V B. 40 V

C. 20 V D. 50 V

$U = \frac{qV}{2}$

146. Capacitance with air is 10F, if a dielectric of $\varepsilon_r = 100$ is inserted then new capacitance

A. 1000 F B. 10 F

C. 10 μF D. 100 F

147. The energy stored between the plates of a capacitor in not represented by

A. $U = \frac{CV^2}{2}$ B. $U = 2qV$

C. $U = \frac{q^2}{2C}$ D. $U = \frac{qV}{2}$

148. **If the potential difference across the two plates of a parallel plate capacitor is doubled then its energy stored in it will be:**

A. 2 times
B. 16 times
C. 4 times
D. remains same

149. **If there are n capacitors in parallel connected to V volt source, then total energy stored is equal to:**

A. CV
B. $\frac{1}{2}nCV^2$
C. CV^2
D. $\frac{1}{2n}CV^2$

150. **If a 10 F capacitor is to have an energy content of 20 J, it must be placed across a potential difference of**

A. 4 volts
B. 9 volts
C. 2 volts
D. 1 volt

ANSWER KEY

1	D	16	D	31	C	46	D	61	A	76	C	91	B	106	B	121	A	136	B
2	D	17	D	32	A	47	A	62	B	77	B	92	C	107	A	122	A	137	C
3	A	18	C	33	D	48	C	63	B	78	B	93	C	108	A	123	D	138	C
4	B	19	D	34	D	49	C	64	C	79	A	94	D	109	B	124	A	139	B
5	C	20	B	35	A	50	D	65	B	80	B	95	B	110	B	125	B	140	B
6	C	21	B	36	D	51	C	66	A	81	A	96	D	111	C	126	B	141	A
7	D	22	D	37	D	52	B	67	A	82	C	97	B	112	C	127	B	142	B
8	D	23	B	38	D	53	D	68	B	83	C	98	D	113	A	128	B	143	B
9	D	24	D	39	B	54	B	69	D	84	B	99	C	114	C	129	C	144	C
10	A	25	D	40	C	55	C	70	D	85	A	100	B	115	D	130	A	145	A
11	D	26	B	41	B	56	A	71	D	86	B	101	D	116	C	131	C	146	A
12	B	27	D	42	B	57	C	72	D	87	B	102	D	117	B	132	C	147	C
13	C	28	A	43	A	58	D	73	A	88	B	103	B	118	C	133	B	148	C
14	A	29	C	44	B	59	A	74	D	89	C	104	C	119	C	134	C	149	B
15	B	30	B	45	B	60	C	75	B	90	B	105	D	120	D	135	B	150	C

SOLUTIONS

1. $\varepsilon_r = \frac{Fvac}{Fmed} = \frac{Evac}{Emed} = \frac{Vvac}{Vmed} = \frac{Cmed}{Cvac}$
(unit less and dimension less)

2. Electric field exerts force only on charge particles.

3. The charge on a body is integral multiple of a minimum value of charge equal to 1.6×10^{-19} C.

4. Coulomb force is a mutual force.
$\rightarrow F_{12} = - \rightarrow F_{21}$

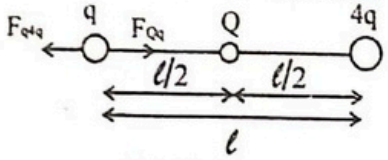
5. $Q = ne$
$n = \frac{Q}{e} = \frac{1}{1.6\times10-19} = 6.25 \times 10^{18}$

6. $E = k\frac{q}{r2} = k\frac{q}{\infty 2} = 0$

7. Let 2d is separation between $+2\mu C$ and $-2\mu C$. Net potential due to both charges at mid way between "P" and "Q" is
$V = V_+ + V_-$
$V = \frac{1}{4\pi\varepsilon o}\frac{q}{d} - \frac{1}{4\pi\varepsilon o}\frac{q}{d} = 0$

8. Coulomb force is a mutual force.
$\rightarrow F_{12} = - \rightarrow F_{21}$

9. Energy $= q\Delta V = (2e)(3V) = 6eV$
$= 6 \times 1.6 \times 10^{-19}\ J = 9.6 \times 10^{-19}\ J$

10. 

$k\frac{(q)(4q)}{l2} = -k\frac{(q)(Q)}{(l/2)2}$
$\frac{4q}{l2} = -\frac{4Q}{l2} \Rightarrow Q = -q$

11. $1\frac{volt}{meter} = 1\frac{(joule)/(coulomb)}{meter}$
$= 1\frac{(newton)\times(meter)/(coulomb)}{meter} = 1\frac{newton}{coulomb}$

12. In S.I units, the value of permittivity of free space is $\varepsilon_o = 8.85 \times 10^{-12}\ C^2\ N^{-1}m^{-2}$

13. $V = k\frac{q}{r} = (9\times10^9)\frac{1\times10-3}{10} = 9 \times 10^5\ V = 900\ kV$

14. $F_P = F_\alpha$
$k\frac{e2}{d2} = k\frac{4e2}{d'2} \Rightarrow d'^2 = 4d^2 \Rightarrow d' = 2d$

15. $\frac{Fair}{Fmed} = \frac{\frac{1}{4\pi\varepsilon o}\frac{q1q2}{r2}}{\frac{1}{4\pi\varepsilon oK}\frac{q1q2}{r2}} = K{:}1$

16. $F = qE = (1.6 \times 10^{-19})(10^6) = 1.6 \times 10^{-13}\ N$

17. The quantity which gives the maximum value of rate of change of potential with distance is known as potential gradient. Potential gradient $= \frac{\Delta V}{\Delta r}$

18. $F_{med} = \frac{Fvac}{\varepsilon r} = \frac{4}{2} = 2N$

19. $t = RC = (5 \times 10^6)(2 \times 10^{-6}) = 10\ s$

20. Capacitive time constant is the time required by the capacitor to deposit 0.63 times the equilibrium charge "q_o" (63% of q_o).

21. Point X, Y and Z lie in the uniform electric field. So, at these points electric force on any charge particle will be same.

22. $E = k\frac{q}{r2} \Rightarrow E \propto \frac{1}{r2}$

As charge is at point "Y", then $r_Q < r_P$

$E_Q > E_P$

23. $F = k\frac{q1q2}{r2} = (9 \times 10^9)\frac{(1)(1)}{(1)2} = 9 \times 10^9\ N$

24. As the charge is same it means that capacitor is charged and battery is disconnected. So, by inserting dielectric (oil) electric field decreases.

ε_r for oil > ε_r for air

$E_{med} = \frac{Evac}{\varepsilon r}$

$E_{air} > E_{oil} \Rightarrow \frac{Eair}{Eoil} > 1$

25. $C = \frac{A\varepsilon o\varepsilon r}{d} \Rightarrow \frac{\varepsilon r}{d}(A\varepsilon_o)$

(thickness of dielectric = separation between the plates = d)

$C_A = \frac{2}{0.1}(A\varepsilon_o) = 20\ (A\varepsilon_o)$

$C_B = \frac{3}{0.2}(A\varepsilon_o) = 15\ (A\varepsilon_o)$

$C_C = \frac{8}{0.4}(A\varepsilon_o) = 20\ (A\varepsilon_o)$

$C_D = \frac{11}{0.5}(A\varepsilon_o) = 22\ (A\varepsilon_o)$

26. $V = Ed$

27. $C = \frac{A\varepsilon o}{d} = \frac{(2 \times 10 - 1)(8.85 \times 10 - 12)}{1 \times 10 - 4} = 17.7 \times 10^{-9}\ F$

$V = \frac{Q}{C} = \frac{40 \times 10 - 7}{17.7 \times 10 - 9} \approx 2 \times 10^2\ V$

28. $C = \frac{Q}{V}$

$1F = \frac{1C}{1V}$

29. $C = \frac{A\varepsilon o}{d}$

$C' = \frac{A\varepsilon o}{2d} = \frac{1}{2}\left(\frac{A\varepsilon o}{d}\right) = C/2$

30. $C = \frac{A\varepsilon o}{d} = \frac{(2\times10-1)(8.85\times10-12)}{1\times10-4} = 17.7\times10^{-9}\,F$

$V = Ed = (2\times10^{6})(1\times10^{-4}) = 2\times10^{2}\,V$

$Q = CV = (17.7\times10^{-9})(2\times10^{2}) \approx 3.5\times10^{-6}\,C$

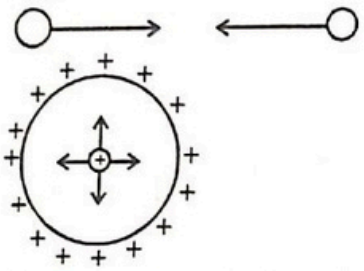
31. Coulomb force is a mutual force.

$\rightarrow F_{XY} = -\rightarrow F_{YX}$

32. $F = k\frac{q1q2}{r2} = (9\times10^{9})\frac{(5)(2)}{(10)2}$

$= 9\times10^{8}$ N towards negative

+5C -2C



33. The vector sum of all the forces acting on a charge placed at the center of the circle is zero.

34. $E = k\frac{q}{r2} = (9\times10^{9})\frac{2\times10-9}{(1\times10-1)2} = 18\times10^{2}\,N/C$

$= 1800N/C$

35. $E = k\frac{q}{r2} \Rightarrow E \propto \frac{1}{r2}$

36. $\Delta V = \frac{W}{q} \Rightarrow q = \frac{W}{\Delta V} = \frac{500}{20} = 25\,C$

37. $K.E. = q\Delta V = 2eV$

38. $V = k\frac{q}{r} \Rightarrow V \propto \frac{1}{r}$

If the charge is placed at the center of concentric spheres. At the surface the distance from the charge is same. So,

= constant (equi-potential)

39. The amount of charge on both plates of the capacitor will be same. If one plate has +Q charge then other will be −Q.

40. $V = k\frac{q}{r} \Rightarrow V \propto q$

41. $Q = ne$

$n = \frac{Q}{e} = \frac{1}{1.6\times10-19} = 6.25\times10^{18}$

42. $E = k\frac{q}{r2} \Rightarrow E \propto q$

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43. $F = k\frac{q1q2}{r2} \Rightarrow r^2 = \frac{kq1q2}{F} \Rightarrow r = \sqrt{\frac{kq1q2}{F}}$

$= \sqrt{\frac{(9\times109)(10\times10-6)(40\times10-6)}{9\times103}} = 2 \text{ cm}$

44. Suppose A and B are positively charged while C and D are negatively charged. As A and C attract each other. So, B and D also attract each other.

45. $C = \frac{A\varepsilon o}{d}$

$C' = \frac{2A\varepsilon o}{2d} = \frac{A\varepsilon o}{d} = C$

46. $E = \frac{\Delta V}{d} \Rightarrow E \propto \Delta V$

$\Delta V_1 = 90V$

$\Delta V_2 = 50V$

$\Delta V_3 = 100V$

$\Delta V_4 = 60V$

$E_2 < E_4 < E_1 < E_3$

47. $W = q\Delta V$

On equi-potential surface

$\Delta V = 0$

$W = 0$

(Electric filed is a conservative field. So, work done along closed path is zero.)

48. $F_{med} = \frac{Fvac}{\varepsilon r}$

$F_{vac} = F_{med}\,\varepsilon_r = (0.3)(6) = 1.8 \text{ N}$

49. $E = k\frac{q}{r2} \Rightarrow E \propto \frac{1}{r2}$

When distance will be doubled, the electric field will be one fourth.

50. $W = q\Delta V \Rightarrow W \propto \Delta V$

$\Delta V_1 = 30V$

$\Delta V_2 = 10V$

$\Delta V_3 = 20V$

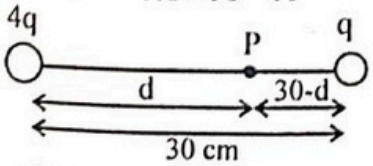
$\Delta V_4 = 10V$

$W_4 = W_2 < W_3 < W_1$

51. $Q = ne$

$n = \frac{Q}{e} = \frac{8\times10-12}{1.6\times10-19} = 5\times10^7 \text{ (lost)}$

52.



$k\frac{4q}{d2} = k\frac{q}{(30-d)2}$

$\frac{4}{d2} = \frac{1}{(30-d)2}$

$$\frac{2}{d} = \frac{1}{(30-d)} \Rightarrow 2(30-d) = d$$

$60 - 2d = d$

$3d = 60 \Rightarrow d = 20$ cm from charge 4q

53. $q_1 = +2C$

$q_2 = +6C$

if $-2C$ is added to both the charges, then

$q_1 = +2C - 2C = 0$

$q_2 = +4C - 2C = +2C$

$$F = k\frac{q1q2}{r2} = 0$$

54. Micro farad is the most convenient unit of C.

55. The automobiles wind shield wipers works on charging and discharging of capacitor.

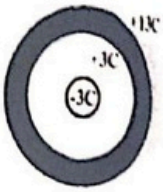
56. $$C = \frac{A\varepsilon o}{d} \Rightarrow A = \frac{Cd}{\varepsilon o} = \frac{(1)(8.85\times10-3)}{8.85\times10-12} = 10^9\ m^2$$

57. $$E = k\frac{q}{r2} = (9\times10^9)\frac{(1\times10-9)}{(1\times10-2)2}$$

$= 9 \times 10^4$ N/C $= 90000$ N/C

58. Now since charge on the inner surface of shell is $-3C$, and total charge of 10 C on the shell should remain conserved, from the principle of conservation of charge, the amount of charge that appears on the outer surface of shell is:

$Q + q = 10 + 3 = +13$ C



59. $$C = \frac{A\varepsilon o}{d} = \frac{A(1/4\pi k)}{d} = \frac{A}{4\pi kd}\left(k = \frac{1}{4\pi\varepsilon o}\right)$$

60. $$\varepsilon_r = \frac{Cmed}{Cvac} = \frac{60}{5} = 12$$

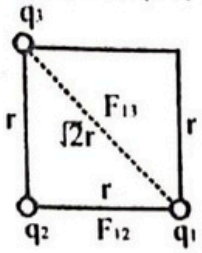
61. The region where electrostatic force is zero is known as field free region. In case of opposite charges the field free region lie outside near the charge having smaller magnitude.

62. $$F = k\frac{q1q2}{r2} \Rightarrow q_1q_2 = \frac{Fr2}{k} = \frac{(75\times10-3)(9)}{9\times109}$$

$= 75 \times 10^{-12}\ C^2 = (15 \times 10^{-6}C)(5 \times 10^{-6}C)$

$= (15\mu C)(5\mu C)$

63.



$$\frac{F12}{F13} = \frac{k\frac{q1q2}{r2}}{k\frac{q1q3}{(\sqrt{2}r)2}} = 2$$

64. $1.6\times10^{-19}\,J = 1eV$

$$1J = \frac{1}{1.6\times10-19}\,eV = 6.25\times10^{18}\,eV$$

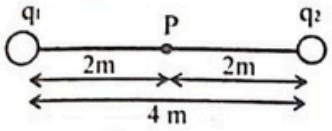
65. If a charge is placed at the center of square, then the vector sum of force along line AC is zero. But the force along the line BD is not zero. So, the net force is along the diagonal BD.

66. The region where electrostatic force is zero is known as field free region.

67. $F = qE = (2\times10^{-2})(400) = 8\ N$

68. $C = \frac{A\varepsilon_o}{d}$

69.



$$E = k\frac{q1}{r12} + k\frac{q2}{r22} = (9\times10^{9})\left(\frac{8\times10-9}{4} + \frac{2\times10-9}{4}\right)$$

$= 9(2+0.5) = 9(2.5) = 22.5\ N/C$

70. $\text{Energy} = \frac{1}{2}qV = \frac{1}{2}(10)(40) = 200\ J$

71. $C = \frac{A\varepsilon o}{d} = 1pF$

$$C' = \frac{A\varepsilon o\varepsilon r}{2d} = 2pF$$

$$\frac{\varepsilon r}{2}\left(\frac{A\varepsilon o}{d}\right) = 2pF \Rightarrow \frac{\varepsilon r}{2}C = 2pF \Rightarrow \varepsilon_r = \frac{2pF}{1pF}\times2 = 4$$

$$\varepsilon_r = \frac{Cmed}{Cvac} = \frac{60}{5} = 12$$

72.

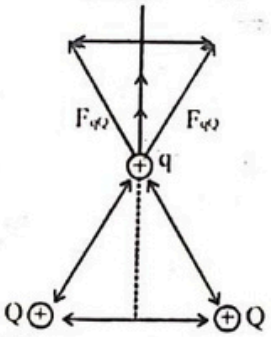


Diagram shows that the net force on q is perpendicular to the bottom side of triangle.

73. The region where electrostatic force is zero is known as field free region. In case of similar and equal charges the field free region lies mid way between the charges.

74. The electric field due to a uniform distribution of charge on a spherical balloon is zero only inside the shell.

75. $\text{Energy} = q\Delta V = (30)(1\times10^{8}) = 30\times10^{9}\ J$

The time period in which this occurs is irrelevant since this is an energy value, not a power value.

76. $\text{Energy} = \frac{1}{2}CV^2 = \frac{1}{2}(20\times10^{-6})(200)^2$

$= (10\times10^{-6})(4\times10^{4}) = 0.4\ J$

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77. $F = k\frac{q1q2}{d2}$

$F' = k\frac{(q1/4)(q2/4)}{(d/2)2} = \frac{1}{4}\left(k\frac{q1q2}{d2}\right) = \frac{F}{4}$

78. When a charges is splitted into two charges. The force between them will be maximum only if the charges are divided into equal magnitudes.
So, $q = Q/2$

79. As the dielectric medium is present between the plates of capacitor. So, DC cannot flow through the capacitor. It behaves like a perfect insulator.

80. In a charged capacitor the energy resides in electric field inside the capacitor.

81. $\sigma = \frac{Q}{A} = \frac{Q}{4\pi r2} \Rightarrow \sigma \propto \frac{1}{r2}$

82. $V = Ed \Rightarrow V \propto d$

83. Cube 1 and 2 have opposite charge while Cube 1 and 3 have same charge. So, cube 2 and 3 attract each other having opposite charge.

84. $K.E. = qV = (0.1)(1000) = 100J$

85. When a dielectric inserted between the plates of charged parallel plates capacitor:
- Charge remains same
- Electric field decreases
- Potential difference decreases
- Capacitance increases
- Energy stored in capacitor decreases

86. When a dielectric inserted between the plates of charged parallel plates capacitor:
- Charge remains same
- Electric field decreases
- Potential difference decreases
- Capacitance increases
- Energy stored in capacitor decreases

87. $q = q_0(1 - e - t/RC)$

88. Field of negative charge point charge is radially inward.

89. $Q = CV = (5\times10^{-6})(200) = 10^{-3}C$

90. $W = qV \Rightarrow q = \frac{W}{V} = \frac{1000}{20} = 50\ C$

91. When a dielectric "K" inserted between the plates of charged parallel plates capacitor:
- Charge remains same
- Electric field becomes 1/K times
- Potential difference becomes 1/K times
- Capacitance becomes K times
- Energy stored in capacitor becomes 1/K times

92. $E = \frac{F}{q} = \frac{10\times10-4}{10\times10-9} = 1\times10^5\ N/C$

$V = Ed = (10^5)(1\times10^{-3}) = 10^2\ V$

93. The quantity which gives the maximum value of rate of change of potential with distance is known as potential gradient.

Potential gradient $= \frac{\Delta V}{\Delta r}$

94. $W = \frac{Q2}{2C}$

$W' = \frac{(2Q)2}{2C} = 4\,W$

95. $E = k\frac{q}{r2} = \frac{1}{4\pi\varepsilon o}\frac{79e}{r2} = \frac{79e}{4\pi\varepsilon o r2}$

96. $V_A - V_B = -Ed$

$V_A + 6 = -(4000)(4\times10^{-3}) = -16$

$V_A = -16 - 6 = -22\ V$

97. $V = k\frac{q}{r} = \frac{1}{4\pi\varepsilon o}\times\frac{16}{2} = \frac{2}{\pi\varepsilon o}$

98. $V = k\frac{q}{r} = kq = 5V$

$V' = k\frac{q}{r'} = \frac{kq}{3} = \frac{5}{3}V$

99. $K.E = q\Delta V \Rightarrow K.E. \propto q$

(For same potential difference)

As

$q_\alpha > q_P = q_e$

100. $\frac{1}{2}mv^2 = eV$

$v^2 = \frac{2eV}{m} \Rightarrow v = \sqrt{\frac{2eV}{m}} \Rightarrow v \propto \sqrt{V}$

101. The electric field of the centre of cube, due to charges gets cancelled so the electric field at the centre is zero.

102. If $r = 2r$

$F = \frac{kq^2}{r^2} \Rightarrow F' = \frac{F}{4}$

103. $F = \frac{kq_1q_2}{r^2}$

$F = \frac{1}{4\pi\in\in_r}\times\frac{q_1q_2}{r^2} \Rightarrow F' = \frac{F}{\in_r}$

104. $F = \frac{kq_1q_2}{r^2} \Rightarrow F \propto \frac{1}{r^2}$

$\frac{F_1}{F_2} = \frac{r_2^2}{r_1^2} = \left(\frac{r_2}{r_1}\right)^2$

$\frac{4}{F_2} = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

$F_2 = 4\times16 = 64\,N$

105. When metallic solid sphere is placed in a uniform electric field, the electrons of the sphere will move against the direction of the electric field. Consequently, the left face of the sphere acquires negative charge while the right face attains positive charge. The field lines will terminate at the left face of sphere and restart from its right face. The electric field inside the sphere is zero. On the surface of the sphere, the field lines are normal at every point i.e., directed towards the centre. Therefore, the correct field line is represented by line 4.

106. In second case, charges will be -2μC and +3μC Since $F \mu Q_1 Q_2$ i.e.

$$\frac{F}{F'} = \frac{Q_1 Q_2}{Q_1' Q_2'} = \frac{40}{F'} = \frac{3\times 8}{-2\times 3} = -4F' = 10\,N(\text{Attractive})$$

107. Because +2C charge will become neutral with -2C charge.

108. $\varepsilon_r = \dfrac{\varepsilon}{\varepsilon_o}$

109. If two electron are removed from a conductor the charge on it is equal to 2 proton

$$q = 2e^+ = 2\times 1.6\times 10^{-19}\,C$$

$$= 3.2\times 10^{-19}\,C$$

110. $F_e = F_g$

$$eE = mg$$

$$E = \frac{mg}{e}$$

111. Electric field between two oppositely charged plates is uniform.

112. $$E = \frac{kq}{r^2} \Rightarrow \frac{9\times 10^9 \times 2\times 10^{-5}}{\left(20\times 10^{-2}\right)^2}$$

$$E = 4.5\times 10^6\, N/C$$

113. $$E = \frac{F}{q} = \frac{mg}{q} = \frac{1.67\times 10^{-27}\times 10}{1.6\times 10^{-19}} = 10^{-7}\, V\, m^{-1}$$

114. $$\phi = \frac{q}{\varepsilon_o} = \frac{0}{\varepsilon_o} = 0$$

$$\phi = \vec{E}.\vec{A} \Rightarrow 0 = \vec{E}.\vec{A}$$

Where $\vec{A} \neq 0,\ \vec{E} = 0$

115. As

$$E = \frac{\Delta V}{\Delta r}$$

$$E = \frac{300}{0.01} = 30000 = 3\times 10^4\, V\, m^{-1}$$

116. $$\vec{E} = \frac{\Delta V}{\Delta r} = \frac{4\Delta V}{2\Delta r}$$

$$E' = 2E$$

117. $$E = \frac{\Delta v}{\Delta r} = \frac{10}{2\times 10^{-2}} = 500\, N/C$$

118. $$E = \frac{\Delta V}{r} = \frac{10/1}{100} = 1000\, N\, C^{-1}$$

119. $E=\frac{V}{d}, d'=\frac{1}{2}d$ at $V=$ constant $\Rightarrow E'=2E$

120. Work done by conservative field is zero in a closed path.

121. A charged conductor has charge always on its surface.

122. In neutral zone no electric field lines passes.

123. Electric field lines are always away from positive charge.

124. Electron experience a force towards positive. $F=\frac{Kq}{r^2}\Rightarrow F\propto\frac{1}{r^2}$

125. By using QE = mg

$$Q=\frac{mg}{E}=\frac{0.003\times10^{-3}\times10}{6\times10^{4}}=5\times10^{-10}C$$

126. Because current flows from higher potential to lower potential.

127. W = QV

$$V=\frac{W}{Q}=\frac{12}{0.01}=1200V$$

128. $\Delta V=\frac{W}{q}=\frac{16}{4}=4V$

129. As we know,

$$V=\frac{kq}{r}$$

$$\frac{V_1}{V_2}=\frac{q_1/r_1}{q_2/r_2}$$

$$V_2=\frac{q_2}{r_2}\times\frac{r_1}{q_1}\times V_1\Rightarrow V_2=\frac{q}{3}\times\frac{1}{q}\times5\Rightarrow V_2=\frac{5}{3}volt$$

130. $V=\frac{1}{4\pi\varepsilon_o}\frac{Ze}{r}$

$$V=\frac{9\times10^{9}\times50\times1.6\times10^{-19}}{9\times10^{-15}}\Rightarrow V=8.0\times10^{6}V$$

131. $C_{med}=\varepsilon_r\times C_{vac}$

$$\frac{Q}{V_{med}}=\varepsilon_r\times\frac{Q}{V_{vac}}$$

$$V_{med}=\frac{V_{vac}}{\varepsilon_r}=\frac{100}{10}=10V$$

132. $C_{eq}=\frac{C}{2}+\frac{C}{2}=C$

133. $V=\frac{1}{4\pi\varepsilon_o}.\frac{Q}{r}\Rightarrow V\propto\frac{1}{r}$

134. Potential energy of the system will be given by $=\frac{(-e)(-e)}{4\pi\varepsilon_o r}=\frac{e^2}{4\pi\varepsilon_o r}$. As r decreases, potential energy increases.

135. Electrostatic force may be attractive or repulsive because charges may be positive or negative.

136. Electrostatic force as compared to the gravitational force is very strong because value of electrostatic constant is greater than gravitational constant.

137. $C_{eq} = \frac{(n-1)A\varepsilon_o}{d} = \frac{(4-1)A\varepsilon_o}{d} = \frac{3A\varepsilon_o}{d}$

138. $C = \frac{K\varepsilon_0 A}{d}; \frac{C_1}{C_2} = \frac{K_1}{K_2} \Rightarrow \frac{C}{C_2} = \frac{5}{20} \Rightarrow C_2 = 4C$

139. As, $Q = CV$ □ also $C = \varepsilon_r C$ and $V = V_0$ then $Q = \varepsilon_r CV_0$

140. $C_{med} = \frac{A\varepsilon_o k}{d} \Rightarrow C_{med} \propto k$

141. Energy stored in a capacitor and some loss of energy in the form of heat in resistance.

142. $Q = CV$

$Q = 2\times10^{-6}\times12$

$Q = 2.4\times10^{-5}\ C$

143. $C = \frac{A\varepsilon_o\varepsilon_r}{d}$

144. $Q = CV$

$V = \frac{Q}{C} = \frac{20\times10^{-6}}{2\times10^{-6}} = 10\ volt$

145. As,

$C_{med} = \varepsilon_r \times C_{vac}$

$C = 100\times10$

$C = 1000\,F$

146. As we know,

$U_m = \frac{1}{2}CV^2 = \frac{Q^2}{2C} = \frac{qV}{2}$

$but\ U_m \neq 2qV$

147. $E = \frac{1}{2}CV^2 \Rightarrow E \propto V^2$

$V' = 2V$

$E' = 4E$

148. Energy stored $= \frac{1}{2}(C_{eq})V^2 = \frac{1}{2}nCV^2$

149. As we know,

$E = \frac{1}{2}CV^2$

$V = \sqrt{\frac{2E}{C}}$

$V = \sqrt{\frac{2\times20}{10}} \Rightarrow V = \sqrt{4} = 2\ volt$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **The electrostatic force between two point charges is independent of one of the following quantities:**
   A. Magnitude of charges
   B. Temperature of the charges
   C. Distance between charges
   D. Medium between charges

2. **If the distance between two equal charges is reduced to half and the magnitude of charges is also decreased to half, then the force between them will be:**
   A. remain same
   B. decreased to half
   C. increased to double
   D. becomes four time

3. **The concept of electric field was introduced by:**
   A. Coulomb
   B. Faraday
   C. Gauss
   D. Ampere

4. **The number of electrons or protons which constitutes a charge of one coulomb is:**
   A. 6.25×10^{-18}
   B. 6.25×10^{18}
   C. 6.25×10^{-19}
   D. 6.25×10^{19}

5. **For static electricity the value of relative permittivity is always:**
   A. Zero
   B. Less than one
   C. Equal to one
   D. Greater than one

6. **A metallic charged sphere is placed in uniform electric field E, the electric field inside the sphere will be:**
   A. E
   B. Less than E
   C. Greater than E
   D. Zero

7. **The electric intensity E at a point in a field due to a dipole depends upon distance 'r' the relationship between them is:**
   A. $E \propto r$
   B. $E \propto \frac{1}{r}$
   C. $E \propto \frac{1}{r^2}$
   D. $E \propto \frac{1}{r^3}$

8. **The dipole moment is defined as the product of:**
   A. Charge and distance
   B. Charge and displacement
   C. Charge and force
   D. Charge and electric field

9. **Debye is the unit of:**
   A. Electric field
   B. Electric charge
   C. Lines of force
   D. Dipole moment

10. **The electric flux is maximum when angle 'θ' between area vector and electric intensity is:**
    A. 0°
    B. 45°
    C. 60°
    D. 90°

11. **Electric flux is independent of one of the following quantities:**
    A. Charge
    B. Medium
    C. Field
    D. Distance

12. **The dimension of an electric potential is same as that of:**
A. Work
B. Work per unit charge
C. Electric field per unit charge
D. Electric force per unit charge

13. **Electron volt is the unit of:**
A. Energy
B. Charge
C. Current
D. Electric potential

14. **The energy of an electron which accelerates through a potential difference of 1000 V is:**
A. 1.6×10^{-22} J
B. 1.6×10^{-20} J
C. 1.6×10^{-19} J
D. 1.6×10^{-16} J

15. **The unit of surface charge density is:**
A. cm
B. C m^{-1}
C. C m^{2}
D. C m^{-2}

16. **Capacitance of a capacitor does not depend upon:**
A. Area of plate
B. Distance between plates
C. Medium between plates
D. Material of the plates

17. **In the presence of dielectric material, the electric field between the plates of the capacitor will be:**
A. Zero
B. Remain same
C. Decreased
D. Increased

18. **When the potential difference across the capacitor is decreased by dielectric then the capacitance of the capacitor will be:**
A. Zero
B. Remain same
C. Decrease
D. Increase

19. **The unit of product of resistance and capacitance is equal to unit of:**
A. Time
B. Work
C. Potential difference
D. Current

20. **A capacitor is approximately full charged after:**
A. Two time constant
B. Three time constant
C. Four time constant
D. Five time constant

ANSWER KEY

1	B	6	D	11	D	16	D
2	A	7	C	12	B	17	C
3	B	8	A	13	A	18	D
4	B	9	D	14	D	19	A
5	D	10	A	15	D	20	D

KPK TEXT BOOK EXERCISE MCQs

1. **A charge Q is divided into two parts q and Q-q and separated by a distance R. The force of repulsion between them will be maximum when:**

   A. $q = Q/4$
   B. $q = Q/2$
   C. $q = Q$
   D. None of these

2. **Some charge is being given to a conductor. Then its potential:**

   A. Is maximum at surface
   B. Is maximum at centre
   C. Is remain same throughout the conductor
   D. Is maximum somewhere between surface and centre

3. **Electric potential of earth is taken to be zero because the earth is good:**

   A. Semiconductor
   B. Insulator
   C. Conductor
   D. Dielectric

4. **A proton is about 1840 time heavier than an electron. When it is accelerated by a potential difference if 1 kV, its kinetic energy will be:**

   A. 1840 keV
   B. 1 keV
   C. 1/1840 keV
   D. 920 keV

5. **A capacitor is charged with a battery and then it is disconnected. A slab of dielectric is now inserted between the plates, then:**

   A. The charge in the plates reduces and potential difference increase
   B. Potential difference between the plates increase, stored energy decreases and charge remains the same
   C. Potential difference between the plates decreases, stored energy decreases and charge remains unchanged
   D. None of the above

6. **A one microfarad capacitor of a TV is subjected to 4000 V potential difference. The energy stored in capacitor is:**

   A. 8J
   B. 4×10^{-3}J
   C. 16J
   D. 2×10^{-3}J

7. **The electric potential between two points A and B is ΔV. The work done W by the field in moving a charge q from A to B is:**

   A. $W = -q\Delta V$
   B. $W = -\Delta V / q$
   C. $W = q\Delta V$
   D. $W = \Delta V / q$

8. **The electric flux through the surface of a sphere due to a charge q placed at its centre depends upon:**

A. the radius of the sphere
B. the quantity of charge outside the sphere
C. the surface area of the sphere
D. the quantity of charge inside the sphere

$\phi_e = \frac{1}{\varepsilon_0} \times q$

9. **Two parallel, metal plates are a distance 8.00m apart. The electric field between the plates is uniform, directed toward the right, and has a magnitude of 4.00 N/C. If an ion of charge +2e is related at rest at the left-hand plate, what is its kinetic energy when it reaches the right-hand plate?**

A. 4 eV
B. 32 eV
C. 64 eV
D. 16 eV

ANSWER KEY

1	B	6	A
2	C	7	C
3	C	8	D
4	B	9	C
5	C		

$E = \frac{V}{d} = V = Ed \Rightarrow$ V = 32

Q d = 8m

E = 4NC⁻¹

q = +2e

$\Delta K \cdot E = q\Delta V$

$\Delta K \cdot E = 2 \times 32 eV$

$C = \frac{A\varepsilon_0}{d}$

$C = \frac{2 \times 8.85 \times 10^{-12}}{2 \times 10^{-3}}$

PAST PAPERS 2008-2020

1. **Resistance in "RC" circuit of time constant 2 seconds in 1000 ohms. What is value of "C" in the circuit?** (UHS 2008)

A. 2 μ farad
B. 20 μ farad
C. 200 μ farad
D. 2000 μ farad

2. **A particle carrying charge of 2e falls through a potential difference of 3.0 V. Calculate the energy required by it:** (UHS 2009)

A. 9.6×10^{-19} J
B. 9.1×10^{19} J
C. 1.6×10^{-19} J
D. 6×10^{19} J

3. **Work done in moving a unit positive charge from one point to another against the electric field is measured of:** (UHS 2009)

A. capacitance
B. Potential difference between two points
C. Intensity of electric field
D. Resistance between two points

4. **Electric intensity is a vector quantity and its direction is:** (UHS 2010)

A. Perpendicular to the direction of field
B. Opposite to the direction of force
C. At a certain angle
D. Along the direction of force

5. **The magnitude of an electric field between two separated plates can be calculated by the relation:** (UHS 2010)

A. $\Delta V = Ed$
B. $\Delta V = \frac{E}{d}$
C. $\Delta V = \frac{E}{qo}$
D. $E = \frac{d}{\Delta V}$

6. **The unit of electric flux is:** (UHS 2010)

A. $Nm^2 C^{-2}$
B. $Nm^2 C^{-1}$
C. $Nm\ C^{-1}$
D. $Nm\ C^{-2}$

7. **What will be the effect on the capacitance of a capacitor if area of each plate is doubled with separation between the plates is halved?** (UHS 2012)

A. Capacitance remains same
B. Capacitance becomes double
C. Capacitance becomes four times
D. Capacitance reduces of half

8. **10 V potential difference is applied across the plates of 1 F capacitor. What is the energy stored in capacitor?** (UHS 2012)

A. 0.5 mJ
B. 0.05 mJ
C. 5 J
D. 50 J

9. **What is the charge stored on a 5μF capacitor charged to the potential difference of 12V?** (UHS 2013)

A. 60 μC
B. 2.4 C
C. 2.4 μC
D. 60 C

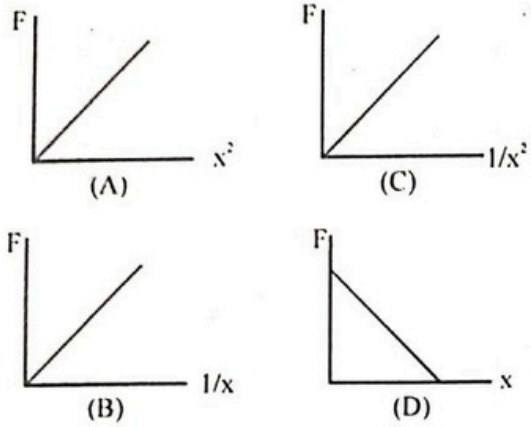
10. **The distance between the plates of a parallel plate capacitor is 2.0 mm and area of each plates is 2.0 m^2. A potential difference of 1.0×10^{-4} V is applied across the plates. Find the capacitance.** (UHS 2014)

A. 4×10^4 F
B. 3.54×10^9 F
C. 8.85×10^{-9} F
D. 9.0×10^{-4} F

11. If the length, width and separation between the plates of a parallel plate capacitor is doubled then its capacitance becomes: (UHS 2016)

A. Double
B. Half
C. Four time
D. Eight time

12. A point charge at a distance "x" from another point charge experiences a force of repulsion, which one of the following graphs shows. How the force is related to "x": (UHS 2017)



13. The Coulomb force between two charges $q_1 = 1$ C and "q_2" is 2N, the distance between charges is 3m. What is the charge of q_2? (UHS 2017)

A. 1×10^9C
B. 1×10^{-9}C
C. 2×10^{-9}C
D. 4×10^9C

14. The electric field strength at the position $\rightarrow r = (4\hat{i} + 3\hat{j})$ m caused by a point charge of 5μC placed at origin is: (UHS 2017)

A. $(1240\hat{i} + 1280\hat{j})$ N/C
B. $(1440\hat{i} + 1080\hat{j})$ N/m
C. $(1440\hat{i} + 1080\hat{j})$ V/m
D. $(1440\hat{i} + 1080\hat{j})$ N/C

15. Coulomb's law is given by the formula $F = k\frac{q1q2}{r2}$.

The magnitude of "k" having the unit of N m^2 C^{-2} for free space is equal to: (UHS 2018)

A. 9×10^7
B. 10×10^9
C. 9×10^9
D. 6×10^7

16. Electric potential due to 2 μC charge at distance of one meter is equal to: (UHS 2019)

A. 1.8×10^9 V
B. 18×10^4 V
C. 1.8×10^4 V
D. 1.8×10^6 V

17. Force experienced per unit positive charge at a point in an electric field is the definition of: (UHS 2018)

A. Electric potential energy
B. Electric potential
C. Electric field strength
D. Electric field

18. Electric field strength of a point charge is "E" and electric potential is "V" at a distance "r" from the point charge. What is the electric potential at a point for the same point charge where electric field strength is E/4? (UHS 2019)

A. V/4
B. 4V
C. V/2
D. 2V

19. A particle carrying a charge of 5e falls through a potential difference of 25 V. what would be energy acquired by the particle in "J": (UHS 2019)

A. 125×10^{-19} J
B. 1.6×10^{-19} J
C. $125 \times 1.6 \times 10^{-19}$ J
D. 125 J

20. **Electric field strength at a point between oppositely charged plates is "E". If the distance between plates is reduced to half, what will be the new value of electric intensity?** (UHS 2019)

A. 4E
B. E/2
C. E/4
D. 2E

21. **If the potential at a point which is 1m from a charge is 1volt, then the potential at a point which is 2m from the same charge will be:** (PMC 2020)

A. 2V
B. 1V
C. 0.5V
D. 3V

22. **The values of electric intensity will _____ due to the presence of dielectric medium:** (PMC 2020)

A. Increase
B. Increase Exponentially
C. Decrease
D. Remains Same

ANSWER KEY

1	D	6	B	11	A	16	C	21	C
2	A	7	C	12	C	17	C	22	C
3	B	8	D	13	C	18	C		
4	D	9	A	14	C	19	C		
5	A	10	C	15	C	20	D		

SOLUTION

1. $RC = t$

$$C = \frac{t}{R} = \frac{2}{1000} = 2\times10^{-3}\ F = 2000\times10^{-6}\ F = 2000\ \mu F$$

2. $\text{Energy} = q\Delta V = (2e)(3V)$

$$= 6\ eV = 6\ (1.6\times10^{-19}\ J) = 9.6\times10^{-19}\ J$$

3. $$\Delta V = \frac{W}{qo}$$

4. $$\rightarrow E = \frac{\rightarrow F}{q}$$

Electric intensity has direction along the direction of force.

5. $$E = \frac{\Delta V}{d} \Rightarrow \Delta V = Ed$$

6. $\Phi_e = EA$

Units of "Φ" $= NC^{-1}m^2$

7. $$C = \frac{A\varepsilon o}{d}$$

$$C' = \frac{(2A)\varepsilon o}{d/2} = 4\left(\frac{A\varepsilon o}{d}\right) = 4C$$

8. $$\text{Energy} = \frac{1}{2}CV^2 = \frac{1}{2}(1)(10)^2 = 50\ J$$

9. $Q = CV = (5\ \mu F)(12V) = 60\ \mu C$

10. $$C = \frac{A\varepsilon o}{d} = \frac{(2)(8.85\times1012)}{(2\times103)} = 8.85\times10^{-9}\ F$$

11. $$C = \frac{A\varepsilon o}{d} = \frac{(L)(w)\varepsilon o}{d}$$

$$C' = \frac{((2L)(2w))\varepsilon o}{2d} = 2\left(\frac{(L)(w)\varepsilon o}{d}\right) = 2C$$

12. $$F = k\frac{q1q2}{x2} \Rightarrow F \propto \frac{1}{x2}$$

Force of repulsion is directly proportional to $1/x^2$. So, the graph between "F" and "$1/x^2$" will be straight line.

13. $$F = k\frac{q1q2}{r2} \Rightarrow q_2 = \frac{Fr2}{kq1} = \frac{(2)(3)2}{(9\times109)(1)} = 2\times10^{-9}\ C$$

14. $$\rightarrow E = k\frac{q}{r2}\hat{r} = k\frac{q}{r3}\rightarrow r$$

$$= (9\times10^9)\frac{5\times10-6}{(\sqrt{42+32})3}(4\hat{i}+3\hat{j})$$

$$= (9\times10^9)\frac{5\times10-6}{125}(4\hat{i}+3\hat{j})$$

$$= 360\ (4\hat{i}+3\hat{j}) = (1440\hat{i}+1080\hat{j})\ V/m$$

15. $$k = \frac{1}{4\pi\varepsilon o} = 9\times10^9\ N\ m^2\ C^{-2}$$

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16. $V = k\frac{q}{r} = (9 \times 10^9)\frac{2\times10-6}{1} = 1.8 \times 10^4\ V$

17. $\rightarrow E = \frac{\rightarrow F}{q}$

18. $E = k\frac{q}{r2}$ and $V = k\frac{q}{r}$

$E \propto \frac{1}{r2}$ and $V \propto \frac{1}{r}$

If r' = 2r, then

E' = E/4 and V' = V/2

19. Energy = $q\Delta V = (5e)(25V)$

$= 125eV = 125 \times 1.6 \times 10^{-19}\ J$

20. $E = \frac{V}{d} \Rightarrow E \propto \frac{1}{d}$

E' = 2E

21. $V \propto \frac{1}{r}$

22. Due to electric polarization of dielectrics the electric field intensity decreases between the plates of a parallel plate capacitor.

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PMC PAST PAPER 2022 (ELECTROSTATICS)

Q.1 Work on charge is equipotential surface is

A. +ve B. -ve
C. Zero D. None

Q.2E normous amount of capacitance is

A. 1 F B. 3 F
C. 5 F D. 7 F

Q.3C apacitance of spherical capacitor is

A. $4\pi \epsilon_0 R$ B. $2\pi \epsilon_0 R$
C. 4π D. $4R$

Q.4A quantity which is related to both N/C and V /m is:

A. Electric intensity B. Electric force
C. electric charge D. electric current

Q.5E lectric intensity at the centre of uniformly distributed charge is

A. Zero B. Kq/r^2
C. q/r^2 D. q/ε

Q.6I f two-point charges of charge q_1 and q_2 are placed at distance d. The force between them is proportional to:

A. d B. d^2
C. 1/d D. $1/d^2$

Q.7Y ou have two identical capacitors. They can be connected in series or in parallel. If you want the smallest equivalent capacitance for the combination, how should you connect them?

A. In parallel
B. In series
C. Either way because both combinations have the same capacitance
D. We cannot determine, because presence of resistance in the circuit determines capacitance

Q.8T he unit of electric flux density is:

A. N/C B. V/m
C. Nm D. A and B

Q.9A capacitor of capacitance C is connected with resistance R. The time constant of the circuit would be:

A. RC B. R / C
C. eRC D. R+C

Q.10 What is the change in kinetic energy of a proton when it is accelerated through a potential difference of 2MV?

A. 0.32 μJ B. 0.32 nJ
C. 0.32 pJ D. 0.32 Fj

Q.11 The energy stored in a parallel plate capacitor is 3J. What is the capacitance of the capacitor if the potential difference between the plates is 220V?

A. 124μF B. 660 μF
C. 75 μF D. 124 mF

Q.12 Two capacitors if we connect in Series are placed in

A. side by side B. end to end
C. both D. None of these

Q.13 Change in potential energy per unit charge between two points
A. Potential difference
B. Electric potential
C. electric field
D. potential energy

Q.14 Force exerted by a unit charge is
A. Electric flux density
B. Charge density
C. electric field intensity
D. electric potential

Q.15 parallel plate capacitor's capacitance depends
A. dielectric constant
B. Area of each plate
C. Distance between plate
D. All

Q.16 What happen to capacitance when dielectric is introduced?
A. increase
B. decrease
C. remain constant
D. None

Q.17 The unit of capacitance is
A. watt
B. henry
C. farad
D. Joule × meter

Q.18 Force per unit charge is
A. Electric field
B. Electric force
C. Electric Intensity
D. Electric potential

Q.19 The formula of capacitance of parallel plate capacitance
A. $\frac{A\epsilon_o}{d}$
B. $\frac{q}{v}$
C. both
D. None

Q.20 The P.E per unit charge is equal to
A. Potential difference
B. Current
C. electric field intensity
D. potential gradient

Q.21 SI unit of permittivity of free space is
A. C/N-m
B. N=m/c^2
C. C^2/N-m^2
D. C^2/N-m^2

Q.22 For n numbers of Capacitors, each of the capacitance is "C" what will be the ratio between maximum and minimum capacitor
A. n^2
B. n^1
C. n^3
D. n^4

Q.23 An 8microF capacitor is connected in series with a 0.5 mega ohm resistor. The DC voltage supply is 200V. Calculate the time constant.
A. 1s
B. 2s
C. 3s
D. 4s

Q.24 The SI unit of electric intensity
A. volt / metre
B. newton –coulomb
C. volt / metre^2
D. volt x metre

Q.25 The force per unit charge is known as
A. Electric flux
B. Electric intensity
C. Electric potential
D. All of above are same

Q.26 An electric charge at rest produces
A. Only a magnetic field
B. Only an electric field
C. Neither electric field nor magnetic field
D. Both electric and magnetic fields

Q.27 The units of electric intensity are:
A. Volt / meter or newton / coulombB
B. Volt / meter or meter / coulomb
C. Volt / coulomb or newton / coulomb
D. Joule / meter or newton / coulomb

Q.28 The ratio of electric force to gravitational force ———— is always:

A. greater than unity
B. less than unity
C. equal to unity
D. zero

Q.29 Two same charges are placed a certain distance apart in air. If a brass plate is introduced between them, the force between them will be

A. Increases
B. Decrease
C. Remain same
D. Not predicted

Q.30 If capacitance is 4F and we insert a dielectric medium of permittivity 8 is introduce between the plates of the capacitor, what will be capacitors?

A. 4F $C = 4F$
B. 8F
C. 32F $\varepsilon_r = 8$
D. None $C =$

Q.31 Electric force and electric field intensity for a charge are

A. Parallel to each other
B. Opposite to each other
C. Perpendicular to each other
D. At any orientation

Q.32 Electric fields lines emerge from

A. Negative charge
B. Positive charge
C. Both
D. None

Q.33 A charge Q placed at the centre of two charges + q and + q. the system is in equilibrium then net force experienced by Q.

A. Zero
B. F
C. At equilibrium, net force will be zero
D. F/2

Q.34 In series combination of capacitors

A. $C_1 + C_2 + C_3$
B. $\frac{C_1 C_2}{C_1 + C_2}$
C. $\frac{C_1 + C_2}{C_1 C_2}$
D. $\frac{1}{C_1 + C_2 + C_3}$

Q.35 Unit of charge

A. Ohm
B. coulomb
C. ampere
D. Tesla

Q.36 Value of Permittivity in Free Space

A. $8.85 \times 10^{-12}\ C^2/Nm^2$
B. $9 \times 10^9\ Nm^2/C^2$
C. $8.85 \times 10^{12}\ C^2/Nm^2$
D. $6.67 \times 10^{-11}\ C^2/Nm^2$

Q.37 Work done per unit coulomb is equal to

A. electric field
B. magnetic field
C. electric potential
D. None

Q.38 Electric charges measured by

A. Coulomb
B. Newton
C. Faraday
D. None

Q.39 E=F/q is the formula for?

A. Electrical field strength
B. Electrical field intensity
C. Both of them
D. None of them

Q.40 Force acting on a positive charge is always:

A. in the direction opposite to electric field
B. in the direction of electric field
C. in the direction perpendicular to electric field
D. in the direction perpendicular to the velocity of charge

Q.41 Electric potential difference can be defined as:
A. $\Delta V = \Delta U - q$ B. $\Delta V = \Delta U / q$
C. $\Delta V = \Delta U + q$ D. $\Delta V = \Delta U * q$

Q.42 You have three capacitors, each of 3 μC. In which of the following combinations of the three capacitors, the resultant capacitance is 9μC?
A. all three capacitors in series B. two capacitors are in series, one in parallel
C. two capacitors are in parallel, one in series D. all three capacitors in parallel

Q.43 Force on a static charge q in uniform electric field E is
A. qE B. -qE
C. qE^2 D. $-qE^2$

Q.44 The study of electric charges at rest in electric field is known as:
A. electromagnetism B. electrostatics
C. quantum physics D. magnetism

Q.45 If a particle has charge q is accelerated through a potential difference V., then energy acquired by the particle is:
A. V/2 B. V/ q
C. qV /2 D. qV

Q.46 A particle carrying a charge 3e, accelerates through a potential difference of 2V. The energy acquired by it is:
A. 6eV B. 1.5eV
C. 0.66eV D. 12eV

Q.47 If the magnitude of charges on two-point objects and the distance between them is doubled, then force will be:
A. two times B. four times
C. unchanged D. halved

Q.48 The electron volt is the unit of:
A. electric current B. electric potential
C. electric energy D. electric flux

Q.49 You have three capacitors and a battery. In which of the following combinations of the three capacitors is the maximum possible energy stored when the combination is attached to the battery?
A. in parallel
B. in series
C. either way because both combinations have the same capacitance
D. we cannot determine, because presence of resistance in the

Q.50 The electric field inside a spherical shell of uniform surface charge density is
A. Zero B. Infinite
C. Constant less than zero D. Directly proportional to distance

Q.51 Two-point charges attract each other with an electric force of magnitude F. If the charge on one of the particles is reduced to one-half its original value and the distance between the particles is doubled, what is the resulting magnitude of the electric force between them?
A. F B. F/2
C. F/4 D. F/8

Q.52 A positive point charge q1 creates an electric field of magnitude E1 at a spot located at a distance r1 from the charge. The charge is replaced by another positive point charge q2, which creates a field of magnitude E2 = E1 at a distance of r2 = 2r1. How is q1 related to q2?
A. q2 = 4 q1 B. q2 = 2 q1
C. q2 = 0.5 q1 D. q2 = 0.25 q1

Q.53 The value of coulomb constant is:

A. 9×10^9 Nm
B. 9×10^9 Nm^2/C^2
C. 9×10^{-9} Nm^2/C^2
D. 9×10^{-9}Nm^2

Q.54 A capacitor stores charge Q at a potential difference ΔV. What happens if the voltage applied to the capacitor by a battery is doubled to 2 ΔV?

A. the capacitance falls to half its initial value, and the charge remains the same
B. the capacitance and the charge both fall to half their initial values
C. the capacitance and the charge both double
D. the capacitance remains the same, and the charge Doubles

Q.55 Electric intensity at the centre of uniformly distributed charge is

A. Zero
B. Kq/r^2
C. q/r^2
D. q/ε

Q.56 A charge is moving with velocity v, it enters a uniform magnetic field B The direction of v is perpendicular to B What is the path of the charge particle inside the magnetic field?

A. parabolic
B. circular
C. parallel to v
D. parallel to E

Q.57 A capacitor can store its energy in its:

A. magnetic field
B. parallel plate
C. electric field
D. coil

Q.58 The electric potential at infinite distance is:

A. infinity
B. zero
C. positive
D. negative

Q.59 If the potential difference across the two plates of a parallel plate capacitor i doubled, then energy stored in the capacitor would be:

A. remains same
B. two times
C. four times
D. three times

Q.60 If peak Voltage across a full wave rectifier is 20V then V_{rms} is

A. 7.07
B. 14.14 V
C. 16.8V
D. 12V

Q.61 Force acting on a positive charge is always:

A. In the direction opposite to electric field
B. In the direction of electric field
C. In the direction perpendicular to electric field
D. In the direction perpendicular to the velocity of charge

Q.62 Electric potential difference can be defined as:

A. $\Delta V = \Delta U - q$
B. $\Delta V = \Delta U / q$
C. $\Delta V = \Delta U + q$
D. $\Delta V = \Delta U * q$

Q.63 Force on a static charge q in uniform electric field E is

A. qE
B. –qE
C. qE^2
D. $-qE^2$

Q.64 If the line frequency is 50 Hz, the output frequency of bridge rectifier is
A. 50Hz
B. 100Hz
C. 200Hz
D. 150Hz

Q.65 The coulomb constant is defined as:
A. $1 / (4\pi\varepsilon_o)$
B. $4\varepsilon_o / (\pi)$
C. $4\pi\varepsilon_o$
D. $\pi\ \varepsilon_o / (4)$

Q.66 The electric potential difference between two points A and B in an electric field can be defined as:
A. Work done in carrying a unit positive charge from infinity to B while keeping the charge in equilibrium.
B. work done in carrying a unit positive charge from A to infinity while keeping the charge in equilibrium.
C. work done in carrying a unit positive charge from A to B while keeping the charge in equilibrium.
D. work done in carrying a unit positive charge from A to B

Q.67 The energy stored in a parallel plate capacitor is 24 J. What is the potential difference between the plates if the capacitance of the capacitor is 3 μF
A. 4 kV
B. 16 kV
C. 54 kV
D. 8 kV

Q.68 Farad is defined as:
A. newton / volt
B. coulomb / volt
C. coulomb / joule
D. coulomb / newton

Q.69 A capacitor stores 5.3 x 10^{-5} C of charge when connected to a 6.0-V battery. How much charge does the capacitor store when connected to a 9.0-V battery?
A. 79.5 μC
B. 35.3 μC
C. 79.5 pC
D. 35.3 pC

Q.70 Object A has a charge of 15 mC, and object B has a charge of 10 mC Which statement is true about the electric forces on the objects?
A. FAB = -3 FBA
B. FAB = - FBA
C. 3 FAB = - FBA
D. -3 FAB = 2 FBA

Q.71 Electrostatic force is
A. Non-conservative
B. Conservative
C. depends on shape of charge
D. None of these

Q.72 Consider a negative point charge is moving along a straight-line path directly toward a stationary positive point charge. Which aspect(s) of the electric force on the negative point charge will remain constant as it moves?
A. direction
B. magnitude
C. both direction and magnitude
D. neither direction and magnitude

Q.73 Electric field lines
A. never cross each other
B. can cross each other
C. depends on shape of charge
D. Not enough information

Q.74 One coulomb charge is carried by:
A. 6.25 x 10^{+18}
B. one electron
C. one proton
D. 1.6 x 10^{+19}

Q.75 An electron is held within electric field What happens when electron is released?
A. it moves in the direction of electric field
B. it accelerates in the direction of electric field
C. it moves in the direction opposite to electric field
D. it accelerates in the direction opposite to electric field

Q.76 The force between two charges Q and q, separated by a distance d is F. What will be the force between them when distance between them is d/2?

A. 4F
B. 2F
C. F
D. F/2

Q.77 You have three capacitors, each of 2 μC In which of the following combinations of the three capacitors, the resultant capacitance is 6μC?

A. all three capacitors in series
B. two capacitors are in series, one in parallel
C. two capacitors are in parallel, one in series
D. all three capacitors in parallel

Q.78 Energy stored in a parallel plate capacitor:

A. CV
B. CV^2
C. ½ CV^2
D. CV^3

Q.79 Consider two capacitors with capacitance 2μF and 4μF. With which type of connection will the 2μF capacitor have a greater amount of stored energy than the 4μF capacitor?

A. series
B. Parallel
C. Either series nor parallel
D. Neither series nor parallel

Q.80 Energy stored in a parallel plate capacitor:

A. CV
B. CV^2
C. ½ CV
D. ½ CV^2

Q.81 If the magnitude of charges on two-point objects and the distance between them is doubled, then force will be:

A. Two times
B. Four times
C. Unchanged
D. Halved

Q.82 The electric field inside a spherical shell of uniform surface charge density is

A. Zero
B. Infinite
C. Constant less than zero
D. Directly proportional to distance

Q.83 The output voltage of a rectifier is

A. Smooth
B. Pulsating
C. Perfectly direct
D. Alternating

Q.84 The capacitance of a capacitor is a measure of its ability to:

A. Store charge
B. Store electric field
C. Gain potential difference
D. Store magnetic field

Q.85 Electric potential difference between the two points can be defined as:

A. Difference of the kinetic energy per unit charge
B. Difference of the kinetic energy
C. Difference of the potential energy per unit charge
D. Difference of the potential energy

Q.86 You have three capacitors, each of 2 μC. In which of the following combinations of the three capacitors, the resultant capacitance is 3μC?

A. All three capacitors in series
B. Two capacitors are in series, one in parallel
C. Two capacitors are in parallel, one in series
D. All three capacitors in parallel

Q.87 Many computer keyboard buttons are constructed using capacitors. When a key is pushed down, the soft insulator between the movable plate and the fixed plate is compressed. When the key is pressed, what happens to the capacitance?

A. It increases
B. It decreases
C. It remains same
D. It changes in a way you cannot determine because of the complex circuit

$F = \frac{kq_1q_2}{d}$

Q.88 The minimum charge on an object cannot be less than:

A. 1.6×10^{-19} C
B. $9 \times 10^{\wedge 9}$ C
C. 9.1×10^{-31} C
D. 1.6×10^{-27}C

Q.89 Time constant is defined as the time required by the capacitor:

A. To deposit 63% of the equilibrium charge
B. To deposit 36% of the equilibrium charge
C. To deposit 63 times of the equilibrium charge
D. To deposit 36 times of the equilibrium charge

Q.90 The electric potential at a point in an electric field can be defined as:

A. Work done in bringing a unit positive charge from infinity to that point
B. Work done in bringing a unit positive charge from infinity to that point while keeping the charge in equilibrium
C. Work done in bringing a unit negative charge from infinity to that point while keeping the charge in equilibrium
D. Work done in bringing a unit negative charge from infinity to that point

Q.91 The value of permittivity of material, other than air or space is:

A. Greater than unity
B. Less than unity
C. Equal to unity
D. Zero

$\Rightarrow \frac{2\times2}{2+2} = \frac{4}{4} = 1$

Q.92 The value for ε_r for air is:

A. 1.6
B.1.06
C.1.006
D.1.0006

Q.93 The force between two charges Q and q, separated by a distance d is F. What will be the force between 4Q and q/2?

A. 2F
B. 4F
C. F
D. F/2

$F = k\frac{4Qq}{2}$

Q.94 Which one is the correct statement about selenium? .

A. Selenium is a good conductor
B. Selenium is a good insulator
C. Selenium is an insulator in the dark and becomes conductor when exposed to light
D. Selenium is an conductor in the dark and becomes insulator when exposed to light

Q.95 The distance between two point charges if halved, the force between them would be:

A. Half
B. Double
C. One fourth
D. Four times

Q.96 The electric intensity between two oppositely charged electric plates is:

A. $\frac{\sigma}{2\epsilon_0}$
B. $\frac{\sigma}{\epsilon_0}$
C. $\frac{4\sigma}{\epsilon_0}$
D. $\frac{2\sigma}{\epsilon_0}$

Q.97 Three objects are brought close to each other, two at a time. When objects A and B are brought together, they repel. When objects B and C are brought together, they also repel. Which of the following are true?

A. Objects A and C possess charges of the same sign, but not B
B. Objects A and C possess charges of opposite sign
C. All three objects possess charges of the same sign
D. One object is neutral

Q.98 Two equal and opposite charges separated by a small distance are said to constitute:

A. A magnetic dipole
B. An electric dipole
C. A couplé
D. An ion

Q.99 What is the formula for Coulomb's law?

A. F=Kq1q2/r2
B. F=2Kq1q2/r3
C. F=Kq1/r
D. F=Kq1/q2

Q.100 Electric field lines provide information about

A. Field strength
B. Direction
C. Nature of charge
D. All of these

ANSWER KEY

1	C	16	A	31	A	46	A	61	B	76	A	91	A
2	A	17	C	32	B	47	C	62	B	77	D	92	C
3	A	18	C	33	A	48	C	63	A	78	C	93	A
4	A	19	C	34	B	49	A	64	B	79	A	94	C
5	A	20	A	35	B	50	A	65	A	80	D	95	D
6	D	21	D	36	A	51	D	66	C	81	C	96	B
7	B	22	A	37	C	52	A	67	A	82	A	97	C
8	D	23	D	38	A	53	B	68	B	83	B	98	B
9	A	24	A	39	C	54	D	69	A	84	A	99	A
10	C	25	B	40	B	55	A	70	B	85	C	100	D
11	A	26	B	41	B	56	B	71	B	86	B		
12	B	27	A	42	D	57	C	72	C	87	A		
13	A	28	A	43	A	58	B	73	A	88	A		
14	C	29	B	44	B	59	C	74	A	89	A		
15	D	30	C	45	D	60	B	75	D	90	B		

CamScanner

UNIT 7 PRACTICE EXERCISE

CURRENT ELECTRICITY

1. **An immersion heater of 400 watts kept on for 5 hours will consume electrical energy of:**
   A. 2kWh
   B. 6kWh
   C. 20kWh
   D. 12kWh

2. **A wire of length L and resistance R is cut into four equal pieces. Resistance of each piece would be:**
   A. R
   B. 2R
   C. R/2
   D. R/4

3. **A piece of copper and a piece of germanium are cooled from the room temperature down to 77K:**
   A. The resistance of each of them increases.
   B. The resistance of each of them decreases.
   C. The resistance of copper increases and that of germanium decreases.
   D. The resistance of copper decreases and that of germanium increases.

4. **In the diagram, the current in the 3-Ω resistor is 4A. The potential difference between points "A" and "B" is:**



   A. 0.8V
   B. 12V
   C. 1.25V
   D. 20V

5. **Specific resistance of a wire:**
   A. will depend on its length
   B. will depend on its radius
   C. will depend on the type of material of the wire
   D. will depend on none of the above

6. **Material of heating element of electric heater should have:**
   A. high resistivity and high melting point
   B. low resistivity and low melting point
   C. high resistivity and low melting point
   D. low resistivity and high melting point

7. **The graphical representation of Ohm's law is:**
   A. Curve line
   B. Straight line
   C. Parabola
   D. Ellipse

8. **The current in an electrolytic cell is carried by:**
   A. Positive ions
   B. Both positive and negative ions
   C. Negative ions
   D. Electrons

9. **Terminal potential difference is greater than emf of the cell when**
   A. Circuit is open
   B. Small batter is charged by bigger battery
   C. Circuit is closed
   D. All of these

10. **A current of 10A flows in conductors of 10 Ω resistance for 1 minute the heat produce will be:**
    A. 10^2 J
    B. 6×10^3 J
    C. 6×10^2 J
    D. 6×10^4 J

11. **The S.I unit of e.m.f. is same as:**
    A. Work
    B. Power
    C. Energy
    D. Voltage

12. **Which one gives pure nature of the material:**
A. Resistivity
B. Temperature co-efficient of resistance
C. Resistance
D. Both A. & B.

13. **The resistivity of a material is ρ. If the area of cross-section of material is doubled and length is halved then the resistivity of material is:**
A. ρ
C. 2ρ
C. 4ρ
D. ρ /4

14. **Four bulbs of 10W, 20W, 30W and 40W are connected in parallel, the bulb that will shine more is:**
A. 10W
B. 30W
C. 20W
D. 40W

15. **The EMF of battery or cell is the voltage between its terminals when:**
A. The circuit is open
B. Its internal resistance is minimum
C. The circuit closed
D. Its internal resistance is maximum

16. **The value of resistance depends upon:**
A. Nature
B. Physical state
C. Dimension
D. All of them

17. **Magnetic effect of current is utilized in:**
A. Iron
B. Measurement of current
C. Thermocouple
D. Electroplating

18. **Conductance is a quantity used to describe the:**
A. Physical state of the conductor
B. Dimension of the conductor
C. Electrical properties of material
D. All of them

19. **A series circuit consists of a battery with internal resistance "r" and an external resistor "R". If these two resistances are equal (r = R) then the thermal energy generated per unit time by the internal resistance "r" is:**
A. the same as by R
B. twice that by R
C. half that by R
D. one-third that by R

20. **A 50 volt battery is connected across a 10 ohm resistor. The current is 4.5A. The internal resistance of the battery is:**
A. 1.1 Ω
B. 1.3 Ω
C. 1.2 Ω
D. 1.4 Ω

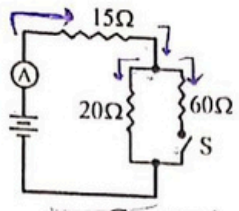
21. **A 100 watt bulb and a 200 watt bulb are designed to operate at 110V and 220V respectively. The ratio of their resistance is**
A. 1
B. 1/3
C. 1/2
D. ¼

22. **An electric current through a conductor produces around it:**
A. A magnetic field
B. Both electric and magnetic field
C. An electric field
D. Nuclear field

23. **1 MWh =**
A. 3.6×10^3J
B. 3.6×10^9J
C. 3.6×10^6J
D. 3.6×10^{12}J

24. **The e.m.f. of a source in the presence of internal resistance is:**
A. IR
B. IR + Ir
C. Ir
D. IR – Ir

25. **When switch S is open, the ammeter in the circuit shown reads 2.0A. When S is closed, the ammeter reading:**



A. increases slightly
B. decreases slightly
C. remains the same
D. becomes doubled

26. **Resistor 1 has twice the resistance of resistor 2. They are connected in parallel to a battery. The ratio of the thermal energy generation rate in 1 to that in 2 is:**
A. 1 : 4
B. 1 : 1
C. 1 : 2
D. 2 : 1

27. **Power dissipated in two parallel resistors is inversely proportional to their:**
A. Potential difference
B. Current
C. Resistance
D. All of these

28. **A car battery is rated at 80A h. An ampere-hour is a unit of:**
A. Power
B. Current
C. Energy
D. Charge

29. **Current is a measure of:**
A. force that moves a charge past a point
B. resistance to the movement of a charge past a point
C. energy used to move a charge past a point
D. amount of charge that moves past a point per unit time

30. **A 10-ohm resistor has a constant current. If 1200C of charge flow through it in 4 minutes what is the value of the current?**
A. 3.0A
B. 11A
C. 5.0A
D. 15A

31. **If the potential difference across a resistor is doubled:**
A. only the current is doubled
B. only the resistance is doubled
C. only the current is halved
D. only the resistance is halved

32. **What is the current in a 5.0 Ω resistor when the potential difference between the ends of the resistor is 2.5 V?**
A. 0.50 A
B. 2.0 A
C. 2.5 A
D. 12.5 A

33. **A cylindrical copper rod has resistance R. It is reformed to twice its original length with no change of volume. Its new resistance is:**
A. R
B. 4R
C. 2R
D. 8R

34. **A nichrome wire is 1m long and 1×10^{-6} m² in cross-sectional area. When connected to a potential difference of 2V, a current of 4A exists in the wire. The resistivity of this nichrome is:**
A. 10^{-7} Ω m
B. 4×10^{-7} Ω m
C. 2×10^{-7} Ω m
D. 5×10^{-7} Ω m

35. **Conductivity is:**
A. The same as resistivity, it is just more convenient to use for good conductors
B. Expressed in Ω^{-1}
C. Equal to 1/resistance
D. Expressed in $(\Omega\ m)^{-1}$

36. **You wish to triple the rate of energy dissipation in a heating device. To do this you could triple:**
A. the potential difference keeping the resistance the same
B. the current keeping the resistance the same
C. the resistance keeping the potential difference the same
D. the resistance keeping the current the same

37. **When the current is drawn from a cell, its terminal potential difference and emf are:**
A. Different
B. Both zero
C. Same
D. Sometime same and sometime different

38. **A 10 m long wire of resistance 20Ω is connected in series with battery of emf 3 V and a resistance of 10Ω. The potential gradient along the wire in volt premature is:**
A. 0.02
B. 0.1
C. 0.2
D. 1.2

39. **A battery is connected across a series combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is I, then:**
A. the potential difference across each resistor is V and the current in each resistor is I
B. the potential difference across each resistor is V/2 and the current in each resistor is I/2
C. the potential difference across each resistor is V and the current in each resistor is I/2
D. the potential difference across each resistor is V/2 and the current in each resistor is I

40. **Two wires made of the same material have the same lengths but different diameters. They are connected in series to a battery. The quantity that is the same for the wires is:**
A. the end-to-end potential difference
B. the current density
C. the current
D. the electric field

41. **The resistance of resistor 1 is twice the resistance of resistor 2. The two are connected in parallel and a potential difference is maintained across the combination. Then:**
A. the current in 1 is twice that in 2
B. the current in 1 is half that in 2
C. the potential difference across 1 is twice that across 2
D. the potential difference across 1 is half that across

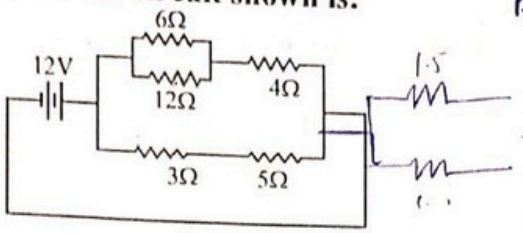
42. **The terminal potential difference of a battery is less than its emf:**
A. under all conditions
B. only when the battery is being charged
C. only when the battery is being discharged
D. When battery is disconnected

43. **Resistances of 2.0 Ω, 4.0 Ω, and 6.0 Ω and a 24 V emf device are all in parallel. The current in the 2.0 Ω resistor is:**
A. 12A
B. 2.4A
C. 4.0A
D. 2.0A

44. **In an antique automobile, a 6 V battery supplies a total of 48W to two identical headlights in parallel. The resistance (in ohms) of each bulb is:**
A. 0.67
B. 3
C. 1.5
D. 4

45. **A battery with an emf of 12V and an internal resistance of 1 Ω is used to charge a battery with an emf of 10V and an internal resistance of 1 Ω. The current in the circuit is:**
A. 1A
B. 4A
C. 2A
D. 11A

46. **The current in the 5.0 Ω resistor in the circuit shown is:**



A. 0.42A
B. 1.5A
C. 0.67A
D. 2.4A

47. **In liquid and gases, the current is due to the motion of:**
A. Negative charges
B. Both positive and negative charges
C. Positive charges
D. Neutral particles

48. **Siemen is the unit of:**
A. resistance
B. resistivity
C. conductance
D. conductivity

49. **When same current passes for same time through a thick and thin wire:**
A. more heat is produced in thick wire
B. more heat is produced in thin wire
C. no heat is produced in wire
D. equal heat is produced in thick and thin wire

50. **For an open circuit:**
A. $E = V_t$
B. $E < V_t$
C. $E > V_t$
D. $E = V_t + Ir$

51. **A battery with an emf of 24 V is connected to a 6 Ω resistor. As a result, current of 3 A exists in the resistor. The terminal potential difference of the battery is:**
A. 0
B. 12V
C. 6V
D. 18V

52. **Temperature co-efficient of resistivity of a material is measured in:**
A. Ω K
B. K
C. Ω m
D. K^{-1}

53. **For an open circuit the resistance of circuit will be:**
A. Infinite
B. maximum
C. Finite
D. zero

54. **Which one of the following substances, the resistance decreases with increase in temperature**
A. Copper
B. Carbon
C. Silver
D. Iron

55. **Internal resistances is the resistance offered by**
A. Conductor
B. Resistor
C. Circuit
D. Electrolyte

56. **Four 20 Ω resistors are connected in series and the combination is connected to a 20 V emf device. The potential difference across any one of the resistors is:**
A. 1 V
B. 5 V
C. 4 V
D. 20 V

57. **A large number of bulbs are connected in series combination with a battery. If one of them is fused:**
A. the others will stop glowing
B. the others will keep glowing
C. the others will start blinking
D. the others will also be fused

58. **"N" identical resistances each of resistance R are connected in parallel. The equivalent resistance of the combination will be:**

A. NR
C. $\frac{R}{N}$
B. $\frac{N}{R}$
D. $\frac{N2}{R}$

59. **A certain wire has resistance R. Another wire, of the same material, has half the length and half the diameter of the first wire. The resistance of the second wire is:**

A. R/4
C. R/2
B. R
D. 2R

60. **Free electrons in an Electric field moves from:**

A. All potentials
C. High potential to low potential
B. Low potential to high potential
D. Remain stationary

61. **Two wires made of the same material have the same lengths but different diameters. They are connected in parallel to a battery. The quantity that is NOT the same for the wires is:**

A. the end-to-end potential difference
C. the current
B. the current density
D. the electric field

62. **A 60 watt light bulb carries a current of 0.5 A. The total charge passing through it in one hour is:**

A. 120 C
C. 3000 C
B. 3600 C
D. 1800 C

63. **A source of 200V provides a current of 10.0 amperes to a house. The power delivered by the source is:**

A. 20 watt
C. 40 watt
B. 2000 watt
D. 200 watt

64. **The current is zero in a conductor when no potential difference is applied because:**

A. The electrons are not moving
B. The electrons are not moving fast enough
C. For every electron with a given velocity there is another with a velocity of equal magnitude and opposite direction.
D. Equal numbers of electrons and protons are moving together

65. **If the length and diameter of conductor is double the resistance is:**

A. Remain same
C. Double
B. Half
D. Four time

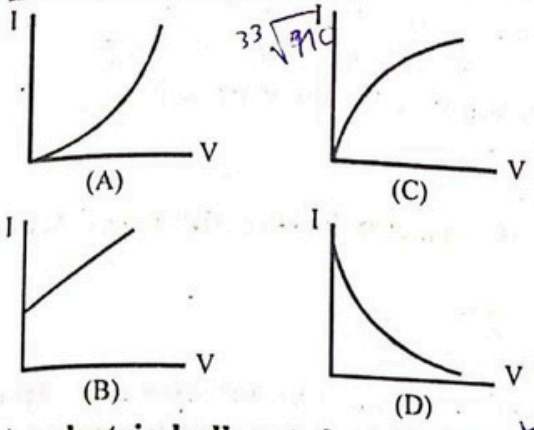
66. **Four 20 Ω resistors are connected in parallel and the combination is connected to a 20 V emf device. The current in any one of the resistors is:**

A. 0.25A
C. 1.0A
B. 4.0A
D. 5.0A

67. **A copper wire has resistance "R". It is stretched such that its length is thrice then its new resistance becomes:**

A. 2R
C. 4R
B. 9R
D. 27R

68. Which of the following graphs best represents the current-voltage relationship of an incandescent light bulb?



69. An electric bulb rated at 220V 140watt is connected to 110V power line, the current that flows in it is:

A. 1.27 A
B. 2.27 A
C. 1.83 A
D. 2.83 A

70. A student kept her 60 watt, 120 volt study lamp turned on from 2:00 PM until 2:00 AM. How many coulombs of charge went through it?

A. 3, 600
B. 18, 000
C. 7, 200
D. 21, 600

71. An certain resistor dissipates 0.5 W when connected to a 3V potential difference. When connected to a 1V potential difference, this resistor will dissipate:

A. 0.5W
B. 1.5W
C. 0.167W
D. 0.056W

72. An ordinary light bulb is marked "60W, 120V". Its resistance is:

A. 60 Ω
B. 180 Ω
C. 120 Ω
D. 240 Ω

73. A current of 0.3A is passed through a lamp for 2 minutes using a 6 V power supply. The energy dissipated by this lamp during the 2 minutes is:

A. 1.8J
B. 36 J
C. 20 J
D. 216 J

74. If we cut a wire of resistance "R" in two equal parts and then make a bundle of both parts of a wire. The resistance of bundle, will be:

A. $\frac{1}{2}$R
B. 2R
C. $\frac{1}{4}$R
D. 4R

75. If a wire of resistance "R" is bent into an equilateral triangle the resistance b/w any two corner will be.

A. $\frac{2}{3}$R
B. $\frac{2}{9}$R
C. $\frac{3}{2}$R
D. $\frac{9}{2}$R

76. Two conductors are made of the same material and have the same length. Conductor "A" is a solid wire of diameter 1m. Conductor "B" is a hollow tube of inside diameter 1m and outside diameter 2m. The ratio of their resistance, R_A/R_B, is:

A. 1
B. 2
C. $\sqrt{2}$
D. 3

77. **A certain sample carries a current of 4 A when the potential difference is 2 V and a current of 10A when the potential difference is 4V. This sample:**
A. obeys Ohm's law
B. has a resistance of 2.5 Ω at 1V
C. has a resistance of 0.5 Ω at 1V
D. has a resistance of 2.5 Ω at 2V

78. **A flat iron is marked "120 V, 600W". In normal use, the current in it is:**
A. 2 A
B. 4 A
C. 5 A
D. 7.2 A

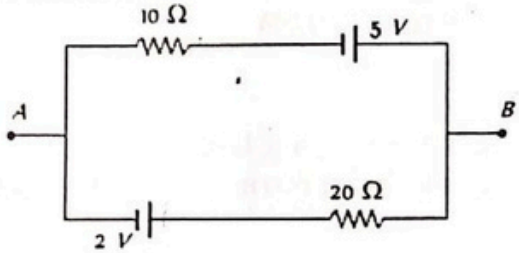
79. **What would be the equivalent resistance of a circuit having three resistance of 9Ω each, connected in parallel:**
A. 6Ω
B. 3Ω
C. 27Ω
D. 1Ω

80. **A 20 ohm resistance takes 5 minutes to boil a given amount of water. How much resistance will be required to boil the same amount of water using the same source in 1 minute?**
A. 20 ohm
B. 40 ohm
C. 5 ohm
D. 100 ohm

81. **A fuse is placed in series with the circuit to protect against:**
A. high power
B. high current
C. high voltage
D. over heating

82. **A certain x-ray tube requires a current of 7 mA at a voltage of 80 kV. The rate of energy dissipation (in watts) is:**
A. 560
B. 5600
C. 26
D. 11.4

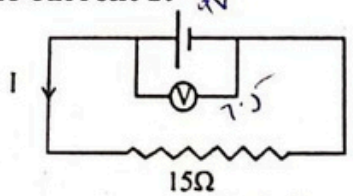
83. **The current in the give circle is:**



A. 0.1 A
B. 0.2 A
C. 0.3 A
D. 0.4 A

84. **Why should a resistance be introduced in a circuit in series deliberately?**
A. to increase current
B. to control current
C. to decrease current
D. just to give a good look to circuit.

85. **The e.m.f of the cell in the following circuit is 9V. The reading on the high resistance voltmeter is 7.5 V what is the current I?**



A. 0.1A
B. 2A
C. 0.6A
D. 0.5A

86. **A 100W ,200V bulb is connected to a 160V supply. The actual power consumption would be:**
A. 64W
B. 100W
C. 72W
D. 90W

87. **An electric iron is marked 20 volts 500W. The units consumed by it in using it for 24 hours will be:**
A. 12
B. 5
C. 24
D. 1100

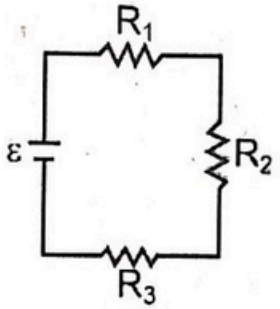
88. **Two wires made of the same material and of the same length are connected in parallel to the same voltage supply. Wire "P" has a diameter of 2 mm. Wire "Q" has a diameter of 1 mm. What is the ratio $\frac{IP}{IQ}$?**
A. $\frac{1}{4}$
B. 2
C. $\frac{1}{2}$
D. 4

89. **There are three bulbs of 60W, 100W and 200W which bulb has thickest filament:**
A. 100W
B. 60W
C. 200W
D. all of these

90. **What can be used as the unit of energy:**
A. watt × second
B. volt per coulomb
C. volt × meter
D. newton per meter

91. **The fractional change in resistivity per Kelvin:**
A. Temperature co-efficient of resistance
B. Resistance
C. Temperature co-efficient of resistivity
D. All of these

92. **In the diagram $R_1 > R_2 > R_3$. Rank the three resistors according to the current in them, least to greatest:**



A. 1, 2, 3
B. 3, 2, 1
C. 1, 3, 2
D. All are the same

93. **For maximum power output from the cell the requirement is:**
A. r>R
B. r< R
C. r = R
D. r=0

94. **Three bulbs of 25W, 50W and 100W are connected in series with same supply. The bulb with maximum brightness is:**
A. 25 W
B. 50 W
C. 100 W
D. All of these

95. **Two 110 V light bulbs, one "25W" and the other "100W", are connected in series to a 110 V source. Then:**
A. The current in the 100 W bulb is greater than that in the 25 W bulb
B. The current in the 100 W bulb is less than that in the 25 W bulb
C. 100 W bulb has greater resistance
D. 25 W bulb has greater resistance

96. A resistor with resistance "R_1" and a resistor with resistance "R_2" are connected in parallel to an ideal battery with emf E. The rate of thermal energy generation in the resistor with resistance R_1 is:

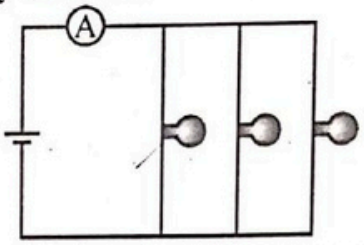
A. $\frac{E_2}{R_1}$

B. $\frac{E_2 R_1}{(R_1 + R_2)^2}$

C. $\frac{E_2}{R_1 + R_2}$

D. $\frac{E_2}{R_2}$

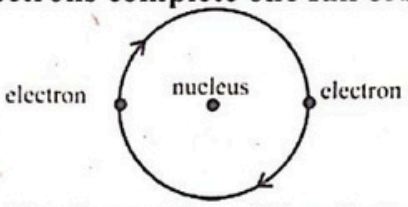
97. Three similar light bulbs are connected to a constant D.C. supply as shown in the diagram. Each bulb operates at normal brightness and the ammeter (of negligible resistance) registers a steady current.



The filament of one of the bulbs breaks. What happens to the ammeter reading and to the brightness of the remaining bulbs?

	Ammeter reading	Bulb brightness
A.	decreases	unchanged
B.	Increases	Unchanged
C.	Unchanged	Unchanged
D.	increases	changed

98. The diagram shows a model of an atom in which two electrons move round a nucleus in a circular orbit. The electrons complete one full orbit in 1.0×10^{-15} s.



What is the current caused by the motion of the electrons in orbit?

A. 1.6×10^{-34}A

B. 1.6×10^{-4}A

C. 3.2×10^{-34}A

D. 3.2×10^{-4}A

99. The current in a component is reduced uniformly from 100 mA to 20 mA over a period of 8.0 s. What is the charge that flows during this time?

A. 160mC

B. 320mC

C. 480mC

D. 640mC

100. If the resistance of a certain length wire, diameter 5 mm is 10 Ω if the diameter is charge to 10 mm, then new resistance is:

A. 40

B. 20

C. 5

D. 2.5

101. How many electrons per second constitute a current of one micro ampere?

A. One electron

B. 10^6 electrons

C. 10^{-6} electrons

D. 6.25×10^{12} electrons

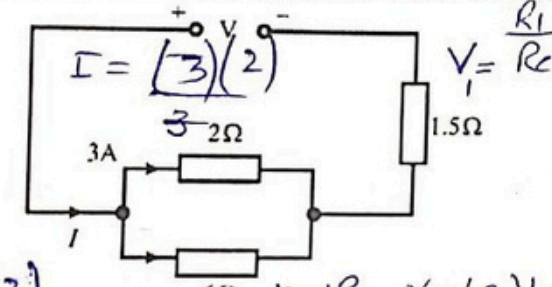
102. **A steady current is flowing in a conductor of non-uniform cross-section. The charge passing through any cross-section per unit time is**
A. Directly proportional to the area of cross-section
B. Inversely proportional to the area of cross-section
C. Proportional to square of the area of cross-section
D. Independent of the area of cross-section

103. **In the case of gases, the charge carries are**
A. Positive and negative ions
B. electrons and holes
C. negative ions and electrons
D. positive ions and electron

104. **What is meant by 5 A?**
A. A charge of 5 C flows through a point in 1 second
B. 5 V electricity flows across 1Ω of resistance
C. 5V electricity is causing 1 C of charge to flow
D. A charge of 5 C flows through a point in 5 seconds.

105. **Slope of the graph between "V" On X-axis and "I" on the Y-axis is**
A. Resistance
B. Emf
C. Conductance
D. Capacitance

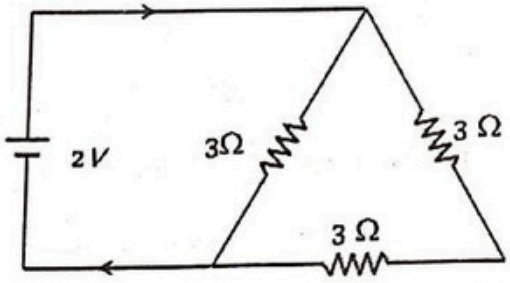
106. **In the circuit shown, there is a current of 3 A in the 2 Ω resistor**



What are the values of current I delivered by, and voltage V across the power supply?

	I/A	V/V
A.3		10.5
B.	4	9
C.	4	12
D.1	2	18

107. **The current in the following circuit is:**



A. $\frac{1}{8}A$
B. $\frac{2}{9}A$
C. $\frac{2}{3}A$
D. 1A

108. **When we double the voltage in a simple electric circuits we double the**
A. Current
B. Resistance
C. Power
D. Both A. and C.

109. **An electric current is passed through a circuit containing two wires of the same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 4/3 and 2/3, then the ratio of the currents passing through the wire will be**

A. 3
B. 1/3
C. 8/9
D. 2

110. **The electromotive force of a primary cell is 2 volts. When it is short-circuited, a current of 4 amperes flows through it. The internal resistance of the cell, in ohms, is:**

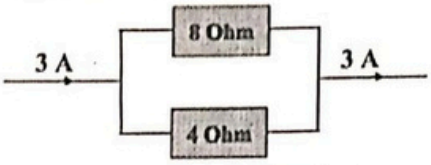
A. 0.5
B. 5.0
C. 2.0
D. 8.0

Hint:

111. **Which of the following statements is not true?**

A. conductance is the reciprocal of resistance and is measured in siemens
B. Ohm's law is not applicable at very low and very high temperatures
C. Ohm's law is applicable to semiconductors
D. Ohm's law is not applicable to electron tubes, discharge tubes and electrolytes

112. **In the given diagram, the current through the 4 ohm resistor will be:**



A. 1 A
B. 2 A
C. 1.5 A
D. 3 A

113. **A wire of resistance R is cut into two equal parts, its resistance becomes R/2, what happens to resistivity:**

A. Double
B. Half
C. Same
D. One fourth

114. **A wire of resistance R is stretched four times its length uniformly. Its new resistance will be**

A. 16 R
B. $\frac{R}{4}$
C. 4 R
D. $\frac{R}{16}$

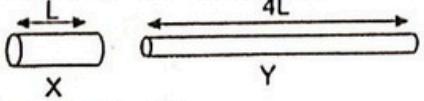
115. **The resistance of a wire is 1 Ω. Which of the following is new resistance if length of wire is doubled?**

A. 2 Ω
B. $\frac{1}{2}\Omega$
C. 4 Ω
D. $\frac{1}{4}\Omega$

116. **When Cu and Ge are cooled to – 150 °C Then resistance of Cu ___ and that of Ge ___**

A. Increases, increases
B. Increases, decreases
C. Decreases, decreases
D. Decreases, increases

117. **Two copper wires X and Y have the same volume. Wire Y is four times as long as wire X.**



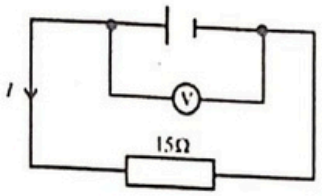
What is the ratio $\frac{\text{resistance of wire Y}}{\text{resistance of wire X}}$?

A. 4
B. 8
C. 16
D. 64

118. By a cell a current of 0.9 A flows through 2 *ohm* resistor and 0.3 A through 7 *ohm* resistor. The internal resistance of the cell is

A. 0.5Ω
B. 1.2Ω
C. 1.0Ω
D. 2.0Ω

119. The emf of the cell in the following circuit is 9.0 V. The reading on the high resistance voltmeter 7.5 V?



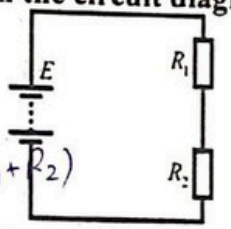
What is the current I?

A. 0.1 A
B. 0.6 A
C. 0.5 A
D. 2.0 A

120. A cell of negligible resistance and e.m.f 2 V is connected across a series combination of 2,3 and 5 ohms. The p.d. across the 3 Ω resistor is

A. 0.6 V
B. 1/3 V
C. 2/3 V
D. 4/3 V

121. A battery of e.m.f *E* and negligible internal resistance is connected to two resistors of resistance R_1 and R_2 as shown in the circuit diagram?



What is the potential difference across the resistors of resistance R_2?

A. $\frac{E(R_1+R_2)}{R_1}$
B. $\frac{ER_1}{(R_1+R_2)}$
C. $\frac{E(R_1+R_2)}{R_2}$
D. $\frac{ER_2}{(R_1+R_2)}$

122. You are given four bulbs of 25 W, 40 W, 50 W and 60 W. Which bulb has the lowest resistance?

A. 25 W
B. 50 W
C. 60 W
D. 40 W

123. Two bulbs having the ratings 40 W, 220 V and 20 W, 110 V. The ratio of their resistance is

A. 1: 2
B. 2 :1
C. 1 :1
D. 1 : 4

124. Out of the two bulbs in a house, one glow brighter than the other. Which of the following has larger resistance?

A. The brighter bulb
B. Both have same resistance
C. The dim bulb
D. Brightness does not depend on resistance

125. A total charge of 100 C flows through a 12 W light bulb in a time of 50s. What is the potential difference across the bulb during this time?

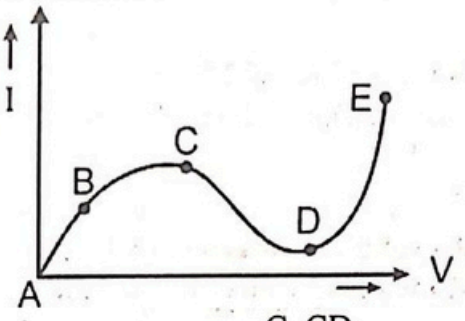
A. 0.12 V
B. 2.0 V
C. 6.0 V
D. 24 V

126. **An ammeter and a voltmeter are joined in series to a cell. Their readings are A and V respectively. If a resistance is now joined in parallel with the voltmeter,**
A. A will increase, V will decrease
B. A will decrease, V ill increase
C. Both A and V will decrease
D. Both A and V will increase

127. **A cell supplies a current of 0.9 A through a 2Ω resistor and a current of 0.3 A through a 7Ω resistor. The internal resistance of the cell is**
A. 2.0Ω
B. 1.2Ω
C. 1.0Ω
D. 0.5Ω

128. **An energy source will supply a constant current into the load if its internal resistance is**
A. Non-zero but less than the load resistance
B. Zero
C. Very large as compared to the load resistance
D. Equal to the resistance of the load

129. **From the graph between current (I) and voltage (V) shown below, identify the portion corresponding to negative resistance:**



A. AB
B. BC
C. CD
D. DE

130. **A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be**
A. Halved
B. One-fourth
C. Four time
D. Doubled

131. **The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp when not in use?**
A. 200Ω
B. 400Ω
C. 20Ω
D. 40Ω

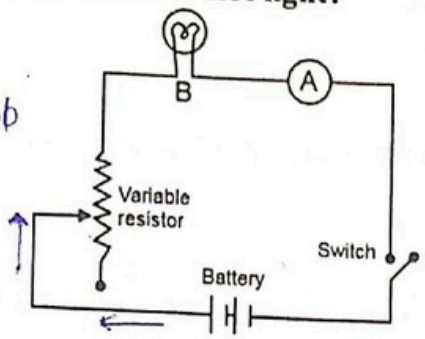
132. **A 5-ampere fuse wire can with stand a maximum power of 1 watt in the circuit. The resistance of the fuse wire is:**
A. 0.4Ω
B. 0.04Ω
C. 5Ω
D. 0.2Ω

133. **A copper wire is stretched to make it 0.1% longer. The percentage increase in resistance will be**
A. 0.2
B. 2
C. 1
D. 0.1

134. **The thermal velocity of free electrons in a conductor is of the order of**
A. 1 ms^{-1}
B. 10^3 ms^{-1}
C. 10 ms^{-1}
D. 10^6 ms^{-1}

135. **A typical value of drift velocity is**
A. 1 mms^{-1}
B. 1 ms^{-1}
C. 10 ms^{-1}
D. 1000 kms^{-1}

136. In the circuit below, bulb B does not light although ammeter A indicates that the current is flowing. Why does the bulb not light?



A. the bulb is fused
B. There is a break in the circuit between bulb and ammeter
C. The variable resistor has too large a resistance
D. There is a break in the circuit between bulb and variable resistor

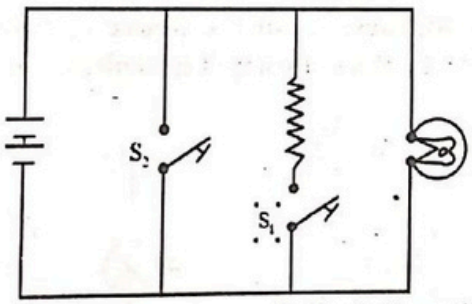
137. Which one of the following is best material for making connecting wires?
A. Manganin
B. Constantan
C. Copper
D. Nichrome

138. The capacity of a storage cell is 5 ampere hour. The maximum current it can supply for ten hour is
A. 5 ampere
B. 0.5 ampere
C. 50 ampere
D. 0.25 ampere

139. Inside the electric cell, charge is transported by
A. Electrons
B. Positive ions only
C. Negative ions only
D. Both positive and negative ions

140. The positive terminal of a 12 V battery is connected to the earth. Then the negative terminal will be at
A. Zero potential
B. – 12 V
C. + 12 V
D. + 24 V

141. Which of two switches S_1 and S_2 shown in fig will produce short-circuiting?



A. S_1
B. S_2
C. Both S_1 and S_2
D. Neither S_1 nor S_2

142. A solenoid is at a potential difference of 60V and current flowing through it is 15 ampere. Then the resistance of coil will be
A. 4Ω
B. 0.25Ω
C. 8Ω
D. 2Ω

143. A 220 volt, 1000 watt bulb is connected across a 110 volt mains supply. The power consumed will be
A. 1000 watt
B. 500 watt
C. 750 watt
D. 250 watt

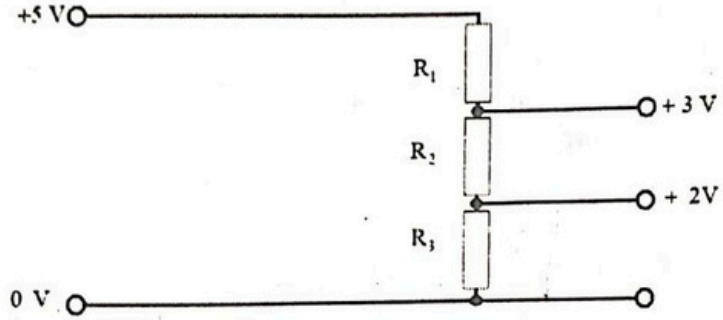
144. **Six 1.1 V cells with internal resistance 3.0 Ω each are connected in three parallel branches of two cells each. If the resistance of external circuit is 2.0 Ω, then the current is**

A. 0.33 A
B. 0.44 A
C. 0.55 A
D. 0.66 A

145. **A cell of emf 4 V, when short circuited, gives a current of 8 A. the internal resistance of the cell is**

A. 0.5Ω
B. 1Ω
C. 2Ω
D. 4Ω

146. **A potential divider is used to give outputs of 2 V and 3 V from a 5 V source, as shown in figure.**



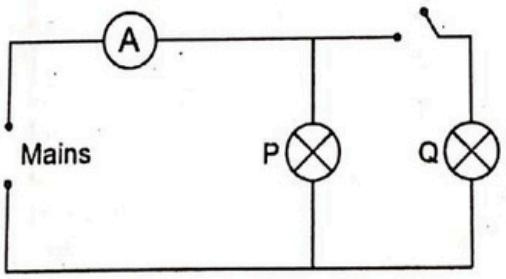
Which combination of resistance, R_1, R_2, R_3 gives the correct voltages?

	R_1kΩ	R_2kΩ	R_3kΩ
A.	1	1	2
B.	2	1	2
C.	3	2	2
D.	3	2	3

$V_1 = \frac{R_1}{Req} V$

$R_1 = V_1$

147. **How will the reading the ammeter A of the figure be affected if another identical bulb Q is connected in parallel to P as shown. The voltage in the mains is maintained at a constant value.**



A. The reading will be reduced to one-half
C. The reading will be double of previous one
B. The reading will not be affected
D. The reading will be increased four-fold

$Q = (8)(\frac{2}{100})$

$= \frac{16}{100}$

148. **The current in a resistor is 8.0 mA. What charge flows through the resistor in 0.020 s?**

A. 0.16 mC
B. 1.6 mC
C. 4.0 mC
D. 0.40 mC

CamScanner

149. A wire made of material with resistivity ρ has length ℓ and area of cross section A. It is connected to an electrical supply and has a potential difference V across it. What is energy supplied to the wire in time t?

A. $\frac{V^2tA}{\rho\ell}$

B. $\frac{VtA}{\rho\ell}$

C. $\frac{V\rho\ell t}{A^2}$

D. $\frac{V^2\rho\ell t}{A}$

150. A battery of emf 6.0 V and internal resistance 0.40Ω is connected to an external resistor 2.9Ω. What is the power supplied to the external resistor?

A. 1.3 W

B. 5.3 W

C. 9.6 W

D. 12.4 W

ANSWER KEY

1	A	16	D	31	A	46	B	61	C	76	D	91	C	106	C	121	D	136	C
2	D	17	B	32	A	47	B	62	D	77	C	92	D	107	D	122	C	137	C
3	D	18	C	33	B	48	C	63	B	78	C	93	C	108	A	123	B	138	B
4	D	19	A	34	D	49	B	64	C	79	B	94	A	109	B	124	C	139	D
5	C	20	A	35	D	50	A	65	B	80	D	95	D	110	A	125	C	140	B
6	A	21	C	36	D	51	D	66	C	81	B	96	A	111	C	126	A	141	B
7	B	22	A	37	A	52	D	67	B	82	A	97	A	112	B	127	D	142	A
8	B	23	B	38	C	53	A	68	C	83	A	98	B	113	C	128	B	143	D
9	B	24	B	39	D	54	B	69	A	84	C	99	C	114	A	129	C	144	C
10	D	25	A	40	C	55	D	70	D	85	D	100	D	115	A	130	D	145	A
11	D	26	C	41	B	56	B	71	D	86	A	101	D	116	D	131	D	146	B
12	D	27	D	42	C	57	A	72	D	87	A	102	A	117	C	132	C	147	C
13	A	28	D	43	A	58	C	73	D	88	B	103	D	118	A	133	A	148	A
14	D	29	D	44	C	59	D	74	C	89	C	104	A	119	C	134	D	149	A
15	A	30	C	45	A	60	B	75	B	90	A	105	C	120	A	135	A	150	C

SOLUTIONS

1. $H = I^2Rt = Pt = (400)(5\times3600) = 7.2 \times 10^6\ J = 2(3.6 \times 10^6 J) = 2kWh$
2. $R = \rho\frac{L}{A} \quad \Rightarrow R \propto L$
3. As we know that the resistance of metallic conductor (copper) is directly propotional to temperarture while resistance of semiconductor (germenium) inversely proportinal to the temperature.
4. $V = IR_e = (4)(3+2) = 20\ V$
5. Specific resistance depends upon:
   i.Nature of material
   ii.Temperature
6. $H = I^2Rt$
   $H \propto R$
   Material of heating element of electric heater should have high resistivity and high melting point.
7. $I \propto V$ (straight line)
8. **i.** In metallic conductors, the charge carries are electrons.
   ii. In electrolytes, charge carries are positive and negative ions.
   iii. In gases, the charge carriers are electrons and ions.
   iv. In semi conductors, charge carriers are electrons and holes.
9. When a battery is being charged, then the current flows in opposite direction to the current produced by the battery. So,
   $V_t = \varepsilon - (-I)r = \varepsilon + Ir$
   So, when the battery is being charged, the terminal potential difference is greater than the emf of battery.
10. $H = I^2RT = (10)^2(10)(60) = 6 \times 10^4\ J$
11. The emf of the source is defined as the energy supplied to a unit positive charge by the cell in moving from negative terminal to the positive terminal of the battery.
    $E = \frac{\Delta W}{\Delta Q}$ (volts)
12. Every element has specific value of resistivity and temperature coefficient of resistance. When nature of material is changed then both will be changed.
13. Specific resistance depnds upon:
    i. Nature of material
    ii. Temperature
14. In parallel combination the bulb with higher power rating will shine more.
15. **EMF** is the potential difference between the terminals of battery when no current is flowing through an external circuit or when the circuit is open.
16. Resistance depends upon:
    i. Nature of material
    ii. Temperature
    iii. Dimension
17. **i.** Magnetic effect is used in the detection and measurement of current.
    ii. All the machine involving electric motors also use the magnetic effect of current.
18. Resistance and conductance are the electrical properties of material.

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19. $P_{out} = \frac{E2R}{(R-r)2+4Rr}$

When "R = r" then the thermal energy generated per unit time by the internal resistance is as that of external resistance.

$(P_{out})_{max} = \frac{E2}{4R}$

The efficiency of such circuit is 50%.

20. $\varepsilon = I(R + r) \Rightarrow r = \frac{\varepsilon}{I} - R = \frac{50}{4.5} - 10$

$= 11.1 - 10 = 1.1\ \Omega$

21. $P = \frac{V2}{R} \Rightarrow R = \frac{V2}{P}$

$\frac{R1}{R2} = \frac{V12/P1}{V22/P2} = \frac{V12}{V22} \times \frac{P2}{P1} = \frac{(110)2}{(220)2} \times \frac{200}{100} = \frac{1}{2}$

22. When a current flows through a wire, magnetic field is produced around it. The strength of magnetic field depends upon
i. The value of current.
ii. Distance from the wire.

23. $1kWh = 3.6 \times 10^6\ J$

$1000(1kWh) = 1000(3.6 \times 10^6)\ J$

$1MWh = 3.6 \times 10^9\ J$

24. $\varepsilon = I(R + r) = IR + Ir$

25. When switch S is open, the $R_e = 35\ \Omega$

When switch S is closed, the $R_e = 30\ \Omega$

When S is closed more current will flow. So, ammeter reading increases.

26. $P = \frac{V2}{R} \Rightarrow P \propto \frac{1}{R}$

$\frac{P1}{P2} = \frac{R2}{R1} = \frac{R2}{2R2} = \frac{1}{2} = 1:2$

27. $P = \frac{V2}{R} \Rightarrow P \propto \frac{1}{R}$

28. $Q = It$

29. The rate of flow of electric charges through a conductor of any cross section in a unit time is called electric current.

If "ΔQ" charge is passing through any section of wire in time "Δt", then electric current "I" is given by

$I = \frac{\Delta Q}{\Delta t}$

30. $I = \frac{\Delta Q}{\Delta t} = \frac{1200}{240} = 5\ A$

31. $I \propto V$ (According to Ohm's law)

32. $I = \frac{V}{R} = \frac{2.5}{5.0} = 0.50A$

33. When the length of wire becomes "n" times keeping mass, volume remain constant, then

$R' = n^2R = 2^2R = 4R$

34. $R = \frac{V}{I} = \frac{2}{4} = 0.5\ \Omega$

$\rho = R\frac{A}{L} = (0.5)\frac{1\times10-6}{1} = 5 \times 10^{-7}\ \Omega m$

35. $\sigma = \frac{1}{\rho}\ (\Omega m)^{-1}$

36. $P = I^2R$

$P \propto R$

37. When current drawn from the circuit

$\varepsilon = V_t + Ir$

$\varepsilon \neq V_t$

38. **P.D. across the wire** $= \frac{20}{30}\times 3 = 2V$

Potential gradient $= \frac{2}{10}\times 0.2V/m$

39. When identical resistances are connected in series:

i. Same potential difference across each resistance (equally divides)

ii. Same current through each resistance

40. In series combination same current through each resistance.

41. In parallel combination

$I = \frac{V}{R} \Rightarrow \qquad I \propto \frac{1}{R}$

42. When current through the circuit, then

$V_t < \varepsilon$

43. $I_1 = \frac{V}{R1} = \frac{24}{2} = 12\ A$

44. In parallel combination

$P_e = P_1 + P_2 + P_3 + \ldots + P_n$

$P_e = 2P = 48\ W \Rightarrow P = 24\ W$

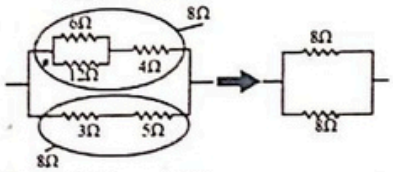
$P = \frac{V2}{R} \Rightarrow R = \frac{V2}{P} = \frac{62}{24} = 1.5\ \Omega$

45. Effective emf, $\varepsilon = 12 - 10 = 2V$

$R_e = 1+1 = 2\Omega$

$I = \frac{\varepsilon}{Re} = \frac{2}{2} = 1\ A$

46.



$R_e = 8/2 = 4\ \Omega$

$I = V/R_e = 12/4 = 3\ A$

When identical resistances are connected in parallel:

Same current flows each resistance (equally divides)

So, current through $5\Omega = 1.5\ A$

47. i. In metallic conductors, the charge carries are electrons.
ii. In electrolytes, charge carries are positive and negative ions.
iii. In gases, the charge carriers are electrons and ions.
iv. In semi conductors, charge carriers are electrons and holes.

48. Conductance $= \frac{1}{R} = \Omega^{-1} =$ seimen

49. $R \propto \frac{1}{A}$
Thin wire has more resistance than thick wire.
$H = I^2Rt$
$H \propto R$
So, more heat is produced in thin wire.

50. $\varepsilon = V_t + Ir$
For open circuit $I = 0$
$\varepsilon = V_t + (0)r = V_t$

51. $V_t = IR = (3)(6) = 18$ V

52. The fractional change in resistance per Kelvin is known as temperature of resistance. Which is given by
$\alpha = \frac{Rt - Ro}{Rot}$ (K^{-1})

$V = IR$
$R = \frac{V}{0} = \infty$

53. For an open circuit, $I = 0$
$R = \frac{V}{I} = \frac{V}{0} = \infty$

54. As $\alpha < 0$ (negative) for carbon. So, its resistance decreases with increase in temperature.

55. The resistance is due to electrolyte present between the two electrodes of the cell is called the internal resistance of cell.

56. When identical resistances are connected in series same potential difference across each resistance (equally divides)
$V' = V/4 = 20/4 = 5V$

57. When one bulb is fused, the circuit will be disconnected, i.e., $I = 0$

58. In parallel combination the Equivalent resistance is always smaller than the smallest individual resistance.
$R_e = \frac{R}{N}$

59. $R = \rho\frac{L}{\pi(d/2)2} = \frac{4\rho L}{\pi d2}$
$R' = \frac{4\rho(L/2)}{\pi(d/2)2} = \frac{4}{2}\left(\frac{4\rho L}{\pi d2}\right) = 2\left(\frac{4\rho L}{\pi d2}\right) = 2R$

60. Electrons move in the direction opposite to the electric field, i.e., (–E). From low potential to high potential.

61. In parallel combination Current through each resistance is different such that sum of current equal to current supplied by battery.

62. $Q = It = (0.5)(3600) = 1800$ C

63. $P = VI = (200)(10) = 2000$ W

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64. The number of free electrons passing through the conductor from right to left is equal to the number of free electrons passing through from left to right. Total number of electrons passing through any cross section is zero. So, net current through the section of wire is zero.

65. $R = \frac{\rho L}{A} = \frac{4\rho L}{\pi d2}$

$R' = \frac{4\rho L}{\pi d2} = \frac{4\rho(2L)}{\pi(2d)2} = \frac{1}{2}\left(\frac{4\rho L}{\pi d2}\right) = \frac{1}{2}R$

66. $R_e = \frac{R}{n} = \frac{20}{4} = 5\ \Omega$

$I = \frac{V}{Re} = \frac{20}{5} = 4\ A$

When identical resistances are connected in parallel same current flows through each resistance (equally divides) So, current through each resistance = 4/4 = 1A

67. When the length of wire becomes "n" times keeping mass, volume remain constant, then
$R' = n^2R = 3^2R = 9R$

68. Ohm's law holds well as long as the physical states and temperature of the conductor remains constant. But the temperature of filament bulb does not remain constant, it increases. This increases in temperature increases the resistance of filament. According to the Ohm's law:

$I = \frac{V}{R}$

The current will decrease and the graph between "V" and "I" is not a straight line. That is why the filament of the light bulb does not obey the Ohm's law.

69. $P = VI \Rightarrow I = \frac{P}{V} = \frac{140}{110} = 1.27\ A$

70. $P = VI \Rightarrow I = \frac{P}{V} = \frac{60}{120} = 0.5\ A$

$Q = It = (0.5)(12 \times 3600) = 6 \times 3600 = 21600C$

71. $P = \frac{V2}{R} \Rightarrow R = \frac{V2}{P} = \frac{32}{0.5} = 18\ \Omega$

$P' = \frac{12}{18} = 0.056\ W$

72. $P = \frac{V2}{R} \Rightarrow R = \frac{V2}{P} = \frac{1202}{60} = 240\ \Omega$

73. $R = \frac{V}{I} = \frac{6}{0.3} = 20\ \Omega$

$H = I^2Rt = (0.3)^2(20)(120) = 9(2)(12) = 216\ J$

74. Resistance of each part = R/2

The resistance of bundle, $R_e = \frac{R/2}{2} = \frac{R}{4}$

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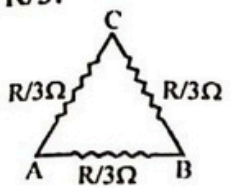
75. If a wire of resistance R is bent into an equilateral triangle, then resistance of each side is R/3.



The R_e between any two corners $= \frac{2(R/3)}{3} = \frac{2R}{9}$

76. $\frac{RA}{RB} = \frac{\rho L/AA}{\rho L/AB} = \frac{AB}{AA} = \frac{\pi dB2}{\pi dA2} = \frac{(22-12)}{12} = 3$

77. $R = \frac{V}{I} = \frac{2}{4} = 0.5\ \Omega$

$R = \frac{V}{I} = \frac{4}{10} = 0.4\ \Omega$

In 2nd case potential difference is doubled from 2 to 4V and current increases from 4 to 10 A (more than double). So, it is not possible.

78. $P = VI \Rightarrow I = \frac{P}{V} = \frac{600}{120} = 5\ A$

79. $R_e = \frac{R}{n} = \frac{9}{3} = 3\ \Omega$

80. $H_1 = H_2$

$I^2R_1t_1 = I^2R_2t_2$

$R_2 = \frac{R1t1}{t2} = \frac{(20)(5min)}{1min} = 100\ \Omega$

81. A fuse is placed in series with the circuit to protect against short circuit (high current). It is used in home appliances to limit the current.

82. $P = VI = (80 \times 10^3)(7 \times 10^{-3}) = 560\ W$

83. $I = \frac{V_T}{R_{eq}} = \frac{5-3}{10+20} = \frac{3}{30} = \frac{1}{10} = 0.1A$

84. A resistance is introduced in a circuit in series to decrease the current because the effective resistance increases in series combination.

85. $V = IR \Rightarrow I = \frac{V}{R} = \frac{7.5}{15} = 0.5\ A$

86. $P = \frac{V2}{R} \Rightarrow R = \frac{V2}{P} = \frac{2002}{100} = 400\Omega$

$P = \frac{V2}{R} = \frac{1602}{400} = \frac{160\times160}{400} = 64\ W$

87. Energy $= \frac{Power(Watts)\times time(hours)}{1000}$ kWh

$= \frac{500\times24}{1000}$ kWh $= 12$ kWh $= 12$ units

88. $R = \frac{\rho L}{A} = \frac{4\rho L}{\pi d2} \Rightarrow R \propto \frac{1}{d2}$

As
$d_P = 2d_Q$
so, $R_Q = 4R_P$
In parallel combination current divides

$I = \frac{V}{R} \Rightarrow \quad I \propto \frac{1}{R}$

$I_P = 4I_Q \Rightarrow \frac{IP}{IQ} = 4$

89. $P = \frac{V2}{R} \Rightarrow R \propto \frac{1}{P}$

The 200W bulb has least resistance.

$R \propto \frac{1}{A}$

So, 200W bulb has thickest filament.

90. $W = Pt$ (watt × second)

91. The fractional change in resistivity per kelvin is called the temperature coefficient of resistivity. $\alpha = \frac{\rho t - \rho o}{\rho o t}$

92. In series combination of resistors same current flows through each resistance.

93. $P_{out} = \frac{E2R}{(R-r)2+4Rr}$

When "R=r" the denominator of the expression of "P_{out}" is least, so "P_{out}" is then maximum.

$(P_{out})_{max} = \frac{E2}{4R}$

94. $P = \frac{V2}{R} \Rightarrow R \propto \frac{1}{P}$

Bulb with least power rating has greatest filament resistance and hence has maximum brightness.

95. $P = \frac{V2}{R} \Rightarrow R \propto \frac{1}{P}$

96. In parallel combination

Power dissipation $= \frac{V2}{R} = \frac{E2}{R1}$

97. When filament of one bulb is break, the equivalent resistance is increased, that causes to decrease the current. So, ammeter reading decreases.
Similar bulbs in parallel combination have same brightness.

98. $I = \frac{Q}{T} = \frac{1.6\times10-19}{1\times10-15} = 1.6 \times 10^{-4}$ A

99. $I = \frac{100mA+20mA}{2} = 60$ mA

$Q = It = (60mA)(8s) = 480$ mC

100. $R = \frac{\rho L}{A} = \frac{4\rho L}{\pi d2} = 10\,\Omega$

$$R' = \frac{4\rho L}{\pi d2} = \frac{4\rho L}{\pi(2d)2} = \frac{1}{4}\left(\frac{4\rho L}{\pi d2}\right) = \frac{1}{4}R = \frac{1}{4}(10) = 2.5\,\Omega$$

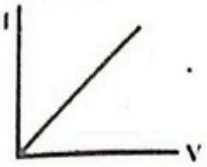
101. Number of free electrons per second $= \frac{10^{-6}}{1.6\times10^{-19}} = 6.25\times10^{12}$ electrons / sec

102. $Q/t \propto A$

103. In case of gases, charge carriers are positive ions and electrons.

104. 5 A of current means that 5 C of charge is passing through a point in 1 s.

105.



$\because slope = \frac{\Delta Y}{\Delta X}$

$slope = \frac{I}{V} = G$

106. For current delivered. Potential across 2Ω
V= 6 volt
thus for 6 Ω
6volt = I × 6 Ω

$I = \frac{v}{R} = \frac{6}{6} = 1A \Rightarrow$ **I=1A**

Total current of circuit.

I=1+3= 4 A

For voltage

$V = IR_{eq}$

$V = 4\left(\frac{6}{4}+\frac{15}{10}\right)$

V=12 volt

107. $I = \frac{V}{R_{eq}} = \frac{V}{\frac{(n-1)R}{n}} = I = \frac{nV}{(n-1)R} = \frac{3\times2}{(3-1)3} = \frac{6}{6} = 1A$

108. According to Ohm's law I ∝ V
If voltage is doubled then current will also be doubled, so power will be four times as
P ∝ V² also P ∝ I²

109. $\frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{\ell_2}{\ell_1}\times\left(\frac{r_1}{r_2}\right)^2 = \frac{3}{4}\left(\frac{2}{3}\right)^2 = \frac{1}{3}$

110. E = Ir

$r = \frac{E}{I} = \frac{2}{4} = \frac{1}{2} = 0.5A$

111. V – I graph of semiconductor is not a straight line.

112. $I_2=\left(\frac{R_2}{R_1+R_2}\right)I=\frac{8}{12}\times 3=2\,A$

113. Resistivity does not depend upon dimension (L,W) of wire. It only depends upon nature & temperature of wire.

114. $R=\frac{\rho L}{A}$

$L'=4L$

$A'=\frac{A}{4}$

$\boxed{R'=16R}$

115. $R=\frac{\rho L}{A}\Rightarrow \boxed{R\propto L}$

116. Temperature coefficient of resistance $=\alpha^{+ve\ for\ Cu}_{-ve\ for\ Ge}$

$\Rightarrow \alpha=+ve$ for $Cu\Rightarrow T\uparrow\Rightarrow R\uparrow$ or $T\downarrow\Rightarrow R\downarrow$

& $\alpha=-ve$ for $Ge\Rightarrow T\uparrow\Rightarrow R\downarrow$ or $T\downarrow\Rightarrow R\uparrow$

So resistance of Cu decreases & that of Ge increases by cooling or decreasing temperature.

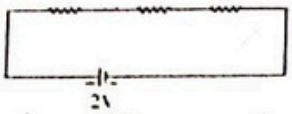
117. $R=\frac{\rho L}{A}\Rightarrow R\propto\frac{L}{A}$

118. $0.9\,(2+r)=0.3\,(7+r)\Rightarrow 6+3r=7+r\Rightarrow r=0.5\,\Omega$

119. $V=IR$

$I=\frac{V}{R}=\frac{7.5}{15}=\frac{1}{2}=0.5\,A$

120.



$V_{3\Omega}=\frac{3}{7+3}\times 2=\frac{6}{10}=0.6V$

121. $V_{R_2}=\frac{R_2}{R_1+R_2}E$

122. The resistance of high power devices is smaller than the low power ones. The resistance of 60 watt bulb is smaller than 40 watt bulb and so on $P=\frac{V^2}{R}$ For a given voltage, $P\propto\frac{1}{R}$. So, 60 W bulb has the lowest resistance.

123. $P=\frac{V^2}{R}\Rightarrow R=\frac{V^2}{P}$

$\frac{R_1}{R_2}=\frac{V_1^2}{V_2^2}\times\frac{P_2}{P_1}=\left(\frac{V_1}{V_2}\right)^2\times\frac{P_2}{P_1}$

$=\left(\frac{22\cancel{0}}{11\cancel{0}}\right)^2\times\frac{2\cancel{0}}{4\cancel{0}}=2:1$

124. Brightness $\propto \frac{1}{R}$

125. $V=\frac{W}{q}=\frac{P\times t}{q}=\frac{12\times 50}{100}=6V$

126. Effective resistance decreases, current increases, and voltage decreases.

127. $E=I(R+r)$; E constant; $I(R+r)=$ constant

$0.9[2+r]=0.3[7+r]$

OR $6+3r=7+r$

OR $2r=1$ or $r=\frac{1}{2}\Omega=0.5\Omega$

128. In the case of an ideal battery, the internal resistance is zero.

129. We know that $R=\frac{V}{I}=\frac{1}{slope\ of\ I-V\ graph}$

At CD slope is negative, so resistance is negative.

130. $Q=\frac{V^2}{R}t$ $W=P\times t$

When R is halved, then Q is doubled?

131. $R_{hot}=10R_{cold}$

$R_{hot}=\frac{V^2}{P}=\frac{200\times 200}{100}=400\Omega$

$\therefore \quad R_{cold}=\frac{400}{10}\Omega=40\Omega$

$P=I^2R$

132. $or\ R=\frac{P}{I^2}=\frac{1}{5\times 5}\Omega=0.04\Omega$

133. $R\propto l^2\Rightarrow\frac{\Delta R}{R}\times 100\%=2\left(\frac{\Delta l}{l}\right)$

134. The velocity of free electrons at room temperature due to their thermal motion is several hundred kilometres per second.

135. The drift velocity is of the order of 10^{-3} ms^{-1}.

136. It is a case of weak current

137. Alloys have high resistivity. So, the are unsuitable for making connecting wires.

138. $I\times 10=5$

$I=\frac{5}{10}A$

$I=0.5A$

139. Ionization of electrolyte.

140. $12=0-V\ \ or\ V=-12\ volt.$

141. When the switch S_2 is closed, the whole of current shall flow through the connecting wire only which is supposed to have zero resistance.

142. $R=\frac{V}{I}=\frac{60}{15}\Omega=4\Omega$

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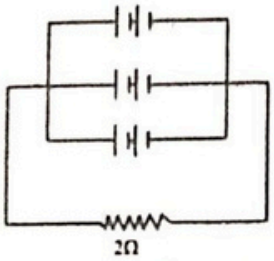
143. $P = \frac{V^2}{R}$. If V is halved, P is reduced by a factor of 4. So, new power is $\frac{1000}{4} W$ i.e. 250 W.

144. Total emf = 2.2 volt

Total internal resistance $= \frac{6}{3}\Omega = 2\Omega$

Total resistance $= 2\Omega + 2\Omega = 4\Omega$



Current, $I = \frac{2.2}{4} A = \frac{11}{20} A = 0.55A$

145. $I = \frac{E}{r}$

$8 = \frac{4}{r}$ or $r = \frac{4}{8}\Omega = 0.5\Omega$

146. For resistors in series connection, current (I) is the same through the resistors. In other words, ratio of the voltage drop across each resistor with tis resistance is the same. That is,

$I = \frac{5-3}{R_1} = \frac{3-2}{R_2} = \frac{2}{R_3}$

i.e. $R_1 : R_2 : R_3 = 2:1:2.$

147. Resistance is halved. Current is doubled.

148. $Q = It = (8.0\ mA)(0.020\ s) = 0.16\ mC$

149. $Energy = Pt = \frac{V^2}{R} t = \frac{V^2}{\frac{\rho\ell}{A}} t = \frac{V^2 At}{\rho\ell}$

150. $I = \frac{6}{2.9 + 0.40} = 1.82\ A$

$P = I^2 R = (1.82)^2 (2.9) = 9.6W$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **A flow of 10^7 electrons per second through a conductor produce a current of.**
   A. $1.6\times10^{-12}\,A$ C. $1.6\times10^{-26}\,A$
   B. $1.6\times10^{12}\,A$ D. $1.6\times10^{26}\,A$

2. **The first source of e.m.f. was discovered by.**
   A. Ampere C. Ohm
   B. Volta D. Coulomb

3. **Which one of the given cells is not rechargeable?**
   A. Lechlanche C. Cadmium
   B. Nickel D. Lead Acid

4. **Which one of the given sources converts light energy into electrical energy?**
   A. Dynamo C. Photocell
   B. Generator D. Thermocouple

5. **While of the following material is non-ohmic:**
   A. Gold C. Copper
   B. Germanium D. Silver

6. **What will be resistance of the wire when its length is doubled**
   A. Remain same C. Double
   B. Half D. Triple

7. **If the resistivity of the conductor is $2\times10^{-6}\Omega m$ then its conductivity is**
   A. $2\times10^{6}\Omega^{-1}m^{-1}$ C. $5\times10^{-5}\Omega^{-1}m^{-1}$
   B. $5\times10^{6}\Omega^{-1}m^{-1}$ D. $5\times10^{5}\Omega^{-1}m^{-1}$

8. **Siemen is a unit of conductance and it is equal to**
   A. ohm C. mho.m
   B. mho D. $mho.m^{-1}$

9. **When resistance of the material increases by increases the temperature then the value of co- efficient of resistivity will be.**
   A. Constant C. Positive
   B. Zero D. Negative

10. **The unit of temperature co-efficient is.**
    A. $^{\circ}C$ C. $^{\circ}C.m$
    B. $^{\circ}C^{-1}$ D. $^{\circ}C^{-1}.m$

11. **In the presence of internal resistance of the source, which one of the following relations between potential difference (V) and e.m.f. (E) is correct**
    A. E=0 C. E>V
    B. E=V D. E<V

12. **The unit of electromotive force is.**
A. Newton
B. Joule
C. Watt
D. Volt

13. **The source of e.m.f transfers its maximum power to the external circuit when (r= internal resistance, R= load resistance).**
A. r=0
B. r=R
C. r<R
D. r>R

14. **Kirchhoff's 1st law is based upon law of conservation of.**
A. Current
B. Charge
C. Voltage
D. Energy

15. **The node in an electric circuit which has zero potential is known as.**
A. Node
B. Antinode
C. Negative mode
D. Datum mode

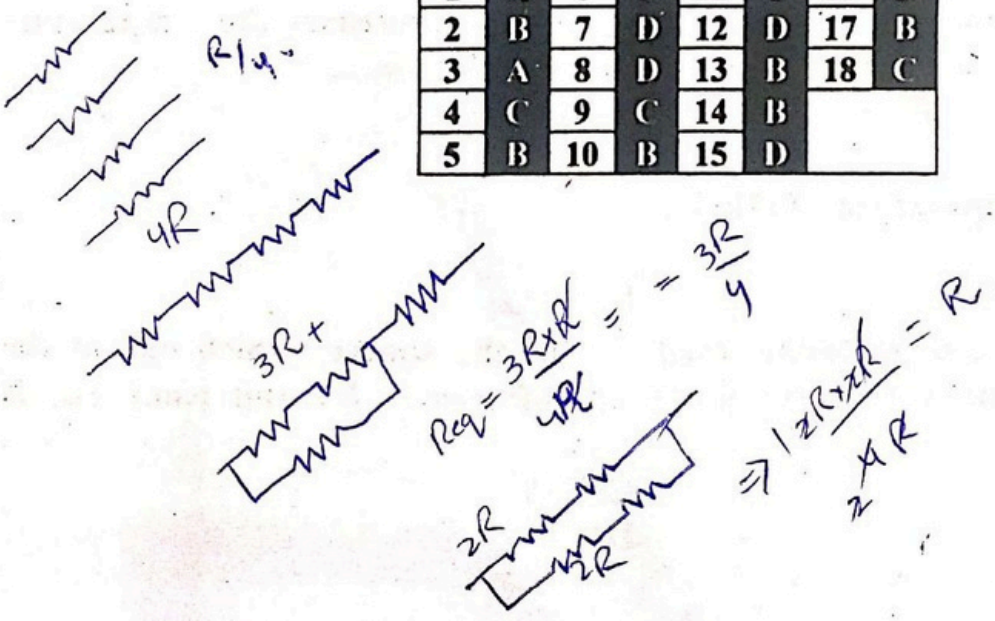
16. **When the direction of current is from negative to positive terminal of the batter then 'E' is taken as.**
A. Zero
B. Normal
C. Positive
D. Negative

17. **An electrical device which controls the current is known as.**
A. Thermocouple
B. Rheostat
C. Thermistor
D. Wheatstone bridge

18. **The electrical device which is being used to compare the e.m.f. of two cell is known as.**
A. Rheostat
B. Wheatstone bridge
C. Potentiometer
D. Galvanometer

ANSWER KEY

1	A	6	C	11	C	16	D
2	B	7	D	12	D	17	B
3	A	8	D	13	B	18	C
4	C	9	C	14	B		
5	B	10	B	15	D		



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KPK TEXT BOOK EXERCISE MCQS

1. Three resistors of resistance R each are combined in various ways. Which of the following cannot be obtained?

A. $3R\Omega$ C. $\frac{2R}{4}\Omega$

B. $\frac{R}{3}\Omega$ D. $\frac{2R}{3}\Omega$

2. 10^6 electrons are moving through a wire per second, the current developed is:

A. $1.6\times10^{-19}A$ C. $1A$

B. $1.6\times10^{-13}A$ D. 10^6A

3. When a wire is stretched and its radius becomes $r/2$, then its resistance will be:

A. 16R C. 4R

B. 2R D. 0

4. A wire of uniform cross-section, A length L and resistance R is cut into two equal parts. The resistivity of each part will be:

A. doubled C. halved

B. remains the same D. one fourth

5. The resistivity of two wires is ρ_1 and ρ_2 which are connected in series. If there dimensions are same then the equivalent resistivity of the combination will be:

A. $(\rho_1+\rho_2)$ C. $\frac{1}{\rho_1}+\frac{1}{\rho_2}$

B. $\frac{\rho_1+\rho_2}{2}$ D. $\frac{\rho_1}{\rho_2}$

6. The powers of two electric bulbs are 100w and 200w. Which are connected to power supply of 220 V. The ratio of resistance of their filament will be,

A. 1:2 C. 2:1

B. 1:3 D. 4:3

7. Thermocouple is an arrangement of two different metals:

A. To convert heat energy in to electrical energy

B. To produce more heat

C. To convert heat energy into chemical energy

D. To convert electric energy in to heat energy

ANSWER KEY

1	C	6	C
2	B	7	A
3	A		
4	B		
5	B		

PAST PAPERS 2008-2020

1. A copper wire has length "L" and cross-sectional area "A". Its resistance "R". If we halved the length and halved the diameter of wire then what will be the resistance of this wire? (UHS 2019)
   A. R
   B. 3R
   C. 2R
   D. 4R
2. A wire has resistance 100 ohm at 0°C and 200 ohm at 100°C. What is its temperature coefficient in K^{-1}? (UHS 2008)
   A. – 0.01
   B. – 1/273
   C. 0.01
   D. 1/273
3. The heat produced by a current "I" in the wire of resistance "R" during time interval is: (UHS 2008)
   A. I^2/Rt
   B. I^2Rt
   C. I^2R/t
   C. IR^2t
4. The deviation of I-V graph from the straight line is due to: (UHS 2009)
   A. Decrease in temperature and decrease in resistance
   B. Increase in temperature and increase in resistance
   C. Decrease in temperature and increase in resistance
   D. Increase in temperature and decrease in resistance
5. The fractional change in resistance per Kelvin is known as: (UHS 2009)
   A. Temperature coefficient of resistance
   B. Thermal coefficient
   C. Linear coefficient of expansion
   D. Volume coefficient of expansion
6. The energy supplied by the cell to the charge carriers is derived from the conversion of: (UHS 2009)
   A. Heat energy into electrical energy
   B. Chemical energy into electrical energy
   C. Solar energy into electrical energy
   D. Mechanical energy into electrical energy
7. The equivalent current which passes from a point at higher potential to a point at a lower potential as if it is represented by movement of positive charges is: (UHS 2010)
   A. Electronic current
   B. Electric current
   C. Magnetic lines
   D. Conventional current
8. If "V" is applied potential difference across resistance "R", then loss in potential energy per unit time is: (UHS 2010)
   A. VI
   B. I^2R
   C. V^2/R
   D. All of the above
9. The substances like germanium and silicon have: (UHS 2010)
   A. Negative temperature coefficients
   B. Positive temperature coefficients
   C. Both A. and B.
   D. None of the above

   $V=IR$ $I=V/R$
10. If 2 A current passes through a resistor when connected to a certain battery. If the resistance is replaced by the double resistance then current will become: (UHS 2011)
    A. 2 A
    B. 4 A
    C. 6 A
    D. 1 A

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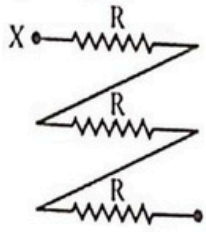
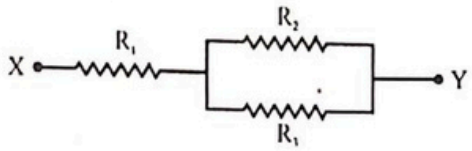
11. Three resistance each having value "R" are connected as shown in figure. What is the equivalent resistance between "X" and "Y"? (UHS 2011,2013)



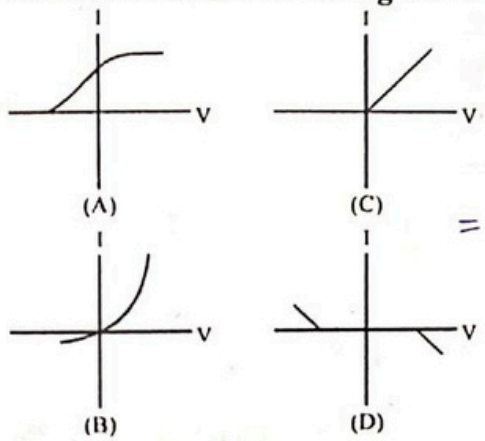
A. R
B. R/3
C. 3R
D. R^3

12. Three resistances "R_1", "R_2" and "R_3" are connected as shown in figure. Equivalence resistance is: (UHS 2011)



A. $R_1 + R_2 + R_3$
B. $\frac{R_1 + R_2 + R_3}{R_1 R_2}$
C. $\frac{R1R2 + R2R3 + R3R1}{R2 + R3}$
D. $\frac{R1R2R3}{R2R3}$

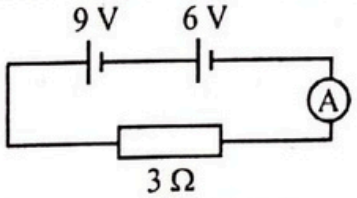
13. Which one of the following is I-V curve of a junction diode? (UHS 2012)



14. 12 volt battery is applied across 6 Ω resistance to have a steady flow of current. What must be the required potential difference across the same resistance to have a steady current of one ampere? (UHS 2013)

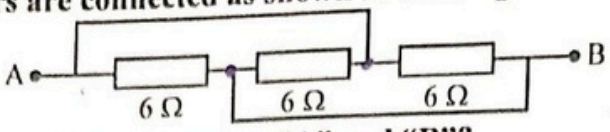
A. 12 V
B. 3 V
C. 1 V
D. 6 V

15. What is the reading of ammeter as shown in the circuit diagram? (UHS 2014)



A. 1 A
B. 15 A
C. 5 A
D. 10 A

16. Three 6 Ω resistors are connected as shown in the diagram. (UHS 2014)



What is the resistance between points "A" and "B"?

A. 0 Ω
B. 18 Ω
C. 4 Ω
D. 2 Ω

17. Which combination of seven identical resistors each of 2 Ω gives rise to the resultant of $\frac{22}{5}$ Ω? (UHS 2015)

A. 5 parallel, 2 series
B. 4 parallel, 3 series
C. 3parallel, 4 series
D. 2parallel,5 Series

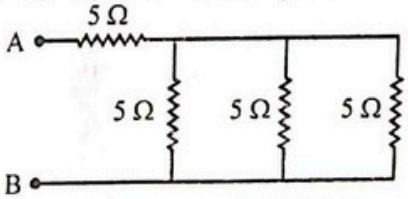
18. If a resister having resistance "R" is cut into three equal parts, then equivalent of parallel combination is: (UHS 2015)

A. $\frac{9}{R}$
B. $\frac{3}{R}$
C. $\frac{R}{9}$
D. $\frac{R}{3}$

19. The resistance of a piece of wire is 12 Ω. It is bent to from an equilateral triangle. What is the equivalent resistance between any two corners of the triangles? (UHS 2015)

A. 1.3 Ω
B. 2.0 Ω
C. 4.0 Ω
D. 2.7 Ω

20. Total resistance between "A" and "B" in the given circuit is: (UHS 2016)



A. 5.6 Ω
B. 3.33 Ω
C. 0.33 Ω
D. 6.6 Ω

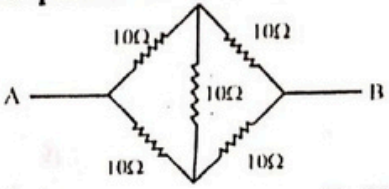
21. 2×10^6 electrons passing through a conductor in 1 ms. Find electric current flowing through conductor: (UHS 2017)

A. 32×10^{-9} A
B. 320×10^{-10} A
C. 3.2×10^{-10} A
D. 0.32×10^{-10} A

22. A carbon resistor is connected to a battery of 50 volts and 2 ampere current is passing through it. If voltage is increased to 75 volts, the current will become: (UHS 2017)

A. 3 A
B. 1.5A
C. 4.5A
D. 6 A

23. If the resistance of each resistor is 10 ohm in the following figure then what will be the effective resistance between points "A" and "B": (UHS 2017)



A. 40 ohms
B. 50 ohms
C. 30 ohms
D. 10 ohms

24. **A torch is rated 2.2 V, 0.25 A. Calculate the charge passing through the bulb in one second and energy transferred by the passage of each coulomb of charge: (UHS 2018)**
A. 0.25 C and 2.2 J
B. 2.5 C and 0.55 J
C. 0.25 C and 0.55 J
D. 0.25 C and 2.2 V

25. **Kirchhoff's first law is manifestation of: (UHS 2018,2019)**
A. Law of conservation of energy
B. Law of conservation of mass
C. Law of conservation of momentum
D. Law of conservation of charge

26. **When a potential difference is applied across the ends of a uniform wire of length "ℓ" and radius "r", a current "I" flows in the wire. If same potential difference is applied to the ends of another wire of the same material but of length "2 ℓ" and radius "2r", the current in the wire is: (UHS 2018)**
A. I
B. I/4
C. 2I
D. I/2

27. **Calculate the rate at which energy is transferred by 220 V mains supply which provides a current of 0.1 A to a LED: (UHS 2019)**
A. 22 kW
B. 2.2 kW
C. 22 W
D. 2.2 W

28. **When a wire is compressed and its radius becomes 2R then its resistance will be: (PMC 2020)**
A. 16R
B. 4R
C. 1/16 R
D. 1/4 R

29. **One of the following is an ohmic device: (PMC 2020)**
A. Filament Bulb
B. Semiconductor Diode
C. Transistor
D. Copper Wire

30. **The change in a resistance of metallic conductor below 0 °C? (PMC 2020)**
A. Nonlinear
B. Curve
C. Linear
D. Curvilinear

ANSWER KEY

1	C	6	A	11	C	16	D	21	C	26	C
2	C	7	D	12	C	17	A	22	A	27	C
3	B	8	D	13	B	18	C	23	D	28	C
4	B	9	A	14	D	19	D	24	C	29	D
5	A	10	D	15	C	20	D	25	D	30	C

SOLUTIONS

1.

$$R = \rho\frac{L}{A} = \rho\frac{L}{\pi(d/2)2} \Rightarrow R \propto \frac{L}{d2}$$

$$\frac{R}{R} = \frac{L}{L} \times \frac{d2}{d2} = \frac{L/2}{L} \times \frac{d2}{(d/2)2} = 2 \Rightarrow R' = 2R$$

2.

$$\alpha = \frac{Rt - Ro}{Ro\Delta t} = \frac{200-100}{(100)(100)} = \frac{100}{(100)(100)} = 0.01$$

3.

$H = I^2Rt$

4.



The deviation in graph is due to increase in temperature and resistance.

5.

$$\alpha = \frac{Rt - Ro}{Ro\Delta t} = \frac{\Delta R}{Ro\Delta t} = \frac{\Delta R/Ro}{\Delta t}$$

6.

Cell converts chemical energy into electrical energy.

7.

Definition of conventional current.

8.

$P = VI = I^2R = V^2/R$

9.

$$\alpha = \frac{Rt - Ro}{Ro\Delta t}$$

Silicon and germanium are the semiconductors their resistances decrease with increase in temperature. So, they both have negative temperature coefficients.

10.

$$I \propto \frac{1}{R}$$

On doubling the resistance, the current will be halved (1A).

11.

As all the resistances are in series combination. So, $R_e = R + R + R = 3R$

12.

$$R_e = R_1 + \frac{R_2R_3}{R_2 + R_3} = R_1 + \frac{R_1(R_2 + R_3) + R_2R_3}{R_2 + R_3}$$

$$= \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2 + R_3}$$

13.

Semiconductor diode is a non ohmic device.

14.

$$I = \frac{V}{R} = \frac{12}{6} = 2\ A$$

As

$I \propto V$

So, for stead current of 1 A, P.d must be 6 V.

15.

$$V = V_1 + V_2 = 9 + 6 = 15\ V$$

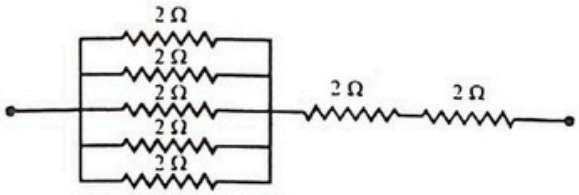
$$I = \frac{V}{R} = \frac{15}{3} = 5\ A$$

16.

This arrangement of resistances is parallel combination. So,

$$R_e = \frac{R}{n} = \frac{6}{3} = 2\ \Omega$$

17.



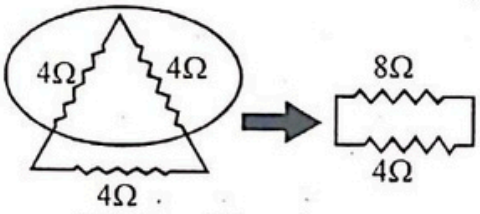
$$R_e = \frac{2}{5} + 2 + 2 = \frac{22}{5}$$

18.

The resistance of each part $= \frac{R}{3}$

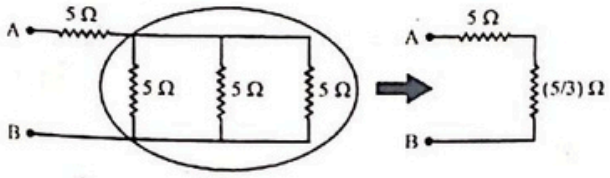
$$R_e = \frac{R/3}{3} = \frac{R}{9}$$

19.



$$R_e = \frac{(8)(4)}{8+4} = \frac{32}{12} = \frac{8}{3} = 2.7\ \Omega$$

20.



$$R_e = \frac{5}{3} + 5 = \frac{20}{3} = 6.6\ \Omega$$

21.

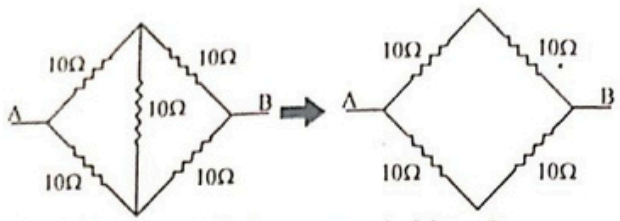
$$I = \frac{Q}{t} = \frac{(2\times106)(1.6\times10-19)}{10-3}\ 3.2 \times 10^{-10}\ A$$

22.

$$R = \frac{V}{I} = \frac{50}{2} = 25\ \Omega$$

$$I' = \frac{V}{R} = \frac{75}{25} = 3\ A$$

23.



This is balanced Wheatstone bridge. So,

$R_e = 10\ \Omega$

24.

$P = VI = (2.2)(0.25) = 0.55\ J\ s^{-1}$

Energy in 1 second = 0.55 J

$$P = \frac{QV}{t} \Rightarrow Q = \frac{Pt}{V}$$

$$Q = \frac{(2.2)(0.25)(1)}{2.2} = 0.25\ C$$

25.

Law of conservation of charge.

26.

$$R = \rho\frac{l}{A} = \rho\frac{l}{\pi r2} \Rightarrow R \propto \frac{l}{r2}$$

$$\frac{R}{R} = \frac{l}{l} \times \frac{r2}{r2} = \frac{2l}{l} \times \frac{r2}{(2r)2} = \frac{1}{2} \Rightarrow R' = \frac{R}{2}$$

As

$$I \propto \frac{1}{R}$$

So, the current will be doubled (2I).

27.

$P = VI = (220)\ (0.1) = 22\ W$

28.

$$R \propto \frac{1}{A^2},\quad R \propto \frac{1}{(\pi r^2)^2},\quad R \propto \frac{1}{r^4}$$

29.

For Ohmic devices I is directly proportional to V and V versus I graph is a straight line. (Keeping T=constant)

30.

For metals $R \propto T$

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Q.1 **An example of highly non-ohmic resistor is**
A. Diode
B. Tungsten wire
C. Carbon resistance
D. Copper wire

Q.2 **A current of 16 amperes divides between two branches in parallel of resistances 8 ohms and 12 ohms respectively. The current in each branch is**
A. 6.4 A, 6.9 A
B. 6.4 A, 9.6 A
C. 4.6 A, 6.9 A
D. 9.6 A, 6.4 A

Q.3 **Four 100 W bulbs are connected in parallel across 200 V supply line. If one bulb gets fused**
A. No bulb will light
B. All the four bulbs will light
C. Rest of three bulbs will light
D. Above B and C

Q.4 **Specific resistance of all metals is mostly affected by**
A. temperature
B. pressure
C. magnetic field
D. volume

Q.5 **1 Watt =**
A. 1 VA
B. 1V/A
C. 1A/V
D. 1/AV

Q.6 **The length and radius of an electric resistance of a certain wire are doubled simultaneously, then the:**
A. resistance will be doubled and specific resistance will be halved
B. resistance will be halved and specific resistance will remain uncharged
C. resistance will be halved and the specific resistance will be doubled
D. resistance and specific resistance will both remain uncharged

Q.7 **Calculate the time taken for the charges to complete the circuit if the total charges were 5000 Coulomb and the current of the circuit was 20 Amp?**
A. 250 seconds
B. 350 seconds
C. 400 seconds
D. 500 seconds

Q.8 **SI Unit of potential difference is?**
A. Coulomb
B. Volts
C. Ampere
D. newton's Meter

Q.9 **The resistance and length of wire are**
A. inversely related
B. directly related
C. not related
D. inversely proportional

Q.10 **The graphical representation of Ohm's law is**
A. Hyperbola
B. Ellipse
C. Parabola
D. Straight line

Q.11 **Two copper conductors have equal length. The cross-sectional area of one conductor is four times that of the other. If the conductor having smaller cross-sectional area has a resistance of 40 ohms the resistance of another conductor will be**
A. 160 ohm
B. 80 ohm
C. 20 ohm
D. 10 ohm

Q.12 **A galvanometer acting as a voltmeter will have a coil with**
A. a high resistance in parallel
B. a high resistance in series
C. a low resistance in parallel
D. a low resistance in series

Q.13 Find the current if power given is 5 Watts and voltage is 0.5 volts.
A. 10 Amp B. 20 Amp
C. 30 Amp D. 50 Amp

Q.14 When bulb is turned on, ohm's law is applicable
A. Yes B. No
C. partly D. None of these

Q.15 Potentiometer is used to
A. to compare potential difference B. To measure potential difference
C. both a and b D. to measure the current

Q.16 Which of the following bulb has least resistance:
A. 50 W B. 100 W
C. 200 W D. 300 W

Q.17 Conductivity is the reciprocal of
A. Resistance B. Resistivity
C. Capacitance D. Magnetic field

Q.18 When a wire is compressed and its radius becomes 2R Then its resistance will be
A. 16R B. 4R
C. 2R D. R/16

Q.19 The resistances of a wire at temperatures t°C and 0°C are related by
A. $R_t=R_0(1+\alpha t)$ B. $R_t=R_0(1-\alpha t)$
C. $R_t=R_0^2(1+\alpha t)$ D. $R_t=R_0^2(1-\alpha t)$

Q.20 The resistance of a coil is 4.2 ohm at 100° C and the temperature coefficient of resistance of its material is 0.004/°C. Its resistance at 0oC
A. 6.5 ohm B. 5 ohm
C. 3 ohm D. 4 ohm

Q.21 What is the relationship between resistance and current?
A. They are directly related to each other.
B. They are inversely related to each other.
C. The resistance has a greater magnitude than current.
D. The current has a greater magnitude than resistance.

Q.22 How much more heat is produced, if the current is doubled?
A. twice the original amount B. thrice the original amount
C. four times the original amount D. five times the original amount

Q.23 Which of the following represents voltage?
A. Work done / Current×Time B. Work done × Charge
C. Work done×Time / Current D. Work done × Charge × Time

Q.24 In order to reduce electricity consumption at home, what kind of appliance should one purchase?
A. one which draws low power B. one which produces less heat
C. one which operates at a higher voltage D. one which draws a high amount of current

Q.25 If I, R and t are the current, resistance and time respectively, then according to Joule's law heat produced will be proportional to
A. I^2Rt B. I^2Rf
C. I^2R^2t D. $I^2R^2t^2$

Q.26 What is the relationship between Power, Current and Resistance?
A. $P=I^2R$ B. $P=I^2R/2$
C. $P=IR$ D. All of them

Q.27 The fractional change in resistance per kelvin is known as
A. coefficient in resistance
B. temperature coefficient of resistance
C. resistance
D. None of these

Q.28 If a current of 5 Amperes flows through the conductor. The number of electrons per second will is:
A. 1.6×10^{-19}
B. 3.12×10^{19}
C. 4×10^{19}
D. 7.68×10^{20}

Q.29 A potential difference of 10 V is applied across a conductor whose resistance is 2.5ohm. What is the value of current flowing through it?
A. 4A
B. 2A
C. 6A
D. 10A

Q.30 Electric current may be defined as
A. Rate of flow of charge
B. Rate of flow of momentum
C. Rate of flow of power
D. None of them

Q.31 Volts / Ampere = _____
A. Ohm
B. Ohm meter
C. Pascal
D. None of them

Q.32 Two incandescent light bulbs of 40 W and 60 W ratings are connected in series across the mains. Then
A. The bulbs together consume 100 W
B. The bulbs together consume 50 W
C. The 60 W bulb glows brighter
D. The 40 W bulb glows brighter

Q.33 When 2Ω, 4Ω and 6Ω resistors are connected in parallel their resultant equivalent resistance will be:
A. 12Ω
B. 11/12Ω
C. 12/11Ω
D. Data is insufficient

Q.34 Correct form of ohm's law:
A. I = VR
B. V ∝ I
C. V = IR
D. Both B and C

Q.35 Four wires of same material, the same cross-sectional area and the same length when connected in parallel give a resistance of 0.25 ohms. If the same four wires are connected is series the effective resistance will be:
A. 1 ohm
B. 2 ohm
C. 3 ohm
D. 4 ohm

Q.36 Basically a potentiometer is a device for
A. Comparing two voltages
B. Measuring a current
C. Comparing two currents
D. Measuring a resistance

Q.37 The length of a conductor is halved. Its resistance will be:
A. halved
B. doubled
C. unchanged
D. quadrupled

Q.38 Two wires of copper are of the same length but 'have different diameters. When they are connected in series across a battery, the heat generated is H1 When connected in parallel across the same battery, the heat generated during the same time is H2 Then:
A. H1 = H2
B. H1 < H2
C. H1 > H2
D. all are possible

Q.39 A wire of uniform area of cross-section A and length L is cut into two equal parts, the resistivity of each part is:
A. Doubled
B. Half
C. Remains the same
D. increase three times

Q.40 Which one of the following does not have negative temperature coefficient?
A. Aluminium B. Paper
C. Rubber D. Mica

Q.41 Reciprocal of resistivity is called
A. Resistance B. Inductance
C. Conductivity D. Flexibility

Q.42 Find the resistance if voltage of the circuit is 45 volts and current 30 Amp?
A. 1.6 ohm B. 1.5 ohm
C. 1.7 ohm D. 1.8 ohm

Q.43 An electrical instrument which is used to measure potential difference between two points is called:
A. Barometer B. Manometer
C. Galvanometer D. Voltmeter

Q.44 An electric filament bulb can be worked from
A. DC supply only B. AC supply only
C. Battery supply only D. All above

Q.45 PD stands for
A. Potential difference B. Potential deviation
C. Power difference D. Power dissipated

Q.46 In parallel combination of resistors, voltage remains?
A. Same B. Different
C. Both of them D. None of them

Q.47 Which of the following has a negative temperature coefficient of resistance?
A. Tungsten B. Carbon
C. Nichrome D. Platinum

Q.48 Emf becomes equal to terminal potential difference when
A. circuit is closed B. current is max
C. circuit is open D. all of these

Q.49 When the length of the conductor is doubled and the area of cross-section remains the same then is resistance
A. Remains the same B. Will be doubled
C. Will become half D. Will increase by four times

Q.50 Resistivity of a wire is ___ ohm-m if 0.75 A current flows through it by applying 1.5V potential difference, take length and cross section as 5m and 2.5 x 10-7 m2.
A. 1×10^{-7} B. 2.63×10^{-8}
C. 19×10^{-8} D. 7.85×10^{-8}

Q.51 _____ relationship exists between current and voltage in terms of Ohm's law.
A. Non linear B. Varying
C. Linear D. None of them

Q.52 Specific resistance of all metals is mostly affected by
A. Temperature B. Pressure
C. Magnetic field D. Volume

Q.53 Ohm's law is applicable to
A. Semiconductors B. Vacuum tubes
C. Carbon resistors D. None of these

Q.54 A light bulb draws 300 mA when the voltage across it is 240 V. The resistance of the light bulb is:
A. 400-ohm B. 600 ohm
C. 800-ohm D. 1000 ohm

Q.55 **The battery of a pocket calculator supplies 0.35A at a potential difference of 6 volts. What is the power of the calculator?**

A. 9 Watt
B. 2.1 Watt
C. 4 Watt
D. 7 Watt

Q.56 **If a cell of emf 2V and internal resistance 0.5 ohm is connected across a resistance R, the current that flows is same as that when a cell of emf 1.5 V and internal resistance 0.3 ohm is connected across the same resistor. Then R=_____Ohm.**

A. 0.3
B. 0.6
C. 0.5
D. 0.75

Q.57 **The heat sensitive device whose resistivity changes very rapidly with change of temperature is called a:**

A. Resistor
B. Super-conductor
C. Thermocouple
D. Thermistor

Q.58 **Maximum power delivered by battery is:**

A. $P_{max}= E^2/4r$
B. $P_{max} = 4rE^2$
C. $P_{max} = VIT$
D. Unlimited

Q.59 **Resistance of human body**

A. 12 ohm
B. 120 ohm
C. 20 ohm
D. 120 kohm

Q.60 **Conductivity depend on**

A. Temperature and nature of material
B. Length
C. Area
D. All.

Q.61 **A load of resistance 0.04 Ω is attached to the cell having E.M.F 1.5 V and 15 A is drawn in the circuit. The internal resistance of cell will be**

A. 0.6 Ω
B. 0.06 Ω
C. 6 Ω
D. 0.3 Ω

Q.62 **Resistivity depends upon**

A. Nature
B. Temperature
C. Both
D. None

Q.63 **Resistance depends upon**

A. Length
B. Area
C. Temperature
D. All of these

Q.64 **Ohm's law is valid at?**

A. Constant Temperature
B. Variable Temperature
C. All kind of temperature
D. None

Q.65 **Electrical power deliver by the source.**

A. VI
B. F.v
C. $\frac{work}{t}$
D. none

Q.66 **Bulb Having Current 200A, and Voltage 220 find Power**

A. 22kw
B. 44kw
C. 44watt
D. 40 kw

Q.67 **Ohm's law is not valid for:**

A. semiconductors
B. Filament bulb
C. copper
D. both a and b

Q.68 **$Req=R_1 + R_2 + R_3 + \ldots\ldots + Rn$ is for which combination?**

A. Series
B. parallel
C. both
D. None

Q.69 Steady current does not change with respect to:
A. time
B. voltage
C. ions
D. temperature

Q.70 A heater of 400 Watt was on for 5 hours what is electrical Consumption
A. 20KwH
B. 12 KWH
C. 2KWH
D. None

Q.71 The unit of power is
A. watt × second
B. Joule
C. Joule × second
D. watt

Q.72 Find potential difference when resistance is 40ohm and Current is 300 Amp
A. 12000 V
B. 10000 V
C. 6000 V
D. 3000 V

Q.73 The sensitivity of a potentiometer can be increased by:
A. Increasing the e.m.f. of the primary cell
B. Increasing the potential gradient
C. Increasing the length of the potentiometer wire
D. Decreasing the length of the potentiometer wire

Q.74 The specific resistance of a rod of copper as compared to that of thin wire of copper is:
A. Less
B. More
C. Same
D. Depends upon the length and area of cross-section of the wire

Q.75 Which one of the following bulbs has the least resistance?
A. 100W
B. 200W
C. 300W
D. 60W

Q.76 The current passing through a conductor is directly proportional to the potential difference applied across its terminals, provided the temperature and other physical conditions of the conductor does not change:
A. Gauss's law
B. Lenz law
C. Pascal's law
D. Ohm's law

Q.77 In order to achieve high accuracy, the slide wire of a potentiometer should be:
A. As long as possible
B. As short as possible
C. Neither too small not too large
D. Very thick

Q.78 Electrical power of a battery is defined as the rate of:
A. Electrical energy consumed by the battery
B. Electrical energy transferred by the battery
C. Both
D. None of these

Q.79 The hot resistance of the bulb's filament is higher than its cold resistance because the temperature coefficient of the filament is:
A. Zero
B. Negative
C. Positive
D. None

Q.80 The condition for the validity of Ohm's law is that the:
A. Temperature should remain constant
B. Current should be proportional to voltage
C. Resistance must be wire wound type
D. All of the above

Q.81 A resistance of 40 Ohms is attached to a circuit having current of 300 Amp, Find its voltage.
A. 12000 volts
B. 15000 volts
C. 20000 volts
D. 300 volts

Q.82 The SI Unit of electric charge is?
A. Coulomb B. Ampere
C. Hertz D. Volt

Q.83 EMF stands for
A. Electromotive force B. Electrical momentum force
C. Electric Magnetic force D. None of them

Q.84 An electrical instrument which is used to measure current passing through a circuit is called?
A. Ammeter B. Voltmeter
C. Galvanometer D. Avometer

Q.85 Copper wire is used as connecting wire because:
A. Copper has high electrical resistivity B. Copper has low electrical resistivity
C. Copper has low electrical conductivity D. Copper has high value of elasticity

Q.86 Which one of the following is a disadvantage of a potentiometer over a voltmeter?
A. it can measure the internal resistance of a cell
B. it can measure the e.m.f. of a cell
C. it is heavy and not portable
D. it can measure accurately very small PD of the order of few microvolt

Q.87 Value of current in a short circuit is _____
A. Infinite B. zero
C. minimum D. maximum

Q.88 A resistance of 40 Ohms is attached to a circuit having current of 300 Amp, Find its voltage.
A. 12000 volts B. 15000 volts
C. 20000 volts D. 300 volts

Q.89 A 200watt bulb operates in a 220V circuit. Find the current.
A. 0.9 Amp B. 0.6 Amp
C. 2 Amp D. 3 Amp

Q.90 A current of 5A flows in a resistor of 2 ohms. Calculate the energy dissipated in 300 seconds in the resistor.
A. 5KJ B. 10KJ
C. 15KJ D. 20 KJ

Q.91 Calculate the work done in a resistor of 20 ohm carrying 5A of current in 3 hours.
A. 1KWh B. 1.5KWh
C. 2KWh D. 3KWh

Q.92 Maximum power is delivered when internal resistance of the source equals
A. zero resistance B. load resistance
C. max resistance D. None of these

Q.93 Resistance of a material always decreases if
A. Temperature of material is decreased
B. Temperature of material is increased
C. Number of free electrons available becomes more
D. None of the above is correct

Q.94 1 microvolt is
A. 1×10^{-3} V B. 1×10^{-4} V
C. 1×10^{-5} V D. 1×10^{-6} V

Q.95 **4000 Coulomb charges were passing from the wire for about 12 seconds. Estimate the current during this process?**

A. 333.3 ampere
B. 333.33 volts
C. 666.67 ampere
D. None of them

Q.96 **Calculate the charge passing through the circuit if it's current it 10 Amp and the recorded time is 15 seconds**

A. 1500 Coulomb
B. 150 Coulomb
C. 3400 Coulomb
D. 140 Coulomb

Q.97 **1 kilo ohm = _____ ohm**

A. 10^3 ohm
B. 10^2 ohm
C. 10^4 ohm
D. None of them

Q.98 **An apparatus which is used to measure current voltage and resistance**

A. Multimeter
B. Ammeter
C. Galvanometer
D. Voltmeter

Q.99 **As compared to thin wires, thick wires have**

A. more resistance
B. no resistance
C. less resistance
D. same resistance

Q.100 **The circuit which gives continuously varying potential is called**

A. Complex network
B. Wheatstone bridge
C. Potential divider
D. All of above

ANSWER KEY

1	A	16	D	31	A	46	A	61	B	76	D	91	B
2	D	17	B	32	D	47	B	62	C	77	A	92	B
3	C	18	D	33	C	48	C	63	D	78	B	93	D
4	A	19	A	34	D	49	B	64	A	79	C	94	A
5	A	20	C	35	D	50	A	65	A	80	A	95	A
6	B	21	B	36	A	51	C	66	B	81	A	96	B
7	A	22	C	37	A	52	A	67	D	82	A	97	A
8	B	23	A	38	B	53	D	68	A	83	A	98	A
9	B	24	A	39	C	54	C	69	A	84	A	99	C
10	D	25	A	40	A	55	B	70	C	85	B	100	C
11	D	26	A	41	C	56	A	71	D	86	C		
12	B	27	B	42	B	57	D	72	A	87	D		
13	A	28	B	43	D	58	A	73	C	88	A		
14	B	29	A	44	D	59	D	74	C	89	A		
15	C	30	A	45	A	60	A	75	C	90	C		

UNIT 8

PRACTICE EXERCISE

ELECTROMAGNETISM

1. **When charge particle enters perpendicular to magnetic field, the path followed by it is:**
   A. A helix
   B. Straight line
   C. A circle
   D. Ellipse

2. **A current carrying conductor carries current away from you the direction of magnetic field with respect to you is:**
   A. Away from you
   B. Clockwise
   C. Towards you
   D. Anti-clockwise

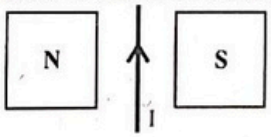
3. **When a charged particle is project perpendicular to a uniform magnetic field, the radius of the circulating path it traverses is proportional to:**
   A. 1/(mass of particle)
   B. 1/(charge of particle)
   C. 1/(applied magnetic field)
   D. both "B" and "C"

4. **When charge particle enters in the uniform magnetic field, the magnetic force will be equal:**
   A. Electric force
   B. Centripetal force
   C. Magnetic force
   D. Gravitational force

5. **An electron moves at 2×10^{2}m/s perpendicular to magnetic field of 2T what is the magnitude of magnetic force:**
   A. 1×10^{-6}N
   B. 3.6×10^{-24}N
   C. 6.4×10^{-17}N
   D. 4×10^{6}N

6. **A charged particle is projected at an angle into a uniform magnetic field. Which of the following parameters of the charged particle will be affected by the magnetic field:**
   A. Energy
   B. Speed
   C. Velocity
   D. Kinetic energy

7. **The diagram shows a wire, carrying an electronic current I, placed between the poles of a magnet. In which direction does the force on the wire act?**



   A. Into the paper
   B. towards the N pole of the magnet
   C. out of the paper
   D. towards the S pole of the magnet

8. **If current flows from top towards bottom through a wire then the direction of magnetic lines of force would be:**
   A. Parallel to the wire
   B. Clockwise
   C. Perpendicular to wire
   D. Anti-clockwise

9. **The magnetic force is simply a:**
   A. Reflecting force
   B. Restoring force
   C. Deflecting force
   D. Gravitational force

10. **A magnetic field acts on a charged particle so as to change its:**
    A. Speed
    B. Direction of motion
    C. Energy
    D. All of these

11. **Right hand palm rule is used to find the direction of:**
    A. current
    B. Force
    C. EMF
    D. Temperature

12. **The unit of "E/B" is:**
A. watt
B. tesla
C. ms^{-1}
D. weber

13. **The force exerted on a wire of one meter length carrying one ampere current placed at right angle to the field is called:**
A. Lorentz force
B. self-inductance
C. magnetic flux
D. magnetic induction

14. **Two parallel wires carrying current in the opposite direction:**
A. repel each other
B. have no effect upon each other
C. attract each other
D. they cancel out their individual magnetic field

15. **Which one of the following particles moving in the magnetic field cannot be deflected:**
A. α-particle
B. electron
C. β-particle
D. neutron

16. **The "e/m" of a proton is:**
A. equal to that of electron
B. greater than that of electron
C. smaller than that of electron
D. sometime smaller and sometime greater

17. **An electron travels from left to right in the plane of the paper in a magnetic field perpendicular to and directed out of the paper. It is deflected?**
A. downward direction
B. into the paper
C. upward direction
D. out of the paper

18. **The magnetic force on an electron travelling with $10^6 ms^{-1}$ parallel to the field of strength 1wb m^{-2} is:**
A. $10^5 N$
B. $10^8 N$
C. $10^{-10} N$
D. zero

19. **The S.I unit of magnetic flux density is:**
A. $NA^{-1}m^{-1}$
B. $NA^{-1}m$
C. NAm^{-1}
D. $NA^{-1}m^2$

20. **The magnetic force acting on a unit +ve charge moving at right angle to the magnetic field with unit velocity is called:**
A. Magnetic flux
B. Motional emf
C. Induced emf
D. Magnetic induction

21. **Charge to mass ratio of neutron is:**
A. 1.758×10^{-11} C kg^{-1}
B. 9.58×10^7 C kg^{-1}
C. 1.758×10^{11} C kg^{-1}
D. Zero

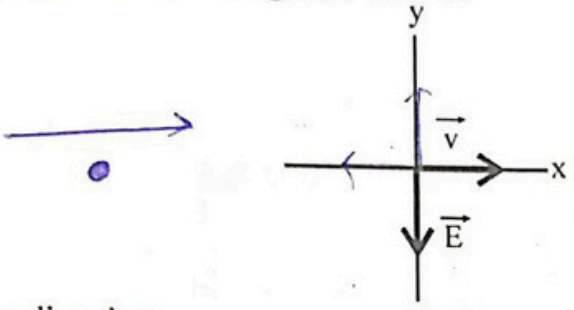
22. **An electron enters a region where the electric field "E" is perpendicular to the magnetic field "B". It will suffer no deflection if:**
A. E = evB
B. E = vB
C. B = eE / v
D. E = evB / 2

23. **In S.I unit, the value of "μ_o" is:**
A. $4\pi \times 10^7$ Wb A^{-1} m^{-1}
B. $4\pi \times 10^7$ Wb A m^{-1}
C. $4\pi \times 10^{-7}$ Wb $A^{-1}m$
D. $4\pi \times 10^{-7}$ Wb $A^{-1}m^{-1}$

24. **Force on a moving charge in a uniform magnetic field will be half of its maximum value, when the angle between "v" and "B" is:**
A. 0°
B. 60°
C. 30°
D. 90°

25. **An electron of mass "m" and charge "e" is moving in a circle of radius "r" with speed "v" in a uniform magnetic field strength "B". Then:**
A. $r \propto m$
B. $r \propto 1/v$
C. $r \propto B$
D. $r \propto 1/m$

26. **An electron is traveling in the positive x direction. A uniform electric field "E" is in the negative y direction. If a uniform magnetic field with the appropriate magnitude and direction also exists in the region, total force on the electron will be zero. The appropriate direction for the magnetic field is:**



A. the positive y direction
B. into the page
C. the negative y direction
D. out of the page

27. **If we double the applied magnetic field, the e/m of electron will be:**
A. Half
B. Remain same
C. Double
D. Zero

28. **An electron is moving north in a region where the magnetic field is south. The magnetic force exerted on the electron is:**
A. zero
B. down
C. up
D. east

29. **Lines of the magnetic field produced by a long straight wire carrying a current are:**
A. circles that are concentric with the wire
B. opposite to the direction of the current
C. radially outward from the wire
D. radially inward toward the wire

30. **A constant current is sent through a helical coil. The coil:**
A. tends to get shorter
B. tends to rotate about its axis
C. tends to get longer
D. produces zero magnetic field at its center

31. **If an electron and a proton enter into a magnetic field perpendicularly with the same momentum:**
A. The proton will deflect more
B. Both will deflect equally
C. The electron will deflect more
D. They will no deflect at all

32. **Amperean path is a:**
A. circular path
B. elliptical path
C. closed path
D. spherical path

33. **The value of _____ around a current carrying wire is found by Ampere circuital law.**
A. magnetic field strength
B. magnetic flux density
C. magnetic induction
D. all of these

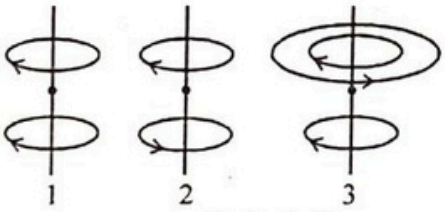
34. **A charge in uniform motion produces:**
A. an electric field only
B. a magnetic field only
C. both an electric and magnetic field
D. no such field at all

35. **If current carrying conductor is placed perpendicular to the magnetic field, the force experienced by it will be:**
A. zero
B. maximum
C. ILB
D. ILB cosα

36. **1 tesla is equal to:**

A. 1 NAm^{-1}
B. 1 $NA^{-1}m^{-1}$
C. 1 $NA^{-1}m$
D. 1 $N^{-1}Am$

37. **The diagram shows three arrangements of circular loops, centered on vertical axes and carrying identical currents in the directions indicated. Rank the arrangements according to the magnitudes of the magnetic fields at the midpoints between the loops on the central axes.**



A. 1, 2, 3
B. 2, 3, 1
C. 2, 1, 3
D. 3, 2, 1

38. **Alpha particles enter into a velocity selector where electric and magnetic fields are mutually perpendicular and have strengths of 200Vm^{-1} and 0.4T respectively. To pass through the region un-deviated, they should move with a speed:**

A. 80 ms^{-1}
B. 0.4/200 ms^{-1}
C. 500 ms^{-1}
D. Impossible B and E should be parallel

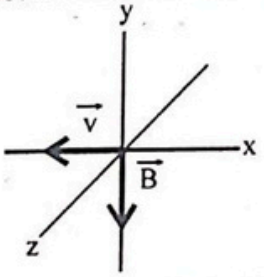
39. **In a certain region, magnetic field is directed vertically downward. If a plane flies due South, which part of the plane will be negatively charged?**

A. Front part
B. Back part
C. left wingtip
D. right wingtip

40. **In the formula $\vec{F} = q(\vec{v} \times \vec{B})$:**

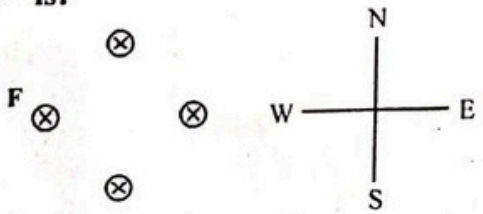
A. $\vec{F}$ must be perpendicular to $\vec{v}$ but not necessarily to $\vec{B}$
B. $\vec{F}$ must be perpendicular to $\vec{B}$ but not necessarily to $\vec{v}$
C. $\vec{v}$ must be perpendicular to $\vec{B}$ but not necessarily to $\vec{F}$
D. $\vec{F}$ must be perpendicular to both $\vec{v}$ and $\vec{B}$

41. **An electron moves in the negative x direction, through a uniform magnetic field in the negative y direction. The magnetic force on the electron is:**



A. in the negative x direction
B. in the negative y direction
C. in the positive y direction
D. in the negative z direction

42. **Four long straight wires carry equal currents into the page as shown. The magnetic force exerted on wire "F" is:**

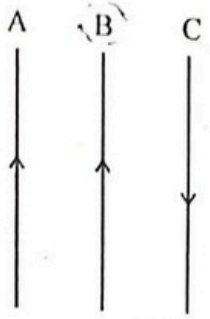


A. north
B. south
C. east
D. west

CamScanner

43. **Two parallel wires, 4 cm apart, carry currents of 2A and 4A respectively, in the same direction. The force per unit length in N/m of one wire on the other is:**
A. 1×10^{-3}, repulsive
B. 4×10^{-5}, repulsive
C. 1×10^{-3}, attractive
D. 4×10^{-5}, attractive

44. **The direction of current in conductor is given then In which direction conductor "B" will move?**



A. left
B. right
C. inward
D. outward

45. **A wire carrying a large current "I" from east to west is placed over an ordinary magnetic compass. The end of the compass needle marked "N" will point:**
A. north
B. south
C. east
D. west

46. **The magnetic field outside a long straight current carrying wire depends on the distance "R" from the wire axis according to:**
A. R
B. 1/R
C. $1/R^2$
D. $1/R^3$

47. **A 20.0 cm wire carrying a current of 10.0A is placed in a uniform magnetic field of 0.30T. If the wire makes an angle of 30° with the direction of magnetic field, find the magnitude of the force acting on it.**
A. 30 N
B. 0.3 N
C. 300 N
D. zero

48. **Find the value of the magnetic field that will cause a maximum force of 7.0×10^{-3} N on a 20.0 cm straight wire carrying a current of 10.0 A.**
A. 3.5×10^{-3}T
B. 7.0×10^{-3}T
C. 3.5×10^{3}T
D. 7.0×10^{3}T

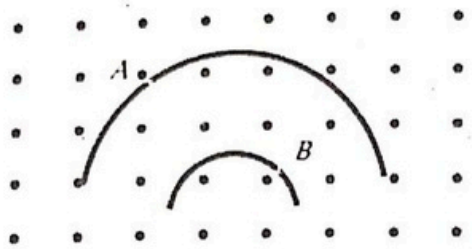
49. **The magnetic field a distance 2 cm from a long straight current carrying wire is 2.0×10^{-5} T. The current in the wire is:**
A. 0.16 A
B. 1.0 A
C. 2.0 A
D. 4.0 A

50. **Magnetic field is set up in a region around a conductor, carrying:**
A. AC current
B. pulsating DC current
C. DC current
D. all of these

51. **Two parallel long wires carry the same current and repel each other with a force F per unit length. If both these currents are doubled and the wire separation tripled, the force per unit length becomes:**
A. 2F/9
C. 2F/3
C. 4F/9
D. 4F/3

52. **Which of the following is a vector quantity?**
A. magnetic flux density
B. magnetic field lines
C. magnetic flux
D. both "A" and "B"

53. **Two particles A and B of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B respectively and trajectories are as shown in the figure. Then**



A. $m_A v_A < m_B v_B$
B. $m_A v_A > m_B v_B$
C. $m_A < m_B$ and $v_A < v_B$
D. $m_A = m_B$ and $v_A = v_B$

54. **A proton (mass m and charge +e) and an α – particle (mass 4m and charge +2e) are projected with the same kinetic energy at right angles to the uniform magnetic field. Which one of the following statements will be true:**
A. The α – particle will be bent in a circular path with a small radius than that of the proton
B. The radius of the path of the α – particle will be greater than that of the proton
C. The α – particle and the proton will be bent in a circular path with the same radius
D. The α – particle and the proton will go through the field in a straight line

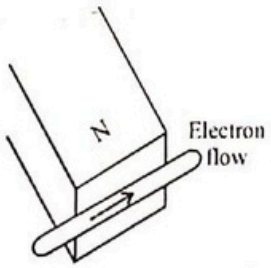
55. **Two parallel wires carrying equal currents of 10A attract each other with a force of 1 mN. If both currents are doubled, the force of attraction will be:**
A. 1mN
B. 0.5mN
C. 4mN
D. 0.25mN

56. **When two straight current carrying conductors are placed parallel near each other, their fields will ____ in the middle region:**
A. tend to cancel each other
B. reinforce each other
C. not affect each other
D. either "A" or "B"

57. **The frequency of cyclotron is given as:**
A. $qBr/2\pi m$
B. $qBr/2\pi$
C. $qB/2\pi m$
D. $qB/2\pi rm$

58. **The radius of an orbit of an electron moving at a rate of $2.0 \times 10^7 ms^{-1}$ in uniform magnetic field of $1.20 \times 10^{-3} T$?**
A. $9.4 \times 10^{-2} m$
B. $19.5 \times 10^{-2} m$
C. $9.5 \times 10^{2} m$
D. 1 cm

59. **The figure shows the motion of electrons in a wire that is near the N pole of a magnet. The wire will be pushed:**



A. toward the magnet
B. downwards
C. away from the magnet
D. upwards

60. **The strength of magnetic field around a straight conductor:**
A. is inversely proportional to radial distance
B. obeys inverse cube law
C. obeys inverse square law
D. Varies exponentially

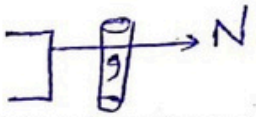
61. **If "L" is length of a wire with cross sectional area A carrying "n" number of charge carriers per unit volume moving with velocity v, then current through it is given as:**
A. nAqv
B. nAq/v
C. Aqv/n
D. qv/nA

62. **If charge particle of mass "m" is free to move in an electric field then its acceleration is given by**
A. qE/m
B. qEm
C. q/Em
D. m/qE

$r = \frac{mv}{qB}$

63. **A proton (charge e), traveling perpendicular to a magnetic field, experiences the same force as an alpha particle (charge 2e) which is also traveling perpendicular to the same field. The ratio of their speeds, v_{proton}/v_{alpha}, is:**
A. 0.5
B. 1
C. 2
D. 4

64. **Electrons (mass m, charge −e) are accelerated from rest through a potential difference V and are then deflected by a magnetic field $\vec{B}$ that is perpendicular to their velocity. The radius of the resulting electron trajectory is:**
A. $\sqrt{(2eV/m)}/B$
B. $B\sqrt{2eV}/m$
C. $\sqrt{(2mV/e)}/B$
D. $B\sqrt{2mV}/e$



65. **An electron travels due north through a vacuum in a region of uniform magnetic field B that is also directed due north. It will:**
A. be unaffected by the field
B. slow down
C. speed up
D. follow a right-handed corkscrew path

66. **J. J. Thomson's experiment, involving the motion of an electron beam in mutually perpendicular $\vec{E}$ and $\vec{B}$ fields, gave the value of:**
A. mass of an electron
B. Earth's magnetic field
C. charge of an electron
D. charge to mass ratio of an electron

67. **A magnetic field exerts a force on a charged particle:**
A. always
B. never
C. if the particle is moving across the field lines
D. if the particle is moving along the field lines

$r = \frac{m}{q} = \frac{3,367}{-2e}$

68. **Two long parallel straight wires carry equal currents in opposite directions. At a point midway between the wires, the magnetic field they produce is:**
A. zero
B. non-zero and along a line connecting the wires
C. non-zero and parallel to the wires
D. non-zero and perpendicular to the plane of the two wires

$r_e = \frac{1}{e}$ $r_p = \frac{1836}{e}$

69. **Two long straight wires are parallel and carry current in the same direction. The currents are 8.0 and 12A and the wires are separated by 0.40 cm. The magnetic field in tesla at a point midway between the wires is:**
A. 0
B. 8.0×10^{-4}
C. 4.0×10^{-4}
D. 12×10^{-4}

70. **Four particles enter in a uniform magnetic field perpendicularly with same speed. Which is deflected the most?**
A. Electron
B. Proton
C. alpha particle
D. All would have same deflection

71. **A hydrogen atom that has lost its electron is moving east in a region where the magnetic field is directed from south to north. It will be deflected:**
A. Up
B. Down
C. north
D. south

72. **Four particles enter in a uniform magnetic field perpendicularly with same speed. Which particle has largest radius?**
A. Electron
B. Proton
C. alpha particle
D. β-particle

73. **An electron (charge = -1.6×10^{-19}C) is moving at 3×10^5 m/s in the positive x direction. A magnetic field of 0.8 T is in the positive z-direction. The magnetic force on the electron is:**
A. 0
B. 4×10^{-14} N, in the negative z direction
C. 4×10^{-14} N, in the positive z direction
D. 4×10^{-14} N, in the positive y direction

74. **At one instant an electron (charge = -1.6×10^{-19} C) is moving in the xy plane, the components of its velocity being $v_x = 5 \times 10^5$ m/s and $v_y = 3 \times 10^5$ m/s. A magnetic field of 0.8 T is in the positive x direction. At that instant the magnitude of the magnetic force on the electron is:**
A. 0
B. 2.6×10^{-14} N
C. 3.8×10^{-14} N
D. 6.4×10^{-14} N

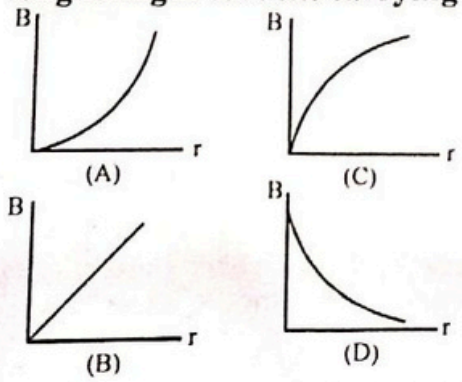
75. **A cyclotron operates with a given magnetic field and at a given frequency. If "R" denotes the radius of the final orbit, the energy of particle is proportional to:**
A. 1/R
B. R^2
C. R
D. R^3

76. **At one instant an electron is moving in the positive x-direction in a region where there is a uniform magnetic field in the positive z direction. When viewed from a point on the positive z axis, it subsequent motion is:**
A. straight ahead
B. clockwise around a circle in the xy plane
C. counterclockwise around a circle in the xy plane
D. in the positive z direction

77. **When a charge particle enter in a magnetic field at an angle of 45° then its path in magnetic field will be:**
A. circular
B. parabolic
C. helix
D. hyparabolic

78. **An electron is launched with velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$. The angle θ between $\vec{v}$ and $\vec{B}$ is between 0 and 90°. As a result, the electron follows a helix, its velocity vector $\vec{v}$ returning to its initial value in a time interval of:**
A. $2\pi m/eB$
B. $2\pi mv/eB$
C. $2\pi mv \sin\theta/eB$
D. $2\pi mv \cos\theta/eB$

79. **Which graph correctly gives the magnitude of the magnetic field outside an infinitely long straight current carrying wire as a function of the distance "r" from the wire?**



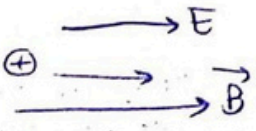
80. **An electron enters a region of uniform perpendicular $\vec{E}$ and $\vec{B}$ fields. It is observed that the velocity $\vec{v}$ of the electron is unaffected. A possible explanation is:**

A. $\vec{v}$ is parallel to $\vec{E}$ and has magnitude E/B

B. $\vec{v}$ is parallel to $\vec{B}$

C. $\vec{v}$ is perpendicular to both $\vec{E}$ and $\vec{B}$ and has magnitude B/E

D. $\vec{v}$ is perpendicular to both $\vec{E}$ and $\vec{B}$ and has magnitude E/B



81. **A charged particle enters in parallel direction to an electric field and a magnetic field such that both fields are parallel to each other. Then force on the charge is:**

A. Zero
B. Due to electric field
C. due to magnetic field
D. due to both fields

82. **A uniform magnetic field is in the positive z-direction. A positively charged particle is moving in the positive x-direction through the field. The net force on the particle can be made zero by applying an electric field in what direction?**

A. Positive y
B. Negative y
C. Positive x
D. Negative x

83. **The unit of permeability of free space is:**

A. $WbmA^{-1}$
B. $WbA^{-1}m$
C. $A^{-1}Wbm^{-1}$
D. no units

84. **If current flows in a horizontal straight wire towards East. The direction of magnetic field around it will be:**

A. N-E
B. E-W
C. W-S
D. N-S

85. **Magnetic field lines around a current carrying wire are drawn in clockwise direction on a page. The current is flowing:**

A. into the page
B. out of the page
C. left side of the page
D. right side of the page

86. **Force acting on a moving charge in a magnitude field will not depend on:**

A. its mass
B. amount of charge
C. its velocity
D. intensity of magnetic field

87. **An "α" particles enters a magnetic field of strength "B" with a speed "v" parallel to the direction of magnetic field. The force on the particle is:**

A. Bev
B. Bev/2
C. infinite
D. zero

88. **A uniform electric field and magnetic field are parallel and point in the same direction. An electron with velocity "v" projected in the same direction will:**

A. Turn to the left
B. Turns to the right
C. Move with decreased velocity
D. Move with the decrease velocity

89. **A proton entering a uniform magnetic field $\vec{B}$ in the direction of $\vec{B}$ will move along a:**

A. Straight line
B. Circle
C. Parabola
D. Helix

90. **A proton moves with a velocity "v" in a perpendicular magnetic field of strength is increased to 2B. If the proton still moves in the same circular path its kinetic energy will:**

A. Be halved
B. Be doubled
C. becomes 4 time
D. Not change

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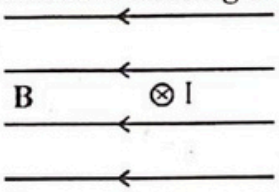
91. **An electron with a velocity "v" is perpendicular to a field moves in a circular path of radius "r". When its velocity is doubled and the magnetic field strength is halved, the radius of the circular path becomes:**

A. r/4
B. r/2
C. 2r
D. 4r

92. **The figure shows a uniform magnetic field "B" directed to the left and a wire carrying a current into the page. The magnetic force acting on the wire is:**



A. toward the top of the page
B. toward the left
C. toward the bottom of the page
D. toward the right

93. **A proton moves in a magnetic field with kinetic energy "E". The kinetic energy of an α particle, to orbit in the same circular path must be:**

A. E
B. 2E
C. 4E
D. E/4

94. **When an electron and a proton having same momentum enter a magnetic field at right angles, then if "r_a" and "r_b" represents the radii of curvatures for electrons and protons respectively then:**

A. $r_a > r_b$
B. $r_b > r_a$
C. $r_a = r_b$
D. $r_a >> r_b$

95. **A proton and α particle are projected into a uniform magnetic field with velocities perpendicular to the magnetic field. If they both move in circles of equal radii the ratio of their momentum P_P/P_α should be:**

A. 2
B. 1/2
C. 1
D. 4

96. **A proton enters a magnetic field of flux density 1.5 Wb/m^2 with a speed of 2×10^7 m/s at angle of 30° with the field. The force on the proton will be:**

A. 0.24×10^{-12} N
B. 2.4×10^{-12} N
C. 24×10^{-12} N
D. 0.024×10^{-12} N

97. **If compass needles are placed on a card board along a circle, with the center at the wire, they will point in:**

A. N-S direction
B. E-W direction
C. N-E direction
D. W-S direction

98. **The S.I. unit of magnetic flux is:**

A. tesla
B. joule
C. weber
D. newton

99. **The flux through an area of 1 m^2 in xy plane in a magnetic field of 1T directed along z -axis will be:**

A. Zero
B. 0.5 Wb
C. 1 Wb
D. 2Wb

100. **The magnetic field in a certain region is given by $\underline{B} = (40\underline{i} + 18\underline{k})$ Wb/m^2. How much flux passes through a 5cm^2 area loop in this region if the loop lies flat in the xy-plane?**

A. 90 Wb
B. 90×10^{-2} Wb
C. 90×10^{-4} Wb
D. 2×10^{-2} Wb

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101. Current I is flowing in a long conducting wire, the magnetic induction at a distance r from it in 0.4 tesla, then its value at double the distance will be

A. 1.6 tesla
B. 0.8 tesla
C. 0.2 tesla
D. 0.1 tesla

102. The magnetic field produced due to the current in a straight wire is proportional to the:

A. Electric current
B. Length of the wire
C. Conducting material
D. Diameter of the wire

103. The magnetic field due to the electric current in a conducting straight wire is:

A. Towards the centre of the conducting wire
B. Circular around the conducting wire
C. In the direction of the electric current
D. In the direction opposite to the electric current

$r = \frac{\sqrt{2mKE}}{qB}$

104. A uniform electric field and a uniform magnetic field exist in a region in the same direction. An electron is projected with velocity pointed in the same direction. The electron will:

A. turn to its right
B. turn to its left
C. keep moving in the same direction but its speed will increase
D. keep moving in the same direction but its speed will decrease

105. Which of the following does not affect the motion of a moving electron?

$f = \frac{F}{LB} = \frac{1}{2}$

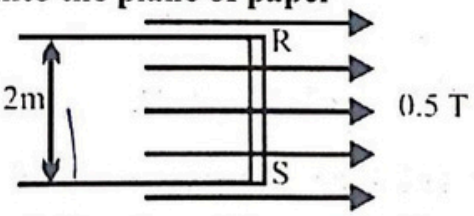
A. Electric field applied in the direction of motion
B. Magnetic field applied in the direction of motion
C. Electric field applied perpendicular to the direction of motion
D. Magnetic field applied perpendicular to the direction of motion

$L = 2m$
$B = 0.5$
$F = 1N$

106. Two wires carry currents in same direction which is correct

A. ↑F / ↑F
B. ↑F / ↓F
C. ↓F / ↑F
D. ↓F / ↓F

107. The diagram shows a current carrying conductor RS of length 2m placed perpendicular to a magnetic field of flux density 0.5 tesla. The resulting force on the conductor is 1 N acting into the plane of paper



What is the magnitude and direction of the current?

A. 1 A from R to S
B. 2 A from R to S
C. 1 A from S to R
D. 2 A form S to R

108. Two parallel wires carrying currents in the opposite directions

A. Repel each other
C. Attract each other
B. Have no effect upon each other
D. They cancel out their individual magnetic fields

109. The direction of the magnetic lines of force depends upon:

A. Nature of the material of the conducting wire
B. Area of the conducting wire
C. Amount of the current
D. Direction of the current

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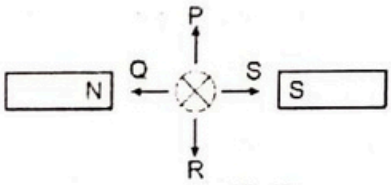
110. The direction at a point on the magnetic lines of force can be taken along:

A. Normal at that point
B. The tangent at that point
C. Axis of the magnetic line of force at that point
D. Can't be taken

111. The figure given below shows a current- carrying conductor placed between two magnets. Which of the given arrows correctly indicates the direction of the force acting on the conductor?



A. R
B. P
C. Q
D. S

112. The direction of the magnetic lines of force can be found by using:

A. Right hand rule
B. Henry's law
C. Left hand rule
D. Faraday's law

113. The Relationship between tesla(T) and smaller unit gauss(G) of magnetic induction is given by

A. $1T = 10^{3} G$
B. $1T = 10^{-2} G$
C. $1T = 10^{-4} G$
D. $1T = 10^{4} G$

114. A current carrying conductor is placed in a uniform magnetic field Parallel to it. The magnetic force experienced by the conductor is

A. F = BIL
B. $F = \frac{BL\sin\theta}{I}$
C. $F = \frac{I}{BL} Sin\theta$
D. F = 0

115. A conductor of length 1m and carrying current of 1 A is placed at an angle of 45° to the magnetic field of 1 gauss. The force acting on the conductor is

A. Zero
B. $\frac{1}{\sqrt{2}} \times 10^{-4}$ N
C. $\frac{1}{\sqrt{2}}$ N
D. 5×10^{-4} N

116. A uniform magnetic field is represented by a set of lines of force which are

A. Parallel
B. Divergent
C. Convergent
D. None of these

117. Weber ampere per metre is equal to

A. Joule
B. Watt
C. Newton
D. Henry

118. A straight conductor carries a current I, is split into a circular loop of radius r as shown in fig. The magnetic field at the centre O of the circle is

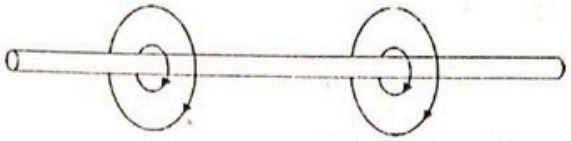


A. $\frac{\mu_o I}{2r}$
B. $\frac{\mu_o I}{\pi r}$
C. $\frac{\mu_o I}{2\pi r}$
D. Zero

119. **When a current carrying conductor is placed in a magnetic field. It moves from a region of**

A. Stronger to weak field
B. Strong to weak if current is large
C. Weak to strong field
D. Weak to strong if current is large

120. **Diagram shows the magnetic field around a conductor. In which direction is the current flowing?**



A. From right to left
B. From left to right
C. Can be either of above
D. Data incomplete

121. **Two conductors shown below will be**



A. Repel
B. Attract
C. Neither repel nor attract
D. Data insufficient

122. **A wire of length 2 m carries a current of 10 A. what is the force acting on it when it is placed at an angle of 45° to the uniform magnetic field of 0.15 T?**

A. 1.2 N
B. 3.2 N
C. 2.5 N
D. $\frac{3}{\sqrt{2}}$ N

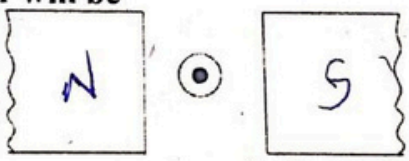
123. **A unit of magnetic induction is:**

A. Weber/metre^2
B. Weber/ampere-metre
C. Weber/metre
D. Weber

124. **A one metre long wire is lying at right angles to the magnetic field. A force of 1 N is acting on it in a magnetic field of 0.98 tesla. The current flowing in it will be**

A. 100 A
B. zero
C. 10 A
D. 1 A

125. **The force on the conductor will be**

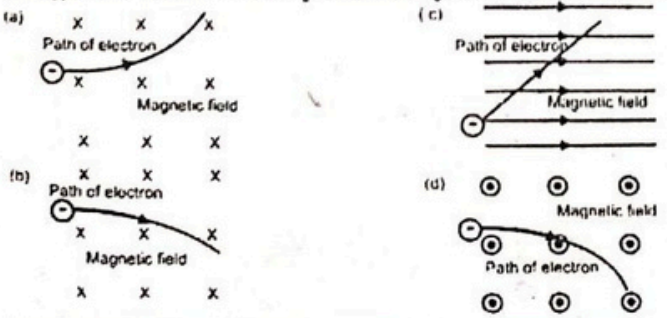


A. Downward
B. From right to left
C. From right to left
D. Upward

126. **A proton is moving northward in a magnetic field directed vertically upward. The electron will be deflected.**

A. Eastward
B. Westward
C. Vertically upward
D. Remain undeflected

127. **The following diagrams shows an electron passing through a magnetic field. Which diagram shows the possible path of the electrons as they pass through the field?**



128. In the formula $F = q(v \times B$.
A. F must be perpendicular to v but not necessarily to B
B. v must be perpendicular to B but not necessarily to F
C. F must be perpendicular to both v and B
D. All three vectors must be mutually perpendicular

129. A proton and an electron both moving with the same velocity v enter into a region of magnetic field directed perpendicular to the velocity of the particles. They will now move in circular orbits such that
A. Their time periods will be same
B. The time period for electron will be higher
C. The time period for proton will be higher
D. Their orbital radii will be same

130. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upwards. The particle will
A. Continue to move due east
B. Move in a circular orbit with its speed unchanged
C. Move in a circular orbit with its speed increases
D. Get deflected vertically upwards

131. A strong magnetic field is applied to a stationary electron, then
A. Electron move in the direction of field
B. Electron move opposite to field
C. Electron start spinning
D. Electron remain stationary

132. The magnitude of force on a moving charge is zero then angle between the velocity of the charge carrier and magnetic field is
A. 0°
B. 90°
C. 45°
D. 120°

133. An electron enters in a uniform magnetic field making an angle 60° with field. The shape of its trajectory in magnetic field is
A. circle
B. parabola
C. straight line
D. helix

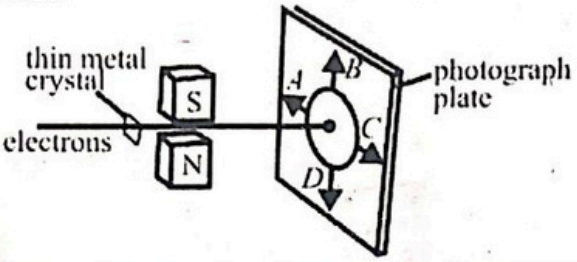
134. The radius of curvature of the path of the charged particle in a uniform magnetic field is directly proportional to
A. the energy of the particle
B. the momentum of the particle
C. the intensity of the field
D. the charge on the particle

135. Which of the following in motion cannot be deflected by magnetic field?
A. Electron
B. Neutron
C. Proton
D. Sodium ion

136. A charged particle enters at 30° to the magnetic field. Its path becomes
A. Helical
B. Elliptical
C. Circular
D. Straight line

137. When a charged particle is projected perpendicularly in a magnetic field its trajectory is
A. Hyperbola
B. Helix
C. Parabola
D. Circular

138. G.P Thomson's early experiments on the diffraction of the electrons by crystals were criticized on the ground that the beams affecting the photographic plate might be X-rays. He proved that this was not so by placing bar magnets on each side of the beam as shown in the diagram.



How would the magnetic field due to magnetic affect the diffraction rings?

A. The rings would be deflected in the direction A
B. The rings would be deflected in the direction C
C. The rings would be deflected in the direction B
D. The rings would be deflected in the direction D

139. **When a charged particle moves through a magnetic field, it suffers a change in**

A. Direction
B. Speed
C. Energy
D. No change

140. **Magnetic field is caused by**

A. Stationary charge
B. A moving positive charge only
C. A moving negative charge only
D. Moving positive and negative charges both

141. **A charged particle moves through a magnetic field in a direction perpendicular to it. Which of the following remain unchanged for the particle?**

A. Velocity
B. Acceleration
C. Speed
D. Direction

142. **If a particle is moving in a region of both electric & magnetic fields then the total force acting on it is.**

A. sum of electric & magnetic force
B. no force will act on it
C. difference of electric & magnetic force
D. none of above

143. **A homogeneous electric field $\vec{E}$ and a uniform magnetic field $\vec{B}$ are pointing in the same direction. A proton is projected with its velocity parallel to $\vec{E}$. It will**

A. Go on moving in the same direction with increasing velocity
B. Go on moving in the same direction with constant velocity
C. Turn to its right
D. Turn to its left

144. **An α-particle, a deuteron and a proton are moving with same momentum in a uniform magnetic field. The ratio of their speeds will be**

A. 1:2:4
B. 4:2:1
C. 1:1:1
D. 2:2:4

145. **The unit of E is N C^{-1} and that of B is N A^{-1} m^{-1} the unit of $\frac{E}{B}$ is**

A. m s^{-2}
B. m s^{-1}
C. m s
D. m^{-1} s^{-1}

146. **The permeability of free space, in Wb/Am, is:**

A. $\frac{1}{4\pi\times10^{-7}}$
B. $\frac{1}{4\pi\times10^{7}}$
C. $4\pi\times10^{-7}$
D. $4\pi\times10^{7}$

147. **The radius of curvature of the path of a charged particle moving in a static uniform magnetic field is**

A. Directly proportional to the magnitude of the charge on the particle
B. Directly proportional to the magnitude of the linear momentum of the particle
C. Directly proportional to the kinetic energy of the particle
D. Inversely proportional to the magnitude of the magnetic field

148. An electron enters a region where the electric field $\vec{E}$ is perpendicular to the magnetic field $\vec{B}$. It will suffer no deflection if _____
A. E = Bev
B. B = eE/v
C. E = Bv
D. E = BeV2

149. A proton (mass m and charge +e) and an α – particle (mass 4m and charge +2e) are projected with the same kinetic energy at right angles to the uniform magnetic field. Which one of the following statements will be true
A. the α – particle and the proton will be bent in a circular path with the same radius
B. the α – particle will be bent in a circular path with a small radius that for the proton
C. α – particle and the proton will go through the field in a straight line
D. the radius of the path of the α – particle will be greater than that of the proton

150. One proton beam enters a magnetic field of 10^{-4}T normally, Specific charge = 10^{11}C/kg. velocity = 10^{7}m/s. What is the radius of the circle described by it
A. 0.1 m
B. 1 m
C. 10 m
D. None of these

ANSWER KEY

1	C	16	C	31	B	46	B	61	A	76	C	91	D	106	C	121	B	136	A
2	B	17	C	32	C	47	B	62	A	77	C	92	A	107	C	122	D	137	D
3	D	18	D	33	D	48	A	63	C	78	A	93	A	108	A	123	A	138	A
4	B	19	A	34	C	49	C	64	C	79	D	94	C	109	D	124	D	139	A
5	C	20	D	35	C	50	D	65	A	80	D	95	B	110	B	125	D	140	D
6	C	21	D	36	B	51	D	66	D	81	B	96	B	111	A	126	A	141	C
7	A	22	B	37	B	52	D	67	C	82	A	97	A	112	A	127	B	142	A
8	B	23	D	38	C	53	B	68	D	83	C	98	C	113	D	128	C	143	A
9	C	24	C	39	D	54	C	69	C	84	D	99	C	114	D	129	B	144	A
10	B	25	A	40	D	55	C	70	A	85	A	100	C	115	B	130	B	145	B
11	B	26	B	41	D	56	D	71	A	86	A	101	C	116	A	131	D	146	C
12	C	27	B	42	C	57	C	72	C	87	D	102	A	117	C	132	A	147	B
13	D	28	A	43	C	58	A	73	D	88	C	103	B	118	D	133	D	148	C
14	A	29	A	44	A	59	D	74	C	89	A	104	D	119	A	134	B	149	A
15	D	30	A	45	B	60	A	75	B	90	C	105	B	120	B	135	B	150	B

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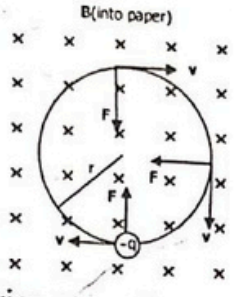
SOLUTIONS

1.



2. A current carrying conductor carries current away from you the direction of magnetic field with respect to you is clockwise by using right hand rule.

3. $qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{mv}{qB} \Rightarrow r \propto \frac{1}{qB}$

4. The magnetic force provides the necessary centripetal force to the charge particle. So, the charge particle moves in circular path.

$F_B = F_c$

$evB = \frac{mv2}{r}$

5. $F = evB \sin\theta$

$= (1.6\times10^{-19})(2\times10^{2})(2)\sin90^{\circ} = 6.4\times10^{-17}\ N$

6. Magnetic force is simply a deflecting force. It will change the direction of charge particle moving in magnetic field. So, only direction of motion will change not magnitude. (Velocity changes but speed does not)

7. $F = I(L\times B)$

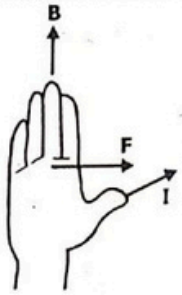
The direction of L is in the direction of current. The direction of magnetic force F is right angle to the plane containing L and B. It is given by right hand rule of the cross product (into the paper).

8. If current flows from top towards bottom through a wire then the direction of magnetic lines of force would be is clockwise by using right hand rule.

9. Magnetic force is simply a deflecting force. It will change the direction of charge particle moving in magnetic field. So, only direction of motion will change not magnitude.

10. Magnetic force is simply a deflecting force. It will change the direction of charge particle moving in magnetic field. So, only direction of motion will change not magnitude.

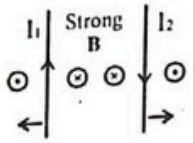
11. Right hand palm rule is used to find the direction of force.



12. In velocity selector

$E = vB \Rightarrow v = \frac{E}{B}\ (ms^{-1})$

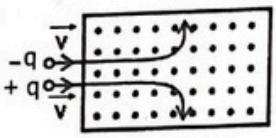
13. $F = ILB\sin\theta = (1)(1)B\sin90^{\circ} = B$

14. 

15. $F = qvB\sin\theta$
For neutron $q = 0$
$F = (0)vB\sin\theta = 0$

16. As
$m_P > m_e$
so, $\left(\frac{e}{m}\right)_P < \left(\frac{e}{m}\right)_e$

17. $F = -e(v \times B)$



18. $F = qvB\sin\theta = qvB\sin0^\circ = 0$

19. $B = \frac{\Phi B}{A} = \frac{F}{ILsin\theta} = NA^{-1}m^{-1}$

20. $F = qvB\sin\theta = (+1)(1)B\sin90^\circ = B$

21. For neutron $q = e = 0$
$\left(\frac{e}{m}\right)_n = 0$

22. Charge particle suffer no deflection only if
$qE = qvB \Rightarrow E = vB$

23. $\sum_{r=1}^{n} (B.\Delta L)_r = \mu_o \times$ (total current enclosed by the loop)
Where μ_o is a constant, known as permeability of free space. In SI units its value is $4\pi \times 10^{-7}$ Wb $A^{-1}m^{-1}$.

24. $F = qvB\sin\theta = F_{max}\sin\theta = F_{max}\sin30^\circ = 0.5\ F_{max}$

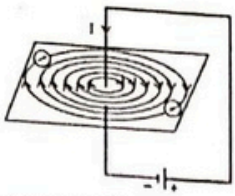
25. The magnetic force provides the necessary centripetal force "F_c" to the electrons, each having mass "m". So, the electrons move in circular path of radius "r".
$F_B = F_c$
$evB = \frac{mv2}{r} \Rightarrow eB = \frac{mv}{r} \Rightarrow r = \frac{mv}{eB} \Rightarrow r \propto m$

26. As the **E** along the – y-axis. It means the electric force on electron will be in + y-axis (against **E**). The net force on electron will be zero, if magnetic force must be along –y-axis (downward). So, the direction of magnetic field will be:
$F = -e\ (v \times B)$
$-\hat{j} = -(\hat{i} \times (-\hat{k})) = \hat{i} \times \hat{k} = -\hat{j}$
For magnetic force in –y-axis, magnetic field must be along –z-axis (into the page).

27. $\frac{e}{m} = \frac{2V}{B2r2} = 1.758 \times 10^{11}\ C\ kg^{-1}$
e/m of electron is constant value. So, it does not depend upon change in magnetic field.

28. The angle between velocity and magnetic field is 180°.
$F = qvB\sin180^\circ = 0$

29.



30. Each turn of helical coil carries current in same direction. Wire carrying current in same direction attract each other. So, the coil tends to get shorter.

31. $F_B = F_c$

$$evB = \frac{mv2}{r} \Rightarrow eB = \frac{mv}{r} \Rightarrow r = \frac{mv}{eB} = \frac{P}{eB} = \text{constant If P}$$

= constant, both will deflect equally.

32. Amperean path is any closed path.

33. Using Ampere's circuital law the magnetic flux density "B" at any point due to a current carrying conductor can be calculated.

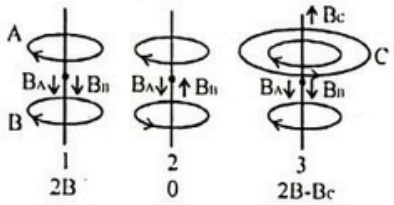
34. A charge in uniform motion produces both an electric and magnetic field.

35. $F = ILB\sin 90^\circ = ILB$

36. $$B = \frac{F}{IL\sin\theta} = NA^{-1}m^{-1}$$

It is independent to area of cross section (radius) of solenoid.

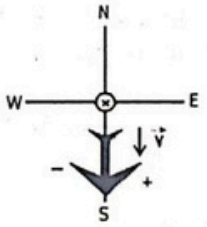
37.



$B' = 2B - Bc$

38. $$v = \frac{E}{B} = \frac{200}{0.4} = 500 \text{ m/s}$$

39. $F = e(V \times B)$



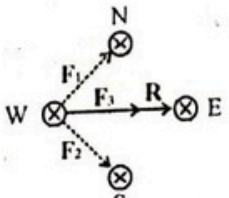
By the right hand rule the direction of magnetic force on the positive charges in the wings towards the East and on the negative charges towards the West. So, the right wingtip is negatively charged.

40. $F = e(V \times B)$

41. F ⊥ v and F ⊥ B

$F = e(V \times B)$

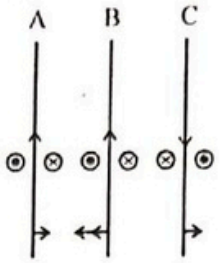
42. $F_{direction} = -(-\hat{i} \times -\hat{j}) = -\hat{k}$ = negative z- direction



43. Force per unit length beween two current carrying straight wires = $\frac{\mu o I1 I2}{2\pi d}$

$$= \frac{(4\pi\times10-7)(2)(4)}{2\pi(4\times10-2)} = 4\times10^{-5} \text{ (attractive)}$$

44.



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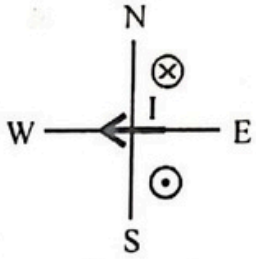

46. $BL = \mu_o I \Rightarrow B = \frac{\mu o I}{L} = \frac{\mu o I}{2\pi R} \Rightarrow B \propto \frac{1}{R}$

47. $F = ILB\sin\theta = (10)(0.2)(0.3)\sin30^\circ = 0.3$ N

48. $F_{max} = ILB \Rightarrow B = \frac{Fmax}{IL} = \frac{7\times10-3}{(0.2)(10)} = 3.5\times10^{-3}$ T

49. $BL = \mu_o I \Rightarrow I = \frac{BL}{\mu o} = \frac{2\pi rB}{\mu o}$

$$= \frac{2\pi rB}{4\pi\times10-7} = \frac{rB}{2\times10-7} = \frac{(2\times10-2)(2\times10-5)}{2\times10-7} = 2 \text{ A}$$

50. When charges are in motion, they have current (AC, DC or pulsating DC); magnetic field is produced around a current carrying conductor due to the flow of these charges.

51. Force per unit length beween two current carrying straight wires = F = $\frac{\mu o I1 I2}{2\pi d}$

$$F' = \frac{\mu o(2I1)(2I2)}{2\pi(3d)} = \frac{4F}{3}$$

52. Magnetic flux density = **B** = magnetic field lines (N → S)

53. $r = \frac{mv}{qB}$

$\because r_A > r_B \Rightarrow m_A v_A > m_B v_B$

54. $r = \frac{\sqrt{2mK}}{qB} i.e. r \propto \frac{\sqrt{m}}{q}$

Here kinetic energy K and B are same.

$$\therefore \frac{r_p}{r_\alpha} = \frac{\sqrt{m_p}}{\sqrt{m_\alpha}} \cdot \frac{q_\alpha}{q_p} = \frac{\sqrt{m_p}}{\sqrt{4m_p}} \cdot \frac{2q_p}{q_p} = 1$$

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55. Force between two current carrying straight wires is $F = \frac{\mu o L I_1 I_2}{2\pi d}$

$F \propto I_1 I_2$

56. If the current flows in straight parallel wires in same direction, then the magnetic field in their middle region tend to cancel each other (attraction).
If the current flows in straight parallel wires in opposite direction, then the magnetic field in their middle region will reinforce each other (repulsion).

57. $qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} = \frac{m(r\omega)}{r} = m2\pi f \Rightarrow f = \frac{qB}{2\pi m}$

58. $evB = \frac{mv2}{r} \Rightarrow eB = \frac{mv}{r}$

$r = \frac{mv}{eB} = \frac{(9.1\times10-31)(2\times107)}{(1.6\times10-19)(1.2\times10-3)} = 9.4\times10^{-2}m$

59. $F = I\,(L\times B)$
Right hand rule is applied only on the direction of conventional current. In the given case the direction of current is due to electron and it is opposite to conventional current. So, By right hand rule the direction of fore will be upward.

60. $BL = \mu_o I \Rightarrow B = \frac{\mu o I}{L} = \frac{\mu o I}{2\pi R} \Rightarrow B \propto \frac{1}{R}$

61. Let "n" is number of charge carriers in unit volume.
Volume of the wire segment = AL
Number of charge carriers wire segment = nAL
Let "q" is the magnitude of charge on each charge carrier.
Total charge on all the charge carriers, $\Delta Q = nALq$
The current "I" through the conductor is given by:
$I = \frac{\Delta Q}{\Delta t} = \frac{nALq}{L/v} = nAqv$

62. $F = qE$
$a = \frac{F}{m} = \frac{q}{m}E$

63. $F_\alpha = F_P$
$(2e)(v_\alpha)B. = (e)(v_P)B. \Rightarrow \frac{vP}{v\alpha} = 2$

64. $\frac{e}{m} = \frac{2V}{B2r2} \Rightarrow r^2 = \frac{2Vm}{eB2} \Rightarrow r = \sqrt{(2mV/e)}/B$

65. $F = -evB\sin\theta$
As velocity and magnetic field are parallel to each other so, $\theta = 0^o$
$F = -evB\sin0^o = 0$

66. J. J. Thomson's experiment, involving the motion of an electron beam in mutually perpendicular $\vec{E}$ and $\vec{B}$ fields, gave the value of charge to mass ratio of an electron.

67. If the particle is moving across the field lines, it means that it makes some angle with magnetic field lines. So,
$F = qvB\sin\theta \neq 0$

$r = \frac{mv}{qB}$

$(r)^2 = \left(\sqrt{\frac{2mK\cdot E}{(qB)_2}}\right)^2$

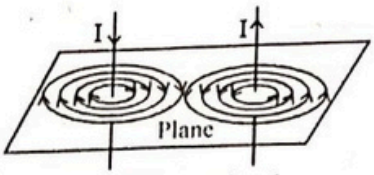
$r^2 = \frac{2mK\cdot E}{q^2B^2}$

$\frac{r^2q^2B^2}{2m} = K.E.$

$r^2 = \frac{2m}{q^2B^2}$

$r^2 = \sqrt{\frac{2m}{qB}}$

68.



69. At midpoint between two wires carry current in the same direction

$B = B_2 - B_1$

$$B = \frac{\mu o I2}{2\pi(r/2)} - \frac{\mu o I1}{2\pi(r/2)} = \frac{\mu o}{\pi r}(I_2 - I_1)$$

$$= \frac{4\pi\times10-7}{\pi(4\times10-3)}(12-8) = 4\times10^{-4}\ T$$

70. Most deflected means small radius

$$qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{mv}{qB} \Rightarrow r \propto m$$

$m_e < m_P < m_\alpha$

$r_e < r_P < r_\alpha$

Smaller the radius means greater will be the deflection.

So, electron will be deflected more

71. $F = e(V \times B)$

Fdirection $= (\hat{i} \times \hat{j}) = \hat{k}$ = z- direction (up)

72. $$qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{mv}{qB} \Rightarrow r \propto m$$

$m_e < m_P < m_\alpha$

$r_e < r_P < r_\alpha$

73. $F = qvB = (1.6\times10^{-19})(3\times10^5)(0.8) \approx 4\times10^{-14}$ N

F direction $= -(\hat{i}\times\hat{k}) = -(-\hat{j}) = \hat{j}$ = + y-direction

74. $F = q(v\sin\theta)B = qv_yB$

$= (1.6\times10^{-19})(3\times10^5)(0.8) = 3.8\times10^{-14}$ N

For magnetic force only vertical component is responsible.

75. $$E = \frac{e2B2R2}{2m} \Rightarrow E \propto R^2$$

76. $F = e(V \times B)$

As given v is in +ve x –direction

B is in +ve z –direction

By using right hand rule the magnetic force acts along the + y-axis. So, the electron will be deflected along +y-axis and will trace a curve path in xy-plane (counter clockwise).

77. When a charge particle enter in a magnetic field at a angle of 45° (any angle other than 90°) then its path in magnetic field will be helical or helix.

78. $$evB = \frac{mv2}{r} \Rightarrow eB = \frac{mv}{r} = \frac{m(r\omega)}{r} = m2\pi f$$

$$f = \frac{eB}{2\pi m} \Rightarrow T = \frac{2\pi m}{eB}$$

79. $B \propto \frac{1}{r}$ (By Ampere's law)

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80. The charge particle moves un-deflected in electric and magnetic field only if
$evB = eE \Rightarrow v = E/B$

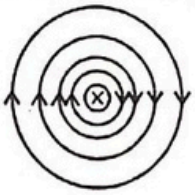
81. $F_B = qvB\sin 0^o = 0$
$F_e = qE \neq 0$

82. F direction $= (\hat{i} \times \hat{k}) = -\hat{j}$ = negative y- direction
If electric field is applied in positive y-direction, then
$F_m = F_e \qquad (F_{net} = 0)$

83. μ_o is a constant, known as permeability of free space. In SI units its value is $4\pi \times 10^{-7}$ Wb $A^{-1}m^{-1}$.

84. By right hand rule the direction of magnetic field is N-S.

85. By right hand rule the direction of current is into the page



86. $F_B = qvB\sin\theta$

87. $F_B = qvB\sin 0^o = 0$

88. $F_B = qvB\sin 0^o = 0.$
$F_e = qE \neq 0$
As the electron moves along the electric field. The electric force acts on electron opposite to its direction of motion. So, its speed decreases.

89. $F_B = evB\sin 0^o = 0$
So, proton will move along the straight line.

90. The energy of charged particle moving in circular path in magnetic field is given by

$$K.E. = \frac{e2B2r2}{2m}$$

K.E. $\propto B^2$ (As "e", "m" and "r" are same)

91. $$qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{mv}{qB} \Rightarrow r \propto \frac{v}{B}$$

$$\frac{r}{r} = \frac{v}{v} \times \frac{B}{B} \Rightarrow \qquad \frac{r}{r} = \frac{2v}{v} \times \frac{B}{B/2} = 4 \Rightarrow r' = 4r$$

92. $F = I(L \times B)$
F direction $= (-\hat{k} \times -\hat{i}) = \hat{j}$ = positive y- direction (towards the top of the page)

93. $$E = \frac{e2B2r2}{2m} \Rightarrow E \propto \frac{e2}{m}$$

$$\frac{EP}{E\alpha} = \frac{eP2}{e\alpha 2} \times \frac{m\alpha}{mP} = \frac{e2}{4e2} \times \frac{4mP}{mP} = 1 \Rightarrow E_P = E_\alpha$$

94. $$qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{P}{qB} = \text{constant}$$

95. $$qvB = \frac{mv2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow r = \frac{P}{qB} \Rightarrow P = qBr$$

$$\frac{PP}{P\alpha} = \frac{qP}{q\alpha} = \frac{qP}{2qp} = \frac{1}{2}$$

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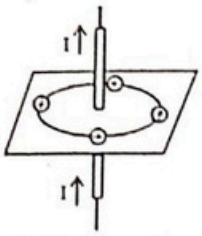
96. $F = qvB\sin\theta$

97.



The magnetic compass will point in N-S direction.

98. $\Phi_B = BA = Tm^2 = \text{weber}$

99. $\Phi_B = BA = (1)(1) = 1Wb$

100. $\Phi_B = B.\Delta A = (40\hat{i} - 18\hat{k}).(5.0 \times 10^{-4}\hat{k})$
$= (40)(0) + (-18)(5.0 \times 10^{-4}) = 90 \times 10^{-4}$ Wb

101. $B = \frac{\mu_o I}{2\pi r}$ (For straight wire)

$B \propto \frac{1}{r}$

So, when distance becomes double "B" will reduce to half.

102. $B = \frac{\mu_o I}{2\pi r}$

$B \propto I$

103. Magnetic field is circular in case of a straight wire.

104. $F_m = 0$ electron will move towards law. Potential and with decreasing speed.

105. $F = qvB\sin 0° = 0$

106. When direction of current in two parallel wires are same then force of attraction will produce due to weak magnetic field between wires.

107. According to right hand rule direction of current is from S to R.

$$F = ILB \rightarrow I = \frac{F}{LB} = \frac{1}{2 \times 0.5} = 1A$$

108. Two parallel wires having current in opposite direction always repel each other because magnetic field between the wires become stronger.

109. Direction of magnetic field depends upon direction of current according to right hand rule.

110. Direction of magnetic field is along the tangent on a curve.

111. According to R.H.R, arrow R correctly indicates the direction of force acting on the conductor

112. Direction of magnetic lines of forces can be found by right hand rule.

113. $1T = 10^4 G$

114. $F = ILB\sin\theta \quad \theta = 0° \Rightarrow F = 0$

115. $1T = 10^4 G$

$1G = 10^{-4} T$

$$F = ILB\sin\theta = (1)(1)\left(10^{-4}\right)\sin 45°$$

$$\boxed{F = \frac{1}{\sqrt{2}} \times 10^{-4} N}$$

116. Parallel lines of forces produce uniform field.

117. $$\frac{weber \times ampere}{meter} = \frac{NmA^{-1}.A}{m} = N$$

118. It is a case similar to that two wires have same current in same direction having field zero at the midway between them.

119. Current carrying conductor will move from stronger to weaker magnetic field.

120. According to R.H.R, curling fingers represent path of magnetic field and thumb indicate direction of current.

121. Both the conductors are marked with dots. The currents are both flowing toward the observer (i.e in same direction).

122. $F = I\,L\,B\sin\theta = 10\times 2\times 0.15\sin 45^\circ = \frac{3}{\sqrt{2}}\ N$

123. $B = \frac{\phi_B}{A} = \frac{Wb}{m^2}$

124. $F = IBL \Rightarrow I = \frac{F}{BL} = \frac{1}{0.98\times 1} = 1.02A = 1A$

125. By using RHR.

126. $\vec{F}_m = -e\vec{v}\times\vec{B} = -e\left(\vec{v}\hat{j}\right)\times B\left(-\hat{k}\right) = evB\hat{i}$

i.e direction of force is eastward

127. Application of right hand palm rule or Fleming's left hand rule.

128. In vector product, all three vectors are mutually perpendicular.

129. We know that time period $T = \frac{2\pi m}{qB}\ i.e. T \propto m$ (Since q and B are same)

Mass of proton > Mass of electron

$\therefore$ Time period of proton > Time period of electron.

130. According to $\vec{F} = q\left(\vec{v}\times\vec{B}\right)$

In perpendicular magnetic field, the path of a charged particle is a circle, and the magnetic field does not cause any change in speed and energy.

131. $F = qvB\sin\theta$

$F = 0 \quad \because \quad v = 0$

So, electron remain stationary

132. $F = qvB\sin\theta \Rightarrow F = 0\ when\ \theta = 0^\circ$

133. If angle equal to 90°, then trajectory will be circle and $90^\circ > \theta > 0^\circ$ trajectory will be helix.

134. $r = \frac{p}{qB} \rightarrow r \propto p$

135. Only charge particle can deflect in a magnetic field.

136. When $\theta = 0^\circ$ path is straight

When $\theta = 90^\circ$ path is circular

When $0^\circ < \theta < 90^\circ$ path is helical

137. When $\theta = 90^\circ$ path is circular

138. According to right hand rule ring will deflect towards "A".

139. Magnetic field is deflecting field which only change the direction.

140. Moving charge (may +ve or –ve) produce magnetic field

141. Magnetic field does no work so, K.E of charge remain same, so speed also remain same.

142. $F_l = F_e + F_b = qE + qvB$

143. Here magnetic force is zero, but the velocity increases due to electric force.

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144. $P = mv$
$P = \text{constant}$

$$v \propto \frac{1}{m}$$

Charge on proton, deuteron and α – particle is +e, +e and +2e respectively.

$$m_\alpha : m_{duet} : m_{proton} = 4:2:1$$

$$v_\alpha : v_{duet} : v_{proton} = 1:2:4$$

145. $\frac{E}{B} = \frac{NC^{-1}}{NA^{-1}m^{-1}} = \frac{C^{-1}}{A^{-1}m^{-1}} = \frac{A^{-1}s^{-1}}{A^{-1}m^{-1}} = ms^{-1} \quad \because \quad C = As$

146. $\mu_o = 4\pi \times 10^{-7} WbA^{-1}m^{-1}$

147. $r = \frac{p}{qB} \rightarrow r \propto p$

148. qvB=qE
E = Bv

149. $r = \frac{\sqrt{2mK}}{qB}$ *i.e.* $r \propto \frac{\sqrt{m}}{q}$ Here kinetic energy K and B are same.

$$\therefore \quad \frac{r_p}{r_\alpha} = \sqrt{\frac{m_p}{m_q}} \cdot \frac{q_\alpha}{q_p} = \sqrt{\frac{m_p}{4m_p}} \cdot \frac{2q_p}{q_p} = 1 \Rightarrow r_p = r_\alpha$$

150. $r = \frac{mv}{qB} = \frac{10^7}{10^{11} \times 10^{-4}} = 1m \left(\because \ q/m = 10^{11} C/kg\right)$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **A maximum force that acts on a current carrying conductor placed in magnetic field, when angel between the field and length of the conductor is.**
   A. 0° C. 90°
   B. 45° D. 180°

2. **Tesla in terms of base units is equal to.**
   A. $kgm^{-1}A^{-1}$ C. $kgs^{-1}A^{-1}$
   B. kg mA D. $kgs^{-2}A^{-1}$

3. **One Gauss is equal to.**
   A. 1T C. $10^{-4}T$
   B. $10^{2}T$ D. $10^{4}T$

4. **The unit of magnetic flux is.**
   A. Tesla C. Gauss
   B. Weber D. Henry

5. **The magnetic flux is maximum when angle between magnetic fields and vector area is.**
   A. 0° C. 60°
   B. 30° D. 90°

6. **Magnetic flux density is defined in terms of.**
   A. Tesla C. $NA^{-1}m^{-1}$
   B. Wbm^{-2} D. All of them

7. **A charged particle is moving along X-axis in a magnetic field along the Y-axis. The direction of magnetic force actin on it is.**
   A. along x-axis C. along z-axis
   B. along y-axis D. in xy-plane

8. **Ampere's Law give us the relationship between.**
   A. Force and velocity of charge C. Current and force
   B. Force and magnitude field D. Current and magnetic field

9. **The value of permeability of free space is.**
   A. $10^{-7}T.m.A^{-1}$ C. $4\pi\times10^{-7}T.m.A^{-1}$
   B. $2\pi\times10^{-7}T.m.A^{-1}$ D. $4\pi\times10^{7}T.m.A^{-1}$

10. **The magnetic field due to a current- carrying solenoid which has 'n' number of turns per unit length is.**
    A. $B=\mu_0 nI$ C. $B=\frac{\mu_0 nI}{\ell}$
    B. $B=\mu_0 n^2 I$ D. $B=\frac{\mu_0 n^2 I}{\ell}$

11. **The magnetic field inside the solenoid is independent of the following quantities.**
    A. Permeability C. Number of turns
    B. Position vector D. Flow of current

12. **What is the magnetic force on a stationary charged particle in a uniform magnetic field?**
A. Zero
B. F=q
C. F=qvB
D. F=ILBsin θ

13. **An electron is moving horizontally toward east. F it enters in magnetic field directed upward then the electron will be deflected in the in the direction of**
A. East
B. North
C. West
D. South

14. **When the direction of motion of a charged particle is perpendicular to the direction of magnetic field, then the particle follows the path of a**
A. Straight line
B. Ellipse
C. helix
D. Circle

15. **The torque due to a current carrying rectangular coil placed in a uniform magnetic field is**
A. τ = IBA sin θ
B. τ = IAN sin θ
C. τ = IBN sin θ
D. τ = NAIB sin θ

16. **The working principle of a galvanometer is based upon**
A. Momentum
B. Torque
C. Force
D. Impulse

17. **The current passing through the coil of a galvanometer is directly proportional to the**
A. Resistance
B. Conductance
C. Reactance
D. Angle of deflection

18. **A shunted galvanometer is called**
A. Voltmeter
B. Ammeter
C. Ohmmeter
D. Potentiometer

19. **A galvanometer can be converted into voltmeter by connecting it with**
A. Low resistance in parallel
B. Low resistance in series
C. High resistance in parallel
D. High resistance in series

20. **Which one of the following quantity is not measured by Avometer?**
A. Charge
B. Current
C. Resistance
D. Potential difference

ANSWER KEY

1	C	6	D	11	B	16	B
2	D	7	C	12	A	17	D
3	C	8	D	13	B	18	B
4	B	9	C	14	D	19	D
5	A	10	A	15	D	20	A

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KPK TEXT BOOK EXERCISE MCQs

1. **A moving charge is surrounded by:**
   A. 2 fields
   B. 4 fields
   C. 3 fields
   D. none of these

2. **A photon while passing through a magnetic field are deflected towards:**
   A. North pole
   B. Are ionized
   C. South pole
   D. None of these

3. **Magnetism is related to:**
   A. Stationary charges
   B. Stationary and moving charge
   C. Moving charges
   D. Law of motion

4. **When charge particle enter perpendicular to magnetic field, the path followed by it is:**
   A. A helix
   B. Straight line
   C. A circle
   D. Ellipse

5. **The torque in the coil can be increased by increasing:**
   A. No, of turns
   B. Area of coil
   C. Current and magnetic field
   D. All of above

6. **The magnetic flux will be max, for an angle of:**
   A. 0°
   B. 90°
   C. 60°
   D. 180°

7. **The weber is unit of measure of:**
   A. Conductance
   B. Magnetic flux
   C. Electric current
   D. Electric flux

8. **One weber is equal to:**
   A. $N.A^2/m$
   B. $N.A/m$
   C. $N.m^2/A$
   D. $N.m/A$

9. **An electron moves at $2\times10^2 m/\sec$ perpendicular to magnetic field of 2T what is the magnitude of magnetic force:**
   A. $1\times10^{-6} N$
   B. $6.4\times10^{-17} N$
   C. $6.4\times10^{17} N$
   D. $4\times10^{6} N$

10. **The force on a charge particle moving parallel to magnetic field is:**
    A. Maximum
    B. Zero
    C. Minimum
    D. None of these

11. **Ampere's law is applicable to:**
    A. Circular path
    B. To any closed path
    C. Rectangular path
    D. None of these

12. **The unit of permeability of free space is:**
    A. T.m/A
    B. $T.m/A^2$
    C. $T.m^2/A$
    D. None of these

ANSWER KEY

1	A	5	D	9	B
2	D	6	A	10	B
3	C	7	B	11	B
4	C	8	D	12	A

PAST PAPERS 2008-2020

1. **An electric charge in uniform motion produces:** (UHS 2008)
   A. An electric field
   B. A magnetic field
   C. Both electric and magnetic field
   D. Neither magnetic nor electric field

2. **Force experienced by moving change in a magnetic field is:** (UHS 2009)
   A. $F = BA\cos\theta$
   B. $F = \mu_o NI$
   C. $\vec{F} = q(\vec{v} \times \vec{B})$
   D. $\vec{F} = I(\vec{L} \times \vec{B})$

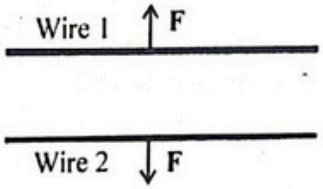
3. **The value of permeability of free space "μ_o" is:** (UHS 2009)
   A. $4\pi \times 10^{-7}\ WbA^{-1}m^{-1}$
   B. $4\pi \times 10^{2}\ WbA^{-2}m^{-2}$
   C. $4\pi \times 10^{-7}\ WbA^{-2}m^{-1}$
   D. $4\pi \times 10^{2}\ WbA^{-1}m^{-2}$

4. **A charge of two micro coulomb (2 μC) moves with velocity of two meter per second (2 m/s) in the direction of two tesla magnetic field. The force that will act on it will be:** (UHS 2009)
   A. 2 N
   B. Zero
   C. 8 N
   D. 4 N

5. **Which one of the following relation is correct?** (UHS 2010)
   A. 1 wb m^{-2} = 1 N $m^{-1}A^{-1}$
   B. 1 wb m^{-2} = 1 tesla
   C. 1 tesla = 10^4 gauss
   D. All of these

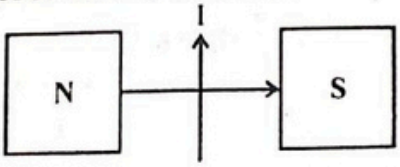
6. **Force on a current carrying conductor in a uniform magnetic field is:** (UHS 2010)
   A. $F = NIA\cos\alpha$
   B. $F = \mu_o nI$
   C. $F = ILB\sin\alpha$
   D. $F = ILA\cos\alpha$

7. **Two long parallel wires Wire 1 and Wire 2 repel each other as shown in figure. What could be the reason?** (UHS 2011)



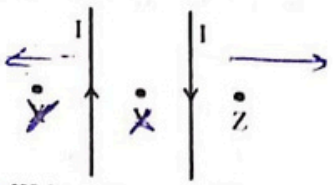
   A. Both carry current in same direction
   B. Both carry current in opposite direction
   C. Wire 1 has current, but Wire 2 has no current
   D. Wire 2 has current, but Wire 1 has no current

8. **The diagram shows a wire, carrying a current "I", placed the poles of a magnet; In which direction does the force on the wire act?** (UHS 2011,2013)



   A. Upward
   B. Downward
   C. Towards the "N" pole of the magnet
   D. Towards the "S" pole of the magnet

9. **Two long straight parallel wires held vertically, have equal but opposite currents as shown in the figure.**



Which of the following effect will be observed? **(UHS 2012)**

A. Magnetic field at "X" is stronger than that at "Y" and "Z"
B. Magnetic field at "X", and "Z" are same
C. Magnetic field at "X" is weaker than that at "Z"
D. Magnetic field at "X" is weaker than that at out, stronger than that at "Z"

10. **A long straight current carrying conductor has current direction from bottom to top when held vertically. What will be the direction of magnetic field lines when observed from below the conductor?** **(UHS 2013)**

A. Clockwise
B. Vertically upward
C. Anticlockwise
D. Vertically downward

11. **Due to current in straight conductor the distance between magnetic field lines:** **(UHS 2014)**

A. Increases away from conductor
B. Increases towards conductor
C. Decreases away from conductor
D. Decreases and then increases towards conductor

12. **Force on current carrying conductor per unit length is given by:** **(UHS 2015)**

A. ILsinθ
B. ILB
C. IL
D. IBsinθ

13. **Magnetic field strength is measured in:** **(UHS 2015)**

A. Wb/m
B. Wb/m^2
C. Wbm^2
D. Wb

14. **If [A] is fundamental dimension of ampere then the dimension of magnetic field strength is:** **(UHS 2015)**

A. $[MT^2A^{-2}]$
B. $[MT^{-2}A^{-1}]$
C. $[MT^2L^2A^{-1}]$
D. $[MT^2L^{-2}A^{-2}]$

15. **"F" is maximum force acting on a conductor. Now if we change the direction of conductor by making an angle of 45° with magnetic field then the force becomes:** **(UHS 2016)**

A. $\frac{F}{2}$
B. 2F
C. $\frac{F}{\sqrt{2}}$
D. $\sqrt{2}$ F

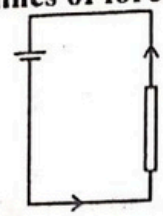
16. **If we doubled all the parameters of the force acting on current carrying conductor and θ = 90° then magnetic force becomes:** **(UHS 2016)**

A. Half
B. Double
C. Eight times
D. Four times

17. **The force acting on current carrying conductor will be maximum if the angle between magnetic field and conductor is:** **(UHS 2016)**

A. 0°
B. 30°
C. 90°
D. 60°

18. **Electronic current is flowing through a straight conductor as shown in figure given below. The direction of magnetic lines of force will be: (UHS 2017)**



A. Anticlockwise
B. From Bottom to Top
C. Clockwise
D. From Top to Bottom

19. **A charge is projected with velocity of 10 m/s in a magnetic field of 10T at angle of 60°. If force of 2.78×10^{-17} N is exerted on the charge then value of charge will be: (UHS 2017)**

A. 1.60×10^{-19} C
B. 2.70×10^{-19} C
C. 4.80×10^{-19} C
D. 3.20×10^{-19} C

20. **If the value of magnetic flux is 10Wb, when magnetic lines of force containing magnetic field strength of 1 tesla passing through unit area of $10m^2$ then the angle between magnetic field and unit area is: (UHS 2017)**

A. 180°
B. 360°
C. 90°
D. 0°

21. **Two long, parallel conductors which are free to move are arranged 1.0 cm apart. A steady current of 20 A flows in each of the conductor in the same direction. The conductors: (UHS 2018)**

A. moves away from each other
B. move towards each other
C. move at right angles to each other
D. remains stationary

22. **A neutron having mass equal to a proton ($m_p = 1.6 \times 10^{-27}$ kg) is moving in a magnetic field of intensity 1.20×10^{-3} T with a speed of 2.0×10^{7} m/s. What is the maximum force experienced by the neutron. (UHS 2018)**

A. 0
B. 3.84×10^{-12} N
C. 3.84×10^{-15} N
D. 38.4×10^{-15} N

23. **e/m of an electron is given by relationship: (UHS 2018)**

A. $e/m = (V/Br)^2$
B. $e/m = 2(V/B^2r^2)$
C. $e/m = (Vr)/B$
D. $e/m = VB/r$

24. **The unit of magnetic flux density is the tesla, "T", it can be expressed as: (UHS 2019)**

A. $1\ N^{-1}\ A^{-1}\ m$
B. $1\ N^{-1}\ A^{-1}\ m^{-1}$
C. $1\ N\ A^{-1}\ m$
D. $1\ N\ A^{-1}\ m^{-1}$

25. **If a conductor of length 7 m is placed in a magnetic field of strength 0.3 T carrying current 1 A, parallel to the field. What will be the force acting on it due to this magnetic field? (UHS 2019)**

A. 2.1 N
B. 0 N
C. 3.1 N
D. 7 N

26. **The horizontal component of Earth magnetic flux density is 1.8×10^{-6} T. The current in a horizontal cable is 160 A. Calculate the maximum force per unit length? (UHS 2019)**

A. 2.88×10^{-4} N/m
B. 2.88×10^{-8} N/m
C. 2.88×10^{-2} N/m
D. 2.88×10^{-6} N/m

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27. **Magnetic flux is maximum when angle between magnetic field and vector area is (PMC 2020)**

A. 0°
B. 90°
C. 180°
D. 45°

ANSWER KEY

1	C	8	B	15	C	22	A
2	C	9	B	16	C	23	B
3	A	10	A	17	C	24	D
4	B	11	A	18	B	25	B
5	D	12	D	19	D	26	A
6	C	13	B	20	D	27	A
7	B	14	B	21	B		

SOLUTIONS

1. Moving charge produces electric as well as magnetic field.
2. $\overline{F} = q(\overline{v} \times \overline{B})$
3. $\mu_o = 4\pi \times 10^{-7}\ WbA^{-1}m^{-1}$
4. As the charge is moving in the direction of magnetic field. So, $\theta = 0°$ $F = q\ vBsin0° = 0$
5. $1\ wb\ m^{-2} = 1\ tesla = 1\ N\ m^{-1}A^{-1} = 10^4\ gauss$
6. $\overline{F} = I(\overline{L} \times \overline{B}) \Rightarrow F = ILB\ sin\alpha$
7. Two straight current carrying conductors will repel each other only when they have current in opposite direction.
8. $\overline{F} = I(\overline{L} \times \overline{B})$

   By right hand rule, the force acts on the wire in downward direction.
9. Two wire carry equal and opposite current repel each other. So, the magnetic field at "Y" must be greater than at "X" and "Z". As the distance of "X" and "Z" from wires is same. So, $B_X = B_Z < B_Y$
10. By right hand rule the direction of magnetic field will be in the clockwise direction.
11. $B \propto \frac{1}{r}$

    On moving away from current carrying conductor, the magnetic field decreases. It means that the distance between magnetic field lines increases.
12. $F = ILBsin\theta \Rightarrow \frac{F}{L} = IB\ sin\theta$
13. $\Phi_B = BA \Rightarrow B = \frac{\Phi B}{A}$

    Unit of "B" = wb /m^2
14. $B = \frac{F}{IL}$

    $[B] = \frac{[F]}{[I][L]} = \frac{[MLT-2]}{[A][L]} = [MA^{-1}T^{-2}]$

15. Force = ILBsinα = Fsinα

Where maximum force = ILB = F

Force = ILBsinα = Fsin45° = $\frac{F}{\sqrt{2}}$

16. F = ILB sinθ = ILB sin90° = ILB

F' = (2I)(2L)(2B) = 8ILB = 8F

17. F = ILB sinθ

The force will be maximum, if the angle between magnetic field and conductor is 90°.

F_{max} = ILB sin90° = ILB

18. The direction of magnetic field will be discussed only by conventional current. (from top to bottom)

So, by right hand rule the direction of magnetic field will be in clockwise.

19. $F = qvB\sin\theta \Rightarrow q = \frac{F}{vB\sin\theta} = \frac{2.78\times10-17}{(10)(10)sin60o}$

$= \frac{2.78\times10-17}{100(0.86)} = \frac{278\times10-19}{86} = 3.23 \times 10^{-19}$ C

20. $\Phi_B = BA\cos\theta \Rightarrow \cos\theta = \frac{\Phi B}{BA} = \frac{10}{(1)(10)} = 1$

$\theta = \cos^{-1}(1) = 0°$

21. Two straight current carrying conductors will attract each other only when they have current in same direction.

22. F = qvBsinθ = (0) vBsinθ = 0

23. $\frac{e}{m} = \frac{2V}{B2r2} = 2(V/B^2r^2)$

24. $B = \frac{F}{ILsin\theta}$

1 T = 1 N A^{-1} m^{-1}

25. As the current is flowing in the direction of magnetic field. So, θ = 0°

F = ILBsin0° = 0

26. F = ILBsinθ

$\frac{F}{L}$ = IB sinθ

$= (160)(1.8\times10^{-6})\sin90° = 2.88 \times10^{-4}$ N/m

27. $\phi_B = \vec{B}.\vec{A} = BA\cos\theta$

$\phi_{B_{max}} = BA\cos0° = BA$

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PMC PAST PAPER 2022 (ELECTROMAGNETISM)

Q.1 **If the direction of the field and area vector is opposite then field is**
A. positive
B. zero
C. negative
D. none of these

Q.2 **An uncharged conductor has**
A. free electrons
B. protons
C. holes
D. all of these

Q.3 **A steady current passing through a conductor produces**
A. Electric field
B. Magnetic field
C. Both of these
D. None of these

Q.4 **If the direction of current is upward pointed by thumb, magnetic field is north side, than force will be**
A. left
B. right
C. top
D. bottom

Q.5 **Magnetic field lines form _____ loops from pole to pole.**
A. open
B. closed
C. branched
D. opened or closed

Q.6 **A solenoid 15.0 cm long has 300 turns of wire, a current 5 A flows through it. The magnitude of magnetic field inside the solenoid is**
A. 1.37×10^{-7} w/m^2
B. 1.37×10^{-5} w/m^2
C. 1.37×10^{-4} w/m^2
D. 1.37×10^{-2} w/m^2

Q.7 **Magnetic Force between two wires is inversely proportional to**
A. distance
B. current on them
C. Charge on them
D. none of these

Q.8 **Can we see magnetic field lines?**
A. Yes
B. No
C. Depends on strength of field
D. Only when the field is large

Q.9 **F= e(vxB) is valid for**
A. electron
B. proton
C. neutron
D. all

Q.10 **What happens to the flux if applied magnetic field is doubled on the same surface**
A. becomes half
B. becomes twice
C. becomes infinite
D. becomes 4 times

Q.11 **Two α-particles have the ratio of their velocities as 3 : 2 on entering the field. If they move in different circular paths, then the ratio of the radii of their paths is**
A. 2 : 3
B. 3 : 2
C. 4 : 9D. 9 : 4

Q.12 **Magnetic field is very strong where magnetic field lines are**
A. zeroB. far apart
C. very close
D. none of these

Q.13 **Lorentz force can be represented as**
A. $q[E + (v \times B)]$
B. $q[E + vB\cos\theta)$
C. bothD. none of these

Q.14 **A circular loop of radius $\tilde{2}$ m placed having area is perpendicular to the direction of magnetic field of 100 T, flux will be:**
A. 1256 wb
B. 12.96 wb
C. 1190 wb
D. 1426 wb

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Q.15 What is the angular frequency during the circular motion?
A. qm/B B. m/qB
C. qB/m D. qmB

Q.16 Magnetic flux is zero
A. when angle is 90 B. angle is 0
C. angle is 180 D. none of these

Q.17 The magnetic force is simply a
A. reflecting force B. deflecting force
C. restoring force D. gravitational force

Q.18 A square loop of side 2 m is placed in a 5T of magnetic field. What will be the related flux?
A. 2.5 Weber B. 5 weber
C. 10 weber D. 20 weber

Q.19 In Lorentz force, magnetic force is
A. work force B. deflecting force
C. resistive force D. none of these

Q.20 Magnetic force between two wires which are having current in opposite direction will
A. attract each other B. repel each other
C. experience no force between them D. none of these

Q.21 When a charge particle enters in the magnetic field perpendicular to the velocity of charge followed path is:
A. circular B. parabolic
C. elliptical D. hyperbolic

Q.22 Work done by the magnetic force on charged particle in presence of perpendicular magnetic field is
A. positive B. zero
C. negative D. none of these

Q.23 If a force of 2 N is applied on charge of 3 Coulomb, the electric field becomes
A. 3/2 N/C B. 2/3 N/C
C. 1/2 N/C D. none of these

Q.24 e/m =
A. mv/Br B. v/Br
C. r/Bv D. B/vr

Q.25 A solenoid bent into a circle is called
A. Resistor B. capacitor
C. inductor D. toroid

Q.26 If a charge particle enters in a region where electric and magnetic field are parallel to its motion, then it will
A. deflect upwards B. deflect downward
C. speed up D. speed down

Q.27 Strength of magnetic field is called
A. strength B. flux
C. magnetic flux density D. density

Q.28 A circular loop of area 0.05 m^2 rotates in a uniform magnetic field of 0.2 T. If the loop rotates about its diameter which is perpendicular to the magnetic field, find flux linked with loop when its plane is inclined 60 degree to the field
A. 0.01 wb B. 0 Wb
C. 8.66×10^{-3} Wb D. 0.86 wb

Q.29 What is the radius of circular path, if particle has mass m and charge q
A. r = qb/m
B. r = mv/B
C. r= mv/qB
D. r = mvr/qB

Q.30 Magnetic field will not produce in case of
A. charged positive particles
B. charged negative particles
C. neutral particles
D. All of these

Q.31 Magnetic flux is a
A. scalar quantity
B. vector quantity
C. sometimes scalar sometimes vector
D. none of these

Q.32 Whenever the magnetic flux linked with an electric circuit changes, an emf is induced in the circuit. This is called
A. electromagnetic induction
B. kirchoff's law
C. hysteresis loss
D. Lenz's law

Q.33 Unit of magnetic flux density is
A. Tesla
B. Wb/m^2
C. N/Am
D. All

Q.34 Force experienced by charged particles in magnetic field is
A. perpendicular to velocity
B. perpendicular to field
C. parallel to field
D. perpendicular to velocity and field

Q.35 1 tesla is equal to
A. 100 N/Am
B. 1 N/Am
C. 0.1 Nm/A
D. 1 Nm/A

Q.36 Unit of relative permeability is:
A. henry
B. henry/m
C. dimensionless
D. henry/sq. m

Q.37 A charged particle enters in a strong magnetic field, its K.E:
A. decreases
B. increases then decreases
C. becomes zero
D. remains constant

Q.38 Do magnetic field lines intersect?
A. Yes
B. No
C. depends on strength of field
D. cannot be determined

Q.39 Magnetic flux is given by
A. dot product of magnetic field and area vector
B. cross product of magnetic field and area vector
C. both of these
D. none of these

Q.40 The magnetic field lines generated in current carrying conductor are
A. circular
B. triangular
C. linear
D. none of these

Q.41 If a current wire of 2 A and length 5m enters perpendicular to magnetic field of 10T. calculate the force experienced by it
A. 50NB. 100N
C. 200N
D. 25N

Q.42 Magnetic field along the axis of solenoid with n turns per unit length carrying current I is given by:
A. $B = \mu_o nI$
B. $B = \mu_o N / L$
C. $B = \mu_o IN$
D. $B = \mu_o INL$

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Q.43 Is it possible to separate north pole only from bar magnet:
A. yes
B. no
C. in some cases it is possible
D. none of these

Q.44 Magnetic field outside the solenoid is:
A. strong
B. infinite
C. negligible
D. none of these

Q.45 Electric charge in uniform motion produces
A. electric field
B. magnetic field
C. both of these
D. none of these

Q.46 Magnetic flux is the dot product of magnetic induction and:
A. area
B. vector area
C. unit area
D. none of these

Q.47 A beam of ion with velocity $2x10^5$ m/s enters normally into a magnetic field of 0.04 T. The specific charge of ion is 5x107 C/kg. Radius of circle is:
A. 0.1 m
B. 0.16 m
C. 0.2 m
D. 0.25 m

Q.48 Electric charge in accelerating motion will produce:
A. electric field
B. magnetic field
C. EM waves
D. none of these

Q.49 SI unit of magnetic induction is:
A. Weber
B. Gauss
C. Tesla
D. Maxwell

Q.50 When north pole of bar magnet move towards a conducting loop, induced current flows in
A. clockwise sense
B. anticlockwise sense
C. not generates
D. not enough information

Q.51 The magnetic field is parallel to a surface, then the magnetic flux through the surface is
A. Zero
B. small but not zero
C. infinite
D. large but not infinite

Q.52 If magnetic field is given by B= (2i + 3j -8k) and a loop of area 10 m^2 is placed in field in y-z plane , max flux will be
A. -20 wb
B. 30 wb
C. 20 wb
D. 80 wb

Q.53 A strong magnetic field is applied on a stationary electron. Then the electron
A. moves in the direction of the field.
B. moves perpendicular to the direction of the field.
C. moves opposite to the direction of the field.
D. remains stationary.

Q.54 Find the electric field when the velocity of the field is 12m/s and the flux density is 8.75 units.
A. 510
B. 105
C. 150
D. 165

Q.55 During the circular path in magnetic field, what is the magnetic force
A. F= qB
B. F = qB2
C. F = qB/v
D. F = qvB

Q.56 For which angle between area and magnetic field, flux is maximum
A. 0 degree
B. 90 degree
C. 45 degree
D. 60 degree

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Q.57 A monoenergetic electron beam with an electron speed of 5.20×10^6 m/s is subject to a magnetic field of 1.30×10^{-4} T normal to the beam velocity. What is the radius of the circle traced by the beam, given e/m for electron equals 1.76×10^{11} C/kg

A. 22.7 cm
B. 21.3 cm
C. 20 cm
D. 21.9 cm

Q.58 A circular loop of area 200 cm^2 sites in x-z plane, then a uniform magnetic field $B = (0.3i + 0.4j)$ is applied on it, find the magnetic flux through the loop:

A. 0.8 Wb
B. 8 Wb
C. 0.008 Wb
D. 0.08 Wb

Q.59 Magnetic Field lines move from_____

A. north to south
B. south to north
C. east to west
D. west to east

Q.60 What is the magnitude of the magnetic field $B= (0.3i + 0.4j)$ T?

A. 5 T
B. 2.5 T
C. 0.5 T
D. 2 T

Q.61 Magnetic field lines created by current carrying wire is

A. Helical
B. Elliptical
C. Hyperbolic
D. Circular

Q.62 If a proton, alpha particle and photon moving with same velocity enter in uniform magnetic field then which particle will deflect more

A. proton
B. alpha particle
C. photon
D. all of these

Q.63 Magnetic field lines have a property that lines are_____

A. non intersecting
B. intersect near south pole
C. intersect near north pole
D. intersect every where

Q.64 $\text{Cos}\ \theta = \Phi/$

A. BA
B. A
C. B
D. B^2

Q.65 Which, among the following qualities, is not affected by the magnetic field?

A. Moving charge
B. charge in magnetic flux
C. current flowing in conductor
D. stationary charge

Q.66 A square coil of side length 2 mm is placed in the x-y plane and parallel to uniform magnetic field 0.1 T. Find total flux through the coil.

A. 1.6 Wb
B. 0.16 Wb
C. 16 Wb
D. 0 Wb

Q.67 Force on a moving charge in a uniform magnetic field will be maximum, when angle between v & B is:

A. 0°
B. 30°
C. 60°
D. 90°

Q.68 If magnetic field vector is $B = (i + 2j + k)$ and area vector is $(2i + j + k)$ then flux related to this is

A. 4wb
B. 5 wb
C. 6 wb
D. 7 wb

Q.69 Find the magnetic force when a charge 3.5C with flux density of 4 T is having a velocity of 2m/s

A. 14
B. 28
C. 7
D. 32

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Q.70 Current and magnetic field in a wire are always
A. perpendicular B. parallel
C. circular D. none of these

Q.71 e/m ratio for an electron in electric and magnetic field is
A. e/m =B r/E B. $E/(B^2r)$
C. E^2/rB^2 D. B^2/Er

Q.72 Find the force due to a current element of length 2 cm and flux density of 12 tesla. The current through the element will be 5A.
A. 1N B. 1.2N
C. 1.4N D. 1.6N

Q.73 Find the magnetic flux density when a flux of 28 Wb is enclosed in an area of 15cm.
A. 178.33 units B. 186.67 units
C. 192.77 units D. 200 units

Q.74 A square loop.of side 4 m is placed in magnetic field of 10 T, surface of the loop is making angle with the field 60 degree. What will be the flux?
A. 160 weber B. 80 weber
C. 40 weber D. 90 weber

Q.75 1 weber is equal to
A. 10 Gauss B. 10^8 Maxwell
C. 10^{-4} Gauss D. 10^4 Maxwell

Q.76 Current carrying loop behaves like a
A. monopole B. dipole
C. quadrupled D. octopole

Q.77 A charged particle is moving on circular path with velocity v in a uniform magnetic field B, if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes
A. 8 times B. 2 times
C. 4 times D. 16 times

Q.78 The flux is the region where magnetic field
A. changes direction B. changes strength
C. changes polarity D. no change occur

Q.79 If a Charge of 2C is travelling parallel to a magnetic field of 4T with 20 m/s Calculate the net force on it.
A. 160N B. 120N
C. 0N D. 100N

Q.80 Is it possible to visualize magnetic field lines
A. yes directly we can see with eyes B. we need microscope
C. we need telescope D. All cases are not possible

Q.81 Magnetic flux density is a
A. scalar quantity B. vector quantity
C. sometimes scalar sometimes vector D. none of these

Q.82 If a charged particle moves through a magnetic field perpendicular to it
A. both momentum and energy of particle change
B. momentum as well as energy are constant
C. energy is constant but momentum changes
D. momentum is constant but energy changes

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Q.83 How can a magnetic field be produced?
A. Using a permanent magnet
B. Electric current
C. Using a temporary magnet
D. Using a permanent magnet or electric current

Q.84 The magnetic flux linked with a coil is inversely proportional to the
A. Area of cross section
B. Number of turns
C. magnetic field
D. none of these

Q.85 Magnetic induction is also called
A. flux
B. magnetization
C. magnetic intensity
D. flux intensity

Q.86 Find the Lorentz force of a charge 2.5C having an electric field of 5 N/C and magnetic field of 7.25 T with a velocity 1.5m/s.
A. 39.68
B. 68.93
C. 89.39
D. 63.98

Q.87 A loop of radius 1 m is placed on a inclined of 60 degree with the magnetic field of 100T, corresponding flux will be:
A. 314 wb
B. 107 wb
C. 157 wb
D. 435 wb

Q.88 What is the strength of magnetic field known as
A. flux
B. density
C. magnetic strength
D. magnetic flux density

Q.89 A 3m wire carrying a current of 10A is placed inside a solenoid of magnetic field 0.35 T. The Net force felt by wire is
A. 11.5N
B. 10.5N
C. 9.5N
D. 8.5N

Q.90 Electron and proton both with same momentum enter perpendicularly in uniform field
A. path of proton will be more curved
B. path of electron will be more curved
C. both have same curved path
D. path of both will straight line

Q.91 Electron in accelerating motion will produce
A. electric field
B. magnetic field
C. EM waves
D. none of these

Q.92 Charged body attracts uncharged body by ___ induction
A. electrostatic
B. magnetic
C. both a and b
D. none of these

Q.93 How can a magnetic field be produced?
A. Using a permanent magnet
B. Electric current
C. Using a temporary magnet
D. all of these

Q.94 A rectangular loop of dimension 3 cm by 5 cm is placed perpendicular in uniform magnetic field of 0.1 T, find the magnetic flux through the loop
A. 1.5 wb
B. 0.15 wb
C. 0.0015 wb
D. 15 wb

Q.95 The magnetic field is parallel to a surface, then the magnetic flux through the surface is:
A. zero
B. small but not zero
C. infinite
D. larger than 1

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Q.96 **One proton beam enters in magnetic field of 10^{-4} T normally with specific charge 10^{11} C/kg and velocity of 10^7 m/s. What will be the radius of circle?**

A. 0.1 m
B. 1 m
C. 10 m
D. none of these

Q.97 **Sensitivity of a galvanometer is defined as**

A. The deflection produced per unit micro ampere current
B. The deflection per force
C. Force per unit area
D. None of them

Q.98 **If velocity of charged particle and magnetic field are at a fixed angle but not 90° then path will be:**

A. circular
B. straight line
C. spherical
D. helical

Q.99 **The magnetic field is parallel to a surface, then the magnetic flux through the surface is:**

A. zero
B. small but not zero
C. infinite
D. larger than 1

Q.100 **If velocity of charged particle and magnetic field are at a fix angle not 90 degrees then path will be:**

A. circular
B. straight line
C. spherical
D. helical

$\mathcal{E} = -NB\frac{\Delta A}{\Delta t}$

$\mathcal{E} \propto \frac{\Delta A}{\Delta t}$

$\mathcal{E} = -N\frac{\Delta \phi}{\Delta t}$

ANSWER KEY

1	A	16	A	31	A	46	B	61	D	76	B	91	C
2	A	17	B	32	A	47	A	62	A	77	C	92	A
3	B	18	D	33	D	48	C	63	A	78	D	93	D
4	A	19	B	34	D	49	C	64	A	79	C	94	C
5	B	20	B	35	B	50	B	65	D	80	D	95	B
6	D	21	A	36	C	51	B	66	D	81	B	96	B
7	A	22	B	37	D	52	C	67	D	82	C	97	A
8	B	23	B	38	B	53	D	68	B	83	D	98	D
9	B	24	B	39	A	54	B	69	B	84	D	99	A
10	B	25	D	40	A	55	D	70	C	85	C	100	D
11	B	26	C	41	B	56	A	71	B	86	A		
12	C	27	C	42	A	57	A	72	B	87	C		
13	A	28	C	43	B	58	C	73	B	88	D		
14	A	29	C	44	C	59	A	74	B	89	B		
15	C	30	C	45	C	60	C	75	B	90	C		

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UNIT 9

PRACTICE EXERCISE

ELECTROMAGNETIC INDUCTION

1. **Magnetic flux passing normally, through a unit area is called:**
   A. Magnetization
   B. Magnetic flux density
   C. Magnetic field intensity
   D. All of these

2. **The induced e.m.f. is produce due to:**
   A. Motion of coil
   B. The time rate of change of flux
   C. Motion of magnet
   D. Resistance of coil

3. **Lenz's law is consistent with law of conservation of:**
   A. Mass
   B. Charge
   C. Energy
   D. Momentum

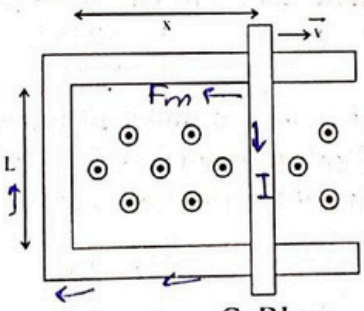
4. **Current can be induced in a coil by changing the area of coil placed in:**
   A. Uniform magnetic field
   B. Uniform magnetic and electric field
   C. Uniform electric field
   D. All of these

5. **The practical application of the mutual induction phenomena is:**
   A. Electric motor
   B. A.C generator
   C. Transformer
   D. Transistor

6. **Turns ratio of a step up transformer is 50. If 220 V A.C. is applied to its primary coil, voltage in the secondary coil will be:**
   A. 44 V
   B. 220 V
   C. 4.4 V
   D. 11000 V

7. **As a loop of wire with a resistance of 10 Ω moves in a non-uniform magnetic field, it loses Kinetic energy at a uniform rate of 5mJ/s. The induced emf in the loop is:**
   A. 0 V
   B. 0.28 V
   C. 0.2 V
   D. 2 V

8. **A rod with resistance "R" lies across frictionless conducting rails in a constant uniform magnetic field B, as shown. Assume the rails have negligible resistance. The magnitude of the force that must be applied by a person to pull the rod to the right at constant speed v is:**



   A. 0
   B. BLv/R
   C. BLv
   D. B^2L^2v/R

9. **The direction of induce current is always so as to oppose the change which causes the current is:**
   A. Faraday's law
   B. Ohm's law
   C. Lenz's law
   D. Kirchhoff's 1st rule

10. **A transformer:**
   A. Works on A.C. only
   B. Works on both A.C and D.C.
   C. Works on D.C. only
   D. Has no hysteresis loss

11. Which one is the correct relation for the transformer:

A. $\frac{Ns}{Np} = \frac{Vp}{Vs}$ C. $\frac{Is}{Ip} = \frac{Vs}{Vp}$

B. $\frac{Ns}{Np} = \frac{Ip}{Is}$ D. $\frac{Ip}{Is} = \frac{Vp}{Vs}$

12. Lamination of core of transformer is to decrease its:

A. Eddy current C. Hysteresis

B. Electric resistance D. Inductance

13. A rectangular loop of wire is placed perpendicular to a uniform magnetic field and then spun around one of its sides at frequency "f".The induced emf is a maximum when:

A. the flux is zero

B. the flux is a maximum

C. the flux is half its maximum value

D. the derivative of the flux with respect to time is zero

14. If we increase the resistance of coil, the induced e.m.f. will be:

A. Increase C. Decrease

B. Remain same D. Increase exponentially

15. Which one of the following is correct for a step down transformer:

A. $N_P > N_S$ C. $N_s > N_P$

B. $N_P = N_s$ D. $N_S \geq N_P$

16. A rectangular loop of wire has area "A". It is placed perpendicular to a uniform magnetic field "B" and then spun around one of its sides at frequency "f". The maximum induced emf is:

A. BAf C. BAf

B. 2BAf D. 2πBAf

17. The turn ratio in a step up transformer is 4:1. On passing a current of 4 A in the primary, the current in secondary will be:

A. 0.25A C. 1A

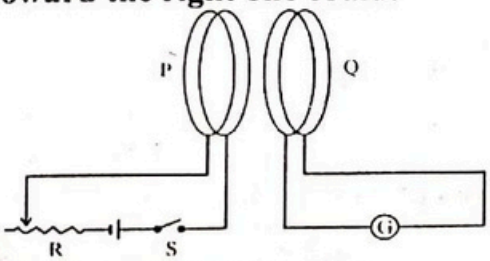
B. 2A D. 8A

18. A metal rod of length 1 m is moving at a speed of $1ms^{-1}$ in the direction making an angle of 30^0 with 0.5 T magnetic field. The emf produced is:

A. 0.25 V C. 0.025 V

B. 2.5 V D. 25 V

19. Coils "P" and "Q" each have a large number of turns of insulated wire. When switch "S" is closed, the pointer of galvanometer "G" is deflected toward the left. To make the pointer of "G" deflect toward the right one could:



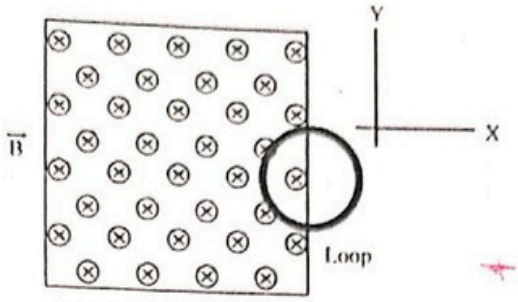
A. move the slide of the rheostat R quickly to the right

B. move coil P toward coil Q

C. move coil Q toward coil P

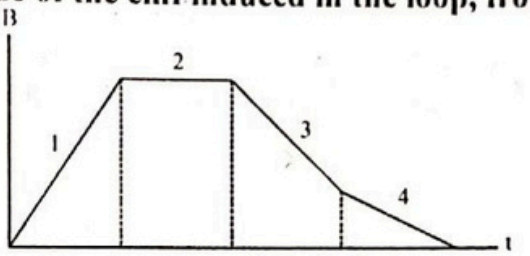
D. open S

20. **A circular loop of wire is positioned half in and half out of a square region of uniform magnetic field directed into the page, as shown. To induce a clockwise current in this loop:**



A. move it in +x direction
B. move it in −y direction
C. move it in +y direction
D. move it in −x direction

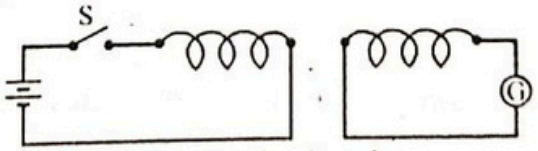
21. **The graph shows the magnitude "B" of a uniform magnetic field that is perpendicular to the plane of a conducting loop. Rank the five regions indicated on the graph according to the magnitude of the emf induced in the loop, from least to greatest.**



A. 1, 2, 3, 4
B. 4, 3, 1, 2
C. 2, 4, 3, 1
D. 1, 3, 4, 2

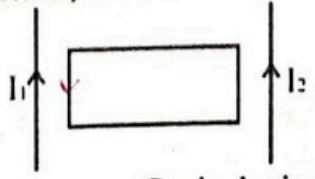
22. **A magnet moves inside a coil. Consider the following factors:**
I. strength of the magnet
II. number of turns in the coil
III. speed at which the magnet moves
Which can affect the emf induced in the coil?
A. I only
B. III only
C. I, II, III
D. I and II only

23. **In the experiment shown:**



A. there is a steady reading in G as long as S is closed
B. a motional emf is generated when S is closed
C. the current in the battery goes through G
D. there is a current in G just after S is opened or closed

24. **A rectangular loop of wire is placed midway between two long straight parallel conductors as shown. The conductors carry currents "I_1" and "I_2", as indicated. If "I_1" is increasing and "I_2" is constant, then the induced current in the loop is:**



A. zero
B. counterclockwise
C. clockwise
D. depends on $I_1 - I_2$

25. **The turn ratio of a step up transformer is 50, the voltage and current ratio will be:**
A. 50, 50
B. 0.02, 0.02
C. 50, 0.02
D. 0.02, 50

26. **For transmission of electricity to far off places, from the A.C. power generation plant, we always use:**
A. step down transformer
B. transformer with several secondaries
C. step up transformer
D. All of these

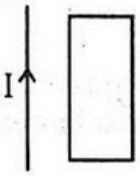
27. **A transformer is a device which step up or stop down:**
A. Energy
B. Voltage
C. Power
D. All of above

28. **To minimize the heating effect in the transmission lines:**
A. High current low voltage is used
B. Same voltage and current is used
C. High voltage low current is used
D. High voltage high current is used

29. **The units of motional emf are:**
A. volt/second
B. tesla/second
C. volt meter/second
D. tesla meter^2/second

30. **A square loop of wire lies in the plane of the page. An increasing magnetic field is directed into the page. The induced current in the loop is:**
A. counterclockwise
B. clockwise
C. zero
D. up the left edge and from right to left along the top edge

31. **A long straight wire is in the plane of a rectangular conducting loop. The straight wire carries a constant current I, as shown. While the wire is being moved toward the rectangle the current in the rectangle is:**



A. zero
B. clockwise
C. counterclockwise
D. clockwise in the left side and counterclockwise in the right side

32. **The rms value of A.C supply is 220 volts its peak value is:**
A. 150 V
B. 110 V
C. 311 V
D. 440 V

33. **The normal to a certain 1m^2 area makes an angle of 60° with a uniform magnetic field. The magnetic flux through this area is the same as the flux through a second area that is perpendicular to the field if the second area is:**
A. 0.866m^2
B. 0.5m^2
C. 1.15m^2
D. 2m^2

34. **The power loss in transformer takes place due to:**
A. eddy current
B. magnetic field
C. hysteresis loss
D. both A. &C.

35. **How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50Hz source?**
A. 50 times
B. 200 times
C. 100 times
D. 150 times

36. **For a good transformer, the material of the core should has the hysterics loop of:**
A. Small area
B. Large area
C. No area
D. moderate area

37. **A copper ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is:**
A. Equal to that due to gravity
B. Less than that due to gravity
C. More than that due to gravity
D. Depends on the diameter of the ring and the length of the magnet

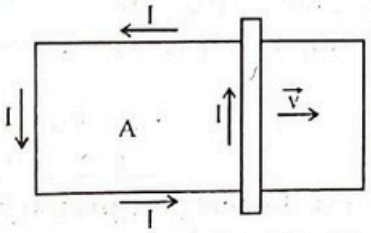
38. **A transformer is used to step up an alternating emf of 220 V to 4.4 kV in order to transmit 6.6 kW of power. If the primary coil has 100 turns, what is the number of turns in the secondary?**
A. 20
B. 2000
C. 200
D. 20000



39. **The coils of a transformer are:**
A. Magnetically linked
B. electrically linked
C. Both "A" and "B"
D. Isolated with each other

40. **A transformer steps down 100 volt to 10 volt to operate a device with an impedance of 2 ohms. Then current in the primary is:**
A. 50 A
B. 5 A
C. 0.5 A
D. 0.05 A

41. **The figure shows a bar moving to the right on two conducting rails. To make an induced current i in the direction indicated, a constant magnetic field in region "A" should be in what direction?**



A. Right
B. Left
C. Into the page
D. Out of the page

42. **In a coil where magnetic flux is constantly changing, there should exist:**
A. a current
B. an emf
C. Torque
D. All of these

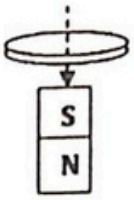
43. **A sine wave has a frequency of 50Hz. Its angular velocity is ____ radian per second:**
A. 50π
B. 75π
C. 100π
D. 125π

44. **The average power delivered during a cycle is:**
A. Zero
B. I^2R
C. one
D. V^2I

45. **An alternating current is represented by the equation. $I = 20\sin 100\pi t$, its frequency is:**
A. 100Hz
B. 50 Hz
C. 20 Hz
D. 80 Hz

46. **The effective value of alternating current is:**
A. $\sqrt{2}$ times its maximum value
B. $1/\sqrt{2}$ times its maximum value
C. 2 times its maximum value
D. ½ times its maximum value

47. **In the following figure, a metallic ring is shown to fall vertically on a bar magnet. The induced current in the ring will be:**



A. zero
B. clockwise
C. counter clockwise
D. along the direction of fall

48. **A sinusoidal voltage V has an rms value of 100 V. Its maximum value is:**
A. 100 V
B. 707 V
C. 70.7 V
D. 141 V

49. **The resistance of the primary coil of 1:10 step down transformer is 1 Ω. With the secondary circuit open, the primary is connected to a 12 V ac generator. The primary current is:**
A. essentially zero
B. about 12 A
C. about 120 A
D. depends on the actual number of turns in the primary coil

50. **The primary of an ideal transformer has 100 turns and the secondary has 600 turns. Then:**
A. the power in the primary circuit is less than that in the secondary circuit
B. the currents in the two circuits are the same
C. the voltages in the two circuits are the same
D. the primary current is six times the secondary current

51. **For an ideal transformer:**
A. $P_{in}=P_{out}$
B. $P_{in}>P_{out}$
C. $P_{in}<P_{out}$
D. $P_{in} \approx P_{out}$

52. **In an ideal 1:8 step down transformer, the primary power is 10 kW and the secondary current is 25 A. The primary voltage is:**
A. 25, 600 V
B. 3200 V
C. 400 V
D. 50 V

53. **The rms value of an ac current is:**
A. its peak value
B. its average value
C. that steady current that produces the same rate of heating in a resistor as the actual current
D. that steady current that will charge a battery at the same rate as the actual current

54. **The current which fluctuates from zero to maximum and maximum to zero is called:**
A. Steady current
B. Direct current
C. Alternate current
D. Pulsating Direct current

55. **Purpose of step down transformer is to make the:**
A. Input current same as output current
B. Output voltage lower than input voltage
C. Output current higher than input current
D. Output current lower than input current

56. **The core of a transformer is made of soft iron because:**
A. Iron is cheaper than copper
B. Iron is a good conductor of current
C. Iron is a good magnetic substance
D. Iron has high melting point

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57. **A magnet is introduced into the coil and a voltage is induced across the coil. Which of the following factor has no effect on the induced voltage?**
A. Thickness of the wire of the coil
B. The time in which magnet is introduced
C. The strength of the magnetic field
D. Number of turns of the coil

58. **Suppose this page is perpendicular to a uniform magnetic field and the magnetic flux through it is 5Wb. If the page is turned by 60° around an edge the flux through it will be:**
A. 2.5Wb
B. 5Wb
C. 4.3Wb
D. 5.8Wb

59. **1weber is the same as:**
A. 1Vs
B. 1T/m
C. 1T s
D. 1V/s

60. **A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop is:**
A. counterclockwise
B. clockwise
C. zero
D. up the left edge and from right to left along the top edge

61. **A transformer has 100 turns on the input side and 500 turns on the output side. If the rms values of the input voltage and current are 220V and 2A respectively, then the output power is about:**
A. 480 Watts
B. 1440 Watts
C. 440 Watts
D. 90 Watts

62. **A generator supplies 100 V to the primary coil of a transformer. The primary has 50 turns and the secondary has 500 turns. The secondary voltage is:**
A. 1000 V
B. 500 V
C. 250 V
D. 100 V

63. **The induced emf does not depend on:**
A. Area of the coil
B. no. of turns of coil
C. resistance of the coil
D. length of coil

64. **If the emf across the conductor of length 1m moving with a uniform speed at right angles to a magnetic field of 0.5T is 2V, the velocity of the conductor is:**
A. 1 ms^{-1}
B. 2 ms^{-1}
C. 4 ms^{-1}
D. 8 ms^{-1}

65. **An emf of 0.003V is induced in a wire when it moves at right angles to uniform magnetic field with a speed of 4m/s if the length of the wire in the field is 15cm, what is the flux density in tesla?**
A. 0.003
B. 0.005
C. 6
D. 12

66. **If a conductor of unit length is moving at 30° through a magnetic field of 1 Tesla. If velocity of the conductor is 1 ms^{-1} then induced emf in the rod will be:**
A. 0.5V
B. 0.25V
C. 0.15V
D. 50V

67. **One can increase the performance of a transformer by:**
A. using primary and secondary wires of less resistance
B. making the sheets of transformer core fully insulated
C. using methods to increase the flux coupling between the coils
D. All of these

68. A transformer steps down 200 volt to 22V to operate a device of resistance 220 Ω then current drawn from mean by primary coil will be:

A. 1 A
B. 0.1 A
C. 0.01 A
D. 10 A

69. The induced current in a loop can be increased by:

A. Using stronger magnetic field
B. replacing loop by a coil of many turns
C. moving the loop faster
D. All of these

70. A rectangular loop of wire with dimensions 0.2m × 0.5m is placed in a uniform magnetic field of 2T. The magnetic field is perpendicular to the plane of loop. What is flux in the loop?

A. 0.1 Wb
B. 0.2 Wb
C. 0.3 Wb
D. 0.4 Wb

71. The unit of the quantity $\Delta\Phi/\Delta t$ are equivalent to those of:

A. Voltage
B. Current
C. Resistance
D. Electric intensity

72. In an ideal transformer, the following factors are used:

A. Input and output power is same
B. Currents are inversely proportional to voltage
C. Currents are directly proportional to voltage
D. Both "A" and "B"

73. At which angle the magnetic flux will be half of its maximum value:

A. 30°
B. 45°
C. 60°
D. 90°

74. The turn ratio in step down transformer is 100:1 if current across primary is 1A then current across secondary will be:

A. 10A
B. 0.01A
C. 100A
D. 0.1A

75. According to Lenz's law, the direction of which of the following is always so as to oppose the change which causes it?

A. Induced emf
B. Induced current
C. magnetic flux
D. magnetic induction

76. If the speed of rotation of AC generator is made four times of its initial value, the percentage increase in an induced emf is:

A. 100%
B. 300%
C. 400%
D. 50%

77. The emf induced in a metal ring whose flux is changing at the rate of 1 wb/s is:

A. 0.5 V
B. 1 V
C. Zero
D. 60 V

78. A 1 m^2 circular coil of 10 loops is placed parallel to changing magnetic felid at 0.3 T/s, the induced emf is:

A. 0.5 V
B. 3 V
C. Zero
D. 3.5 V

79. The emf induced by the motion of a conductor across a magnetic field is called:

A. Back emf
B. Motional emf
C. Directional emf
D. back emf

80. For a step up transformer, we have:

A. $V_S/V_P > I_S/I_P$
B. $P_S/P_P > 1$
C. $I_P/I_S > 1$
D. All of these

81. **North pole of a magnet is moving towards a face of a metallic loop then that face of the loop becomes:**
A. north pole
B. south pole
C. both "A" and "B"
D. Mono pole

82. **If a 3cm of wire is moved at right angle to the magnetic field with a speed of 2 m/sec and if flux density is 5 Tesla, what is the magnitude of induced e.m.f?**
A. 0.03V
B. 0.6V
C. 0.3V
D. 10V

83. **The number of turns in a secondary coil is twice the number of turns in primary coil. An a.c source of 200 V is connected across the primary. The voltage across secondary is:**
A. 440 V
B. 100 V
C. 200 V
D. 400 V

84. **A transformer is said to be 100 % efficient if:**
A. Output voltage = Input voltage
B. Output power = Input power
C. Output current = Input current
D. Output energy = Input energy

85. **For transformer, if $N_S/N_P = 2:1$ then $I_P/I_S =$**
A. 1 : 2
B. 2 : 1
C. 4 : 1
D. 1 : 1

86. **When a transformer is connected to 120 volt A.C it supplies 300 volt to device, the current through secondary winding is 0.6 amp and current through primary is 2 amp, the no. of turns on primary is 400. What is the efficiency of transformer?**
A. 75%
B. 80%
C. 85%
D. 100 %

87. **A glass rod of length "L" moves with velocity "v" perpendicular to a uniform magnetic field "B", the emf induced in rod is:**
A. $vBL\sin\theta$
B. vBL
C. Zero
D. $N\omega AB\sin\theta$

88. **In the actual transformer, the output is always:**
A. Equal to input
B. More than input
C. Less then input
D. Infinity

89. **In ideal transformer when potential difference is double the current is:**
A. Doubled
B. Halved
C. Tripled
D. Same

90. **A transformer steps down the voltage of 220V to 40V with the help of 40 turns on the secondary coil, than number of turns on the primary are:**
A. 20
B. 40
C. 220
D. 120

91. **The instantaneous value of A.C. voltage is:**
A. $V = V_o \sin(2\pi ft)$
B. $V = V_o \sin(2\pi\omega t)$
C. $V = V_o\sin(2ft)$
D. $V = V_o\sin(ft)$

92. **A transformer changes 12V to 1800V and there are 6000 turns in secondary coil, the no. of turn on primary coil is:**
A. 40
B. 20
C. 10
D. 2

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93. Which statement is true for step up transformer:

A. $I_s < I_p$ C. $I_s = I_p$

B. $I_s > I_p$ D. $I_s = 2I_p$

94. Alternating current changes:

A. Its magnitude as well as direction C. Only direction but not magnitude

B. Only magnitude but not direction D. Both remains same

95. The coil in A.C generator rotates with rotational speed of 10 rad/s its frequency is:

A. 2π Hz C. 5π Hz

B. $5/\pi$ Hz D. $\pi/5$ Hz

96. The correct relation for transformer is:

A. $N_sN_p = I_sI_p$ C. $N_s/N_p = I_s/I_p$

B. $N_s/I_s = N_p/I_p$ D. $N_s/N_p = I_p/I_s$

97. The correct relation for transformer is:

A. $V_sV_p = I_sI_p$ C. $V_s/V_p = I_s/I_p$

B. $V_s/I_s = V_p/I_p$ D. $V_s/V_p = I_p/I_s$

98. As a loop of wire with a resistance of 10 Ω moves in a constant non-uniform magnetic field, it loses kinetic energy at a uniform rate of 4.0 mJ/s. The induced current in the loop is:

A. 0 C. 2.8 MA

B. 2 mA D. 20 mA

99. An A.C varies as function of:

A. Time C. Current

B. Voltage D. Displacement

100. For a plane surface, 50 magnetic field lines are passing through a unit area at 30°.T he magnitude of the flux is:

A. $50\sqrt{3}/2$ C. $20/\sqrt{2}$

B. 50 D. $50/\sqrt{2}$

101. The magnetic induction B is also called the

A. flux C. flux density

B. density D. tesla

102. The unit of magnetic flux density is

A. Wb m^{-2} C. tesla

B. N A^{-1} m^{-1} D. all of these

103. A straight copper wire is moved in a uniform magnetic field such that it cuts the magnetic lines of force. Then

A. emf will not be induced

B. emf will be induced

C. sometimes emf will be induced and sometimes not

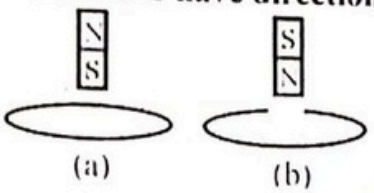
D. nothing can be predicted

104. At what angle the magnetic flux will be half of its maximum value

A. 30° C. 90°

B. 60° D. 45°

105. **In a closed ring (a) and in an open ring (b) magnets are falling along the axis of the ring. The current generated in a and b have directions**

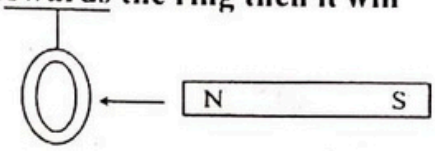


A. Clockwise, Zero
B. Anticlockwise, zero
C. Anticlockwise, clockwise
D. Zero, zero

106. **The direction of induced current in a coil or circuit is such that it opposes every cause of its production. This law is given by**

A. Faraday
B. Kirchhoff
C. Lenz
D. Ampere

107. **A metallic circular ring is suspended by a string and is kept in a vertical plane. When a magnet is approached towards the ring then it will**



A. Remain stationary
B. Get displaced away from the magnet
C. Get displaced towards the magnet
D. Nothing can be said

108. **In the equation $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$ the negative sign indicates that**

A. The self-induced current opposes its cause
B. The accordance of equation with the Lenz's Law
C. The induced e.m.f opposes the change which produces it.
D. All of the above

109. **The e.m.f. induced in a coil is _____ the rate of change in flux linkages.**

A. Directly proportional to
B. Inversely proportional to
C. Independent of
D. None of the above

110. **A coil having 500 square loops each of side 10 cm is placed normal to a magnetic induction which increases at the rate of 1.0 tesla/second. The induced e.m.f. in volts is**

A. 5
B. 0.1
C. 1
D. 0.5

111. **In a circuit with a coil of resistance 2 ohms, the magnetic flux changes from 2.0 Wb to 10.0 Wb in 0.2 second. The charge that flows in the coil during this time is**

A. 5.0 coulomb
B. 4.0 coulomb
C. 1.0 coulomb
D. 0.8 coulomb

112. **When magnet is in motion relative to a coil, an induced e.m.f. is produced. It does not depend upon**

A. Resistance of the coil
B. Pole strength of the pole
C. Motion of the magnet
D. Number of turns of the coil

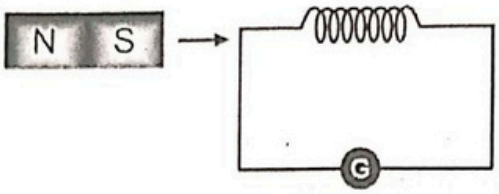
113. **When a wire loop is rotated in two poles of magnetic field, the direction of e.m.f. change once in every**

A. 1 revolution
B. 2 revolution
C. $\frac{1}{4}$ revolution
D. $\frac{1}{2}$ revolution

114. To induce an emf in a coil the linking magnetic flux

A. must decrease
B. must increase
C. must remain constant
D. can either increase or decrease

115. As shown in the figure, a magnet is moved with a fast speed towards a coil at rest. Due to this induced electromotive force, induced current and induced charge in the coil is E, I and Q respectively. If the speed of the magnet is doubled, the incorrect statement



A. E increases
B. Q remains same
C. I increases
D. Q increases

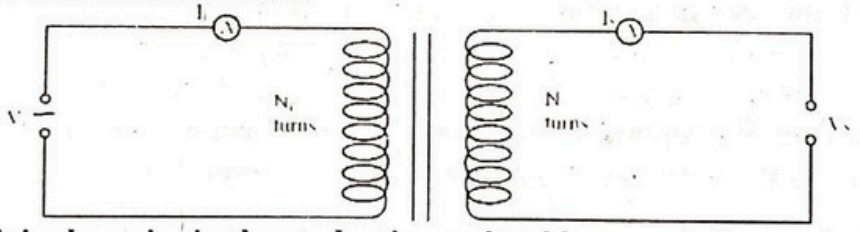
116. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increasing with time. The induced current in the inner loop then, is

A. zero
B. counter clockwise
C. clockwise
D. in a direction that depends on the ratio of the loop radii

117. When a coil of cross-sectional area A and number of turns N is rotated in a uniform magnetic field B with angular velocity ω, then the maximum emf induced in the coil will be

A. BNA
B. $\frac{Ba\omega}{N}$
C. BNAω
D. zero

118. In a laboratory experiment of test a transformer, a student used the circuit shown in the diagram to take measurements.



Two of the original entries in the student's result table are missing as shown:

V_P/V	I_P/mA	N_P turns	V_S/V	I_S/mA	N_S turns
240	2.0	?	?	50	50

Assuming the transformer was 100% efficient, what are the missing results?

	Np turns	Vs/V
A.	2	6000
B.	50	9.6
C.	480	1.0
D.	1250	9.6

119. A flat circuit coil of 120 turns, each of area 0.070 m^2, is placed with its axis parallel to a uniform magnetic field. The flux density of the field is changed steadily from 80 mT to 20 mT over a period of 4.0 s.

What is the e.m.f. induced in the coil during this time?

A. 0
B. 170 mV
C. 130 mV
D. 500 mV

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120. **Which quantity is increased in step-down transformer?**
A. Current
B. Voltage
C. Power
D. Frequency

121. **Which of the remain constant in a transformer?**
A. current
B. power
C. potential
D. frequency

122. **The voltage in the primary and the secondary coils of a step-up transformer are 200 V and 4 kV respectively. If the current in the primary is 1 ampere then the current in the secondary coil will be**
A. 50 mA
B. 5A
C. 500 mA
D. 5 mA

123. **The turn ratio of a transformer is 2:3. If the current through primary is 3A, then current through load resistance is**
A. 1A
B. 2A
C. 4.5 A
D. 1.5 A

124. **A transformer is used to**
A. Convert alternating current to direct current
B. Convert direct current to alternating current
C. Convert mechanical energy to electrical energy
D. change the level of alternating voltage

125. **A transformer is used to light a 100 W and 110 V lamp from 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is approximately.**
A. 10%
B. 50 %
C. 30%
D. 90 %

126. **If the current in the primary coil and number of turns in it are I_p and N_p respectively and the number of turns and current in the secondary are N_s and I_s respectively then the value the of $N_s : N_p$**
A. $I_s : I_p$
B. $I_p : I_s$
C. $I_s^2 : I_p^2$
D. $I_p^2 : I_s^2$

127. **The ratio of emf across primary coil to the emf across secondary coil is**
A. $\frac{N_s}{N_p}$
B. $\frac{I_s^2}{I_p^2}$
C. $\frac{I_s}{I_p}$
D. None of these

128. **In step up transformer, voltage in the secondary increases and power in secondary**
A. Remain same
B. Decreases because voltage increases
C. Increases because current decreases
D. May increases if voltage remain same

129. **In a transformer heat is produced due to eddy current in**
A. Primary coil
B. Iron core
C. Secondary coil
D. All of these

130. **_____ is the energy expended to magnetize and demagnetize the core material in each cycle of the A.C.**
A. Power loss
B. Hysteresis loss
C. Heat loss
D. All of the above

131. **Laminated core in a transformer is used to reduce**
A. Eddy current losses
B. Iron losses
C. Hysteresis losses
D. Heat losses due to resistance

132. The loss of power in transformer is due to

A. Eddy current
B. Resistance of coils
C. Magnetic hysteresis
D. All

133. A step-down transformer, transforms 220 volt to 11 volt. If the current in primary and secondary coil are 5A and 90 A respectively, efficiency of transformer is

A. 70%
B. 40%
C. 20%
D. 90%

134. If turns in primary = 50, secondary = 200, primary voltage = 120V, primary current 3A, then output power will be about

A. 360 W
B. 300 W
C. 460 W
D. Zero

135. To improve efficiency of transformer the flux coupling between primary & secondary coils should be

A. small
B. may be small or may be maximum
C. maximum
D. Zero

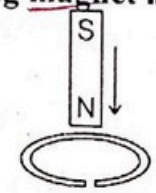
136. Primary secondary coils of a transformer have 50 and 200 turns respectively. When primary is connected to 9 volt battery secondary voltage is

A. 90
B. 36
C. 18
D. Zero

137. If flux associated with a loop varies at the rate if 1 Wb/min, the induced emf is

A. 1V
B. 1/60 V
C. 60 V
D. zero

138. A copper ring having a cut such as not to from a complete loop is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is



A. g
B. Less than g
C. More than g
D. 0

139. The ratio of no. of turns of primary coil to secondary coil in a transformer is 2:3. If a source of alternating emf of 6V is connected across the primary coil, then emf across secondary will be

A. 3V
B. 6V
C. 9V
D. 12V

$\frac{N_p}{N_s} = \frac{1}{20} = \frac{J_s}{J_p}$

140. The ratio of the number of turns in primary and secondary coils of a transformer is 1:20. The ratio of the currents in the primary and secondary will be

A. 1:20
B. 20:1
C. 1:400
D. 400:1

141. In a step-up transformer the ratio of voltages is 8. If the voltage across primary is 120 V, the voltage across secondary will be

A. 150 V
B. 120 V
C. 180 V
D. 960 V

142. In a step-up transformer the turns ratio is 1:2. A cell of emf 15 V is connected across the primary. The voltage across secondary is

A. 3.0 V
B. 0.75 V
C. Zero
D. 1.5 V

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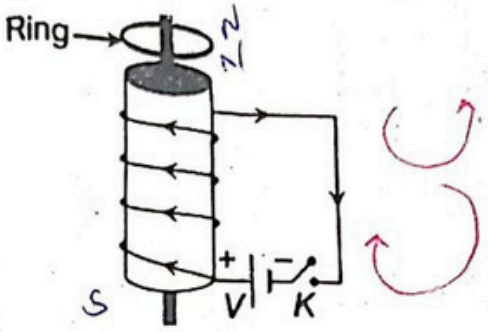
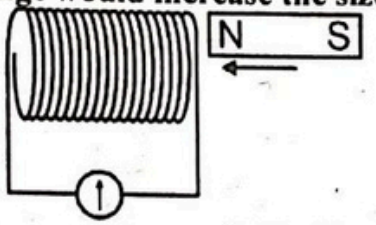
143. A step-down transformer reduces the voltage from 220V to 11 V. The primary coil draws a current of 5A while secondary draws 90 A. The efficiency of the transformer is
A. 20 %
B. 40 %
C. 70%
D. 90%

144. A conducting ring is placed around the core of an electromagnet as shown in the figure. When key K is pressed, the ring



A. Remains stationary
B. Is attracted towards the electromagnet
C. Jumps out of the core
D. None of these

145. When a magnet is moved into the coil of wire shown, there is a small reading on the sensitive meter. Which change would increase the size of the reading?



A. Moving the magnet faster
B. Pilling the magnet out
C. Pushing in the S-pole
D. Unwinding some of the turns of wire

146. The rod of unit length is moving at 30° through a magnetic field of 1 T. If velocity of rod is 1 ms^{-1}, then induced emf in the rod will be given by
A. 1 V
B. 0.5 V
C. 0.25 V
D. 0.6 V

147. A metal rod of length 30cm is moving at a speed of 0.5ms^{-1} in a direction perpendicular to a 0.25T magnetic field. Find the emf produced in the rod.
A. 3.13×10^{-2}V
B. 4.13×10^{-2}V
C. 3.75×10^{-2} V
D. 4.75×10^{-2} V

148. If 2.2 kW power is transmitted through a 10Ω line at 22000V, the power loss in the form of heat will be
A. 0.1 W
B. 1 W
C. 10 W
D. 100 W

149. Find the length of a conductor which is moving with a velocity 0.4m/s in a magnetic field of 8T, inducing an emf of 20V if magnetic field, velocity and length of conductor are mutually perpendicular to each other.
A. 50m
B. 5m
C. 6.25m
D. 0.5m

150. Quantity that remains unchanged in a transformer is:
A. Voltage
B. Current
C. Frequency
D. None of these

ANSWER KEY

1	B	16	D	31	C	46	B	61	C	76	B	91	A	106	C	121	D	136	D
2	B	17	C	32	C	47	C	62	A	77	B	92	A	107	B	122	A	137	B
3	C	18	A	33	B	48	D	63	C	78	C	93	A	108	D	123	C	138	A
4	A	19	D	34	D	49	A	64	C	79	B	94	A	109	A	124	D	139	C
5	C	20	A	35	D	50	D	65	B	80	C	95	B	110	A	125	D	140	B
6	D	21	C	36	A	51	D	66	A	81	A	96	D	111	B	126	B	141	D
7	C	22	C	37	B	52	B	67	D	82	C	97	D	112	A	127	C	142	C
8	D	23	D	38	B	53	C	68	C	83	D	98	D	113	D	128	A	143	D
9	C	24	B	39	A	54	D	69	D	84	B	99	A	114	D	129	B	144	C
10	A	25	C	40	C	55	B	70	B	85	B	100	A	115	D	130	B	145	A
11	B	26	C	41	C	56	C	71	A	86	A	101	C	116	B	131	A	146	B
12	A	27	B	42	B	57	D	72	D	87	C	102	D	117	C	132	D	147	C
13	A	28	C	43	C	58	C	73	C	88	C	103	B	118	D	133	D	148	A
14	B	29	D	44	B	59	A	74	C	89	B	104	B	119	B	134	A	149	C
15	A	30	A	45	B	60	B	75	B	90	C	105	A	120	A	135	C	150	C

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SOLUTIONS

1. Magnetic flux density or flux density, $B = \frac{\Phi e}{A}$

2. $\varepsilon = -N\frac{\Delta\Phi}{\Delta t} \Rightarrow \varepsilon \propto -\frac{\Delta\Phi}{\Delta t}$

3. The Lenz's law is also a statement of law of conservation of energy that can be conveniently applied to the circuits involving induced currents.

4. $I = -\frac{N\Delta\Phi}{R\Delta t} = -\frac{NB\Delta A}{R\Delta t}$

   If magnetic field is uniform (B = constant)

   $I \propto -\frac{\Delta A}{\Delta t}$

5. Transformer works on the principle of mutual induction between the two coils.

6. $\frac{VS}{VP} = \frac{NS}{NP} = 50$

   $V_S = 50 \times V_P = 50 \times 220 = 11000$ V

7. $P = \varepsilon^2/R \Rightarrow \varepsilon^2 = PR = (5 \times 10^{-3})(10) = 5 \times 10^{-2}$

   $\varepsilon = 2.2 \times 10^{-1}$ V $= 0.22$ V

8. $\varepsilon = vBL$

   $I = \frac{\varepsilon}{R} = \frac{vBL}{R}$

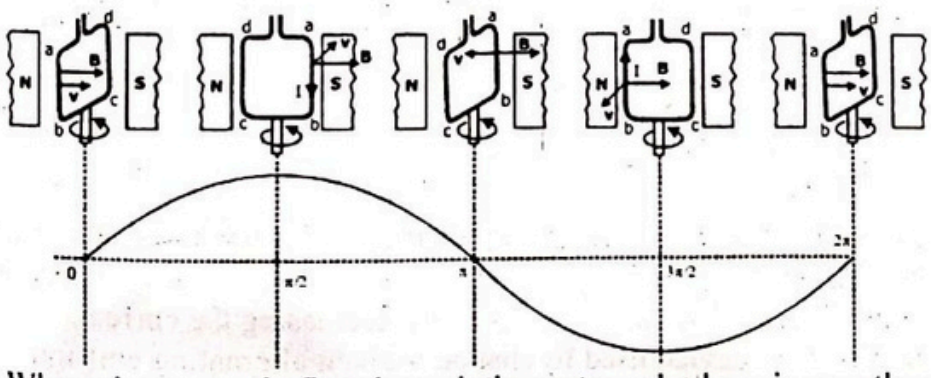
   $F = ILB = \left(\frac{vBL}{R}\right)LB = \frac{vB2L2}{R}$

9. According to Lenz's law, "The direction of induced current is always so as to oppose the change which causes the current".

10. A transformer is an electrical device used to change a given alternating emf into a large or small alternating emf. It works only on AC.

11. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{IP}{IS}$

12. The insulation between lamination sheets should be perfect so as to stop the flow of eddy currents.

13. 

    Where the magnetic flux through the rectangular loop is zero the emf is maximum.

14. If we change the resistance of the loop keeping the speed same, then the product of "I" and "R" remains constant.

    IR = constant

    This constant is the induced emf.

15. $\frac{VS}{VP} = \frac{NS}{NP}$

For step down transformer

$V_S < V_P$ and $N_S < N_P$

16. $\varepsilon_o = NBA\omega = (1)BA(2\pi f) = 2\pi BAf$

17. $\frac{IP}{IS} = \frac{NS}{NP} = 4$

$I_S = I_P/4 = 4/4 = 1A$

18. $\varepsilon = vBL\sin\theta = (1)(1)(0.5)\sin30^o = 0.25V$

19. When "S" is closed the magnetic flux will be in increasing order in coil Q and galvanometer shows left deflection. While when "S" is opened, the magnetic flux will be in decreasing order. So, the direction of current will be reversed (right deflection) according to Lenz law.

20. When circular loop of wire moves in +x direction, the magnetic flux will decrease. So, according to Lenz law clock wise current will be induced in the loop.

21. $\varepsilon = N\frac{\Delta\Phi}{\Delta t} = N\frac{\Delta BA}{\Delta t} \Rightarrow \varepsilon \propto \frac{\Delta B}{\Delta t}$ = slope of B-t graph

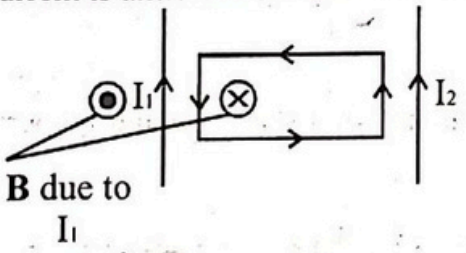
Slope of 2 < Slope of 4 < Slope of 3 < Slope 1

$\varepsilon_2 < \varepsilon_4 < \varepsilon_3 < \varepsilon_1$

22. The induced current and induced emf can be increased by
    - i. Using a strong magnetic field.
    - ii. Moving the loop faster.
    - iii. Replacing the loop by a coil of many turns.

23. In case of DC only change in magnetic flux takes place when the stitch "S" is opened or closed.

24. As $I_2$is constant. So, there will be no induction due to I_2 in the loop. The current will be induced in the loop is only due to increase in I_1 (increasing magnetic flux). So, by Lenz law the direction of induced current is anticlockwise.



25. $\frac{VS}{VP} = \frac{NS}{NP} = 50$

$\frac{IS}{IP} = \frac{NP}{NS} = \frac{1}{50} = 0.02$

26. In a step up transformer when the voltage across the secondary is raised, the value of current is reduced. This is the principle behind its use in the electric supply networks. Power loss by heating effect is "I^2R" and is reduced by decreasing the current.

27. A transformer is an electrical device used to change a given alternating emf into a large or small alternating emf.

28. In a step up transformer when the voltage across the secondary is raised, the value of current is reduced. This is the principle behind its use in the electric supply networks. Power loss by heating effect is "I^2R" and is reduced by decreasing the current.

29. $\varepsilon = vBL\sin\theta = (m/s)(T)(m) = Tm^2/s$

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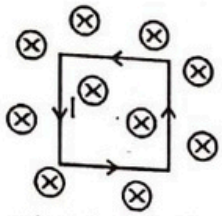
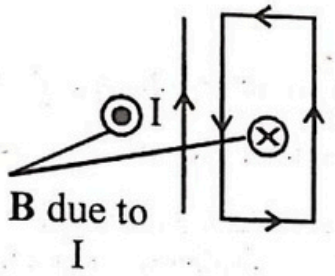
30. A.
As the square loop of wire lies in the plane of the page and increasing magnetic field is directed into the page. According to Lenz law the induce current opposes the increasing magnetic flux. By right hand rule the direction of induce current will be anti clockwise (counter clockwise).



31. As the constant current carrying wire is moving towards the rectangular loop causes to increase the magnetic flux in the loop. According to Lenz law the induce current opposes the increasing magnetic flux. By right hand rule the direction of induce current will be anti clockwise (counter clockwise).



32. $V_{rms} = \frac{Vo}{\sqrt{2}} \Rightarrow V_o = \sqrt{2}\ V_{rms} = \sqrt{2}\,(220) = 311\ V$

33. $\Phi_B = \Phi_B'$
$BA\cos\theta = BA' \Rightarrow A' = A\cos\theta = 1\cos 60^\circ = 0.5\ m^2$

34. There are two main causes of power loss in the transformer.
i) Eddy Currents ii) Hysteresis Loss

35. In one cycle, the current becomes maximum twice. So, the lamp will glow maximum twice in one cycle. As the frequency of the source is 50Hz, the maximum brilliance shown by the lamp is given by:
Max. brilliance of lamp per second = twice the frequency of source = 2(50) times = 100 times

36. Core of transformer should be assembled from the laminated sheets of a material whose hysteresis loop area is very small.

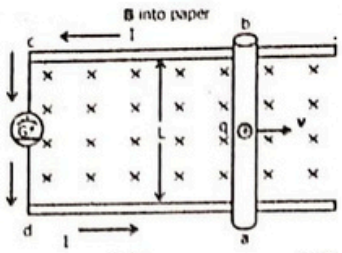
37. When a bar magnet is dropped through the ring. According to Lenz law direction of induce current will decrease (oppose) the motion of freely falling bar magnet. So, the acceleration of bar magnet is less than "g".

38. $\frac{NS}{NP} = \frac{VS}{VP} = \frac{4400}{220} = 20$
$N_S = 20 \times N_P = 20 \times 100 = 2000$

39. There is no electrical connection between the two coils but they are magnetically linked with each other.

40. $P_{out} = V^2/R = (100)/2 = 50\ W$
$P_{in} = P_{out}$
$V_P I_P = 50 \Rightarrow I_P = 50/V_P = 50/100 = 0.5\ A$

41.



42. $\varepsilon = -N\dfrac{\Delta\Phi}{\Delta t} \Rightarrow \varepsilon \propto -\dfrac{\Delta\Phi}{\Delta t}$

43. $\omega = 2\pi f = 2\pi(50) = 100\pi \text{ rad s}^{-1}$

44. The average value of alternating voltage or alternating current over a cycle is zero, but the power delivered in one complete cycle is not zero ($P = I^2R$ or $P = V^2/R$).

45. Compare given equation with

$I = I_o\sin(\omega t)$

$\omega = 2\pi f = 100\pi \Rightarrow f = 50\text{Hz}$

46. The root mean square value of current or voltage is the effective value in the circuit.

$I_{rms} = = \dfrac{Io}{\sqrt{2}} = \dfrac{1}{\sqrt{2}}$ times its maximum value

47. When the ring is falling, there is a change of magnetic flux across the ring and an induced current is produced in the ring. According to the Lenz's law: "The induced current in the ring should oppose the cause that produces it".

The magnetic field produced by the induced current in the ring will oppose the motion of the ring towards the bar magnet. So, by right hand rule the current will be in anti clockwise direction.

48. $I_o = \sqrt{2}\, I_{rms} = \sqrt{2}\,(100) = 141 \text{ V}$

49. When the secondary circuit is open

Output power = zero

$V_sI_s = 0$

So, the input power must be zero or very small. Thus, a very small current (I_P) flows in the primary coil.

50. $\dfrac{IP}{IS} = \dfrac{NS}{NP} = \dfrac{600}{100} = 6 \Rightarrow I_P = 6I_S$

51. For an ideal transformer:

Power Input = Power Output

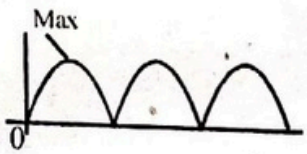
$V_PI_P = V_SI_S$

52. $\dfrac{IP}{IS} = \dfrac{NS}{NP} = \dfrac{1}{8} \Rightarrow I_P = \dfrac{1}{8}I_S = \dfrac{25}{8}$

$P_{in} = V_PI_P \Rightarrow V_P = \dfrac{Pin}{IP} = \dfrac{10000}{25/8} = 3200 \text{ V}$

53. The rms value of an ac current is that steady current that produces the same rate of heating in a resistor as the actual current.

54.



55. A transformer in which voltage across secondary is less than the primary is called a step down transformer.

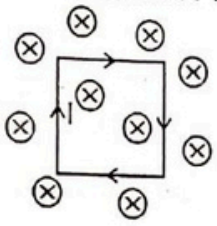
56. In order enhance the magnetic flux, the primary and secondary coils of transformer are wound on soft iron core and also hysteresis loop area of iron is very small that causes the decreases in hysteresis loss.

57. $wbm^{-2} = T = NA^{-1}m^{-1}$

58. $\Phi_B = (\Phi_B)_{max}\cos\theta = (5)\cos 30^o = 5(0.86) = 4.3$ Wb

59. $\varepsilon = -N\frac{\Delta\Phi}{\Delta t} \Rightarrow \Delta\Phi = \varepsilon\Delta t \Rightarrow 1$ wb $= 1$ Vs

60. As the square loop of wire lies in the plane of the page and decreasing magnetic field is directed into the page. According to Lenz law the induce current opposes the decreasing magnetic flux. By right hand rule the direction of induce current will be clock wise.



61. $P_{out} = P_{in}$

$P_{out} = V_P I_P = (220)(2) = 440$ W

62. $\frac{VS}{VP} = \frac{NS}{NP} \Rightarrow V_S = \frac{NS}{NP} \times V_P = \frac{500}{50} \times 100 = 1000$

63. Induced emf does not depend upon the resistance of circuit. It depends upon the time rate of change of magnetic flux. According to Faraday's law:

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$

64. $\varepsilon = vBL\sin\theta$

$v = \frac{\varepsilon}{BL\sin\theta} = \frac{2}{(0.5)(1)\sin 90o} = 4$m/s

65. $\varepsilon = vBL\sin\theta$

$B = \frac{\varepsilon}{vL\sin\theta} = \frac{3\times10-3}{(4)(1.5\times10-1)\sin 90o} = 0.005$ T

66. $\varepsilon = vBL\sin\theta = (1)(1)(1)\sin 30^o = 0.5$ V

67. In order to improve the efficiency, to minimize all the power losses:

i. Core should be assembled from the laminated sheets of a material whose hysteresis loop area is very small.

ii. The insulation between lamination sheets should be perfect so as to stop the flow of eddy currents.

iii. The resistance of primary and secondary coils should be kept to minimum.

iv. As power transfer from primary to secondary takes place through flux linkages, so the primary and secondary coils should be wound in such a way that flux coupling between them is maximum.

68. $P_s = \frac{V2}{R} = \frac{22\times22}{220} = 2.2$ W

$I_P V_P = P_s \Rightarrow I_P = \frac{PS}{VP} = \frac{2.2}{220} = 0.011$ A

$I_{rms} = \frac{I_0}{\sqrt{2}}$

$I_0 = \frac{100\times1.41}{100}$

$I_{rms} = 0.707\, I_0$

$\frac{100\times1000}{0.707} = I_0$

69. The induced current can be increased by:
i. Using a strong magnetic field.
ii. Moving the loop faster.
iii. Replacing the loop by a coil of many turns

70. $A = 0.2 \times 0.5 = 0.1\ m^2$
$\Phi_B = BA = (2)(0.1) = 0.2\ Wb$

71. $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ (volt)

72. For an ideal transformer:
Power Input = Power Output
$V_P I_P = V_S I_S$
$\frac{VS}{VP} = \frac{IP}{IS}$

73. $\Phi_B = (\Phi_B)_{max}\cos\theta = (\Phi_B)_{max}\cos 60^o = \frac{(\Phi B)max}{2}$

74. $\frac{IS}{IP} = \frac{NP}{NS} = 100 \Rightarrow I_S = 100 \times I_P = 100 \times 1 = 100\ A$

75. The direction of induced current is always so as to oppose the change which causes the current.
Lenz's law refers to induced current not the induced emf.

76. $\varepsilon = NBA\omega \Rightarrow \varepsilon \propto \omega$
$\varepsilon_f = 4\varepsilon$
$\Delta\varepsilon = 3\varepsilon = 300\%$

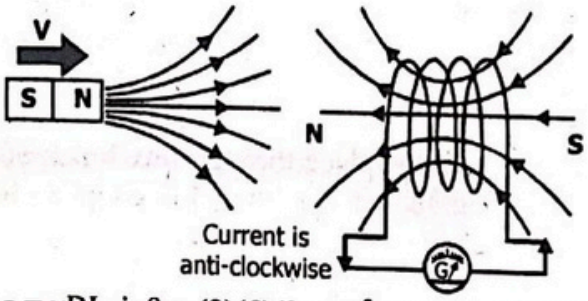
77. $\varepsilon = N\frac{\Delta\Phi}{\Delta t} = (1)(1) = 1V$

78. When loop is placed parallel to changing magnetic field, then the angle between magnetic field and vector area is 90°.
$\varepsilon = N\frac{\Delta\Phi}{\Delta t} = N\frac{\Delta BAcos90o}{\Delta t} = 0$

79. The emf induced by the motion of a conductor across a magnetic field is called motional emf.

80. A transformer in which voltage across secondary is greater than the primary is called a step up transformer.
$V_S > V_P$ and $N_S > N_P$ and $I_P > I_S$

81.



82. $\varepsilon = vBL\sin\theta = (2)(5)(3\times10^{-2})\sin 90^o = 0.3V$

83. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{2NP}{NP} = 2 \Rightarrow Vs = 2\times V_P = 2\times200 = 400V$

84. For an ideal transformer (100% efficiency)

Power Input = Power Output

85. $\frac{IP}{IS} = \frac{NS}{NP} = 2:1$

86. $\text{Efficiency} = \frac{Poweroutput}{Powerinput} \times 100\%$

$= \frac{VSIS}{VPIP} \times 100\% = \frac{(300)(0.6)}{(120)(2)} \times 100\%$

$= \frac{180}{240} \times 100\% = 75\%$

87. As glass is an insulator. So, there no free charges in the glass rod to produce an induce emf.

88. For an ideal transformer:
Power Input = Power Output
But in case of actual transformer
Power Input > Power Output

89. $\frac{VP}{VS} = \frac{IS}{IP} \quad \Rightarrow V_s \propto \frac{1}{Is}$

90. C.

$\frac{NP}{NS} = \frac{VP}{VS} = \frac{220}{40} = \frac{11}{2}$

$N_P = \frac{11}{2} \times N_S = \frac{11}{2} \times (40) = 220$

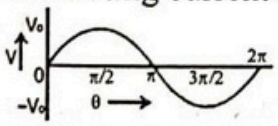
91. Instantaneous value of current and voltage is $V = V_o \sin(2\pi ft)$ and $I = I_o \sin(2\pi ft)$ respectively.

92. $\frac{NP}{NS} = \frac{VP}{VS} = \frac{12}{1800} = \frac{2}{300}$

$N_P = \frac{2}{300} \times N_S = \frac{2}{300} \times (6000) = 40$

93. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{IP}{IS}$

94. Alternating current changes its magnitude as well as direction.



95. $\omega = 2\pi f = 10 \Rightarrow f = 10/2\pi = 5/\pi$ Hz

96. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{IP}{IS}$

97. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{IP}{IS}$

98. $P = I^2R \Rightarrow I^2 = \frac{P}{R} = \frac{4\times10-3}{10} = 4 \times 10^{-4}$

$I = 2 \times 10^{-2}A = 20 \times 10^{-3}A = 20$ mA

99. $V = V_o \sin(\omega t)$

100. $\Phi_B = BA\cos 30^o = 50(1)(\sqrt{3}/2) = 50\sqrt{3}/2$ Wb

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101. The magnetic induction B is the flux per unit area of a surface perpendicular to B, hence it is also called as flux density.

$\phi = BA$

$B = \frac{\phi}{A} = flux\ density$

102. As

Flux density $= \frac{\phi}{A}$

So

Unit of flux density $\frac{Wb}{m^2}$

$= Wb\,m^{-2}$

$= N\,mA^{-1}m^{-2} \qquad \because Wb = N\,mA^{-1}$

$= N\,m^{-1}A^{-1}$

$= T \qquad \because 1T = N\,m^{-1}A^{-1}$

103. When wire cuts the magnetic field then emf will be induced due to flux changing.

104. $\phi = BA\cos\theta°$

$\phi_{max} = BA \qquad \because \theta = 0°$

$\phi = \phi_{max}\cos\theta$

According to given condition

$\frac{\phi_{max}}{2} = \phi_{max}\cos\theta$

$\cos\theta = \frac{1}{2}$

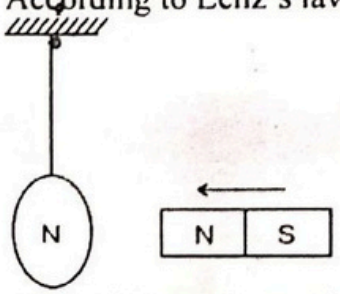
$\theta = \cos^{-1}\left(\frac{1}{2}\right) = 60°$

105. (i) A magnet falls with S-pole along the axis of ring. So according to Lenz's law S-pole form along the face of magnet. As shown in Fig. the current clock wise.

(ii) The ring is open. So, no current induced in the ring i.e I = 0

106. It is the statement of Lenz's law.

107. According to Lenz's law, the current induced in the ring oppose the cause that produce it



108. All options are correct by using Lenz's law.

109. $\varepsilon = -N\frac{\Delta\phi}{\Delta t} \Rightarrow \varepsilon \propto \frac{\Delta\phi}{\Delta t}$

110. $\varepsilon = N\left(\frac{\Delta B}{\Delta t}\right).A\cos\theta = 500\times1\times\left(10\times10^{-2}\right)^2\cos0° = 5V$

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111. $\varepsilon = \frac{\Delta\phi}{\Delta t} \Rightarrow IR = \frac{\Delta\phi}{\Delta t} \Rightarrow Q\Delta t = \frac{\Delta\phi}{R\Delta t}$

$\phi = \frac{10-2}{2} = 4C$

112. $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$

113. For 1st half rotation, emf in sinusoidal wave above the mean line and for 2nd half rotation below the mean line.

114. Induced emf can only be produced when magnetic flux changes.

115. Induced charge doesn't depend upon the speed of magnet. $(\varepsilon = VBL\sin\theta)$

116. The induced current will be in such a direction so that it opposes the change due to which it is produced.

117. As

$\varepsilon = N\omega AB\sin\theta$

For maximum induced emf $\theta = 90°$

$\varepsilon = N\omega AB$

118. $\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}$

Given $V_p = 240$ V,

$N_s = 50$ turns,

$I_s = 50$ mA

$I_p = 2.0$ mA

$\therefore \frac{240}{V_s} = \frac{N_p}{50} = \frac{50}{2} = 25$

$\Rightarrow V_s = 9.6$ V and $N_p = 1250$ turns

119. $q = NA\frac{\Delta B}{\Delta t}$

$= 120 \times 0.070 \times \frac{(80-20)\times 10^{-3}}{4.0}$

$= 0.126$ V

$\approx 130mV$

120. Transformer is a device which is use to increase or decrease the alternating voltage.

$P = VI \Rightarrow P = same \Rightarrow V \propto \frac{1}{I}$

121. As

$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$

From relation current and voltage changes. Only for ideal transformer power remain same otherwise power also changes. But frequency in transformer does not change.

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122. As

$$\frac{V_S}{V_P} = \frac{I_P}{I_S}$$

$$\frac{4\times10^3}{200} = \frac{1}{I_S}$$

$$I_S = \frac{200}{4\times10^3}$$

$$= 50\times10^{-3}\,A = 50\,mA$$

123. As

$$\frac{N_S}{N_P} = \frac{I_P}{I_S}$$

$$\frac{2}{3} = \frac{3}{I_S}$$

$$I_S = \frac{9}{2} = 4.5\,A$$

124. Because transformer only works with alternating voltage and it is used increase or decrease the alternating voltages.

125. $$efficiency = \frac{P_{output}}{P_{input}}\times100$$

$$= \frac{100}{V_P I_P}\times100$$

$$= \frac{100}{220\times0.5}\times100$$

$$= \frac{100}{110}\times100$$

$$= 90\%$$

126. As

$$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$$

127. As

$$\frac{V_S}{V_P} = \frac{I_P}{I_S} \Rightarrow \frac{V_P}{V_S} = \frac{I_S}{I_P}$$

128. In an ideal transformer power remain same.

129. The magnetic flux changes through solid conductor (core material), induce current (i.e eddy current) are setup in closed path in the body of conductor. It results in power dissipation and heating of core material.

130. Hysteresis loss

131. The insulation between lamination sheets should be perfect so as to stop the flow of eddy currents.

132. **(i)** The eddy current results in power dissipation and heating of the core material.

(ii) Hysteresis loss (magnetic hysteresis) is the energy spent to magnetize and demagnetize the core material

(iii) The power also loss in transformer due to resistance of coil.

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133. $\eta = \frac{P_{output}}{P_{input}} \times 100\% = \frac{V_s I_s}{V_p I_p} = \frac{11(90)}{220(5)} = \frac{990}{1100} = 0.9$

$\%\eta = 0.9 \times 100\% = 90\%$

134. $P_o = P_i = I_i V_i = 120 \times 3 = 360\ W$

135. Flux coupling between primary and secondary coils must be maximum.

136. Voltage by a battery is D.C but transformer operates on A.C

137. $\varepsilon = \frac{\Delta\phi}{\Delta t} = \frac{1Wb}{60s} = \frac{1}{60} V$

138. Lenz' s Law is not applicable to open circuits/ loops. In open circuit emf will be induced but there will no induced current. Therefore, 'a' will be equal to g for a falling magnet

139. $V_s = \frac{N_s}{N_p} \times V_p = \frac{3}{2} \times 6 = 9V$

140. $\frac{N_p}{N_s} = \frac{I_s}{I_p}$

141. $\frac{V_s}{V_p} = 8$

$V_s = 8V_p = 8(120) = 960V$

142. Transformer does not work for DC. It works only for AC

143. $\eta = \frac{V_s I_s}{V_p I_p} \times 100\% = \frac{11 \times 90}{220 \times 5} \times 100\% = 90\%$

144. According to lenz's law the ring will jump out of the core

145. Induced emf can be increased by
1. Using large no. of turns
2. Using stronger B
3. Moving the loop faster

146. $\varepsilon = vBL\sin\theta$

$\varepsilon = vBL\sin\theta = \frac{1}{2} \times \frac{1}{4} \times \frac{30}{100} = \frac{3}{80}$

147. $\varepsilon = 0.0375$

$\varepsilon = 3.75 \times 10^{-2} V$

148. $P_L = I^2 R$

$P_L = \frac{P^2}{V^2} R = 0.1W$

149. $L = \frac{\varepsilon}{VB} = \frac{20}{\frac{4}{10} \times 8} = \frac{50}{8} = 6.25\,m$

150. Time period, frequency and phase remain the same at the output of the transformer.

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BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **The source of induced e.m.f is**
   A. Cell
   B. Battery
   C. Interaction between stationary magnet and coil
   D. Relative motion between magnet and coil

2. **When the coil and a bar magnet are placed very closed to each other then the value of their induced e.m.f will be**
   A. Maximum
   B. Positive
   C. Negative
   D. Zero

3. **The unit of induced e.m.f is**
   A. Ampere
   B. Volt
   C. Watt
   D. Weber

4. **The law of electromagnetic induction was introduced by**
   A. Maxwell
   B. Faraday
   C. Lenz
   D. Fleming

5. **According to Faraday's law of electromagnetic induction, the induced e.m.f depends upon**
   A. Minimum magnetic flux
   B. Maximum magnetic flux
   C. Change in magnetic flux
   D. rate of change of magnetic flux

6. **Lenz's law of electromagnetic induction explains**
   A. The Production of induced e.m.f
   B. Magnitude of induced e.m.f
   C. Direction of induced e.m.f
   D. Both magnitude and direction of induced e.m.f

7. **Lenz's law is related to the law of conservation of**
   A. Momentum
   B. Energy
   C. Mass
   D. Charges

8. **The mutual inductance of two coil is maximum when the coils are**
   A. Parallel to each other
   B. Perpendicular to each other
   C. Facing each other
   D. Touching each other

9. **When a current change in a coil from 4 A to 6 A in 0.05s and it induces an e.m.f of 8 V. The co-efficient of self-inductance is**
   A. 0.1 H
   B. 0.2 H
   C. 0.4 H
   D. 0.8 H

10. **The unit of inductance is**
    A. Weber
    B. Tesla
    C. Henry
    D. Watt

11. **A conducting rod of length 0.5m moves in a magnetic field of magnitude 2 T with velocity 5 ms^{-1}, the e.m.f induced in the moving rod is**
A. 5 V
B. 10 V
C. 20 V
D. 50 V

12. **Which one of the following device stores magnetic potential energy in its magnetic field**
A. Resistor
B. Capacitor
C. Inductor
D. Thermistor

13. **At constant inductance of 'L' henry, the energy stored in a magnetic field is**
A. $\frac{1}{2}CQ^2$
B. $\frac{1}{2}mv^2$
C. $\frac{1}{2}kx^2$
D. $\frac{1}{2}LI^2$

14. **The working principle of an A.C. motor is**
A. Self-induction
B. Motional e.m.f
C. Mutual induction
D. None of these

15. **The stator and the rotor of an A.C. motor are connected by a**
A. Copper wire
B. Silver wire
C. Aluminum wire
D. No physical connection between them

16. **Two phase A.C. contains**
A. One wire two stators
B. Two wires two stators
C. Three wires two stators
D. Three wires three stators

17. **A transformer works when we apply**
A. A.C. voltage
B. D.C voltage
C. A.C. as well as D.C
D. Neither A.C. nor D.C

18. **The quantity that remains constant in a transformer is**
A. Voltage
B. Current
C. Power
D. Frequency

19. **The soft iron core is used in a transformer in order to**
A. Enhance the magnetic flux
B. Increase the weight
C. Increase the copper losses
D. Decrease the copper losses

20. **Which relation is true for an ideal transformer?**
A. Input power > output power
B. Input power < output power
C. Input power = output power
D. Output power = 0

21. When a step-up transformer delivers high voltage then the current will be

A. Remain same
B. Decreased
C. Increased
D. Maximum

22. For long distance electrical power transmission, we use

A. Smaller current and lower voltage
B. Larger current and higher voltage
C. Larger current and lower voltage
D. Smaller current and higher voltage

23. Lamination is used in a transformer in order to

A. Reduced flux leakage
B. Minimize hysteresis loss
C. Decrease coil resistance
D. Minimize eddy current

ANSWER KEY

1	D	6	C	11	A	16	C	21	B
2	D	7	B	12	C	17	A	22	D
3	B	8	A	13	D	18	C	23	D
4	B	9	B	14	D	19	A		
5	D	10	C	15	D	20	C		

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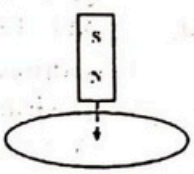
KPK TEXT BOOK EXERCISE MCQs

1. **For inducing emf in a coil the basic requirement is that**
   A. Flux should link the coil
   B. Change in flux should link the coil
   C. Coil should form a closed loop
   D. both (b) and (c) are true

2. **The device in which induced emf is statically induced emf is:**
   A. transformer
   B. alternator
   C. ac generator
   D. dynamo

3. **The north pole of a magnet is brought near a metallic ring as shown in the fig. The direction of induced current in the ring will be:**
   A. anticlockwise
   B. clockwise
   C. first anti-clockwise and then clockwise
   D. first clockwise and then anti-clockwise



4. **What is the coefficient of mutual inductance, when the magnetic flux changes by 2×10^{-2} Wb, and change in current is 0.01 A?**
   A. 2H
   B. ½ H
   C. 3H
   D. zero

5. **The induced emf in a coil is proportional to:**
   A. magnetic flux through the coil
   B. rate of change of magnetic flux through the coil
   C. area of the coil
   D. product of magnetic flux and area of the coil

6. **In a coil current change from 2 to 4 A in 0.05 s. If the average induced emf is 8V then coefficient of self-inductance is:**
   A. 0.2 henry
   B. 0.8 henry
   C. 0.1
   D. 0.04 henry

7. **Which of the following quantities remain constant in step up transformer?**
   A. current
   B. power
   C. voltage
   D. heat

8. **Step-up transformer has a transformation ratio of 3:2. What is the voltage is secondary, if voltage in primary is 30 V?**
   A. 45 V
   B. 90 V
   C. 15 V
   D. 300V

9. **Eddy current is produced when:**
   A. a metal is kept in varying magnetic field
   B. a metal is kept in steady magnetic field
   C. a circular coil is placed in a steady magnetic field
   D. a current is passed through a circular coil

ANSWER KEY

1	D	6	A
2	A	7	B
3	A	8	A
4	A	9	A
5	B		

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PAST PAPERS 2008-2020

1. **The Lenz's law refers to induced_____.** (UHS 2008)
   A. emf
   B. Resistance
   C. Shear
   D. Current

2. **In a step-down transformer the output current.** (UHS 2008)
   A. Is reduced
   B. Is increased
   C. Remains same
   D. None of these

3. **Power losses in a transformer can be minimized:** (UHS 2009)
   A. By increasing turn ratio
   B. By decreasing turn ratio
   C. By stopping the flow of eddy current
   D. Using material of the core whose hysteresis area is large

4. **We have two coils placed close to each other. When we switch on the battery connected to primary coil while keeping the sliding contact of rheostat at fixed position, the reading of galvanometer:** (UHS 2009)
   A. First increases and then becomes zero
   B. First increases and then becomes constant at same value
   C. Increases with the passage of time
   D. Remains zero

5. **A loop of 5 turns of wire is placed in uniform magnetic field of 0.5 T, then area of loop shrinks at a constant rate of 10 m^2/s, the emf induced is:** (UHS 2017)
   A. 2.5 V
   B. 25 V
   C. 250 V
   D. 0.25 V

6. **The phase at negative peak of AC voltage is:** (UHS 2017)
   A. $\pi/2$
   B. π
   C. $2\pi/3$
   D. $3\pi/2$

7. **A metal rod of length 10.0 cm is moving at a speed of 0.5 m/s in a direction perpendicular to a 0.20 T magnetic field. Find the emf produced in the rod:** (UHS 2018)
   A. 1.0×10^{-3} V
   B. 0.50×10^{-2} V
   C. 1.0×10^{-2} V
   D. 2.0×10^{-3} V

8. **In a practical transformer mutual induction between primary and secondary coils takes place. In such transformer what can be deduced about the power:** (UHS 2018)
   A. Power output > Power input
   B. Power output = Power input
   C. Power output ≥ Power input
   D. Power output < Power input

9. **Lenz's law in electromagnetic induction is the direct consequence of the principle of conservation of:** (UHS 2018)
   A. Momentum
   B. Energy
   C. Charge
   D. Mass

10. **If we give a direct current to the transformer's primary coil, then there will be:** (UHS 2019)
    A. Less emf produced in the secondary
    B. No emf produced in the secondary
    C. Equal emf produced in the secondary
    D. More emf produced in the secondary

11. **If we change the magnetic flux linking a coil by rotating the coil in a constant magnetic field, the rate of change if this flux is:** (UHS 2019)
    A. Proportional to the emf produced in it
    B. Proportional to the change in magnetic field
    C. Proportional to the resistance of coil
    D. Proportional to the material of coil

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12. **An alternating voltage V (in volts) is represented by the equation: $V = 300 \sin(100\pi t)$ What is the value of "f" for this voltage?(UHS 2019)**

A. 25 Hz
B. 200 Hz
C. 50 Hz
D. 100 Hz

13. **Transformer is a device which steps up or steps down the input: (PMC 2020)**

A. Current
B. Voltage
C. Energy
D. Power

14. **If a stationary bar magnet is placed near a coil at rest so maximum lines of force passes through the coil, the galvanometer shows: (PMC 2020)**

A. Maximum Current
B. Minimum Current
C. No Current
D. Intermediate Value of Current

15. **In transmission from grid station, power losses are minimized by: (PMC 2020)**

A. Increasing Current
B. Decreasing Current
C. Increasing Resistance
D. Increasing Voltage

ANSWER KEY

1	D	6	D	11	A
2	B	7	C	12	C
3	C	8	D	13	B
4	A	9	B	14	C
5	B	10	B	15	D

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SOLUTION

1. Lenz's law refers to induced current not the induced emf.

2. $\frac{VS}{VP} = \frac{NS}{NP} = \frac{IP}{IS}$

   In step-down transformer $V_S < V_P$, $N_S < N_P$ and $I_S > I_P$.

3. Power losses in transformer can be minimized by:
   i. Stopping the flow of eddy current

   ii. Using material of the core whose hysteresis area is small.

4. At that instant when switch is closed a momentarily current flows through the secondary coil due to change in magnetic flux. So, galvanometer shows deflection. After that the no further flux will change. So, current in secondary will be zero.

5. $$\varepsilon = \frac{N\Delta\Phi}{\Delta t} = \frac{NB\Delta A}{\Delta t}$$
   $$= NB\left(\frac{\Delta A}{\Delta t}\right) = (5)(0.5)(10) = 25 \text{ V}$$

6. $V = V_o \sin\theta = V_o \sin(3\pi/2) = V_o \sin 270^o = -V_o$

7. $\varepsilon = vBL\sin\theta = (0.5)(0.2)(0.1)\sin 90^o = 1 \times 10^{-2}$ V

8. In actual transformer
   Power output < Power Input

9. Lenz's law is the statement of energy conservation.

10. The principle of transformer is mutual induction. But direct current cannot do induction.

11. By Faraday's law of electromagnetic induction
    $$\varepsilon = -N\frac{\Delta\Phi}{\Delta t} \Rightarrow \varepsilon \propto -\frac{\Delta\Phi}{\Delta t}$$

12. $V = 300 \sin(100\pi t)$
    Compare the above equation with

    $V = V_o \sin(\omega t)$

    $\omega = 100\pi \Rightarrow 2\pi f = 100\ \pi$

    $f = 50$ Hz

13. Transformer is a device which converts given alternating voltage into larger or smaller alternating voltage. $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

14. There must be a relative motion between conductor and magnetic field in order to induce the current in the conductor.

15. By increasing voltage current decreases in a transformer. According to $H=I^2Rt$ if current decreases heating effect also decreases.

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PMC PAST PAPER 2022 (ELECTROMAGNETIC INDUCTION)

Q.1 **Basic source of magnetism is:**
A. Magnetic domains
B. magnetic dipoles
C. charge moving in magnetic field
D. None

Q.2 **Find Turn ratio if Vs/Vp=2**
A. 2 : 1
B. 1 : 2
C. 4 : 8
D. None

Q.3 **Lenz's law is used to find direction of**
A. Induced current
B. Induced emf
C. Both
D. None

Q.4 **A.C generator is similar to**
A. Transformer
B. Capacitor
C. Inductor
D. None

Q.5 **In step down transformer the current in primary coil is _____ than secondary coil**
A. More
B. Less
C. Equal
D. None

Q.6 **Which law is based upon law of conservation of energy?**
A. Lenz's Law
B. Faraday Law
C. Ohms Law
D. Coulombs Law

Q.7 **How can a magnetic field be produced?**
A. Using a permanent magnet
B. Electric current
C. Using a temporary magnet
D. Using a permanent magnet or electric current

Q.8 **Magnetic Field lines move from**
A. North to south
B. South to north
C. West to east
D. East to west

Q.9 **Magnetic field lines seek the path of _____ resistance.**
A. Maximum
B. Minimum
C. Infinite
D. Zero

Q.10 **Two alpha-particles have the ratio of their velocities as 3 : 2 on entering the uniform field. If they move in different circular paths, then the ratio of the radii of their paths is**
A. 2 : 3
B. 3 : 2
C. 9 : 4
D. 4 : 9

Q.11 **If the instantaneous current in a circuit is given by I = A sin (ωt) ampere, the rms value of the current is:**
A. 2A
B. $\frac{A}{\sqrt{2}}$
C. $2\sqrt{2}A$
D. Zero

Q.12 **Power transformers are designed to have maximum efficiency at:**
A. Full load
B. 50%
C. 80%
D. No load

Q.13 **For step down transformer Ns_Np.**
A. Equal to
B. Less than
C. Greater than
D. Not equal

Q.14 **The transformer laminations are insulated from each other by:**
A. Mica strip
B. Paper
C. Thin coating of Varnish
D. Any of the above

Q.15 What is the duration of one cycle known as?
A. Period B. Cycle
C. Instantaneous value D. Sin wave

Q.16 Transformer is based on the theory of:
A. Self-inductance only B. Mutual inductance
C. Capacitive effect D. All of these

Q.17 emf = $-N(\Delta\Phi/\Delta t)$ is according to:
A. Ampere's Law B. Faraday's Law
C. Lenz's Law D. None of these

Q.18 SI unit of inductance is
A. Henry B. Farad
C. Maxwell D. Weber

Q.19 Henry is unit of
A. Self-inductance only B. Mutual inductance
C. Both 'a' and 'b' D. Emf

Q.20 The direction of induced current is always so as to oppose the change which causes the current is
A. Faraday's Law B. Lenz's Law
C. Ohm's Law D. Kirchoff's Law

Q.21 According to Faraday's Law, emf induced in circuit depends on
A. Max. magnetic flux B. Rate of change of magnetic flux
C. Change in magnetic flux D. Initial flux

Q.22 If we make the magnetic field stronger, the value of induced current is
A. Decreased B. Increased
C. Vanished D. Kept constant

Q.23 Which one of the following is not found in a DC generator?
A. Armature B. Slip rings
C. Commutators D. Magnets

Q.24 What is the work done by the magnetic field on a moving charged particle?
A. Maximum B. Minimum
C. Depends on the strength of the magnetic field D. Zero

Q.25 1 Tesla is equal to:
A. 1 Weber/m^2 B. 1 Gauss
C. 10^{-4} Weber/m^2 D. 10^4 Gauss.

Q.26 In electromagnetic induction, the induced charge is independent of
A. change of flux B. time.
C. resistance of the coil D. None of these

Q.27 A moving conductor coil produces an induced e.m.f. This is in accordance with
A. Lenz's law B. Faraday's law
C. Coulomb's law D. Ampere's law

Q.28 Faraday's laws are consequence of the conservation of
A. charge B. energy
C. magnetic field D. both B. and C.

Q.29 What is emf?
A. Force B. Voltage
C. Current D. Flux

Q.30 **Voltage induced in secondary coil of transformer is given by**
A. $N_P \times V_P/N_S$ B. $N_S \times V_P/N_P$
C. $(N_P/V_P) \times N_S$ D. $N_P/(V_P \times N_S)$

Q.31 **Power loss in the actual transformer is due to**
A. Small output B. Eddy currents and magnetic hysteresis
C. Soft iron core D. Back emf

Q.32 **The output voltage of a transformer is 3 times the input voltage then turns ratio will be**
A. 5 B. 3
C. 1 D. 6

Q.33 **When a wire loop is rotated in a magnetic field, the direction of induced emf changes in energy**
A. 1 revolution B. 1/2 revolution
C. 1/4 revolution D. 2 revolution

Q.34 **What is the function of a transformer?**
A. Transformer is used to step down or up the AC voltages and currents
B. Transformer is used to step down or up the DC voltages and currents
C. Transformer converts DC to AC voltages
D. Transformer converts AC to DC voltages

Q.35 **Transformer ratings are given in**
A. kVA B. HP
C. kVAR D. kW

Q.36 **The frictional loss in a transformer is**
A. 10 % B. 50 %
C. 0 % D. More than 50 %

Q.37 **Which of the following is most suitable for the core of electromagnets?**
A. Soft iron B. Steel
C. Copper-nickel alloy D. Air

Q.38 **Find out the correct relation from the following.**
A. 1 Wb = 1 G cm B. 1 Wb = 1 Tm
C. 1 Wb = 1 G cm^2 D. 1 Wb = 10^8 Maxwell

Q.39 **Identify the law used to find the direction of eddy currents.**
A. Lenz's law B. Maxwell's law
C. Ampere's law D. Faraday's law

Q.40 **In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is**
A. 2 A B. 18 A
C. 12 A D. 1 A

Q.41 **A step-down transformer reduces the supply voltage from 220 V to 11 V and increase the current from 6 A to 100 A. Then its efficiency is**
A. 1.2 B. 0.83
C. 0.12 D. 0.9

Q.42 **Weak ionic current in our body that travels along the nerve can produce the**
A. atoms B. heat
C. potential difference D. magnetic effect

Q.43 **It is made of many loops mounted on a shaft or axle**
A. fuse B. transformer
C. armature D. circuit

Q.44 **A transformer steps down from 200V to 50 V. It has secondary winding = 40 turns, then windings in primary coil are**

A. 150 B. 160
C. 170 D. 200

Q.45 **Time varying magnetic field creates electric field, this is called**

A. electric induction B. magnetic induction
C. electromagnetic induction D. dipole induction

Q.46 **A 100-turn coil of area 0.1 m^2 rotates at half a revolution per second. It is placed in a uniform magnetic field of 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil?**

A. 256.33 V B. 89.12V
C. 0.314V D. 3.1455 V

Q.47 **The turns ratio of transformer is 10, It means that;**

A. Is=10Ip B. Ns=Np/10
C. Ns=10Np D. Vs=Vp/10

Q.48 **If magnetic field is doubled then magnetic energy density becomes**

A. four times B. two times
C. three times D. six times

Q.49 **The mutual induction happens in**

A. AC generator B. DC generator
C. Battery D. Transformer

Q.50 **Alternating Current Generators use:**

A. coiled rings B. split rings
C. slip rings D. solenoid rings

Q.51 **Faraday law states that the rate of change of magnetic flux is equal to**

A. electromotive force B. induced current
C. induced flux D. induced magnetic field

Q.52 **Face of coil having clockwise current:**

A. behaves like north pole B. behaves like south pole
C. becomes magnet of varying poles D. does not behave like magnet

Q.53 **The root mean square value of the alternating current is equal to**

A. twice the peak value B. half the peak value
C. equal to the peak value D. $(1/\sqrt{2})$ times the peak value

Q.54 **For a coil self-inductance L and current I then flux passing through it is**

A. LI B. LI^2
C. $L^2 I$ D. $(LI)^2$

Q.55 **Lenz law is in accordance with conservation of**

A. momentum B. charge
C. current D. energy

Q.56 **Energy stored in an inductor is**

A. electric energy B. magnetic energy
C. electromagnetic energy D. both a) and b)

Q.57 **A sinusoidal current has rms value of 10A What is the peak value of current?**

A. 144.4A B. 1.4A
C. 0.1414A D. 14.4A

Q.58 **A device that consumes electrical energy in the external circuit of generator is known as**

A. appliances B. machines
C. motors D. load

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Q.59 **The maximum instantaneous value measured from zero value is known as?**
A. peak value
B. peak to peak value
C. cycle
D. period

Q.60 **A real transformer does not change**
A. voltage level
B. current level
C. power level
D. frequency level

Q.61 **The coupling coefficient of perfectly coupled coils is**
A. zero
B. 1
C. more than 1
D. infinite

Q.62 **If the peak-to-peak voltage is 10V, calculate the peak voltage.**
A. 2V
B. 10V
C. 4V
D. 5V

Q.63 **According to Faraday law induced voltage is produced by change in**
A. electric field
B. magnetic field
C. both a or b
D. position

Q.64 **Principle of electric generator is based on**
A. biot savart's law
B. biot savart's law
C. newton's law
D. faraday law

Q.65 **In step down transformer _____ is decreased in secondary coils**
A. electric field
B. magnetic field
C. number of turns
D. none of these

Q.66 **Motional emf can be produced with**
A. Changing magnetic field in space
B. Changing magnetic field in time
C. Changing flux with space
D. Constant magnetic field

Q.67 **For ideal step-up transformer Ps_Pp.**
A. Equal to
B. Greater than
C. Less than
D. None of these

Q.68 **Magnetic flux is product of B and A**
A. Scalar
B. Vector
C. Simple
D. None of these

Q.69 **The secondary turns of which of the following transformers is always kept closed for Transformer**
A. Power
B. Voltage
C. current
D. Step down

Q.70 **Identify the factor on which mutual inductance does not depend.**
A. Relative orientation
B. Relative separation of two coils
C. Reciprocity
D. Permeability of the core material

Q.71 **A device that consumes electrical energy in the external circuit of generator is known as**
A. Appliances
B. Machines
C. Motors
D. Load

Q.72 **Calculate the frequency if the number of revolutions is 300 and the paired poles are 50.**
A. 15 kHz
B. 150 kHz
C. 1500 kHz
D. 150 Hz

Q.73 **If the peak voltage is 9V, calculate the peak-to-peak voltage.**
A. 9V
B. 18V
C. 4.5V
D. 0V

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Q.74 Lenz's law provides information about direction of:
A. Inductance
B. Induced current
C. Induced flux
D. Induced magnetic field

Q.75 Electric motor converts to energy.
A. Electrical, mechanical
B. Mechanical, electric
C. Mechanical, potential
D. Not enough information

Q.76 One of the major reasons for heat loss in transformer is:
A. Radiation loss
B. Convection loss
C. Eddy current loss
D. None of these

Q.77 Weber is the unit of:
A. Magnetic flux
B. Electric flux
C. Both A or B
D. None of these

Q.78 SI Unit of current is?
A. Ampere
B. Volt
C. Joules
D. Watt

Q.79 For a metal rod of length L and moving with speed v in perpendicular to magnetic field then motional emf at its end is:
A. lvB
B. lvB2
C. lv2B
D. None of these

Q.80 Transformer is used to
A. Transform voltage
B. Transform current
C. Generator
D. Self inductor

Q.81 Self-Induction depends on
A. Current
B. Voltage
C. Number of turns
D. All

Q.82 In modulation which quantity doesn't change in Frequency modulation
A. Amplitude
B. frequency
C. time period
D. all

Q.83 Which of following act as motor
A. Ammeter
B. Voltmeter
C. Galvanometer
D. All

Q.84 When transformer is heated the which of the following decrease
A. current
B. voltage
C. magnetic induction
D. all

Q.85 An open-circuit test transformer is used to measure the loss.
A. current
B. voltage
C. core
D. All

Q.86 Which is the correct relation:
A. Ns/Np = Vs/Vp
B. NsNp =Vs/Vp
C. Ns/Np = Is/Ip
D. None

Q.87 In a step-up transformer, current across secondary is _____
A. more
B. less
C. equal
D. None

Q.88 Current that fluctuates periodically with time is:
A. DC current
B. BC current
C. AC current
D. Magnetic current

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Q.89 An ideal transformer dissipates
A. unit power
B. infinite power
C. zero power
D. limited power

Q.90 The number of coils in a transformer is
A. 2
B. 3
C. 4
D. 5

Q.91 An electromagnet is
A. permanent magnet
B. temporary magnet
C. insulator
D. conductor

Q.92 The power is transmitted over long distances and high voltages to
A. minimize the energy loss
B. maximize the energy loss
C. make energy content constant
D. preserve energy

Q.93 To increase or decrease AC voltages, we use
A. fuse
B. circuit breaker
C. transformer
D. generator

Q.94 In an A.C generator, increase in number of turns in the coil
A. Increases emf
B. Decreases emf
C. Makes the emf zero
D. Maintains the emf at a constant value

Q.95 Which of the following is the unit of mutual inductance?
A. VsA^{-2}
B. $V^3 sA^2$
C. $V^2 s$
D. VsA^{-1}

Q.96 Voltage in secondary winding is _____ to current in secondary coil
A. directly proportional
B. inversely proportional
C. directly squared proportional
D. not enough information

Q.97 For a 100 efficient step down transformer
A. voltage in primary and secondary are equal
B. current in primary and secondary are equal
C. input power is same as the output power
D. output power is zero

Q.98 Which one of the following is not present in AC generator
A. Armature
B. Magnet
C. slip rings
D. Commutator

Q.99 Lamination of the transformer core is made of
A. cast iron
B. silicon steel
C. Aluminum
D. cast steel

Q.100 When currents are moving in the same direction in two conductors, then the force will be
A. Attractive
B. Repulsive
C. Retracting
D. Opposing

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ANSWER KEY

1	A	16	B	31	B	46	C	61	B	76	C	91	B
2	A	17	B	32	B	47	C	62	D	77	A	92	A
3	A	18	A	33	B	48	A	63	B	78	A	93	C
4	D	19	C	34	A	49	D	64	D	79	A	94	A
5	A	20	B	35	A	50	C	65	C	80	A	95	D
6	A	21	B	36	C	51	A	66	B	81	C	96	B
7	D	22	B	37	A	52	B	67	A	82	A	97	C
8	A	23	B	38	D	53	D	68	A	83	D	98	D
9	B	24	D	39	A	54	A	69	C	84	A	99	A
10	B	25	D	40	A	55	D	70	C	85	C	100	A
11	B	26	B	41	B	56	B	71	D	86	A		
12	A	27	B	42	D	57	D	72	A	87	B		
13	B	28	B	43	C	58	D	73	B	88	C		
14	C	29	B	44	B	59	A	74	B	89	C		
15	A	30	B	45	C	60	D	75	A	90	A		

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UNIT 10

PRACTICE EXERCISE

ELECTRONICS

1. **A diode characteristic curve is a graph between:**
   A. Current and time
   B. Voltage and current
   C. Voltage and time
   D. Forward voltage and reverse current
2. **In half ware rectification, the output DC voltage is obtained across the load for:**
   A. The positive half cycle of input AC
   B. The negative half cycle of input AC
   C. The positive and negative half cycles of input AC
   D. Either positive or negative half cycle of input AC
3. **The device used for conversion of AC into DC is:**
   A. An oscillator
   B. An amplifier
   C. A detector
   D. A rectifier
4. **A junction diode when forward biased behaves as a device of:**
   A. Zero resistance
   B. Low resistance
   C. Infinite resistance
   D. High resistance
5. **The potential barrier in a diode stops the movement of:**
   A. Holes only
   B. Both electrons and holes
   C. Electrons only
   D. Bounded electrons
6. **Which circuit is used for the smooth output voltage in rectification?**
   A. Oscillator
   B. Rectifier
   C. Filters
   D. Amplifier
7. **The width of depletion region of a diode:**
   A. Increases under forward bias
   B. Increases under reverse bias
   C. Is independent of applied voltage
   D. All of these
8. **How many diodes are used for the full wave rectification in bridge rectifier?**
   A. Two
   B. Four
   C. Three
   D. Five
9. **Depletion region carries:**
   A. Negative charge
   B. No free charge
   C. Positive charge
   D. Positive ions
10. **The single Germanium or Silicon crystal formed after adding the pentavalent impurity is known as:**
    A. Semi-conductor
    B. N- type substance
    C. p-n substance
    D. P-type substance
11. **The forward current through a semiconductor diode circuit is due to the:**
    A. Minority carriers
    B. Holes
    C. Majority carriers
    D. Electrons
12. **Identify the correct statement about minority carriers:**
    A. holes in n-type and free electrons in p-type
    B. holes in n-type and p-type
    C. free electrons in n-type and holes in p-type
    D. free electrons in n-type and p-type

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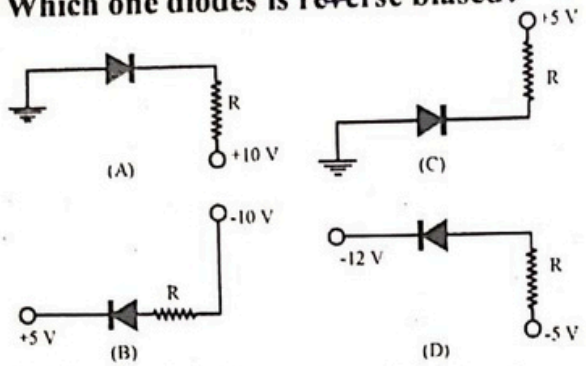
13. **When a PN junction diode is forward biased, the flow of current across the junction is mainly due to:**
A. drift of charges
B. Diffusion of charges
C. both drift and diffusion of charges
D. Depends on the nature of the material

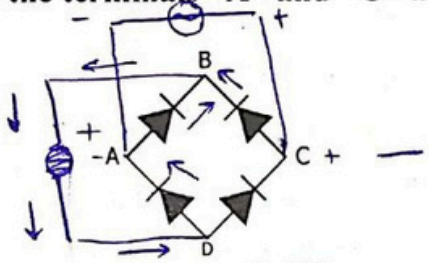
14. **Which one diodes is reverse biased?**



15. **On increasing the reverse bias to a large value in a p-n junction diode, current**
A. increases slowly and then remains fixed
B. suddenly increases and then remains fixed
C. remains fixed
D. decreases slowly

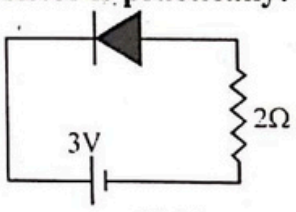
16. **The depletion layer in the p-n junction region is caused by:**
A. diffusion of carries
B. drift of electrons
C. drift of holes
D. migration of impurity ions

17. **In Fig. the input is across the terminals "A" and "C" and the output is across "B" and "D" Then the output is:**



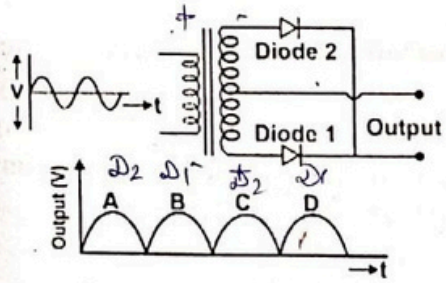
A. zero
B. same as the input
C. full wave rectified
D. half wave rectified

18. **In Fig. the current through the resistor is practically:**



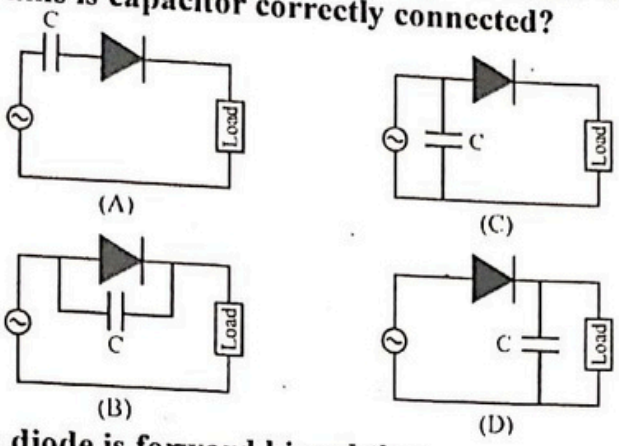
A. 5A
B. 2A
C. 1A
D. zero

19. **A full wave rectifier along with the output is shown in Fig. The contribution (s) from the diode 1 are:**



A. C
B. A, C
C. B, D
D. A, B, C, D

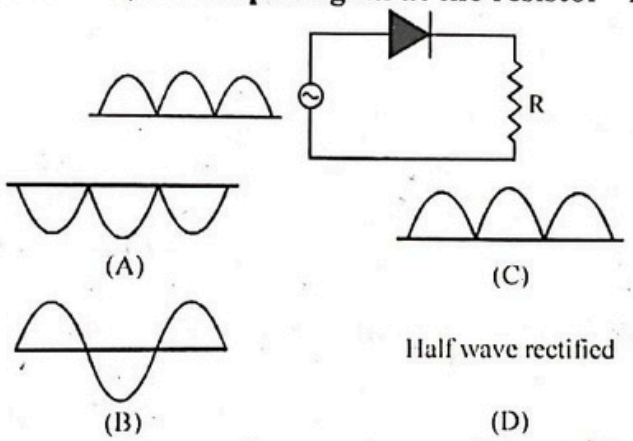
20. **A capacitor is to be used to provide smoothing for a half wave rectifier. In which of the following diagrams is capacitor correctly connected?**



21. **When p-n junction diode is forward biased then**
A. both the depletion region and barrier height are reduced
B. The depletion region is widened and barrier height is reduced
C. The depletion region is reduced and barrier height is increased
D. both the depletion region and barrier height are increased

22. **A PN junction diode cannot be used:**
A. as rectifier
B. for getting light radiation
C. for converting light energy to electrical energy
D. for increasing the amplitude of an ac signal

23. **For the input signal shown, the output signal at the resistor "R" will look be:**

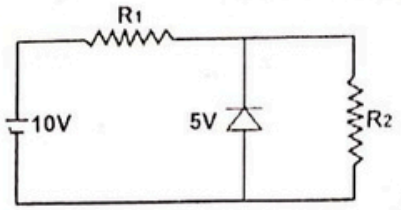


24. **A series combination of a 100Ω resistor and an ordinary silicon diode is connected to a 10V battery. The current flowing through the circuit will be:**
A. 0.1 A
B. 0.093 A
C. 10.75 A
D. zero

25. **If AC voltage of 60Hz is applied as input to a full wave rectifier, the frequency of output voltage (ripple) will be:**
A. 30 Hz
B. 60 Hz
C. 120 Hz
D. 60/2π Hz

26. **If an AC voltage of 100V peak value is applied as input to a half wave rectifier and then a full wave rectifier, the rms values of outputs will be respectively:**
A. 35V and 35V
B. 35V and 70V
C. 50V and 70V
D. 70V and 140V

27. **What is the current flowing in R_2 in the circuit shown in Fig.? Given: $R_1 = 500\ \Omega$ and $R_2 = 1\ k\Omega$.**

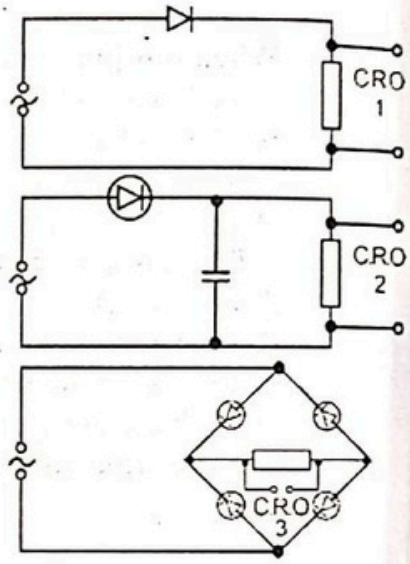


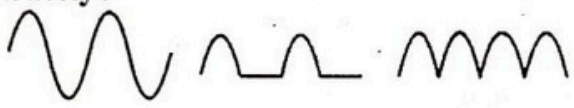
A. 0 mA
B. 5 mA
C. 10 mA
D. 15 mA

28. **In a bridge full wave rectifier, the input sine wave is $250\sin 100\pi t$. The output ripple frequency will be:**

A. 50Hz
B. 100Hz
C. 200Hz
D. 25Hz

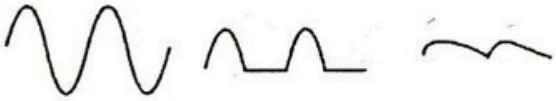
29. **Fig. shows three circuits used to rectify an alternating current. A cathode ray oscilloscope (CRO) with fixed settings of time base and Y gain is connected in in turn as shown and produces a different trace in each case. Which of set of diagrams shows these traces most accurately?**



A. 

B. 

C. 

D. 

30. **When an impurity is doped into an intrinsic semiconductor, the conductivity of the semiconductor:**

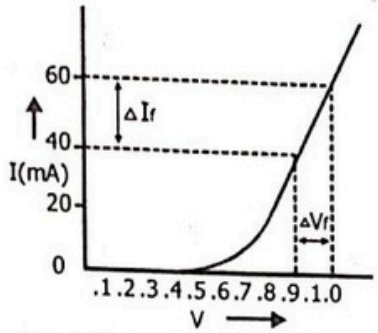
A. increases
B. decreases
C. remains the same
D. becomes zero

ANSWER KEY

1	B	11	C	21	A
2	D	12	C	22	B
3	D	13	A	23	C
4	B	14	D	24	B
5	B	15	B	25	C
6	C	16	A	26	C
7	B	17	C	27	B
8	B	18	D	28	A
9	B	19	C	29	B
10	B	20	D	30	A

SOLUTIONS

1.



$R_{eq} = 1500\Omega$

$V = IR$

2. The rectification in which output flows only during alternate half cycle is known as half wave rectification.

3. The process of converting alternating current into direct current is called rectification. The device used for this purpose is known as rectifier.

4. The forward resistance offered by the p-n junction when it is conducting is given by:

$$r_f = \frac{\Delta Vf}{\Delta If}$$

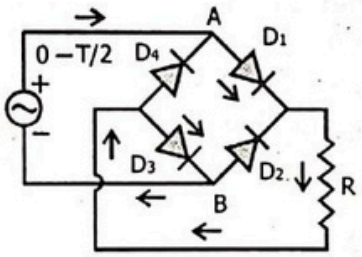
The value of "r_f" is only few ohms.

5. The value of potential barrier is 0.7V in case of "Si" and 0.3V in case of "Ge" at room temperature. This potential difference stops further diffusion of electrons and holes.

6. In full wave rectification the output voltage is pulsating. To make the voltage smooth a circuit known as filter can be used.

7. When the diode is forward biased, the width of depletion region decreases and when it is reverses biased then the width of depletion region increases.

8.



9. Just after the formation of the junction, the free electrons in the n-region due to their random motion diffuse into the p-region. As a result of their diffusion, the recombination of electrons and holes take place within the depletion region. So, a charge less region is formed around the junction in which free charge carriers are not present.

10. When a silicon or Germanium crystal is doped with a pentavalent element, four valence electrons of impurity atom form covalent bonds with the four neighbouring "Si" or "Ge" atoms, while the fifth valence electron provides a free electron such a doped or extrinsic semiconductor is called N-type semiconductor.

11. When a battery is connected across a p-n junction. Due to this, the depletion region becomes narrow. When this energy is sufficient to overcome the potential barrier, a current of the order of few mili-amperes begins to flow across the p-n junction due to majority charge carriers.

12. In N-type semiconductor free electrons are in majority while free holes are in minority. In P-type semiconductor free holes are in majority while free electrons are in minority.

13. When a PN junction diode is forward biased, the flow of current across the junction is mainly due to drift of charges. The formation of junction is mainly due to the diffusion of charges.

14. When a battery is connected across a p-n junction with its high potential (positive terminal) to the p-type and its low potential (negative terminal) to the n-type is called forward biasing. −5V is high potential as compared to −12 V (low potential).

15. As the reverse voltage is increased from "0", the reverse current quickly rises to its saturation value "I_o". As the reverse current remains almost constant. Here the resistance offered by the junction is very high of the order of the several mega ohms.

16. Just after the formation of junction, the free electrons from the n–region diffused into the p–region and holes from p–region diffused into the n–region. As a result of this diffusion, a charge less region formed around the junction in which charge carriers are not present. The formation of junction is mainly due to the diffusion of charges.

17.

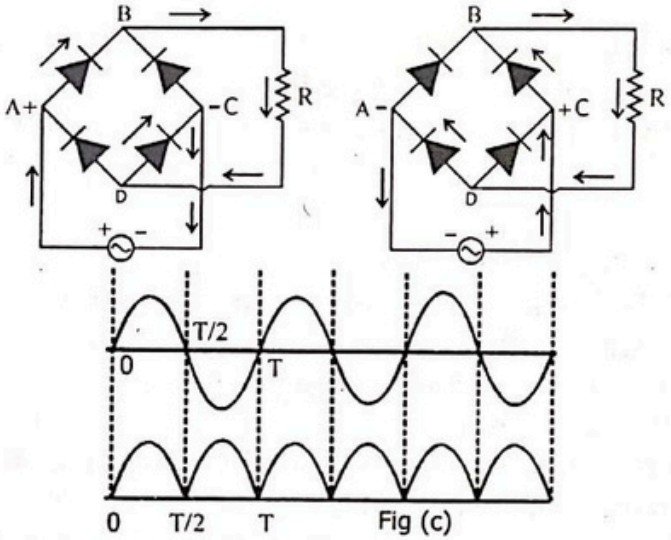


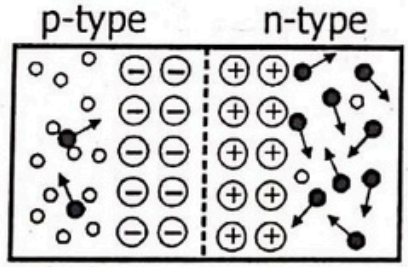
Fig (c)

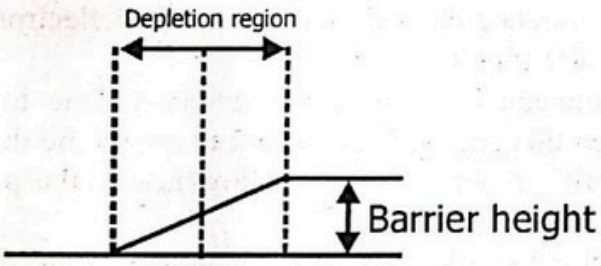
18. In the circuit the diode is reverse biased. So, no current flows through the circuit.

19. Diodes conduct electricity alternatively so cycles by diode 1 are B and D.

20. To make the voltage smooth a circuit known as filter can be used. Which basically a capacitor connected in parallel with the load.

21. When the diode is forward biased, the width of depletion region and barrier height is decreases.





22. The voltage at which the reverse current in the p–n junction rises sharply is called break down voltage. After breakdown voltage the reverse current will rise to high value which will damage the junction.

23. The diode will conduct for every ripple (pulse). So, the output will be same as that of input.

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24. The potential barrier of silicon diode is 0.7 volt. So, the remaining potential difference across 100 Ω is

$V_R = 10 - 0.7 = 9.3V$

$I = \frac{VR}{R} = \frac{9.3}{100} = 0.093$ A

25. In full wave rectification

Pulse frequency (ripple frequency) = 2 ×Frequency of source

= 2×60Hz = 120 Hz

26. In half wave rectifier

$V_{rms} = \frac{Vo}{2} = \frac{100}{2} = 50$ V

In full wave rectifier

$V_{rms} = \frac{Vo}{\sqrt{2}} = 0.7V_o = 0.7(100)$ V = 70 V

27. Voltage across parallel remains same, so Voltage across R2 is also 5V.

$I_2 = \frac{5}{R_2} = \frac{5}{1\times10^3} = 5\times10^{-3} = 5mA$

28. $\omega = 100\pi \Rightarrow 2\pi f = 100\pi \Rightarrow f = 50$ Hz

In full wave rectification

Pulse frequency (ripple frequency) = 2 ×Frequency of source

= 2×50Hz = 100 Hz

29. 1st circuit represents half-wave rectification and 2nd circuit represents filtered output with the help of capacitor and 3rd circuit represents output of full wave rectification.

30. Doping is the process by which the conductivity of intrinsic semiconductors is increased.

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. A germanium at 0K is
A. Conductor
B. Semiconductor
C. Insulator
D. P and N types semiconductor

2. By increasing the temperature, the conductivity of the semiconductor is
A. Decreased
B. Increased
C. Constant
D. Not affected

3. Which one of the following is an intrinsic semiconductor?
A. Boron
B. Copper
C. Indium
D. Silicon

4. In extrinsic semiconductor, the doping level should be in the ratio
A. $1 : 10^{-6}$
B. $1 : 10^{6}$
C. $1 : 10^{-8}$
D. $1 : 10^{8}$

5. In P-type semiconductor, the doping of Silicon is taken place with
A. Bivalent
B. Trivalent
C. Tetravelent
D. Pentavalent

6. When p-type and N-type semiconductor are combined then we have a
A. Resistor
B. Capacitor
C. Diode
D. Triode

7. The depletion region in PN-Junction carries
A. Positively charge
B. Negatively charge
C. Both positively and negatively charge
D. No mobile charge carrier

8. The potential difference across the silicon PN-junction is
A. 0.3 V
B. 0.5 V
C. 0.7 V
D. 0.9 V

9. When P-type of the PN-junction is connected with the negative terminal and N-type with positive terminal of the battery, the width of the depletion region
A. Decreases
B. Increases
C. Remain constant
D. Vanished

10. In forward biasing, the knee voltage for Germanium PN-Junction is
A. 0.3 V
B. 0.7 V
C. 3 V
D. 7 V

11. One of the most important property of a diode
A. Allow current in one direction
B. Allow current in bi-direction
C. use as an amplifier
D. Use as an oscillator

12. The number of diodes used in a bridge rectifier is
A. One
B. Two
C. Three
D. Four

13. Transistor stands for
A. Transfer of Resistance
B. Transfer of charge carriers
C. Transfer of power
D. Transfer of voltage

14. Which region of the transistor is most wide in terms of area?
A. Emitter
B. Base
C. Collector
D. All have equal area

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15. **In biasing of a transistor, which region must be reverse biased?**
A. Emitter-Base
B. Collector-Base
C. Emitter-Collector
D. None of these

16. **The thickness of the base region of a transistor is**
A. 10^{-2} m
B. 10^{-4} m
C. 10^{-6} m
D. 10^{-8} m

17. **Which one of the following relation is true for a transistor?**
A. $I_E = I_C - I_B$
B. $I_E = I_B - I_C$
C. $\alpha = \frac{I_C}{I_E}$
D. $\beta = \frac{I_B}{I_E}$

18. **Which one of the following relations holds for cutoff mode of transistor?**
A. $I_C = I_B$
B. $I_C = \beta I_B$
C. $I_C = \alpha I_B$
D. $I_C = 0$

19. **The flow of charge carriers in a transistor is controlled by**
A. Emitter
B. Base
C. Collector
D. All of them

20. **If the base current of a silicon transistor is 0.01 mA, its collector current is**
A. 0.99 mA
B. 9.9 μA
C. 0.1 mA
D. 1 mA

21. **V_{CE} drops across the load resistor of a transistor when**
A. $I_C = 0$
B. $I_C = I_B$
C. $I_C = \alpha I_B$
D. $I_C = \beta I_B$

ANSWER KEY

1	C	6	C	11	A	16	C	21	D
2	B	7	D	12	D	17	C		
3	D	8	C	13	A	18	B		
4	B	9	B	14	C	19	B		
5	B	10	A	15	A	20	D		

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KPK TEXT BOOK EXERCISE MCQs

1. **In an N-type silicon, which of the following statement is true:**
   A. Electrons are majority carriers and trivalent atoms are the dopants.
   B. Electrons are minority carriers and pentavalent atoms are the dopants.
   C. Holes are minority carriers and pentavalent atoms are the dopants.
   D. Holes are majority carriers and trivalent atoms are the dopants.
2. **The reverse saturation current in a PN junction diode is only due to:**
   A. majority carriers
   B. acceptor ions
   C. minority carriers
   D. donor ions
3. **Improper biasing of a transistor circuit produces:**
   A. heavy loading of emitter current
   B. excessive heat at collector terminal
   C. distortion in the output signal
   D. faulty location of load line
4. **When transistors are used in digital circuits they usually operate in the:**
   A. breakdown region
   B. saturation and cutoff regions
   C. breakdown region
   D. linear region
5. **Most of the electrons in the base of an NPN transistor flow:**
   A. out of the base lead
   B. into the emit
   C. into the collector
   D. into the base supply
6. **In a transistor, collector current is controlled by:**
   A. collector voltage
   B. collector resistance
   C. base current
   D. all of the above

ANSWER KEY

1	C	6	A
2	C		
3	C		
4	B		
5	C		

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PAST PAPERS 2008-2020

1. **In LED when an electron combines with a ____ during forward bias condition, a photon of visible light is emitted.** **(UHS 2008)**
   A. High voltage
   B. Photon
   C. Hole
   D. Positron

2. **Practically _____ current flows in a reverse biased p-n junction.** **(UHS 2008)**
   A. no
   B. very large
   C. few milliampere
   D. Both A. and C.

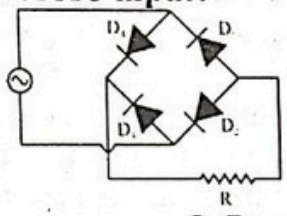
3. **An n-type semi-conductor is made by doping silicon crystal with ____** **(UHS 2008)**
   A. Indium
   B. Aluminum
   C. Arsenic
   D. Both B. and C.

4. **To convert the "Si" crystal into p-type semi-conductor, which group element will be doped:** **(UHS 2009)**
   A. Trivalent element
   B. Fourth group element
   C. Second group element
   D. Pentavalent element

5. **The net charge on an N-type substance is:** **(UHS 2010)**
   A. 0.7e
   B. – e
   C. – 0.7e
   D. 0

6. **Output voltage of rectifier is not smooth, it can be made smooth by circuit known as:** **(UHS 2017)**
   A. Wheatstone circuit
   B. Bridge circuit
   C. Filter circuit
   D. Ripple circuit

7. **What happens in positive cycle of AC input?** **(UHS 2017)**



$\frac{I_0}{\pi}$ $\frac{2I_0}{\pi}$ $\frac{2I_0}{\pi}$

   A. D_1 and D_3 conduct
   B. D_1 and D_2 conduct
   C. D_3 and D_4 conduct
   D. D_2 and D_4 conduct

$\frac{V_0}{2}$ $\frac{V_0}{\sqrt{2}}$ $\frac{V_0}{\sqrt{2}}$

8. **In case of half wave rectification the resistance of diode during negative half of A.C is:** **(UHS 2018)**
   A. Very high
   B. Very low
   C. Negative
   D. A few ohms

9. **The direction of current through the load resistance of a full-wave rectification circuit:** **(UHS 2019)**
   A. Inverts for negative cycle
   B. Changes for every cycle
   C. Inverts for positive cycle
   D. Remains constant

10. **In full wave rectification, the diodes are used:** **(PMC 2020)**
    A. 1
    B. 2
    C. 3
    D. 4

ANSWER KEY

1	C	6	C
2	A	7	D
3	C	8	B
4	A	9	D
5	D	10	B

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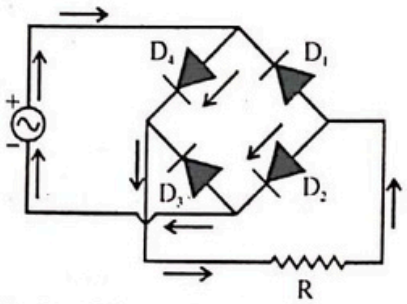
SOLUTION

1. Electrons are in high energy level (conduction band) while holes are in low energy level (valence band). So, when electron combines with hole a photon of light is emitted.
2. p-n junction has insulating nature in reverse biased condition. So, practically no current will flow through the junction.
3. For n-type semiconductor, pentavalent impurity is added to intrinsic semiconductor. (Arsenic)
4. For p-type semiconductor, trivalent impurity is added to Si crystal.
5. There is no net charge on an N-type or p-type substances because are formed by neutral atoms.
6. The output voltage is not smooth but pulsating. It can be made smooth by using a circuit known as filter.
7. 

8. In half wave rectification diode will conduct only in one half cycle of A.C. (Either +ve or –ve half). So, the resistance of diode may be very high or very low during negative half of A.C. As it may be either forward or reverse biased.
9. In full wave rectification both the half cycles of A.C is converted into D.C. so, the direction of current through the load resistance remains constant.
10. In full wave rectification by using center tapped transformer minimum two diodes are required and by using bridge rectifier 4 diodes are required.

$\frac{V_0}{\sqrt{2}} = 0.7 \times 10$

0.7×20

$\frac{14 \times 10}{10}$

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Q.1 **Half wave rectifier uses**
A. one diode
B. two diode
C. three diodes
D. Four diodes

Q.2 **The number of diodes in bridge rectifier is**
A. 4
B. 3
C. 2
D. 5

Q.3 **In half wave rectification, the output DC voltage is obtained across the load for**
A. the positive half cycle of input AC
B. the negative half cycle of input AC
C. the positive and negative half cycles of input AC
D. Either positive or negative half cycle of input AC

Q.4 **A circuit that adds positive or negative dc voltage to an input sine wave is called**
A. Clamper
B. clipper
C. diode clamp
D. limiter

Q.5 **Transformer is used in rectifier to**
A. step up voltage
B. step down voltage
C. both A and B
D. output power increase

Q.6 **Which has less ripple factor**
A. Half wave rectifier
B. Full wave rectifier
C. Both
D. None

Q.7 **Ripple factor of full wave rectifier?**
A. 0.482
B. 1.21
C. 0.21
D. 0.84

Q.8 **The work done by the electric field on a particle when it is moved from one point on an equipotential surface to another point on the same equipotential surface is**
A. qE x d
B. Maximum
C. May be zero
D. Always Zero

Q.9 **If Input Voltage of Input Diode is 10 V for Full Wave Rectifier, then Output Voltage will be:**
A. 8
B. 5
C. 10
D. 20

Q.10 **Transistor is used to Convert _____.**
A. Half wave
B. Full wave
C. Both
D. None

Q.11 **Rectifier circuits are?**
A. single-phase
B. multi-phase
C. Both A and B
D. Can not say

Q.12 **If peak Voltage across a full wave rectifier is 20V then V_{rms} is**
A. 7.07V
B. 14.14V
C. 16.8V
D. 12V

Q.13 **Transistors can be used as:**
A. half wave rectifier
B. full wave rectifier
C. both
D. none of these

Q.14 **Maximum efficiency of half wave rectifier is**
A. 80.6 %
B. 40.60%
C. 70%
D. 50%

Q.15 **A full wave rectifier uses load resistor of 1500Ω. Assume the diodes have Rf=10Ω, Rr=∞. The voltage applied to diode is 30V with a frequency of 50Hz. Calculate the AC power input:**

A. 358.98mW
B. 275.2 mW
C. 145.76 mW
D. 456.78 mW

Q.16 **A full wave rectifier passes _____ into positive cycles**

A. lower half cycle
B. upper half cycle
C. both cycles
D. none of them

Q.17 **In a rectifier, larger the value of shunt capacitor filter**

A. larger the peak-to-peak value of ripple voltage
B. larger the peak current in the rectifying diode
C. longer the time that current pulse flows through the diode
D. smaller the dc voltage across the load

Q.18 **Average dc Voltage across the load in full wave rectifier in terms of Vmax is**

A. $0.532\ V_{max}$
B. $0.637V_{max}$
C. $0.759V_{max}$
D. $0.437V_{max}$

Q.19 **In a bridge type full wave rectifier, if Vm is the peak voltage across the secondary of the transformer, the maximum voltage coming across each reverse biased diode is**

A. Vm
B. $Vm/\sqrt{2}$
C. 2Vm
D. Vm/3

Q.20 **Peak voltage of output of half wave rectifier is 10V so dc component of output voltage is**

A. $10\sqrt{2}$
B. $10/\sqrt{2}$
C. $10/\pi$
D. 10π

Q.21 **In a half wave rectification, during negative cycle of the wave the diode is:**

A. reversed biased
B. forward biased
C. potential barrier
D. none of these

Q.22 **If a half wave rectifier is used to convert 50Hz AC into DC, then the number of pulses present in rectifier voltage is**

A. 25
B. 50
C. 100
D. 75

$I_{rms} = \frac{10}{\sqrt{2}}$

Q.23 **Ripple factor is defined as**

A. Irms/Vrms
B. Idc/Irms
C. Irms/I dc
D. Irms + I dc

Q.24 **The bridge rectifier is preferred to an ordinary two diode full wave rectifier because**

A. it needs much smaller transformer for the same output
B. no center tap required
C. less PIV rating per diode
D. All of the above

Q.25 **Half wave rectifier uses**

A. one diode
B. two diode
C. three diodes
D. Four diodes

Q.26 **Transformer is used in rectification to _____ the supply voltage**

A. step up
B. step down
C. equalize
D. none of them

Q.27 **Transistors can be used as**

A. half wave rectifier
B. full wave rectifier
C. both
D. none of these

Q.28 Rectifier is a device which converts
A. AC to DC
B. DC to AC
C. AC to triangular current
D. DC to triangular current

Q.29 Which of the following are component of half wave rectifier
A. transformer
B. load resistance
C. power supply
D. All of the above

Q.30 Centre tap rectifier circuit consists of _____ diode
A. 1
B. 2
C. 3
D. 4

$P = IV$

Q.31 The output voltage of a rectifier is
A. smooth
B. pulsating
C. perfectly direct
D. alternating

Q.32 The basic purpose of filter is to
A. minimize variation in ac signal
B. suppress harmonics in rectified output
C. remove ripples from the rectified output
D. stabilize dc output voltage

Q.33 In a half wave rectification, the diode conducts during
A. both half cycles
B. positive half
C. negative half
D. none of these

Q.34 The use of a capacitor filter in a rectifier circuit gives satisfactory performance only when the load:
A. Current is high
B. Current is low
C. Voltage is high
D. Voltage is low

Q.35 Half wave voltage multiplier can provide any degree of voltage multiplication by cascading diodes and capacitors.
A. any doubler
B. any tripler
C. any multiplication
D. none of them

Q.36 Ripple factor of full wave rectifier is
A. 1.21
B. 0.6
C. 0.482
D. 0.9

Q.37 In half wave rectification, the output DC voltage is obtained across the load for
A. the positive half cycle of input AC
B. the negative half cycle of input AC
C. the positive and negative half cycles of input AC
D. Either positive or negative half cycle of input AC

Q.38 A half wave rectifier is equivalent to
A. Clamper
B. Clipper
C. Clamper circuit with negative bias
D. Clamper circuit with positive bias

Q.39 A Bridge rectifier is used more than full rectifier because
A. performs on less secondary voltage
B. no center tap transformer required
C. power loss is minimum
D. All of them

Q.40 The half wave rectifier have input l0V its dc component is
A. $10/\pi$
B. 0
C. 1π
D. 2π

Q.41 Half wave Rectifier contain, how many Diodes
A. 2
B. 3
C. 4
D. 1

Q.42 Ripple factor of half wave rectifier?
A. 0.482
B. 1.21
C. 0.21
D. 0.84

Q.43 The efficiency of full wave rectifier?
A. 40.6 %
B. 10.6 %
C. 81.2 %
D. 0.84%

Q.44 Bridge rectifier is an alternative for
A. Full wave rectifier
B. Peak rectifier
C. Half wave rectifier
D. None of the mentioned

Q.45 A rectifier is a
A. Bilateral device
B. Linear device
C. Non-linear device
D. Passive device.

Q.46 The ripple factor indicates the number of ripples in the
A. A.C output
B. D.C output
C. A.C input
D. none of these

Q.47 The ripple factor γ =
A. $\sqrt{\left(\frac{V_{rms}}{V_{DC}}\right)^2 - 1}$
B. $\sqrt{1 - \left(\frac{V_{rms}}{V_{DC}}\right)}$
C. $\sqrt{\left(\frac{V_{DC}}{V_{rms}}\right)^2 - 1}$
D. $\sqrt{1 - \left(\frac{V_{DC}}{V_{rms}}\right)}$

Q.48 A half wave rectifier is operating from 50 Hz mains. Fundamental frequency of ripple will be
A. 100 Hz
B. 25 Hz
C. 200Hz
D. 50Hz

Q.49 Non-inverting amplifier circuits have
A. A very high input impedance
B. A very low input impedance
C. A low output impedance
D. None of the above

Q.50 Which of the following rectifier uses wheatstone bridge to rectify signal
A. half wave
B. full wave
C. bridge
D. All of the above

ANSWER KEY

1	A	16	C	31	B	46	B
2	A	17	C	32	C	47	A
3	D	18	B	33	B	48	D
4	A	19	A	34	B	49	A
5	B	20	C	35	C	50	C
6	B	21	A	36	C		
7	A	22	B	37	D		
8	D	23	C	38	B		
9	C	24	D	39	D		
10	D	25	A	40	A		
11	A	26	B	41	D		
12	B	27	D	42	B		
13	D	28	A	43	C		
14	B	29	D	44	A		
15	B	30	B	45	D		

PRACTICE EXERCISE

MODERN PHYSICS AND ATOMIC SPECTRA

1. **Linear momentum of a photon is:**
   A. Zero
   B. hf/c
   C. hf/c^2
   D. c^2/hf

2. **Stopping potential for a metal surface in case of photoelectric emission depends on:**
   A. The threshold frequency for the metal surface
   B. The intensity of incident light
   C. The frequency of incident light and the work function for metal surface
   D. The threshold energy for the metal surface

3. **Rest mass of photon is:**
   A. Infinite
   B. Very small
   C. Zero
   D. Very large

4. **A photon is a:**
   A. Unit of energy
   B. Quantum of electromagnetic radiations
   C. Positively charged particle
   D. Unit of wavelength

5. **Which one of the following has the highest energy content?**
   A. 10^3 photons of wavelength 2pm (γ–rays)
   B. 10^2 photons of wavelength 1mm (X–rays)
   C. 10^6 photons of wavelength 50mm (Infrared
   D. 10^6 photons of wavelength 200mm (UV)

6. **In a photoelectric effect, monochromatic light, is incident on a metal surface. If the incident light of twice the intensity but the same wave length, the kinetic energy of the emitted electron:**
   A. Becomes double
   B. Becomes half
   C. remains same
   D. First increase then decreases

7. **If "n" number of photon are striking on a metal surface, then the total momentum exerted is:**
   A. $\frac{nh}{\lambda}$
   B. Zero
   C. $\frac{2nh}{\lambda}$
   D. nhf

8. **Photo electric effect for visible light can be obtain from:**
   A. Sodium-Potassium
   B. Helium-Neon
   C. Carbon-oxygen
   D. Magnesium-Sodium

9. **The total number of spectral lines for an electron transition from n=5 to n=1 state is:**
   A. 1
   B. 7
   C. 5
   D. 10

10. **The reverse process of Photoelectric effect is:**
    A. Compont Effect
    B. Annihilation
    C. Pair–production
    D. X–rays production

11. **The stopping potential when intensity is kept constant is:**
    A. Same
    B. Different
    C. Both A. & B.
    D. Independent of frequency of incident light

12. **Photon "A" has twice the energy of photon "B". What is the ratio of the momentum of "A" to that of "B"?**
A. 4 : 1
B. 1 : 2
C. 2 : 1
D. 1 : 4

13. **Number of photo electrons emitted from metal depends upon:**
A. Intensity of incident light
B. Wavelength of incident light
C. Energy of incident light
D. Frequency of incident light

14. **Which physical quantity will change if intensity of light falling on metal's surface is increased?**
A. K.E of photo electrons
B. Plate potential
C. Velocity of photo electrons
D. Current

15. **Consider the following three particles:**
1. a free electron with kinetic energy K_o
2. a free proton with kinetic energy K_o
3. a free proton with kinetic energy $2K_o$
Rank them according to the wavelengths of their matter waves, least to greatest.
A. 1, 2, 3
B. 2, 3, 1
C. 3, 2, 1
D. 1, 3, 2

16. **Minimum energy required by the electron to leave the metal surface is called as _____ of the metal surface:**
A. Threshold frequency
B. Work function
C. Cut–off frequency
D. Threshold energy

17. **The photon is the particle, which has:**
A. Infinite rest mass
B. No rest mass and no charge
C. Rest mass but no change
D. A. and B. are correct

18. **Energy of photon is directly proportional to its:**
A. Temperature
B. Wavelength
C. Frequency
D. Intensity

19. **Evidence for the wave nature of matter is:**
A. electron diffraction experiment of Davisson and Germer
B. Thompson's measurement of e/m
C. Young's double slit experiment
D. the Compton effect

20. **For two lights of different frequencies. If $f_2 > f_1$ then:**
A. $\lambda_1 > \lambda_2$
B. $\lambda_1 = \lambda_2$
C. $\lambda_2 > \lambda_1$
D. $\lambda_1 \geq \lambda_2$

21. **The momentum of moving photon is:**
A. Zero
B. $h\lambda^{-1}$
C. $h\lambda$
D. λh^{-1}

22. **Maximum kinetic energy of photoelectrons depends upon ____ of incident light.**
A. Frequency
B. Brightness
C. Intensity
D. Power

23. **In photoelectric effect, light exhibits:**
A. Wave nature
B. Both wave and particle nature
C. Particle nature
D. All of these

24. **Einstein's photoelectric equation is given by:**
A. $\frac{1}{2} mv^2_{max} = hf + \Phi$
B. $\frac{1}{2} mv^2_{max} = hf - \Phi$
C. $\frac{1}{2} mv^2_{max} - hf = \Phi$
D. $\frac{1}{2} mv^2_{max} - \Phi = hf$

25. **An electron and a proton are accelerated through the same potential. If their masses are "m_e" and "m_p" respectively, then the ratio of their de-Broglie wave length is:**
A. 1
B. m_p/m_e
C. m_e/m_p
D. $\sqrt{mp/me}$

26. **The virtual mass of photon is:**
A. Zero
B. $m = hf/c^2$
C. $m = hf/c$
D. $m = c^2/hf$

27. **The maximum energy of photo electron is:**
A. $V_o e^2$
B. $V_o^2 e$
C. $V_o e$
D. work function

28. **In a photoelectric effect experiment the stopping potential is:**
A. the energy required to remove an electron from the sample
B. the kinetic energy of the most energetic electron ejected
C. the potential energy of the most energetic electron ejected
D. the electric potential that causes the electron current to vanish

29. **Of the following which is the best evidence for the wave nature of matter?**
A. The photoelectric effect
B. The Compton effect
C. The relationship between momentum and energy for an electron
D. The diffraction of electrons by crystals

30. **In a photoelectric effect experiment at a frequency above cut off, the stopping potential is proportional to:**
A. the energy of the least energetic electron before it is ejected
B. the energy of the least energetic electron after it is ejected
C. the energy of the most energetic electron before it is ejected
D. the energy of the most energetic electron after it is ejected

$\lambda \propto \frac{1}{m}$

31. **Photon of high frequency will be absorbed when transition takes place from:**
A. 1st to 5th orbit
B. 3rd to 5th orbit
C. 2nd to 5th orbit
D. 4th to 5th orbit

32. **If an electron in a hydrogen atom jumps from third orbit to the second orbit, the emitted radiation has wavelength (R is the Rydberg's constant):**
A. 36 / 5R
B. 6 / 5R
C. 5R / 36
D. 5R / 6

33. **Dimensions of the Rydberg constant is:**
A. $[ML^{-2}]$
B. $[L^{-1}]$
C. $[ML^{-1}]$
D. $[ML^{-1}T^{-1}]$

34. **The shortest wavelength radiation in Bracket series has wavelength:**
A. $\frac{16}{RH}$
B. $16R_H$
C. $\frac{RH}{16}$
D. $\frac{4}{RH}$

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35. **The product $\mu_o\varepsilon_o$ has the same units as:**
A. $(\text{velocity})^2$
B. 1/velocity
C. $(\text{velocity})^{1/2}$
D. $1/\text{velocity}^2$

36. **Which light photon has the least momentum:**
A. Red
B. Yellow
C. Blue
D. radio wave

37. **The relation between Rydberg constant "R_H" and ground state energy "E_o" is given by:**

A. $R_H = \frac{Eo}{hc}$ C. $R_H = \frac{hc}{Eo}$

B. $E_o = \frac{RH}{hc}$ D. $R_H = E_o hc$

38. **For longest wavelength in the Balmer series the value of "n" in the relation $\frac{1}{\lambda} = R_H \left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ should be:**

A. 3 C. 4

B. ∞ D. 5

39. **The frequency of light beam "A" is twice that of light beam "B" The ratio E_A/E_B of photon energies is:**

A. ½ C. 1/4

B. 1 D. 2

40. **The stopping potential for electrons ejected by 6.4×10^{14}Hz electromagnetic radiation incident on a certain sample is 1.8V. The kinetic energy of the most energetic electrons ejected and the work function of the sample, respectively, are:**

A. 1.8 eV, 2.8 eV C. 1.8 eV, 0.8 eV

B. 1.8 eV, 4.6 eV D. 2.8 eV, 1.0 eV

41. **The series limit for the Balmer series represents a transition m → n, where (m, n) is:**

A. (2, 1) C. (3, 2)

B. (∞, 1) D. (∞, 2)

42. **A non relativistic free electron has kinetic energy "K". If its wavelength doubles, its kinetic energy is:**

A. 4K C. 2K

B. K/2 D. K/4

43. **In Balmer series the shortest wavelength radiations have wavelength equal to:**

A. $\frac{RH}{4}$ C. $\frac{4}{RH}$

B. $\frac{RH}{9}$ D. $9R_H$

44. **The longest wavelength radiations in Paschen series have wavelength equal to:**

A. $-\frac{25}{16}R_H$ C. $\frac{16}{25}R_H$

B. $\frac{135}{27R_H}$ D. $\frac{1}{R_H}\left(\frac{144}{7}\right)$

45. **The wavelength of light beam "A" is twice the wavelength of light beam "B" The energy of a photon in beam "A" is:**

A. half the energy of a photon in beam B

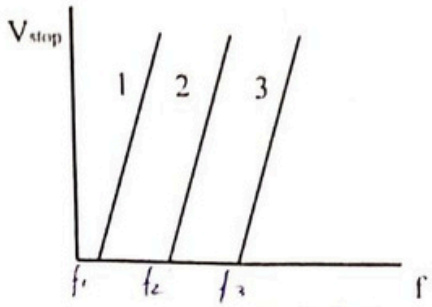
B. one-fourth the energy of a photon in beam B

C. equal to the energy of a photon in beam B

D. twice the energy of a photon in beam B

46. **In a photoelectric effect experiment at a frequency above cut off, the number of electrons ejected is proportional to:**
A. their kinetic energy
B. the work function
C. the number of photons that hit the sample
D. the frequency of the incident light

47. **The diagram shows the graphs of the stopping potential as a function of the frequency of the incident light for photoelectric experiments performed on three different materials. Rank the materials according to the values of their work functions, from least to greatest.**



A. 1, 2, 3
B. 2, 3, 1
C. 3, 2, 1
D. 2, 1, 3

48. **Consider the following three particles:**
1. a free electron with speed v_0
2. a free proton with speed v_0
3. a free proton with speed $2v_0$
Rank them according to the wavelengths of their matter waves, least to greatest.
A. 1, 2, 3
B. 2, 3, 1
C. 3, 2, 1
D. 1, 3, 2

49. **The momentum of a photon of electromagnetic radiation is 3.3×10^{-29} kg m/sec the frequency of associated waves is**
A. 3.0×10^3 Hz
B. 6.0×10^3 Hz
C. 7.5×10^{12} Hz
D. 1.5×10^{13} Hz

50. **The velocity of most energetic photoelectrons emitted from a metal surface depends upon:**
A. frequency of the incident light
B. intensity of the incident light
C. time for which the light falls on the metal
D. All of above

51. **A beam of light of wavelength "λ" and with illumination "L" falls on a clean surface of sodium. If "N" photoelectron are emitted each with kinetic energy E:**
A. $N \propto L$ and $E \propto \lambda$
B. $N \propto L$ and $E \propto L$
C. $N \propto L$ and $E \propto 1/\lambda$
D. $N \propto 1/\lambda$ and $E \propto 1/L$

52. **Photoelectric effect is the conversion of:**
A. light into heat
B. electricity into light
C. light into electricity
D. light into heat

53. **The number of photoelectrons ejected from a metal when light falls on its surface is directly proportional to:**
A. intensity of light
B. frequency of light
C. work function of the metal
D. Nature of material

54. **The energy of a photon of wavelength λ is:**
A. hc/λ
B. $hc\lambda$
C. λ/hc
D. $h\lambda/c$

55. **The absorbed energy of incident photons is used in two ways: (I) Work Function: part of energy is used to free the electron from metal surface and (II) Remaining part is converted to**
A. kinetic energy
B. potential energy
C. binding energy
D. thermal energy

56. **Maximum kinetic energy of photoelectron is _____ frequency of incident radiation.**
A. directly proportional to
B. inversely proportional to
C. independent of
D. directly proportional to square root of intensity

57. **Frequency below which no electrons are emitted from metal surface is:**
A. minimum frequency
B. angular frequency
C. maximum frequency
D. threshold frequency

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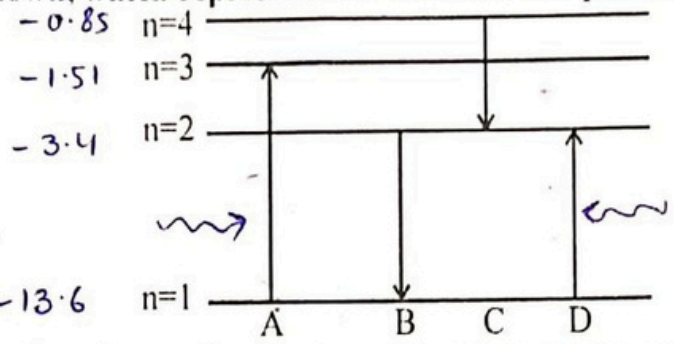
58. **The diagram shows the energy levels for an electron in a certain atom. Of the transitions shown, which represents the emission of a photon with the most energy?**



$f = R\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$

59. **When a hydrogen atom makes the transition from the second excited state to the ground state (at −13.6 eV) the energy of the photon emitted is:**
A. 0
B. 9.1 eV
C. 1.5 eV
D. 12.1 eV

60. **The Balmer series of hydrogen is important because it:**
A. is the only one for which the quantum theory be used
B. is the only series that occurs for hydrogen
C. is in the visible region
D. involves the lowest possible quantum number "n"

61. **Which of the following statement is incorrect:**
A. Photoelectric emission does not occur below the threshold frequency
B. The photoelectric current increases with the frequency of incident light
C. Threshold frequency depends on the metal used
D. The emission of photoelectrons is an instantaneous process

62. **The threshold wavelength of photoelectric emission of a metal is 4000Å. Then the minimum energy required to eject photo electron is** ϕ
A. 4.96 eV
B. 3.1 eV
C. 49.6 eV
D. 31 eV

63. **Wave like characteristic of electron is demonstrated by:**
A. Line spectrum of atoms
B. Diffraction by crystalline solids
C. Production of X-rays
D. Photo electric effect

64. **The photoelectric threshold frequency depends upon:**
A. Frequency of incident light
B. nature of material
C. Intensity of incident light
D. frequency of light and nature of material

65. **The stopping potential for electrons ejected by 6.8×10^{14}Hz electromagnetic radiation incident on a certain sample is 1.8 V. The kinetic energy of the most energetic electrons ejected is:**
A. 0.8 eV
B. 1.8 eV
C. 2.8 eV
D. 3.8 eV

66. **The Einstein's photoelectric equation $K.E_{max}=hf - hf_o$ is valid for:**
A. The electrons coming out of the metal surface with minimum energy
B. The electrons coming out of the metal surface with full surplus energy (without losing any energy during collisions with the atoms of metal)
C. The photons of light that reflect back from the metal surface
D. All the electrons that come out of the metal surface

67. **A device whose working is based upon photoelectric effect is:**
A. photo-voltaic cell
B. photo-cell
C. photo-phone
D. photo-door

68. **Paschen series lies in:**
A. visible region
B. ultraviolet region
C. infrared region
D. x-ray region

69. **The maximum wavelength in the Brackett series is given by:**
A. $\lambda_{max} = R_H\left(\frac{09}{400}\right)$
B. $\lambda_{max} = R_H\left(\frac{400}{09}\right)$
C. $\lambda_{max} = \frac{1}{R_H}\left(\frac{09}{400}\right)$
D. $\lambda_{max} = \frac{1}{R_H}\left(\frac{400}{09}\right)$

70. **If wave number is $\frac{R_H}{9}$, the corresponding series is:**
A. Lyman series
B. Ballmer series
C. Paschen Series
D. Brackett series

71. **The radiations of which spectral series are more energetic than others?**
A. Lyman series
B. Paschen series
C. Pfund series
D. Brackett series

72. **An electron in hydrogen atom will emit radiations of least wavelength when it returns from:**
A. 2nd orbit to 1st orbit
B. 5th orbit to 2nd orbit
C. 10th orbit to 3rd orbit
D. 20th orbit to 4th orbit

73. **In an electronic transition, atom cannot emit:**
A. γ-rays
B. Visible light
C. Infrared radiation
D. Ultraviolet rays

74. **The total energy of an electron in the 4th orbit in a H–atom is:**
A. – 13.60eV
B. – 0.85eV
C. – 3.40eV
D. – 1.51eV

75. **Total number of series in hydrogen spectrum is:**
A. Three
B. Five
C. Four
D. Six

76. **The radiations emitted from hydrogen filled discharge tube show:**
A. Bound spectrum
B. Continuous spectrum
C. Line spectrum
D. Absorption spectrum

77. **Radiation with wavelength longer than red light:**
A. Ultraviolet rays
B. Infrared radiation
C. X-rays
D. Visible radiations

78. **Bracket series is obtained when all transition of electron terminate on:**
A. 4th orbit
B. 3rd orbit
C. 5th orbit
D. 2nd orbit

79. **Photon of highest frequency will be absorbed when transition takes place from _____.**
A. 1st to 5th orbit
B. 2nd to 5th orbit
C. 3rd to 5th orbit
D. 4th to 5th orbit

80. **The value and units of the Plank's constant 'h' can be expressed as:**
A. $6.63 \times 10^{-34}\ Js^{-1}$
B. $6.63 \times 10^{-43}\ Js$
C. $6.63 \times 10^{-34}\ Js$
D. $3.63 \times 10^{-34}\ Js$

81. **The curve between photoelectric current (I) and frequency (f) is**



82. **The reverse process of photo electric effect is**
A. annihilation of matter
B. pair production
C. production of X-rays
D. nuclear fission

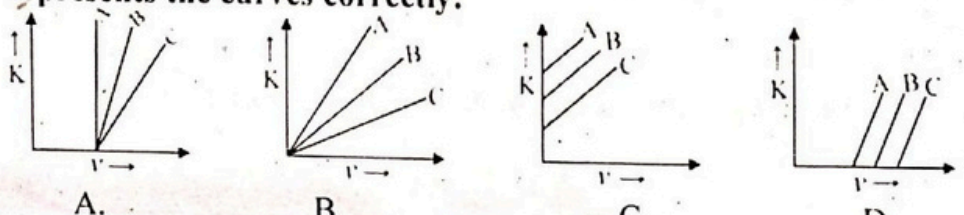
83. **If the wavelength of incident radiation in a photoelectric experiment is decreased then**
A. the photoelectric current will decrease
B. the photoelectric current will increase
C. the stopping potential will decrease
D. the stopping potential will increase

84. **A photoelectric cell is illuminated by a point source of light 1m away. When the source is taken 2m away**
A. The number of electrons emitted is a quarter of the initial number
B. The number of electrons emitted is half the initial number
C. Each electron emitted carries one quarter of initial energy
D. Each emitted electron carries half the initial energy

85. **In a photoelectric effect experiment the stopping potential is:**
A. The electric potential that causes the electronic current to vanish
B. The photon energy
C. The kinetic energy of the most energetic electron ejected
D. The energy required to remove an electron from the sample

86. **Stopping potential for a metal surface in case of photoelectric emission depends on _____**
A. The threshold frequency for the metal surface
B. The intensity of incident light
C. The frequency of incident light and work function of the metal surface
D. All of the above

87. **For three different metals A, B, C photo-emission is observed one by one and maximum kinetic energy (K) versus frequency (ν) of incident light graphs are plotted. Which fig. represents the curves correctly:**



88. **The work function of a metallic substance is 5 eV. Then threshold frequency is approximately**

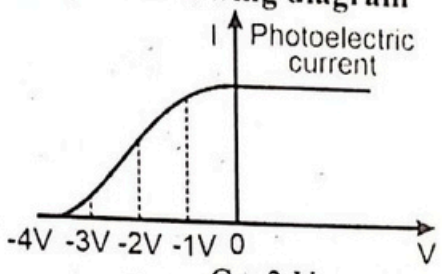
A. 1.6×10^7 Hz
B. 8.68×10^{15} Hz
C. 9.68×10^{17} Hz
D. 1.2×10^{15} Hz

89. **An ultraviolet light source causes the emission of photoelectrons from a zinc plate. A more intense source of the same wavelength would give**

	Maximum energy / electron	No. of electrons / second
A.	more	the same
B.	the same	more
C.	the same	the same
D.	more	more

$\phi = hf_0$

90. **The value of stopping potential in the following diagram**



A. –2 V
B. – 4 V
C. –3 V
D. –1 V

91. **In a photoelectric effect experiment at a frequency above threshold frequency, the number of electrons ejected is proportional to**

A. The frequency of the incident light
B. Their potential energy
C. The number of photons that hit the sample
D. Their kinetic energy

$I \propto \frac{1}{d^2}$ $\frac{I}{4}$

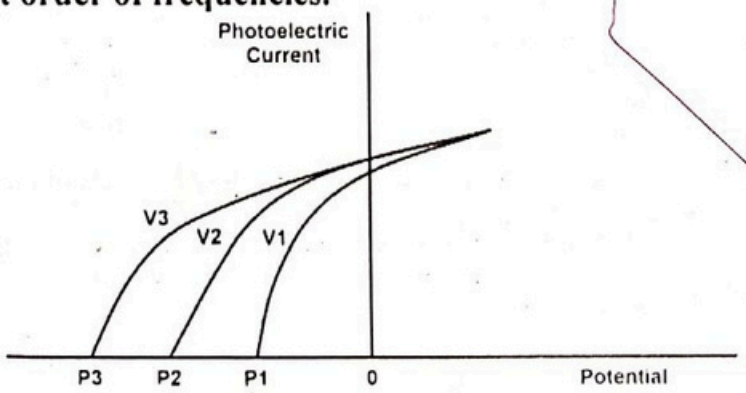
92. **During Einstein's Photoelectric Experiment, what changes are observed when the frequency of the incident radiation is increased?**

A. The value of saturation current increases
B. No effect
C. The value of stopping potential increases
D. The value of stopping potential decreases

93. **How does the intensity affect the photoelectric current?**

A. As intensity increases, the photoelectric current increases
B. As the intensity increases, the photoelectric current decreases
C. As the intensity decreases, the photoelectric current becomes twice
D. No effect

94. **Identify the correct order of frequencies.**



A. $v_1 > v_2 > v_3$
B. $v_2 > v_3 > v_1$
C. $v_3 > v_2 > v_1$
D. $v_1 > v_3 > v_2$

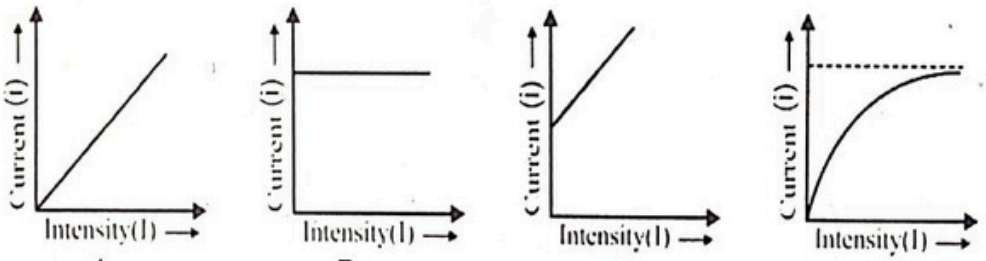
95. **What is the effect of intensity on the stopping potential?**
A. As intensity increases, stopping potential increases linearly
B. As intensity increases, stopping potential decreases linearly
C. As intensity decreases, stopping potential increases exponentially
D. No effect

96. **The maximum energy of the electrons released in a photo cell is independent of**
A. frequency of incident light
B. intensity of incident light
C. nature of cathode rays
D. none of these

97. **Light of frequency 1.5 times the threshold frequency is incident on a photo sensitive material. If the frequency is halved and intensity is doubled the photo electric current becomes**
A. four times
B. double
C. half
D. zero

98. **If the intensity of incident light is made double, then the maximum number of emitted electrons will become**
A. double
B. eight times
C. four times
D. half

99. **Which one of the following graphs represents correctly the variation of photoelectric current (i) with intensity (I) of incident radiations?**



A. B. C. D.

100. **Einstein's photoelectric equation is**
A. $\frac{1}{2}mv_{max}^2 = hf$
B. $\frac{1}{2}mv^2 = hf - \phi$
C. $\frac{1}{2}mv_{max}^2 = \phi$
D. $\frac{1}{2}mv_{max}^2 = hf - \phi$

101. **Two photons of energy 2.5 eV each are incident on a metal plate whose work function is 4.0 eV, then the number of electrons emitted from the metal surface will be.**
A. One
B. More than two
C. Two
D. Electron emission is not possible

102. **$(K.E.)_{max} = hf - hf_0$ is known as:**
A. Compton equation
B. Planks equation
C. Newton's equation
D. Photoelectric equation

103. **The threshold wavelength for a metal whose work function is W_0 is λ_0. What is the threshold wavelength for a metal whose work function is $W_0/2$?**
A. $\frac{\lambda_0}{4}$
B. $\frac{\lambda_0}{2}$
C. $2\lambda_0$
D. $4\lambda_0$

104. For Pair Production phenomenon to occur the photon must have energy, greater than or equal to _____
A. 0.51 MeV
B. 1.02 MeV
C. 0.32 MeV
D. 0.85 MeV

105. What kind of photon is required for the pair production phenomenon to occur?
A. Visible Light Photon
B. X-ray Photon
C. γ-ray Photon
D. UV Photon

106. What is the rest mass energies for electron, E_e, and positron, E_P?
A. E_e = 1.02 MeV, E_P = 1.02 MeV
B. E_e = 0.51 MeV, E_P = 1.02 MeV
C. E_e = 1.02 MeV, E_P = 0.51 MeV
D. E_e = 0.51 MeV, E_P = 0.51 MeV

107. A photon of energy 4.1 MeV is incident on a lead nucleus, causing the creation of electron-positron pair. They travel perpendicular to the initial direction of the photon. The energy of the electron is _____
A. 4.1 MeV
B. 2.05 MeV
C. 1.02 MeV
D. 0.51 MeV

108. Of the following transitions in a hydrogen atom, the one which gives an absorption line of highest frequency is
A. $n = 2 \rightarrow n = 3$
B. $n = 3 \rightarrow n = 2$
C. $n = 3 \rightarrow n = 8$
D. $n = 8 \rightarrow n = 3$

109. If the series limit wavelength of the Lyman series 920 Å, then that for the Balmer series is
A. 920×2 Å
B. $\frac{920}{2}$ Å
C. 920×4 Å
D. $\frac{920}{4}$ Å

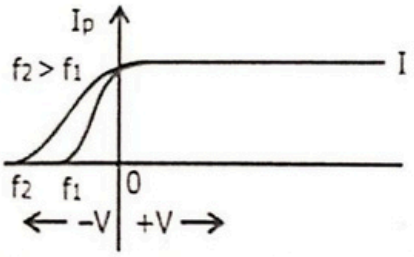
110. The ratio of the longest to shortest wave length in Bracket series of hydrogen spectra is
A. $\frac{25}{9}$
B. $\frac{9}{5}$
C. $\frac{17}{6}$
D. $\frac{4}{3}$

ANSWER KEY

1	B	11	C	21	B	31	A	41	D	51	C	61	B	71	A	81	A	91	C	101	D
2	C	12	C	22	A	32	A	42	D	52	C	62	B	72	A	82	C	92	C	102	D
3	C	13	A	23	C	33	B	43	C	53	A	63	B	73	A	83	D	93	A	103	C
4	B	14	D	24	B	34	A	44	D	54	A	64	B	74	B	84	A	94	C	104	B
5	A	15	C	25	D	35	D	45	A	55	A	65	B	75	B	85	A	95	D	105	C
6	C	16	B	26	B	36	D	46	C	56	A	66	B	76	C	86	C	96	B	106	D
7	A	17	B	27	C	37	A	47	A	57	D	67	B	77	B	87	D	97	D	107	B
8	A	18	C	28	D	38	A	48	A	58	B	68	C	78	A	88	D	98	A	108	A
9	D	19	A	29	D	39	D	49	D	59	D	69	D	79	A	89	B	99	A	109	C
10	D	20	A	30	D	40	C	50	A	60	C	70	C	80	C	90	B	100	D	110	A

SOLUTIONS

1. $E = mc^2 = hf$
   $pc = hf \Rightarrow p = hf/c$

2. 

   The current is same but stopping potential is different for each frequency of incident light. This fact shows that maximum K.E. of photoelectrons directly depends upon the frequency of light but independent of the intensity of light.
   Energy of photon = work function + Max. K.E. of photoelectrons
   $hf = \Phi + K.E._{max} = \Phi + V_o e$
   $V_o e = hf - \Phi$

3. Photons are the bundles of energy are integral part of electromagnetic radiations and they could not be sub divided. It does not exist at rest. So, its rest mass is zero.

4. Photons are the bundles of energy are integral part of electromagnetic radiations and they could not be sub divided. It does not exist at rest. So, its rest mass is zero.

5. $E = \frac{hc}{\lambda} \Rightarrow E \propto \frac{1}{\lambda}$
   As the wavelength of γ-rays is smaller than others. So, it has highest energy.

6. The maximum energy of photoelectrons depends on the nature of metal surface and the frequency of incident light. Electrons are emitted instantaneously; the intensity of light determines only their numbers.

7. For single photon
   $p = \frac{h}{\lambda}$
   For "n" photon
   $p = \frac{nh}{\lambda}$

8. Sodium or potassium cathode emits electrons for visible light. Cesium coated oxidized silver emits electrons for infrared light and some other metals respond to ultraviolet radiations.

9. Total no. of spectral lines (from n=5 to n=1) = 4+3+2+1 = 10

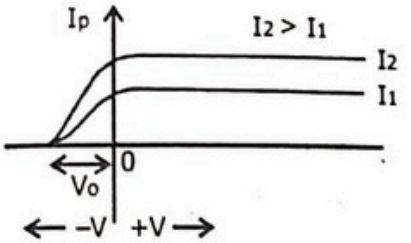
10. In photoelectric effect the electrons are emitted from the metal surface when it is exposed to light, while in production of X–rays when fast moving electron strike the metal surface electromagnetic waves are produced.

11. **i.** In photoelectric effect If the intensity is kept constant and experiment is performed with different frequencies of incident light the current is same but stopping potential is different for each frequency of incident light.
    ii. If frequency remains same then stopping potential also remains same.

12. $E_A = 2E_B$
    $p_A c = 2p_B c$
    $p_A : p_B = 2$

13. In photoelectric effect electrons are emitted instantaneously; the intensity of light determines only their numbers.

14.



By increasing intensity of light, numbers of emitted electrons are increased. Hence current will be increased.

15. $\lambda = \frac{h}{mv}$

$\frac{1}{2} mv^2 = K$

$m^2v^2 = 2mK \Rightarrow mv = \sqrt{2mK}$

$\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow \lambda \propto \frac{1}{\sqrt{mK}}$

As $m_p(2K_o) > m_p(K_o) > m_eK_o$

So,

$\lambda_3 > \lambda_2 > \lambda_1$

16. The minimum amount of energy required to escape the electron from the metal surface is called work function "Φ".

17. Photons are the bundles of energy are integral part of electromagnetic radiations and they could not be sub divided. It does not exist at rest. So, its rest mass is zero and it carries no charge.

18. $E = hf \Rightarrow E \propto f$

19. Evidence for the wave nature of matter is electron diffraction experiments of Davisson and Germer.

20. $f_2 > f_1$

$\frac{c}{\lambda 2} > \frac{c}{\lambda 1} \Rightarrow \lambda_1 > \lambda_2$

21. $p = \frac{h}{\lambda} = h\lambda^{-1}$

22. In photoelectric effect the electrons are emitted with different energies. The maximum energy of photoelectrons depends on the nature of metal surface and the frequency of incident light.

23. The phenomenon of photoelectric effect cannot be explained if we assume that light consists of waves and energy is uniformly distributed over its wavefront. It can only be explained by assuming light consists of corpuscles of energy known as photon and each photon is absorbed by a single electron. Thus it shows the corpuscular nature of light.

24. Energy of photon = work function + Max. K.E. of photoelectrons

$hf = \Phi + K.E._{max}$

$K.E._{max} = hf - \Phi$

$\frac{1}{2} mv^2_{max} = hf - \Phi$

This equation is known as Einstein's photoelectric equation.

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25. $\lambda = \frac{h}{mv}$

$\frac{1}{2} mv^2 = Ve$

$m^2v^2 = 2mVe \Rightarrow mv = \sqrt{2mVe}$

$\lambda = \frac{h}{\sqrt{2mVe}} \Rightarrow \lambda \propto \frac{1}{\sqrt{m}}$

$\frac{\lambda e}{\lambda p} = \sqrt{\frac{mp}{me}}$

26. $E = mc^2 = hf \Rightarrow m = hf/c^2$

27. The maximum energy of photoelectrons is:

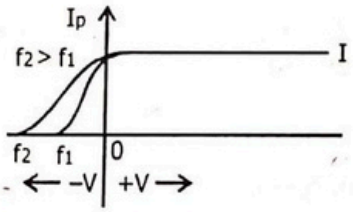
$K.E._{max} = V_o e$

$\frac{1}{2} mv^2_{max} = V_o e$

28. The stopping potential is that retarding voltage for which the photoelectric current becomes zero. Even the electrons of maximum K.E. are not able to reach collector plate.

29. By Davison–Germer the diffraction pattern (diffraction of electrons by crystals) have been observed with electron, protons, neutron, hydrogen atoms and helium atoms thereby giving substantial evidence for the wave nature of particles.

30.



This fact shows that maximum K.E. of photoelectrons directly depends upon the frequency of light but independent of the intensity of light.

31. Photon of high frequency will be absorbed when transition takes place from 1st to 5th orbit because the energy difference is maximum than others.

$E_5 - E_1 = hf$

32. $\frac{1}{\lambda} = R\left(\frac{1}{p2} - \frac{1}{n2}\right)$

$\frac{1}{\lambda} = R\left(\frac{1}{4} - \frac{1}{9}\right) = R\left(\frac{5}{36}\right) \Rightarrow \lambda = \frac{1}{R}\left(\frac{36}{5}\right)$

33. Unit of $R_H = m^{-1}$

$[R_H] = [L^{-1}]$

34. $\lambda_{min} = \frac{p^2}{R} = \frac{4^2}{R} = \frac{16}{R}$

35. $c = \frac{1}{\sqrt{\varepsilon o \mu o}} \Rightarrow c^2 = \frac{1}{\varepsilon o \mu o} \Rightarrow \varepsilon_o \mu_o = \frac{1}{c2}$

36. $p = \frac{h}{\lambda} \Rightarrow p \propto \frac{1}{\lambda}$

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As wavelength of radio wave is greatest than others. So, its photon has least momentum.

37. $R_H = \frac{Eo}{hc} = 1.097 \times 10^7\ m^{-1}$

38. $\frac{1}{\lambda} = R_H\left(\frac{1}{p2} - \frac{1}{n2}\right)$

For Balmer series p = 2

For longest wavelength in any Balmer series n = p + 1

= 2 + 1 = 3

39. $\frac{EA}{EB} = \frac{hfA}{hfB} = \frac{2fB}{fB} = 2$

40. $K.E_{max} = V_o e = 1.8eV$

$E = hf$

$= (6.63 \times 10^{-34})(6.4 \times 10^{14})\ J = \frac{(6.63\times10-34)(6.4\times1014)}{1.6\times10-19}\ eV$

$= (6.63)(4) \times 10^{-1}\ eV = 2.6\ eV$

$\Phi = hf - K.E_{max} = 2.6eV - 1.8\ eV = 0.8\ eV$

41. For Balmer series electron should jump from any higher energy level to 2nd energy level. For this (m, n) = (∞,2)

42. $\lambda = \frac{h}{mv}$ ✓

$\frac{1}{2}mv^2 = K$

$m^2v^2 = 2mK \Rightarrow mv = \sqrt{2mK}$

$\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow \lambda^2 = \frac{h2}{2mK} \Rightarrow K = \frac{h2}{2m}\left(\frac{1}{\lambda 2}\right) \Rightarrow K \propto \frac{1}{\lambda 2}$ ✓

43. $\frac{1}{\lambda} = R_H\left(\frac{1}{p2} - \frac{1}{n2}\right)$

For shortest wavelength in any Balmer series n =∞ and p = 2

$\frac{1}{\lambda min} = R_H\left(\frac{1}{22}\right) \Rightarrow \lambda_{min} = \frac{4}{RH}$

44. $\frac{1}{\lambda} = R_H\left(\frac{1}{p2} - \frac{1}{n2}\right)$

For longest wavelength in Paschen series p =3 and n = 4

$\frac{1}{\lambda max} = R_H\left(\frac{1}{9} - \frac{1}{16}\right) = R_H\left(\frac{7}{144}\right) \Rightarrow \lambda_{max} = \frac{1}{RH}\left(\frac{144}{7}\right)$

45. $\frac{EA}{EB} = \frac{hc/\lambda A}{hc/\lambda B} = \frac{\lambda B}{\lambda A} = \frac{\lambda B}{2\lambda B} = \frac{1}{2} \Rightarrow E_A = \frac{EB}{2}$

46. In photoelectric effect electrons are emitted instantaneously; the intensity (the number of photons that hit the sample) of light determines only their numbers.

47. $E = \Phi + K.E$

$hf = \Phi + V_s e$

If $V_s = 0$

$\Phi = hf_o \Rightarrow \Phi \propto f_o$

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$\Phi_1 < \Phi_2 < \Phi_3$

48. $\lambda = \frac{h}{mv} \Rightarrow \lambda \propto \frac{1}{mv}$

As $m_p(2v_o) > m_p(v_o) > m_e v_o$

So,

$\lambda_3 > \lambda_2 > \lambda_1$

49. $E = mc^2 = hf$

$pc = hf \Rightarrow p = hf/c$

$f = \frac{pc}{h} = \frac{(3.3\times10-29)(3\times108)}{6.6\times10-34}$

$= 1.5 \times 10^{-29+8+34}$ Hz

$= 1.5 \times 10^{13}$Hz

50. In photoelectric effect electrons are emitted with different energies. The maximum energy of photoelectrons depends on the nature of metal surface and the frequency of incident light.

51. In photoelectric effect Electrons are emitted instantaneously; the intensity of light determines only their numbers.

$N \propto L$

In photoelectric effect electrons are emitted with different energies. The maximum energy of photoelectrons depends on the nature of metal surface and the frequency of incident light.

$E \propto \frac{1}{\lambda}$

52. The emission of electrons from a metal surface when light of suitable frequency falls upon it is called photo electric effect. It converts the light energy into electrical energy.

53. In photoelectric effect Electrons are emitted instantaneously; the intensity of light determines only their numbers.

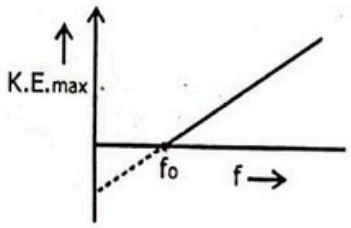
No. of electrons ∝ Intensity of light

54. $E = hf = \frac{hc}{\lambda}$

55. Energy of photon = work function + Max. K.E. of photoelectrons

$hf = \Phi + K.E._{max}$

56.



Maximum K.E of photoelectrons ∝ Frequency of incident light

57. There is a minimum frequency below which no electrons are emitted however intense the light may be. This minimum frequency is called threshold frequency.

58. Figure show that the radiation of most energy is emitted when electron jumps from n=2 orbit to n=1orbit.

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59. 2nd excited state means 3rd energy level (n = 3)

$$\Delta E = -\frac{Eo}{9} - (-E_o) = -\frac{Eo}{9} + E_o = -\frac{13.6}{9} + \frac{13.6}{1}$$

$$= -1.5 \text{ eV} + 13.6 \text{ eV} = 12.1 \text{ eV}$$

60. Balmar series is the only series that lies in visible region.

61. In photoelectric effect Electrons are emitted instantaneously; the intensity of light determines only their numbers. So, photoelectric current is independent on the frequency of light.

62. $$\Phi = hf_o = \frac{hc}{\lambda o} = \frac{hc}{e\lambda o}(\text{eV}) = \frac{1240\times10-9}{4\times10-7}(\text{eV})$$

$$= 310 \times 10^{-9+7}\text{eV} = 3.1 \text{ eV} \qquad \left(\frac{hc}{e} = 1240 \times 10-9\right)$$

63. Electrons are diffracted from metal crystals in exactly the same manner as x–rays or any other waves.

64. The threshold frequency depends upon the mature of the metal. It is different for different metals.

65. $K.E_{max} = V_o e = 1.8\text{eV}$

66. If the energy of the photon is greater than the work function, then a part of it is used in escaping an electron from the metal surface. The remaining energy is taken up by electron as its kinetic energy.

Energy of photon = work function + Max. K.E. of photoelectrons

$hf = \Phi + K.E._{max}$

$K.E._{max} = hf - \Phi = hf - hf_o$

67. A photocell is a device which converts light energy into electrical energy. It works on the photoelectric effect.

68. Paschen series lies in infrared region and its wavelength is given by:

$$\frac{1}{\lambda} = R_H\left(\frac{1}{32} - \frac{1}{n2}\right) \text{ Where } n = 4,5,6,\ldots$$

69. $$\frac{1}{\lambda} = R_H\left(\frac{1}{p2} - \frac{1}{n2}\right)$$

For longest wavelength in Bracket series p =4 and n = 5

$$\frac{1}{\lambda max} = R_H\left(\frac{1}{16} - \frac{1}{25}\right) = R_H\left(\frac{9}{400}\right) \Rightarrow \lambda_{max} = \frac{1}{RH}\left(\frac{400}{9}\right)$$

70. Wave number $= \frac{1}{\lambda} = R_H\left(\frac{1}{p2} - \frac{1}{n2}\right)$

If p = 3 and n= ∞

Wave number $= R_H\left(\frac{1}{32}\right) = \frac{RH}{9}$ (Paschen series)

71. Lyman series lies in ultra violet region.
Balmer series lies in visible region.
Paschen series lies in infra red region.
Brackett series lies in infra red region.
Pfund series lies in infra red region.

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72.

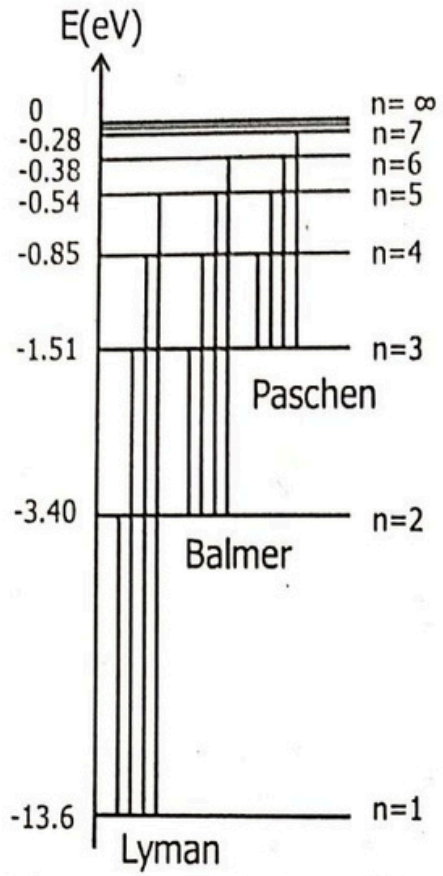

Figure show that the radiation of least wavelength (maximum energy and frequency) is emitted when electron jumps from 2nd orbit to 1st orbit.

73. In an electronic transition the maximum energy photon can be emitted in x–ray region. γ–rays can only be emitted in nuclear transition.

74. $E_n = -\frac{Eo}{n2}$

$E_4 = -\frac{Eo}{16} = -\frac{13.6}{16}\ eV = -0.85\ eV$

75. Lyman series lies in ultra violet region.
Balmer series lies in visible region.
Paschen series lies in infra red region.
Brackett series lies in infra red region.
Pfund series lies in infra red region.

76. A line spectrum which consists of discrete lines corresponding to single wavelength or frequency of emitted or absorbed radiation is called discrete or line spectrum.

Example:

Atomic spectrum such as hydrogen spectrum

77. The wavelength of infrared radiation is greater than visible light. So, the radiation with wavelength greater than red light is infrared.

78. Bracket series is obtained when all transition of electron terminate on 4th orbit

79. If energy gap is maximum then energy required will also be maximum.

80. $h = 6.63 \times 10^{-34}$ Js

81. Photo electric current does not depend upon frequency of photon.

82. In photoelectric effect photons produce electrons. But in X-ray production electrons produce photons.

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83. Stopping potential $\propto$ f So, $V_o \propto \frac{1}{\lambda}$

84. Intensity $\propto \frac{1}{(distance)^2} \propto$ No of electrons

If distance from source becomes double then intensity of light and number of emitted electrons reduce to one fourth.

85. Stopping potential is applied to stop photoelectrons to vanish photo electric current.

86. As, $hf = \phi + (K.E)_{max} \Rightarrow hf = \phi + eV_o$ Hence $eV_o = hf - \phi$

So stopping potential depends upon incident frequency and work function of metal.

87. After the threshold frequency

$(K.E)_e \propto$ Frequency of incident light.

88. $\phi = hf_o \Rightarrow f_o = \frac{5(1.6\times10^{-19})}{6.63\times10^{-34}} \Rightarrow f_o = 1.2\times10^{15}\ Hz$

89. Intensity $\propto$ number of electrons

$K.E_{max} \propto f \propto \frac{1}{\lambda}$

90. Stopping potential is that negative potential for which photo electric current is zero.

91. No of electrons ejected $\propto$ intensity of light (No of photons)

92. As the frequency of the incident radiation increases, the kinetic energies of the emitted electron increase as well and therefore requires more repulsive force to be applied to stop them. Thus, the stopping potential increases.

The value of saturation current increases, as the intensity of the incident radiation, increases.

The value of stopping potential decreases, as the frequency decreases.

93. Since each incident photon ejects one photoelectron from a metal surface, therefore, the number of photoelectrons emitted depends on the number of photons falling on the metal surface, which in turn depends on the intensity on the incident light.

Hence, as the intensity increases, the number of photoelectrons ejected increases and hence photoelectric current increases.

94. As the frequency of the incident radiation increases, the potential required to stop the ejected electron (Stopping Potential) increases. Hence, $v_3 > v_2 > v_1$.

The stopping potential varies linearly with the frequency of the incident radiation.

95. Changing the intensity of incident radiation does not affect the stopping potential. As the intensity increases, the number of photoelectrons ejected increases. However, the maximum velocity attained by them remains independent of the intensity of the radiation. It only depends on the frequency of the incident radiation.

96. Kinetic energy of photo electrons does not depend upon intensity of light but it depends upon energy (frequency) of photons.

97. When the frequency of light is less than threshold frequency then no photo electron will be emitted hence photo electric current will be zero

98. Intensity $\propto$ No of electrons

99. I $\propto$ Intensity of incident light

100. $E_{incident} = \phi + K.E \Rightarrow \frac{1}{2}mv^2 = hf - \phi$

101. Here incident energy of photon < work function

So, photoelectric effect will not start.

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102. Photoelectric equation is

$$hf = hf_o + (K.E)_{max}$$

103. $$\phi = hf_o \Rightarrow W_o = hf_o = \frac{hc}{\lambda_o} \Rightarrow \boxed{W_o \propto \frac{1}{\lambda_o}}$$

104. In Pair Production, a proton with energy, greater than or equal to 1.02 MeV is required to create a pair of electron and positron. 1.02 MeV is the minimum required energy for their creation.

105. When a γ-ray Photon passes close to an atomic nucleus and it possesses energy greater than 1.02 MeV, the photon is converted into electron-positron pair. This is called pair production.

106. The rest mass energy for both electron and positron is 0.51 MeV. Therefore, the incident photon must have energy greater than or equal to 1.02 MeV.

107. We Know, in pair production momentum and energy is conserved.

By conserving energy, $E_{total} = E_e + E_P$

$4.1\ MeV = E_e + E_P$

Now, by conserving momentum in y-direction we get

$P_e - P_P = 0$

$P_e = P_P$

Hence, if momentum is same the energy should be same

Therefore, $4.1\ MeV = 2E_e$

$E_e = 2.05\ MeV.$

108.

$$f \propto \left(\frac{1}{p^2} - \frac{1}{n^2}\right)$$

$$f_{2\to3} \propto \left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5}{36}$$

$$f_{3\to8} \propto \left(\frac{1}{3^2} - \frac{1}{8^2}\right) = \frac{55}{64\times9}$$

109.

$$\lambda_{min} = \frac{p^2}{R} = \frac{1}{4} = 920\,\mathring{A}$$

$$\lambda'_{min} = \frac{p^2}{R} = \frac{2^2}{4} = 4\left(\frac{1}{4}\right) = 4\times920\,\mathring{A}$$

110.

$$\frac{\lambda_{max}}{\lambda_{min}} = \frac{n^2}{n^2 - p^2} = \frac{5^2}{5^2 - 4^2} = \frac{25}{9}$$

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BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. **Inertial frame of reference is one which satisfies**
   A. Newton's Theory
   B. Einstein Theory
   C. Hertz Theory
   D. Special theory of relativity

2. **Non-inertial frame of reference has**
   A. Zero acceleration
   B. Zero velocity
   C. Uniform velocity
   D. Variable velocity

3. **If the source of light is moving towards the observer, then the speed of light received by the observer will be**
   A. Decreased
   B. Increased
   C. Remain same
   D. Maximum

4. **The relativistic length of an moving object will be**
   A. Remain same
   B. Decreased
   C. Increased
   D. Doubled

5. **If the rest mass of a particle is zero, then its speed is**
   A. Equal to speed light
   B. Less than speed of light
   C. Greater than speed of light
   D. Not comparable with speed of light

6. **Blackbody radiation depends upon**
   A. Pressure
   B. Volume
   C. Temperature
   D. Density

7. **If the temperature of black body is doubled then the emitted energy from it will be increased**
   A. Doubled
   B. Four time
   C. Eight time
   D. Sixteen time

8. **The dimension of a Planck's constant is**
   A. $[MLT^{-1}]$
   B. $[ML^2T^{-1}]$
   C. $[ML^2T^{-2}]$
   D. $[ML^2T^2]$

9. **Who did observe 1st time the photoelectric effect?**
   A. Maxwell
   B. Hertz
   C. Einstein
   D. Heisenberg

10. **Photo electric effect depends upon the photon's**
    A. Pressure
    B. Temperature
    C. Intensity
    D. Frequency

11. **A photon can transfer its energy into an electron, it was first explained by**
    A. Maxwell
    B. Hertz
    C. Einstein
    D. Bohr

12. **The momentum of a photon is**
    A. mv
    B. mc
    C. hf
    D. $\frac{hf}{c}$

13. **A change in energy of a photon occurs when it collides with an electron at rest is known as**
    A. Photoelectric effect
    B. Compton effect
    C. Pair conduction
    D. Annihilation

14. Which phenomenon does not verify the particle nature of light

A. Photoelectric effect
B. Compton effect
C. Pair production
D. Diffraction

15. The antiparticle of electron is

A. Neutron
B. Proton
C. Photon
D. Positron

16. Davisson and Germer proved experimentally the wave nature of particle under the phenomenon of

A. Reflection
B. Refraction
C. Interference
D. Diffraction

17. In the electron position pair production, the speed of electron is

A. Zero
B. Less than speed of positron
C. Equals to speed of positron
D. Greater than speed of positron

18. The energy of the used light is high, then the momentum of the investigated particle has

A. Less uncertainty
B. High uncertainty
C. High accuracy
D. Equal uncertainty

19. For small uncertainty in the measurement of position of a particle, the wavelength of the incident light should be

A. Small
B. Large
C. Average
D. Does not depend of wavelength

ANSWER KEY

1	A	6	C	11	C	16	D
2	D	7	D	12	D	17	C
3	C	8	B	13	B	18	B
4	B	9	B	14	D	19	A
5	A	10	D	15	D		

$mc\,c = hf$

$pc = hf$

$pc = E$

$p = \frac{E}{c}$

$\frac{h}{\lambda} = \frac{E}{c}$

$\lambda E = \text{constant}$

$\lambda = \frac{h}{\sqrt{2mk \cdot E}}$

KPK TEXT BOOK EXERCISE MCQs

1. **If the K.E of a free electron doubles, its de Broglie wavelength changes by the factor.**

A. $\sqrt{2}$ C. $\frac{1}{\sqrt{2}}$

B. 2 D. $\frac{1}{2}$

2. **Einstein's Photoelectric equation is $K_k = hf - \phi$ in this equation E_k refers to:**

A. K.E of all the emitted electrons C. Maximum K.E of emitted electron

B. Mean K.E of emitted electrons D. Minimum K.E of emitted electrons

3. **De-Broglie waves are associated with:**

A. Moving charged particles only C. All moving particles

B. Moving neutral particles only D. All particles whether in motion or at rest

4. **A perfect absorber must also be perfect:**

A. Cavity C. Source of radiation

B. Radiator D. None of them

5. **Pair production occurs only when energy of photon is at least equal to:**

A. 1.02 keV C. 1.02 eV

B. 1.02 MeV D. 1.02 GeV

6. **Pair production cannot take place in vacuum because:**

A. Mass is not conserved C. Momentum is not conserved

B. Energy is not conserved D. Charge is not conserved

7. **The positron has charge which is in magnitude equal to the charge on:**

A. Electron C. Proton

B. β–particle D. All

8. **We can never accurately describes all aspects of subatomic particles simultaneously. It is correct according to**

A. Uncertainty Principle C. De–Broglie Theory

B. Einstein Theory D. Photo electric effect

9. **An electron microscope employs which to one of the following principles?**

A. Electron have a wave nature

B. Electrons can be focused by an electric filed

C. Electrons can be focused by a magnetic field

D. All of the above

ATOMIC SPECTRA

10. **If 13.6eV energy is required to ionize the hydrogen atom, then the required energy to remove an electron from n = 2 is:**

A. 10.2eV C. 0 eV

B. 3.4 eV D. 6.8 eV

11. **For an atom of hydrogen atom the radius of the first orbit is given by,**

A. $\frac{h}{me^2}$ C. $\frac{me}{4h^2}$

B. $\frac{h^2}{4\pi^2 kme^2}$ D. h^2m^2

12. **The Balmer series is obtained when all the transition of electrons terminate on:**

A. 1st orbit C. 2nd orbit

B. 3rd orbit D. 4th orbit

13. In accordance with Bohr's theory the K.E of the electron is equal to:

A. $\frac{1}{2}\frac{Ze^2}{r}$ C. $\frac{Ze^2}{r}$

B. $\frac{Ze^2}{r^2}$ D. $\frac{1}{2}\frac{Ze^2}{r^2}$

14. According to Bohr's theory the radius of quantized orbit is given by:

A. $\frac{4\pi^2 m}{n^2h^2Ze^2}$ C. $\frac{n^2h^2}{4\pi^2 mZe^2}$

B. $\frac{4\pi^2 mZe^2k}{n^2h^2}$ D. $\frac{n^2h^2Ze^2}{4\pi^2 m}$

15. In the Bohr's model of the hydrogen atom, the lowest orbit corresponds to:

A. Infinite energy C. Maximum energy

B. Minimum energy D. Zero energy

16. When an electron in an atom goes from a lower to higher orbit its:

A. K.E increases, P.E decreases C. K.E increase, P.E increases

B. K.E decreases, P.E increases D. K.E decrease, P.E decreases

17. Frequency of X-rays depends upon:

A. Number of electrons striking target C. Accelerating potential

B. Nature of the target D. both b and c

18. Target material used in X-rays tube must have following properties.

A. High atomic number and high melting point

B. High atomic number and low melting point

C. Low atomic number and low melting point

D. Coherent beam of light

19. Laser is a device which can produce:

A. Intense beam of light C. Coherent beam of light

B. Monochromatic beam of light D. All of the above

ANSWER KEY

1	C	6	C	11	B	16	B
2	C	7	D	12	C	17	D
3	A	8	A	13	A	18	A
4	B	9	D	14	C	19	D
5	B	10	B	15	B		

PAST PAPERS 2008-2020

1. **For atomic hydrogen spectrum, which of the following series lies in visible region of electromagnetism spectrum?** **(UHS 2008)**
   A. Lyman series
   B. Paschen series
   C. Balmer series
   D. Bohr series

2. **Cesium coated oxidized silver emits electrons for ____ light.** **(UHS 2008)**
   A. Infrared
   B. Ultraviolet
   C. Visible
   D. Green

3. **In photoelectric effect removal of photons is observed at _____ energies. (UHS 2008)**
   A. Low
   B. High
   C. Intermediate
   D. Both A. and C.

4. **Einstein's photoelectric equation is given by:** **(UHS 2009)**
   A. $hf - \phi = \frac{1}{2} mv^2$
   B. $E = mc^2$
   C. $E = hc^2$
   D. $hf = \frac{1}{2} mv^2$

5. **If a particle of mass 5.0 mg moves with the speed of 8.0 m/s, then the de-Broglie's wavelength will be:** **(UHS 2009)**
   A. 1.68×10^{-27} m
   B. 1.70×10^{-25} m
   C. 1.65×10^{-29} m
   D. 1.66×10^{-29} m

6. **Speed of electron in the first hydrogen orbit is:** **(UHS 2010)**
   A. 2.19×10^6 m/s
   B. 2.5×10^6 m/s
   C. 2.2×10^6 m/s
   D. 3×10^6 m/s

7. **The minimum frequency below which no electrons are emitted in photoelectric effect is called:** **(UHS 2010)**
   A. Threshold frequency
   B. Low frequency
   C. High Frequency
   D. Resonance frequency

8. **Wavelength of X-rays is of the order of:** **(UHS 2011)**
   A. 10^{-6} m
   B. 10^{-10} m
   C. 10^{-13} m
   D. 100 m

9. **When electrons lose all of their kinetic energy in the first collision, the entire kinetic energy appears as an X-ray photon of energy:** **(UHS 2011)**
   A. K.E = eV
   B. $K.E = \frac{h\lambda min}{c}$
   C. $K.E = \frac{hc}{\lambda min}$
   D. $K.E = \frac{h}{\lambda min}$

10. **The characteristics X-rays spectrum is due to:** **(UHS 2011)**
    A. The absorption of neutrons by target material
    B. The bombardment of target material by protons
    C. The bombardment of target material by electrons
    D. The bombardment of target material by alpha = particles

11. **The kinetic energy K.E. with which the electron strikes the target is given by:** **(UHS 2012)**
    A. $K.E. = e^2V$
    B. $K.E. = hc/2$
    C. $K.E. = hf^2$
    D. K.E. = eV

12. **X-rays can be produced by bombardment of _____ on target metal: (UHS 2012)**
A. Protons
B. Electrons
C. Neutron
D. Alpha particles

13. **If an electron in the "K" shell is removed and an electron from "L" shell jumps to occupy the hole in the "K" shell, it emits a photon of energy. (UHS 2012)**
A. $hf_{K\alpha} = E_L - E_K$
B. $hc = E_L - E_K$
C. $h/\lambda_{K\alpha} = E_L - E_K$
D. $hf_{\beta K} = E_L - E_K$

14. **Which of the following property must be there in a substance so that it can be used as target in X-ray tube? (UHS 2012)**
A. It must have low melting point
B. It must have low atomic number
C. It must have high reflecting ability
D. It must have high atomic number

15. **X-rays from a given X-ray tube operating under specified conditions have a minimum wavelength. The value of this minimum wavelength could be reduced by: (UHS 2013)**
A. Cooling the target
B. Increasing the potential different between the cathode and the target
C. Reducing the temperature of the filament
D. Reducing the pressure in the tube

16. **What is the type of characteristics X-ray photon whose energy is given by relation "$hf = E_M - E_K$"? (UHS 2013)**
A. K-alpha
B. M-alpha
C. K-beta
D. M-beta

17. **Kinetics energy of electrons by applying potential difference V_1 across the X-ray tube is KE_1 while V_2 potential difference produces kinetic energy equal to KE_2. What will be value of $KE_1 : KE_2$ if ratio of potential difference $V_1:V_2 = 2:3$? (UHS 2013)**
A. 3:2
B. 4:9
C. 9:4
D. 2:3

18. **What will be the relation for the speed of electron accelerated towards the target in X-ray tube by applying potential difference "V"; take mass of electron 'm' and charge on electron "e"? (UHS 2013,2015)**
A. $v = \sqrt{\frac{2Ve}{m}}$
B. $v = \sqrt{\frac{2me}{V}}$
C. $v = \sqrt{\frac{2V}{me}}$
D. $v = \sqrt{2meV}$

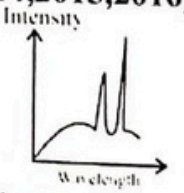
19. **For what CAT stands in X-rays technology? (UHS 2013)**
A. Capacitor amplifier transistor
B. Computerized axial tomography
C. Cathode anode technique
D. Current amplification technology

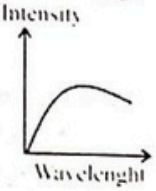
20. **Bones absorb greater amount of incident X-rays than flesh. This is because of the fact that: (UHS 2014)**
A. Bones lie between the flesh
B. Bones are light in colour
C. Bones contain material of low densities
D. Bones contain material of high densities

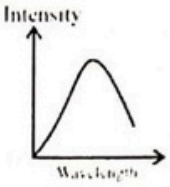
21. **Which of the following technique is the practical application of X-rays? (UHS 2014)**

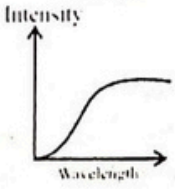
A. Magnetic resonance imaging
B. Ultrasonography
C. Computerized axial tomography
D. Positron emission tomography

22. **Which of the following spectra is most typical of the output of an X-ray tube? (UHS 2014,2015,2016)**

A. 

B. 

C. 

D. 

23. **What will be the energy of accelerated electron used to produce x-rays accelerating potential is 2 kV? (UHS 2014)**

A. 2×10^{10} J
B. 1.6×10^{19} J
C. 3.2×10^{-16} J
D. 3.2×10^{18} J

24. **In the case when the electrons lose all their kinetic energy (K.E) in the first collision, the X-ray photon emitted has which of the following set of frequency and wavelength? (UHS 2015)**

A. f_{max}, λ_{min}
B. f_{max}, λ_{max}
C. f_{min}, λ_{max}
D. f_{min}, λ_{min}

25. **The potential difference between target and cathode of an X-rays tube is 20 kV and current is 20 mA. What is the λ_{min} of the emitted X-ray? (UHS 2015)**

A. 6.19×10^{-4} m
B. 6.19×10^{-14} m
C. 6.19×10^{-11} m
D. 6.19×10^{-19} m

26. **In X-ray tube, electrons after being accelerated through velocity 'v' strike the target, then the wavelength of emitted X-rays is: (UHS 2015)**

A. Not greater than $\frac{hc}{eV}$
B. Not less than $\frac{hc}{eV}$
C. Equal to the $\frac{h}{mv}$
D. equal to $\frac{hc}{eV}$

27. **The shadow of the bones in X-rays photographic film appears lighter than the surrounding flesh due to: (UHS 2016)**

A. Bones reflect greater amount of X-rays .
B. Bones absorb greater amount of X-rays
C. Bones absorb less amount of X-rays
D. Bones totally reflect X-rays

28. **The atom is excited to an energy level E_i from its ground state energy level E_o the wavelength of the radiations emitted is: (UHS 2016)**

A. $\frac{Eo-Ei}{hc}$
B. $\frac{Ei-Eo}{hc}$
C. $\frac{hc}{Ei-Eo}$
D. $\frac{Ei}{hc}-\frac{Eo}{hc}$

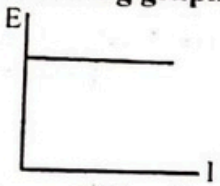
29. **The target of X-ray tube is made of which metal?** **(UHS 2016)**
A. Iron C. Brass
B. Nickel D. Tungsten

30. **The X-rays consist of:** **(UHS 2016)**
A. High energy proton C. High energy γ-rays
B. High energy electrons D. High energy photon

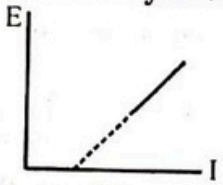
31. **The continuous spectrum of X-ray is formed due to:** **(UHS 2016)**
A. Characteristics of X-ray C. Soft X-ray
B. Bremsstrahlung X-ray D. Hard X-ray

32. **The frequency of a photon having a momentum of 4.42×10^{-26} Ns is:** **(UHS 2017)**
A. 2×10^{14} Hz C. 5×10^{16} Hz
B. 2×10^{16} Hz D. 2×10^{18} Hz

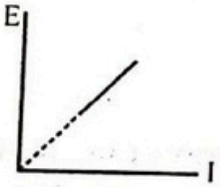
33. **The maximum kinetic energy "E" of photoelectrons ejected by light of a certain wavelength from a metal is measured as function of the intensity "I" of the light. Which one of the following graphs represents the way in which "E" depends on "I"?** **(UHS 2017)**



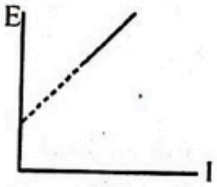
(A)



(C)



(B)



(D)

34. **The momentum of wave of wavelength 1.32×10^{-9} m is:** **(UHS 2017)**
A. 5×10^{-26} Ns C. 5×10^{-43} Ns
B. 5×10^{-25} Ns D. 5×10^{-44} Ns

35. **Ionization energy of hydrogen atom is equal to:** **(UHS 2017)**
A. 13.6 eV C. 0.85 eV
B. 0.54 eV D. 3.39 eV

36. **A 5 watt LED bulb converts 80% of the power into light photons of wavelength 660 nm. What is the number of photons emitted from the bulb in one second?** **(UHS 2018)**
A. 1.3×10^{19} C. 6.6×10^{7}
B. 5.8×10^{34} D. 7.5×10^{18}

37. **Light photons, each of energy 3.5×10^{-19} J falls on a cathode of photocell. The current through the cell is reduced to zero by taking the cathode to a potential + 0.25 V relative to anode. The work function of the cathode is** **(UHS 2018)**
A. 3.5×10^{-19} J C. 3.25×10^{-19} J
B. 3.1×10^{-19} J D. 3.35×10^{-19} J

38. **The de-Broglie wavelength of an electron travelling with a speed of 1.0×10^{7} m/s is equal to, ($h = 6.6 \times 10^{-34}$ J s and $m_e = 9.1 \times 10^{-31}$ kg)** **(UHS 2018)**
A. 7.3×10^{8} m C. 7.3×10^{-11} m
B. 7.3×10^{-13} m D. 7.3×10^{11} m

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39. In photo-emission from a metal, if light of "λ" is replaced by light of wavelength "λ/4", the maximum kinetic energy of photo-electrons: (UHS 2019)

A. Increase by an amount equal to the work function of the metal
B. Decrease by an amount equal to half of an incident photon of wavelength "λ"
C. Decrease by an amount equal to the energy of an incident photon of wavelength "λ"
D. Increase by an amount equal to four times energy of an incident photon of wavelength "λ"

40. Minimum energy required to eject an electron from metal surface is called: (UHS 2019)

A. Work function
B. Stopping potential
C. Threshold frequency
D. Electromotive force

41. The value and units of the Plank constant "h" can be expressed as: (UHS 2019)

A. 6.63×10^{-34} J s^{-1}
B. 6.63×10^{-43} J s
C. 6.63×10^{-34} J s
D. 3.63×10^{-34} J s

42. Calculate the energy of photon of frequency 3.0×10^{18} Hz. ($h = 6.63 \times 10^{-34}$ J s) (UHS 2019)

A. 19.89×10^{-18} J
B. 1.89×10^{-16} J
C. 11.89×10^{-16} J
D. 19.89×10^{-16} J

43. Which of the following series lies in ultraviolet region? (PMC 2020)

A. Balmer Series
B. Pascher Series
C. Lyman Series
D. Bracket Series

44. The main difference between X-Rays and γ-Rays is: (PMC 2020)

A. Frequency
B. Wave Length
C. Energy
D. Origin

ANSWER KEY

1	C	6	A	11	D	16	C	21	C	26	D	31	B	36	A	41	C
2	A	7	A	12	C	17	D	22	A	27	B	32	B	37	A	42	B
3	A	8	B	13	A	18	A	23	C	28	C	33	A	38	C	43	C
4	A	9	C	14	D	19	B	24	A	29	D	34	B	39	D	44	D
5	D	10	C	15	B	20	D	25	C	30	D	35	A	40	A		

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SOLUTION

1. Balmer series lies in visible region.

$$\frac{1}{\lambda} = R_H\left(\frac{1}{22} - \frac{1}{n2}\right) \qquad \text{Where } n = 3,4,5,\ldots$$

2. Sodium or potassium cathode emits electrons for visible light. Cesium coated oxidized silver emits electrons for infrared light and some other metals respond to ultraviolet radiations.
3. Photoelectric effect is observed with photons of low energies. (IR, Visible and UV radiations)
4. $hf = \phi + \frac{1}{2}mv^2 \Rightarrow hf - \phi = \frac{1}{2}mv^2$
5. $\lambda = \frac{h}{mv}$

$$= \frac{6.63\times10-34}{(5\times10-6)(8)} = \frac{6.63\times10-34}{(4\times10-5)} = 1.66 \times 10^{-29}\ \text{m}$$

6. $v_n = \frac{2\pi ke2}{nh} \Rightarrow v_1 = \frac{2\pi ke2}{h} = 2.19 \times 10^6\ \text{m/s}$
7. The minimum frequency below which no electrons are emitted however intense the light maybe. This minimum frequency is called threshold frequency.
8. Wavelength of X-rays is of the order of 10^{-10} m or 1A°.
9. $K.E = hf_{max} = \frac{hc}{\lambda min}$
10. When fast moving electrons are bombarded on the target material, they knocked out the electrons of inner most electrons. Due to this inner shell transition X-rays are produced which are known as characteristics.
11. The electrons accelerated with potential difference "V" having K.E is K.E = Ve
12. X-rays (characteristics as well as bremsstrahlung) are produced by the bombardment of electrons on the target material.
13. The electron from the L-shell jumps to occupy the hole in the K-shell, thereby emitting a photon of energy $hf_{K\alpha}$ called K_α x-ray given by $hf_{K\alpha} = E_L - E_K$
14. In heavy atoms the inner shell electrons are tightly bound and large amount of energy is required for their displacement from their normal energy levels. After excitation, when an atom returns to its normal state, photons of large energy are emitted (X-rays).
15. $K.E = hf_{max} = \frac{hc}{\lambda min} = Ve$

$$\lambda_{min} = \frac{hc}{Ve} \Rightarrow \lambda_{min} \propto \frac{1}{V}$$

16. The electron from M-shell might also jump to occupy the hole in the K-shell. The photons emitted are K_β X-rays with energies $hf_{K\beta} = E_M - E_K$
17. $K.E = Ve \Rightarrow K.E \propto V$

$K.E_1 : K.E_2 = 2:3$

18. $K.E = \frac{1}{2}mv^2 = Ve \Rightarrow v^2 = \frac{2Ve}{m} \Rightarrow v = \sqrt{\frac{2Ve}{m}}$
19. CAT (computerized axial tomography)

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20. Shadow of bones appears lighter than the surrounding flesh, it is due to the fact that bones contain greater proportions of elements with high atomic number and so they absorb greater amount of incident X-rays than flesh.

21. CAT (computerized axial tomography).

22. Graph A. is the best representation of X-rays which shows both characteristic and continuous X-rays.

23. $K.E = Ve = (2000)(1.6 \times 10^{-19}) = 3.2 \times 10^{-16}\ J$

24. When electron losses its whole energy in 1st collision, then X-ray photon of maximum energy (maximum frequency and minimum wavelength) is emitted. $K.E = hf_{max} = \frac{hc}{\lambda min}$

25. $K.E = hf_{max} = \frac{hc}{\lambda min} = Ve$

$$\lambda_{min} = \frac{hc}{Ve} = \frac{hc/e}{V} = \frac{1240\times10-9}{20\times103} = 6.2\times10^{-11}\ m$$

26. $K.E = hf_{max} = \frac{hc}{\lambda min} = Ve$

$$\lambda_{min} = \frac{hc}{Ve}$$

27. Shadow of bones appears lighter than the surrounding flesh, it is due to the fact that bones contain greater proportions of elements with high atomic number and so they absorb greater amount of incident X-rays than flesh.

28. $\Delta E = E_f - E_i = E_i - E_o \Rightarrow \frac{hc}{\lambda} = E_i - E_o$

$$\lambda = \frac{hc}{Ei - Eo}$$

29. The target of X-ray tube is made of tungsten because it has high atomic number and high melting point.

30. X-rays are the electromagnetic radiations of high energy, frequency and very small wavelength.

31. The continuous X-rays spectrum is due to the effect known as bremsstrahlung or braking radiation. In which fast moving electrons are strongly decelerated on impacting the target.

32. $E = pc \Rightarrow hf = pc$

$$f = \frac{pc}{h} = \frac{(4.42\times1026)(3\times108)}{(6.63\times10-34)} = 2\times10^{16}\ Hz$$

33. As the energy of photo electron depends upon frequency not the intensity of incident light. So, energy remains same with the variation of intensity of light.

34. $p = \frac{h}{\lambda} = \frac{6.63\times10-34}{1.32\times10-9} = 5\times10^{-25}\ Ns$

35. $E_{ion} = \frac{2\pi2k2e4m}{h2}$

$$= \frac{2\pi2(9\times109)2(1.6\times10-19)4(9.1\times10-31)}{(6.63\times10\ \ 34)2} = 13.6\ eV$$

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36. As LED converts 80% of rated power into light. So, energy radiated per second is 4 J.

$$E = \frac{nhc}{\lambda} \quad \Rightarrow n = \frac{E\lambda}{hc} = \frac{(4)(660\times10-9)}{(6.6\times10-34)(3\times108)}$$

$$= 1.3 \times 10^{19}$$

37. $E = \phi + K.E_{max} = \phi + Ve \Rightarrow \phi = E - Ve$

$\phi = 3.5 \times10^{-19} - (0.25)(1.6\times10^{-19})$

$\phi = 3.5 \times10^{-19} - 0.4\times10^{-19} = 3.1 \times 10^{-19}$ J

38. $\lambda = \frac{h}{mv} = \frac{6.6\times10-34}{(9.1\times10-31)(1\times107)} = 7.3 \times 10^{-11}$ m

39. The kinetic energy of photo-electrons increases by increasing the frequency of incident light. When "λ" becomes one fourth (λ/4), then frequency becomes 4 times (4f). so, the kinetic energy becomes 4 times.

40. The minimum amount of energy required to eject electron from the metal surface is called work function.

41. $h = 6.63 \times 10^{-34}$ J s

42. $E = hf = (6.63 \times 10^{-34})(3 \times 10^{18}) = 19.89 \times 10^{-16}$ J

43. Lyman series lies in UV region

44. X-rays are produced due to inner shell transition and γ-rays are produced due to de-excitation of the nucleus.

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PMC PAST PAPERS 2022

Q.1 **He-Ne laser light has wavelength of:**
A. RED
B. YELLOW
C. BLUE
D. ORANGE

Q.2 **The linear momentum of a 3 MeV photon is:**
A. 0.01eV s m−1
B. 0.01eV s m−1
C. 0.03eV s m−1
D. 0.04eV s m−1

Q.3 **What is the frequency of a photon whose energy is 66.3 eV**
A. 12.6×10^6 Hz
B. 19.6×10^6 Hz
C. 1.6×10^{16} Hz
D. 81.6×10^6 Hz

Q.4 **In annihilation process..... are produced:**
A. Positron
B. Photons
C. Electrons
D. B & C are correct

Q.5 **Platinum wire becomes yellow at a temperature of _____ degree C.**
A. 900
B. 500
C. 1300
D. 1600

Q.6 **Numbers of photo electrons emitted from metal depends upon:**
A. Intensity of incident light
B. Energy of incident light
C. Wavelength of incident light
D. None of these

Q.7 **If two photons interact in same direction what will change**
A. Mass
B. Energy
C. Intensity
D. None of these

Q.8 **In pair production..... are produced:**
A. positron & electron
B. Photons
C. Electron & neutron
D. B & C are correct

Q.9 **Wave nature and particle nature of photon is linked by:**
A. Rest mass of photon
B. Wavelength of photon
C. Light speed
D. Momentum of photon

Q.10 **The photon is the particle, which has:**
A. Infinite rest mass
B. Rest mass but no charge
C. No rest mass & no charge
D. A & C are correct

Q.11 **Which is incorrect for photon**
A. $P = h/\lambda$
B. $E = hv$
C. $E = h\lambda$
D. $E = hc/\lambda$

Q.12 **What is the relation between mass and energy?**
A. $E = Mc^2$
B. $E = C/m^2$
C. $E = M^2C$
D. None

Q.13 **Rest mass of electron is**
A. 9.1×10^{11}kg
B. zero
C. 1.62×10^{-19}kg
D. None

Q.14 **Compton shift is maximum at**
A. 90°
B. 0°
C. 180°
D. None

Q.15 **The Light we are seeing is**
A. Visible
B. Infrared
C. Ultraviolet
D. None

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Q.16 Electron Microscope produce

A. 20 image B. 3D image
C. HD image D. None

Q.17 If velocity Becomes 5 times, what happened to De Broglie Wavelength

A. Decrease by 5 times B. Increase by 5 times
C. both D. None

Q.18 Which one of the following radiations has the strongest photon?

A. T.V waves B. Microwaves
C. X-rays D. γ-rays

Q.19 The linear momentum of a photon is

A. Zero B. Hv/c^2
C. Hv/c D. c^2/hv

Q.20 The linear momentum of an X-ray photon of wavelength 0.1A is

A. 6.625×10^{-23}N-s B. 66.25×10^{-23}N-s
C. 662.5×10^{-23}N-s D. Data is insufficient

Q.21 If a material object moves with speed of light its mass becomes

A. Equal to its rest mass B. Double of its rest mass
C. Infinite D. Zero

Q.22 A photon is

A. A unit of energy B. A positively charged particle
C. A quantum of electromagnetic radiation D. A unit of wavelength

Q.23 In an electron microscope, we use energetic particles because of

A. Penetrating power is high B. Kinetic energy is large
C. Wavelength is very short D. All the above reasons

Q.24 The energy radiated is directly proportional to the fourth power of Kelvins temperature is

A. Karl-Weins law B. Rayleigh-Jeans law
C. Stephens law D. Plancks

Q.25 Which photon is more energetic: A red one or a violet one?

A. Both B. Red
C. Violet D. Neither

Q.26 Which theory of light is wave theory or particle theory?

A. Dynamic physics B. Static physics
C. Quantum mechanics D. de – Broglie hypothesis

Q.27 What type of nature do electromagnetic waves have?

A. Dual nature B. Wave nature
C. Particle nature D. Photon nature

Q.28 Identify the de – Broglie expression from the following.

A. $\lambda=h\times p$ B. $\lambda=h/p$
C. $\lambda=h+p$ D. $\lambda=h-p$

Q.29 Photocell is a device to

A. Store photons
B. Measure light intensity
C. Convert photon energy into mechanical energy
D. Store electrical energy for replacing storage batteries

Q.30 Photons are deflected by

A. electric field only B. magnetic field only
C. electromagnetic field D. None of these

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Q.31 Electrically, photons are
A. positively charged
B. negatively charged
C. neutral
D. strongly charged, may be positive or negative

Q.32 Which of the following shows particle nature of light?
A. Refraction
B. Interference
C. Polarization
D. Photoelectric effect

Q.33 The maximum value of photoelectric current is called
A. base current
B. saturation current
C. collector current
D. emitter current

Q.34 Which phenomenon best supports the theory that matter has a wave nature?
A. Electron momentum
B. Electron diffraction
C. Photon momentum
D. Photon diffraction

Q.35 A photon will have less energy, if its
A. amplitude is higher
B. frequency is higher
C. wavelength is longer
D. wavelength is shorter

Q.36 The mass of a moving photon is:
A. hv/c^2
B. hv/c
C. hv
D. zero

Q.37 The wavelength of de Broglie waves is independent of:
A. charge
B. momentum
C. velocity
D. mass

Q.38 The fast-moving light photons are
A. alpha radiation
B. gamma radiation
C. beta radiations
D. no radiations

Q.39 Photon is made up _____ quarks
A. Basons
B. no quark
C. quarks in hadrons
D. masons

Q.40 Electrons are accelerated in electron microscope to produce
A. X-rays
B. β -rays
C. High resolution image
D. None

Q.41 Black body radiation light
A. emit
B. absorbed
C. Both
D. None

Q.42 Find De-Broglie wave wavelength if mass of 150g and velocity is 50m/s
A. 3.1×10^{-38} m
B. 8.81×10^{-35} m
C. 4.41×10^{-34} m
D. 3.31×10^{-38} m

Q.43 Planck's constant was named after scientist
A. Planck
B. Maxwell
C. Einstein
D. None

Q.44 What is the de Broglie wavelength associated with an electron, accelerated through a potential difference of 200 volts?
A. 1nm
B. 0.5nm
C. 0.0056 nm
D. 0.086 nm

Q.45 Black body radiations are:
A. Infrared and visible light rays
B. All radiations
C. Visible light and ultraviolet rays
D. Ultraviolet and X-rays

Q.46 Planck's constant is analogous to:
A. Inertia
B. Wave nature
C. Angular momentum
D. Linear momentum

Q.47 Photocell is similar to
A. Photoelectric effect
B. Compton effect
C. Photoluminescence
D. None of these

Q.48 Where does the energy lost by fast moving electron goes:
A. Appears as photon
B. Appears as electron - positron pair
C. Appears as its K.E.
D. It vanishes

Q.49 Range of wavelength of visible light is:
A. 700°A - 1000°A
B. 1nm - 100nm
C. 0.1nm - 1nm
D. 4000°A - 7000°A

Q.50 The frequency of the incident photon after compton effect will:
A. Remain constant
B. Increases
C. Decreases
D. None of these

Q.51 The electron is purely a ____ when free
A. particle nature
B. wave nature
C. dual nature
D. it transform to photon

Q.52 Which of the following statements is incorrect about the photons:
A. Momentum of photon h/λ
B. Rest mass of photon is zero
C. Photon exert no pressure
D. Energy of photon is $h\nu$

Q.53 In Compton scattering process, wavelength of scattered X-rays:
A. Remains same
B. Increases
C. Decreases
D. None of these

Q.54 What will be the de – Broglie wavelength when the kinetic energy of the electron increases by 5 times?
A. $\sqrt{5}$
B. 5
C. $1/\sqrt{5}$
D. $1/5$

Q.55 According to Planck's quantum theory:
A. a body emits energy in quanta
B. a body absorb quanta energy in quanta
C. emits or absorb radiations discontinuously
D. All of these

Q.56 By Wein's constant, the wavelength and temperature Are related.
A. inversely
B. directly
C. equal
D. None

Q.57 If wavelength = 500 nm of a photon, then its frequency is:
A. 5×10^{14} Hz
B. 6×10^{14} Hz
C. 7×10^{14} Hz
D. 8×10^{14} Hz

Q.58 Photoelectric effect is not given by
A. X-rays
B. Gamma
C. Beta
D. All

Q.59 Wave nature of electron resemble with
A. Alpha
B. beta
C. gamma
D. x-rays

Q.60 When electron and positron combine
A. Annihilation occurs
B. Pair production
C. Photoelectric effect
D. None

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Q.61 Find E in eV "Photon Wavelength was given 1440nm"
A. 0.867 eV
B. 18.67 eV
C. 9.32 eV
D. 0.932 eV

Q.62 Einstein was awarded Nobel prize:
A. Photoelectric effect
B. Compton effect
C. Pair production
D. None

Q.63 Which rays has highest mass
A. Alpha rays
B. Beta rays
C. Gamma rays
D. None of these

Q.64 Which of the following blocks will release heat fast
A. rough white surface
B. polished white surface
C. rough black surface
D. polished black surface

Q.65 Which color of heat shows highest temperature
A. red
B. blue
C. black
D. orange

Q.66 Which light has more velocity
A. He-Ne laser
B. white
C. yellow
D. all are equal

Q.67 Blackbody shows a _____ spectra.
A. continuous
B. discrete
C. both a) and b)
D. None of these

Q.68 Which rays are lasers?
A. x-rays
B. beta rays
C. gamma rays
D. coherent photons

Q.69 The value of Rydberg constant varies with atomic number as
A. Z^3
B. $1/Z^2$
C. Z^2
D. Z

Q.70 LED TV produce ____ radiation
A. alpha
B. beta
C. gamma
D. none of these

Q.71 Atomic spectra is a _____ spectra
A. continuous
B. discrete
C. both a) and b)
D. None of these

Q.72 The wavelength of beta rays is measured by
A. interference
B. polarization
C. absorption
D. diffraction

Q.73 Which of the following is the rapid process
A. conduction
B. radiation
C. convection
D. all of these

Q.74 The Davisson Germer experiment is used to explain
A. interference
B. polarization
C. diffraction
D. none of these

Q.75 x-rays are produced in _____ tube
A. Ar filled
B. He filled
C. H filled
D. Vacuum

Q.76 The speed of photons in vacuum is ___ than in liquid water
A. higher
B. smaller
C. equal
D. none of these

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Q.77 The star which is very hot will emit____ color
A. Blue B. red
C. orange D. orange

Q.78 Laser light is a type of
A. spontaneous B. stimulated
C. both a) and b) D. None of these

Q.79 The radiation reached on earth by sun is:
A. alpha B. beta
C. gamma D. all of these

Q.80 The spectrum of perfect black body is
A. line B. continuous
C. band D. all of these

Q.81 A body at temperature T radiates heat according to relation
A. T^2 B. T^4
C. T^{-4} D. none of these

Q.82 Which rays have highest charge
A. alpha B. beta
C. gamma D. none of these

Q.83 The good absorbers of heat normally are
A. poor conductor B. good conductor
C. poor reflector D. none of these

Q.84 Which of the constants is not related to radiation
A. Boltzmann B. planck
C. solar constant D. all of these

Q.85 UV radiation is formed by bombarding gas molecules with
A. electron B. protons
C. alpha rays D. any of these

Q.86 The frame of reference could be
A. fixed always B. not fixed always
C. at rest D. none of these

Q.87 What is the energy of a photon in a beam of infrared radiation of wavelength 1240 nm? Give your answer in eV.
A. 1 B. 6.25×10^{18}
C. 1.6×10^{-19} D. 3.6×10^{6}

Q.88 Joule - second is the unit of:
A. Energy B. Heat
C. Work D. Planck's constant

Q.89 Among the following four spectral regions, in which of them, the photon has the highest energy in?
A. Infrared B. Violet
C. Blue D. Ultraviolet

Q.90 Charge of photon is
A. 0 B. positive
C. negative D. positive/negative

Q.91 The wavelength of matter wave is independent of:
A. Mass B. Velocity
C. Kinetic energy D. Charge

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Q.92 Existence of photon was confirmed by:
A. Compton B. De-broglie
C. Einstein D. Max planck

Q.93 The photon when scattered from mirror its momentum becomes
A. Double B. Half
C. Remain same D. Zero

Q.94 From the following properties of a wave, the one that is independent of the other is its
A. Amplitude B. Frequency
C. Wavelength D. Time period

Q.95 Which among the following phenomenon shows particle nature of light?
A. Photoelectric effect B. Interference
C. Polarization D. Matter waves

Q.96 Calculate the energy of a photon of wavelength 6600 angstroms.
A. 0.3×10^{-19}J B. 3×10^{-19}J
C. 30×10^{-19}J D. 300×10^{-19}J

Q.97 Wave theory of light is unable to prove:
A. Black body radiation B. Photoelectric effect
C. Compton effect D. All of them

Q.98 Momentum of a photon is
A. 0 B. α
C. hf/c D. mv

Q.99 _____ is conserved in pair production
A. charge B. momentum
C. both a & B D. none of these

Q.100 The reverse process of pair production is known as :
A. Annihilation of matter B. Anti Pair production
C. Materialization of matter D. Annihilation of practical into its antiparticle

Q.101 Which source is associated with a line emission spectra?
A. Electric fibre B. Neon street sign
C. Red traffic light D. Sun

Q.102 x-rays are diffracted from:
A. mirror B. crystal
C. gas molecules D. all of these

Q.103 Which ray shows comparable penetrating power to x rays:
A. alpha B. beta
C. gamma D. white

Q.104 Lifetime of an excited state is:
A. 10^{-6}s B. 10^{-7}s
C. 10^{-8}s D. 10^{-3}s

Q.105 Solar spectra is a type of:
A. continuous B. discrete
C. both a) and b) D. None of these

Q.106 In ground state, high energy photons will be
A. reflected B. absorbed
C. transmitted D. any of these

Q.107 Spectra corresponding to sodium vapour lamp is
A. band spectra B. line spectra
C. emission spectra D. absorption spectra

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Q.108 The characteristic x-rays are formed due to bombardment of:
A. photon
B. proton
C. electron
D. none of these

Q.109 In Bohr's model electrons are revolving in a circular orbits around the nucleus called as
A. stationary orbits
B. non radiating orbits
C. Bohr's orbits
D. all of these

Q.110 The first spectral series was discovered by
A. Balmer
B. Lyman
C. Paschen
D. Pfund

Q.111 When electron jump into orbit 1 then series obtained is
A. Lyman
B. Paschen
C. Pfund
D. Brackett

Q.112 Atomic spectra is an example of?
A. line spectra
B. continuous spectra
C. band spectra
D. both a and b

Q.113 The energy of each orbit is
A. same
B. fixed
C. changes with time
D. none of the above

Q.114 Which is a non-central force?
A. Electrostatic force
B. Nuclear force
C. Gravitational force
D. Spring force.

Q.115 When an electron jumps from 3rd orbit to 2nd orbit, which series of spectral lines are obtained?
A. Balmer
B. Lyman
C. Paschen
D. Brackett

Q.116 The energy of electron in nth orbit of Hydrogen atom is
A. –0.0136 eV
B. –1.136 eV
C. 0.136 eV
D. None of these

Q.117 The white laser cannot be produced because
A. its is not coherent
B. it has low energy
C. it diffracts easily
D. all of these

Q.118 X-ray is the reverse process of:
A. Pair production
B. Compton effect
C. Photoelectric effect
D. A & B are correct

Q.119 Which light has more velocity
A. He-Ne laser
B. white
C. yellow
D. all of these

Q.120 Blackbody shows a _____ spectra.
A. continuous
B. discrete
C. both a) and b)
D. None of these

Q.121 Why x-rays are used in crystallography
A. to prevent interference
B. to prevent diffraction
C. to perform interference
D. to perform diffraction

Q.122 Which rays are lasers?
A. x-rays
B. beta rays
C. gamma rays
D. coherent photons

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Q.123 The value of Rydberg constant varies with atomic number as
A. Z^3 B. $1/Z^2$
C. Z^2 D. Z

Q.124 Atomic spectra is a
A. continuous B. discrete
C. both a) and b) D. None of these

Q.125 Coherent source of light means
A. multiple wavelength B. double wavelength
C. single wavelength D. coherent photons

Q.126 LASER is a
A. Stimulated emission B. Spontaneous emission
C. Both D. None

Q.127 Which rays are Used In LASAR?
A. electromagnetic Radiation B. α -rays
C. β -rays. D. None

Q.128 How many Hydrogens spectrum are there
A. 2 B. 3
C. 4 D. 5

Q.129 X- rays are produced from
A. Na B. H
C. He D. Cu

Q.130 Highest energy is in
A. Lyman series B. Ballmer series
C. Pascha series. D. bracket series

Q.131 In electron A Move in the energy level n = 1, While other electron Move in n = 3, What the ratio of electron Kinetic Energies A to B
A. 1 : 3 B. 9 : 1
C. 3 : 1 D. 1 : 9

Q.132 In a hydrogen atom, which of the following electronic transitions would involve the maximum energy change
A. n = 2 to n = 1 B. n = 3 to n = 1
C. n = 4 to n = 2 D. n = 3 to n = 2

Q.133 Hydrogen atom excites energy level from fundamental state to n = 3. Number of spectral lines according to Bohr, is
A. 4 B. 3
C. 1 D. 2

Q.134 The transition from the state n = 4 to n = 3 in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from
A. $2 \rightarrow 1$ B. $3 \rightarrow 2$
C. $4 \rightarrow 2$ D. $5 \rightarrow 4$

Q.135 Laser light is
A. multi directional B. bi-directional
C. uni-directional D. none of these

Q.136 Which of the following is the rapid process
A. conduction B. radiation
C. convection D. all of these

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Q.137 An Ionic atom which is equivalent to hydrogen atom has wavelength equal to 1/4th of hydrogen lines is:

A. He+ B. Li++
C. Ne+9 D. Na10+

Q.138 Sun spectra also has dark lines in pattern which corresponds to

A. absorption B. emission
C. release D. free particle

Q.139 A person with dark skin will feel

A. more heat B. more cold
C. both a and b D. heat doesn't depend on skin color

Q.140 Electron cannot reside inside nucleus is explained by

A. Compton effect B. Photoelectric effect
C. Zeeman effect D. Uncertainty principle

Q.141 He-Ne laser light has wavelength of:

A. RED B. YELLOW
C. BLUE D. ORANGE

Q.142 Which rays need medium to travel?

A. x-rays B. beta rays
C. gamma rays D. none of these radiation need medium to travel

Q.143 The penetrating power of x rays depends on

A. frequency B. amplitude
C. wavelength D. all of these

Q.144 Which one of them is a type of emission?

A. spontaneous B. stimulated
C. both a) and b) D. None of these

Q.145 Spectral lines is like a _____ of absorbed or emission energy in a spectrum

A. charged pattern B. fingerprint pattern
C. discharged pattern D. None of these

Q.146 x-rays used to measure

A. fractures B. temperature
C. blood pressure D. all of these

Q.147 The wavelength of x-ray is controlled by____

A. increasing temperature B. decreasing pressure
C. increasing P.D of electrodes D. none of these

Q.148 The wavelength of x-ray is measured by__

A. diffraction B. interference
C. reflection D. all of these

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ANSWER KEY

1	A	16	B	31	C	46	C	61	A	76	A	91	D	106	B	121	D	136	B
2	A	17	A	32	D	47	A	62	A	77	A	92	C	107	C	122	D	137	A
3	C	18	D	33	B	48	A	63	A	78	B	93	A	108	C	123	C	138	A
4	B	19	C	34	B	49	D	64	D	79	D	94	A	109	D	124	B	139	C
5	C	20	A	35	C	50	C	65	B	80	B	95	A	110	A	125	C	140	D
6	A	21	C	36	D	51	C	66	D	81	B	96	B	111	A	126	A	141	A
7	C	22	C	37	A	52	C	67	A	82	A	97	D	112	A	127	A	142	D
8	A	23	D	38	B	53	B	68	D	83	C	98	C	113	B	128	C	143	C
9	B	24	C	39	C	54	C	69	C	84	B	99	C	114	B	129	D	144	C
10	C	25	C	40	C	55	D	70	D	85	A	100	A	115	A	130	A	145	B
11	C	26	D	41	C	56	A	71	B	86	D	101	B	116	D	131	C	146	A
12	A	27	A	42	B	57	B	72	D	87	A	102	B	117	D	132	B	147	C
13	D	28	B	43	A	58	D	73	B	88	D	103	C	118	C	133	B	148	A
14	C	29	B	44	D	59	D	74	C	89	D	104	C	119	D	134	D		
15	A	30	D	45	B	60	A	75	D	90	A	105	A	120	A	135	C		

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UNIT 13 PRACTICE EXERCISE

NUCLEAR PHYSICS

1. **The isotopes of an element:**
   A. cannot be separated at all
   B. have similar chemical behavior
   C. occur well separated in nature
   D. cannot be separated by physical methods

2. **Let "A" be the mass number and "Z" be the atomic number of a nucleus. Which of the following is approximately correct for light nuclei?**
   A. $Z = 2A$
   B. $Z = A/2$
   C. $Z = A$
   D. $Z = \sqrt{A}$

3. **The relation between the disintegration constant "λ" and the half-life T of a radioactive substance is:**
   A. $\lambda = 2T$
   B. $\lambda = 2/T$
   C. $\lambda = 1/T$
   D. $\lambda T = \ln 2$

4. **Possible units for the disintegration constant "λ" are:**
   A. kg/s
   B. hour
   C. s/kg
   D. day^{-1}

5. **The half–life of radium is about 1600 years. If a rock initially contains 1 g of radium, the amount left after 6400 years will be about:**
   A. 938 mg
   B. 31 mg
   C. 62 mg
   D. 16 mg

6. **Starting with a sample of pure ^{66}Cu, 7/8 of it decays into Zn in 15 minutes. The corresponding half-life is:**
   A. 15 minutes
   B. 7 minutes
   C. 5 minutes
   D. 3.75 minutes

7. **Radioactive ^{90}Sr has a half-life of 30 years. What percent of a sample of ^{90}Sr will remain after 60 years?**
   A. 0%
   B. 50%
   C. 25%
   D. 75%

8. **The half-life of a radioactive isotope is 6.5 h. If there are initially 48×10^{32} atoms of this isotope, the number of atoms of this isotope remaining after 26 h is:**
   A. 12×10^{32}
   B. 3×10^{32}
   C. 6×10^{32}
   D. 6×10^{4}

9. **An alpha particle is:**
   A. a helium atom with two electrons removed
   B. an aggregate of two or more electrons
   C. a hydrogen atom
   D. the ultimate unit of positive charge

10. **Radioactive polonium, ^{214}Po (Z = 84), decays by alpha emission to:**
    A. ^{214}Po (Z = 84)
    B. ^{214}At (Z = 85)
    C. ^{210}Pb (Z = 82)
    D. ^{218}Po (Z = 84)

11. **A beta particle is:**
    A. a helium nucleus
    B. a radioactive element
    C. an electron or a positron
    D. any negative particle

12. **A radioactive atom "X" emits a β-particle. The resulting atom:**
A. must be very reactive chemically
B. has an atomic number that is one more than that of "X"
C. has a mass number that is one less than that of "X"
D. must be radioactive

13. **A nucleus with mass number "A" and atomic number "Z" undergoes β^+ decay. The mass number and atomic number, respectively, of the daughter nucleus are:**
A. A − 1, Z − 1
B. A + 1, Z − 1
C. A, Z − 1
D. A, Z +1

14. **An atom of ^{235}U (Z = 92) disintegrates to ^{207}Pb (Z = 82) with a half–life of about a billion years by emitting seven alpha particles and β–particles:**
A. 3
B. 5
C. 4
D. 6

15. **A certain nucleus, after absorbing a neutron, emits a β^- and then splits into two alpha particles. The (A, Z) of the original nucleus must have been:**
A. 6, 2
B. 7, 2
C. 6, 3
D. 7, 3

16. **Nuclei having the same mass number but different atomic number are:**
A. Isotopes
B. Isotones
C. Isobars
D. Isomers

17. **An α-particle is emitted from $_{88}Ra^{226}$, what is the mass and atomic number of the daughter nucleus?**
Mass Number Atomic Number
A. 224 84
B. 220 80
C. 222 86
D. 226 87

18. **Radioactive materials can be identified by measuring their:**
A. Hardness
B. Masses
C. Densities
D. Half-lives

19. **The breakage of $^{235}_{92}U$ produces the fragments as:**
A. Kr and Ba
B. Xe and Sr
C. Sn and Mo
D. All of them

20. **The rate of decay of a radioactive substances:**
A. Remains constant with time
B. Decrease with time
C. Increase with time
D. May increase or decrease with time

21. **When a radioactive nucleus emits a β-particle, the proton-neutron ratio:**
A. Remains the same
B. Decreases
C. Increases
D. Equals to 1

22. **The amount of energy equivalent to "1u" is:**
A. 9.315 MeV
B. 931 MeV
C. 93.45 MeV
D. 1.025 MeV

23. **A sample contains "N" radioactive nuclei. After 4 half-lives numbers of nuclei decayed is:**
A. N /16
B. N / 8
C. 15N /16
D. 7N / 8

24. **When α–particle is emitted from any nucleus, its mass number_____ and charge number_____:**
A. increases by 2, increases by 2
B. decreases by 4, decreases by 2
C. decreases by 4, increases by 2
D. decreases by 4, decreases by 4

25. **The half-life of radioactive element depends on:**
A. Temperature
B. Nature of element
C. Pressure
D. Amount of radioactive substance

26. **Half-life of radium–226 is:**
A. 1820 years
B. 1620 years
C. 1940 years
D. 1680 years

27. **Both Xenon and Cesium each have isotopes:**
A. 12
B. 36
C. 33
D. 39

28. **In unified mass scale, 1 u equals:**
A. 1.66×10^{-27} g
B. 1.66×10^{-24} g
C. 12 g
D. 1.66×10^{-24} kg

29. **The half-life of a radioactive substance is:**
A. half the time it takes for the entire substance to decay
B. usually about 50 years
C. the time for radium to change into lead
D. the time for half the substance to decay

30. **A large collection of nuclei are undergoing alpha decay. The rate of decay at any instant is proportional to:**
A. the number of un–decayed nuclei present at that instant
B. the time since the decays started
C. the time remaining before all have decayed
D. the half-life of the decay

31. **The half-life of a radioactive isotope is 140 days. In how many days does the decay rate of a sample of this isotope decrease to one–fourth of its initial decay rate?**
A. 35
B. 280
C. 105
D. 210

32. **The particle which has its mass number and charge number equal to zero:**
A. Proton
B. Neutron
C. Electron
D. Photon

33. **In an alpha decay the disintegration energy appears chiefly as:**
A. photon energies
B. the kinetic energies of the alpha and the daughter nucleus
C. the excitation energy of the daughter nucleus
D. the excitation energy of the alpha particle

34. **The nuclei $_6C^{13}$ and $_7N^{14}$ can be described as:**
A. Isotones
B. Isobars
C. Isotopes
D. isomers

35. **There are three lumps of a given radioactive substance. Their activity is in the ratio of 1:2:3 now. What will be the ratio of their activities at any further date?**
A. 1:2:3
B. 3:2:1
C. 2:1:3
D. 2:3:1

36. **In the reaction represented by:**

$$_ZX^A \rightarrow {}_{Z-2}Y^{A-4} \rightarrow {}_{Z-2}Y^{A-4} \rightarrow {}_{Z-1}K^{A-4}$$

The decay in the sequence are:
A. α,β,γ
B. γ,α,β
C. β,α,γ
D. α,γ,β

37. **The ratio of half-life times of two elements "A" and "B" is "T_A/T_B". the ratio of respective decay constant "λ_A/λ_B" is:**
A. T_B/T_A
B. $(T_A+T_B/T_A$
C. T_A/T_B
D. None of these

38. **In nucleus of uranium the number of neutrons will be:**
A. 92
B. 143
C. 235
D. Different for different isotopes

39. **The α– particle ionizes the particles in its way and adopt the path which is:**
A. Curved
B. Zig-Zag
C. Straight
D. Straggling

40. **The half of uranium-238 is:**
A. 1.67×10^8 years
B. 4.5×10^8 years
C. 3.3×10^9 years
D. 4.5×10^9 years

41. **Half-life of Radium is 1590 years. In how many years shall the Earth loss all his radium due to radioactive decay?**
A. 1590×10^6 years
B. 1590×10^{25} years
C. 1590×10^{12} years
D. Never

42. **Which one of the following radiation possesses maximum penetrating power?**
A. α-rays
B. γ-rays
C. β-rays
D. All have equal penetrating power

43. **Radioactivity is a:**
A. Spontaneous activity
B. Self disintegration property
C. Chemical property
D. Both A. and B.

44. **Heavy radioactive elements eventually turn into:**
A. Barium
B. hydrogen
C. lead
D. radium

45. **β-particle ionizes an atom:**
A. Through direct collision
B. Through electrostatic repulsion
C. Through electrostatic attraction
D. All of above

46. **Marie Curie and Pierre Curie discovered two new radioactive elements which:**
A. Uranium and Polonium
B. Radium and Uranium
C. Polonium and Radium
D. Uranium and Plutonium

47. **Radioactive decay obeys which one of the following data?**
A. $N = N_o e^{-\lambda t}$
B. $N = N_o e^{xt}$
C. $N = N_o e^{-xt/2}$
D. $N_o = N(1e^{xt})$

48. **Which one of the following possesses maximum velocity?**
A. α-rays
B. γ-rays
C. β-rays
D. All of the above have same speed

49. **A particle having the mass of an electron and the charge of a proton is called:**
A. Antiproton
B. Gamma rays
C. Positron
D. Photon

50. **Which one of the following possesses greater penetrating power?**
A. α-rays
B. X–rays
C. β-rays
D. Neutron

51. **Which one of the following will be better shield against γ-rays?**
A. Ordinary water
B. Lead
C. Heavy water
D. Aluminum

52. An α-particle is emitted from $_{88}Ra^{226}$, what is the mass and atomic number of the daughter nucleus?
Mass Number Atomic Number
A. 224 84
B. 220 80
C. 222 86
D. 226 87

53. Complete the reaction:
$_{Z}^{A}X \rightarrow {}_{Z+1}^{A}Y + {}_{-1}^{0}\beta + ... + Q$
A. Neutrino
B. α-particle
C. Anti-neutrino
D. Positron

54. The path of β-particle is:
A. Rectilinear
B. Zigzag or erratic
C. Carved
D. Elliptical

55. β-particles possess greater penetration power than that of α-particle due to its:
A. Smaller ionization power
B. Same ionization power
C. Energy is not conserved
D. Neither greater nor smaller ionization power

56. Average distance covered by α-particle in air before its ionizing power ceases is called its:
A. Trajectory
B. Firing level
C. Range
D. Limit

57. A α-particle can produce fluorescence in:
A. Zns
B. sodium iodide
C. Barium Palatino cyanide
D. All of above

58. The penetration power of β-particle as compared to α–particle is:
A. 10 times more
B. 100 times less
C. 100 times more
D. 10 times less

59. If a radioactive isotope of silver have a half-life of about 7.5 days. After 15 days the remaining isotope of its original is:
A. 25%
B. 7.5%
C. 50%
D. 15%

60. A nuclide $_{86}^{220}R$ decays to a new nuclide by two α–emissions, the nuclide S is:
A. $_{84}^{212}S$
B. $_{80}^{220}S$
C. $_{82}^{212}S$
D. $_{82}^{210}S$

61. Fluorescence is the property of:
A. high frequency particles
B. Moderate frequency particles
C. Low frequency particles
D. Visible light

62. In the uranium disintegration series:
A. The emission of a β^- particle increases the mass number "A" by one and decreases the atomic number "Z" by one.
B. The disintegrating element merely ejects atomic electrons
C. The emission of an α particle decreases the mass number "A" by four and decreases the atomic number "Z" by two
D. The nucleus always remains unaffected

63. **In a nuclear reaction a beam of α-particle strike a target of ^{60}Ni. The product of this reaction might be:**
A. $^{63}Zn + n$
B. $^{61}Ni + n$
C. $^{63}Cu + n$
D. All of these

64. **By emitting β–particle and γ–particle simultaneously the nucleus changes its charge by:**
A. Losses by 1
B. No change will be observed
C. Increases by 1
D. Increases by 2

65. **Among the following select the correct statement:**
A. The rate of disintegration is directly proportional to the number of atoms present in the sample at that instant
B. Equal fractions disintegrate in equal intervals of time
C. Radioactive sample takes an infinite time to disintegrate
D. All of the above

66. **Beta particles from various radioactive sources all have:**
A. the same mass
B. the same charge
C. the same speed
D. the same deflection

67. **After two half-lives, the numbers of un-decayed nuclei of an element are:**
A. N
B. N / 4
C. N / 2
D. 3N / 4

68. **γ-rays are emitted by the de-excitation of:**
A. An atom
B. An element
C. Molecule
D. Nucleus

69. **Radioactive ^{90}Sr has a half-life of 30 years. What percent of a sample of ^{90}Sr will remain after 60 years?**
A. 0%
B. 50%
C. 25%
D. 75%

70. **At the end of 14 min, 1/16 of a sample of radioactive polonium remains. The corresponding half-life is:**
A. (7/8) min
B. (7/4) min
C. (8/7) min
D. (7/2) min

71. **Half-life of iodine-131 is 8 days and it weight 20 mg. after 4 half-lives, the amount left un–decayed will be:**
A. 2.5 mg
B. 0.625 mg
C. 1.25 mg
D. 0.3125 mg

72. **An α-particle contains:**
A. "1" proton and "1" neutron
B. "3" protons and "3" neutrons
C. "2" protons and "2" neutrons
D. "4" protons and "4" neutrons

73. **^{210}Bi (an isotope of bismuth) has a half-life of 5.0 days. The time for three quarters of a sample of ^{210}Bi to decay is:**
A. 2.5days
B. 15 days
C. 10 days
D. 20 days

74. **Which is the equation of beta decay?**
A. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{+1}e$
B. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e$
C. ${}^{A}_{Z}X \rightarrow {}^{A-1}_{Z}Y + {}^{0}_{-1}e$
D. ${}^{A}_{Z}X \rightarrow {}^{A-1}_{Z-1}Y + {}^{0}_{-1}e$

75. The particles equal in mass or greater than protons are called:

A. Mesons
B. Muons
C. Baryons
D. Electrons

76. Starting with a sample of pure ^{66}Cu, 7/8 of it decays into "Zn" in 15 minutes. The corresponding half-life is:

A. 15 minutes
B. 7 minutes
C. 5 minutes
D. 3.75 minutes

77. Which is true for both α-particles and γ-rays:

A. They cause ionization in air
B. They can be deflected by magnetic field
C. They can be deflected by electric field
D. They can penetrate a few millimeter of aluminum

78. When a radioactive nuclide decays consecutively by emitting an α-particle, a β-particle and γ-rays the change in nucleon number and atomic number are:

	A.	B.	C.	D.
Change in mass number	–2	–3	–3	–4
Change in atomic number	–3	–2	–3	–1

79. When a nucleus with atomic number "Z" and mass number "A" undergoes a radioactive decay process:

A. Both "Z" and "A" will decrease, if the process is α-decay
B. "Z" will decrease but "A" will not change, if the process is β^+decay
C. "Z" will increase but "A" will not change, if the process is β^- decay.
D. All of these

80. The half-life of a radioactive element is such that 7/8 of a quantity of it decays in 12 days what fraction of it remain un–decayed after 24 day?

A. 0
B. 1/128
C. 1/64
D. 1/32

81. Decay constant "λ" given by:

A. $-\frac{\Delta N / N}{\Delta t}$
B. $-N\Delta N\Delta t$
C. $\frac{\Delta N / N}{\Delta t}$
D. $-\frac{\Delta t}{\Delta N / N}$

82. The radioactive nuclide $^{228}_{88}Ra$ decays by emission of three α-particles. The nuclide "X" finally formed is:

A. $^{220}_{84}X$
B. $^{222}_{86}X$
C. $^{216}_{82}X$
D. $^{215}_{88}X$

83. The ionizing power when we compare α, β and γ rays is:

A. Same in all the three
B. Maximum in α–particles
C. Maximum in β–particles
D. Maximum in γ–rays

84. The mass of α–particle is:

A. $4M_p$
B. $4M_n$
C. $2M_p + 2M_n$
D. $2M_e + 2M_p$

85. Which one of the following combination of radioactive decay results in the formation of an isotope of original nuclide?

A. α and β
B. α and two β
C. Two α and β
D. α and four β

86. Which one of the following is formed during beta emission:
A. Isobars
B. Isotones
C. Isotopes
D. Isomers

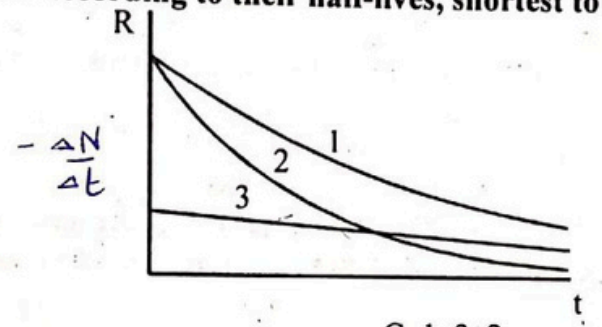
87. A certain radioactive nuclide of mass number "X" decays by β-emission and γ-emission to a second nuclide of mass number "Y", the correct relation between "X" and "Y" is:
A. $Y = X - 4$
B. $Y = X - 1$
C. $Y = X + 1$
D. $Y = X$

88. The half-life of radium is about 1600 years. If 100g radium existing now, 25g will remain un–decayed after:
A. 4800 years
B. 6400 years
C. 6400 years
D. 3200 years

89. In γ-emission atomic number of nucleus:
A. Increases by 1
B. Decreases by 1
C. Increases by 2
D. No change

90. In radioactivity, the rate of decay:
A. can be increased by magnetic field
B. can be decreased by the magnetic fields
C. can be kept constant by the electric field
D. in not effected by electric and magnetic field

91. The graph shows the activity R as a function of time "t" for three radioactive samples. Rank the samples according to their half-lives, shortest to longest.



A. 1, 2, 3
B. 2, 1, 3
C. 1, 3, 2
D. 2, 3, 1

92. Sequence of radiation emitted in the radioactive process:
$${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y \rightarrow {}^{A-4}_{Z-1}L \rightarrow {}^{A-4}_{Z-1}L$$
A. α,β,γ
B. γ,β,α
C. β,γ,α
D. β,α,γ

93. ${}^{222}_{86}A \rightarrow {}^{210}_{84}B$ in this reaction how many "α" and "β" emission have occurred:
A. 6α,3β
B. 6α, 4β
C. 4α,3β
D. 3α, 4β

94. If 10% of a radioactive substance decays in every 5 years, then the percentage of the substance what will decayed in 20 years will be:
A. 40%
B. 50%
C. 65.6%
D. 34.4%

95. If "A" is the atomic mass and "Z" is the atomic number of an atom, then the charge on its nucleus will be:
A. + (A – Z)e
B. + (Z)e
C. + (Z – A.e
D. + A.e

96. **An α-particles travel a well defined distance before coming to rest. This distance is known as range of the particle. The range depends upon.**
A. Charge of the particle
B. Mass of the particle
C. Energy of the particle
D. All of these

97. **Which of following is a correct statement?**
A. Protons and neutrons have exactly same mass
B. Gamma rays are higher energy neutrons
C. ά-particle are single ionized helium neutrons
D. β-rays are same as cathode rays

98. **Ar-40, Ca-40 and K-40 are:**
A. Isotopes of each other
B. Isotones of each other
C. Isobars of each other
D. All of these

99. **If 15/16 of radioactive atoms decay in 16 hours, the half-life of element is:**
A. 16 hours
B. 8 hours
C. 4 hours
D. 2 hours

100. **Which one of following process is not related to radioactive disintegration:**
A. Positron emission
B. β-decay
C. ά-decay
D. Nuclear fusion

101. **If a nucleus ${}^{A}_{Z}X$ emits an α-particle and resultant nuclear emits a β-particle, then atomic charge and mass number of final nucleus will be:**
A. $Z-2, A-4$
B. $Z-1, A-4$
C. $Z-32, A-4$
D. $Z, A-Z$

102. **A nuclide ${}^{220}R_{84}$ decay to a new nuclide S by two α-emissions and two β-emissions, the nuclide S is**
A. ${}^{218}S_{84}$
B. ${}^{216}S_{84}$
C. ${}^{212}S_{82}$
D. ${}^{216}S_{82}$

103. **Radiation from a point source obeys the inverse square law. If the count rate at a distance of 1.0m from counter is 360 counts per minute. The count rate at the distance of 3m will be:**
A. 90 count per minute
B. 40 count per minute
C. 120 count per minute
D. 45 count per minute

104. **Particle not emitted by a radioactive substance are:**
A. γ-rays
B. Electrons
C. Protons
D. ${}^{4}_{2}He$

105. **Radioactivity is the phenomenon associated with:**
A. Production of radio waves
B. Transmissions of radio waves
C. Reception of radio waves
D. Decay of atomic nucleus

106. **When a tritium captures a proton, it becomes:**
A. Neutron
B. Meson
C. α–particle
D. Deuteron

107. **α, β and γ-rays emitted by a radioactive substance are passed through a region containing a magnetic field at right angles to their path. The energy gained will be:**
A. Maximum for ά-rays
B. Maximum for β– rays
C. Maximum for γ– rays
D. Zero for all of them

108. **Half-life of a radioactive element can be increased by:**
A. Increasing temperature
B. Changing volume
C. Increasing pressure
D. Can't be increased

109. A nucleons "Q" has notation ${}^{Y}_{X}Q$ which of following is an isotope of Q:

A. ${}^{Y-1}_{X}Q$
B. ${}^{Y}_{X-1}Q$
C. ${}^{Y}_{X+1}Q$
D. ${}^{Y-1}_{X+1}Q$

110. The end product of the decay of ${}^{232}_{90}Th$ is ${}^{208}_{82}Pb$. The number of α and β-particles emitted are respectively:

A. 3,3
B. 6,4
C. 6,0
D. 4,6

111. A radioactive nucleus "X" undergoes a series of decays according to scheme:

$$X \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$$

If mass number and atomic number of "X" are 180 and 72 respectively. The corresponding numbers for "X_4" are:

A. 176,69
B. 172,69
C. 176,71
D. 172,71

112. The ratio of number of protons and the number of neutrons is:

A. almost one, in light elements
B. smaller than one, in heavy elements
C. greater than one, in heavy elements
D. both A. and B.

113. When a β-particle is slowed down by the electric field of a charged particles in a solid material, the energy is radiated as:

A. α-particles
B. β-particles
C. X-rays
D. both A. and B.

114. Due to the emission of beta-particles by a thorium nucleus, we get:

A. radium
B. protactinium
C. uranium
D. radon

115. The weight of a radioactive element is 1g. After 3 days, it becomes 0.25g. The half-life of the element is:

A. 72 hours
B. 144 hours
C. 36 hours
D. impossible fact

116. What are the number of neutrons, protons and electrons in a neutral atom of ${}^{235}_{92}U$?

	Number of neutrons	Number of protons	Number of electrons
A.	92	143	143
B.	92	235	235
C.	143	92	92
D.	235	92	92

117. Which two nuclei contain the same number of neutrons?

A. ${}^{12}_{6}C$ and ${}^{14}_{6}C$
B. ${}^{16}_{7}N$ and ${}^{15}_{8}O$
C. ${}^{23}_{11}Na$ and ${}^{24}_{12}Mg$
D. ${}^{32}_{14}Si$ and ${}^{32}_{15}P$

118. Nucleus of an atom whose atomic mass is 24 consists of

A. 11 electrons, 11 protons and 13 neutrons
B. 11 electrons, 13 protons and 11 neutrons
C. 11 protons and 13 neutrons
D. 11 protons and 13 electrons

119. As compared 12C atom, 14C atom has

A. Two extra protons and two extra electrons
B. Two extra protons but no extra electrons
C. Two extra neutrons and no extra electrons
D. Two extra neutrons and two extra electrons

120. During a negative β-decay
A. An atomic electron is ejected
B. A neutron in the nucleus decays emitting an electron
C. An electron which already present with in the nucleaus is ejected
D. A part of binding energy of nuclei is converted into electron

121. The most penetrating radiations out of the following is that of
A. γ-rays
B. β-rays
C. α-particles
D. X-rays

122. In a given reaction $\overset{A}{\underset{Z}{X}} \longrightarrow \overset{A}{\underset{Z+1}{Y}} \longrightarrow \overset{A-4}{\underset{Z-1}{B}} \longrightarrow \overset{A-4}{\underset{Z-1}{B}}$
Radioactive radiations are emitted in the sequence
A. γ,β,γ
B. γ, α, β
C. β, α, γ
D. α, γ, β

123. When boron $_{5}^{10}B$ **is bombarded by neutrons, α-particles are emitted. The resulting nucleus has the mass number**
A. 11
B. 7
C. 6
D. 15

124. In which radioactive disintegration neutron dissociates into proton and electron?
A. α–emission
B. γ–emission
C. β–emission
D. None of these

125. What is a correct order of magnitude estimate for the diameter of a typical atomic nucleus?
A. 10^{-14} m
B. 10^{-18} m
C. 10^{-22} m
D. 10^{-26} m

126. When a radioactive nucleus emits a beta particle, the proton neutron ratio:
A. Decreases
B. Remains the same
C. Increases
D. None of the above

127. Beta particles have penetration of about:
A. 100 times more than that of the gamma particles
B. 100 times less than that of an alpha ray
C. 100 times more than that of an alpha ray
D. 10 times more than that of an alpha particle

128. $_{92}U^{238}$ **nucleus emits two α-particles and two β-particles and transforms into a thorium nucleus. Which of the following is the mass number and atomic number of the thorium nucleus so produced?**
A. 230, 90
B. 234, 90
C. 230, 88
D. 234, 88

129. Isotopes of a given element all have the same:
A. charge/mass ratio
B. neutron number
C. nucleon number
D. proton number

130. Which statement concerning α-particles, is correct?
A. An α-particle has charge +4e
B. An α-particle is a helium atom
C. When α particle travel through air, they cause ionization
D. When α-particle travel through a sheet of gold foil, they make the gold radioactive

131. **The following represents a sequence of radioactive decays involving two α-particles and one β-particles. $^{217}_{85}At \xrightarrow{\alpha} V \xrightarrow{\alpha} W \xrightarrow{\beta} X$ What is the nuclide X?**

A. $^{213}_{85}At$
B. $^{215}_{77}Ir$
C. $^{209}_{82}Pb$
D. $^{217}_{81}Tl$

132. **The decay of a nucleus of neptunium is accompanied by the emission of a β-particle and γ-radiation. What effect (if any) does this decay have on the proton number and the nucleon number of the nucleus?**

	proton number	nucleon number
A.	increases	decreases
B.	decreases	increases
C.	unchanged	decreases
D.	increases	unchanged

133. **Radon-220 is radioactive and decays to Polonium-216 with the emission of an α-particle. The equation for the radioactive decay is shown. $^{220}_{86}Rn \rightarrow ^{216}_{84}Po + ^{4}_{2}He$ How many neutrons are in the radon and polonium nuclei?**

	Rn	Po
A.	86	84
B.	134	132
C.	220	212
D.	220	216

134. **Rodon $^{222}_{86}Rn$ decays by α-and β-emission to bismuth $^{214}_{83}Bi$ for the decay of each nucleus of radon. How many α–and β– particles are emitted?**

	α–particles	β–particles
A.	1	1
B.	2	1
C.	1	2
D.	2	2

135. **A radioactive nucleus undergoes a series of decay according to the scheme $A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$. If the mass number and atomic number of A are 180 and 72 respectively, then what are these number for A4.**

A. 172 and 69
B. 174 and 70
C. 176 and 69
D. 176 and 70

136. **The decay constant λ of a radioactive sample**

A. Decrease as the age of atoms increase
B. Is independent of the age
C. Increase as the age of atoms increase
D. Depends on the nature of activity

137. **A radioactive decay rate of radioactive elements is found to be 10^3 disintegration per sec at a certain time. If the half-life of the element is 1 second, the decay rate after one second is and after 3 second is_____**

A. 500, 125
B. 10^3, 10^3
C. 125, 500
D. 100, 10

138. A detector is exposed to a radioactive source. Fluctuations in the count – rate are observed.
What do these fluctuations indicate about radioactive decay?
A. It is random
B. It is spontaneous
C. It is exponential
D. It is non – linear

139. The activity of a radioactive sample is 1.6 curie and its half-life is 2.5 days. Its activity after 10 days will be
A. 0.8 curie
B. 0.4 curie
C. 0.1 curie
D. 0.16 curie

140. If the radioactive decay constant of radium is 1.07×10^{-4} per year, then its half-life period is approximately equal to
A. 8,900 years
B. 7,000 years
C. 6,476 years
D. 2,520 years

141. A radioactive element emits 200 particles per second. After three hours 25 particles per second are emitted. The half-life period of element will be
A. 50 minutes
B. 60 minutes
C. 70 minutes
D. 80 minutes

142. The half-life of a certain radioactive element is such that 7/8 of a given quantity decays in 12 days.
What fraction remains undecayed after 24 days?
A. 0
B. $\frac{1}{128}$
C. $\frac{1}{64}$
D. $\frac{1}{32}$

143. Which set of radioactive emissions corresponds to the descriptions given in the table headings?

	High – speed electrons	High – speed helium nuclei	High – frequency photons
A.	α	β	γ
B.	α	γ	β
C.	β	α	γ
D.	β	γ	α

144. The symbol $^{77}_{32}Ge$ represents a nucleus of germanium that decays to a nucleus of arsenic by emitting a β – particle.
What is the symbol of this arsenic nucleus?
A. $^{76}_{32}As$
B. $^{78}_{32}As$
C. $^{78}_{31}As$
D. $^{77}_{33}As$

145. A newly prepared radioactive nuclide has a decay constant λ of $10^{-6}\ s^{-1}$.
What is the approximate half-life of the nuclide?
A. 1 hour
B. 1 day
C. 1 week
D. 1 month

146. Half-life of radioactive element depends upon
A. Amount of element present
B. Pressure
C. Temperature
D. None

147. **Relation for half-life of any radioactive element is**

A. $T_{½} = \lambda \ln 2$

B. $T_{½} = \frac{\ln 2}{\lambda}$

C. $\lambda = T_{½} \ln 2$

D. $T_{½} = \frac{\lambda}{\ln 2}$

$T_m = \frac{1}{\lambda} = \frac{T_{1/2}}{0.693} = 1.44(1600)$

$\therefore \lambda = 0.693$

148. **The half-life period of radium is 1600 years. Its average life time will be** $T_{1/2}$

A. 3200 years

B. 4800 years

C. 2319 years

D. 4217 years

149. **A student conducts an experiment using an α – particle source. When considering safety precautions, what can be assumed to be the maximum range of α – particles in air?**

A. between 0 and 5 mm

B. between 5 mm and 200 mm

C. between 200 mm and 500 mm

D. between 500 mm to 1000 mm

150. **A radioactive sample with a half-life of 1 month has activity 2μ Ci Its activity 2 months earlier was**

A. 1μ Ci

B. 0.5μ Ci

C. 4μ Ci

D. 8μ Ci

$n \Rightarrow 3$

ANSWER KEY

1	B	16	C	31	B	46	C	61	D	76	C	91	B	106	C	121	A	136	B
2	B	17	C	32	D	47	A	62	C	77	A	92	D	107	D	122	C	137	A
3	D	18	D	33	B	48	B	63	C	78	D	93	D	108	D	123	B	138	A
4	D	19	D	34	A	49	C	64	C	79	D	94	A	109	A	124	C	139	C
5	C	20	B	35	A	50	D	65	A	80	C	95	B	110	B	125	A	140	C
6	C	21	C	36	D	51	B	66	B	81	A	96	D	111	B	126	C	141	B
7	C	22	B	37	A	52	C	67	B	82	C	97	D	112	B	127	C	142	C
8	B	23	C	38	D	53	C	68	D	83	B	98	C	113	C	128	A	143	C
9	A	24	B	39	C	54	A	69	C	84	C	99	C	114	B	129	D	144	D
10	C	25	B	40	D	55	B	70	D	85	B	100	D	115	C	130	C	145	C
11	C	26	B	41	D	56	C	71	C	86	A	101	B	116	C	131	C	146	D
12	B	27	B	42	B	57	D	72	C	87	D	102	C	117	C	132	D	147	B
13	C	28	B	43	B	58	C	73	C	88	D	103	B	118	C	133	B	148	C
14	C	29	D	44	C	59	A	74	B	89	D	104	C	119	C	134	B	149	B
15	D	30	A	45	B	60	C	75	C	90	D	105	D	120	B	135	A	150	D

$t = n T_{1/2}$

$n = \frac{24}{4} = 6$

$\lambda = \frac{0.693}{10^{-6}}$

$= \frac{693 \times 1000000}{1000}$ 693000

$A = 1.6\,Ci$

$A = -\lambda N$

$T_{1/2} = 2.5\ day.$

λ

$A = ?$

SOLUTIONS

1. Chemical properties of all the isotopes of an element are similar, because the chemical properties of an element depend upon the number of electrons around the nucleus. Isotopes of an element have same number of electrons and same number of protons.
So, it is not possible to separate the isotopes of an element by chemical methods. Physical methods are found to be successful for this purpose.

2. In light nuclei
$Z = A/2$
For example
$^{4}_{2}He$, $^{12}_{6}C$

3. $\lambda T_{1/2} = \ln 2$
$\lambda T_{1/2} = 0.693$
$T_{1/2} = \dfrac{0.693}{\lambda}$

4. Decay constant of any element is equal to the fraction of decaying atoms per unit time. $\lambda = -\dfrac{\Delta N / N}{\Delta t}$

The SI unit of decay constant is per second "s^{-1}" (time^{-1})

5. Amount remaining after n half-lives = $\dfrac{1}{2^n}$ (m_o)

Number of half-lives, $n = \dfrac{t}{T1/2} = \dfrac{6400}{1600} = 4$

Amount remaining after 4 half-lives = $\dfrac{1}{24}$ (1)

$= 0.0625$ g $= 62$ mg

6.

If "N_o" is the initial number of atoms (amount).		
Half-lives	Remaining atoms (amount)	Decayed atoms (amount)
$T_{1/2}$	$\frac{1}{2}$ No	$\frac{1}{2}$ No
$2T_{1/2}$	$\frac{1}{4}$ No	$\frac{3}{4}$ No
$3T_{1/2}$	$\frac{1}{8}$ No	$\frac{7}{8}$ No
$4T_{1/2}$	$\frac{1}{16}$ No	$\frac{15}{16}$ No
$5T_{1/2}$	$\frac{1}{32}$ No	$\frac{31}{32}$ No

7/8 of sample will be decayed after three half-lives.
$3T_{1/2} = 15$ min $\Rightarrow T_{1/2} = 5$ min

7. Number of half-lives, $n = \dfrac{t}{T1/2} = \dfrac{60}{30} = 2$

Amount remaining after n half-lives = $\dfrac{1}{2^n}$ (N_o)

Amount remaining after 2 half-lives = $\dfrac{1}{22}$ (N_o)

=

$\dfrac{1}{4}$ $(N_o) = 0.25N_o = 25\%$ of N_o

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8. Number of half-lives, $n = \frac{26h}{6.5hr} = 4$

Amount remaining after n half-lives = $\frac{1}{2^n}(N_o)$

Amount remaining after 4 half-lives = $\frac{1}{24}(N_o)$

$= \frac{1}{16}(48 \times 10^{32}) = 3 \times 10^{32}$

9. α–particles are helium nuclei (atom with two electrons removed). The charge on them is +2e while their mass is 4u that is every α–particle has two protons and two neutrons.

10. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$

${}^{214}_{84}Po \rightarrow {}^{210}_{82}Pb + {}^{4}_{2}He$

11. β–particles are the fast moving electrons or positrons which come out of the nucleus of a radioactive element.

12. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}e$

13. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y + {}^{o}_{+1}e$

14. ${}^{235}_{92}U \rightarrow {}^{207}_{82}Pb + 7\,{}^{4}_{2}He + 4\,{}^{o}_{-1}e$

Atomic mass number of resulting nucleus = 207 = 235 – 28

Atomic number of resulting nucleus 82 = 92 – 14 + 4

15. ${}^{A}_{Z}X + {}^{1}_{o}n \rightarrow 2\,{}^{4}_{2}He + {}^{o}_{-1}e$

Atomic mass number of nucleus, A = 8 –1 = 7

Atomic number of nucleus, Z = 4 – 1 = 3

16. Nuclei having same atomic mass number but different atomic number are called isobars.

17. Atomic mass number of resulting nucleus, A = 226 –4 = 222

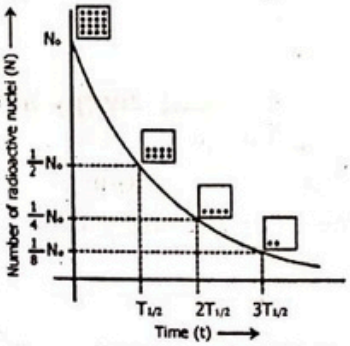
Atomic number of resulting nucleus, Z = 88 – 2 = 86

18. Radioactive materials can be identified by measuring their half-lives. For that purpose Carbon dating is use

19. ${}^{235}_{92}U + {}^{1}_{o}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3\,{}^{1}_{o}n + Q$ heat

${}^{235}_{92}U + {}^{1}_{o}n \rightarrow {}^{132}_{50}Sn + {}^{101}_{42}Mo + 3\,{}^{1}_{o}n + Q$

${}^{235}_{92}U + {}^{1}_{o}n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + 2\,{}^{1}_{o}n + Q$



20. Rate of decay of radioactive substance decreases exponentially with time.

21. ${}^{1}_{o}n \rightarrow {}^{1}_{1}H + {}^{o}_{-1}e$

${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}e$

Proton $Z \rightarrow Z + 1$

Neutron $N \rightarrow N - 1$

So, proton to neutron ratio will be increase

22. $1\ u = 1.6606 \times 10^{-27}\ kg = 931\ MeV$

23.

If "N_o" is the initial number of atoms (amount).		
Half-lives	**Remaining atoms (amount)**	**Decayed atoms (amount)**
$T_{1/2}$	$\frac{1}{2}$ No	$\frac{1}{2}$ No
$2T_{1/2}$	$\frac{1}{4}$ No	$\frac{3}{4}$ No
$3T_{1/2}$	$\frac{1}{8}$ No	$\frac{7}{8}$ No
$4T_{1/2}$	$\frac{1}{16}$ No	$\frac{15}{16}$ No
$5T_{1/2}$	$\frac{1}{32}$ No	$\frac{31}{32}$ No

24. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$

25. $T_{1/2}\lambda = \ln 2$

$T_{1/2} = \frac{ln2}{\lambda}$

Every radioactive element has particular value of decay constant. It depends upon the nature of material. So, every radioactive element has particular half-life.

26. Half–life of radium–226 is 1620 years.

27. Both Xenon and caesium each have 36 isotopes.

28. $1u = 1.66 \times 10^{-27}\ kg = 1.66 \times 10^{-27}\ (10^3\ g)$

$= 1.66 \times 10^{-24}\ g$

29. The half-life "$T_{1/2}$" of a radioactive element is that period in which half of the atoms decay.

30. As the decaying atoms "ΔN" is proportional to the time interval "Δt" and the number of atoms un–decayed atoms "N". So,

$\Delta N \propto -N$

$\Delta N \propto \Delta t$

31. $T_{1/2} = 140$ days

The decays rate decreases to $1/4^{th}$ of initial decay rate after 2 half-lives. So,$t = 2T_{1/2} = 2(140) = 280$ days

32. Photon is the charge less and mass less particle.

33. The energy emitted during disintegration appears in the form of kinetic energy alpha and daughter nucleus and their kinetic energy gets transformed in heat energy

34. ${}_6C^{13}$ and ${}_7N^{14}$ have same number of neutrons (N=7). So, they are called isotones.

35. As the ratio of activity of radioactive substance remains same after particular time interval. So,$A_1:A_2:A_3 = 1:2:3$

36. **1.** ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}\alpha$

2. ${}^{A-4}_{Z-2}Y \rightarrow {}^{A-4}_{Z-2}Y + \gamma$–radiation

3. ${}^{A-4}_{Z-2}Y \rightarrow {}^{A-4}_{Z-1}K + {}^{o}_{-1}\beta$

37. $T_{1/2}\lambda = 0.693$

$$\lambda = \frac{0.693}{T1/2}$$

$$\frac{\lambda A}{\lambda B} = \frac{0.693/TA}{0.693/TB} = \frac{TB}{TA}$$

38. Atoms of an element having same number of protons but different number of neutron are called isotopes.

39. α–particle is about 7000 times more massive than an electron, so it is not easy for it to change its direction from its straight path, provided it does not approach too close to the nucleus of the atom.

40. Half–life of Uranium–238 is 4.5×10^9 year

41. No radioactive element can completely decay. It is due to the reason that in any half-life period only half of the nuclei decay and in this way an infinite time is required for all the atoms to decay.

42. The penetrating power of radioactive radiations in the increasing order is given below

$$\alpha < \beta < \gamma$$

43. Radioactivity is a spontaneous, random and natural phenomenon.

44. For stable elements $Z \leq 82$. Heavy radioactive elements continuously emit radiations until its atomic number become 82. Element having Z = 82 is lead (Pb).

45. β–particle is a negatively charge particle, it ionizes the atom due to the electrostatic force of repulsion.

46. Marie Curie and Pierre Curie discovered two new radioactive elements that they called polonium and radium.

47. $N = N_o e^{-\lambda t}$ (Law of radioactivity)

48. γ–rays are the electromagnetic waves. They travel with the speed of light (3×10^8m/s).

49. A particle having the mass of an electron and the charge of a proton is called positron. It is the anti-particle of electron.

50. The penetrating power in the increasing order is given below $\alpha < \beta < \gamma <$ neutron

51. Lead shielding refers to the use of lead as a form of radiation protection to shield people or objects from radiation so as to reduce the effective dose. Lead can effectively attenuate certain kinds of radiation because of its high density and high atomic number; principally, it is effective at stopping gamma rays and x–rays.

52. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$

Charge no. of daughter nuclei = Z–2 = 88–2 = 86

Mass no. of daughter nuclei = A–4 = 226–4 = 222

53. During ${}^{o}_{-1}\beta$ emission anti–neutrino emits while in case of ${}^{o}_{+1}\beta$ emission neutrino emits.

54. β–particles are more easily deflected by collisions than heavy α–particles. Thus the path of β–particles in matter is not straight but shows much straggling or scattering.

55. The range of the β–particle is 100 times more than that of α–particles. But its ionizing ability is about 100 times less than that of α–particle.

56. An α–particle travels a well define distance in a medium before coming to rest. This distance is called the range of the particle. The range depends on the:

i. charge, mass and energy of particle

ii. The density of the medium and ionization potential of the atoms of the medium.

57. Charged particles α or β and γ–radiation produce fluorescence or glow on striking some substance like Zinc sulphide, sodium iodide or barium platinocyanide coated screens.

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58. The range of the β–particle is 100 times more than that of α–particles. But its ionizing ability is about 100 times less than that of α–particle.

59. No. of half-lives $= \frac{t}{T1/2} = \frac{15}{7.5} = 2$

No. of atoms of isotope remaining after 2 half-lives $= \frac{1}{22} N_o = 0.25N_o = 25\%$ of N_o

60. $^{A}_{Z}X \rightarrow {}^{A-8}_{Z-4}Y + 2\,{}^{4}_{2}He$

$^{220}_{86}R \rightarrow {}^{212}_{82}S + 2\,{}^{4}_{2}He$

61. Fluorescence is the property of absorbing radiant energy of high frequency and re–emitting energy of low frequency in the visible region of electromagnetic spectrum.

62. Atoms with A > 210 have greater probability to emit the α–particles.

63. $^{60}Ni + {}^{4}He \rightarrow {}^{63}Cu + {}^{1}n$

64. $^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}e$

γ–rays are chargeless and massless.

65. The number of atoms decaying in a particular period is proportional to the number of atoms present in the beginning of the period If the number of atoms to start with is large then a large number of atoms will decay in this period and if the number of atoms present in the beginning is small then less atoms will decay.

$$\Delta N \propto -N$$

$$\Delta N \propto \Delta t$$

66. Beta particles from various radioactive sources all have charge. Their masses will be decided by their speed

$$m = \frac{mo}{\sqrt{1 - \frac{v2}{c2}}}$$

67. No. of un–decayed of nuclei after 2 half-lives $= \frac{1}{22} N = \frac{1}{4} N$

68. The nucleus is sometimes excited to a higher state following the emission of α or β–particle. This excited state of nucleus is unstable state in coming back to its ground state from the excited state, γ–radiation is emitted The emission of γ–radiation from the nucleus is generally represented by this equation

$$^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \gamma\text{–radiation}$$

69. Amount remaining after n half-lives $= \frac{1}{2n}(m_o)$

Number of half-lives, $n = \frac{t}{T1/2} = \frac{60}{30} = 2$

Amount remaining after 2 half-lives $= \frac{1}{22} m_o$

$= 0.25m_o = 25\ \%$ of m_o

70. After $4T_{1/2}$ a sample of radioactive polonium remains $= \frac{1}{24} = \frac{1}{16}$

$4T_{1/2} = 14$ min

$T_{1/2} = 7/2$ min

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71. Amount of un–decayed Iodine after 4 half-lives
$= \frac{1}{24} N = \frac{1}{16}(20) = 1.25$ mg

72. α–particles are helium nuclei. The charge on them is +2e while their mass is 4u that is every α–particle has two protons and two neutrons.

73. After $2T_{1/2}$ the sample decayed $= \frac{3}{4} N$
$t = 2T_{1/2} = 2(5 \text{ days}) = 10$ days

74. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}e$

75. The particles equal in mass or greater than protons are called baryons.

76. After $3T_{1/2}$ the sample decayed $= \frac{7}{8} N$
$3T_{1/2} = 15$ min
$T_{1/2} = 5$ min

77. Ionization is the main interaction with the matter to detect the particle or to detect its energy. The more dense the material through which the particle move, the more ionization and shorter will be its range.

78. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-1}Y + {}^{4}_{2}He + {}^{o}_{-1}e$

79. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$
${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}\beta$
${}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y + {}^{o}_{+1}\beta$

80. 7/8 of a quantity will decay in three half-lives.
$3T_{1/2} = 12$ days
$T_{1/2} = 4$ days
No. of half-lives $= \frac{t}{T1/2} = \frac{24}{4} = 6$
No. of un–decayed quantity after 6 half-lives $= \frac{1}{26} N = \frac{1}{64} N$

81. The decay constant of any element is equal to the fraction of decaying atoms per unit time.
$$\lambda = -\frac{\Delta N / N}{\Delta t}$$

82. ${}^{228}_{88}Ra \rightarrow {}^{216}_{82}X + 3{}^{4}_{2}He$

83. Ionization ability in the increasing order is given by
$\gamma < \beta < \alpha$

84. α–particles are helium nuclei. The charge on them is +2e while their mass is 4u that is every α–particle has two protons and two neutrons.
Mass of α-particle $= 2M_p + 2M_n$

85. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z}Y + {}^{4}_{2}He + 2{}^{o}_{-1}\beta$
Element remain unchanged if atomic number does not change.

86. Atoms having same atomic mass but different atomic number are called isobars.
${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}\beta$

87. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}\beta + \gamma$
After emitting "β" and "γ" atomic mass number remains same.

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88. After $T_{1/2}$ un–decayed radium = 50 g
After $2T_{1/2}$ un–decayed radium = 25 g
$2T_{1/2} = 2(1600 \text{ years}) = 3200 \text{ years}$

89. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \gamma$–radiation

90. Radioactivity is a spontaneous, random and natural phenomenon. So, it is not effected by electric and magnetic field

91. More Steeper the curve means less half-life of sample.

92. ${}^{A}_{Z}X \ \beta \rightarrow {}^{A}_{Z+1}Y \ \alpha \rightarrow {}^{A-4}_{Z-1}L \ \gamma \rightarrow {}^{A-4}_{Z-1}L$

93. $$\text{No. of } \alpha = \frac{222-210}{4} = \frac{12}{4} = 3$$

${}^{222}_{86}A \ \ 3\alpha \rightarrow {}^{210}_{80}C$

$$\text{No. of } \beta = \frac{84-80}{1} = \frac{4}{1} = 4$$

${}^{222}_{86}A \ \ 3\alpha \rightarrow {}^{210}_{80}C \ \ 4\beta \rightarrow {}^{210}_{84}B$

94. In 5 years radioactive substance decay = 10 %
In 20 years radioactive substance decay = 40 %

95. Charge on nucleus = Z(+e)

96. An α–particle travels a well define distance in a medium before coming to rest. This distance is called the range of the particle. The range depends on the:
i. charge, mass and energy of particle
ii. The density of the medium and ionization potential of the atoms of the medium.

97. β–particles are the fast moving electrons (cathode rays) which come out of the nucleus of a radioactive element.

98. Atoms having same atomic mass but different atomic number are called isobars.

99. 15/16 of a radioactive atoms will decay in four half-lives.
$4T_{1/2} = 16$ hours
$T_{1/2} = 4$ hours

100. Fusion is a nuclear reaction in which two light nuclei merge to form a heavy nucleus. so, there is no radioactive disintegration in fusion reaction.

101. ${}^{A}_{Z}X \ \ \alpha \rightarrow {}^{A-4}_{Z-2}Y \ \ \beta \rightarrow {}^{A-4}_{Z-1}L$

102. ${}^{220}_{84}R \ \ 2\alpha \rightarrow {}^{212}_{80}Y \ \ 2\beta \rightarrow {}^{212}_{82}S$

103. $I \propto \frac{1}{r2}$

$$\frac{I2}{I1} = \frac{r12}{r22}$$

$$I_2 = \frac{r12}{r22} \times I_1 = \frac{12}{32} \times (360) = 40 \text{ counts per minutes}$$



104. In natural radioactivity α, β and γ radiations are emitted These only three are the nuclear radiations.

105. Radioactivity is the phenomenon in which nucleus is disintegrated (decay).

106. ${}^{3}_{1}H + {}^{1}_{1}H \rightarrow {}^{4}_{2}He$ (α–particle)

107. As the work done by magnetic field is zero. So, According to work energy principle the energy gained will be zero for all of them.

108. Radioactivity is a spontaneous, random and natural phenomenon. So, it cannot be increase

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109. Isotopes are nuclei of an element having the same charge number "Z" but different mass number "A". So, ${}^{Y-1}_{X}Q$ is the isotope.

110. No. of $\alpha = \frac{232-208}{4} = \frac{24}{4} = 6$

${}^{232}_{90}Th \quad 6\alpha \rightarrow \quad {}^{208}_{78}D$

No. of $\beta = \frac{82-78}{1} = \frac{4}{1} = 4$

${}^{222}_{86}A \quad 6\alpha \rightarrow \quad {}^{208}_{78}D \quad 4\beta \rightarrow \quad {}^{208}_{82}Pb$

111. $Z = 72 - 2 + 1 - 2 - 0 = 69$

$A = 180 - 4 - 0 - 4 - 0 = 172$

112. In light elements

$P = N$

In heavy elements

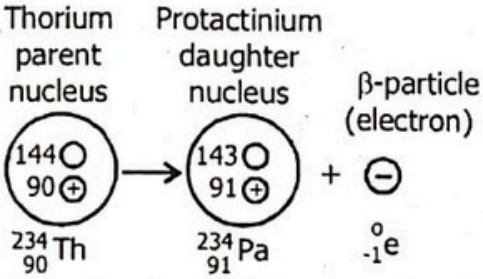
$P < N \Rightarrow \frac{P}{N} < 1$

$2(6) - 12$

$= 0$

113. α, and β–particles both radiate energy as X–rays photons when they are slowed by the electric field of the charged particles in the solid material.

114.



115. After $T_{1/2}$ the weight of un–decayed radioactive element = 0.5 g

After $2T_{1/2}$ the weight of un–decayed radioactive element = 0.25 g

$2T_{1/2} = 3$days

$T_{1/2} = 1.5$days = 36 hours

116. ${}^{235}_{92}U$ Number of protons = Number of electrons = Z = 92

Number of neutrons = N = A–Z = 143

117. Number of neutrons in $Na^{23}_{11} = 23 - 11 = 12$

Number of neutrons in $Mg^{24}_{12} = 24 - 12 = 12$

118. Nucleus of an atom whose atomic mass is 24 consist of

$A = P+N$

$24 = 11+13$

So, number of protons = 11

Number of neutrons = 13

119. For ${}_6C^{12}$, $p = 6, e = 6, n = 6$

For ${}_6C^{14}$, $p = 6, e = 6, n = 8$

120. 'β' particle is emitted when neutron breaks.

121. γ-rays are more penetrating than that of α, β and other electromagnetic radiations.

122. ${}^{A}_{Z}X \xrightarrow{-1\beta} {}^{A}_{Z+1}Y \xrightarrow{2\alpha} {}^{A-4}_{Z-1}B \xrightarrow{\gamma} {}^{A-4}_{Z-1}B$

- When β is emitted then charge will increase.
- When α is emitted then mass will reduce by 4 and charge will reduce by 2.

123. ${}^{10}_{5}B + {}^{1}_{0}n \rightarrow {}^{7}_{3}X + {}^{4}_{2}He$ Resultant nucleus has mass number "7".

124. In β-emission ${}^{1}_{0}n \rightarrow {}^{0}_{-1}\beta + {}^{1}_{1}H$

125. By definition, size of nucleus is 10^{-14} m.

126. β-particle emits when a neutron break and proton is produced as follow.

${}^{1}_{o}n \rightarrow {}^{1}_{+1}p + {}^{o}_{-1}\beta + \bar{\nu} \quad \left(\frac{p+1}{n-1} > \frac{p}{n}\right)$

So, number of protons increase and number of neutrons decrease and proton-neutron ratio increases

127. Range of β-particle is 100 times more than α-particles.

128. ${}^{238}_{92}u \rightarrow {}^{230}_{90}Th + 2{}^{4}_{2}He + 2{}^{0}_{-1}\beta$

129. Isotopes have the same proton (atomic) number and different mass (nucleon) number.

130. Alpha particles are helium nuclei $\left({}^{4}_{2}He\right)$ they cause ionization when they pass through air.

131. ${}^{217}_{85}At \xrightarrow{\alpha} {}^{213}_{83}V \xrightarrow{\alpha} {}^{209}_{81}W \xrightarrow{\beta} {}^{209}_{82}X$

132. By the emission of a β – particle and γ – radiation from nucleus of neptunium then, "proton number" increases by "1" but "nucleon number" remains same.

133. Number of neutrons in radon = 220-86=134
Number of neutrons in polonium = 216-84=132

134. ${}^{222}_{86}Rn \xrightarrow{\alpha} {}^{218}_{84}X \xrightarrow{\alpha} {}^{214}_{82}Y \xrightarrow{\beta} {}^{214}_{83}Bi$

No of α – particles = 2
No of β – particles = 1

135. ${}_{72}A^{180} \xrightarrow{\alpha} {}_{70}A_1^{176} \xrightarrow{\beta} {}_{71}A_2$
${}^{176} \xrightarrow{\alpha} {}_{69}A_3^{172} \xrightarrow{\gamma} {}_{69}A_4^{172}$

136. "λ" is decay constant that remain constant and does not depend upon age.

137. After 1 sec, 1 half-life will pass so, remaining activity $= \frac{10^3}{2^1} = 500$

After 3 sec, 3 half-lives will pass so, Remaining activity $= \frac{10^3}{2^3} = \frac{1000}{8} = 125$

138. Radioactive sources are random in nature, i.e. emission of radioactive particles is unpredictable.

$$n = \frac{10}{2.5} = 4 \Rightarrow \frac{A}{A_o} = \frac{N}{N_o} = \left(\frac{1}{2}\right)^n$$

139. Number of half-lives

$$\Rightarrow A = 1.6 \times \left(\frac{1}{2}\right)^4 = 0.1\,curie$$

140. $Half-life\left(T_{\frac{1}{2}}\right) = \frac{0.693}{\lambda} = \frac{0.693}{1.07\times10^{-4}} = 6476\,years$

141. $R = \frac{dN}{dt} \propto N \Rightarrow \frac{R_2}{R_1} = \frac{N_2}{N_1}$ *But* $\frac{N_2}{N_1} = \left(\frac{1}{2}\right)^{t/t_{1/2}} \Rightarrow \frac{25}{200} = \frac{1}{8} = \left(\frac{1}{2}\right)^3 \Rightarrow \frac{t}{t_{1/2}} = 3$

$\therefore t_{1/2} = \frac{t}{3} = \frac{3}{3} = 1\,hour = 60$ minutes

142. The radioactive element has 1/8 of a given quantity remains after 12 days. After 24 days, or in additional 12 days, the fraction remains undecayed is:

$\left(\frac{1}{8}\right)\left(\frac{1}{8}\right) OR \frac{1}{64}$

143. α – particles are helium nuclei.
β – particles are electrons.
γ – particles are photons.

144. ${}^{77}_{32}Ge \rightarrow {}^{0}_{-1}\beta + {}^{77}_{33}As$

145. Decay constant, $\lambda = 10^{-6}\ s^{-1}$
The half-life $T_{1/2}$ is thus given by

$T_{1/2} = \frac{0.693}{\lambda} = \frac{0.693}{10^{-6}} = 0.93 \times 10^6 s$

$= 192.5\,hrs \approx 8\,days \approx 1.14\,week \approx 1 week$

146. Half-life is a natural process that does not depend upon amount ~~of~~ element present, pressure and temperature.

147. $T_{1/2} = \frac{\ell n 2}{\lambda}$

148. Average life $= \frac{1}{\lambda} = \frac{1600}{0.693} = 2308 \approx 2319\,years$

Behavior of λ with time depends on the nature of the activity

149. By definition, range of α – particles is 5 mm to 200 mm.

150. $8\mu Ci \xrightarrow{17\frac{1}{2}} 4\mu Ci \xrightarrow{27\frac{1}{2}} 2\mu Ci$

BALOCHISTAN TEXT BOOK EXERCISE MCQs

1. Proton was discovered by

A. J.J Thomson
B. Chad wick
C. Ruther ford
D. Neil Bohr

2. Which of the following particle was discovered by Chadwick?

A. Electron
B. Proton
C. Neutron
D. Photon

3. Which of the following particle has the greatest mass?

A. Electron
B. Positron
C. Proton
D. Photon

4. The energy equivalent of one atomic mass unit (a.m.u) is

A. 1.6×10^{-19} J
B. 1.6×10^{19} J
C. 931 MeV
D. 9.31 MeV

5. The number of neutrons in the nucleus of $^{235}_{92}U$ is

A. 92
B. 143
C. 235
D. 327

6. The nuclei $^{22}_{11}Na$ and $^{22}_{10}Ne$ are known as

A. Isotopes
B. Isobars
C. Isotones
D. Isomers

7. Which of the following nucleus has the highest value of binding energy?

A. $^{4}_{2}He$
B. $^{56}_{26}Fe$
C. $^{141}_{56}Ba$
D. $^{235}_{92}U$

8. The binding energy per nucleon remains constant at

A. 8 MeV per nucleon
B. 7 MeV per nucleon
C. 6 MeV per nucleon
D. 9 MeV per nucleon

9. The nuclei have maximum binding energy per nucleon whose mass number lies between

A. 50 – 60
B. 100 – 150
C. 150 – 200
D. 200 – 235

10. Curie is the unit of

A. Energy
B. Intensity
C. Radioactivity
D. Half-life

11. The rate of decay depends upon

A. Pressure
B. Temperature
C. Intensity
D. Number of nuclei

12. Which rays have highest ionization power?

A. α-rays
B. β-rays
C. γ-rays
D. X-rays

13. A radioactive element will decay when its atomic number is

A. Equal to 82
B. Less than 82
C. Greater than 82
D. Does not depend upon number

14. When a radioactive element emits a β-particle the mass number of the atom will be

A. Increased by 1
B. Decreased by 1
C. Increased by 2
D. Remain the same

15. **The unit of decay constant 'λ' is**
A. m
B. m^{-1}
C. s
D. s^{-1}

16. **The energy released per fission reaction is**
A. 0.85 MeV
B. 28 MeV
C. 150 MeV
D. 200 MeV

17. **Moderator used in a nuclear reactor is**
A. Ice
B. Heavy water
C. Boron rods
D. Cadmium rods

18. **The energy released in a fusion reaction is**
A. 0.85 MeV
B. 28 MeV
C. 200 MeV
D. 400 MeV

19. **On average, the number of neutrons emitted per fission is**
A. 2
B. 2.5
C. 3
D. 3.5

20. **Which force has the negligible effect on elementary particles?**
A. Strong nuclear force
B. Weak nuclear force
C. Electromagnetic force
D. Gravitational force

21. **The particles with half integral spin are known as**
A. Fermion
B. Photon
C. Bosons
D. Meson

22. **Which of the following particles have the highest value of mass?**
A. Photons
B. Leptons
C. Mesons
D. Baryons

ANSWER KEY

1	A	6	B	11	D	16	D	21	A
2	C	7	B	12	A	17	B	22	D
3	C	8	A	13	C	18	B		
4	C	9	A	14	D	19	B		
5	B	10	C	15	D	20	D		

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KPK TEXT BOOK EXERCISE MCQs

1. **The binding energy for nucleus A is 7.7 MeV and that for nucleus B is 7.8 MeV. Which nucleus has the larger mass?**
   A. Nucleus A
   B. Less than nucleus A
   C. Nucleus B
   D. None of these

2. **How many neutrons are there is the nuclide Zn^{66}?**
   A. 22
   B. 36
   C. 30
   D. 66

3. **Mass equivalent of 931 MeV energy is:**
   A. 6.02×10^{-23} kg
   B. 2.67×10^{-27} kg
   C. 1.66×10^{-27} kg
   D. 6.0210^{-27} kg

4. **The energy equivalent of 1 kg of matter is about:**
   A. 10^{-15} J
   B. 10^{-12} J
   C. 1 J
   D. 10^{17} J

5. **The radioactive nuclide $_{86}Ra^{228}$ decays by a series of emissions of three alpha particles and one beta particle. The nuclide X finally formed is,**
   A. $_{84}X^{220}$
   B. $_{83}X^{216}$
   C. $_{86}X^{222}$
   D. $_{88}X^{215}$

6. **A radioactive substance has a half-life of four months. 3 – fourth of the substance will decay in:**
   A. 6 months
   B. 12 months
   C. 8 months
   D. 16 months

7. **Gamma radiations are emitted due to:**
   A. De-excitation of atom
   B. Excitation of atom
   C. De-excitation of nucleus
   D. Excitation of nucleus

8. **Unit of decay constant λ is,**
   A. ms
   B. m
   C. m^{-1}
   D. S^{-1}

9. **Which of the following basic forces is able to provide an attraction between two neutrons?**
   A. Electrostatic and nuclear
   B. Gravitational and strong nuclear
   C. Electrostatic and gravitational
   D. only nuclear force

10. **Bottom quark carries charge:**
    A. $\frac{2}{3}e$
    B. $\frac{+1}{3}e$
    C. $\frac{-2}{3}e$
    D. $\frac{-1}{3}e$

ANSWER KEY

1	A	6	C
2	B	7	C
3	C	8	D
4	D	9	B
5	B	10	D

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PAST PAPERS 2008-2020

1. **When a helium atom loses an electron, it becomes:** (UHS 2008)
   A. An alpha particles
   B. Proton
   C. A positive helium ion
   D. A negative helium ion

2. **Beta ray emitted by a radioactive substance is:** (UHS 2008)
   A. An electron which was existing outside the nucleus
   B. An electron which was existing inside the nucleus
   C. An electron emitted by the nucleus as a result of the decay of neutron inside the nucleus
   D. A pulse electromagnetic wave

3. **Which one is the most stable element on the basis of binding energy?** (UHS 2008)
   A. Sn
   B. Ba
   C. Kr
   D. Fe

4. **_____ are the particles that experience strong nuclear force.** (UHS 2008)
   A. Electrons
   B. Muons
   C. Neutrinos
   D. Neutrons

5. **For photons of energy greater than 1.02 MeV the probability of pair production occurrence _____ as the energy increases.** (UHS 2008)
   A. Increase
   B. Completely diminishes
   C. Reduced to half
   D. Remains unchanged

6. **The neutron is assumed to be made of:** (UHS 2008)
   A. One up and two down quarks
   B. Two up and two down quarks
   C. Two up and one down quarks
   D. One up and one down quarks

7. **The emission of γ-radiations from the nucleus is generally represented by equation:** (UHS 2009)
   A. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \gamma$–radiations
   B. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \beta$–radiations
   C. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z-1}X + \gamma$–radiations
   D. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z+1}X + \gamma$–radiations

8. **For intermediate energy of radiations, the dominant process is:** (UHS 2009)
   A. Compton Effect
   B. Nuclear effect
   C. Photoelectric effect
   D. Pair production

9. **In pair production, the type of photon used:** (UHS 2010)
   A. α-particles
   B. β-particles
   C. X-rays
   D. γ-radiations

10. **In the half-life an element, the equation for the number of decaying atoms is given by:** (UHS 2010)
    A. $\Delta N \propto - N\Delta t$
    B. $\Delta N = kN\Delta t$
    C. $\Delta N \propto \times - n\Delta t$
    D. $\Delta N \propto \Delta N\Delta t$

11. **Decay constant is given as:** (UHS 2010)
    A. $-\frac{\Delta N / N}{\Delta t}$
    B. $-\frac{\Delta N}{\Delta t}$
    C. $-\frac{N}{\Delta t}$
    D. $\frac{\Delta N / N}{\Delta t}$

12. **Ionizing capability of gamma rays is:** (UHS 2011)
    A. Equal to alpha and beta particles
    B. Less than alpha but greater than beta particles
    C. Less than both alpha and beta particles
    D. Less than beta but greater than alpha particles

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13. **Half-life of a radioactive element is:** (UHS 2011)
A. Inversely proportional to square of decay constant
B. Directly proportional to square of decay constant
C. Directly proportional to decay constant
D. Inversely proportional to decay constant

14. **The time rate of decay of a parent atom to the number of radioactive nuclei present at that time is equal to:** (UHS 2011)
A. Half-life of radioactive element
B. Mean life
C. Decay constant of radioactive element
D. Activity of radioactive element

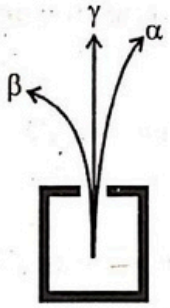
15. **Which one of the following particle is emitted as a result of nuclear reaction?** (UHS 2011)
$Ra^{226} \rightarrow Rn^{222}$
A. Beta
B. Alpha
C. Gamma rays
D. one alpha and one beta

16. **What is the charge on alpha particles emitted during the phenomenon of radioactivity?** (UHS 2012)
A. +e
B. –e
C. –2e
D. +2e

17. **A radioactive nuclide decays by emitting an α-particle and a γ-ray photon, the change in the nucleon number will be:** (UHS 2012)
A. –4
B. –2
C. –2
D. –3

18. **A half-life of sodium-24 is _____ which is used to estimate the volume of blood in a patient:** (UHS 2012)
A. 6 hours
B. 15 hours
C. 8 hours
D. 15 days

19. **In a radioactive phenomenon, observation shown in figure where "α" deviates lesser than "β" in same electric or magnetic field (not shown in the figure). What is the reason of less deviation of α?** (UHS 2012)



A. α is a lighter particle
B. α is very fasting moving particle
C. α is heavier particle
D. None of these

20. **Which of the following effect is observed due to emission of β– during the phenomenon of radioactivity?** (UHS 2012)
A. "A" increases by 1 and "Z" remains same
B. "Z" increases by 1 and "A" remains same
C. "Z" decreases by 1 and "A" remains same
D. "A" decreases by 1 and "Z" remains same

21. **Among the three types of radioactive radiation, which have strongest penetration power?** (UHS 2013)
A. Alpha
B. Gamma
C. Beta
D. α, β and γ have same penetration

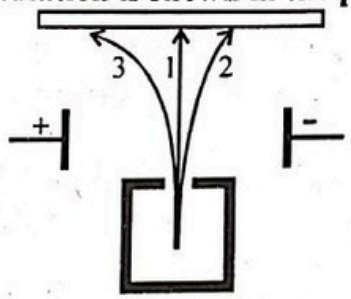
22. **Emission of alpha decay from a radioactive substance causes:** (UHS 2013)
A. Decrease in "Z" by 4 and decrease in "A" by 2
B. Decreases in "A" by 1 and "Z" remains same
C. Decrease in "Z" by 1 and "A" remains same
D. Decrease in "A" by 4 and decrease in "Z" by 2

23. **Which one of the following emission takes place in a nuclear reaction?** (UHS 2013)
$_{90}Th^{234} \rightarrow {}_{91}Pa^{234} +$ ____
A. Alpha
B. Gamma
C. Beta
D. Photons

24. **Isotopes are those nuclei of an element that have:** (UHS 2013)
A. Same mass number but different atomic number
B. Same mass number as well as atomic number
C. Different mass number as well as atomic number
D. Same atomic number but different mass number

25. **Emission of radiation from radioactive substance is:** (UHS 2013)
A. Dependent on both temperature and pressure
B. Independent of temperature but dependent on pressure
C. Independent of both temperature and pressure
D. Independent of pressure but dependent on temperature

26. **Three points of radioactive radiation are observed as shown in the figure presence of electric field, which type of radiation is shown in the path "1"?** (USH 2014)



A. Alpha
B. Gamma
C. Beta
D. Cathode ray

27. **A uranium isotope $^{232}_{92}U$ undergoes one α-decay an one $^{0}_{-1}\beta$-decay. What is the atomic number of final product?** (USH 2014)
A. 90
B. 91
C. 89
D. 88

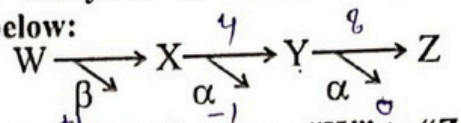
28. **A beta (β) particle is a fast moving electron. During a β-decay how the atomic number and mass number of a nucleus change?** (USH 2014)

	Atomic number	Mass number
A.	Remains the same	Increases by one
B.	Increase by one	Dcreases by one
C.	Increase by one	Remains same
D.	Decrease by two	Decrease by four

29. **A naturally occurring radioactive element decays two alpha particles. Which one of the following represents status of daughter element with respect to mass number "A" and charge number "Z"?** (USH 2014)
A. "Z" decreases by 4 and "A" decreases by 2
B. "Z" decreases by 2 and "A" decreases by 4
C. "Z" decreases by 4 and "A" decreases by 8

D. "Z" decreases by 8 and "A" decreases by 4

30. **A radioactive isotope "W" decays to "X" which decays to "Y" and "Y" decays to "Z" as represented by figure below:**



What is the change in the atomic number from "W" to "Z"? **(USH 2014)**

A. Increase by 3
B. Decrease by 3
C. Increase by 5
D. Decrease by 5

31. **In the reaction $^{234}_{90}Th \rightarrow ^{234}_{91}Pa + ^{0}_{-1}e$ the electron $^{0}_{-1}e$ emits from the:** **(UHS 2015)**

A. 1st orbit
B. 2nd orbit
C. Nucleus
D. Valence shell

32. **According to the equation $^{A}_{Z}X \rightarrow Y + 3\alpha$ particles, what are the atomic and mass numbers of "Y"?** **(UHS 2015)**

A. Z–6, A–12
B. Z–2, A–4
C. Z+1, A
D. Z+3, A

33. **A certain radioactive nuclide of mass number "x" decay by β-emission and α-emission to a second nuclide of mass number "t", which of the following correctly relates "x" and "t"?** **(UHS 2015)**

A. $x = t - 4$
B. $x = t + 4$
C. $x + 3 = t$
D. $x - 1 = t$

34. **During the decay of radioactive isotopes $^{232}_{90}X$ to a stable isotopes , six α-particles and four β-particles are emitted, what is the atomic number "Z" and mass number "A" of the stable isotopes:** **(UHS 2015)**

A. Z = 70, A = 220
B. Z = 78, A = 212
C. Z = 82, A = 212
D. Z = 82, A = 208

35. **Wavelength of γ-rays is:** **(UHS 2016)**

A. Equal to the X-rays
B. Longer than X-rays
C. Shorter than X-rays
D. Broader than X-rays

36. **Thorium is transformed after the emission of β-particle into:** **(UHS 2016)**

A. Bismuth
B. Protactinium
C. Polonium
D. Palladium

37. **Emission of γ-rays from radioactive element result into:** **(UHS 2016)**

A. Increase of charge number 1
B. Decrease of mass number by 1
C. No change in the charge number
D. Decrease charge number by 1

38. **The relation between decay constant "λ" and half-life '$T_{1/2}$' of radioactive substance is:** **(UHS 2016)**

A. $\lambda = \frac{1}{T1/2}$
B. $\lambda = 0.693\ T_{1/2}$
C. $\lambda = T_{1/2}$
D. $\lambda = \frac{0.693}{T1/2}$

39. **Complete the radioactive equation: $^{?}_{?}Z \rightarrow ^{a}_{b}Y + \gamma$** **(UHS 2017)**

A. $^{a}_{b+1}Z$
B. $^{a+1}_{b-1}Z$
C. $^{a+1}_{b+1}Z$
D. $^{a}_{b}Z$

40. **The quantity of uranium is 400 g. The amount of uranium left after 3 half-lives is: (UHS 2017)**

A. 50g
B. 25g
C. 100g
D. 200g

41. **Calculate the activity (decaying atom per unit time) of radioactive strontium -90 having 6.7×10^{21} atoms at t = 0. Decay constant of strontium-90 is $8.3 \times 10^{-10}\ s^{-1}$. (UHS 2018)**

A. 12×10^{11} Bq
B. $5.6 \times 10^{11}\ s^{-1}$
C. 8.01×10^{10} Bq
D. 5.6×10^{12} Bq

42. **Calculate the half-life of bismuth-214 which has a decay constant of $4.3 \times 10^{3}\ s^{-1}$. (UHS 2018)**

A. 3×10^{3} s
B. 2.9×10^{-3} s
C. 2.9×10^{3} s
D. 1.6×10^{-4} s

43. **Heavy nucleus of atoms go through fission so that they can: (UHS 2019)**

A. Absorb high amount of energy
B. Absorb low amount of energy
C. Increase their binding energy per nucleon
D. Reduce their binding energy per nucleon

44. **There are initially 400 atoms in a radioactive sample. What would be the number of atoms after 3 half-lives? (PMC 2020)**

A. 400
B. 200
C. 50
D. 25

45. **While using radiation therapy, cancerous thyroid is treated with _____ radioisotope: (PMC 2020)**

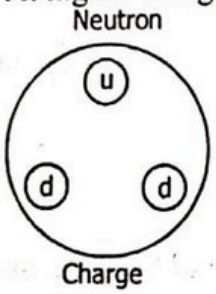
A. Carbon
B. ^{235} Uranium
C. Thorium
D. Iodine – 131

ANSWER KEY

1	C	6	A	11	A	16	D	21	B	26	B	31	C	36	B	41	D
2	C	7	A	12	C	17	A	22	D	27	B	32	A	37	C	42	D
3	D	8	A	13	D	18	B	23	C	28	C	33	B	38	D	43	C
4	D	9	D	14	C	19	C	24	D	29	C	34	D	39	D	44	C
5	A	10	A	15	B	20	B	25	C	30	B	35	C	40	A	45	D

PAST PAPERS 2008-2020

1. He-atom has two electrons in its outermost orbit. When it loses one electron it becomes a positive He-ion. (He^{+1})
2. Negative β-particle is an electron, it emits from the nucleus. As there is no electron present inside the nucleus. So, it is formed at the time of emission. A neutron is converted into to a proton and negative β-particle. ${}^{1}_{0}n \rightarrow {}^{1}_{1}H + {}^{0}_{-1}e$
3. The binding energy per nucleon increases with the mass number till it reaches a maximum value of 8.8 MeV at mass number 58 (Fe).
4. Hadrons are particles that experience the strong nuclear force. In addition to protons, neutrons and mesons are hadrons.
5. At higher energies (more than 1.02 MeV), the dominant process is pair production.



6. 2/3 - 1/3 -1/3 = 0
7. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \gamma$-radiation

   Here ${}^{A}_{Z}X^{*}$ represents an excited nucleus while ${}^{A}_{Z}X$ shows ground state of the nucleus.
8. At intermediate energies, the dominant process is Compton scattering.
9. At higher energies (more than 1.02 MeV i.e., γ- rays), the dominant process is pair production.
10. The decaying atoms "ΔN" is proportional to the time interval "Δt" and the number of atoms "N". So,

    $\Delta N \propto -N$ and $\Delta N \propto \Delta t$ By co${}^{4}_{2}$mbining $\Delta N \propto -N\Delta t$
11. The decay constant of any element is equal to the fraction of decaying atoms per unit time.$\lambda = -\frac{\Delta N / N}{\Delta t}$
12. Ionization ability of α,β and γ is given by: $\gamma < \beta < \alpha$
13. $T_{1/2} = \frac{0.693}{\lambda} \Rightarrow T_{1/2} \propto \frac{1}{\lambda}$
14. $\lambda = -\frac{\Delta N / N}{\Delta t}$
15. ${}^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + He$
16. α-particles are helium nuclei. The charge on them is +2e while their mass is 4u that is every α-particle has two protons and two neutrons.
17. ${}^{A}_{Z}X \quad \alpha \rightarrow {}^{A-4}_{Z-2}Y \quad \gamma \rightarrow {}^{A-4}_{Z-2}Y$
18. Sodium-24 is 15 hours.
19. As α-particle is massive (inertia) than β. So, it will show less deviation under same electric and magnetic field.
20. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e$

CamScanner

21. Ionization order
$\alpha > \beta > \gamma$
Penetration order
$\alpha < \beta < \gamma$

22. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y$

23. ${}^{234}_{90}Th \rightarrow {}^{234}_{91}Pa + {}^{o}_{-1}e$

24. Isotopes are nuclei of an element having the same charge number "Z" but different mass number "A".

25. Radioactivity is a pure nuclear phenomenon which is independent of both temperature and pressure.

26. Gamma rays are electromagnetic radiation (charge less). It is unaffected by electric and magnetic fields.

27. ${}^{232}_{92}U \ \alpha \rightarrow {}^{228}_{90}Y \ \beta \rightarrow {}^{228}_{91}Y$

28. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{o}_{-1}e$

29. ${}^{A}_{Z}X \ 2\alpha \rightarrow {}^{A-8}_{Z-4}Y$

30. ${}^{A}_{Z}W \ \beta \rightarrow {}^{A}_{Z+1}X \ \alpha \rightarrow {}^{A-4}_{Z-1}Y \ \alpha \rightarrow {}^{A-8}_{Z-3}Z$

31. Negative β-particle is an electron, it emits from the nucleus. A neutron is converted into to a proton and negative β-particle.
${}^{1}_{o}n \rightarrow {}^{1}_{1}H + {}^{o}_{-1}e$

32. ${}^{A}_{Z}W \ 3\alpha \rightarrow {}^{A-12}_{Z-6}Y$

33. ${}^{x}_{Z}W \ \beta \rightarrow {}^{x}_{Z+1}X \qquad \alpha \rightarrow {}^{x-4}_{Z-1}Z = {}^{t}_{Z-1}Z$
$t = x - 4 \Rightarrow x = t + 4$

34. ${}^{232}_{90}X \ 6\alpha \rightarrow {}^{208}_{78}Y \qquad 4\beta \rightarrow {}^{208}_{82}Z$

35. γ-rays are the electromagnetic waves of energy greater than x-rays and wavelength shorter than x-rays.

36. ${}^{234}_{90}Th \rightarrow {}^{234}_{91}Pa + {}^{o}_{-1}e$

37. ${}^{A}_{Z}X^{*} \rightarrow {}^{A}_{Z}X + \gamma\text{-radiation}$

38. $T_{1/2}\lambda = \ln 2 = 0.693 \Rightarrow \lambda = \dfrac{0.693}{T1/2}$

39. ${}^{a}_{b}Z \rightarrow {}^{a}_{b}Y + \gamma$
No change in atomic number and mass number.

40. Amount of un–decayed "U" after 3 half-lives
$= \dfrac{1}{23}(m) = \dfrac{1}{8}(400\ g) = 50\ g$

41. $\text{Activity} = \dfrac{\Delta N}{\Delta t} = \lambda N$
$= (8.3 \times 10^{-10}\ s^{-1})(6.7 \times 10^{21}) = 5.6 \times 10^{12}\ Bq$

42. $T_{1/2} = \dfrac{0.693}{\lambda} = \dfrac{0.693}{4.3 \times 103} = 1.6 \times 10^{-4}\ s$

43. When heavy element having small value of binding energy per nucleon breaks into lighter elements of binding energy per nucleon (fission), then a large amount of energy can be obtained.

44. $N = \dfrac{N_o}{2^n} = \dfrac{400}{2^3} = \dfrac{400}{8} = 50$

45. Radioactive iodine-131 is used to combat cancer of the thyroid gland.

PMC PAST PAPER 2022 (NUCLEAR PHYSICS)

Q.1 **Radius ratio has units**
A. nano meter
B. millimeter square
C. Unit less
D. Fermi

Q.2 **The binding energy for nucleus A is 7.7 MeV and that for nucleus B is 7.8 MeV. Which nucleus has larger mass?**
A. A
B. B
C. More info required
D. None of these

Q.3 **One AMU is equal to**
A. 1.66×10^{-27}kg
B. 166×10^{-15}ng
C. 166×10^{-20}g
D. All of above

Q.4 **Antimatter consists of**
A. Antiproton
B. Antineutron
C. Positron
D. All of above

Q.5 **Neutron and proton are commonly known as**
A. Nucleon
B. Meson
C. Boson
D. Quartz

Q.6 **The charge on alpha particles is**
A. Plus one
B. Plus two
C. Minus two
D. Minus one

Q.7 **Alpha particle ionizes an atom**
A. Through direct collision
B. Through electrostatic attraction
C. Through electrostatic repulsion
D. All of above

Q.8 **T.V sets and microwave ovens emit**
A. X-rays
B. α-rays
C. β-rays
D. γ-rays

Q.9 **An alpha particle in a single encounter**
A. Loses a small fraction of its energy
B. Losses most of its energy
C. Loses no energy at all
D. Loses all of its energy

Q.10 **X-rays are electromagnetic waves like**
A. Light waves
B. Heat waves
C. Microwaves
D. γ-rays

Q.11 **The charge on beta particle is**
A. 1
B. -1
C. +2
D. -2

Q.12 **The matter is built from small particles called**
A. radiant
B. atoms
C. isotopes
D. ions

Q.13 **The lifetime of unstable nuclei is**
A. limited
B. unlimited
C. 100 years
D. 50 years

Q.14 **If the half-life of the radioactive element is $T_{1/2}$ then at the end of this time the number of atoms in the sample will become**
A. one quarter
B. double
C. half
D. triple

Q.15 **The word atom is derived from the Greek word**
A. antimum
B. atomos
C. otomos
D. optium

Q.16 What is the half-time of a radioactive sample (in minutes), if its mean life is 200 s?
A. 0.69 min
B. 2 min
C. 2.57 min
D. 2.31 min

Q.17 Nucleus of an atom whose atomic mass is 24 consists of
A. 11 electrons, 11 protons and 13 neutrons
B. 11 electrons, 13 protons and 11 neutrons
C. 11 protons and 13 neutrons
D. 11 protons and 13 electrons

Q.18 A nuclei having same number of neutron but different number of protons / atomic number are called
A. isobars
B. isomers
C. isotones
D. isotopes

Q.19 Nuclear forces exists between
A. neutron – neutron
B. proton – proton
C. neutron – proton
D. all of these

Q.20 The antiparticle of electron is
A. positron
B. α-particle
C. proton
D. β-particle

Q.21 Radioactivity is
A. irreversible process
B. self-disintegration process
C. spontaneous
D. all of the above

Q.22 Given the following properties of the up and down quarks and of the proton, what combination of quarks makes up a proton?
A. uuu
B. uud
C. udd
D. ddd

Q.23 The neutrino interacts with the world primarily through the _____ force.
A. strong
B. electromagnetic
C. weak
D. gravitational

Q.24 The mass of a positron is
A. the same as that of an electron.
B. the negative of that of an electron.
C. zero.
D. about the same as that of a neutron.

Q.25 The large scale destruction, that would be caused due to the use of nuclear weapons is called
A. Nuclear holocaust
B. Thermo-nuclear reaction
C. Neutrons reproduction factor
D. None of these

Q.26 Sample of radioactive element with initial mass of 24 gm decayed to 3 gm in 36 minutes. How much of original sample remained after the first 12 minutes?
A. 12 g
B. 6 g
C. 2 g
D. 8 g

Q.27 C^{14} decays with a half-life of about 5800 years. In a sample of bone, the ratio of C^{14} to C^{14} is found to be 1/4th of what it is in free air. This bone may belong to a period about X centuries ago, where X is nearest to:
A. 2×5800
B. 5800
C. 5800/2
D. 3×5800

Q.28 Which is not radioactive?
A. ozone
B. hydrogen
C. sodium
D. all of these

Q.29 Protons and neutrons are composed of smaller particles called
A. Quarks
B. baryons
C. bosons
D. photons

Q.30 A nucleus emits an α- particle, followed by two β- particles. The final nucleus will be:
A. an isotone of the original one
B. an isotope of the original one.
C. an isobar of the original one.
D. none of these

Q.31 C14 has half-life 5700 years. At the end of 11400 years, the actual amount left is
A. 0.0625 of original amount
B. 0.5 of original amount
C. 0.25 of original amount
D. 0.125 of original amount

Q.32 A radioactive decay rate of 3.7×10^{10} disintegrations per second defines the unit of measurement known as the
A. Curie
B. Rutherford
C. Rontgen
D. Rad

Q.33 Absorbed dose D is defined as energy absorbed from ionization radiation per unit _____.
A. mass
B. charge
C. time
D. area

Q.34 If 238U decay two gamma particles the new atomic mass will be
A. 238U
B. 234U
C. 237U
D. none of these

Q.35 Isotopes of an element have a different number of
A. proton
B. neutron
C. electron
D. atom

Q.36 Two spherical nuclei have mass number 216 and 64 with radius R1 and R2 respectively. The ratio of R2/R1 is
A. 1.5
B. 2
C. 2.5
D. 3

Q.37 Value of charge on Up Quark is
A. +2e/3
B. -2e/3
C. 1e/3
D. -1e/3

Q.38 Particles that have less mass than protons
A. Mesons
B. Baryons
C. Photon
D. Meons

Q.39 Biological weapon used is?
A. radiations
B. chemicals
C. virus
D. All

Q.40 Treatment of cancer cannot produce _____rays
A. α
B. β
C. γ
D. cosmics

Q.41 Number of Down Quark in Proton
A. 1
B. 2
C. 3
D. 4

Q.42 Number of Quarks in hydrogen atom
A. 1
B. 2
C. 3
D. 4

Q.43 Which of following has high mass
A. α
B. β
C. γ
D. Neutron

Q.44 Which of the following radiation have more ionization?
A. Alpha
B. beta
C. gamma
D. None

Q.45 How many Type of Quarks are there
A. 2
B. 6
C. 8
D. 10

Q.46 C-14 decay into Betta and change to
A. N14 B. C14
C. C13 D. C12

Q.47 Spin of photon
A. 1 B. 1/2
C. 1/3 D. 1/4

Q.48 Nucleus doesn't contain
A. Neutron B. Free Electron
C. Proton D. None

Q.49 High speed beta rays are
A. Electron B. Positron
C. Electron and positron D. Proton

Q.50 Photons have mass ____ than proton
A. Greater B. Less
C. Equal D. Zero mass

Q.51 Who discover neutron:
A. JJ Thomson B. Chadwick
C. Maxwell D. Max planks

Q.52 Radiotherapy used in treatment of cancer usually use gamma-rays from
A. copper-60 B. cobalt-60
C. gold D. silver

Q.53 1 Curie is equal to
A. 1 MBq B. 37 MBq
C. 37 GBq D. 3.7 GBq

Q.54 _____ are such nuclei of an element that have the same mass number A, but have different charge number Z
A. isotopes B. isobars
C. isomers D. isotherms

Q.55 The radioactive isotope of Carbon is
A. 12C B. 14C
C. 10C D. none of these

Q.56 One isotope of Uranium is U-238. Any other isotope of Uranium must have
A. 146 protons B. 92 protons
C. 92 neutrons D. 146 neutrons

Q.57 What will be the means life of a source whose half-life is 1 hour?
A. 0.693 hour B. 1 hour
C. 1.9 hour D. 1.443 hour

Q.58 The radioactive element when decay to first half-life then, new element is called:
A. daughter element B. modified element
C. radioactive element D. all of these

Q.59 Which reaction is endothermic:
A. fission B. fusion
C. formation of gas D. none of these

Q.60 How many quarks in electron:
A. 0 B. 1
C. 2 D. 3

Q.61 Radon-222 has 136 neutrons, how many neutrons are there in Radon-220:
A. 131 B. 134
C. 136 D. none of these

Q.62 In fusion reaction of sun which element isotopes are used
A. 0 B. C
C. U D. H

Q.63 If a photon is absorbed by an electron the energy of electron
A. increase B. decrease
C. remains same D. another photon will be released by electron

Q.64 What is the atomic number and mass number of Helium?
A. A=4, Z=2 B. A=2 Z=4
C. A=1 Z=1 D. A=3, Z=1

Q.65 What will be the decay constant of a material whose half-life is 1600 years in (year)^-1?
A. 4.33×10^{-4} B. 2.33×10^{-4}
C. 4.33×10^{4} D. 2.33×10^{4}

Q.66 The charge and mass of photon is
A. 0,0 B. 1+,0
C. 1-,0 D. 1,1

Q.67 The deuterium atom has _____ quarks
A. 3 B. 6
C. 9 D. 12

Q.68 Iodine-131 is used to trace which cancer
A. lungs B. thyroid gland
C. breast D. liver

Q.69 The source of gamma radiation is
A. outside nucleus B. inside nucleus
C. electron transition D. none of these

Q.70 The isotope of 235U92 has _____ number of neutrons
A. 141 B. 142
C. 143 D. 144

Q.71 Numbers of neutrons present in a nucleus is given by
A. N= A+Z B. N=AZ
C. N=A-Z D. N=Z-A

Q.72 What will happen in a time of 7 hours, if a radioactive substance has an average life of 7 hours?
A. Half of the active nuclei decay B. Less half of the active nuclei decay
C. More than half of the active nuclei decay D. All active nuclei decay

Q.73 The unstable atom means
A. electrons are increasing B. protons are increasing
C. neutrons are increasing D. None of these

Q.74 Which of the following is the same for isotopes?
A. neutrons B. protons
C. electrons D. all of them

Q.75 Which one of the following statements is correct?
A. The mass of the nucleus must be less than the sum of the masses of the constituent neutrons and protons.
B. The mass of the nucleus must be equal to the sum of the masses of the constituent neutrons and protons.
C. The mass of the nucleus must be greater than the sum of the masses of the constituent neutrons and protons.
D. The mass of the nucleus must be greater than the sum of the masses of the constituent neutrons and protons.

Q.76 How many down quarks in Neutron?
A. 1 B. 2
C. 3 D. 4

Q.77 Which isotope has highest momentum when moving with same velocity
A. Protium B. deuterium
C. tritium D. all of these have same momentum

Q.78 What will be the decay constant of substance whose half-life is 1 hour? Give your answer in (hour^{-1}).
A. 0.693 B. 2494.8
C. 2294.8 D. 41.58

Q.79 Half-life of a radiation active element is that period in which half of the atoms:
A. diffuses B. decomposes
C. disturbed D. decays

Q.80 The fission reaction is slow reaction:
A. TRUE B. FALSE
C. true when neutrons slows down D. any of these

Q.81 What is the unit of decay constant?
A. Second B. Minute
C. Hour D. sec^{-1}

Q.82 Half-life of radioactive element means
A. Full life decays B. Quarter life decay
C. Half of decay D. All of These

Q.83 The artifacts and fossils are used to estimate ages by measured _____ content
A. Mineral B. Chemical
C. Radioactive D. All of these

Q.84 The half-life of a radioactive substance is 40 years. How long will it take to reduce to one fourth of its original amount and what is the value of decay constant?
A. 40 year, 0.9173/year B. 80-year, 0.0173 year
C. 90 year, 9.017/year D. none of these

Q.85 Whenever new nuclei are formed energy is
A. absorbed B. released
C. remains unchanged D. none of these

Q.86 SI unit of equivalent dose is
A. gray B. radiation
C. Sievert D. rem

Q.87 The radiations all around us are called_____ radiations
A. natural B. artificial
C. background radiations D. no radiation is around us

Q.88 1 barn is a unit of area having the magnitude of:
A. 10^{24} cm^2 B. 10^{-28}m^2
C. 10^{-28}cm^2 D. none of these

Q.89 To start a fusion reaction, energy required is:
A. small B. large
C. infinite D. zero

Q.90 The number of protons in the nucleus is called number.
A. atomic B. charge
C. atomic or charge D. neither atomic nor charge

Q.91 The process by which a heavy nucleus splits up into lighter nuclei is known as
A. fission B. fusion
C. alpha-decay D. a chain reaction

Q.92 Ozone reflects radiation from sun back into space
A. IR B. UV
C. alpha D. all of these

Q.93 Which water is used to reduce the speed of fast moving neutrons
A. Salty water B. Pure water
C. heavy water D. muddy water

Q.94 When deuterium and tritium fuse together they form
A. O atom B. U atom
C. N atom D. He atom

Q.95 The reason that white light is not harmful radiation is that:
A. its speed is less than other radiations B. it is composed of different lights
C. it is originated from non-radioactive element D. none of these

Q.96 The radius R of a nucleus is given by:
A. $R=r_oA^{-1/3}$ B. $R= r_o A^{1/3}$
C. $R= r_o A^3$ D. none of these

Q.97 Time is required for all the atoms to decay.
A. finite B. infinite
C. very short D. zero

Q.98 The ionization power of ray is highest.
A. beta B. gamma
C. He-Ne laser D. none of these

Q.99 β- decay means emission of electron from:
A. radioactive nucleus B. innermost electron orbit
C. a stable nucleus D. outer mot electron orbit

Q.100 The effect of nuclear bomb radiation lasts for
A. few minutes B. few weeks
C. few days D. more than 90 Years

ANSWER KEY

1	C	11	B	21	D	31	C	41	A	51	B	61	B	71	C	81	D	91	A
2	B	12	B	22	B	32	A	42	C	52	B	62	D	72	C	82	C	92	B
3	A	13	B	23	C	33	A	43	A	53	C	63	A	73	D	83	C	93	C
4	D	14	C	24	A	34	A	44	A	54	B	64	A	74	B	84	B	94	D
5	A	15	B	25	A	35	B	45	B	55	B	65	A	75	A	85	B	95	C
6	B	16	D	26	A	36	A	46	A	56	B	66	A	76	C	86	C	96	B
7	D	17	A	27	A	37	A	47	A	57	A	67	B	77	C	87	C	97	B
8	A	18	C	28	D	38	A	48	B	58	A	68	B	78	A	88	B	98	B
9	B	19	D	29	A	39	A	49	C	59	B	69	B	79	D	89	B	99	A
10	D	20	A	30	B	40	D	50	D	60	A	70	C	80	C	90	C	100	D

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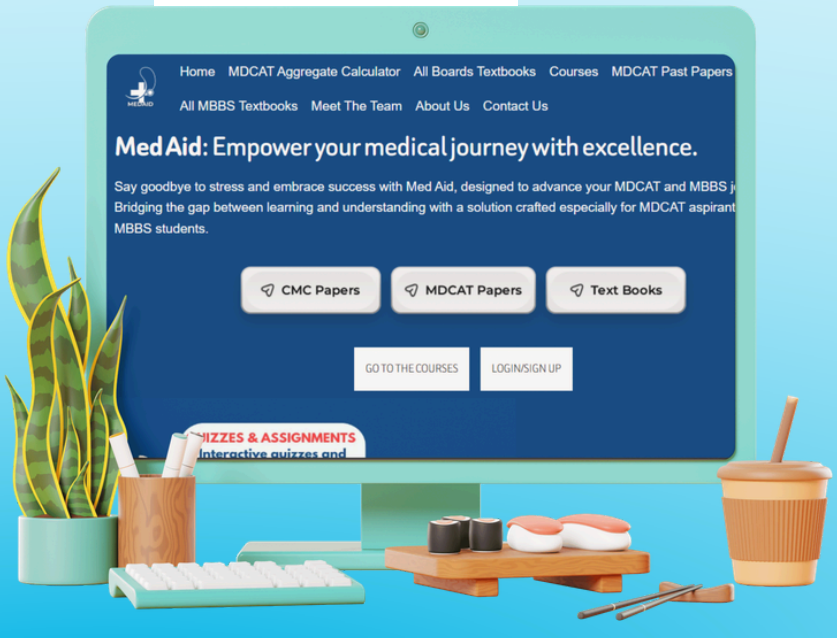

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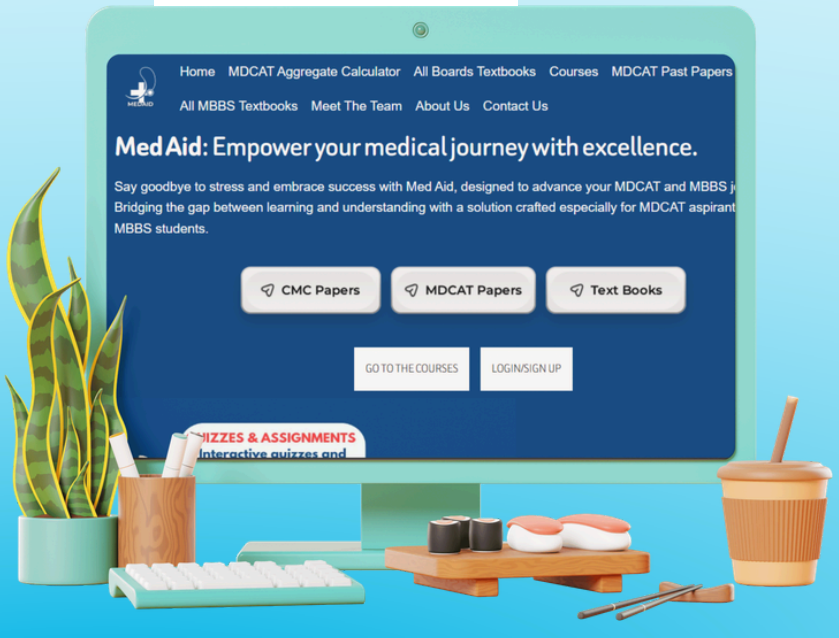

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