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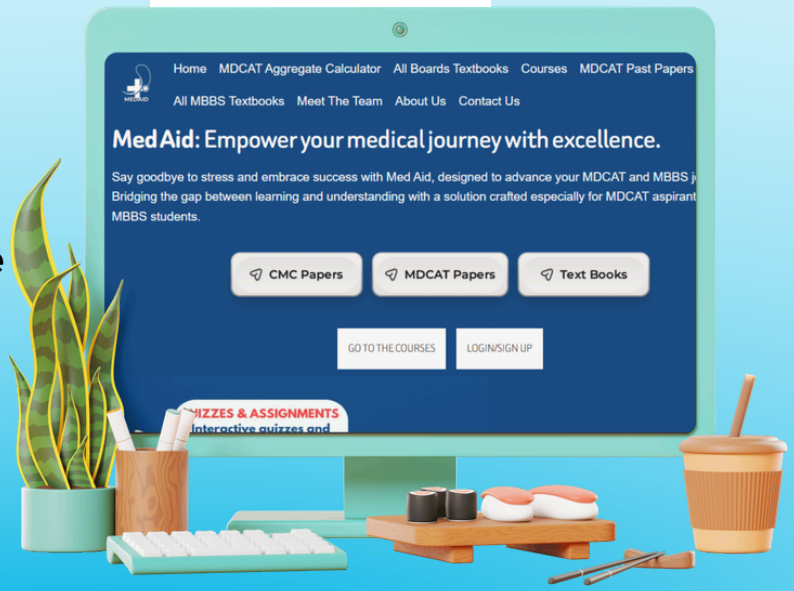
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CONTENTS

01	MEASUREMENTS	07-22
02	MOTION AND FORCE	23-44
03	WORK, ENERGY AND POWER	45-60
04	CIRCULAR MOTION	61-75
05	OSCILLATIONS	77-94
06	WAVES	95-107
07	LIGHT	109-121
08	HEAT AND THERMODYNAMICS	123-144
09	ELECTROSTATICS	145-162
10	CURRENT ELECTRICITY	163-180

11	ELECTROMAGNETISM	181-194
12	ELECTROMAGNETIC INDUCTION	195-206
13	DEFORMATION OF SOLIDS	207-216
14	ELECTRONICS	217-224
15	MODERN PHYSICS	225-243
16	NUCLEAR PHYSICS	245-263

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UNIT 01 MEASUREMENTS

01. **Which of the following pair has same units:**
(A) year and wavelength
(B) Momentum and force
(C) Energy density and Young's Modulus
(D) Force and Pressure

02. **Which physical quantity is measured in meter:**
(A) Light year (C) Diameter
(B) Breadth (D) All of these

03. **Which of the following quantity is not expressed in proper units:**
(A) Young's modulus = Nm^{-2}
(B) Surface tension = Nm^{-1}
(C) Pressure = Nm^{-2}
(D) Energy = kg m/s

04. **The base unit which has the same power in the dimensional formula of surface tension and co-efficient of viscosity:**
(A) Mass (C) Time
(B) Length (D) Temperature

05. **$1kg\ m^2s^{-2}$ =**
(A) $10^2 g\ cm^2s^{-2}$ (C) $10^7 g\ cm^2s^{-2}$
(B) $10^5 g\ cm^2s^{-2}$ (D) $10^9 g\ cm^2s^{-2}$

06. **For a well calibrated and standard instrument, which one of the following cannot occur during a measurement:**
(A) Random error (C) Systematic error
(B) Personal error (D) Unassigned error

07. **The frequency "f" of vibration of a mass "m" suspended from a spring of spring constant "k" is given by the relation $f = cm^x k^y$, the value of "x" and "y" are:**
(A) $x = \frac{1}{2}, y = \frac{1}{2}$ (C) $x = \frac{1}{2}, y = -\frac{1}{2}$
(B) $x = -\frac{1}{2}, y = -\frac{1}{2}$ (D) $x = -\frac{1}{2}, y = \frac{1}{2}$

08. **Which of the following has no units?**
(A) Efficiency (C) Refractive index
(B) Strain (D) All of these

09. **A radio aerial of length "L", when the current "I", emits a signal of wavelength "λ" and power "P". These quantities are related by $P = kI^2\left[\frac{L}{\lambda}\right]^2$ where "k" is a constant. What unit if any, should be used for the constant "k":**
(A) Volt (C) Watt
(B) Ohm (D) No unit

10. **How many femto seconds are there in one millisecond?**
(A) 10^9 (C) 10^{15}
(B) 10^{-15} (D) 10^{12}

11. **Which of the following is unit less? Letters have usual meanings:**
(A) $\frac{v^2}{rg}$ (C) $\frac{v^2 r}{g}$
(B) $\frac{v^2 g}{r}$ (D) $v^2 rg$

12. **The unit of $\sqrt{\frac{energy}{mass}}$ is the same as that of:**
(A) mass (C) length
(B) time (D) velocity

13. **How many nano coulomb in one micro coulomb:**
(A) $1\mu = 10^{-9}n$ (C) $1\mu = 10^{3}n$
(B) $1\mu = 10^{-3}n$ (D) $1\mu = 10^{6}n$

14. **The ratio of atto to exa is:**
(A) 10^0 (C) 10^{36}
(B) 10^{-18} (D) 10^{-36}

15. **A quantity which has SI unit but no dimension is:**
(A) Solid angle
(B) Radioactive decay constant
(C) Frequency
(D) Inertia

16. **An accurate measurement is one which has less:**
(A) Precision (C) fractional error
(B) Absolute uncertainty (D) zero error

17. **Solid angle subtended by a sphere's surface is multiplied by square of its radius is equal to :**
(A) density of sphere (C) mass of sphere
(B) volume of sphere (D) surface area of sphere

18. **One light year is equal to:**
(A) 9.5×10^{14}m (C) 9.5×10^{16}m
(B) 9.5×10^{15}m (D) 9.5×10^{17}m

19. **How many years are there in one second :**
(A) 3.1×10^{-5}years (C) 3.1×10^{-7}years
(B) 3.1×10^{-6}years (D) 3.1×10^{-8}years

20. **An example of derived unit is:**
(A) candela (C) coulomb
(B) ampere (D) mole

21. **The $\sqrt{2gh}$ is same that of:**
(A) Distance (C) Acceleration
(B) Velocity (D) Power

22. **Random errors can be reduced by:**
(A) taking zero correction
(B) comparing the instrument with another more accurate one
(C) taking mean of several measurement
(D) all methods explained in (A), (B) and (C)

23. **Which is not equal to the time:**
(A) Frequency
(B) Resistance × capacitance
(C) Inductance ÷resistance
(D) All of these

24. **Which of the following quantities have the same units:**
(A) Frequency and decay constant
(B) Force and mass
(C) Acceleration and displacement
(D) Impulse and force

25. **E, M, L and G denote energy, mass, angular momentum, and gravitational constant. The dimension of $\frac{EL^2}{M^5G^2}$ is that of:**
(A) Time (C) Mass
(B) Length (D) Angle

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26. **The SI unit of electric field strength is:**
(A) newton (coulomb)$^{-1}$ (C) newton (ampere)$^{-1}$
(B) volt (coulomb)$^{-1}$ (D) joule (coulomb)$^{-1}$

27. **A watt is defined as:**
(A) volt × ampere (C) coulomb × volt
(B) volt × (ampere)^2 (D) ampere × ohm

28. **Density of liquid is 15.7 g cm^{-3}. Its value in the international System of Units is:**
(A) 15.7kgm^{-3} (C) 157 kgm^{-3}
(B) 1570 kgm^{-3} (D) 15700 kgm^{-3}

29. **Let "L" denote the self inductance of a coil which is in series with a capacitor of capacitance "C". Which of the following has the unit second:**
(A) $\sqrt{LC}$ (C) C/L
(B) CL (D) L^2/C^2

30. **The unit of fractional uncertainty in length is:**
(A) cm (C) mm
(B) dm (D) no units

31. **The dimensions of angular displacement are:**
(A) [L^2] (C) [LT^{-1}]
(B) [L^0] (D) [L^{-1}T^{-1}]

32. **The dimensions of gravitational constant "G" are:**
(A) [M^{-1}L^{3}T^{-2}] (C) [ML^{2}T^{-2}]
(B) [M^{2}L^{-1}T^{-2}] (D) [ML^{-2}T^{-1}]

33. **The dimensions of viscosity and pressure are:**
(A) [ML^{-1}T & MLT^{-2}]
(B) [ML^{-2}T^{-1} & M^{-1}LT^{-1}]
(C) [ML^{-1}T^{-1} & ML^{-1}T^{-2}]
(D) [ML^{2}T^{-1} & ML^{-1}T^{-2}]

34. **[M^{0}L^{0}T^{-1}] refer to quantity:**
(A) Velocity (C) Time period
(B) Frequency (D) Force

35. **The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimate of kinetic energy obtained by measuring mass and speed:**
(A) 11% (C) 8%
(B) 5% (D) 1%

36. **Given: Resistance $R_1 = (8 \pm 0.4)\ \Omega$ and Resistance $R_2 = (8 \pm 0.6)\ \Omega$. What is the net resistance when R_1 and R_2 are connected in series?**
(A) $(16 \pm 0.4)\ \Omega$ (C) $(16 \pm 0.6)\ \Omega$
(B) $(16 \pm 1.0)\ \Omega$ (D) $(16 \pm 0.2)\ \Omega$

37. **The density of the material of a cube is measured by measuring its mass and length of this side. If the maximum errors in the measurement of mass and the length are 3% and 2% respectively, the maximum error in the measurement of density is:**
(A) 1% (C) 5%
(B) 7% (D) 9%

38. **Given: Potential difference V = (8 ± 0.5) V and current, I = (2 ± 0.2) A. The value of resistance R is:**
(A) $4 \pm 16.25\%$ (C) $4 \pm 6.25\%$
(B) $4 \pm 10\%$ (D) $4 \pm 8\%$

39. **V m^{-1} is the SI unit of:**
(A) thermal energy (C) thermal power
(B) electric potential (D) electric field intensity

40. **The physical quantity having the unit dyne g^{-1} is**
(A) velocity (C) force
(B) mass (D) acceleration

41. **The SI unit of luminous intensity is**
(A) watt (C) lumen
(B) lux (D) candela

42. **In the equation $N = N_0e^{-\lambda t}$ the unit of "λ" are same as unit of:**
(A) Mass (C) Time period
(B) Angular Frequency (D) torque

43. **One micron is related to centimeter as:**
(A) 1 micron = 10^{-8} cm (C) 1 micron = 10^{-5} cm
(B) 1 micron = 10^{-6} cm (D) 1 micron = 10^{-4} cm

44. **How many steradians are there in semi–sphere from a point inside that semi–sphere?**
(A) π (C) 2π
(B) 3π (D) 4π

45. **If $x = a^n$. Then relative error is (where n is power of "a")**
(A) $\frac{\Delta a}{a} - n$ (C) $n\frac{\Delta a}{a}$
(B) $\frac{\Delta a}{a} + n$ (D) $n^2\frac{\Delta a}{a}$

46. **Unit of power in terms of base units:**
(A) kg m^2 s^{-3} (C) kg m^3 s^{-3}
(B) kg m^2 s^{-2} (D) kgms^{-3}

47. **Poor calibration is the example of:**
(A) Personal error (C) Random error
(B) Systematic error (D) Zero error

48. **Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is**
(A) 6% (C) 1%
(B) 0% (D) 3%

49. **In calculating the area of cross section 'A' of wire the total percentage uncertainty in the final result:**
(A) A= 2 × percentage uncertainty in radius
(B) A = 2 × percentage uncertainty in diameter
(C) A = 3 × percentage uncertainty in radius
(D) Both (A) and (B)

50. **The unit of coefficient of viscosity is:**
(A) Ns m^{-2} (C) Pa s
(B) kg m^{-1} s^{-1} (D) All of these

51. **The least count of a stop watch is 0.2 second. The time of 20 oscillations of a pendulum is measured to be 25 second. The percentage error in the measurement of time will be:**
(A) 8% (C) 0.8%
(B) 1.8% (D) 0.1%

52. **Sub-multiples and multiples of units are indicated using a prefix to the unit. For example, the prefix milli (m) represents 10^{-3}. Which of the following**

gives the sub-multiples represented by pico (p) and (giga) (G)?

	pico (p)	giga (G)
(A)	10^{-9}	10^{9}
(B)	10^{-9}	10^{9}
(C)	10^{-12}	10^{+9}
(D)	10^{-12}	10^{12}

53. **Which is highest sub–multiple?**
(A) Pico (C) Femto
(B) Atto (D) Nano

54. **Out of the following pairs which one does not have same unit?**
(A) Angular momentum ,Plank's constant
(B) Impulse and momentum
(C) Work and energy
(D) Pressure and kinetic energy

55. $\frac{1\ mm}{1\ Gm} =$
(A) 10^{-3} (C) 10^{-12}
(B) 10^{-9} (D) 10^{-15}

56. **Smaller is the least count of the instrument more is the reading:**
(A) Accurate (C) Precise
(B) Accurate and Precise (D) All of these

57. **Which of the following does not have same units?**
(A) Electric field, electric flux
(B) Pressure, young's modulus
(C) Electromotive force, potential difference
(D) Heat , potential energy

58. **The unit of B^2/μ_o :**
(A) kgm^2s^{-2} (C) $kgm^{-1}s^{-1}$
(B) $kgm^{-1}s^{-2}$ (D) $kg^2m^{-2}s^{-2}$

59. **Which of the following is not a derived unit?**
(A) joule (C) dyne
(B) erg (D) mole

60. **Which of the following is the correct way of writing units?**
(A) 25 μμ m (C) 5 Newton
(B) 30 Kg (D) 10 N

61. **$1\ km^2$=**
(A) $1\times10^2\ m^2$ (C) $1\times10^6\ m^2$
(B) $1\times10^4\ m^2$ (D) $1\times10^8\ m^2$

62. **Precise measurement has:**
(A) No Uncertainty
(B) Less absolute uncertainty
(C) high absolute uncertainty
(D) both (A) & (B)

63. **Units of $\frac{1}{\mu_o\varepsilon_o}$ where symbols have their usual meaning are:**
(A) ms^{-1} (C) $m^{-1}s$
(B) m^2s^2 (D) $m^{-2}s^{-2}$

64. **What is the unit of "k" in the relation $U = \frac{ky}{y^2 + a^2}$ where "U" represents the potential energy, "y" represents the displacement and "a" represents the maximum displacement i.e., amplitude?**
(A) $m\ s^{-1}$ (C) m s
(B) J m (D) $J\ s^{-1}$

65. **Unit of permittivity "ε_o" is:**
(A) $Nm^{-2}\ kg^2$ (C) $N^{-1}m^{-2}kg^2$
(B) Nm^2C^{-2} (D) $N^{-1}m^{-2}C^2$

66. **The velocity of a particle is given by $v = a + \frac{b}{t} + ct^2$. The unit of b will be:**
(A) m (C) $m\ s^2$
(B) $m\ s^{-1}$ (D) $m\ s^{-2}$

67. **Two physical quantities of which one is a vector and other is a scalar, having same dimensions are:**
(A) moment and momentum
(B) power and momentum
(C) impulse and momentum
(D) torque and work

68. **The quantity $X = m\ c^2$ has the same units as that of:**
(A) Momentum (C) Impulse
(B) work (D) moment of inertia

69. **Slug is the unit of:**
(A) length (C) mass
(B) time (D) foot

70. **Which one of the following is not the name of physical quantity?**
(A) Density (C) Energy
(B) candela (D) Impulse

71. **Which one of the following is not a unit of length?**
(A) Angstrom (C) Radian
(B) Micron (D) Light year

72. **Error in the measurement of radius of a sphere is 1%. The error in the calculating the surface area of sphere is:**
(A) 2% (C) 3%
(B) 4% (D) 7%

73. **Radian is defined as ratio of arc length to its:**
(A) Radius (C) Sector
(B) Diameter (D) Chord

74. **Accuracy is inversely related to:**
(A) % uncertainty (C) significant figures
(B) Least Count (D) Absolute uncertainty

75. **Precision is inversely related to:**
(A) % uncertainty (C) significant figures
(B) Least Count (D) Fractional uncertainty

76. **In assessment of total uncertainty in the final result for timing experiment, uncertainty is inversely proportional to:**
(A) % uncertainty (C) No. of vibrations
(B) Least Count (D) Stop watch

77. **The SI units of $\frac{mg}{\eta r}$ is same as that of:**
(A) mass (C) Velocity
(B) Length (D) Acceleration

78. **$1\ cm^3$=**
(A) $0.01\ m^3$ (C) $1000\ mm^3$
(B) $0.001\ m^3$ (D) $100\ dm^3$

79. **Which of the following set contains base and derived units?**
(A) radian & kilogram (C) kelvin & time
(B) mole & kilogram (D) ampere & coulomb

80. The rest mass of proton is 1.67×10^{-27} kg. Its mass in grams is:
(A) 1.67×10^{-30} g (C) 1.67×10^{-24} g
(B) 1.67×10^{-28} g (D) 1.67×10^{-29} g

81. The type of the systematic error is:
(A) Personal error (C) Theoretical error
(B) Instrumental error (D) All of these

82. Which pair of physical quantities given below has not the same units and dimensions?
(A) torque and angular momentum
(B) momentum and impulse
(C) pressure and modulus of elasticity
(D) acceleration and gravitational field strength

83. The initial temperature of a liquid is $(80.0 \pm 0.1)^\circ C$. After it has been cooled, its temperature is $(10.0 \pm 0.1)^\circ C$. The fall in temperature in degree centigrade is:
(A) 70.0 ± 0.0 (C) 70.0 ± 0.3
(B) 70.0 ± 0.2 (D) 70.0 ± 0.1

84. Which is correct record for the diameter of wire when measured by a screw gauge of least count 0.001 cm:
(A) 2.3 cm (C) 2.31 cm
(B) 2.312 cm (D) 2.3124 cm

85. Error in the measurement of radius of sphere is 2%. Then error in the measurement of volume is:
(A) 1% (C) 5%
(B) 3% (D) 6%

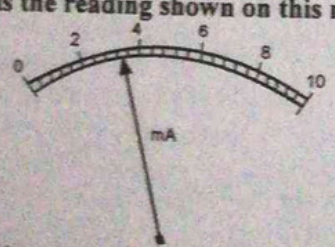
86. If the pointer of the voltmeter is not exactly at the zero of the scale then the error in the voltmeter is said to be:
(A) instrumental error (C) personal error
(B) systematic error (D) random error

87. If radius of the sphere is (5.3 ± 0.1) cm. Then percentage error in its volume will be:
(A) $3 + 6.01\times\frac{100}{5.3}$ (C) $\left(\frac{3\times0.1}{5.3}\right)\times100$
(B) $\frac{1}{3}\times0.01\times\frac{100}{5.3}$ (D) $\frac{0.1}{5.3}\times100$

88. Percentage uncertainty in the area of rectangular plate with having length "a" and width "b":
(A) $\left[\frac{\Delta a}{a-b}+\frac{\Delta b}{a-b}\right]100$ (C) $\left[\frac{\Delta a}{a}-\frac{\Delta b}{b}\right]100$
(B) $\left[\frac{\Delta a}{a-b}-\frac{\Delta b}{a-b}\right]100$ (D) $\left[\frac{\Delta a}{a}+\frac{\Delta b}{b}\right]100$

89. Instrumental error can be minimized by
(A) taking large number of readings.
(B) using different accurate instrument for the same reading.
(C) by zero correction of instrument.
(D) Both (B) and (C)

90. What is the reading shown on this millimeter?



(A) 2.35 mA (C) 3.4mA
(B) 2.7mA (D) 3.7 mA

91. Units of $\sqrt{\frac{F\times\ell}{m}}$ are:
(A) $m^{-1}s$ (C) ms^{-2}
(B) $(ms^2)^2$ (D) ms^{-1}

92. In $v = xt + y$, if 'v' and 't' are the velocity and time respectively, then the units of "x" and "y" are:
(A) $m^{-1}s^{-1}, ms^{-2}$ (C) m, ms^{-1}
(B) ms, ms^{-2} (D) ms^{-2}, ms^{-1}

93. If "ρ" is the density, then units of "ρgh" are same as the units of:
(A) Kinetic energy (C) Pressure
(B) Energy (D) Flow rate

94. Of the following quantities, which one has units different from the remaining three:
(A) Energy per unit volume
(B) Product of voltage and charge per unit volume
(C) Force per unit area
(D) Angular momentum

95. Which one of the following shows only unit of length:
(A) A°, kg, gm (C) m, m^3, s
(B) A°, km, m (D) Gm, m^2, deci–m

96. Which of the following is least multiple:
(A) pico (B) femto
(C) nano (D) atto

97. Which of the following do not have the unit of energy?
(A) force × distance
(B) couple × angle turned through
(C) impulse × time
(D) moment of inertia × (angular velocity)^2

98. The radioactive decay constant has the same dimensional formula as:
(A) mole (C) frequency
(B) time (D) mass

99. If C and R denotes the capacitance and resistance respectively, then the dimensional formula for CR is same as that of:
(A) frequency (C) (frequency)^2
(B) time period (D) (time period)^2

100. The error in a certain measurement occurs due to:
(A) Faulty apparatus (C) negligence of person
(B) In-appropriate method (D) All of these

101. The pair of physical quantities not having the same units is:
(A) Planck's constant, Angular momentum
(B) spring constant, tension
(C) Pressure, Young's Modulus
(D) Frequency, decay constant

102. Which one is the highest power multiple?
(A) giga (C) mega
(B) peta (D) deca

103. The pressure is of 10^3 dynes/cm^2 is equivalent to:
(A) 10 N/m^2 (C) 10^{-1} N/m^2
(B) 10^2N/m^2 (D) 10^{-2} N/m^2

104. In S.I system, a set of supplementary units contains:
(A) 7 units (C) many units
(B) 2 units (D) 3 units

105. 100×10^{-41} is equal:
(A) pico (C) nano
(B) femto (D) atto

106. The heat generated in a circuit is given by $Q = I^2Rt$, where "I" is current, "R" is resistance and "t" is time. If the percentage errors in measuring I, R and t are 2%,1% and 1% respectively then the maximum error in measuring heat will be:
(A) 2% (C) 3%
(B) 4% (D) 6%

107. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate by using the formula $P=\frac{F}{L^2}$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then the maximum errors in the measurement of pressure is:
(A) 1% (C) 2%
(B) 8% (D) 10%

108. Which of the following is the equivalent of (joule ohm)/(volt second)?
(A) watt (C) henry
(B) kWh (D) volt

109. If the percentage errors of A, B and C are "a", "b" and "c" respectively then the total percentage error in the product ABC is:
(A) abc (C) a + b + c
(B) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}$ (D) a + bc + ca

110. Light year is the unit of:
(A) Light (C) Time
(B) Velocity (D) Distance

111. Jm^{-1} is a possible unit for:
(A) momentum (C) power
(B) force (D) work

112. Which one of the following is correct:
(A) $1f = 10^{-6}$ (C) $1f = 10^{-15}$
(B) $1f = 10^{-12}$ (D) $1f = 10^{-14}$

113. The ratio of killo to pico is:
(A) 10^9 (C) 10^{-9}
(B) 10^{15} (D) 10^{-15}

114. For total assessment of uncertainty in the final result obtained by multiplication and division:
(A) Absolute uncertainties are added
(B) Fractional uncertainties are added
(C) %age uncertainties are added
(D) both (B) and (C)

115. The principal characteristics of an ideal standard:
(A) accessible
(B) Invariable
(C) both (A) & (B)
(D) it must be of expensive metal

116. If velocity (v), Force (F) and energy (E) are taken as fundamental units then formula for mass will be:
(A) $v^{-2}F^6E$ (C) $vF^{-2}E^6$
(B) v^6FE^2 (D) $v^{-2}F^6E^{-2}$

117. What are the S.I units of "k" so that the equation velocity = k × density is correct.
(A) $kg^{-1}m^4s^{-1}$ (C) kg ms
(B) $kg\,m^4s^{-1}$ (D) $kg\,m\,s^{-1}$

118. Product of nano and giga is:
(A) 0 (C) 10^{-18}
(B) 1 (D) 10^{-9}

119. In the relation "$v_t = v_o + 0.61t$" the unit of 0.61 are:
(A) ms^{-2} (C) $ms^{-1}{}^{\circ}C^{-1}$
(B) $N\,{}^{\circ}C^{-1}$ (D) No unit

120. 1 kg of mass is equivalent to:
(A) 9×10^{12}J (C) 9×10^{11}J
(B) 9×10^{16}J (D) 1.9×10^{16}J

121. Which of the following has not been expressed in suitable units?
(A) Potential energy → kg ms^{-1}
(B) Surface tension → N m^{-1}
(C) Stress → N m^{-2}
(D) Resistance → kg m^2 A^{-2} s^{-3}

122. Which of the following is not equal to watt?
(A) ampere/volt (C) ampere × volt
(B) $(ampere)^2$ ohm (D) joule/second

123. The base unit of Planck's constant are the same as:
(A) electrostatic energy (C) kinetic energy
(B) angular momentum (D) linear momentum

124. The numerical value of "G" in SI is 6.67×10^{-11}. The numerical value in cgs system is:
(A) 6.67×10^{-8} (C) 6.67×10^{-9}
(B) 6.67×10^{-10} (D) 6.67×10^{-14}

125. Screw gauge is more precise than vernier callipers by:
(A) 10 times (B) 100 times
(C) 1000 times (D) 50 times

126. The ratio of dimensions of angular momentum to linear momentum is:
(A) [L] (C) $[LT^{-1}]$
(B) $[L^{-1}]$ (D) $[L^{-1}T^{-1}]$

127. Which of the following quantities have same units:
(A) Stress, strain (C) Momentum, impulse
(B) Force, momentum (D) Mass, weight

128. Which of following quantity can be expressed in $kg\,s^{-2}$:
(A) Viscosity (C) Spring constant
(B) Density (D) Momentum

129. If L = inductance R = Resistance C = Capacitance and V = Potential difference then units of $\frac{RCV}{L}$ is same that of:
(A) Current (C) $(current)^{-1}$
(B) Charge (D) $(charge)^{-1}$

130. The dimension of product PV is same that of ("P" is Presser and "V" is Volume):

(A) Energy (C) Temperature
(B) Power (D) Momentum

131. **Choose the correct statement about base quantities:**
(A) All base quantities are independent of temperature
(B) They are all scalar quantities
(C) They can be measured by a single universal instrument
(D) They are all immune to errors

132. **The angle subtended at the center of a circle by an arc of length $2\pi r$ is:**
(A) 1 radian (C) 2π radian
(B) π radian (D) $\pi/2$ radian

133. **All are the units of time except:**
(A) Light year (C) Decade
(B) Solar day (D) Lunar year

134. **The ratio of units of power and pressure gives the measurement of:**
(A) Cross sectional area
(B) Rate of change in momentum
(C) Volume flow per second
(D) Energy

135. **Two physical quantities can be added only when they have same:**
(A) Kind (C) Directions
(B) Magnitudes (D) All are correct

136. **Which of the following is not the name of a physical quantity?**
(A) time (C) mass
(B) impulse (D) kilogram

137. **Which of the following statements is wrong?**
(A) Unit of co-efficient of viscosity is poise
(B) Work and energy have same units
(C) Unit of kinetic energy is newton meter
(D) Unit of surface tension is newton meter

138. **If the force and velocity are double, then the power will be:**
(A) twice (C) 4 times
(B) thrice (D) 8 times

139. **$\frac{B^2}{\mu_o}$ has the same dimensional formula as that of: (B is magnetic field and μ_o is absolute permeability of free space):**
(A) energy density
(B) stress × strain
(C) magnetic energy per unit volume
(D) All of these

140. **Which of the following is a derived unit;**
(A) unit of mass (C) unit of volume
(B) unit of length (D) unit of time

141. **If u_1 and u_2 are the units selected in two systems of measurement and n_1 and n_2 are their numerical values, respectively, then**
(A) $n_1u_1 = n_2u_2$ (C) $n_1n_2 = u_1u_2$
(B) $n_1u_1 + n_2u_2 = 0$ (D) $(n_1 + u_1) = (n_2 + u_2)$

142. **The time of 30 vibrations of a simple pendulum recorded by stopwatch accurate up to one tenth of a second is 60 seconds. The uncertainty in the time period may be:**
(A) 0.003 s (C) 0.3 s
(B) 0.03 s (D) 3.0 s

143. **The least count of a vernier callipers is 0.005 cm. The diameter of a wire is 0.020 cm as measured by it. The percentage error in measurement is**
(A) 25% (C) 15%
(B) 20% (D) 5%

144. **In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as $P = \frac{a^3b^2}{cd}$ % error in P is:**
(A) 14% (C) 7%
(B) 10% (D) 4%

145. **In the equation $v = at - \frac{b}{c^2 + t}$, units of "c" is:**
(A) s (C) s^2
(B) $s^{1/2}$ (D) ms^{-1}

146. **All are the base quantities except:**
(A) Mole (C) Intensity of light
(B) Electric current (D) All are base quantities

147. **A^o is equal to:**
(A) 10^{-9} mm (C) 10^{-7} mm
(B) 10^{-8} mm (D) 10^{-6} mm

148. **Which of the following sets cannot enter into the list of fundamental quantities in any system?**
(A) Length, mass, time
(B) Amount of substance, mass, length
(C) Mass, time, intensity
(D) Temperature, charge, length

149. **In given equation $f = \frac{1}{2\ell}\sqrt{\frac{F}{m}}$, fundamental frequency of stretched string, the units of 'm' is:**
(A) kgm^{-1} (C) $kgms^{-1}$
(B) $kgm^{-1}s$ (D) No units

150. **Two particles are located at $x_1 = 10.5 \pm 0.1$ cm and $x_2 = 26.8 \pm 0.1$ cm. The distance between them will be recorded as:**
(A) 16.3 cm (C) 16.3 ± 0.1 cm
(B) 16.3 ± 0.2 cm (D) 37.3 ± 0.01 cm

151. **Which of the following in not a unit of time:**
(A) Leap year (C) Light year
(B) Lunar month (D) Micro–second

152. **To reduce the uncertainty in the timing experiment:**
(A) highly precise instrument
(B) count more number of vibration
(C) conduct at room temperature
(D) both A and C

153. **If $y = a + bt + ct^2$, where y is in meter and "t" is in second, the unit of "b" is:**
(A) m (C) s^{-2}
(B) ms^{-1} (D) ms^{-2}

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154. In equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ the SI unit of "a":
(A) N m (C) N m^4
(B) N m^{-3} (D) N m^{-2}

155. Number of physical quantities in system international:
(A) 7 (C) 3
(B) 2 (D) 9

156. Which one is not allowed as standard prefix?
(A) 1pF (C) 1μF
(B) 1μμF (D) 1nF

157. A physical quantity 'X' is represented as velocity $= \sqrt{\frac{X}{\text{density}}}$, the units of "X" are:
(A) $kgms^{-1}$ (C) $kgm^{-1}s^{-2}$
(B) kgm^2s^{-2} (D) kgm^2s^{-1}

158. The mean time period of second's pendulum is 2.00 s and mean absolute error in the time period is 0.05s. To express maximum estimate of error, the time period should be written as:
(A) (2.00 ± 0.01) s (C) (2.00 ± 0.05) s
(B) (2.00 + 0.025) s (D) (2.00 ± 0.10) s

159. Minimum length an instrument can measure is called its:
(A) Accuracy (C) Estimate
(B) Precision (D) Limitations

160. One nanometre is equal to:
(A) 10^{-9} mm (C) 10^{-6} cm
(B) 10^{-7} cm (D) 10^{9} cm

161. If "h" is the height and "g" is the acceleration due to gravity, then the unit of $\sqrt{\frac{2h}{g}}$ is the same as that of:
(A) Time (C) Volume
(B) Mass (D) Velocity

162. Which of the following pairs of units are both SI base units?
(A) ampere, degree celsius
(B) coulomb, degree celsius
(C) ampere, kelvin
(D) coulomb, kelvin

163. If 'P' is the momentum of an object and 'm' is the mass then expression $\frac{P^2}{2m}$ has base unit identical to:
(A) Energy (C) Force
(B) Power (D) Velocity

164. Choose the pair in decreasing order:
(A) centi, milli, micro (C) micro, milli, centi
(B) deca, kilo, mega (D) kilo, mega, deca

165. 3μμF can be written as:
(A) 3 pF (C) 3nF
(B) 3mF (D) 3cF

166. To change SI units by factors of ten into smaller or bigger units they uses:
(A) prefixes (C) suffixes
(B) symbols (D) ratios

167. The resistance R = V/I where V = 100 ± 5 volts and I = 10 ± 0.2 amperes. What is the total error in R?
(A) 5% (C)7%
(B) 5.2% (D) $\frac{5}{2}$%

168. Measurement which is close to true value is:
(A) Accurate (C) Average
(B) Precise (D) Error

169. Systematic errors can be removed by:
(A) Buying new instrument
(B) Dusting the instrument
(C) Breaking the instrument
(D) Recalibrating the instrument

170. Depth of water in a bottle is 24.0 cm and uncertainty is 0.2 cm, percentage uncertainty in measurement of depth
(A) 0.8% (C) 9%
(B) 1% (D) 2%

171. An ideal standard of measurement of a base quantity has characteristics:
(A) Accessible
(B) Invariable
(C) Transportable
(D) Only (A) and (B) are correct

172. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value of time period. His percentage error in the measurement of g by the relation $g = 4\pi^2(\ell/T^2)$ will be:
(A) 2% (C) 7%
(B) 4% (D) 10%

173. A body travels uniformly a distance of (10.0 ± 0.2) m in a time (4.0 ± 0.3) s. The percentage error in velocity of the body is:
(A) 7.5% (C) 12%
(B) 5.7% (D) 9.5%

174. $N\ kg^{-1}$ is the unit of:
(A) Velocity (C) Momentum
(B) Acceleration (D) Angular momentum

175. Which of the following relation is incorrect?
(A) $t = \frac{x}{v}$ (C) $v = \frac{a}{t}$
(B) $a = \frac{v^2}{x}$ (D) $t^2 = \frac{2x}{a}$

176. The unit of ampere-volt is equal to:
(A) Power (C) Current
(B) Energy (D) Quantity of electricity

177. Which of the following is unitless quantity?
(A) $\frac{\text{momentum}}{\text{...ation}}$ (C) $\frac{\text{volume}}{\text{area}}$
(B) $\frac{\text{energy}}{\text{work}}$ (D) $\frac{\text{power}}{\text{force}}$

178. Which of the following is not a unit of energy?
(A) kilo watt (C) joule
(B) election volt (D) kilo watt-hour

179. 1000 kilogram is equivalent to:
(A) 1 mega gram (C) 1 peta kg
(B) 1 tera kg (D) 1 exa gram

180. $\frac{1\ Tm}{1\ Gm} =$

(A) 10^{-6}m (C) k

(B) μ (D) 10μ

181. **The uncertainty recorded in the radius of a sphere is 1.6%. The uncertainty in the area of that sphere is:**

(A) 4.8% (C) 1.6%

(B) 3.2% (D) 0.8%

182. **Which one of the following quantities has been expressed in proper S.I base units?**

(A) $\frac{\text{stress}}{\text{strain}}$ = newton meter^{-2}

(C) Energy = g ms^{-2}

(B) Force = kgms^{-2}

(D) Pressure = newton meter^{-1}

183. **What is the unit of gravitational constant?**

(A) $Nm^2 kg^2$ (C) $kg\,m^{-1}\,s^{-3}$

(B) $kg^{-1}\,m^3\,s^{-2}$ (D) $J\,kg^{-1}$

184. **Which of the following is a unit of energy?**

(A) pascal (C) Newton

(B) watt × day (D) newton/meter

185. **One thousand microns is equal to:**

(A) 10^{-3} m (C) 10^{-9} m

(B) 10^{-6} m (D) 10^{-12} m

186. **In the equation $x = x_o \sin\omega t$ the unit of "ω"is:**

(A) rad (C) Hz

(B) rad s^{-2} (D) rad s^{-1}

187. **The base unit of $\sqrt{LC}$ will be:**

(A) ms^{-1} (C) s

(B) m^{-1} (D) s^{-1}

188. **Unit of permittivity "ε_o" is:**

(A) farad (C) $\frac{\text{farad}}{\text{m}}$

(B) farad m (D) ampere m^{-2}

189. $\frac{\text{Energy}}{\text{Mass} \times \text{Length}}$ **is equal to:**

(A) Acceleration (C) Power

(B) Force (D) Work

190. **Convert 72km h^{-1} into ms^{-1}**

(A) 2 ms^{-1} (C) 20 ms^{-1}

(B) 200 ms^{-1} (D) 2 kms^{-1}

191. **Which of the following pair has same units?**

(A) Light year and wavelength

(B) Momentum and force

(C) Energy and Young's Modulus

(D) Force and Pressure

192. **Which of the following is the largest value?**

(A) 1mm×1pm (C) 1nm×1Em

(B) 1cm×1km (D) 1nm×1Mm

193. **Which of the following is most precise instrument?**

(A) Meter rod (C) Vernier calipers

(B) Screw gauge (D) All of these

UNIT 01 MEASUREMENTS (SOLUTIONS)

01. (C)

Energy density = $\frac{\text{energy}}{\text{volume}}$

= $Jm^{-3} = Nm\,m^{-3} = Nm^{-2}$ = Young's modulus

02. (D)

All represent length. So, all have unit in meters.

03. (D)

Units of Energy is kgm^2s^{-2}.

04. (A)

Dimensions of surface tension = $[MT^{-2}]$

Dimensions of co-efficient of viscosity = $[ML^{-1}T^{-1}]$

In both cases the power of "M" is same i.e., "1".

05. (C)

$1kgm^2s^{-2} = (1000g)(100cm)^2s^{-2} = 10^7\ gcm^2s^{-2}$

06. (C)

By definition of systematic error

07. (D)

$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = c\,m^{-1/2}k^{1/2}$ $(\frac{1}{2\pi} = c = \text{constant})$

08. (D)

All given quantities are the ratios of same physical quantities. So, these are the unit less and dimensionless.

09. (B)

$P = kI^2\left[\frac{L}{\lambda}\right]^2 = I^2R$

$\left[\frac{L}{\lambda}\right]^2$ = unit less

k = R = ohm

10. (B)

$\frac{1\ ms}{1fs} = \frac{10^{-3}}{10^{-15}} = 10^{12} \Rightarrow 1ms = 10^{12}\ fs$

11. (A)

$\frac{v^2}{rg} = \frac{m^2s^{-2}}{m.ms^{-2}}$ = no unit or unit less

12. (D)

$\sqrt{\frac{\text{energy}}{\text{mass}}} = \left(\frac{\text{energy}}{\text{mass}}\right)^{1/2}$

$= \left(\frac{kgm^2s^{-2}}{kg}\right)^{1/2} = (m^2s^{-2})^{1/2} = ms^{-1}$ = velocity

13. (C)

$\frac{1\mu C}{1nC} = 10^3 \Rightarrow 1\mu C = 10^3\ nC$

14. (D)

$\frac{\text{atto}}{\text{exa}} = \frac{10^{-18}}{10^{18}} = 10^{-36}$

15. (A)

Steradian (sr) is the SI unit of solid angle. By definition of Sr

$1sr = \frac{\text{Area of circular patch on sphere}}{\text{square of radius of sphere}} = \frac{[L^2]}{[L^2]}$

= Dimension less

16. (C)

A precise measurement is the one which has less absolute uncertainty and accurate measurement is the one which has less fractional or percentage uncertainty or error.

17. (D)

(solid angle of sphere) × (square of radius)
$= 4\pi r^2$ = Surface Area of sphere

18. (B)

$S = ct = (3\times10^8)(365\times24\times3600) = 9.5\times10^{15}$ m

19. (D)

$1\ s = \frac{1}{365\times24\times3600}$ years $= 3.1\times10^{-8}$ years

20. (C)

coulomb = ampere × second

21. (B)

The velocity of body at any instant during vertically downward motion under the influence of force of gravity is given:

$$v = \sqrt{2gh}$$

22. (C)

When repeated measurements of the quantity give different values under the same conditions, such type of error is called random error. It is due to some unknown causes. This error can be reduced by repeating the measurements several times and taking an average.

23. (A)

$RC = t$, $L/R = t$ while $f = 1/T$

24. (A)

$f = 1/T = s^{-1}$

$$\lambda = \frac{\Delta N/N}{\Delta t} = s^{-1}$$

25. (D)

$$\frac{EL^2}{M^5G^2} = \frac{[ML^2T^{-2}][ML^2T^{-1}]^2}{[M]^5[M^{-1}L^3T^{-2}]^2} = \frac{[M^3L^6T^{-4}]}{[M^3L^6T^{-4}]}$$

= dimension less

26. (A)

$$E = \frac{F}{q} = Fq^{-1} = \text{newton (coulomb)}^{-1}$$

27. (A)

$P = VI$ = (volt)×(ampere)

28. (D)

As $1 gcm^{-3} = 1000\ kgm^{-3}$

$15.7 gcm^{-3} = 15.7\times1000\ kgm^{-3} = 15700\ kgm^{-3}$

29. (A)

As $$f_r = \frac{1}{2\pi\sqrt{LC}} \Rightarrow \sqrt{LC} = \frac{1}{2\pi f_r} = \frac{T}{2\pi} = \text{second}$$

30. (D)

$$\text{Fractional uncertainty} = \frac{\text{Absolute uncertainty or least count}}{\text{Measured value}}$$

As it the ratio of same dimensional quantities. So, it has no unit or unit less.

31. (B)

$$\theta = \frac{\text{arc length}}{\text{radius}} \Rightarrow [\theta] = \frac{[\ell]}{[r]} = \frac{[L]}{[L]} = [L^\circ]$$

32. (A)

$$[G] = \frac{[F][r^2]}{[m_1][m_2]} = \frac{[MLT^{-2}][L^2]}{[M][M]} = [M^{-1}L^3T^{-2}]$$

33. (C)

$$\eta = \frac{F}{6\pi vr} \Rightarrow [\eta] = \frac{[F]}{[v][r]} = [ML^{-1}T^{-1}]$$

$$P = \frac{F}{A} \Rightarrow [P] = \frac{[F]}{[A]} = [ML^{-1}T^{-2}]$$

34. (B)

$$f = \frac{1}{T} \Rightarrow [f] = [T^{-1}] = [M^\circ L^\circ T^{-1}]$$

35. (C)

$$K.E = \frac{1}{2}mv^2$$

Uncertainty in K.E = %age uncertainty in mass + 2(%age uncertainty in velocity) = 2% + 2(3%)
= 8%

36. (B)

$R_e = R_1 + R_2$

In addition and subtraction absolute uncertainties are added.

37. (D)

$$\rho = \frac{m}{V} = \frac{m}{L^3}$$

Uncertainty in ρ = %age uncertainty in mass + 3(%age uncertainty in length)
= 3% + 3(2%) = 9%

38. (A)

$$\%\text{age uncertainty in } V = \frac{0.5}{8}\times100\% = 6.25\%$$

$$\%\text{age uncertainty in } I = \frac{0.2}{2}\times100\% = 10\%$$

Uncertainty in R = %age uncertainty in V + %age uncertainty in I
= 6.25% + 10% = 16.25%

$$R = \frac{V}{I} = \frac{8}{2} = 4\ \Omega \pm 16.25\%$$

39. (D)

$$E = -\frac{\Delta V}{\Delta r} = Vm^{-1}$$

40. (D)

$$a = \frac{F}{m} = \frac{dy}{g} \text{ in CGS system}$$

41. (D)

candela is the SI unit of luminous intensity.

42. (B)

unit of term "λt" = 1

$\lambda = 1/t = s^{-1}$ = unit of angular frequency

43. (D)

1 micron = 10^{-6} m

1 micron = $10^{-4}.10^{-2}$m = 10^{-4}cm

44. (C)

Total solid angle in a sphere = 4π sr

solid angle in semi sphere $= \frac{1}{2}(4\pi)$ sr = 2π sr

45. (C)

Fractional or relative error in "a" $= \frac{\Delta a}{a}$

Fractional or relative error in "x" = $n\left(\frac{\Delta a}{a}\right)$

46. (A)

$$P = \frac{W}{t} = \frac{kgm^2s^{-2}}{s} = kgm^2s^{-3}$$

47. (B)

By definition of systematic error.

48. (A)

Error in R = %age error in "V" + %age error in "I"
= 3% + 3% = 6%

49. (D)

Area of wire = $\pi r^2 = \pi(d/2)^2$

%age uncertainty in area of wire = 2× (%age uncertainty in radius or diameter)

50. (D)

$$\eta = \frac{F}{6\pi vr} = \frac{N}{m^2s^{-1}} = Nm^{-2}s = kgm^{-1}s^{-1} = Pa\ s$$

51. (C)

$$\%age\ uncertainty\ in\ time = \frac{Least\ count}{Measured\ value} \times 100\%$$
$$= \frac{0.2}{25} \times 100\ \% = 0.8\%$$

52. (C)

1 pico = 10^{-12} and 1 G = 10^9

53. (D)

nano = 10^{-9}

54. (D)

Unit of pressure = Nm^{-2}
Unit of K.E = Nm = J

55. (C)

$$\frac{1\ mm}{1\ Gm} = \frac{10^{-3}}{10^9} = 10^{-12}$$

56. (C)

A precise measurement is the one which has less absolute uncertainty or least count.

57. (A)

Unit of electric filed intensity = NC^{-1}
Unit of electric flux = Nm^2C^{-1}

58. (B)

$$\frac{B^2}{2\mu_o} = \text{Energy density} = Jm^{-3} = kgm^{-1}s^{-2}$$

59. (D)

mole is a base unit.

60. (D)

The symbol of unit named after a scientist has initial capital letter such as "N" for newton.

61. (C)

$1km^2 = 1\ (km)^2 = 1\ (10^3\ m)^2 = 10^6\ m^2$

62. (B)

The precision of a measurement is determined by the instrument being used. A precise measurement is that which has less absolute uncertainty.

63. (D)

As speed of light, $c = \frac{1}{\sqrt{\mu_o\varepsilon_o}} \Rightarrow c^2 = \frac{1}{\mu_o\varepsilon_o}$

By the principle of homogeneity both sides have same SI units and dimensions.

64. (B)

$$U = \frac{ky}{y^2 + a^2} \Rightarrow k = \frac{U(y^2 + a^2)}{y} = \frac{J\ m^2}{m} = J\ m$$

65. (D)

$$F = \frac{1}{4\pi\varepsilon_o}\frac{q_1q_2}{r^2} \Rightarrow \varepsilon_o = \frac{1}{4\pi}\frac{q_1q_2}{Fr^2} = \frac{C^2}{Nm^2} = N^{-1}m^{-2}C^2$$

66. (A)

$$v = a + \frac{b}{t} + ct^2$$

By the principle of homogeneity

$$\frac{b}{t} = ms^{-1} \Rightarrow bs^{-1} = ms^{-1} \Rightarrow b = m$$

67. (D)

By definition

$\vec{\tau} = \vec{r} \times \vec{F}$ (vector) and

$W = \vec{F}.\vec{d}$ (scalar)

68. (B)

mc^2 = X = Energy = work

69. (C)

Slug is the unit of mass in FPS system (British Engineering system).

1 slug = 14.6 kg

70. (B)

candela is the base unit not physical quantity.

71. (C)

Radian is the supplementary unit. It is the unit of plane angle.

72. (A)

Area of sphere = $4\pi r^2$
Error in area = 2(%age error in radius)
Error in area = 2(%1) = 2%

73. (A)

By definition of radian.

$$\theta = \frac{\text{arc length}}{\text{radius of circle}}\ (rad)$$

74. (A)

An accurate measurement is that which has less fractional or percentage uncertainty.

75. (B)

A precise measurement is that which has less absolute uncertainty.

76. (C)

$$\text{Uncertainty in the time period} = \frac{\text{Absolute Uncertainty of stop watch}}{\text{Total number of vibrations}}$$

77. (C)

$$F_D = W \Rightarrow 6\pi\eta rv = mg \Rightarrow v = \frac{mg}{6\pi\eta r}$$

78. (C)

$1cm^3 = 1000\ mm^3$

79. (D)

ampere is a base unit while coulomb is a derived unit.

80. (C)

$1.67 \times 10^{-27}\ kg = 1.67 \times 10^{-27}(10^3 g) = 1.67 \times 10^{-24}\ g$

81. (B)

Error refers to an effect that influences all

measurements of a particular quantity equally is called systematic error. It produces a consistent difference in reading. It occurs to some definite rule. It may occur due to the zero error, poor calibration of instruments or incorrect marking etc.

82. (A)

Unit of torque $= N\,m = kgm^2s^{-2}$
Unit of angular momentum $= J\,s = kgm^2s^{-1}$

83. (B)

In addition and subtraction absolute uncertainties are added.

84. (B)

As the absolute uncertainty (least count) of screw gauge is 0.001 cm. so, it recorded up– to three decimal places.

85. (D)

$$V = \frac{4}{3}\pi r^3$$

Uncertainty in V = 3(%age uncertainty in radius)
$= 3(2\%) = 6\%$

86. (B)

Error refers to an effect that influences all measurements of a particular quantity equally is called systematic error. It produces a consistent difference in reading. It occurs to some definite rule. It may occur due to the zero error, poor calibration of instruments or incorrect marking etc.

87. (C)

Error in volume of sphere = 3(%age error in radius)

$$= 3\left(\frac{\text{Least count}}{\text{Mesaured value}} \times 100\right) = 3\left(\frac{0.1}{5.3} \times 100\right)$$

88. (D)

Area of plate = ab
Error in area of plate = (%age error in "a") + (%age error in "b")

$$= \left(\frac{\Delta a}{a} + \frac{\Delta b}{b}\right) \times 100$$

89. (D)

This error can be reduced by comparing the instrument with another which is known to be more accurate or applying a correction factor.

90. (C)

1 division $= 0.4$ mA
8.5 divisions $= 8.5 \times 0.4$ mA $= 3.4$ mA

91. (D)

$$\text{Units of } \sqrt{\frac{F \times \ell}{m}} = \left[\frac{kgms^{-2}\,m}{kg}\right]^{1/2}$$
$$= [m^2s^{-2}]^{1/2} = ms^{-1}$$

92. (D)

By the principle of homogeneity

$xt = ms^{-1} \Rightarrow x = \frac{ms^{-1}}{t} = ms^{-2}$ and

$y = ms^{-1}$

93. (C)

Unit of "ρgh" $= kgm^{-3} \times ms^{-2} \times m = kgms^{-2} \times m^{-2}$
$= Nm^{-2} =$ Pressure

94. (D)

Energy density and pressure have same SI units $kgm^{-1}s^{-2}$ while angular momentum have dimension kgm^2s^{-1}.

95. (B)

$1A^\circ = 10^{-10}$ m, $1km = 10^3$ m

96. (D)

1 atto $= 10^{-18}$

97. (C)

Unit of energy is joule $= kgm^2s^{-2}$
But the unit of(Impulse × time) $= kgms^{-1}s = kgm$

98. (C)

$$\lambda = \frac{\Delta N/N}{\Delta t} = s^{-1} = \text{frequency}$$

99. (B)

RC = t = capacitive time constant

100. (D)

The error in a measurement may occur due to:
i. Negligence or inexperience of a person.
ii. The faulty apparatus.
iii. Inappropriate method or technique.

101. (B)

Unit of spring constant, $k = Nm^{-1}$
Unit of tension (force), $F = N$

102. (B)

peta $= 10^{15}$

103. (B)

10^3 dy $cm^{-2} = 10^3\,(10^{-5}\,N)(10^4\,m^{-2}) = 10^2\,Nm^{-2}$

104. (B)

There are only two supplementary units. Radian and steradian.

105. (C)

$100 \times 10^{-11} = 10^{-9} =$ neno

106. (D)

Error in Q=2(Error in current)+ error in Resistance + error in Time
Error in Q = 2(2%) + 1%+ 1% = 6%

107. (B)

Error in Pressure = error in force + 2(Error in length)
Error in Pressure = 4% + 2(2%) = 8%

108. (D)

$$\frac{\text{joule} \times \text{ohm}}{\text{volt} \times \text{second}} = \frac{\text{volt} \times \text{coulomb} \times \text{ohm}}{\text{volt} \times \text{second}}$$
$$= \frac{\text{coulomb}}{\text{second}} \times \text{ohm} = \text{ampere} \times \text{ohm} = \text{volt}\ (V = IR)$$

109. (C)

Because errors are always be added.

110. (D)

Light year is the distance that light travels in one year (S = ct).

111. (B)

$$W = Fd \Rightarrow \frac{W}{d} = F$$

112. (C)

1 femto $= 10^{-15}$

113. (B)

$$\frac{\text{kilo}}{\text{pico}} = \frac{10^3}{10^{-12}} = 10^{15}$$

114. (D)

In multiplication and division percentage or fractional uncertainties are added.

115. (C)

An ideal standard has two characteristics:

i. It is accessible.

ii. It is invariable.

116. (A)

$[v^{-2}F^{o}E] = [L^{-2}T^{2}][1][ML^{2}T^{-2}] = [M]$

117. (B)

$k = \frac{\text{velocity}}{\text{density}} = \frac{ms^{-1}}{kgm^{-3}} = kg^{-1}m^{4}s^{-1}$

118. (B)

$(\text{nano})(\text{giga}) = (10^{-9})(10^{9}) = 10^{0} = 1$

119. (C)

According to principle of homogeneity

$0.61t = ms^{-1} \Rightarrow 0.61 = \frac{ms^{-1}}{t} = ms^{-1}{}^{o}C^{-1}$

($\therefore$ t = temperature)

120. (B)

$\text{Energy} = mc^{2} = (1)(3\times10^{8})^{2} = 9\times10^{16}\ J$

121. (A)

Unit of P.E = $J = kgm^{2}s^{-2}$

122. (A)

$P = VI = I^{2}R = V^{2}/R$

123. (B)

$L = mvr = \frac{nh}{2\pi} = Js$

124. (A)

As $1N = 10^{5}\ dy$

$1m^{2} = 10^{4}\ cm^{2}$

$1kg^{2} = 10^{6}\ g^{2}$

$G = 6.67\times10^{-11}\frac{Nm^{2}}{kg^{2}}$

$= 6.67\times10^{-11}\times\frac{10^{5}\times10^{4}}{10^{6}}\ dy\ cm^{2}g^{-2}$

$= 6.67\times10^{-11+9-6}\ dy\ cm^{2}g^{-2} = 6.67\times10^{-8}\ dy\ cm^{2}g^{-2}$

125. (A)

$\frac{\text{Leat count of screw gauge}}{\text{Leat count of vernier calliper}} = \frac{0.1mm}{0.01mm} = 10$

Smaller the least count means more precise is the reading.

126. (A)

$L = rP \Rightarrow r = \frac{L}{P} = [L]$

127. (C)

$\text{Impulse} = \Delta P = kgms^{-1} = N\ s$

128. (C)

$k = \frac{F}{x} = \frac{kgms^{-2}}{m} = kg\ s^{-2}$

129. (A)

$\frac{RCV}{L} = \frac{(RC)V}{L} = \frac{TV}{V\Delta T/\Delta I} = \Delta I = \text{current}$

$\therefore V = L\frac{\Delta I}{\Delta T} \Rightarrow L = \frac{V\Delta T}{\Delta I}$ and $\therefore RC = T$

130. (A)

In thermodynamic process

$W = P\Delta V = \text{energy} = \text{joule}$

131. (B)

All the seven base quantities are scalar in nature.

132. (C)

$\theta = \frac{\text{Arc length}}{\text{Radius}} = \frac{2\pi r}{r} = 2\pi\ \text{rad}$

133. (A)

Light year is the unit of distance.

134. (C)

$\frac{\text{Power}}{\text{Pressure}} = \frac{[ML^{2}T^{-3}]}{[ML^{-1}T^{-2}]}$

$= [L^{3}T^{-1}] = m^{3}s^{-1} = \text{volume flow per second}$

135. (A)

Quantities of same kind (dimensions) are added or subtracted according to principle of homogeneity.

136. (D)

kilogram is the base unit not base quantity.

137. (D)

Unit of surface tension = Nm^{-1}

138. (C)

$P = Fv$

$P' = (2F)(2v) = 4Fv = 4P$

139. (D)

As energy density $= \frac{1B^{2}}{2\mu_{o}} = Jm^{-3} = kgm^{-1}s^{-2}$

As "A", "B" and "C" options have same dimensional units as that of energy density.

140. (C)

Volume is a derived quantity. So, its unit is derived unit.

141. (A)

For example

$n_1u_1 = n_2u_2 \Rightarrow 1m = 100\ cm \Rightarrow (1)(m) = (100)(cm)$

142. (A)

$\text{Uncertainty in time period} = \frac{\text{Least count}}{\text{No. of vibrations}}$

$= \frac{0.1}{30}\ s = 0.003\ s$

143. (A)

$\text{Error in diameter of wire} = \frac{\text{Least count}}{\text{Mesaured value}} \times 100\ \%$

$= \frac{0.005}{0.020}\times 100\% = 25\%$

144. (A)

Error in P = 3(%age error in "a") + 2(%age error in "b") + (%age error in "c") + (%age error in "d")

Error in P = 3(1%) + 2(2%) + (3%) + (4%) = 14%

145. (B)

By principle of homogeneity

$c^{2} = s \quad \Rightarrow c = s^{1/2}$

146. (D)

All are base quantities.

147. (C)

$1A^{o} = 10^{-10}m = 10^{-7}\times10^{-3}\ m = 10^{-7}\ mm$

148. (D)

All are fundamental quantities except "Charge".

$Q = I\times t$

149. (A)

The speed of wave in stretched string is given by:

$v = \sqrt{F/m}$

F = tension in the string

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m = mass per unit length of string

$$f = \frac{v}{2\ell} = \frac{1}{2\ell}\sqrt{\frac{F}{m}}$$

unit of "m" = kgm^{-1}

150. (B)

$\Delta x = x_2 - x_1 = (26.8 - 10.5) \pm (0.1 + 0.1)$

$= 16.3 \pm 0.2$ cm

In addition and subtraction absolute uncertainties are added.

151. (C)

Light year the unit of distance.

152. (B)

$$\text{Uncertainty in time period} = \frac{\text{Least count}}{\text{No. of vibrations}}$$

153. (B)

By the principle of homogeneity

Unit of "y" = unit of term "bt"

$m = bs \Rightarrow b = ms^{-1}$

154. (C)

By the principle of homogeneity

Unit of term "a/V^2" = unit of "P"

$a/m^6 = Nm^{-2} \Rightarrow a = Nm^{-2}.m^6 = N\,m^4$

155. (A)

Total numbers of base physical quantities in SI are "7".

156. (B)

Compound prefixes are not allowed.

157. (C)

The speed of wave in any medium is given by:

$$v = \sqrt{\frac{\text{Elastic modulus}}{\text{density}}} = \sqrt{\frac{E}{\rho}} \Rightarrow X = E = kgm^{-1}s^{-2}$$

158. (C)

Maximum error in any measurement = Least count of instrument being used (absolute uncertainty)

So, $T = (2.00 \pm 0.05)$ s

159. (B)

Precision relates to the least count of instrument. Smaller the least count, more precise will be the instrument.

The minimum reading (length) that can be measured by any instrument (L.C) is the precision of that instrument.

160. (B)

$1nm = 10^{-9}\,m = 10^{-7} \times 10^{-2}m = 10^{-7}$ cm

161. (A)

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

162. (C)

The only pair of SI base units is "ampere" and "kelvin".

163. (A)

$$K.E = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m} = \frac{P^2}{2m}$$

164. (A)

Centi, milli, micro → 10^{-2}, 10^{-3}, 10^{-6} (decreasing order)

165. (A)

Compound prefixes are not allowed.

$3\mu\mu F = 3pF$

166. (A)

Example:

$1m = 10^2$ cm $= 10^3$ mm $= 10^6\,\mu$m (Prefixes)

167. (C)

$$\%\text{age error in } V = \frac{5}{100} \times 100 = 5\%$$

$$\%\text{age error in } I = \frac{0.2}{10} \times 100 = 2\%$$

Total error in R = 5% + 2% = 7%

(errors always be added)

168. (A)

Accurate measurement is the one which is near to true value.

169. (D)

Systematic error is the instrumental error that may occur due to poor calibration. So, to remove this recalibrating the instrument.

170. (A)

$$\%\text{age uncertainty in depth} = \frac{0.2}{24} \times 100 = 0.8\%$$

171. (D)

Characteristics of an ideal standard:

i. Accessible ii. Invariable

172. (C)

$$\%\text{age error in } L = \frac{5}{100} \times 100 = 5\%$$

$$\%\text{age error in } I = \frac{0.2}{10} \times 100 = 2\%$$

Total error in g= %age error in L+2(%age error in T)

$= 1\% + 2(3\%) = 7\%$

(errors always be added)

173. (D)

$$\%\text{age error in distance} = \frac{0.2}{10} \times 100 = 2\%$$

$$\%\text{age error in time} = \frac{0.3}{4} \times 100 = 7.5\%$$

Total error in velocity = 2% + 7.5% = 9.5%

(errors always be added)

174. (B)

$$F = ma \Rightarrow a = \frac{F}{m}\,(N\,kg^{-1})$$

175. (C)

$$v = \frac{a}{t}$$

$m/s \neq m/s^3$

The only equation exist that have same units on both sides of equality.

176. (A)

$P = VI \Rightarrow$ watt = ampere × volt

177. (B)

Both energy and work have same units. So, their ratio will be unit less.

178. (A)

All are the units of energy except kilo watt (kW). kilo watt (kW) is the unit of power.

179. (A)

1000 kg = 1000(1000 g) = 10^6 g = 1 Mg

180. (C)

$$\frac{1\,Tm}{1Gm} = \frac{10^{12}\,m}{10^{9}\,m} = 10^{3} = k = kilo$$

181. (B)

$A = 4\pi r^2$

Uncertainty in area = 2(%age uncertainty in radius)

Uncertainty in area = 2(1.6 %) = 3.2 %

182. (B)

$F = ma$

Units of "F" = $kgms^{-2}$

183. (B)

$$F = G\frac{m_1m_2}{r^2} \Rightarrow G = \frac{Fr^2}{m_1m_2}$$

Units of "G" $= Nm^2kg^{-2}$

$= (kgms^{-2})(m^2kg^{-2}) = kg^{-1}m^3s^{-2}$

184. (B)

$$P = \frac{W}{t} \Rightarrow W = (P)(t) \Rightarrow Energy = (power)(time)$$

Unit of energy = (watt)(day)

185. (A)

1000 microns = 1000×10^{-6} m = 10^{-3} m

186. (D)

$$\omega = \frac{\theta}{t}$$

Unit of "ω" = rad s^{-1}

187. (C)

$$f = \frac{1}{2\pi\sqrt{LC}} \Rightarrow \sqrt{LC} = \frac{1}{2\pi f} = \frac{T}{2\pi}$$

unit of $\sqrt{LC}$ = s

188. (C)

$$C = \frac{A\varepsilon_o}{d} \Rightarrow \varepsilon_o = \frac{Cd}{A}$$

Units of "ε_o" $= \frac{Fm}{m^2} = \frac{F}{m}$

189. (A)

$$\frac{Energy}{Mass \times Length} = \frac{Fd}{m \times d} = \frac{(ma)d}{m \times d} = a\ (acceleration)$$

190. (C)

$$72\ kmh{-}1 = 72 \times \frac{1000}{3600}\ ms^{-1} = 20\ ms^{-1}$$

191. (A)

Light year and wavelength both have the dimensions of distance [L].

192. (C)

$1nm \times 1Em = 10^{-9} \times 10^{18}\ m^2 = 10^9\ m^2$

193. (B)

As the least count of screw gauge is smallest than meter rod and vernier calipers. So, it is most precise among them.

UHS PAST MDCAT (2008-2019)

1. The units of "E" in $E = mc^2$ are: (UHS 2008)

(A) kg ms^{-2} (C) kg m^2s^{-2}

(B) N ms^{-2} (D) Both "B" and "C"

(C)

$E = mc^2$

Units of "E" = $kg(ms^{-1})^2 = kgm^2s^{-2}$

2. Light year is the measure of: (UHS 2008)

(A) Distance (C) Intensity of light

(B) Time (D) Velocity

(A)

Light year is the distance travelled by light in one year. It is the unit of distance.

3. The dimensions of gravitational constant "G" are: (UHS 2009)

(A) $[ML^{-2}T^{-1}]$ (C) $[ML^{-2}T^{-2}]$

(B) $[M^2L^{-2}T^{-1}]$ (D) $[M^{-1}L^3T^{-2}]$

(D)

$$F = G\frac{m_1m_2}{r^2} \Rightarrow G = \frac{Fr^2}{m_1m_2}$$

$$[G] = \frac{[F][r]^2}{[m_1][m_2]} = \frac{[MLT^{-2}][L]^2}{[M][M]} = [M^{-1}L^3T^{-2}]$$

4. Principal of homogeneity of equation used to check: (UHS 2010)

(A) Variables of equation

(B) Both variable and constants equation

(C) Constants of equation

(D) Correctness of equation

(D)

According to principle of homogeneity every equation would be correct if it has same dimensions or SI base units on both sides.

5. Which one is the highest power multiple: (UHS 2010)

(A) giga (C) mega

(B) tera (D) deca

(B)

deca < mega < giga < tera $\rightarrow 10^1 < 10^6 < 10^9 < 10^{12}$

6. SI unit of charge is: (UHS 2010)

(A) ampere (C) coulomb

(B) volt (D) calorie

(C)

$$I = \frac{Q}{t} \Rightarrow Q = It$$

Unit of charge "Q" = A s = C = coulomb

7. When the dimensions of both sides of an equation are equal, then equation is said to be: (UHS 2011)

(A) Simultaneous (C) Instantaneous

(B) Homologous (D) Quadratic

(B)

By principle of homogeneity, the dimension of both side of equation will be same. So, the

equation is said to be homologous.

8. Radian is a unit of angular displacement which can also be measured in degrees. How many radians are equal to one degree: (UHS 2011)

(A) $\frac{\pi}{180}$ (C) $\frac{2\pi}{180}$

(B) $\frac{180}{\pi}$ (D) $\frac{\pi}{57.3}$

(A)

As we know that

$360^\circ = 2\pi$ rad

$1^\circ = \frac{2\pi}{360}$ rad $= \frac{\pi}{180}$ rad

9. Electric charge on an object is measured as 5 micro coulombs. How the value of this charge can be expressed in terms of base units: (UHS 2012)

(A) 5×100 ampere second

(B) 5×10^{-6} ampere second

(C) $5 \times 10^{+6}$ coulomb second

(D) 5×100 coulomb second

(B)

5 micro coulomb $= 5 \times 10^{-6}$ ampere second

10. If "m" is the mass, "c" is the velocity of light and $x = mc^2$, then the dimensions of "x" will be: (UHS 2012)

(A) $[LT^{-1}]$ (C) $[MLT^{-1}]$

(B) $[ML^2T^{-2}]$ (D) $[MLT^{-2}]$

(B)

$[x] = [m][c]^2 = [M][LT^{-1}]^2 = [M][L^2T^{-2}]$

11. The wavelength "λ" of a wave depends on the speed "v" of the wave and its frequency "f". Decide which of the following is correct? (UHS 2013)

(A) $f = \frac{v}{\lambda}$ (C) $f = \frac{\lambda}{v}$

(B) $f = v\lambda$ (D) $f = v\lambda^{-2}$

(A)

Unit of "f" $= Hz = s^{-1}$

Unit of "v/λ" $= s^{-1}$

12. Name the quantity which can be measure by using base unit "kg m^2 s^{-3}": (UHS 2013)

(A) Weight (C) Power

(B) Pressure (D) Work

(C)

$$P = \frac{W}{t} = \frac{kgm^2s^{-2}}{s} = kgm^2s^{-3}$$

13. The formula for electric field strength is E= F/Q, where E is electric field strength, F is force and Q is charge. Which of the following options gives the correct base units for electric field strength? (UHS 2014)

(A) $kgms^{-3}A^{-1}$ (C) $kgs^{-2}A^{-2}$

(B) $kg^2m^{-1}s^2A$ (D) $m^2s^{-1}A^{-1}$

(A)

$$E = \frac{F}{Q}$$

Unit of "E" $= \frac{N}{C} = \frac{kgms^{-2}}{As} = kgms^{-3}A^{-1}$

14. Which set of the prefixes give values in increasing order? (UHS 2014)

(A) pico, mego, kilo, tera

(B) pico, micro, mega, giga

(C) tera, pico, micro, kilo

(D) giga, kilo, milli, nano

(B)

Pico, Micro, Mega, Giga → 10^{-12}, 10^{-6}, 10^{6}, 10^{9}

15. The unit of temperature in base unit is: (UHS 2015)

(A) celsius (C) kelvin

(B) degree (D) Fahrenheit

(C)

kelvin is the SI base unit of temperature.

16. the dimensions of pressure is: (UHS 2015)

(A) $[M^{-1}L^2T^{-2}]$ (C) $[M^{-1}L^{-2}T^{-2}]$

(B) $[ML^{-1}T]$ (D) $[ML^{-1}T^{-2}]$

(D)

$$P = \frac{F}{A} \Rightarrow [P] = \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$$

17. The time period "T" of a simple pendulum depends on its length "ℓ" and acceleration due to gravity "g". Using units, the correct equation for time period is: (UHS 2016)

(A) $T = k\sqrt{\frac{g}{\ell}}$ where "k" is constant

(B) $T = k\sqrt{\frac{\ell}{g}}$ where "k" is constant

(C) $T = \frac{1}{k}\sqrt{\frac{g}{\ell}}$ where "k" is constant

(D) $T = \frac{1}{k}\sqrt{\frac{\ell}{g}}$ where "k" is constant

(B)

$$T = k\sqrt{\frac{\ell}{g}} = 2\pi\sqrt{\frac{\ell}{g}}$$

Where $k = 2\pi$ = constant

18. The unit for electric charge is coulomb and one coulomb in terms of base unit is equivalent to: (UHS 2016)

(A) Am (C) As

(B) Js^{-1} (D) C

(C)

$I = \frac{Q}{t} \Rightarrow Q = It$

Unit of "Q" $= C = As$

19. An observer notes reading of a scale from different angles (parallax) while measuring the length of wire, what kind of error can occur? (UHS 2017)

(A) Systematic Error (C) Precised Error

(B) Zero Error (D) Random Error

(D)

As observer takes readings from different angles of same experiment under same conditions, results would be different due to random error.

20. The quantities which can be measured accurately are called: (UHS 2017)

(A) Base Quantities
(B) Derived Quantities
(C) Physical Quantities
(D) Supplementary Quantities

(C)

All measurable quantities in terms of which the laws of physics are expressed are called physical quantities.

21. Force is a derived quantity, its derived unit can be expressed in terms of the base units as: (UHS 2018)

(A) $kgcms^{-2}$ (C) $kgms^{2}$
(B) $kgm^{2}s^{2}$ (D) $kgms^{-2}$

(D)

$F = ma$
Units of "F" = $kgms^{-2}$

22. The different magnitudes of same physical quantities are measured by comparing them to: (UHS 2018)

(A) Available scale
(B) Other physical quantities
(C) Each other
(D) Standard size

(C)

Same physical quantities are measured by comparing them to each other.
Example:
1 m = 100 cm = 1000 mm

23. Percentage uncertainty in the length and width of a rectangle is 2% and 3%. The total uncertainty in area of that rectangle is: (UHS 2019)

(A) 1.5% (C) 6%
(B) 5% (D) 1%

(B)

Area of rectangle = length × width
Total uncertainty in area = 2% + 3% = 5%
(Errors always be added)

24. The diameter of a wire is measured by using a micrometer screw gauge with least count of 0.01 mm, then which of the following reading will be correct? (UHS 2019)

(A) 0.067 cm (C) 0.67 cm
(B) 0.0067 mm (D) 6.70 cm

(A)

Least count of screw gauge = 0.01 mm
= 0.001 cm
Screw gauge measures reading up-to three decimal places. So, the correct answer is 0.067 cm.

UNIT 02 MOTION AND FORCE

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

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

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

02. **When two bodies move toward each other with constant speed the distance between them decreases at the rate of 6m/sec. If they move in the same direction the distance between them decreases at the rate of 4m/s. Then their speeds are:**

(A) 5m/s, 1m/s (C) 6m/s, 1m/s

(B) 3m/s, 3m/s (D) 4m/s, 2m/s

03. **The distance covered by a body with uniform acceleration in time "t" starting from rest is:**

(A) $at^2/2$ (C) $a^2t/2$

(B) vt (D) Both (A) and (B)

04. **Flight of a rocket in the space is an example of:**

(A) second law of motion

(B) third law of motion

(C) first law of motion

(D) law of conservation of linear momentum

05. **Time rate of change of momentum is equal to:**

(A) force (C) impulse

(B) velocity (D) both "a" and "c"

06. **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} (C) 15 ms^{-1}

(B) 29.4 ms^{-1} (D) 12.2 ms^{-1}

07. **The unit of momentum in SI unit is:**

(A) $kgms^{-2}$ or N m (C) kg^2ms^{-1} or $N\,m^2$

(B) kgm^2s or N^2m (D) $kgms^{-1}$ or N s

08. **The mass of fuel consumed by a typical rocket to overcome Earth's gravity is:**

(A) $1000kgs^{-1}$ (C) $100kgs^{-1}$

(B) $10000kgs^{-1}$ (D) $10kgs^{-1}$

09. **A body is thrown vertically upward with a velocity $9.8ms^{-1}$. It will reach the height:**

(A) 19.8m (C) 29.4m

(B) 9.8m (D) 4.9m

10. **For maximum horizontal distance to travel, a projectile must be fired at an angle of:**

(A) 30° (C) 45°

(B) 60° (D) 90°

11. **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 (C) 4.0 s

(B) 5.0 s (D) 8.0 s

12. **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 (C) 7 m/s south

(B) 43 m/s north (D) 20 m/s north

13. **At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at 3 m/s^2. How much time does the car take to catch up to the truck?**

(A) 5 s (C) 10 s

(B) 15 s (D) 20 s

14. **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

15. **Which one of the following statements is correct for an object released from rest?**

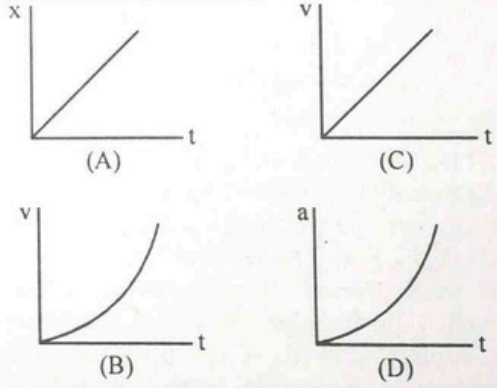
(A) The average velocity during the first second of time is 4.9m/s

(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

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



17. **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

18. **If the total momentum of a system is changing:**

(A) particles of the system must be exerting forces on each other

(B) the system must be under the influence of gravity

(C) the center of mass must have constant velocity

(D) a net external force must be acting on the system

19. **When you step on the accelerator to increase the speed of your car, the force that accelerates the car is:**

(A) the force of your foot on the accelerator

(B) the force of friction of the road on the tires

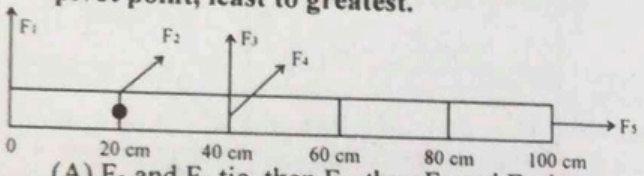
(C) the force of the engine on the drive shaft

(D) the normal force of the road on the tires

20. **A projectile in flight explodes into several fragments. The total momentum of the fragments immediately after this explosion:**
(A) is the same as the momentum of the projectile immediately before the explosion
(B) has been changed into kinetic energy of the fragments
(C) is less than the momentum of the projectile immediately before the explosion
(D) is more than the momentum of the projectile immediately before the explosion

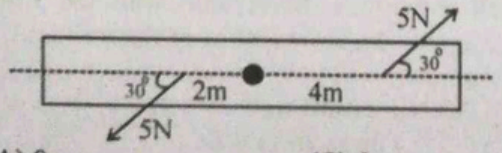
21. **Bullets from two revolvers are fired with the same velocity. The bullet from gun #1 is twice as heavy as the bullet from gun #2. Gun #1 weighs three times as much as gun #2. The ratio of the momentum imparted to gun #1 to that imparted to gun #2 is:**
(A) 2:3 (C) 3:2
(B) 2:1 (D) 3:1

22. **The meter stick shown below rotates about an axis through the point marked "•", 20 cm from one end. Five forces act on the stick: one at each end, one at the pivot point, and two 40 cm from one end, as shown. The magnitudes of the forces are all the same. Rank the forces according to the magnitudes of the torques they produce about the pivot point, least to greatest.**



(A) F_2 and F_5 tie, then F_4, then F_1 and F_3 tie
(B) F_2 and F_5 tie, then F_4, F_1, F_3
(C) F_1 and F_2 tie, then F_3, F_4, F_5
(D) F_2, F_5, F_1 and F_3 tie, then F_4

23. **A rod is pivoted about its center. A 5 N force is applied 4m from the pivot and another 5 N force is applied 2 m from the pivot, as shown. The magnitude of the total torque about the pivot (in N m) is:**



(A) 0 (C) 5
(B) 8.7 (D) 15

24. **Two cars are moving in opposite directions with speed "v". What is the magnitude of their relative velocity:**
(A) 0 (C) v/2
(B) v (D) 2v

25. **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 (C) 30 m
(B) 60 m (D) 15 m

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

27. **The numerical ratio of velocity and speed of a particle is always:**
(A) equal to or less than one
(B) equal to one
(C) less than one
(D) zero

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

29. **When a certain force is applied to the standard kilogram its acceleration is 5.0 m/s^2. When the same force is applied to another object its acceleration is one–fifth as much. The mass of the object is:**
(A) 0.2 kg (C) 0.5 kg
(B) 1.0 kg (D) 5.0 kg

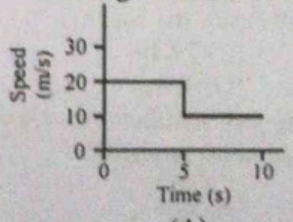
30. **At what angle height of a projectile is $1/4^{th}$ of its maximum height:**
(A) 30° (C) 45°
(B) 40° (D) 60°

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

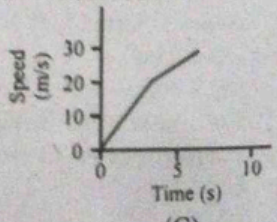
32. **A car travels east at constant velocity. The net force on the car is:**
(A) east (C) west
(B) up (D) zero

33. **A block slides down a frictionless plane that makes an angle of 30° with the horizontal. The acceleration of the block is:**
(A) 980 cm/s^2 (C) 566 cm/s^2
(B) 0 cm/s^2 (D) 490 cm/s^2

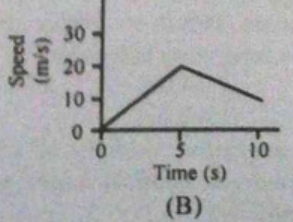
34. **A skier is travelling downhill. The acceleration on hard snow is 4 m/s^2 and on soft snow is 2 m/s^2 Which graph shows the motion of the skier when moving from hard snow to soft snow?**



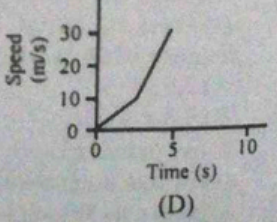
(A)



(C)



(B)



(D)

35. **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

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

37. **The velocity component with which a projectile covers certain horizontal distance, is maximum at the moment of :**
(A) Hitting the ground (C) Projection
(B) Highest point (D) remain constant

38. **The velocity component with which a projectile covers certain vertical distance is minimum at the moment of:**
(A) Hitting the ground (C) Projection
(B) Highest point (D) None of these

39. **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° (C) 65°
(B) 55° (D) 70°

40. **A ball is allowed to fall freely from certain height. It covers a distance in first second equal to:**
(A) 2g (C) g
(B) g/2 (D) 3g

41. **The height of projectile is maximum at an angle of:**
(A) 45° (C) 60°
(B) 30° (D) 90°

42. **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) 5 N
(B) 2 N (D) 1 N

43. **Acceleration of bodies of different masses allowed to fall freely is (air friction is negligible):**
(A) same in magnitude and direction
(B) same in direction only
(C) Same in magnitude only
(D) Different for both bodies

44. **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 (C) 10 s
(B) 12 s (D) 14 s

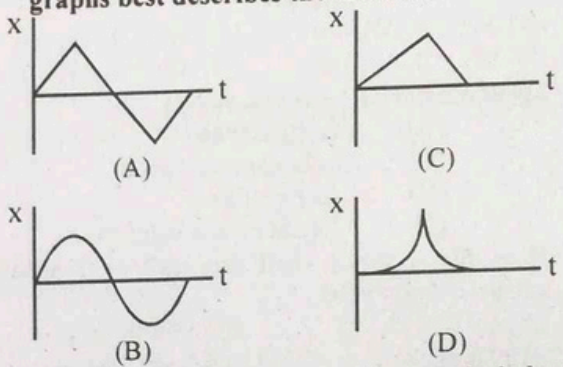
45. **For a rocket, the change in momentum per second of the ejecting gases is equal:**
(A) Acceleration of the rocket
(B) Velocity of the rocket
(C) Momentum of the rocket
(D) Thrust acting on rocket

46. **The velocity of projectile is maximum:**
(A) At the highest point
(B) At a point of launching and just before striking the ground
(C) At the half of the height
(D) After striking the ground

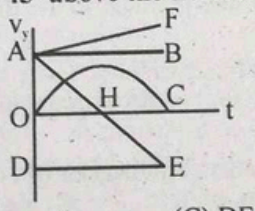
47. **Velocity of an object dropped from a building at any instant "t" is given by:**
(A) $\frac{1}{2}gt^2$ (C) $v_i t + \frac{1}{2}gt^2$
(B) at (D) gt

48. **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} (C) 10 ms^{-1}
(B) 20 ms^{-1} (D) 16 ms^{-1}

49. **A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following distance versus time graphs best describes the motion?**



50. **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 (C) DE
(B) AB (D) AE

51. **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 (C) 60m
(B) 80m (D) 120m

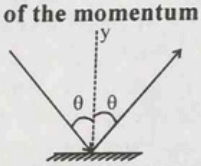
52. **The mass of a body:**
(A) is slightly different at different places on Earth
(B) is a vector
(C) is independent of the free-fall acceleration
(D) is the same for all bodies of the same volume

53. **Feather and a lead ball are dropped from rest in vacuum on the Moon. The acceleration of the feather is:**
(A) more than that of the lead ball

(B) less than that of the lead ball
(C) the same as that of the lead ball
(D) $9.8 m/s^2$

54. **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

55. **A ball hits a wall and rebounds with the same speed, as diagramed below. The changes in the components of the momentum of the ball are:**



(A) $\Delta P_x > 0, \Delta P_y > 0$ (C) $\Delta P_x < 0, \Delta P_y > 0$
(B) $\Delta P_x = 0, \Delta P_y > 0$ (D) $\Delta P_x = 0, \Delta P_y < 0$

56. **Speedometer of a car measures:**
(A) average speed
(C) instantaneous speed
(B) acceleration
(D) instantaneous velocity

57. **How far a stone shall free fall in 1 second if released from rest?**
(A) 4.9 m (C) 19.6 m
(B) 9.8 m (D) 3×9.8 m

58. **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°

59. **The numerical ratio displacement to distance**
(A) always = 1 (C) always > 1
(B) always < 1 (D) always ≤ 1

60. **The correct statement from the following is:**
(A) a body have zero velocity will not necessary will have zero acceleration
(B) a body have zero velocity will necessary have zero acceleration
(C) a body have uniform speed can have only uniform acceleration
(D) a body can have non–uniform velocity will have zero acceleration

61. **A ball thrown vertically up with a speed "v" come back to the starting point with speed "v" the ratio of the distance covered and displacement is**
(A) 0 (C) –1
(B) 1 (D) infinite

62. **Area under the velocity-time graph shows the:**
(A) acceleration of a body (C) Work done
(B) distance covered (D) Force of the body

63. **A freely falling body has a constant acceleration of $9.8 m/s^2$. This means that:**
(A) the body falls 9.8 m during each second
(B) the body falls 9.8 m during the first second only
(C) the speed of the body increases by 9.8 m/s during each second
(D) the acceleration of the body increases by 9.8 m/s^2 during each second

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

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

66. **At one instant of time a rocket is traveling in outer space at 2500 m/s and is exhausting fuel at a rate of 100 kg/s. If the speed of the fuel as it leaves the rocket is 1500 m/s, relative to the rocket, the thrust is:**
(A) 0 (C) 1.0×10^5 N
(B) 1.5×10^5 N (D) 2.9×10^5 N

67. **Force bear by wall on which water strike normally at speed of 10 m sec^{-1} and at a discharge 0.0001 m^3/sec is:**
(A) 1 N (C) 100 N
(B) 10 N (D) 1000 N

68. **The acceleration produced in a body can have an angle with the force:**
(A) 90° (C) 0°
(B) 180° (D) All of these

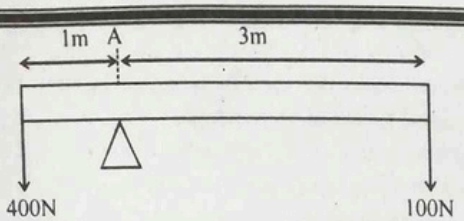
69. **Two forces are said to be equal if:**
(A) Have same magnitude only
(B) Have same direction only
(C) Have same magnitude and direction
(D) Can't be sure

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

71. **Which pairs of the following forces can give a resultant force 2N?**
(A) 1 N and 1 N (C) 1 N and 3 N
(B) 4 N and 2 N (D) all of these

72. **When a constant force acts on a body of mass "m" initially at rest, then the velocity acquired is proportional to:**
(A) $\sqrt{m}$ (C) m
(B) $\frac{1}{\sqrt{m}}$ (D) $\frac{1}{m}$

73. **A uniform rod loaded as shown in the fig. below is pivoted at the point "A" so that it is in equilibrium. The weight of the rod will be:**



(A) 700N (C) 500N
(B) 300N (D) 100N

74. **Laws of motions are valid in a system is:**
(A) Non inertial frame (C) at rest
(B) inertial frame (D) in the space

75. **When a climber reaches the top of mountain:**
(A) his mass is now greater
(B) his mass is now slightly smaller
(C) his weight is now greater
(D) his weight is now slightly smaller

76. **The slope of the displacement–time graph gives:**
(A) distance (C) work
(B) average velocity (D) average acceleration

77. **Pull of earth on a mass of 20kg on the surface of Earth is:**
(A) 20 N (C) 196 N
(C) 19.6 N (D) 1960 N

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

79. **The acceleration in the rocket at any instant is proportional to the n^{th} power of the velocity of the expelled gases. Where the value of n must be?**
(A) -1 (C) 1
(B) -2 (D) 2

80. **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 (C) 5 km/hr^2
(B) 5 m/hr^2 (D) 5 km/sec^2

81. **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 (C) 125 m
(B) 40 m (D) 10 m

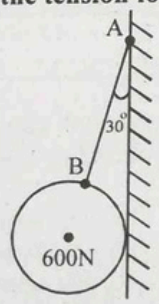
82. **A particle accelerates uniformly from 10 km/hr to 20 km/hr with acceleration of 2 km/hr^2. The total time it takes is:**
(A) 20 hr (C) 10 hr
(B) 10 min (D) 5 hr

83. **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

84. **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 (C) 10 Ns downward
(B) 2.0 Ns upward (D) 2.0 Ns downward

85. **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

86. **The 600 N ball shown is suspended on a string AB and rests against a frictionless vertical wall. The string makes an angle of 30° with the wall. The magnitude of the tension force of the string is:**



(A) $400\sqrt{3}$ N (C) 1200N
(B) $400\sqrt{2}$N (D) 2400N

87. **In rotational motion, the counterpart of force is:**
(A) torque (C) momentum
(B) angular acceleration (D) angular inertia

88. **A door has height and width of 1.5m and 0.5m respectively. Choose a force that will produce highest value of torque:**
(A) 25 N force, at 0.5m from axis of rotation
(B) 50 N force, at 1m from axis of rotation
(C) 100 N force, at 2m from axis of rotation
(D) 12.5 N force, at 0.25m from axis of rotation

89. **A force of 5N is acting along Y-axis. Its component along X-axis is:**
(A) 5N (C) zero
(B) 10N (D) 2.5N

90. **Two stones are projected from the same point with same speed making angles $45°+\theta$ and $45°-\theta$ with the horizontal respectively. If $\theta \leq 45^0$, then the horizontal ranges of the two stones are in the ratio of:**
(A) 1 : 1 (C) 1 : 2
(B) 1 : 3 (D) 1 : 4

91. **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 (C) Greater than that of Q
(B) Less than that of Q (D) 3/7 times that of Q

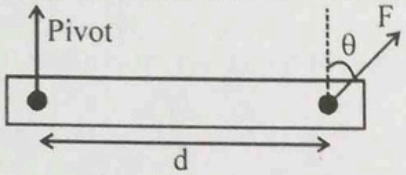
92. **Ballistic missiles are of:**
(A) short range (C) long range

(B) no range (D) fixed range

93. **The range of projectile is directly proportional to:**
(A) $\sin\theta$ (C) $\sin2\theta$
(B) $\sin 3\theta$ (D) $\sin\theta$ and $\sin2\theta$

94. **Horizontal range of a projectile is related with maximum range according to relation:**
(A) $R = R_{max}\sin2\theta$
(B) $R_{max} = \frac{R}{\sin2\theta}$
(C) $R_{max} = R\sin\theta$
(D) $R = R_{max}\sin2\theta$ and $R_{max} = \frac{R}{\sin2\theta}$

95. **A force F is applied to a beam at a distance d from a pivot. The force acts at an angle θ to a line perpendicular to the beam.**



Which combination will cause the largest turning effect about the pivot?

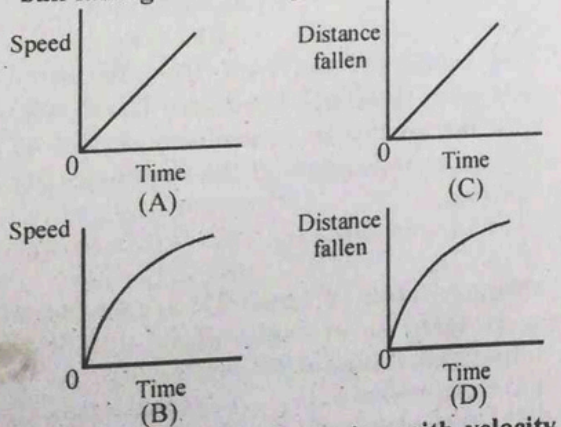
	F	d	θ
(A)	large	large	large
(B)	large	large	small
(C)	small	small	large
(D)	small	large	small

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

97. **Two forces each of magnitude 10N acting on a string in opposite direction, the tension in the string is:**
(A) 10N (C) 20 N
(B) 40 N (D) 0 N

98. **Distance covered by a freely falling body in 2 sec will be:**
(A) 4:9 m (C) 3.92m
(B) 19.6m (D) 44.1m

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



100. **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 (C) 36m/s
(B) zero (D) infinite

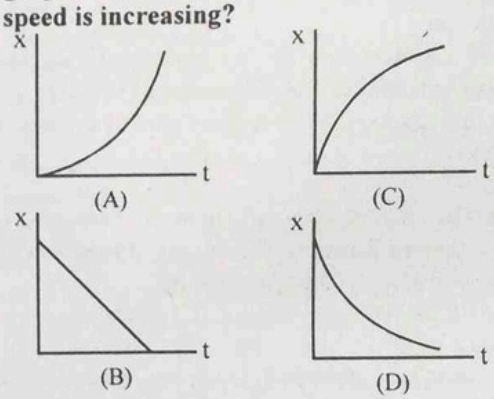
101. **When velocity time graph is a straight line parallel to time axis then:**
(A) acceleration is constant
(B) acceleration is zero
(C) acceleration is variable
(D) velocity is zero

102. **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

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

104. **An object is thrown vertically upward with a certain initial velocity in a planet where the acceleration due to gravity is 19.6 m/s^2. 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 (C) $\sqrt{2}$ times
(B) twice (D) four times

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

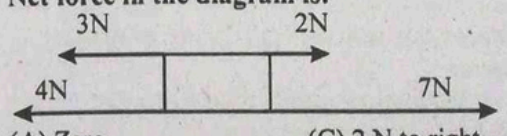


106. **The angular momentum of a body changes from 30 Js to 50 Js in 0.5 sec. The torque acting on it is:**
(A) 40 N m (C) 50 N m
(B) 100 N m (D) 150 N m

107. **The direction of torque is perpendicular to:**
(A) $\vec{r}$ (C) both $\vec{r}$ and $\vec{F}$
(B) $\vec{F}$ (D) No direction

108. **A fan rotates at 10 rad/sec. The torque acting on it is:**
(A) maximum (C) zero
(B) minimum (D) negative

109. **Net force in the diagram is:**



(A) Zero (C) 2 N to right
(B) 6 N to left (D) 11 N to right

110. **The minimum number of forces that keeps the body in equilibrium are:**
(A) Two (C) Three
(B) Four (D) Five

111. **When two or more than two forces acting on a common point, the forces are called:**
(A) Collinear forces (C) Concurrent forces
(B) Couple (D) Antiparallel forces

112. **Torque acting on a body determines its:**
(A) acceleration
(B) Uniform angular velocity
(C) angular acceleration
(D) Force

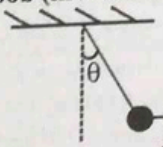
113. **A net torque applied to a rigid object always tends to produce:**
(A) linear acceleration (C) rotational equilibrium
(B) angular acceleration (D) rotational inertia

114. **For a body to be in equilibrium under the combined action of several forces:**
(A) all the forces must be applied at the same point
(B) all of the forces form pairs of equal and opposite forces
(C) the sum of the components of all the forces in any direction must equal zero
(D) any two of these forces must be balanced by a third force

115. **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 (C) 2m/s
(B) 4m/s (D) 8m/s

116. **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) $0.50 m/s^2$ (C) $2.0 m/s^2$
(B) $2.8 m/s^2$ (D) $10 m/s^2$

117. **A 1N pendulum bob is held at an angle θ from the vertical by a 2N horizontal force "F" as shown. The tension in the string supporting the pendulum bob (in newtons) is:**

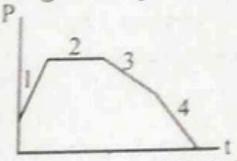


(A) cos θ (C) 2/cos θ
(B) $\sqrt{5}$ (D) 1

118. **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

119. **Two objects, "P" and "Q", have the same momentum. "Q" has more kinetic energy than P if it:**
(A) weight more than P
(B) weight the same as P
(C) is moving faster than P
(D) is moving slower than P

120. **A particle moves along the x axis. Its momentum is graphed below as a function of time. Rank the numbered regions according to the magnitude of the force acting on the particle, least to greatest.**



(A) 1, 2, 3, 4 (C) 2, 3, 4, 1
(B) 1, 4, 3, 2 (D) 1, 3, 4, 2

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

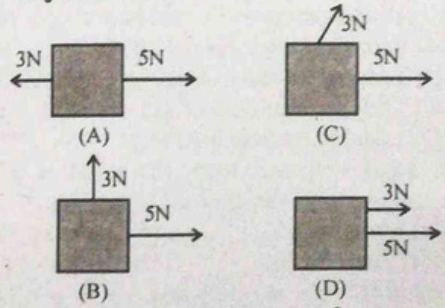
122. **Two objects moving along the same direction with different masses but same velocity. There relative velocity becomes:**
(A) 2 time (C) 0
(B) 4 time (D) variable

123. **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°

124. **Two bodies are projected at angles θ and $(90^0 - \theta)$ to the horizontal with the same speed. The ratio of their times of flight is:**
(A) sin θ :1 (C) cos θ: 1
(B) Sin θ : Cos θ (D) cos θ : sin θ

125. **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) $\frac{u^2}{g}$ (C) $\frac{u^2}{2g}$
(B) $\frac{u^2}{3g}$ (D) $\frac{u^2}{4g}$

126. **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?**



127. **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

128. The unit of couple is:
(A) J m^{-1} (C) J m
(B) N m^{-1} (D) N m

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

130. 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 (C) 98 kgm/s
(B) 50 kgm/s (D) 49 kgm/s

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

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

133. 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 (C) 30N
(B) 20N (D) 40N

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

135. 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 (C) 100 times
(B) 1000 times (D) 10000 times

136. In the projectile motion the vertical component of velocity:
(A) Remains constant (C) Varies point to point
(B) Become zero (D) Increases with time

137. An object is thrown along a direction inclined at an angle of 45° with the horizontal direction. The horizontal range of the particle is:
(A) Four times the vertical height
(B) Twice the vertical height
(C) Thrice the vertical height
(D) Equal to vertical height

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

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

140. What is the angle of projection of a projectile for which its height and horizontal range are equal:
(A) 46° (C) 56°
(B) 66° (D) 76°

141. For flat earth approximation the trajectory of the projectile is:
(A) Straight line (C) Parabolic
(B) Elliptic (D) Hyperbolic

142. The time taken by the projectile to reach its maximum height is:
(A) $\frac{2v_i\sin\theta}{g}$ (C) $\frac{v_i\cos\theta}{g}$
(B) $\frac{v_i\sin\theta}{g}$ (D) $\frac{2v_i\cos\theta}{g}$

143. 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} (C) 7.1 ms^{-1}
(B) 5 ms^{-1} (D) 10 ms^{-1}

144. 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 (C) I and II only
(B) I and III only (D) II and III only

145. 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

146. 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 (C) 2 m / s^2
(B) 15 m / s^2 (D) 50 m / s^2

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

148. The area between the velocity-time graph and the time axis is numerically equal to:
(A) velocity (C) distance
(B) time (D) acceleration

149. Water flows out from a pipe at 3kg s^{-1} and its velocity changes from 5ms^{-1} to zero on striking the wall. The force due to the water flow is:
(A) 3 N (C) 5 N

(B) 10 N (D) 15 N

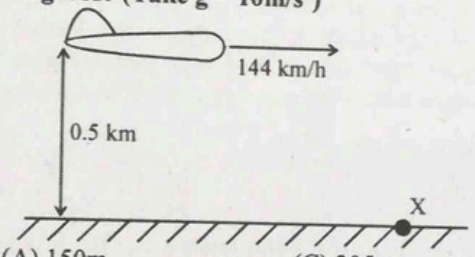
150. Which of the following is NOT an example of accelerated motion?

(A) Vertical component of projectile motion
(B) A swinging pendulum
(C) Circular motion at constant speed
(D) Horizontal component of projectile motion

151. 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:

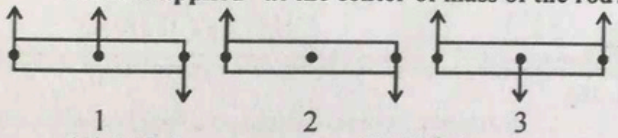
(A) strikes the plane at the same time as the other body
(B) strikes the plane earlier than the other body
(C) has the vertical component of its velocity altered
(D) has the vertical component of its acceleration altered

152. 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)



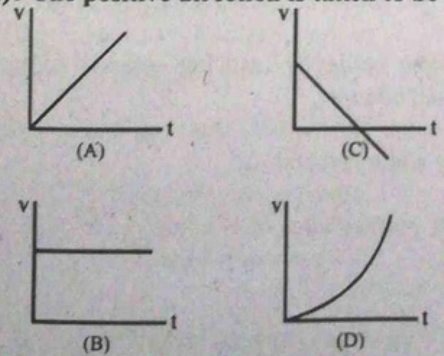
(A) 150m (C) 305m
(B) 400m (D) 2550m

153. Three identical uniform rods are each acted on by two or more forces, all perpendicular to the rods and all equal in magnitude. Which of the rods could be in static equilibrium if an additional force is applied at the center of mass of the rod?



(A) Only 1 (C) Only 2
(B) Only 3 (D) Only 1 and 2

154. 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.



155. When the body moves with constant acceleration, the velocity time graph is:

(A) parabola (C) ellipse
(B) straight line (D) curve

156. Rocket equation is given as:

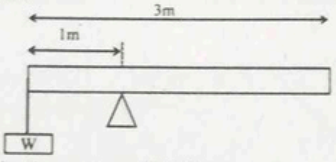
(A) $\vec{a} = \frac{M\vec{v}}{m}$ (C) $\vec{a} = \frac{m\vec{v}}{M}$

(B) $\vec{a} = \frac{M}{m\vec{v}}$ (D) $\vec{a} = \frac{m}{M\vec{v}}$

157. If a shell explodes in mid air, its fragments fly off in different directions. Total momentum of the fragments:

(A) decreases (C) increases
(B) remains constant (D) becomes zero

158. A uniform beam of weight 50 N is 3.0 m long and is supported on a pivot situated 1.0 m from one end. When a load of weight W is hung from that end, the beam is in equilibrium as shown in the diagram.



What is the value of W?

(A) 25 N (C) 50 N
(B) 75 N (D) 100 N

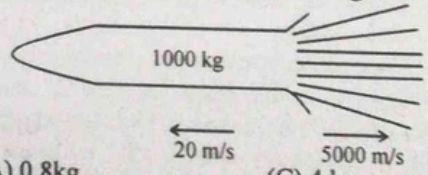
159. A bullet shot straight up returns to its starting point in 10 s. Its initial speed was:

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

160. 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:

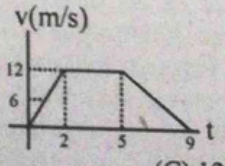
(A) 10 kgms^{-2} (C) 50 kgms^{-2}
(B) 5 kgms^{-2} (D) 2 kgms^{-2}

161. A 1000 kg space probe is motionless in space. To start moving, its main engine is fired for 5s during which time it ejects exhaust gases at 5000m/s. At the end of this process it is moving at 20m/s. The approximate mass of the ejected gas is:



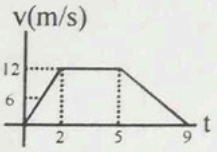
(A) 0.8kg (C) 4 kg
(B) 5 kg (D) 20 kg

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



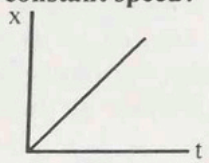
(A) 4 m (C) 12 m
(B) 24 m (D) 36 m

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

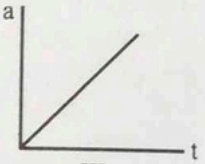


(A) The car accelerates, stops, and reverses
(B) The car is moving for a total time of 12 s
(C) The car accelerates at 6 m/s^2 for the first 2 s
(D) The car decelerates at 12 m/s^2 for the last 4s

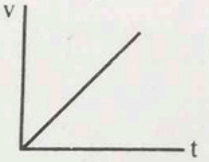
164. **Consider the following graphs (note the axes carefully). Which of these represents motion at constant speed?**



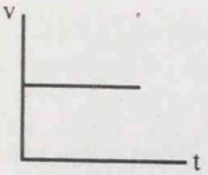
I



III



II



IV

(A) IV only (C) III only
(B) I, II, and III only (D) I and IV only

165. **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 (C) 30 m/s
(B) 2 m/s (D) 0 m/s

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

167. **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

168. **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 (C) − v/3, 2v/3
(B) − v, v (D) −2v/3, v/3

169. **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 (C) m << M
(B) m = M (D) m = M/2

170. **A body of mass "m" moving with velocity "v" makes a head on elastic collision with another body of mass "2m" which is initially at rest. The loss of kinetic energy of the colliding body (mass "m") is:**
(A) 1/2 of its initial kinetic energy
(B) 8/9 of its initial kinetic energy
(C) 1/9 of its initial kinetic energy
(D) 1/4 of its initial kinetic energy

171. **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 (C) 1000 J
(B) 800 J (D) 1200 J

172. **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 (C) 0 and 13 m/s
(B) – 13 m/s and 14 m/s (D) 0 and 14 m/s

173. **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 $\frac{m_1}{m_2}$ is:**
(A) 0.75 (C) 3.0
(B) 1.33 (D) 4.0

174. **If distance of a point from pivot is "L" and a force "F" is applied such that it passes from the pivot then the torque produced in the body will be:**
(A) Zero (C) LF sin θ $\hat{n}$
(B) L F cos θ (D) LF

UNIT 02 MOTION AND FORCE (SOLUTIONS)

01. (B)

The relation between height and range of a projectile projected at any angle "θ" is

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

If R= H

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

02. (A)

When bodies are moving parallel to each other

$$v_r = v_1 - v_2 \Rightarrow 4 = v_1 - v_2 \ldots\ldots(i)$$

When bodies are moving opposite to each other to each other

$$v_r = v_1 + v_2 \Rightarrow 6 = v_1 + v_2 \ldots\ldots(ii)$$

by adding (i) and (ii)

$$10 = 2v_1 \Rightarrow v_1 = 5\ ms^{-1}$$

By putting value of v_1 in eq.(i)

$$v_2 = 1\ ms^{-1}$$

03. (A)

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

04. (D)

The motion of rocket is an application of law of conservation of momentum. Rocket moves upward by ejecting hot gases at the tail of the rocket with very high velocity in downward direction. The rocket gain momentum equal to the momentum of gas ejected from the tail of the rocket, but in opposite direction.

05. (A)

$$\vec{F} = \frac{\vec{P_f} - \vec{P_i}}{t} = \frac{\vec{\Delta P}}{t}$$

$\vec{F}$ = Time rate of change of momentum

Time rate of change of momentum of a body is equal to the applied force.

06. (B)

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

$v_i = gt = (9.8)(3) = 29.4\ ms^{-1}$

07. (D)

$P = mv = kgms^{-1} = N\ s$

08. (B)

A rocket carries its own fuel in the form of solid or liquid hydrogen and oxygen. A typical rocket consumes about 10000 kgs^{-1} of fuel and ejects gases at speed more than 4000 ms^{-1}.

09. (D)

$-2gh = v_f^2 - v_i^2 \Rightarrow -2gh = 0 - v_i^2 = -v_i^2$

$2(9.8)h = (9.8)^2 \Rightarrow h = \frac{9.8}{2} = 4.9\ m$

10. (C)

The horizontal distance (range) of projectile is given by:

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

The range is maximum when $\sin 2\theta$ has maximum value that is

$\sin 2\theta = 1$

$2\theta = \sin^{-1}(1)$

$2\theta = 90^o$

$\theta = 45^o$

$$R_{max} = \frac{v_i^2 \sin 90^o}{g} = \frac{v_i^2}{g}$$

11. (A)

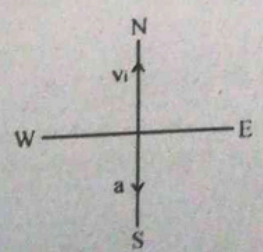
$2aS = v_f^2 - v_i^2$

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

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

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

12. (A)



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

13. (C)

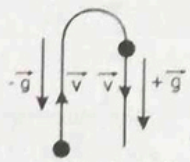
When the car catch up the truck, both cover the same distances. So,

$S_{truck} = S_{car}$

$vt = v_i t + \frac{1}{2}at^2 = 0 + \frac{1}{2}at^2 = \frac{1}{2}at^2$

$v = \frac{1}{2}at \Rightarrow t = \frac{2v}{a} = \frac{2(15)}{3} = \frac{30}{3} = 10\ s$

14. (A)



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

15. (A)

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

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

16. (C)

As stone is moving with constant acceleration (gravitational acceleration).

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

17. (D)

$P_i = mv_i = (1)(2) = 2\ N\ s$

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

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

18. (D)

In an isolated system (no external force) the total linear momentum of system remains constant.

19. (C)

When step on the accelerator then we send a feedback to the engine that we required more power. Then the engine supplies more power and then the force by the engine help us to accelerate.

20. (A)

When a projectile explodes in mid air. Its parts fly off in different directions. The total momentum of all of its parts is equal to the initial momentum of the projectile.

21. (B)

For Gun#1

By law of conservation of momentum

Momentum of Gun = Momentum of bullet

$P_1 = m_1 v$

For Gun#2

By law of conservation of momentum

Momentum of Gun = Momentum of bullet

$P_2 = m_2 v$

$$\frac{P_1}{P_2} = \frac{m_1 v}{m_2 v} = \frac{m_1}{m_2} = \frac{2m_2}{m_2} = 2$$

$P_1 : P_2 = 2:1$

22. (A)

Torque, $\tau = rF\sin\theta$

Torque due to "F_2" and "F_5" = 0 (line of action of force is passing through pivot)

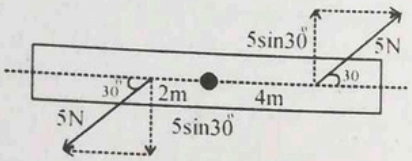
Torque due to "F_1" and "F_3" = $rF\ \sin 90^o = rF$

(Greatest)

Line of action of force is perpendicular and at equi-distance from pivot.

Torque due to "F_4" = rF sinθ (in between zero (0) and maximum)

23. (D)



Torque due to couple, τ = (magnitude perpendicular component of Force)(couple arm)

Torque due to couple, $\tau = (5\sin30^\circ)(2+4)$

$= (5)(6)\sin30^\circ = 15$ Nm

24. (D)

$$v_r = \sqrt{v_1^2 + v_2^2 - 2v_1v_2\cos\theta} = \sqrt{v^2 + v^2 - 2vv\cos180^\circ}$$
$$= \sqrt{v^2 + v^2 + 2v^2} = \sqrt{4v^2} = 2v$$

25. (A)

$S = v_r t = (10+5)(8) = (15)(8) = 120$m

26. (C)

Basic concept of gravitational acceleration.

27. (A)

As

Displacement ≤ Distance

So, velocity ≤ speed $\Rightarrow \frac{\text{velocity}}{\text{speed}} \le 1$

28. (B)

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

29. (D)

$$a = \frac{F}{m} \Rightarrow a \propto \frac{1}{m}$$

30. (A)

$$H = \frac{v_i^2\sin^2\theta}{2g} = H_{max}\sin^2\theta = H_{max}(\sin30^\circ)^2 = H_{max}(1/2)^2$$
$$= \frac{H_{max}}{4} \qquad \left(H_{max} = \frac{v_i^2}{2g}\right)$$

31. (A)

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

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

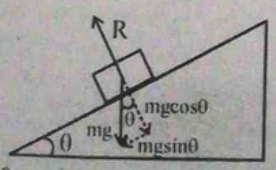
$$\frac{H}{T^2} = \frac{\frac{v_i^2\sin^2\theta}{2g}}{\frac{4v_i^2\sin^2\theta}{g^2}} = \frac{g}{8} \Rightarrow H = \frac{gT^2}{8}$$

32. (D)

v = constant $\Rightarrow \Delta v = 0 \Rightarrow a = 0$

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

33. (D)



$F = mg\sin\theta \Rightarrow ma = mg\sin\theta$

$a = g\sin\theta = g\sin30^\circ = \frac{g}{2} = 4.9\ ms^{-2} = 490\ cms^{-2}$

34. (C)

Magnitude of acceleration = slope of speed-time graph

The slope of speed-time graph at hard snow is greater than at soft snow. In graph (C) first slope increase then decrease i.e., slope = $4ms^{-2}$ to $2ms^{-2}$.

35. (D)

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

36. (A)

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

37. (D)

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.

38. (B)

The velocity of projectile at any instant is

$$v = \sqrt{v_{fx}^2 + v_{fy}^2}$$

at highest point of trajectory

$v_{fx} = v_i\cos\theta$ (remains same)

but $v_{fy} = 0$ (minimum)

so,

velocity of projectile = $v_i\cos\theta$ (no vertical component)

39. (B)

Ranges at angles $(45^\circ + \theta)$ and $(45^\circ - \theta)$ are equal.

Here $\theta = 10^\circ$

So,

$R_{35^\circ} = R_{55^\circ}$

40. (B)

$$h = \frac{1}{2}gt^2 = \frac{1}{2}g(1)^2 = \frac{g}{2}$$

41. (D)

The height "h" of projectile is

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

for maximum height $\theta = 90^\circ$

$$h_{max} = \frac{v_i^2(\sin90^\circ)^2}{2g} = \frac{v_i^2}{2g}$$

42. (B)

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

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

43. (A)

$$g = \frac{GM}{(R+h)^2} \Rightarrow g \propto \frac{1}{(R+h)^2}$$

Gravitational acceleration does not depend upon the mass of object. It depends upon the altitude.

44. (C)

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

45. (C)

Rocket moves upward by ejecting hot gases at the tail of the rocket with very high velocity in downward direction. The rocket gain momentum equal to the momentum of gas ejected from the tail of the rocket, but in opposite direction.

46. (B)

The speed of projectile is maximum at the point of projection and at the point where it strikes the ground because the vertical component of velocity has maximum value at these points.

47. (D)

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

48. (C)

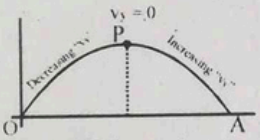
$v_x = v\cos\theta = (20)\cos 60^\circ = (20)(0.5) = 10\ ms^{-1}$

49. (D)

Speed = slope of distance-time graph

The slope of graph (D) first increasing and finally decreasing.

50. (D)



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

51. (D)

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

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

52. (C)

The mass of body remains same in the universe while the weight is different for different planets in the universe.

53. (C)

Gravity is the intrinsic property of the planet and it does not depend upon the any medium. All object (same or different masses) fall with same gravitational acceleration.

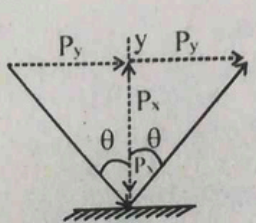
54. (D)

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.

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

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

55. (B)



From figure

$\Delta P_x = 0$ and $\Delta P_y > 0$

56. (C)

Speedometer measures speed of car at a given instant.

57. (A)

$$h = v_i t + \frac{1}{2}gt^2 = 0 + 4.9(1)^2 = 4.9\ m$$

58. (A)

Acceleration = slope of velocity-time graph

Slope of line parallel to velocity axis is infinite.

59. (D)

$$\text{Displacement} \le \text{Distance} \Rightarrow \frac{\text{Displacement}}{\text{Distance}} \le 1$$

60. (A)

When body is thrown vertically upward, at maximum height it has zero velocity but non-zero acceleration (gravitational acceleration).

61. (D)

Displacement depends upon the initial and final position of body while distance does not do so.

In this case displacement = 0 while distance ≠ 0

$$\frac{\text{Distance}}{\text{Displacement}} = \frac{\text{Distance}}{0} = \infty$$

62. (B)

Area of velocity-time graph = distance covered by body

63. (C)

Basic concept of acceleration.

64. (B)

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

65. (A)

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

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

66. (B)

$$Ma = \frac{m}{t}v \Rightarrow F = (100)(1500) = 1.5 \times 10^5\ N$$

67. (B)

From equation of continuity

$$\frac{m}{t} = \rho Av = \rho\left(\frac{V}{t}\right) = 1000(0.0001) = 0.1\ kgs^{-1}$$

$$\left(Av = \frac{V}{t}\right)$$

Force due to water flow $= \frac{m}{t}v = (0.1)(10) = 10\ N$

68. (C)

According to Newton's 2nd law of motion

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

Acceleration always produces in the direction of force.

69. (C)

By definition of equal vectors "Vectors having the same magnitude and direction are called equal vectors regardless of the position of their initial points. This means that parallel vectors of same

magnitude are equal".

70. (A)

Time rate of change of momentum = Applied force

$$\frac{\vec{P_f} - \vec{P_i}}{t} = \frac{\vec{\Delta P}}{t} = \vec{F}$$

In freely falling motion

Force = Weight $\Rightarrow F = W = mg$

$$\frac{\vec{\Delta P}}{t} = \vec{W} = \vec{mg}$$

71. (D)

Resultant force = 1N + 1N = 2 N if forces are parallel

Resultant force = 3N − 1N = 2 N if forces are anti-parallel

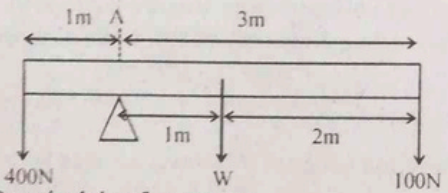
Resultant force = 4N − 2N = 2 N if forces are anti-parallel

72. (D)

By Newton's 2nd law of motion

$$F = ma = \frac{m\Delta v}{\Delta t} \Rightarrow \Delta v = \frac{F\Delta t}{m} \Rightarrow \Delta v \propto \frac{1}{m}$$

73. (D)



By principle of moments

Clockwise torque = Anticlockwise torque

$(100)(3) + (W)(1) = (400)(1)$

$300 + W = 400$

$W = 400 - 300 = 100$ N

74. (B)

A frame of reference, in which Newton's 1st law of motion holds, is known as inertial frame of reference. It is non accelerated frame of reference.

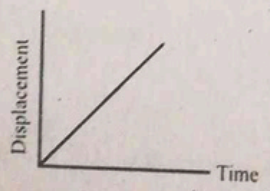
$a = 0$

75. (D)

$$g = \frac{GM}{(R+h)^2} \Rightarrow g \propto \frac{1}{(R+h)^2}$$

"g" decreases with increase in altitude. So, weight decreased (W = mg)

76. (B)



Slope of displacement-time graph $= \frac{\Delta y}{\Delta x} = \frac{\Delta d}{\Delta t} = v$ = velocity

77. (C)

$W = mg = (20)(9.8) = 196$ N

78. (A)

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

79. (C)

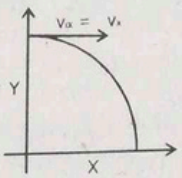
$$\vec{a} = \frac{m\vec{v}}{M}$$

$a \propto v^1$

80. (C)

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

81. (C)



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

82. (D)

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

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

83. (A)

$F = ma$

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

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

84. (A)

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

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

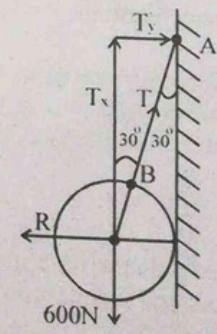
$\Delta P = mv_f - mv_i = +4 - (-6) = +10$ Ns

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

85. (B)

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

86. (A)



$T_x = W$

$T\cos\theta = 600$

$$T = \frac{600}{\cos 30^\circ} = \frac{600}{\sqrt{3}/2} = \frac{1200}{\sqrt{3}} = \frac{(400)(3)}{\sqrt{3}}$$

$$= \frac{(400)(\sqrt{3})(\sqrt{3})}{\sqrt{3}} = 400\sqrt{3}\text{ N}$$

87. (A)

i. Torque plays the same role in rotational motion as

the force plays in translational motion.

ii. Force determines the linear acceleration in the body while Torque determines the angular acceleration in the body for rotational motion.

So, torque is the analogues of force for rotational motion.

88. (A)

In (B) and (C) the distance given from axis of rotation is greater than the width of the door. So, in these cases the force does not act upon on door.

Maximum value of moment arm = width of the door = 0.5 m

For different forces the torque will be maximum, if the product of force and moment arm is maximum.

The torque in case of (A) is maximum than (B).

89. (C)

As force is acting along y-axis. So, its angle with x-axis is 90°.

$$F_x = F\cos 90^\circ = 0$$

90. (A)

Ranges at angles $(45^\circ + \theta)$ and $(45^\circ - \theta)$ are equal.

So, $R_1 : R_2 = 1:1$

91. (A)

Ranges at angles $(45^\circ + 5^\circ)$ and $(45^\circ - 5^\circ)$ are equal.

So, $R_P = R_Q$

92. (A)

The ballistic missiles are useful only for short ranges. For long ranges and greater precision, powered and remote control guided missiles are used.

93. (C)

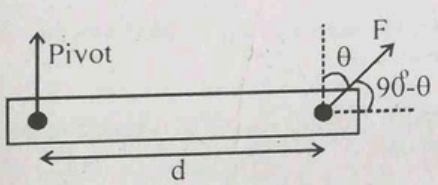
$$R = \frac{v_i^2 \sin 2\theta}{g} \Rightarrow R \propto \sin 2\theta$$

94. (D)

$$R = \frac{v_i^2 \sin 2\theta}{g} \quad \text{and} \quad R_{max} = \frac{v_i^2}{g}$$

$$R = R_{max} \sin 2\theta \quad \text{or} \quad R_{max} = \frac{R}{\sin 2\theta}$$

95. (B)



$\tau = F d \sin(90^\circ - \theta)$

$= Fd\cos\theta$ $[\sin(90^\circ - \theta) = \cos\theta]$

For maximum value of torque

F=large, d=large and θ=small

(at smaller angle cosθ has large value)

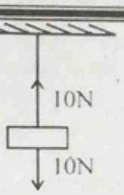
96. (C)

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

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

97. (A)

When one end of the string is connected with a rigid body and by applying 10N force on a free end then the force with same magnitude but in opposite direction will be acted in the string.



98. (B)

$$h = v_i t + \frac{1}{2}gt^2 = 0 + \frac{1}{2}gt^2 = \frac{1}{2}(9.8)(2)^2 = 19.6 \text{ m}$$

99. (A)

$v_f = v_i + at$

for freely falling body

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

100. (B)

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

101. (B)

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

102. (B)

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.

103. (C)

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.

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

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.

104. (A)

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

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

105. (A)

Speed = slope of distance-time graph

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

106. (A)

As we know that "the rate of change of angular momentum is equal to the applied torque".

$$\tau = \frac{\Delta L}{\Delta t} = \frac{L_f - L_i}{\Delta t} = \frac{50 - 30}{0.5} = \frac{20}{0.5} = 40 \text{ N m}$$

107. (C)

The turning effect of force on a body about an axis is called Torque or moment of force. Torque is also defined as the cross product of position vector "$\vec{r}$" and force "$\vec{F}$".

$$\vec{\tau} = \vec{r} \times \vec{F}$$

It is a vector quantity. Its direction is perpendicular

to the plane containing "$\vec{r}$" and "$\vec{F}$". It can be found by right hand rule.

108. (C)

If a body is at rest or rotating with uniform angular velocity, the angular acceleration will be zero. In this case the torque acting on the body will be zero.

109. (C)

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

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

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

110. (A)

"The vector sum of all the forces acting on a body must be equal to zero". Mathematically:

$$\Sigma \vec{F} = \vec{0}$$

Upward forces balance downward forces, rightward forces balance by leftward forces.

If two equal and opposite forces acting on a body, the net force is zero, and the body is said to be in equilibrium.

111. (C)

When two or more than two forces acting on a common point, the forces are called concurrent forces.

112. (C)

i. Torque plays the same role in rotational motion as the force plays in translational motion.

ii. Force determines the linear acceleration in the body while Torque determines the angular acceleration in the body for rotational motion.

So, torque is the analogues of force for rotational motion.

113. (B)

Force determines the linear acceleration in the body while Torque determines the angular acceleration in the body for rotational motion.

114. (C)

"The vector sum of all the forces acting on a body must be equal to zero". Mathematically:

$$\Sigma \vec{F} = \vec{0}$$

Upward forces balance downward forces, rightward forces balance by leftward forces.

In case of coplanar forces the condition is expressed in term of "x" and "y" component of forces.

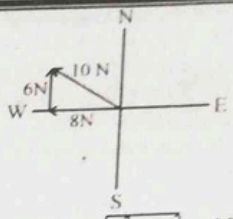
$$\Sigma \vec{F_x} = \vec{0}, \qquad \Sigma \vec{F_y} = \vec{0}$$

115. (C)

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

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

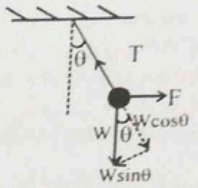
116. (C)



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

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

117 (A)



$T = W\cos\theta = (1)\cos\theta = \cos\theta$

118. (B)

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.

119. (C)

$$K.E = \frac{P^2}{2m} \Rightarrow K.E. \propto \frac{1}{m} \qquad (P = \text{constant})$$

If $(K.E.)_Q > (K.E.)_P$ then $m_Q < m_P$

So, for same momentum $v_Q > v_P$

120. (C)

As

Force = Slope of momentum-time graph

Slope of "2" < Slope of "3" < Slope of "4" < Slope of "1"

121. (B)

Uniform velocity means that the velocity of body remains same at any instant. So,

Instantaneous velocity = average velocity

122. (C)

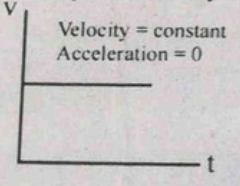
Relative velocity of bodies moving in opposite direction is

$$v_r = v_1 - v_2 = v - v = 0$$

Relative velocity does not depend upon the masses of bodies.

123. (A)

Acceleration = slope of velocity-time graph



124. (B)

$$\frac{T_1}{T_2} = \frac{2v_1 \sin\theta/g}{2v_1 \sin(90^\circ - \theta)/g} = \frac{\sin\theta}{\cos\theta} = \sin\theta : \cos\theta$$

125. (A)

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

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

126. (A)

Net force, F = ma

In figure (A) net force is least. So, the acceleration is also least.

127. (D)

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

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

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

$\sin 2(30^\circ) = \sin 2(60^\circ)$

$R_{30^\circ} = R_{60^\circ}$ (if initial velocities are same)

128. (D)

Couple = torque = $rF\sin\theta$ = N m

129. (B)

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

$v_f^2 = 2gh$

$v_f = \sqrt{2gh}$

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

130. (A)

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

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

131. (A)

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.

132. (B)

Uniform acceleration means that the acceleration of body remains same at any instant. So,

Instantaneous acceleration = average acceleration

133. (A)

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

134. (D)

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.

135. (C)

Maximum height attained by body thrown vertically upward is

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

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

136. (C)

Due to force of gravity the vertical component of velocity varies point to point.

137. (A)

The relation between height and range of a projectile projected at any angle "θ" is

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

For 45°

$$4H = R\tan 45^\circ \Rightarrow R = 4H$$

138. (C)

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.

139. (D)

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

140. (D)

The relation between height and range of a projectile projected at any angle "θ" is:

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

If R= H

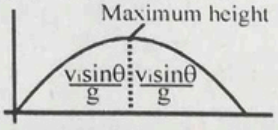
$4H = H\tan\theta \Rightarrow \tan\theta = 4 \Rightarrow \theta = \tan^{-1}(4) = 76^\circ$

141. (C)

For short ranges and flat Earth approximation, the trajectory is parabolic. But the drag less ballistic trajectory for spherical Earth should actually be elliptical.

142. (B)

Time of flight = 2 (Time to reach the maximum height)



143. (C)

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

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

144. (C)

$$g_{moon} = \frac{g_{Earth}}{6}$$

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

$t_{Moon} > t_{Earth}$

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

145. (C)

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}).

146. (C)

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

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

147. (D)

v = constant $\Rightarrow \Delta v = 0 \Rightarrow a = 0$

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

148. (C)

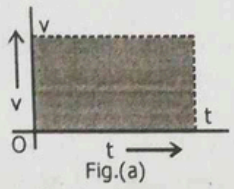


Fig.(a)

In fig(a) when the body moves with constant velocity "v" for a time "t", then

Area under the velocity time graph $= (v)(t)$

Area under the velocity time graph $= S$

149. (D)

$F = \frac{m}{t}(\Delta v) = (3)(5) = 15\ N$

150. (D)

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.

151. (A)

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.

152. (B)

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

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

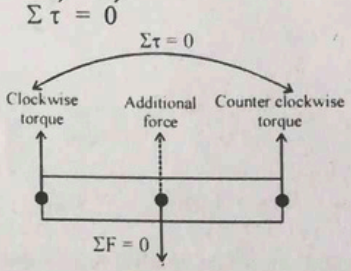
153. (B)

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

i. $\Sigma \vec{F} = \vec{0}$

i.e $\Sigma \vec{F_x} = \vec{0}$, $\Sigma \vec{F_y} = \vec{0}$

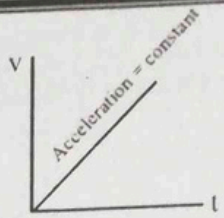
ii. $\Sigma \vec{\tau} = \vec{0}$



154. (C)

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

155. (B)



156. (C)

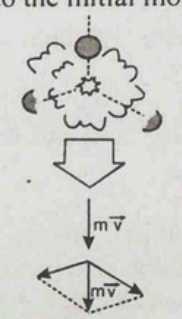
If "m" is the mass of the gases ejected per second with velocity $\vec{v}$ relative to the rocket, the change in momentum per second of the ejecting gases is $m\vec{v}$. This equals the thrust produced by the engine on the body of rocket. So, the acceleration $\vec{a}$ of the rocket is

$\vec{a} = \frac{m\vec{v}}{M}$

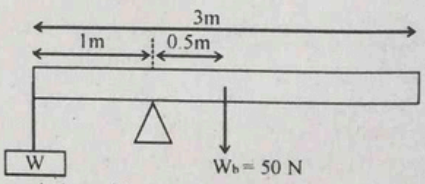
With the passage of time, mass of the rocket "M" decreases, so acceleration "$\vec{v}$" of the rocket increases.

157. (B)

When a shell explodes in mid air. Its parts fly off in different directions. The total momentum of all of its parts is equal to the initial momentum of the shell.



158. (A)



The weight of beam lies at center of gravity which is at the middle of beam 1.5 m from each side.

By principle of moments

Clockwise torque = Anticlockwise torque

$(0.5)(50) = (W)(1)$

$W = 25\ N$

159. (B)

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

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

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

160. (A)

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

161. (C)

Rocket moves upward by ejecting hot gases at the tail of the rocket with very high velocity in downward direction. The rocket gain momentum equal to the momentum of gas ejected from the tail

of the rocket, but in opposite direction.

Momentum of expelled gases = Momentum of Rocket

$(5000)m = (1000)(20)$

$m = 4$ kg

162. (D)

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

163. (C)

Acceleration = slope velocity-time graph

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

164. (D)

Speed = slope of distance-time graph

The slope of graph (I) is constant. So, speed is constant.

Also in graph (IV) speed is constant.

165. (A)

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

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

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

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

166. (C)

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

167. (B)

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

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

168. (C)

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

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

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

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

169. (B)

$v_M = 0$

$v'_m = 0$

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

If m=M

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

170. (B)

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

$$v_1' = \left(\frac{m-2m}{m+2m}\right)v + 0 = \left(\frac{-m}{3m}\right)v = \frac{-v}{3}$$

$$(K.E)_i = \frac{1}{2}mv^2$$

$$(K.E)_f = \frac{1}{2}m\left(\frac{-v}{3}\right)^2 = \frac{1}{9}\left(\frac{1}{2}mv^2\right) = \frac{1}{9}(K.E)_i$$

$$\Delta K.E = (K.E)_f - (K.E)_i = \frac{1}{9}(K.E)_i - (K.E)_i = \left(\frac{1}{9} - 1\right)$$

$$(K.E)_i = -\frac{8}{9}(K.E)_i$$

$$\text{Loss of K.E} = \frac{\Delta K.E}{(K.E)_i} = \frac{8}{9}$$

171. (B)

By law of conservation of linear momentum

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

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

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

172. (A)

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

173. (C)

By law of conservation of linear momentum

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

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

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

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

174. (A)

If line of action of force passes through pivot then moment arm will be zero (L = 0).

$\tau = LF\sin\theta = (0)F\sin\theta = 0$

UHS PAST MDCAT (2008-2019)

1. Force in terms of base units is expressed as: **(UHS 2008)**

(A) kg ms^{-2} (C) $\text{kg m}^2\text{s}^{-3}$

(B) $\text{kg m}^2\text{s}^{-2}$ (D) kg ms^{-3}

(A)

$F = ma$

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

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

(D)

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

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

(B)

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

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

4. **If the body is rotating with uniform angular velocity, then its torque is:** (UHS 2009)

(A) zero (C) Maximum
(B) Clockwise (D) Remains the same

(A)

$\tau = I\alpha$
ω = constant $\Rightarrow \Delta\omega = 0 \Rightarrow \alpha = 0$
$\tau = I(0) = 0$

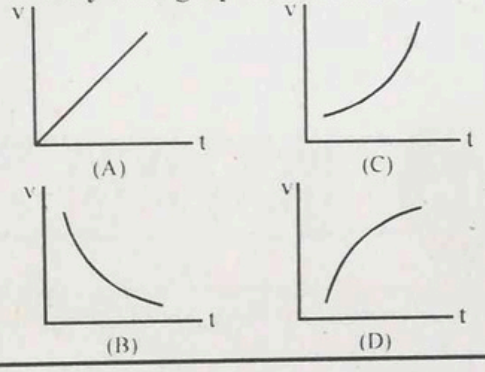
5. **A body is moving with an initial velocity of 2 kms^{-1}. After a time of 50 s its velocity becomes 1.5 kms^{-1}. Its acceleration will be:** (UHS 2009)

(A) 30 ms^{-2} (C) – 20 ms^{-2}
(B) 40 ms^{-2} (D) – 10 ms^{-2}

(D)

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

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



(A)

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

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) $v_1' \approx -v_1 ; v_2' \approx v_1$ (C) $v_1' \approx v_1 ; v_2' \approx 2v_1$
(B) $v_1' \approx v_1 ; v_2' \approx 0$ (D) $v_1' \approx -v_1 ; v_2' \approx 0$

(C)

$$v'_1 \approx \left(\frac{m_1 - 0}{m_1 + 0}\right)v_1 + \left(\frac{2m_2(0)}{0 + m_2}\right)$$

$$v'_1 \approx \left(\frac{m_1}{m_1}\right)v_1 + 0$$

$$v'_1 \approx v_1 + 0$$

$$v'_1 \approx v_1$$

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

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

$$v'_2 \approx 2v_1$$

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

(A)

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

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:** (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

(D)

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

10. **Time of projectile's flight is:** (UHS 2010)

(A) $\frac{v_i^2 \sin^2\theta}{g}$ (C) $\frac{v_i^2 \sin\theta}{g}$
(B) $\frac{2v_i \sin\theta}{g}$ (D) $\frac{v_i^2}{g}\sin 2\theta$

(B)

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

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 (C) uniform velocity
(B) Uniform acceleration (D) Negative acceleration

(C)

Definition of uniform velocity.

12. **For finding the height of projectile, the equation used is:** (UHS 2010)

(A) $2S = a(v_f^2 - v_i^2)$ (C) $S = 2a(v_f^2 - v_i^2)$

(B) $2aS = v_f^2 - v_i^2$ (D) $a = 2S(v_f^2 - v_i^2)$

(B)

$$2aS = v_f^2 - v_i^2$$
$$2a_y y = v_{fy}^2 - v_{iy}^2$$
$$2(-g)h = (0)^2 - (v_i\sin\theta)^2$$
$$-2gh = -v_i^2\sin^2\theta$$
$$2gh = v_i^2\sin^2\theta$$
$$h = \frac{v_i^2\sin^2\theta}{2g}$$

13. If a force of 12N is applied on a body and its momentum is changed form 60 kgms^{-1} to 36 kg ms^{-1}, then find the time during, which this force acts: (UHS 2010)

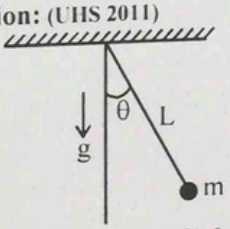
(A) 1 second (C) 12 seconds
(B) 2 seconds (D) 24 seconds

(B)

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

Time can never be negative.

14. A simple pendulum length "L" with bob of mass "m" is slightly displaced from its mean position so that its string makes an angle "θ" with vertical line as shown in figure. Then bob of pendulum released. What will be the expression of torque with which the bob starts to move towards the mean position: (UHS 2011)



(A) mgL (C) 0
(B) mgLsinθ (D) mgLcosθ

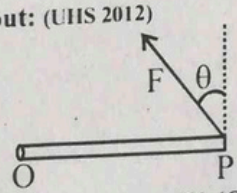
(B)

$\tau = rF$

In simple pendulum the force responsible for the oscillatory motion of pendulum is mgsinθ.

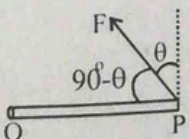
$\tau = Lmgsin\theta$

15. A force "F" is acting at point "P" of a uniform rod capable to rotate about "O". What is the torque about: (UHS 2012)



(A) (OP)(Ftanθ) (C) (OP)(Fsinθ)
(B) (OP)(F) (D) (OP)(Fcosθ)

(D)



$\tau = (OP)F\sin(90^\circ - \theta) = (OP)(F\cos\theta)$

16. Ratio of moment of inertia of two objects "A" and "B" is 2:3. Which of one of the following is the ratio of torques of "A" and "B" respectively, if both are being rotated with constant angular acceleration? (UHS 2013)

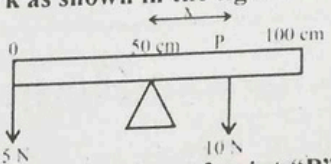
(A) 3:4 (C) 3:2
(B) 2:3 (D) 4:3

(B)

$\tau = I\alpha \Rightarrow \tau \propto I$

$$\frac{\tau_A}{\tau_B} = \frac{I_A}{I_B} = \frac{2}{3} \Rightarrow \tau_A : \tau_B = 2:3$$

17. Two forces 5N and 10 N are acting at "O" and "P" respectively on a uniform mete rod suspended at the position of centre of gravity 50 cm mark as shown in the figure.



Then find the position of point "P" on meter rod. (UHS 2014)

(A) 80 cm (C) 70 cm
(B) 75 cm (D) 65 cm

(B)

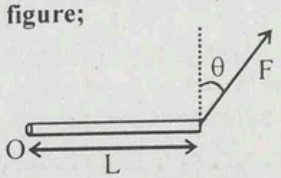
Clockwise torque = Anticlockwise torque

$(10cm)(x) = (5)(50cm)$

$x = 25$ cm

So, the position of point "P" on meter rod is 75 cm.

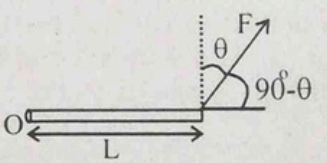
18. A bar of length "L" pivoted at "O" is acted by a force "F" at an angle "θ" with vertical line as shown in figure;



What is the moment of force? (UHS 2015)

(A) L sinθ (C) LF cosθ
(B) L cosθ (D) LF sinθ

(C)



$\tau = LF\sin(90^\circ - \theta) = LF\cos\theta$

19. If we double the moment arm the value of torque becomes: (UHS 2016)

(A) half (C) two times
(B) three times (D) four times

(C)

$\tau = rF\sin\theta \Rightarrow \tau \propto r$

20. The ratio of displacement along diameter and total distance along circle: (UHS 2017)

(A) 1 : π (C) 2 : π
(B) π : 1 (D) π : 2

(A)

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

21. **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 (C) 8.33m/s
(B) 126m/s (D) 58.33m/s

(C)

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

22. **The distance travelled by a moving car with velocity 15 m/s in 2 seconds, decelerates at 2m/s² is equal to:** (UHS 2017)
(A) 30m (C) 16m
(B) 34m (D) 26m

(D)

$$S = v_i t + \frac{1}{2}at^2 = (15)(2) + \frac{1}{2}(-2)(2)^2$$
$$S = 30 - 4 = 26 \text{ m}$$

23. **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

(C)

Slope of v-t graph = Acceleration
In case of increasing acceleration, slope will be different at different points of graph.

24. **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

(B)

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

25. **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} (C) 5.3 ms^{-2}
(B) 12.5 ms^{-2} (D) 13 ms^{-2}

(A)

$$2aS = v_f^2 - v_i^2 \Rightarrow 2(a)(18) = 0 - 15^2$$
$$a = \frac{-225}{36} = -6.3 \text{ m/s}^2$$

26. **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

(C)

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

27. **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

(D)

$$R = \frac{v_i^2}{g}\sin 2\theta \Rightarrow R \propto \sin 2\theta$$
$$H = \frac{v_i^2}{g}\sin^2\theta \Rightarrow H \propto \sin^2\theta$$
If angle of projection is larger than 45°, then value $\sin^2\theta$ is more than $\sin 2\theta$.

28. **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 (C) 2mv kg/s
(B) mv kg m/s (D) 0 kg m/s

(D)

Initial momentum = mv + (−mv) = 0
In elastic collision momentum remains constant.
So,
Final momentum = 0

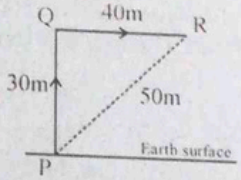
UNIT 03 WORK, ENERGY AND POWER

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

02. **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

03. **The escape velocity of a body in gravitational field of Earth is independent of:**
(A) its mass
(B) the angle at which it is thrown
(C) both its mass and the angle at which it is thrown
(D) gravitational field of Earth

04. **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 (C) 200 J
(B) 280 J (D) 1200 J

05. **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

06. **One mega watt hour is equal to.**
(A) 36×10^6 J (C) 36×10^{12} J
(B) 36×10^9 J (D) 36×10^8 J

07. **Which of the following is not conservative force:**
(A) Friction (C) electric
(B) gravitational (D) elastic spring force

08. **The relation between the escape velocity "v_{esc}" and orbital speed "v_o" is given by:**
(A) $v_{esc} = \frac{1}{2} v_o$ (C) $v_{esc} = \sqrt{2} v_o$
(B) $v_{esc} = v_o$ (D) $v_{esc} = 2v_o$

09. **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

10. **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.

11. **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 (C) 4.9 J
(B) 196 J (D) 98 J

12. **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 (C) 1.4 m/sec
(B) 20 sin 30° m/sec (D) 14 m/sec

13. **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

14. **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 (C) 3000 J sec^{-1}
(B) 600 watt (D) 60 kilowatt

15. **To pump up 2400 kg of water up 74.6 m in 5 minutes, the required in horse power is:**
(A) 8 hp (B) 25 hp
(B) 15 hp (D) 16 hp

16. **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 (C) 1 J
(B) 2 J (D) 4 J

17. **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 (C) 8 units
(B) 4 units (D) 2 units

18. **A 2 kg object is moving at 3 m/s. A 4 N force is applied in the direction of motion and then removed after the object has traveled an additional 5 m. The work done by this force is:**
(A) 12 J (C) 15 J
(B) 18 J (D) 20 J

19. **In order to calculate the exact value of work done by a variable force:**
(A) Δd is made such small to approach zero
(B) calculate average work
(C) Δt is made such small to approach zero
(D) both (A) and (B)

20. **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

21. 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) $K.E_A = K.E_B$ (C) $K.E_A = 2K.E_B$
(B) $K.E_A = \frac{1}{2} K.E_B$ (D) $K.E_A = 4K.E_B$

22. 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

23. Which of the following statement is not true?
(A) work is a scalar quantity
(B) if θ is 0^0 work done will be maximum
(C) if θ is 90^0 then work done will be zero
(D) if $\theta < 90^0$ then work done will be negative

24. 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 (C) 49 J
(B) 98 J (D) 980 J

25. 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

26. Work is defined as:
(A) dot product of force & displacement
(B) product of magnitude of displacement and component of force in the direction of displacement
(C) product of displacement and force
(D) both (A) and (B)

27. 1 horse power =
(A) 746 J (C) 3×10^6W
(B) 746000mW (D) 10^{-5}W

28. The velocity of a particle moving along the x axis changes from "v_i" to "v_f". For which values of "v_i" and "v_f" is the total work done on the particle positive?
(A) $v_i = 5m/s, v_f = 2m/s$ (C) $v_i = 5m/s, v_f = -2m/s$
(B) $v_i = -5m/s, v_f = -2m/s$ (D) $v_i = 2m/s, v_f = -5m/s$

29. 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

30. Two objects with masses of m_1 and m_2 have the same kinetic energy and are both moving to the right. The same constant force "F" is applied to the left to both masses. If $m_1 = 4m_2$, the ratio of the stopping distance of m_1 to that of m_2 is:
(A) 1:4 (C) 4:1
(B) 1:2 (D) 1:1

31. 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 (C) 25m
(B) 45m (D) 70m

32. 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 (C) 1500 J
(B) 100 J (D) 750 J

33. A body at rest may have:
(A) Momentum (C) speed
(B) velocity (D) energy

34. 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 (C) 10,000 J
(B) 5000 J (D) 100 J

35 A force $\vec{F} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ acts on a particle and produces a displacement $\vec{S} = 2\hat{i} - 3\hat{j} + x\hat{k}$, what is the value of "x". If work done is zero?
(A) 2 (C) $\frac{1}{2}$
(B) –2 (D) d

36. The kinetic energy of a body of mass 2 kg and momentum equal to 2 N s is:
(A) 1 J (C) 3 J
(B) 2 J (D) 4 J

37. A 4 kg mass and 1 kg mass are moving with equal kinetic energies. What is the ratio of their momenta?
(A) 1:2 (C) 4:1
(B) 2:1 (D) 1:1

38. A car moving with speed of 40 km/h can be stopped by applying brakes after at least 2 m. If the same car is moving at a speed equal to 80 km/h, the minimum stopped displace will be:
(A) 4 m (C) 8 m
(B) 6 m (D) 2 m

39. 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 y–axis will be:
(A) 50 J (C) 150 J
(B) 100 J (D) 160 J

40. 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 (C) 12 J
(B) 10 J (D) 8 J

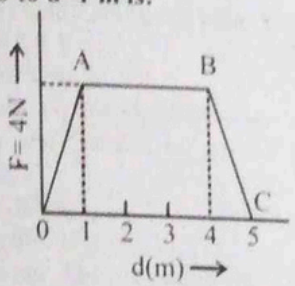
41. A crane can raise a body of mass 100 kg vertically upward with a speed of 5 m/s. The power of its engine is ($g = 10 m/s^2$):
(A) 2 kW (C) 5 kW
(B) 10 kW (D) 4 kW

42. 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 (C) 300 W
(B) 60 W (D) 294 W

43. 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 (C) 73.5 J
(B) –73.5 J (D) 75 J

44. 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 (C) 10,000 J
(B) 2000 J (D) 20,000 J

45. A force F acts on a body as a function of "x" as shown in the Fig. Work done in moving the body from d=0 to d=1 m is:



(A) 4 J (C) 2 J
(B) 3 J (D) 1 J

46. 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

47. 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

48. 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) $\frac{9}{2}$

49. 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°

50. 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

51. If the linear momentum changes by 10%, the kinetic energy will change by
(A) 10% (C) 100%
(B) 50% (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) $\frac{mv^2}{t}$ (C) $\frac{mv^2}{2t}$
(B) $\frac{4mv^2}{t}$ (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 (C) 160 J
(B) 80 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 (C) 120 J
(B) 48 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 (C) 2:1
(B) 1:2 (D) 4:1

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 $g=10\ m/s^2$):
(A) 500 watt (C) 1250 watt
(B) 1000 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 (C) acceleration
(B) Momentum (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 (C) 8 J
(B) 4 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) $\sqrt{2gh}$ (C) $\sqrt{gh}$
(B) $\sqrt{gh/2}$ (D) $2\sqrt{gh}$

60. If a power of 1kW is maintained for 1 sec then work done is equal to:
(A) 10^3J (C) 3.6×10^5J
(B) 10^5J (D) 3.5×10^6J

61. Momentum and K.E. of a body are numerically equal to each other. Velocity of body is:
(A) 1 m/s (C) 3 m/s
(B) 2 m/s (D) 4 m/s

62. 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

63. 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) $\frac{1}{2}\left(\frac{m^2v^2}{M+m}\right)$

64. The work done by a force on a body depends upon:
(A) The initial velocity of body
(B) The distance covered by the body
(C) The mass of body
(D) The angle between the displacement vector and force vector

65. 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 (C) 5/6
(B) 5/4 (D) 1

66. Neglecting air resistance, a 1.0 kg projectile has an escape velocity of about 11 km/s at the surface of Earth. The corresponding escape velocity for a 2.0 kg projectile is:
(A) 3.5 km/s (C) 5.5 km/s
(B) 11 km/s (D) 10 km/s

67. A body with a mass 100 g has a velocity $\vec{v} = (2\hat{i} + 4\hat{j})$ m/s at a certain instant of time. Its kinetic energy is:
(A) 0.5 J (C) 2.0 J
(B) 1.0 J (D) 3 J

68. Which of the following energy can never be negative?
(A) P.E (C) Nuclear energy
(B) K.E (D) All of these

69. The consumption of energy by 60 watt bulb in 2 s is:
(A) 10 J (C) 60 J
(B) 30 J (D) 120 J

70. A body of mass 5 kg is in motion and has a momentum 10 kgm/s. A force of 0.5 N acts on it along the direction of motion for 10 s. The increase in the kinetic energy is:
(A) 2.5 J (C) 10 J
(B) 5 J (D) 12.5 J

71. 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 (C) $E/\sqrt{2}$
(B) E/2 (D) zero

72. 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 (C) $F\cos 30^\circ$
(B) 0.866F (D) 0.707 F

73. The energy used by a car from petrol in its lifetime is:
(A) 0.1×10^{12} J (C) 0.2×10^{12} J
(B) 1×10^{12} J (D) 2×10^{12} J

74. Proton, electron, neutron and α-particle have same momentum. Which of them have highest K.E?
(A) Proton (C) Neutron
(B) Electron (D) α-particle

75. Work is independent of:
(A) Force (C) Time
(B) Displacement (D) All of these

76. 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 (C) 2800 J
(B) 3920 J (D) 4000 J

77. A man of mass 50 kg jumps to a height of 1 m. His potential energy at the highest point is ($g = 10\ m/s^2$):
(A) 50 J (C) 500J
(B) 60 J (D) 600 J

78. An object of mass m was at height "h" falls through a vertical distance "x", the its K.E is:
(A) mgx (C) mg(h – x)
(B) mgh (D) mg(x – h)

79. The work energy expression is written as (in horizontal motion):
(A) $W = \Delta K.E$ (C) both (A) and (B)
(B) $W = \Delta P.E$ (D) All of these

80. 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 (C) 1000 Watt
(B) 100 Watt (D) 10,000 Watt

81. If the momentum of a body is doubled , it kinetic energy becomes:
(A) double (C) 8 times
(B) 4 times (D) ½ times

82. 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 (C) Zero
(B) 500 J (D) 5 kJ

83. The work done will be zero when the angle between force $\vec{F}$ and displacement $\vec{d}$ is:
(A) 45° (C) 60°
(B) 90° (D) 150°

84. The dimensions of the work is :
(A) $[MLT^{-1}]$ (C) $[MLT^{-2}]$
(B) $[ML^2T^{-2}]$ (D) [MLT]

85. When the force is parallel to the direction of motion of the body, then work done on the body is:
(A) zero (C) minimum
(B) maximum (D) infinity

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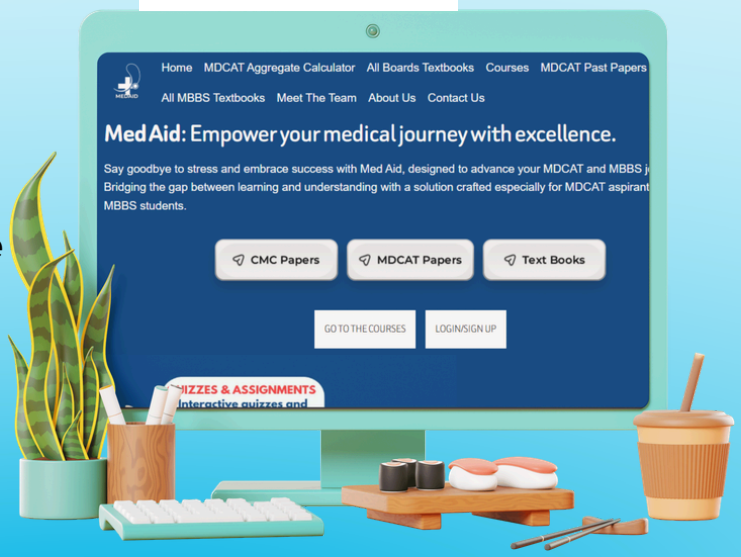
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