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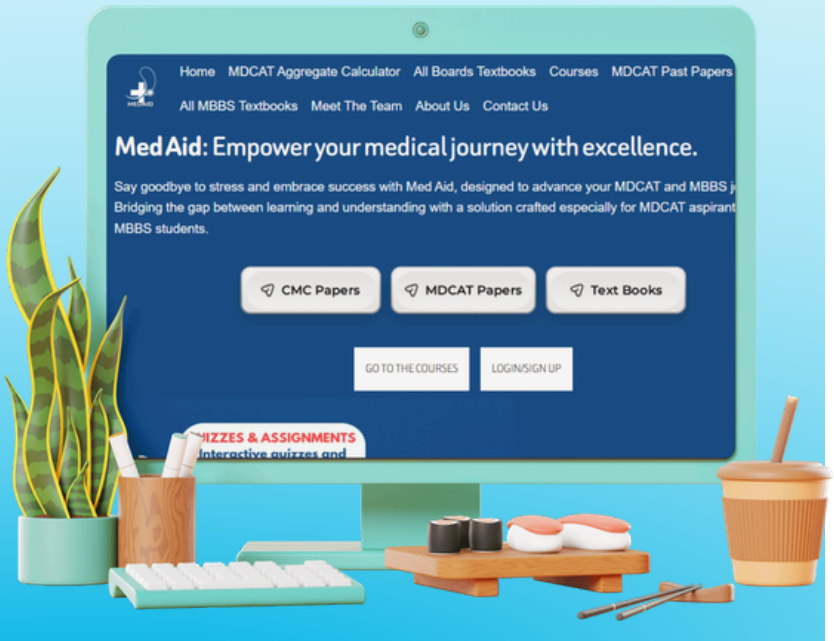

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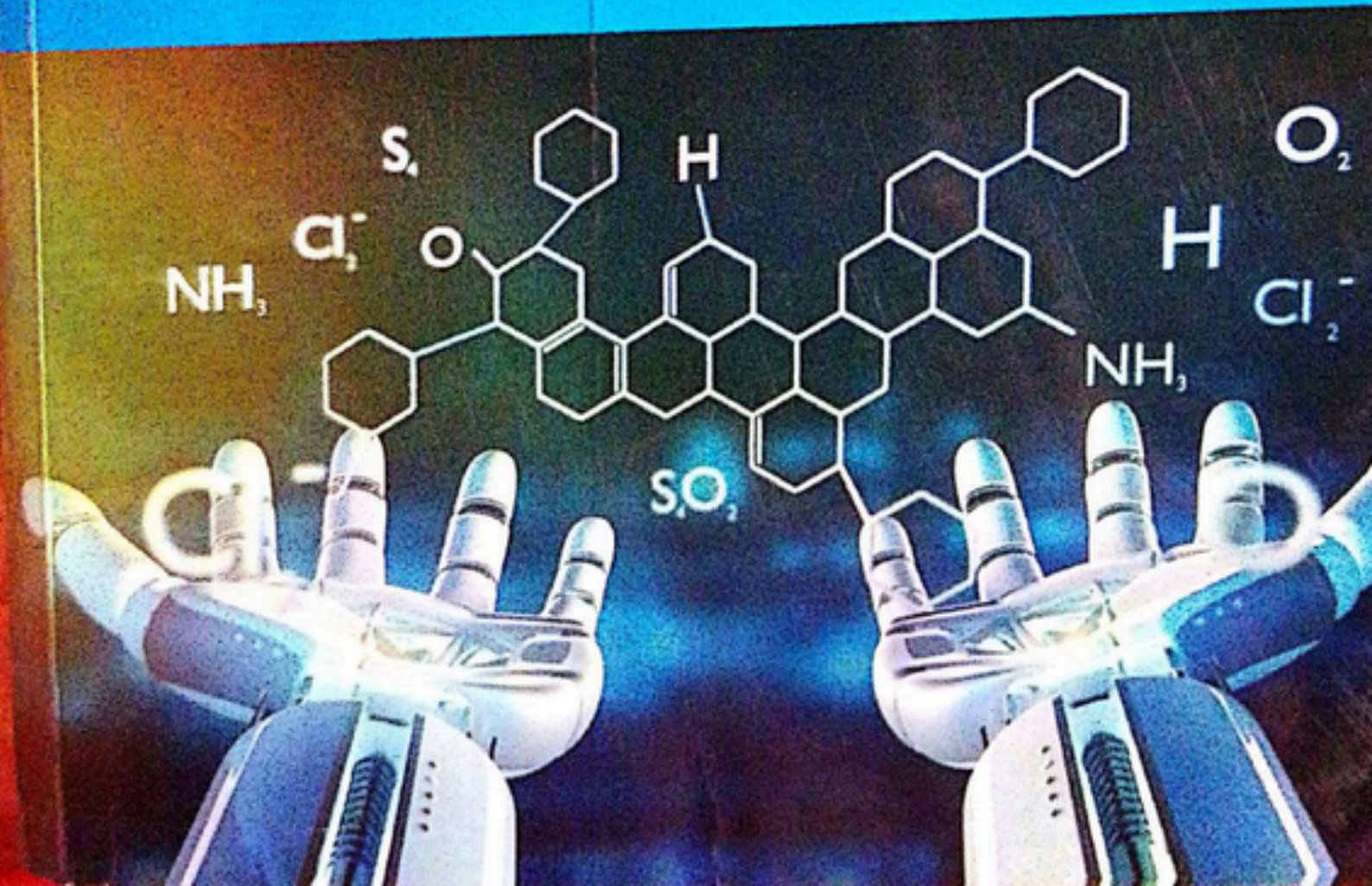

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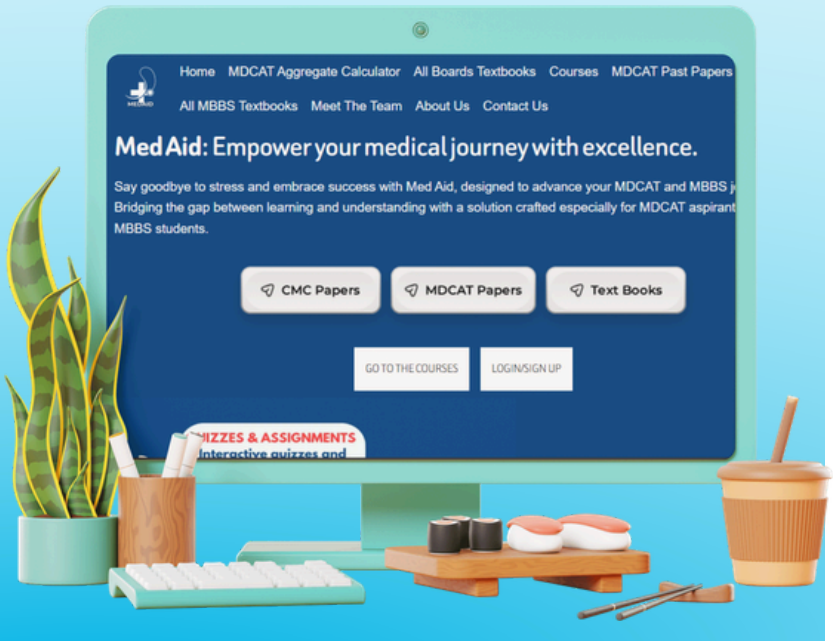

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Topic 1 INTRODUCTION TO FUNDAMENTAL CONCEPTS OF CHEMISTRY

PRACTICE EXERCISE

Q.1 Atom of which of the following has independent existence

A. F
B. Kr
C. O
D. N

Q.2 98g is equal to

A. 1gram molecule of H_2O
B. 1gram molecule of H_2SO_4
C. 1gram molecule of CO_2
D. 1gram molecule of NH_3

Q.3 1 mole of NH_3 contains

A. N_A atoms of N
B. $4N_A$ of total atoms
C. $3N_A$ atoms of H
D. All of these

Q.4 Which statement is correct about molar volume?

A. 22.414 dm^3 at STP
B. 24 dm^3 at RTP
C. 22414 cm^3 at STP
D. All of these

Q.5 Combustion analysis technique is used to determine

A. % composition
B. Empirical formula
C. Molecular formula
D. All of these

Q.6 Which statement is correct about limiting reactant?

A. Consumes earlier
B. Having amount less than stoichiometric value
C. Control the amount of product
D. All of these

Q.7 Efficiency of reaction means

A. Actual yield
B. Theoretical yield
C. % yield
D. None of these

Q.8 Which of the following statement is not correct about the 20.18 amu (mass of Ne)

A. It is isotopic mass
B. It is average atomic mass
C. It is fractional atomic mass
D. It is relative atomic mass

Q.9 Which of the following is not condition of molar volume

A. 1 atm pressure
B. 273k temperature
C. 22.414 dm^3 per mole
D. True for non-ideal gas

Q.10 Chemical equation do not tell us about

A. Condition of reaction
B. Rate of reaction
C. Chemical change that even does not occur
D. All

Q.11 How many unstable radioactive isotopes have been produced through artificial disintegration?

A. 280
B. 300
C. 40
D. 154

Q.12 The total types of fundamental nuclear sub-atomic particles are there in an atom:

A. More than 100
B. 3
C. 2
D. Equal to 100

Q.13 Isotopes are:

A. Chemically similar
B. Chemically dissimilar
C. Physically similar
D. Both 'A' and 'B'

Q.14 Correct representation of element with atomic number and atomic mass is:

A. ${}^{A}_{Z}X$
B. ${}^{Z}_{A}X$
C. ${}^{A}X^{Z}$
D. ${}^{Z}X^{A}$

Q.15 Molecular ions are formed by passing:
A. High energy electron beam
B. α-particle
C. X-rays
D. All of the above

Q.16 Which one is not true about isotope?
A. Same number of neutrons
B. Same mass number
C. Same physical properties
D. All of these

Q.17 Number of moles present in 0.6 gram of silica is (Atomic mass Si = 28, O = 16):
A. 0.01 mole
B. 0.1 mole
C. 0.06 mole
D. 0.6 mole

Q.18 Volume occupied by 4.4g of CO_2 at STP is:
A. 2.24 dm^3
B. 22.4 dm^3
C. 112 cm^3
D. 1.12 dm^3

Q.19 Which one is the molar volume of a gas at STP?
A. 24 dm^3
B. 22414 dm^3
C. 22.4 dm^3
D. 0.22414 dm^3

Q.20 Number of H^+ ions when 0.1 mole of sulfuric acid is completely ionized in water:
A. $4 \times 6.022 \times 10^{23}$
B. $2 \times 6.022 \times 10^{23}$
C. $1 \times 6.022 \times 10^{23}$
D. $2 \times 6.022 \times 10^{22}$

Q.21 How many electrons have to be removed to ionize 1.0×10^{-6} moles of Ne atoms to Ne^+ ions in a neon advertising tube?
A. $\frac{6.02\times10^{23}}{1.0\times10^{-6}}$
B. $1.0 \times 10^{-6} \times 6.02 \times 10^{23}$
C. $\frac{1.0\times10^{-6}\times6.02\times10^{23}}{20.2}$
D. $\frac{1.0\times10^{-6}\times6.02\times10^{23}}{9.65\times10^{4}}$

Q.22 When 0.5 moles of $Al_2(SO_4)_3$ are dissolved in water, total number of particles produced?
A. 1.5×10^{23}
B. 1.5×10^{24}
C. 3.0×10^{23}
D. 2.5×10^{23}

Q.23 Which of the following contains 1 mole of particles?
A. Chlorine molecules in 35.5 g of chlorine gas
B. Hydrogen ions in 1 dm^3 of 1 mol. dm^{-3} aqueous sulphuric acid
C. Electrons in 1 gram of hydrogen gas
D. Oxygen atoms in 22.4 dm^3 of oxygen gas at STP

Q.24 The number of moles of CO_2 which contain 16g of oxygen:
A. 0.25 mole
B. 0.50 mole
C. 1.00 mole
D. 1.50 mole

Q.25 The mass of one molecule of O_2 is:
A. $\frac{6.02\times10^{23}}{32}$ g
B. 0.32g
C. 32g
D. $\frac{32}{6.02\times10^{23}}$ g

Q.26 Amount of oxygen in grams which contains 1.5×10^{22} molecules:
A. 0.08 g
B. 80 g
C. 0.80 g
D. 8.0 g

Q.27 Number of electrons in half mole of Na^+:
A. 10
B. 5
C. 5.5 N_A
D. 5 N_A

Q.28 3×10^{-21} moles of an amino acid having molecular mass 200 g mol^{-1}, would have molecules:

A. 200
B. 300
C. 1800
D. 180

Q.29 The relative atomic mass of oxygen is 16amu. What is the mass of 2 mole of oxygen gas?

A. 64g
B. 100g
C. 32g
D. 71g

Q.30 Which of the following has maximum mass?

A. 25g of iodine
B. 25g mole of water
C. 25g atom of oxygen
D. 25g of nitrogen gas

Q.31 Mass of one mole of chlorine gas is:

A. 32g
B. 35.5g
C. 71g
D. 46g

Q.32 Which of the following is not true for a mole?

A. It is counting unit
B. It is the gram atomic or gram formula mass of a substance
C. It contains 6.023×10^{23} particles
D. It contains different number of particles for different substances

Q.33 During combustion analysis, which one is used for absorbing carbon dioxide?

A. 50 % KOH solution
B. 5% KOH
C. $Mg(ClO_4)_2$
D. Silica gel

Q.34 Absorption of CO_2 in 50% KOH solution during combustion analysis is:

A. Chemical change
B. Physical change
C. Neither chemical nor physical change
D. CO_2 absorbed in $Mg(ClO_4)_2$

Q.35 Which of the following compounds has highest percentage of oxygen by weight?

A. CH_3OH
B. HCOOH
C. C_2H_5OH
D. H_2O

Q.36 Which of the following compound have empirical formula, but no molecular formula?

A. H_2O
B. C_6H_6
C. H_2O_2
D. NaCl

Q.37 The sole products of combustion analysis are:

A. CO_2 and NH_3
B. H_2O and $Mg(ClO_4)_2$
C. CO_2 and KOH
D. CO_2 and H_2O

Q.38 An acid with molecular mass 104 contain 34.6%C, 3.85% H and rest is O. The molecular formula of acid is:

A. $C_3H_4O_4$
B. $C_2H_2O_4$
C. C_2H_2O
D. C_2HO

Q.39 $6Na + Fe_2O_3 \longrightarrow 3Na_2O + 2Fe$

For above reaction, if you are provided with 230g Na and 320g Fe_2O_3, then limiting reactant is:

A. Na
B. O_2
C. Fe_2O_3
D. Fe

Q.40 Mg reacts with HCl as per the following reaction
$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$
Given that; Mg = 24g and HCl=21g, then excess reactant is:
A. Mg
B. HCl
C. Both are in stoichiometric amounts
D. $MgCl_2$

Q.41 What volume of oxygen is required for complete combustion of $5cm^3$ of CH_4?
A. $2cm^3$
B. $5cm^3$
C. $12.5cm^3$
D. $15.5cm^3$

Q.42 $11.207dm^3$ of methane at NTP has _____ moles of hydrogen atoms:
A. 4
B. 2
C. 8
D. 16

Q.43 How much Al is required to form alumina with 12g of oxygen?
A. 27g
B. 13.5g
C. 54g
D. 24g

Q.44 The actual yield is always less than the theoretical yield due to:
A. Side reaction
B. Reversible nature
C. Mechanical loss
D. All of these

Q.45 Indicate the incorrect statement from the following:
A. A limiting reactant is consumed at the end of reaction
B. Actual yield is always greater than theoretical yield
C. Stochiometric calculation can be only done if no side reaction happens
D. The empirical formula and molecular formula of some of compounds are same

Q.46 The calculation of the efficiency of a chemical reaction can be checked by knowing the amount of:
A. The limiting reactant
B. The access reagent
C. The product formed
D. The substance left unused

Q.47 When one mole of each of the following is completely burnt in oxygen, which will give the largest mass of CO_2?
A. CO
B. Ethane
C. Diamond
D. Methane

Q.48 If we know the mass of one substance, we can calculate the volume of other substance and vice versa with the help of chemical equation is called:
A. Mass-mass relationship
B. Mass-volume relationship
C. Mass-mole relationship
D. Mole-volume relationship

Q.49 With the help of spectral data given calculate the mass of Neon and encircle the best option. (Percentage of $^{20}_{10}Ne$, $^{21}_{10}Ne$ and $^{22}_{10}Ne$ are 90.92%, 0.26% and 8.82% respectively).
A. 22.18 amu
B. 20.18amu
C. 21.18amu
D. 22.20amu

Q.50 How many chlorine atoms are in 2 moles of Cl?
A. $2\times6.022\times10^{23}$ atoms
B. 2×10^{23} atoms
C. $35.5\times6.022\times10^{23}$ atoms
D. $2\times6.02\times10^{22}$ atoms

Topic 1 INTRODUCTION TO FUNDAMENTAL CONCEPT OF CHEMISTRY

PAST PAPER MCQ'S

Q.51 If we know the mass of one substance, we can calculate the volume of other substance and vice versa with the help of chemical equation is called: MDCAT (2010)

A. Mass-mass relationship
B. Mass-volume relationship
C. Mass-mole relationship
D. Mole-volume relationship

Q.52 One mole of any gas at STP occupies a volume of: MDCAT (2010)

A. $22.414 dm^3$
B. $23.414 dm^3$
C. $22.414 cm^3$
D. $20.414 dm^3$

Q.53 How many chlorine atoms are in 2 moles of Cl? MDCAT (2011)

A. $2 \times 6.022 \times 10^{23}$ atoms
B. $35.5 \times 6.022 \times 10^{23}$ atoms
C. 2×10^{23} atoms
D. $2 \times 6.02 \times 10^{22}$ atoms

Q.54 An organic compound has empirical formula C_3H_3O if molar mass of the compound is 110.15. Molecular formula of this organic compound is: MDCAT (2012)
(Atomic mass of C = 12, H = 1.008 and O = 16)

A. $C_6H_6O_2$
B. $C_8H_9O_3$
C. C_2H_2O
D. $C_6H_6O_3$

Q.55 When 8 grams (4 moles) of H_2 react with 2 moles of O_2, how many moles of water will be formed? MDCAT (2012)

A. Five
B. Six
C. Four
D. Three

Q.56 Hydrogen burns in chlorine to produce hydrogen chloride. The ratio of masses of reactants in chemical reaction $H_2 + Cl_2 \rightarrow 2HCl$ is: MDCAT (2013)

A. 2:35.5
B. 1:35.5
C. 1:71
D. 2:70

Q.57 A polymer of simplest formula CH_2 has molar mass of 28000 $gmol^{-1}$. Its molecular formula will be: MDCAT (2014)

A. 100 times that of its empirical formula
B. 500 times of its empirical formula
C. 200 times that of its empirical formula
D. 2000 times that of its empirical formula

Q.58 The number of molecules in 9g of ice (H_2O) is: MDCAT (2014)

A. 6.02×10^{23}
B. 6.02×10^{22}
C. 3.01×10^{22}
D. 3.01×10^{23}

Q.59 How many moles of sodium are present in 0.1g of sodium? MDCAT (2015)

A. 4.3×10^{-3}
B. 4.01×10^{-2}
C. 4.03×10^{-1}
D. 4.3×10^{-2}

Q.60 10.0 grams of glucose are dissolved in water to make 100 cm^3 of its solution, its molarity is: MDCAT (2015)

A. 0.55
B. 10
C. 0.1
D. 1

Q.61 An organic sample consisting of carbon, hydrogen and oxygen was subjected to combustion analysis. 0.5439 g of this compound gave 1.039g carbon dioxide, 0.6369g of water vapors. The empirical formula of this compound is: MDCAT (2016)

A. CH_3O
B. C_2H_6O
C. $C_4H_{12}H_2O$
D. CH_4O

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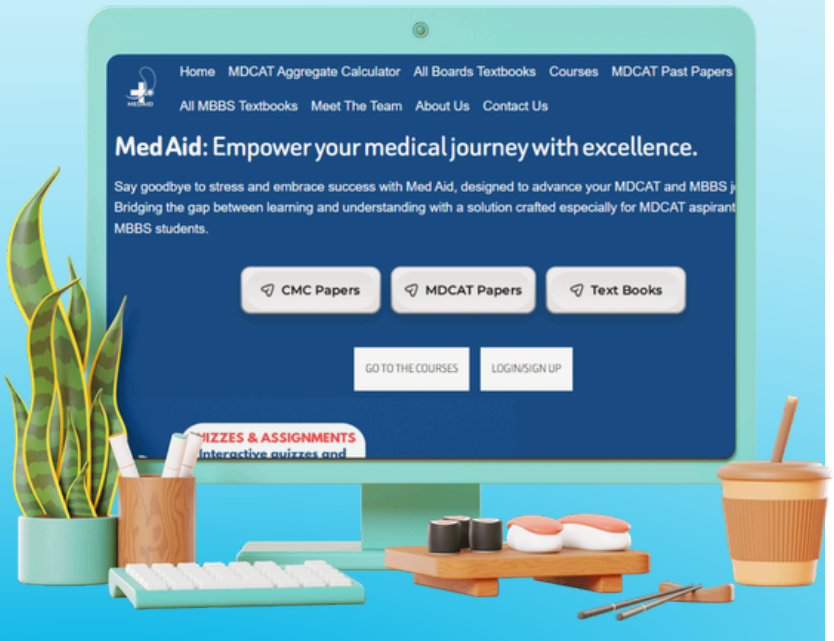

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Q.62 The number of moles of CO_2 which contain 8.00g of oxygen is: MDCAT (2016)
A. 0.75 B. 0.25
C. 1.50 D. 1.00

Q.63 A researcher has prepared a sample of 1-Bromopropane from 10g of 1-propanol. After purification he had made 12g of product. Which of the following is percentage yield? (The test was reconducted) MDCAT (2017)
A. 60% B. 90%
C. 58% D. 50%

Q.64 Which one of the followings has same number of molecules as present in 11g of CO_2? MDCAT (2017)
A. 4g of O_2 B. 4g of O
C. 4.5 g of H_2O D. ¼ moles of NaCl

Q.65 Choose the correct option regarding number of particles associated with one mole of a substance: MDCAT (2017)
A. 6.03×10^{23} B. 6.02×10^{-23}
C. 6.01×10^{-19} D. 6.02×10^{23}

Q.66 Determinate the number of moles of O in 10.6g of $NaCO_2$: MDCAT (2017)
A. 0.4 moles B. 0.2 moles
C. 0.3 moles D. None of these

Q.67 Calculate the gram of H_2O formed when 8 g of CH_4 burns in excess of oxygen. MDCAT (2017)
A. 21 grams B. 18 grams
C. 19 grams D. 15 grams

Q.68 While finding the relative atomic mass, which of the following standard is used to compare the atomic mass of chlorine (35.5amu)? MDCAT (2018)
A. Neon-20 B. Nucleon number
C. Carbon-13 D. Carbon -12

Q.69 The formula which shows the simplest whole number ratio for the atoms of different elements in compound? MDCAT (2018)
A. Ionic formula B. Empirical formula
C. Structural formula D. Molecular formula

Q.70 3.0 mole of calcium will contain _____ g of calcium. MDCAT (2018)
A. 105gm B. 80gm
C. 100gm D. 120gm

Q.71 The average atomic mass of Boron is 10.8. It has two isotopes of masses 10 and 11 respectively. What is the percentage of isotope with the average mass of 10? MDCAT (2019)
A. 80% B. 60%
C. 50% D. 20%

Q.72 Which two elements are isotopes? MDCAT (2019)
A. ${}^{12}_{6}X$ and ${}^{12}_{7}Y$ B. ${}^{16}_{8}X$ and ${}^{16}_{8}Y$
C. ${}^{18}_{9}X$ and ${}^{20}_{10}Y$ D. ${}^{11}_{8}X$ and ${}^{15}_{8}Y$

Q.73 The best standard for the calculation of relative atomic mass NUMS (2019)
A. H-1.008 B. Carbon -12
C. Carbon-13 D. Oxygen -16

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Q.74 A piece of diamond embedded in a gold ring weighs 6.0 gram. How many numbers of moles of Carbon does it contain? SET (2019)

A. 6.0 mole
B. 0.5 mole
C. 1.0 mole
D. 1.5 mole

Q.75 Iron is manufactured industrially in Blast furnace using Hematite (an ore of iron) and a reducing agent Carbon monoxide. $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$ Calculate the mass of iron ore used to manufacture 56g of iron with excess carbon monoxide. Assume that the process gives 100% yield. SET (2019)

A. 160g
B. 112g
C. 280g
D. 80g

Q.76 How many moles of calcium carbonate are present in 1.75 kg of calcium carbonate? (Ar of Ca = 40, Ar of C = 12, Ar of O=16) MDCAT (2019)

A. 0.0175 mol
B. 1.75 mol
C. 17.5 mol
D. 1750 mol

Q.77 According to law of definite proportion, what is the mass ratio of hydrogen and oxygen in water? SET (2019)

A. Hydrogen is 11.11% and oxygen is 88.89%
B. Hydrogen is 10.11% and oxygen is 89.89%
C. Hydrogen is 20% and oxygen is 80%
D. Hydrogen is 30% and oxygen is 70%

Q.78 $2XeF_6 + SiO_2 \longrightarrow 3XeOF_4 + SiF_4$ Consider the above chemical reaction. If 122.6g of XeF_6 reacts with 60g of SiO_2 to form the products. Select the limiting reagent and amount of SiF_4 formed (XeF_6 245.3 amu, SiO_2 = 60 amu, SiF_4 = 104 amu). ETEA (2016)

A. XeF_6, 26g
B. SiO_2, 26g
C. XeF_6, 52g
D. SiO_2, 52g

Q.79 How many oxygen atoms are present in 278g of Hydrated Ferrous Sulphate? ($FeSO_4.7H2O$ = 278amu) ETEA (2016)

A. 6.023×10^{23}
B. 6.525×10^{24}
C. 2.408×10^{23}
D. 6.023×10^{23}

Q.80 The water formed in the combustion analysis is usually absorbed by: ETEA (2016)

A. $Mg(NO_3)_2$
B. $Mg(ClO_4)_2$
C. $Mg(OH)_2$
D. $Mg(ClO_3)_2$

Q.81 Which contains more atoms? ETEA (2019)

A. 7 gram Mg
B. 8 gram Na
C. 9 gram Al
D. All same

Q.82 Which contains highest percentage of nitrogen? ETEA (2019)

A. NO
B. NO_2
C. N_2O
D. N_2O_5

Q.83 A mixture of $10cm^3$ of oxygen and $50cm^3$ of hydrogen is sparked continuously. What is the maximum theoretical decrease in volume? ETEA (2019)

A. $10cm^3$
B. $15cm^3$
C. $20cm^3$
D. $30cm^3$

Q.84 The number of moles of water in 1Kg ice are: MDCAT (2019)

A. 50 moles
B. 1000 moles
C. 55.5 moles
D. 100 moles

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Q.85 During stoichiometric calculations, which of the following laws must be followed? MDCAT (2019)
A. Law of conservation of mass
B. Law of conservation of energy
C. Avogadro's law
D. Dalton's law

Q.86 The efficiency of a chemical reaction can be expressed as: NMDCAT (2020)
A. Theoretical yield
B. Actual yield
C. % yield
D. Maximum yield

Q.87 In a vessel, 10 g N_2 10 g H_2 and 10 g O_2 are present. Which one will have least number of atoms? NMDCAT (2020)
A. H_2
B. N_2
C. O_2
D. Both A & B

Q.88 The empirical formula of glucose ($C_6H_{12}O_6$) is: NMDCAT (2020)
A. $C_6H_{12}O_6$
B. CHO
C. CH_2O
D. CH_2O_2

Q.89 1 amu is equal to: PMC (2021)
A. 0.666×10^{-27}kg
B. 1.661×10^{28}kg
C. 1.661×10^{27}kg
D. 1.661×10^{-27}kg

Q.90 Number of single covalent bonds in water molecule are: PMC (2021)
A. 1
B. 2
C. 3
D. 4

Q.91 NH_3 can be called: PMC (2021)
A. Molecule of atoms
B. Molecule of element
C. Molecule of compound
D. Molecule of ion

Q.92 Chemical equations do not tell about the _____ because of certain limitations. PMC (2021)
A. Rate of reaction
B. Conditions
C. Pressure
D. All of these

Q.93 One a.m.u stands for: UHS (2022)
A. An atom of C-12
B. $1/12^{th}$ of H
C. 1/12th of a carbon
D. 1 atom of all the elements

Q.94 A compound of sodium oxide has 74.2% sodium and 25.8% of oxygen. The empirical formula of the compound is? UHS (2022)
A. NaO
B. Na_2O
C. NaO2
D. Na_2O_2

Q.95 30g of 2-propanol were mixed with excess acidified $K_2Cr_2O_7$ and boiled under reflux for 20minutes. The organic product was then collected by distillation. The yield of product was 75.0%. What is the mass of product produced? UHS (2022)
A. 1.74g
B. 2.74g
C. 21.75g
D. 29g

Q.96 For the reaction given below SZABMU (2022)

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

How many moles N_2 are required for synthesis of 4 moles of NH_3? SZABMU (2022)
A. 4 moles of N_2
B. 2 moles of N_2
C. 3 moles of N_2
D. 4.5 moles

Q.97 Al reacts with O_2 according to following reaction SZABMU (2022)

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$

27 g of Al will react with how much of O_2?
A. 8 g
B. 16 g
C. 24 g
D. 32 g

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Q.98 One mole of a substance is the amount of that substance that has the same number of particles (atom, ions or molecules) as there are atoms in exactly: SZABMU (2022)
A. 1.008g of hydrogen gas (H_2)
B. 16 g of oxygen gas (O_2)
C. 12 g of carbon -12 isotopes
D. 12 g of magnesium

Q.99 Which of the following contains the same number of molecules as 22 gram of carbon dioxide? ETEA (2022)
A. 9 g of water
B. 2 g of hydrogen gas
C. 32 g of oxygen gas
D. 71 g of chlorine gas

Q.100 Molecular mass of the compound is 60 and its empirical formula is CH_2O. What will be the molecular formula of the compound? ETEA (2022)
A. $C_6H_{11}O_4$
B. $C_2H_4O_2$
C. $C_2H_6O_2$
D. $C_2H_4O_2$

Q.101 The amount of products that is actually produced during a chemical reaction by performing experiment is called. ETEA (2022)
A. Mole
B. Actual yield
C. Theoretical yield
D. Percent yield

Q.102 3.0 g of C on combustion gives $C+O_2 \longrightarrow CO_2$: DUHS (2022)
A. 5.5 g of CO_2
B. 22 g of CO_2
C. 6.02×10^{23} molecules of CO_2
D. 3.01×10^{23} molecules of CO_2
E. 1.505×10^{23} molecules of CO_2

Q.103 Ratio of atomic mass of hydrogen to atomic mass of C is: DUHS (2022)
A. One fourth
B. One twelfth
C. Half
D. Double
E. Equal

Q.104 Which of the following statement is correct about the Avogadro's constant? BMU (2022)
A. It is the mass of one mole of any element
B. It is the mass of 6.023×10^{23} atoms of any element
C. It is the number of atoms in one mole of an element
D. It is the number atoms in 12 g of any element.

Q.105 The atomic weight of an elements is represented by_____: BMU (2022)
A. a.m.u
B. Grams
C. Kg
D. Mole

Q.106 One of the reactants consumed earlier than others in a chemical reaction is called: BMU (2022)
A. Active reactant
B. Excess reactant
C. Limiting reactant
D. More active reactant

Q.107 One mole of ethanol and one mole of ethane have an equal: NUMS (2022)
A. Mass
B. Number of electrons
C. Number of atoms
D. Number of molecules

Q.108 The 1st step involved in the determination of Empirical formula of chemical compound is: NUMS (2022)
A. Finding number of gram atoms of each element
B. Percentage composition of each element
C. Atomic ratio of each element
D. Multiplication of atomic ratio with whole number

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Q.109 The number of moles of CO_2 contains 16 g of oxygen is: NUMS (2022)

A. 0.25
B. 1.00
C. 0.5
D. 1.50

Q.110 Percentage composition of mass in CO_2 is: NUMS (2022)

A. 30.45% Carbon & 69.54% Oxygen
B. 24.22% Carbon & 75.78% Oxygen
C. 27.27% Carbon & 72.72% Oxygen
D. 41.68% Carbon & 58.12% Oxygen

Q.111 A compound of phosphorus oxide has 43.6% of Oxygen. Its empirical formula is? UHS (2023)

A. P_2O_5
B. P_2O_3
C. P_5O_2
D. PO_2

Q.112 Which element is used as standard to determine atomic mass of an element? UHS (2023)

A. H
B. C
C. P
D. Cl

Q.113 The average weight of atoms of an element compared to the weight of one atom of _____ is called atomic weight. UHS (2023)

A. Carbon
B. Helium
C. Hydrogen
D. Nitrogen

Q.114 The same moles of H_2, N_2 and O_2 are present in 0.1 cc volume at STP. Which one gas has greatest number of molecules: UHS (2023)

A. N_2
B. H_2
C. O_2
D. Number of molecules are equal

Q.115 Number of H_2O molecules in 10 g of ice are SZABMU (2023)

A. 3.34×10^{23}
B. 0.34×10^{23}
C. 33.1×10^{23}
D. 10

Q.116 The efficiency of chemical reaction can be expressed as SZABMU (2023)

A. Theoretical yield
B. Actual yield
C. Percent yield
D. Maximum yield

Q.117 1 mol of any substance contains _____ particles SZABMU (2023)

A. 6.02×10^{23}
B. 6.02×10^{24}
C. 6.02×10^{22}
D. 3.01×10^{23}

Q.118 Consider the reaction below, if 5 moles each of hydrogen and oxygen are reacted to _____ form water, the reaction reveals: ETEA (2023)

$$2H_2 + O_2 \longrightarrow 2H_2O$$

A. H_2 is excess reagent
B. O_2 is limiting regent
C. H_2 is limiting reagent
D. Reaction has no limiting reagent

Q.119 Oxygen can be prepared by the decomposition of potassium chlorate ($KClO_3$). How many moles of oxygen $O_{2(g)}$ can be formed by taking 12 moles of potassium chlorate ($KClO_3$) according to the following equation? ETEA (2023)

$$2KClO_{3(s)} + \text{heat} \longrightarrow 2KCl_{(s)} + 3O_{2(g)}$$

A. 12 moles of oxygen
B. 15 moles of oxygen
C. 18 moles of oxygen
D. 21 moles of oxygen

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Q.120 117g of NaCl have — ETEA (2023)

A. 1.204×10^{24} formula units of NaCl
B. 12.04×10^{22} formula units of NaCl
C. 1.204×10^{23} formula units of NaCl
D. 6023×10^{23} formula units of NaCl

Q.121 Which of the following is different in Na^{+} (Z=11), Mg^{+2}(Z=12) and Al^{+3}(Z=13)? DUHS (2023)

A. Number of shells
B. Number of electrons
C. Electronic configuration
D. Number of protons

Q.122 What volume of oxygen at S.T.P required to burn 500 dm^3 of ethene? DUHS (2023)

A. 500 dm^3
B. 1000 dm^3
C. 1500 dm^3
D. 2000 dm^3

Q.123 Ca (Z=20) forms ionic bond with (Z=17)? What is the chemical formula of calcium chloride? DUHS (2023)

A. CaCl
B. $CaCl_2$
C. Ca_2C
D. Ca_2Cl

Q.124 An organic compound has C=40%, H=6.67% and O=53.3%. What is the empirical formula of the compound? DUHS (2023)

A. CH_3O
B. C_2H_3O
C. CH_2O
D. C_2H_2O

Q.125 7.6 grams of CS_2 is reacted with 12.8g of O_2, $CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$, limiting reactant is: DUHS (2023)

A. CS_2
B. O_2
C. CO_2
D. SO_2

Q.126 Which one is incorrect for actual yield is less than theoretical yield due to: BUMHS (2023)

A. Mechanical losses
B. Reversibility of reaction
C. All molecules do not possess activation energy
D. Substance is pure

Q.127 What is the weight of oxygen that is required for the complete combustion of 3.2 kg of methane? BUMHS (2023)

A. 3.2 kg
B. 6.4 kg
C. 12.8 kg
D. 15.4 kg

Q.128 How many moles of a gas occupy 30.57 L at 55 °C and 0.83 atm? BUMHS (2023)

A. 0.1 mol
B. 0.62 mol
C. 0.84 mol
D. 0.94 mol

Q.129 When equal moles of reactants A and B are allowed to react according to the following balanced equation (2 A + B → Product.) The limiting reactant in this chemical equation will be? BUMHS (2023)

A. Reactant A
B. Reactant B
C. Reactant A and B
D. No limiting reactant

Q.130 What is the mass of sulphur in 24.5 g of H_2SO_4? NUMS (2023)

A. 32 g
B. 24 g
C. 16 g
D. 8 g

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Q.131 From the equation ($N_2 + 3H_2 \rightleftharpoons 2NH_3$), How many moles of NH_3 are produced from 2.5 moles of N_2? NUMS (2023)

A. 2.5 moles
B. 2 moles
C. 5 moles
D. 7.5 moles

Q.132 The type and relative amount of each isotope in an element can be found by (out of syllabus) UHS (2024)

A. R spectroscopy
B. U.V spectroscopy
C. Mass spectroscopy
D. N.M.R

Q.133 The atomic masses of element depend upon: UHS (2024)

A. Atomic number
B. Number of electrons
C. Number of isotopes & their abundance
D. None of the above

Q.134 Number of moles in an element is directly proportional to UHS (2024)

A. Mass of an element
B. Empirical formula mass
C. Molar mass of an element
D. Formula mass

Q.135 How many moles of oxygen gas are needed for combustion of 2 moles of propane? SZABMU (2024)

A. 8
B. 10
C. 12
D. 14

Q.136 If percentage yield of chemical reaction is 60%, actual yield is 15g, what is its theoretical yield? SZABMU (2024)

A. 18g
B. 20g
C. 25g
D. 30g

Q.137 What will be the number of atoms in 2 moles of water molecule? SZABMU (2024)

A. 6.02×10^{23}
B. 1.24×10^{24}
C. 1.92×10^{24}
D. 3.61×10^{24}

Q.138 What will be mole ratio of Al to O_2 after balancing equation given below? SZABMU (2024)

$$Al_2O_3 \longrightarrow Al + O_2$$

A. 1:1
B. 2:3
C. 3:4
D. 4:3

Q.139 $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ SZABMU-RC (2024)

How many moles of N_2 required to manufacture 8 moles of NH_3?

A. 2.5 moles
B. 4 moles
C. 3.5 moles
D. 5 moles

Q.140 1g H_2 has SZABMU-RC (2024)

A. 1 mol
B. 2 moles
C. 0.5 moles
D. 0.25 moles

Q.141 Percentage composition by mass in CO_2 is SZABMU-RC (2024)

A. 30% Carbon & 70% Oxygen
B. 25% Carbon & 75% Oxygen
C. 27.27% Carbon & 72.72% Oxygen
D. 40% Carbon & 60% Oxygen

Q.142 The volume occupied by 3.2 g of oxygen gas at S.T.P is: ETEA (2024)

A. 1.12 dm^3
B. 2.24 dm^3
C. 22.4 dm^3
D. 24 dm^3

Q.143 Which of the following elements cannot be detected directly in a given organic compound? ETEA (2024)

A. Chlorine
B. Nitrogen
C. Oxygen
D. Phosphorous

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Q.144 How many moles are there in 240g of sodium hydroxide (NaOH)? ETEA (2024)

A. 2 B. 4
C. 6 D. 8

Q.145 Heating 24.8g of copper carbonate ($CuCO_3$) in a crucible produced only 13.9g of copper oxide (CuO). What is the percentage yield of copper oxide? ETEA (2024)

A. 81.79% B. 83.98%
C. 86.87% D. 89.68%

Q.146 Efficiency of chemical reaction can be checked by calculating ETEA (2024)

A. Actual yield B. Theoretical yield
C. Percentage yield D. Amount of the reactant unused

Q.147 Actual yield will reach the ideal (theoretical) value if the % yield of the reaction is, ETEA (2024)

A. 10% B. 50%
C. 90% D. 100%

Q.148 What is the mass of 1 mole of calcium carbonate ($CaCO_3$)? ETEA (2024)

A. 50g B. 70g
C. 100g D. 125g

Q.149 How many grams of CO_2 can be produced by thermally decomposing 10 moles of $ZnCO_3$? ETEA (2024)

A. 320 B. 360
C. 400 D. 440

Q.150 How many moles of NaCl are produced from 16.5g of HCl, according to the neutralization reaction? ETEA (2024)

A. 0.252 B. 0.452
C. 0.652 D. 0.852

Q.151 What mass of aluminium oxide (Al_2O_3) is produced from 18.5g of Al metal, when it reacts completely with oxygen gas according to the following equation? ETEA (2024)

A. 30.8g B. 32.6g
C. 34.9g D. 36.5g

Q.152 Stoichiometry is the study of _____ relationship between reactant and products in a chemical reaction by using a balanced chemical equation DUHS (2024)

A. Quantitative B. Qualitative
C. Chemical D. Descriptive

Q.153 Isotopes differ from each other on the basis of BMU (2024)

A. Number of electrons B. Mass number
C. Electronic configuration D. Crystal lattice

Q.154 In a chemical reaction, a limiting reactant is that BMU (2024)

A. Which is present in excess
B. Which is not in excess
C. Which acts as catalyst
D. Which is not taking part in the reaction but its presence is helpful in completion of the reaction

Q.155 Carbon atom is used to measure relative BMU (2024)

A. Atomic size B. Atomic number
C. Atomic mass D. Atomic volume

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ANSWER KEY

PRACTICE EXERCISE

1	B	11	B	21	B	31	C	41	C
2	A	12	C	22	B	32	D	42	B
3	D	13	A	23	C	33	A	43	B
4	D	14	A	24	B	34	A	44	D
5	D	15	D	25	D	35	D	45	B
6	D	16	D	26	C	36	D	46	C
7	C	17	A	27	D	37	D	47	B
8	A	18	A	28	C	38	A	48	B
9	D	19	C	29	A	39	A	49	B
10	D	20	D	30	B	40	A	50	A

PAST PAPER MCQS

51	B	61	B	71	D	81	B	91	C	101	B	111	B	121	D	131	C	141	C	151	C
52	A	62	B	72	D	82	C	92	D	102	E	112	B	122	C	132	C	142	B	152	A
53	A	63	C	73	B	83	D	93	C	103	B	113	A	123	B	133	C	143	C	153	B
54	A	64	C	74	B	84	C	94	B	104	C	114	D	124	C	134	A	144	C	154	B
55	C	65	D	75	D	85	A	95	C	105	A	115	A	125	A	135	B	145	C	155	C
56	B	66	C	76	C	86	C	96	B	106	C	116	C	126	D	136	C	146	C		
57	D	67	B	77	A	87	C	97	C	107	D	117	A	127	C	137	D	147	D		
58	D	68	D	78	A	88	C	98	C	108	B	118	C	128	D	138	D	148	C		
59	A	69	B	79	B	89	D	99	A	109	C	119	C	129	A	139	B	149	D		
60	A	70	D	80	B	90	B	100	B	110	C	120	A	130	D	140	C	150	B		

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EXPLANATORY NOTES

Q.11

- 280 different isotopes occur in nature including 40 radioactive isotopes.
- 300 unstable radioactive isotopes produced through artificial disintegration.
- Out of 280 naturally occuring isotopes, 154 have even mass number and even atomic number.

Q.12 There are 2 types of fundamental particles present in the nucleus i.e. proton & neutron.

Q.13 As atomic number of different isotopes of an element is same so they have same electronic configuration hence they will show same chemical properties.

Q.14 ${}^{A}_{Z}X$

'A' is atomic mass and 'Z' is atomic number.

Q.15 Molecular ions are formed by passing high energy electron beam, X-rays or *a* particles

Q.16 As atomic number of different isotopes of an element is same so they have same electronic configuration hence they will show same chemical properties.

Q.17

$$SiO_2 = 28 + 32 = 60\,g\,mol^{-1}$$

$$n = \frac{m}{M} = \frac{0.6}{60} = 0.01\,moles$$

Q.18 No. Of moles (n) = mass/ M.mass = 4.4 / 44 = 0.1 mole
Volume = n × 22.414 dm^3 = 0.1 × 22.414 = 2.24 dm^3

Q.19 1 mole of any gas occupies 22.4 dm^3 volume at STP. This is called molar volume (V_m).

Q.20

$$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{-2}$$

0.1 mole 2×0.1 mole

No. of H^+ ions $= n \times N_A$

$= 0.2 \times 6.02 \times 10^{23}$

$= 2 \times 6.02 \times 10^{22}$

Q.21 No. of electron $= n \times N_A$

$= 1.0 \times 10^{-6} \times 6.02 \times 10^{23}$

Q.22

$$Al_2(SO_4)_3 \rightleftharpoons 2Al^{3+} + 3SO_4^{2-}$$

1 mole of $Al_2(SO_4)_3$ produces number of particles $= 5N_A$

0.5 $Al_2(SO_4)_3$ produces number of particles $= 2.5N_A$

$= 2.5 \times 6.02 \times 10^{23}$

$= 15 \times 10^{23}$

$= 1.5 \times 10^{24}$

Q.23 Mass of hydrogen = 1 g
Mole of hydrogen = 0.5 mole
No. of electrons in $H_2 = 2 \times n \times N_A = 2 \times 0.5 \times N_A = 1\,N_A\,(6.02 \times 10^{23})$

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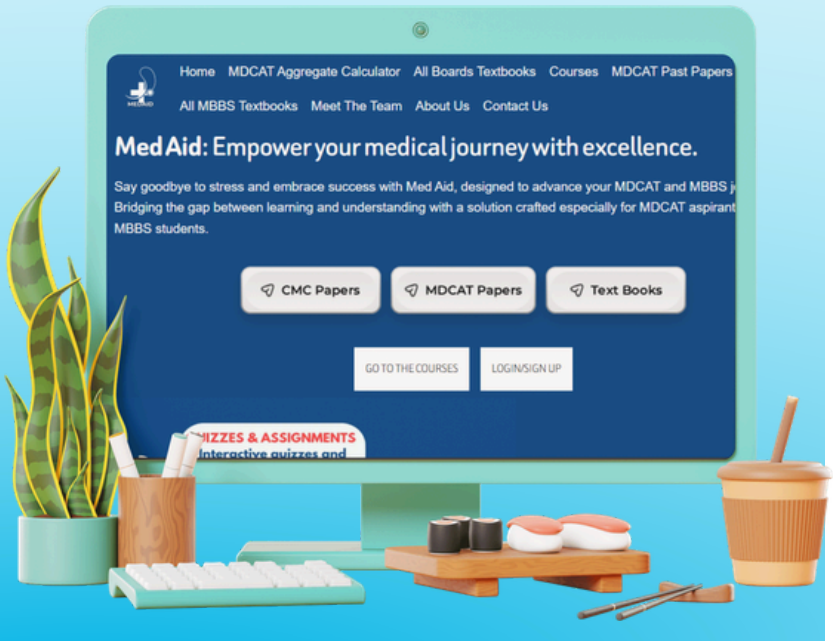

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Q.24

32g of O_2 present in = 1 mole of CO_2

1g of O_2 present in $= \frac{1}{32}$ mole of CO_2

16g of O_2 present in $= \frac{1}{32} \times 16$ mole of CO_2

$= 0.5$ mole of CO_2

Q.25 6.02×10^{23} molecules have mass = 32g

1 molecule will have mass $= 32 / 6.02 \times 10^{23}$ g

Or

Mass of one molecule = molar mass of substance / N_A

$= 32 / 6.02 \times 10^{23}$

Q.26 $\text{Mole of oxygen} = \frac{N}{N_A} = \frac{\text{Given no. of particles}}{\text{Avogadro's number}} = \frac{1.5 \times 10^{22}}{6.02 \times 10^{23}} = 0.025\text{mol}$

Mass in grams = mole × molar mass of O_2

$= 0.025 \times 32$

$= 0.80$g

Q.27 One Na^{+1} carry 10 electrons. So,

One mole Na^+ ion $= 10N_A$ electrons

1/2 moles Na^+ ion $= 5N_A$ electrons

Q.28

$N = n \times N_A$

$= 3 \times 10^{-21} \times 6.02 \times 10^{23}$

$= 1800$ molecules

Q.29 $\text{Mole (n)} = \frac{\text{Mass}}{\text{M. mass of oxygen gas}} = \frac{n}{M}$

$2 = \frac{\text{Mass}}{32}$

Mass $= 2 \times 32 = 64$g

Q.30

A. Mass of I_2 is 25g

C. g atom means mole of atoms

Mass of O – atoms = Mole × M. mass of oxygen atoms

$= 25 \times 16$

$= 400$g

B. g molecule means mole

Mass of H_2O = Mole × M. mass

$= 25 \times 18 = 450$g

D. Mass of N_2 gas is 25g

Q.31 Relative atomic mass of Cl = 35.5 amu

Relative molecular mass of Cl_2 gas = 71 amu

If molecular mass is expressed in g, then it is called mole, so

1mol of Cl_2 gas = 71g

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Q.32 According to Avogadro's law, 1 mole of any substance contains equal No. of particle i.e. 6.02×10^{23}.

Q.33 During combustion analysis, CO_2 is chemically absorbed in 50% KOH

$CO_2 + 2KOH \longrightarrow K_2CO_3 + H_2O$

While H_2O vapour are physically absorbed in $Mg(ClO_4)_2$ because $Mg(ClO_4)_2$ is hygroscopic.

Q.34 During combustion analysis, CO_2 is chemically absorbed in 50% KOH

Q.35 It can be solved theoretically but short cut is to check molecular mass of given options

$$In\ CH_3OH = \frac{16}{32}\times 100 = 5\%$$

$$In\ C_2H_5OH = \frac{16}{46}\times 100 = 34.7\%$$

$$In\ HCOOH = \frac{32}{46}\times 100 = 69.5\%$$

$$In\ H_2O = \frac{16}{18}\times 100 = 88.8\%$$

Q.36 Ionic compounds do not have molecule rather they have formula unit so they don't have molecular formula but have empirical formula.

Q.37 In combustion analysis, only those compounds can be analyzed which contain C, H, and O.

Organic compound + $O_2 \xrightarrow{\text{Combustion}} CO_2 + H_2O$

(C, H and O containing)

So sole product of combustion analysis are CO_2 and H_2O.

Q.38

$$C_3H_4O_4 = 12\times3+1\times4+16\times4$$

$$= 104 gmol^{-1}$$

Q.39 To find limiting reactant, its short cut is

(i) Find no. of moles from given amount

(ii) Divide no. of moles by molar coefficient

(iii) Small ratio is considered as liming reactant while large ratio is excess reactant

$$n_{Na} = \frac{230}{23} = 10mol,\ n_{Fe_2O_3} = \frac{320}{160} = 2mol$$

$$6Na + Fe_2O_3 \longrightarrow 3Na_2O + 2Fe$$

$$\frac{10mol}{6} \quad \frac{2mol}{1}$$

Limiting reactant $\rightarrow 1.66$ $\quad 2 \rightarrow$ Excess reactant

Q.40 If equal masses of reactants are given then the reactant whose larger molar mass is used in balance chemical equation is limiting reactant so Mg will be in excess.

Q.41 $C_2H_2 + 5/2O_2 \rightarrow 2CO_2 + H_2O$

$C_2H_2 : O_2$

$1\ cm^3 : 5/2\ cm^3$

$5\ cm^3 : 5\times5/2\ cm^3$

$= 25/2 = 12.5\ cm^3$

Q.42 Moles of 'H' atom in given volume of gas,

22.414 dm^3 (1mole) of methane gas contain 4 moles of H-atoms.

11.207 dm^3 (0.5) of methane gas contain 2 moles of H-atoms.

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Q.43

$$n_{O_2} = \frac{12}{32} = \frac{3}{8}\text{ mol}$$

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$

O_2	:	Al
3	:	4
1	:	$\frac{4}{3}$
$\frac{3}{8}$	:	$\frac{4}{3}\times\frac{3}{8}$
		$=\frac{1}{2}$

Mass of Al = Mole × Molar mass

$$= \frac{1}{2}\times 27$$

$$= 13.5\text{g}$$

Q.44 Due to side reaction, reversible reaction and mechanical loss, actual yield is less than theoretical yield.

Q.45 Actual yield is always less than theoretical yield.

Q.46 Efficiency of chemical reaction is expressed in term of % age yield.

$$\%\text{ age yield} = \frac{\text{Actual / experimental yield}}{\text{Theoretical / calculated yield}} \times 100$$

Actual yield is amount of product formed in chemical reaction while theoretical yield is amount of product obtained in balanced chemical equation.

Q.47 Combustion of the given compounds explained as,

a) $CO + \frac{1}{2}O_2 \longrightarrow CO_2$

b) $C_{(D)} + O_2 \longrightarrow CO_2$

c) $C_2H_6 + \frac{7}{2}O_2 \longrightarrow 2CO_2 + 3H_2O$

d) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

1 mole of ethane give largest mol and mass of CO_2.

Q.48 When reactants are given in grams and products in cm^3 or dm^3. This is called as mass-volume relationship between reactants and products.

Q.49

$$\text{Relative atomic mass} = \frac{(20\times 90.92)+(21\times 0.26)+(22\times 8.82)}{100} = 20.1\text{ amu}$$

Q.50 Number of atoms = $n \times N_A$

No. of Cl atoms $= 2 \times 6.02\times 10^{23}$

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 When reactants are taken in grams and products in cm^3/dm^3 then it means mass-volume relationship between reactants and products.

Q.52 At STP (0°C and 1 atm pressure) one mole of any gas occupies $22.414 dm^3/22414$ cm^3 volume.

Q.53 1 mole of Cl-atoms = 6.02×10^{23}

2 mole of Cl-atoms = $2 \times 6.02 \times 10^{23}$

Q.54 $$n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}} = \frac{110}{55} = 2$$

So molecular formula $= n \times E.F$

$= 2 \times C_3H_3O$

$= C_6H_6O_2$

Q.55 According to balance equation $2H_2 + 1O_2 \rightarrow 2H_2O$

2 mole of water will produce from 2 mole of H_2 and 1 mole of O_2. So, 4 mole of H_2 and 2 mole of O_2 2 will produce 4 mole of water.

H_2 : H_2O	O_2 : H_2O
2 : 2	1 : 2
4 : 4	2 : 4

Q.56 $H_2 + Cl_2 \rightarrow 2HCl$

2 : 71

1 : 35.5

Q.57 $$n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}} = \frac{28000}{14} = 2000$$

So, molecular formula of polymer is 2000 times to its empirical formula.

Q.58 $$\text{mole "n"} = \frac{\text{mass}}{\text{Molar mass}} = \frac{9}{18} = \frac{1}{2}$$

No. of molecules "N" $= n \times N_A$

$= \frac{1}{2} \times 6.02 \times 10^{23}$

$= 3.01 \times 10^{23}$

Q.59 $$\text{mole "n"} = \frac{\text{Mass of element}}{\text{Molar mass of element}} = \frac{0.1}{23} = \frac{1}{23 \times 10} = \frac{1}{230} = 4.3 \times 10^{-3} \text{ mol}$$

Q.60 $$\text{Molarity} = \frac{\text{Mass of substance}}{\text{Molar mass of substance}} \times \frac{1000}{\text{Vol. of solution in } cm^3}$$

$$= \frac{10}{180} \times \frac{1000}{100} = \frac{10}{18} = 0.55M$$

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Q.61 E.F of any compound can be find out by using four steps.

$$\%\text{ of C} = \frac{\text{Mass of C}}{\text{Mass of organic compound}} \times \frac{12}{44} \times 100$$

$$= \frac{1.039}{0.5439} \times \frac{12}{44} \times 100 = 52.108\%\text{C}$$

$$\%\text{ of H} = \frac{\text{Mass of Hydrogen}}{\text{Mass of organic compound}} \times \frac{2.016}{18} \times 100$$

$$= \frac{0.6369}{0.5439} \times \frac{2.016}{18} \times 100 = 13.11\%\text{H}$$

$$\%\text{ of O} = 10 - (\%\text{ of C} + \%\text{ of H})$$

$$= 100 - (58.108 + 13.11) = 34.77\%\text{ H}$$

No. of g-atoms

$$\text{C} = \frac{52.108}{12} = 4.34 \quad \text{H} = \frac{13.11}{1.008} = 13.01 \quad \text{O} = \frac{34.77}{16} = 2.17$$

Atomic Ratio C : H : O

$$\frac{4.34}{2.17} : \frac{13.01}{2.17} : \frac{2.17}{2.17}$$

C : H : O

2 : 6 : 1

C_2H_6O

Q.62

32g of O_2 present in = 1 mole of CO_2

1g of O_2 present in $= \frac{1}{32}$ mole of CO_2

8g of O_2 present in $= \frac{1}{32} \times 8$ mole of CO_2

$= 0.25$ mole of CO_2

Q.63 $CH_3CH_2CH_2\text{-}OH \rightarrow CH_3CH_2CH_2\text{-}Br$

1-propanol 1-Bromopropane

Molar Mass = 60 Molar Mass = 123

So, 60g of 1-propanol will produce = 123g of 1-Bromopropane

1g ---------- $= \frac{123}{60}$ g

10g given 1-propanol will produce $= \frac{123}{60} \times 10 = 20.5$g

$$\%\text{ yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$

$$= \frac{12g}{20.5g} \times 100 = 58.5\%$$

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Q.64 11g of CO_2 = 0.25mole of CO_2 or ¼ mole CO_2 molecule

a) 4g of $O_2 \rightarrow n = \frac{m}{M} = \frac{4}{32} = \frac{1}{8}$ mole of O_2 molecule

b) 4g of $O \rightarrow n = \frac{m}{M} = \frac{4}{16} = \frac{1}{4}$ mole of O - atom

c) 4.5g of $H_2O \rightarrow n = \frac{m}{M} = \frac{4.5}{18} = \frac{1}{4}$ mole of H_2O molecule

d) 1/4 mole of NaCl formula units

In B and D option 1/4 mole of O-atom and ¼ mole of formula units of NaCl given, statement is about No. of molecules. So, C-option is right. Equal no. of moles means equal no. of molecules.

Q.65 1 mole of any substance has no. of particles N_A (6.02×10^{23}).

Q.66 $n = \frac{\text{Mass of substance}(g)}{\text{Molar mass of substance}} = \frac{10.6}{67} = 0.15$

In $NaCO_2$, there are 2-oxygen atoms so No. of moles of oxygen atom will be,

No. of moles of oxygen atom = mole × atomicity of oxgen $= 0.15 \times 2 = 0.30$ mol.

Q.67 According to balance chemical equation

$1CH_4 + 2O_2 \rightarrow 1CO_2 + 2H_2O$

16g 36g

16g CH_4 on burning in O_2 producing = 36g H_2O

1g ---------- $= \frac{36}{16}$

8g ---------- $= \frac{36}{16} \times 8 = 18g$

Q.68 C – 12 is used as standard to compare the masses of element / compound because it is stable and its relative atomic amss is 12.0000 amu.

Q.69 Empirical formula shows the simplest whole no. ratio for the atoms of different elements in compound.

Q.70 1 mole fo Ca = 40g

So, 3 mole of Ca will be = 40×3= 120g

$m = n \times M$
$m = 3 \times 40$
$= 120g$

Q.71 To calculate relative abundance of an element which has two isotopes we use formula

$\%\text{of Heavier isotope} = \frac{\text{fractional number of average mass}}{\text{Difference in mass of two isotopes}} \times 100$

$\%\text{of } B_{11} = \frac{0.8 \times 100}{1} = 80\%$

If B_{11} is 80% then B_{10} will be, 100-80 = 20%

Q.72 Elements having same atomic number and different atomic mass are called isotopes

Q.73 Carbon-12 is used as standard to compare the masses of elements / compound because it is stable and its relative atomic mass is 12.0000 amu.

Q.74 $n = \frac{m}{M} = \frac{6}{12} = \frac{1}{2} = 0.5$mole

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Q.75 According to balance chemical equation

$1Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

160g 112g

112g Fe produced from iron are =160g

$1g\ Fe \text{ ---------- } = \frac{160}{112}$

$56g \text{ ---------- } = \frac{160}{112} \times 56 = 80g$

Q.76 Molar mass of $CaCO_3 = 40 + 12 + 48 = 100$

So, 1.75kg of $CaCO_3$ = 1750g $CaCO_3$

$$\text{No.of moles } (n) = \frac{m}{M} = \frac{\text{Mass of } CaCO_3}{\text{Molar mass of } CaCO_3} = \frac{1750}{100} = 17.5\text{mole}$$

Q.77 Molar mass of H_2O =18

$$\text{Mass ratio \% of Hydrogen} = \frac{\text{Mass of hydrogen in water}}{\text{Molar mass of water}} \times 100$$

$$= \frac{2}{18} \times 100 = 11.11\%$$

$$\text{Mass ratio \% of oxygen} = \frac{\text{Mass of oxygen in water}}{\text{Molar mass of water}} \times 100$$

$$= \frac{16}{18} \times 100 = 88.89\%$$

Q.78 For given reaction, $2XeF_6 + SiO_2 \rightarrow 3XeOF_4 + SiF_4$

We can find limiting reactant in two step.

Step (1) Find mole

Mole of XeF_6.

$$n = \frac{m}{M} = \frac{122.5}{245} = \frac{1}{2} = 0.5 \text{ mol}$$

Mole of SiO_2

$$n = \frac{m}{M} = \frac{60}{60} = 1 \text{ mol}$$

Step (2) Divide no. of mole with coefficient (no used in balance chemical equation).

For XeF_6,

$$\frac{\text{Mole}}{\text{Co-efficient}} = \frac{0.50}{2} = 0.25$$

For SiO_2

$$\frac{\text{Mole}}{\text{Co-efficient}} = \frac{1}{1} = 1$$

XeF_6 is limiting reactant.

So. 2 mole of XeF_6 (490g) and 1 mole SiF_4 (104g).

490g of XeF_6 producing = 104g SiF_4

$1g$ of XeF_6 will produce = $\frac{104}{490}$

$122.5g \text{ ---------- } = \frac{104}{490} \times 122.5 = 26g$

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Q.79 $\text{No. of moles} = \frac{\text{Mass of substance}}{\text{Molar mass of substance}} = \frac{278}{278} = 1\text{mole}$

No. of oxygen atoms in $FeSO_4.7H_2O = 11$

So, no. of oxygen atoms = mole × N_A × Atomicity of oxygen

$= 1 \times 6.02 \times 10^{23} \times 11$

$= 6.62 \times 10^{24}$ atoms.

Q.80 During combustion analysis water absorbed by $Mg(ClO_4)_2$.

Q.81 Number of atoms for each can be calculated as;

a) $n = \frac{m}{M} = \frac{7}{24} = 0.291 \Rightarrow N = n \times N_A \Rightarrow 0.291 \times N_A$

b) $n = \frac{m}{M} = \frac{8}{23} = 0.347 \Rightarrow N = n \times N_A \Rightarrow 0.347 \times N_A$

c) $n = \frac{m}{M} = \frac{9}{27} = 0.333 \Rightarrow N = n \times N_A \Rightarrow 0.333 \times N_A$

8g Na has highest number of moles so it will contain more atoms than others.

Q.82

$$\%\text{of Nitrogen} = \frac{\text{Mass of Nitrogen}}{\text{Molar mass of compound}} \times 100$$

a) $\%\text{of Nitrogen} = \frac{14}{30} = \frac{14}{30} \times 100 = 46.6\%$

b) $\%\text{of Nitrogen} = \frac{14}{46} = \frac{14}{46} \times 100 = 30.4\%$

c) $\%\text{of Nitrogen} = \frac{28}{44} = \frac{14}{22} \times 100 = 63.63\%$

d) $\%\text{of Nitrogen} = \frac{28}{108} = \frac{14}{54} \times 100 = 25.9\%$

Denominator of (c) option (N_2O) is smallest so it will have highest % of nitrogen.

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Q.83 $2H_2 + 1O_2 \rightarrow 2H_2O$

H_2 : O_2

$2\ cm^3$: $1\ cm^3$

According to balance chemical equation $1cm^3$ O_2 will use $2\ cm^3$ H_2 so $10\ cm^3$ will use $20\ cm^3$ H_2.

So, total volume consumed = $30cm^3$

Q.84 1 kg ice = 1000g ice

$$\text{mole "n"} = \frac{\text{mass of ice}}{\text{Molar mass of ice}} = \frac{1000}{18} = 55.5\,\text{moles}$$

Q.85 Two laws should be obeyed during stoichiometric calculations. i.e. law of conservation of mass and law of definite proportion.

Q.86 Efficiency of chemical reaction expressed by %age yield

$$\%\text{ age yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$

Q.87 Least no. of moles carrying substance will have least No. of atoms

a) $10g\ N_2$ $n = \frac{m}{M} = \frac{10}{28}$ mol

b) $10g\ H_2$ $n = \frac{m}{M} = \frac{10}{2}$ mol

c) $10g\ O_2$ $n = \frac{m}{M} = \frac{10}{32}$ mol

In case of oxygen denominator is larger than other. So, it will have least no. of moles and atoms.

Q.88 Empirical formula of $C_6H_{12}O_6$ is CH_2O

Q.89 1 amu = 1.66×10^{-27} kg = 1.66×10^{-24} g = 1.66×10^{-21}mg

Q.90 In H_2O molecule there are two covalent bonds.

Q.91

- Heterogeneous molecule is known as compound. NH_3 is heterogeneous molecule.
- Therefore, it is molecular compound.
- Homogeneous molecule is known as an element.

Q.92

- It does not tell us about the conditions of a chemical reaction.
- It can be return for those reactions which are practically not feasible.
- It does not tell us about rate of reaction.

These are the limitations of stoichiometric equations.

Q.93 a.m.u is unit used to expressed the relative atomic mass which $1/12^{th}$ of the mass of one carbon atom.

Q.94

Na	:	O
74.2	:	25.8
$\frac{74.2}{23}$	:	$\frac{25.8}{16}$
3.2	:	1.6
$\frac{3.2}{1.6}$	:	$\frac{1.6}{1.6}$
2	:	1
E.F	=	Na_2O

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Q.95

$$\%age\ yield = \frac{Actual\ yield}{Theoratical\ yield} \times 100$$

$$Actual\ yield = \frac{\%age\ yield \times theoratical\ yield}{100}$$

$$= \frac{75 \times 30}{100} = \frac{225}{10} = 22.5g$$

Q.96

NH_3 : N_2

2 mol : 1 mol

4 mol : x mol

cross multiply

$2x = 4$

$x = 2$ mol

Q.97

Al : O_2

4 : 3

Cross multiply

$4x = 3$

$x = \frac{3}{4}$ mole

$4x = n \times mol.mass$

$= \frac{3}{4} \times 32$

$= 24g$

Q.98 $n = \frac{m}{M}$

Number of moles of ${}_6C^{12} = \frac{12}{12} = 1$

Q.99 Number of moles of $CO_2 = \frac{22}{44} = 0.5$ mol

Number of moles of $H_2O = \frac{9}{18} = 0.5$ mol

Therefore, CO_2 and H_2O have same number of molecules ($n \times N_A$)

Q.100 E.F = CH_2O = E.F mass = 30 $gmol^{-1}$, Molar mass =60g mol^{-1}

$$n = \frac{M.F\ mass}{E.F\ mass} = \frac{60}{30} = 2$$

M.F = n(E.F), $2(CH_2O) = C_2H_4O_2$

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Q.101 The amount of products that is actually produced during a chemical reaction is known as actual yield or experimental yield.

Q.102

$$\text{moles of C} = \frac{3}{12} = \frac{1}{4}\ \text{mol}$$

One mole of carbon produces one mole of CO_2

$$\text{No. of molecules of } CO_2 = n \times N_A$$

$$= \frac{1}{4} \times 6.02 \times 10^{23}$$

$$= 1.505 \times 10^{23} \text{ molecules}$$

Q.103

H	:	C
1	:	12
	=	$\frac{1}{12}$

Q.104 Avogadro's constant is the number of atoms in one mole of an element.

Q.105 Atomic weight of an elements is represented by atomic mass unit (a.m.u).

Q.106 Limiting reactant is that reactant which is consumed earlier than others in chemical reaction.

Q.107 One mole of ethanol and one mole of ethane have equal number of molecules ($n \times N_A$).

Q.108 For determination of empirical formula first of all %age composition of each element is to be determined.

Q.109 32g O_2 present in = 1 mole of CO_2

16g O_2 = "x" mole of CO_2

Cross Multiply

$32x = 16$

$$x = \frac{16}{32} = 0.5 \text{ moles}$$

Q.110

$$\%\text{age of C} = \frac{12}{44} \times 100$$

$$= 27.27\%$$

$$\%\text{age of } O_2 = \frac{32}{44} \times 100$$

$$= 72.72\%$$

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Q.111

	P	:	O
%	56.4	:	43.6
Grams atom	$=\frac{56.4}{31}$	:	$\frac{43.6}{16}$
	=1.81	:	2.7
Simplest ratio	$=\frac{1.81}{1.81}$	:	$\frac{2.7}{1.81}$
	= 1	:	1.50
Whole No. ratio	=1×2	:	1.50×2
	$=P_2$	:	O_3
Empirical formula	$=P_2O_3$		

Q.112

C – 12 is used as a standard to determine the atomic mass of an element.

Q.113

The average weight of atoms of an element compared to the weight of one atom of carbon is called atomic weight.

Q.114

The same moles of H_2, N_2 and O_2 are present in 0.1 cc volume at STP. So, number of moles are equals of H_2, N_2 and O_2.

Q.115

$$\textit{Moles of water} = \frac{10g}{18gmol^{-1}} = 0.55mol$$

$$\textit{No. of molecules of water} = 0.55\times6.02\times10^{23} = 3.34\times10^{23}$$

The same moles of H_2, N_2 and O_2 are present in 0.1 cc volume at STP. Which one gas has greatest number of molecules

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Q.116

The efficiency of chemical reaction can be expressed as percentage yield.

Q.117

1 mol. of any substance contains 6.02×10^{23} particles

Q.118

$$2H_2 + O_2 \longrightarrow 2H_2O$$

According to balance chemical equation, oxygen required 10 moles of hydrogen to react completely to form water so hydrogen is limiting reactant.

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Q.119

$$2KClO_{3(s)} + heat \longrightarrow 2KCl_{(s)} + 3O_{2(g)}$$

According to balance chemical equation

2 moles $KClO_3$ gives moles of O_2 = 3

1 moles $KClO_3$ gives moles of O_2 = $\frac{3}{2}$

12 moles $KClO_3$ gives moles of O_2 = $\frac{3}{2} \times 12$

= 18 moles

Q.120

Moles of $NaCl$ = $\frac{117}{58.5} = 2$ mol.

Formula units of $NaCl = 2 \times 6.02 \times 10^{23}$

$= 1.2 \times 10^{24}$

Q.121

	Na^+	Mg^{+2}	Al^{+3}
No. of electrons	10	10	10
Electronic Configuration	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$
Shell No.	2	2	2
No. of Protons	11	12	13

So, No. of protons are different

Q.122

Balance chemical equation is,

$$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$

According to balance chemical equation,

$1dm^3$ C_2H_4 required oxygen = $3dm^3$

$500dm^3$ C_2H_4 required oxygen = 3×500

= $1500\ dm^3$

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Q.123

The chemical formula of calcium chloride is $CaCl_2$

Q.124

		C	H	O
%	=	40	6.67	53.3
Grams atom	=	$\frac{40}{12}$	$\frac{6.67}{1.008}$	$\frac{53.3}{16}$
	=	3.33	6.61	3.33
Ratio	=	$\frac{3.33}{3.33}$	$\frac{6.61}{3.33}$	$\frac{3.33}{3.33}$
	=	1	2	1

So, Empirical Formula is CH_2O

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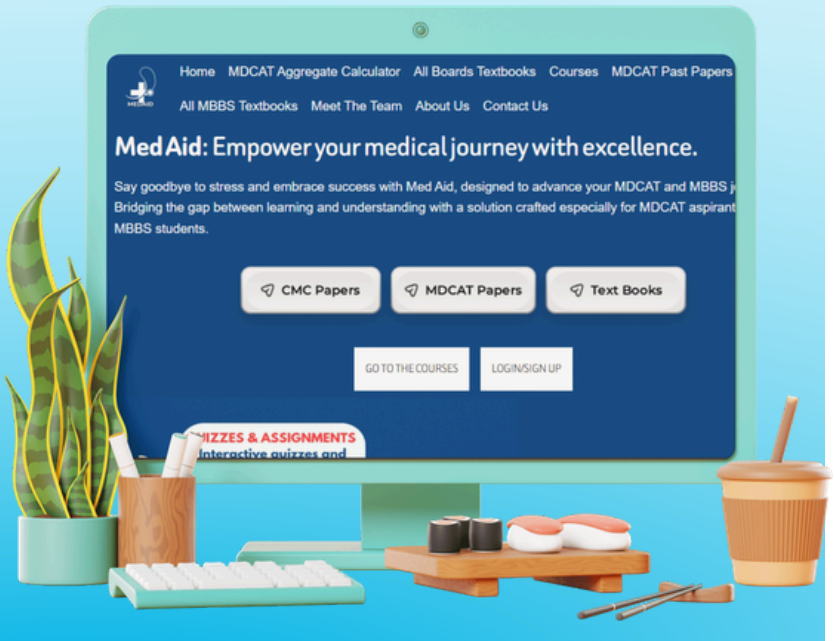

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Q.125

Balance chemical equation is

$CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$

No. of moles of $CS_2 = \frac{7.6}{76} = 0.1$

No. of moles of $O_2 = \frac{12.8}{32} = 0.4$

According to balance chemical equation,

CS_2 required oxygen to complete reaction is equal to $= 0.1 \times 3 = 0.3$

According to balance chemical equation,

Oxygen required CS_2 to complete reaction $= 0.4 \times 1 = 0.4$

So, CS_2 limiting reactant

Q.126

Substance is pure gives maximum yield .

Q.127

As balance chemical equation is,

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

From balance chemical equation = $CH_4 : O_2$

Given and required = 16g 64g

3200 x

$16g\ x = 64 \times 3200g$

$x = \frac{64 \times 3200}{16} = 12800g$

$x = \frac{12800}{1000} = 12.8kg$

Q.128

$PV = nRT$

$0.83 \times 30.57 = n \times 8.314 \times 328$

$\frac{0.83 \times 30.57}{8.314 \times 328} = n$

$\frac{2537.31}{2726.992} = n$

So,

$n = 0.94$

Q.129

According to balanced equation,

(2 A + B → Product.)

A is limiting reactant

Q.130

Mass of S in 98g H_2SO_4=32g

Mass of S in 1g H_2SO_4=$\frac{32}{98}$ g

Mass of S in 24.5g $H_2SO_4 = \frac{32}{98} \times 24.5 = 7.9g$

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Q.131

The balance chemical equation is

$(N_2 + 3H_2 \rightleftharpoons 2NH_3)$

		N_2	:	NH_3
According to balance chemical equation	=	1		2
Given and required	=	2.5		x

$x = 2.5 \times 2$

$= 5$

Q.132

The type and relative amount of each isotope in an element can be found by Mass spectroscopy.

Q.133

The atomic masses of element depend upon Number of isotopes & their abundance.

Q.134

Number of moles in an element is directly proportional to mass of an element.

Q.135 Balance chemical equation is,

$C_3H_8 + 5O_2 \rightarrow 3O_2 + 4H_2O$

		C_3H_8	:	O_2
Acording to balance chemical equation	=	1		5
Given and required	=	2		x

$x = 2 \times 5$

$= 10$

Q.136

$$\%\text{yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$

$$60 = \frac{15}{\text{Theoretical yield}} \times 100$$

$$\text{Theoretical yield} = \frac{15}{60} \times 100 = 25$$

Theoretical yield $= 25g$

Q.137

No. of atoms of $= 2 \times 6.02 \times 10^{23} \times 3$

$= 3.6 \times 10^{24}$ atoms

Q.138

Balance chemical equation is,

$2Al_2O_3 \longrightarrow 4Al + 3O_2$

According to balance chemical equation mole ratio of Al to O_2 is 4:3

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Q.139 Balance chemical equation is

$$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$$

According to balance chemical equation = $N_2 : NH_3 = 1 : 2$

Given and required = $x : 8$

$$2x = 8$$

$$x = \frac{8}{2} = 4$$

Q.140

$$\text{No. of hydrogen gas} = \frac{1\text{g}}{2\text{ g mol}^{-1}}$$

$$= 0.5\text{mole}$$

Q.141

$$\% \text{ of carbon} = \frac{12}{44} \times 100$$

$$= 27.27\%$$

$$\% \text{ of Oxygen} = \frac{32}{44} \times 100$$

$$= 72.72\%$$

Q.142

$$\frac{\text{Volume of 32g oxygen}}{10} = \frac{22.414\text{dm}^3}{10}$$

$$\text{Volume of 3.2 g oxygen} = 2.2414\text{dm}^3$$

Q.143 Oxygen elements cannot be detected directly in a given organic compound?

Q.144 Moles of NaOH $= \frac{240g}{40\text{gmol}^{-1}} = 6$ mol.

Q.145 Balance chemical equation is

$$CuCO_3 \longrightarrow CuO + CO_2$$

According to balance chemical equation = $CuCO_3 : CO_2 = 124 : 80$

Given and required = $24.8 : x$

$$124x = 80 \times 24.8$$

$$x = \frac{80 \times 24.8}{124} = 16$$

$$\% \text{ yield} = \frac{13.9}{16} \times 100 = 86.87\%$$

Q.146 Efficiency of chemical reaction can be checked by calculating Percentage yield

Q.147 Actual yield will reach the ideal (theoretical) value if the % yield of the reaction is 100%

Q.148 The mass of 1 mole $CaCO_3 = 100$g

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Q.149 The balance chemical equation is

$$ZnCO_3 \longrightarrow ZnO + CO_2$$

According to balance chemical equation

Moles of $CO_2 = 10$

Mass of 10 moles of $CO_2 = 10 \times 44$

$= 440g$

Q.150 Balance chemical equation is

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

		HCl	:	*NaCl*
According to balance chemical equation	=	36.5	:	58.5
Given and required	=	16.5	:	x

$$36.5x = 58.5 \times 16.5$$

$$x = \frac{58.5 \times 16.5}{36.5} = 26.44g$$

Moles of NaCl $= \frac{26.44}{58.5} = 0.454$mol.

Q.151 The balance chemical equation

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

		Al	:	Al_2O_3
According to balance chemical equation	=	108	:	204
Given and required	=	18.5	:	x

$$108x = 204 \times 18.5$$

$$x = \frac{204 \times 18.5}{108} = 34.9g$$

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Q.152 Stoichiometry is the study of Quantitative relationship between reactant and products in a chemical reaction by using a balanced chemical equation.

Q.153 Isotopes differ from each other on the basis of Mass number.

Q.154 In a chemical reaction, a limiting reactant is that, which is not in excess.

Q.155 Carbon atom is used to measure relative atomic mass.

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Topic 2 ATOMIC STRUCTURE

PRACTICE EXERCISE

Q.1 Which of the following has the lowest e/m value?
A. Cathode rays
B. H_2^+ rays
C. Neutron rays
D. He^{+2}

Q.2 The ratio of energy and the frequency of photon is equals to:
A. 6.626×10^{-34} Js
B. 2.178×10^{-18} J
C. 9.108×10^{-31}Kg
D. $2.188 \times 10^{6}ms^{-1}$

Q.3 Angstrom is the unit of:
A. Time
B. Length
C. Mass
D. Frequency

Q.4 Electronic configuration of F^- resembles with:
A. He
B. Ne
C. Ar
D. Kr

Q.5 Which of the following orbital is spherically symmetrical?
A. s-orbital
B. p-orbital
C. d-orbital
D. f-orbital

Q.6 Number of nodes in 2s orbital:
A. 0
B. 1
C. 2
D. 3

Q.7 Number of lobes in $2dz^2$
A. 2
B. 4
C. 6
D. 10

Q.8 Order of energy of subshells was given by:
A. n + *l* rule
B. Pauli's exclusion principle
C. Hund's rule
D. Both n + *l* and Aufbau principle

Q.9 Triply degenerate orbitals are:
A. p-orbitals
B. d-orbitals
C. f-orbitals
D. s-orbitals

Q.10 Magnetic quantum number is also known as:
A. Angular quantum number
B. Orientation quantum number
C. Both
D. None

Q.11 The mass of proton is:
A. 9.1095×10^{-31} kg
B. 1.602×10^{-19} kg
C. 1.6726×10^{-27} kg
D. 1.6750×10^{-27} kg

Q.12 What will be the effect on proton when passes through the electric field?
A. Deflection towards anode
B. Deflection perpendicular to electric field
C. Deflection towards cathode
D. Deflection downwards in electric field

Q.13 Positive rays are produced:
A. By burning of gas
B. By cooling of the gas
C. By the bombardment of cathode rays on gas molecules
D. From anode like cathode rays, produced from cathode

Q.14 Pressure in a gas discharge tube was kept:
A. 10 torr
B. 1 torr
C. 0.1 torr
D. 0.01 torr

Q.15 Positive rays give flash on:
A. $AgNO_3$ plate
B. AgCl plate
C. ZnO
D. ZnS

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Q.16 The relationship between energy of a photon of light and its frequency is given by:
A. de-Broglie dual nature of matter
B. Bohr's model
C. Planck's Quantum theory
D. Rutherford's atomic model

Q.17 The velocity of the photon:
A. Is independent of wavelength
B. Depends upon source
C. Depends upon its frequency
D. Equals to the square of amplitude

Q.18 Plank's theory says energy is emitted:
A. In continuous manner
B. In discontinuous manner
C. Simultaneously
D. In the form of heat

Q.19 Planck's equation is:
A. $E = mc^2$
B. $mvr = nh/2\pi$
C. $E = h\upsilon$
D. $\lambda = h/mv$

Q.20 Quantum number which is not derived from Schrodinger wave equation:
A. Principal
B. Azimuthal
C. Magnetic
D. Spin

Q.21 A nodal plane in an orbital is the plane where electron density is:
A. Maximum
B. Zero
C. Infinity
D. Minimum

Q.22 The number of degenerate orbitals in a sub-shell having sausage shape/double dumble are:
A. 1
B. 3
C. 5
D. 7

Q.23 Quantum number values for 3p orbital are:
A. $n = 3, l = 0$
B. $n = 3, l = 1$
C. $n = 2, l = 1$
D. $n = 2, l = 3$

Q.24 Maximum number of electrons that can be accommodated in p-subshell:
A. 2
B. 6
C. 10
D. 14

Q.25 Which sub-shell has highest energy?
A. $n=5, l=3, m=+1$
B. $n=5, l=2, m=+2$
C. $n=4, l=3, m=0$
D. $n=4, l=0, m=+1$

Q.26 Magnetic quantum number values for the d subshell are:
A. 2
B. 3
C. 5
D. 7

Q.27 A p-orbital has _____ energy than the s-orbital of same principal quantum number.
A. Lower
B. Higher
C. Equal
D. Variable orbit to orbit

Q.28 Which set of quantum number represents 29th electron of Cu atom?
A. $n = 4, \ell = 0, m = 0, s = +\frac{1}{2}$
B. $n = 3, \ell = 2, m = 0, s = +\frac{1}{2}$
C. $n = 4, \ell = 1, m = 0, s = +\frac{1}{2}$
D. $n = 3, \ell = 0, m = 0, s = +\frac{1}{2}$

Q.29 The d-orbital which is bi-lobed with collar is represented as:
A. d_{xy}
B. d_{yz}
C. d_{z^2}
D. $d_{x^2-y^2}$

Q.30 _____ is/are isoelectronic with K^+.
A. P^{-3}
B. Si^{-4}
C. S^{-2}
D. All of these

Q.31 The atomic number of an element is 26. How many electrons are present in M-Shell of this element in ground state?
A. 11
B. 14
C. 15
D. 16

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Q.32 The electronic configuration of an element is $1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$. This represents a/an:

A. Ground state
B. Excited state
C. Hybridized state
D. Molecular state

Q.33 The correct electronic configuration of $_{29}Cu$ is:

A. $[Ar], 4s^2, 3d_{xy}^2, 3d_{xz}^2, 3d_{xz}^2, 3d_{x^2-y^2}^2, 3d_{z^2}^1$
B. $[Ar], 4s^1, 3d_{xz}^2, 3d_{yz}^2, 3d_{xz}^2, 3d_{x^2-y^2}^2, 3d_{z^2}^2$
C. $[Ar], 4s^1, 3d_{xz}^2, 3d_{yz}^2, 3d_{xz}^2, 3d_{x^2-y^2}^2, 3d_{z^2}^1$
D. $[Ar], 4s^1, 3d_{xz}^2, 3d_{yz}^2, 3d_{xz}^2, 3d_{x^2-y^2}^1, 3d_{z^2}^1$

Q.34 Which one of the following ions has similar electronic configuration like Ar?

A. Sc^{+2}
B. Ti^{+4}
C. Cr^{+2}
D. Mn^{+6}

Q.35 In electronic configuration of Cu and Cr, which of following is true?

A. 3d is full filled
B. 3d is half filled
C. 7 electrons in s-orbitals
D. 8 electrons in s-orbitals

Q.36 Which of the following violates Hund's rule?

A. $1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$
B. $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^1$
C. $1s^2, 2s^1$
D. $1s^2, 2s^2, 2p_x^2, 2p_y^0, 2p_z^0$

Q.37 Which one of the following represents most stable configuration of three electrons for ground state of an element in group VA?

A. np_x^2, np_y^1, np_z^0
B. np_x^1, np_y^1, np_z^1
C. np_x^2, np_y^0, np_z^1
D. np_x^0, np_y^1, np_z^2

Q.38 Which one of following electronic configuration represents an element that will form a simple ion with -3 charge?

A. $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$
B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$
C. $1s^2, 2s^2, 2p^6, 3s^1$
D. $1s^2, 2s^2, 2p^1$

Q.39 A specie Z has following electronic configuration $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^2, 3s^2, 3p_x^2, 3p_y^1, 3p_z^1$ What could Z be?

A. Ar
B. Cl
C. S
D. P^3

Q.40 The total number of lobes in all the orbitals of a d-subshell are:

A. 2
B. 16
C. 4
D. 18

Q.41 "Two electrons in the same orbital should have opposite spins" according to:

A. Aufbau's principle
B. Pauli's exclusion rule
C. Hund's rule
D. $(n+l)$ rule

Q.42 Which of following configuration is not correct according to Hund's rule?

A. [↑↓] [↑ | ↑ | ↑]
B. [↑↓] [↑ | ↑ |]
C. [↑↓] [↑ | ↓ | ↑]
D. [↑↓] [↑↓ | ↑↓ | ↑]

Q.43 The e/m value for the canal rays is maximum for.

A. Hydrogen
B. Nitrogen
C. Helium
D. Argon

Q.44 Correct order of energy in the given sub-shells is:

A. 5s > 3d > 3p > 4s
B. 3p > 3d > 5s > 4s
C. 5s > 3d > 4s > 3p
D. 3p > 3d > 4s > 5s

Q.45 Maximum number of electrons in a sub-shell is given by

A. $2(2l-1)$
B. $2(2l+1)$
C. $2(l+1)$
D. $2l+1$

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Topic 2 ATOMIC STRUCTURE

PAST PAPER MCQ'S

Q.46 Which quantum number tells us about orientation of orbitals? MDCAT (2010)
A. Principal quantum number
B. Spin quantum number
C. Azimuthal quantum number
D. Magnetic quantum number

Q.47 The relative energies of 4s, 4p and 3d orbitals are in the order: MDCAT (2012)
A. 3d < 4p < 4s
B. 4p < 4s < 3d
C. 4s < 3d < 4p
D. 4p < 3d < 4s

Q.48 With increase in the value of principal quantum number "n", the shape of the s orbitals remains same although their sizes: MDCAT (2012)
A. Decrease
B. Remain the same
C. Increase
D. May or may not remain the same

Q.49 Number of electrons in the outermost shell of chloride ion(Cl^-) is: MDCAT (2013)
A. 17
B. 1
C. 7
D. 8

Q.50 Correct order of energy in the given sub-shells is: MDCAT (2013)
A. 5s > 3d > 3p > 4s
B. 3p > 3d > 5s > 4s
C. 5s > 3d > 4s > 3p
D. 3p > 3d > 4s > 5s

Q.51 According to the number of protons, neutrons and electrons given in the table, which one of the following options is correct? MDCAT (2014)

Species	Proton	Neutron	Electron
As	33	42	30
Ga	31	39	28
Ca	20	20	20

A. As^{+3}, Ga^{+3}, Ca
B. $As^{+3}, Ga^{+3}, Ca^{+2}$
C. As^{+3}, Ga^{+2}, Ca
D. As^{+3}, Ga, Ca^{+2}

Q.52 There are four orbitals s, p, d and f. Which order is correct with respect to the increasing energy of the orbitals? MDCAT (2015)
A. 4s < 4p < 4d < 4f
B. 4s < 4f < 4p < 4d
C. 4p < 4s < 4f < 4d
D. 4f < 4s < 4d < 4p

Q.53 Which one of the following pairs has the same electronic configuration as possessed by neon (Ne-10)? MDCAT (2015)
A. Na^+, Cl^-
B. Na^+, Mg^+
C. K^+, Cl^-
D. Na^+, F^-

Q.54 Number of neutrons in $^{66}_{30}Zn$ will be: MDCAT (2016)
A. 30
B. 38
C. 35
D. 36

Q.55 The maximum number of electrons in electronic configuration can be calculated by using formula: MDCAT (2016)
A. 2*l*+1
B. $2n^2$
C. $2n^2+2$
D. $2n^2+1$

Q.56 Number of electrons in $^{71}_{31}Ga^{3+}$ will be MDCAT (2017)
A. 28
B. 30
C. 29
D. 34

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Q.57 Isotopic symbol of ion of Sulphur–33 is $^{33}_{16}S^{-2}$ How many numbers of protons and neutrons are present if number of electrons are 18? MDCAT (2017)

A. P = 18, n = 15 B. P = 16, n = 18
C. P = 16, n = 17 D. P = 17, n = 16

Q.58 Among the following, which contains same no. of electrons & proton but different no. of neutron: MDCAT (2017)

A. Isobars B. Isotones
C. Isotopes D. None of the these

Q.59 Identify the correct option associated with the shape of p-orbital: MDCAT (2017)

A. 
B. 
C. 
D. 

Q.60 Which is the correct electronic configuration of chromium ($_{24}Cr$)? MDCAT (2018)

A. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^4$ B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$
C. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6$ D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^6$

Q.61 Maximum numbers of electron in a sub-shell is given by: NUMS (2019)

A. $2(2l-1)$ B. $2(2l+1)$
C. $2(l+1)$ D. $2l+1$

Q.62 The order of energy level in $_{19}K$ is: NUMS (2019)

A. 4s, 4p B. 4s, 3d
C. 3p, 4s D. 3s, 3d

Q.63 Which of the following element in its atomic state has electrons fully occupying first two spherically symmetrical orbitals? SET (2019)

A. Oxygen B. Helium
C. Beryllium D. Carbon

Q.64 What are the values of principal quantum number and azimuthal quantum number for the last electron in chlorine atom? ETEA (2016)

A. 1, 6 B. 1, 3
C. 3, 1 D. 6, 1

Q.65 Which of the following electronic configuration is / are correct? ETEA (2016)

(i) $_{29}Cu = 1s^2 2s^2 3p^6, 3s^1$ (ii) $_{29}Cu = [Ar]4s^1 3d^{10}$
(iii) $_{24}Cr = [Ar]4S^1 3d^{10}$ (iv) $_{24}Cr = [Ar]4S^2 3d^4$

A. (i) only B. (ii) only
C. (i) and (ii) only D. (ii) and (iii) only

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Q.66 Quantum number which describes the orientation of orbitals in three dimensional space is: ETEA (2019)
A. Spin quantum number
B. Azimuthal quantum number
C. Magnetic quantum number
D. Principal quantum number

Q.67 Which of the following is the electronic configuration of Cr? MDCAT (2019)
A. $[Ar], 3d^5, 4s^2$
B. $[Ar], 3d^4, 4s^2$
C. $[Ar], 3d^6, 4s^0$
D. $[Ar], 3d^5, 4s^1$

Q.68 The relationship between quantum number n and ℓ is: NMDCAT (2020)
A. $n = \ell - 1$
B. $\ell = n-2$
C. $\ell = n-1$
D. $n = \ell - 2$

Q.69 Quantum number values for "2p" orbitals are: NMDCAT (2020)
A. $n=2\ \ell=1$
B. $n=1\ \ell=2$
C. $n=1\ \ell=0$
D. $n=2\ \ell=0$

Q.70 Which pair has 1 electron in its outer most 's' orbital? NMDCAT (2020)
A. Li & Fe
B. Na & Cr
C. K & Mn
D. H & He

Q.71 Which of the following has the lowest e/m ratio? NMDCAT (2020)
A. Li^{2+}
B. H^{+1}
C. He^{+}
D. Be

Q.72 M-shell contain: PMC (2021)
A. s
B. s, p, d
C. s, p, d, f
D. s, p

Q.73 Total no. of electrons that can be accommodated in f-subshell: PMC (2021)
A. 6
B. 14
C. 10
D. 18

Q.74 $n+l$ value for 5d is: PMC (2021)
A. 5
B. 6
C. 7
D. 8

Q.75 Each electron in an atom must have its own unique set of quantum number is a statement of _____. PMC (2021)
A. Aufbau principle
B. Hand's rule
C. Pauli exclusion principle
D. None of these

Q.76 According to which scientist, the probability of finding an electron at a certain position is possible? UHS (2022)
A. Bohr
B. Hund
C. de-Broglie
D. Schrodinger

Q.77 Which gas in the discharge tube produces lightest canal rays particles? UHS (2022)
A: Ar
B. H_2
C. He
D. Ne

Q.78 Which element has the ground state electronic configuration of $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$ UHS (2022)
A. Ar
B. Na
C. Cl
D. S

Q.79 What is the proton (Atomic Number) of an element that has four unpaired electrons in its ground state? UHS (2022)
A. 6
B. 22
C. 14
D. 26

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Q.80 Principal quantum number is represented by the symbol: SZABMU (2022)
A. m B. n
C. s D. *l*

Q.81 Shape of the sub shell is explained by which quantum number: SZABMU (2022)
A. Principal quantum number B. Azimuthal quantum number
C. Magnetic quantum number D. Spin quantum number

Q.82 The electronic configuration for degenerated orbitals is explained by: SZABMU (2022)
A. Aufbau's Principle B. (n + 1) rule
C. Hund's rule D. Pauli's exclusion principle

Q.83 Maximum number of electrons which can be placed in one orbital is: SZABMU (2022)
A. 1 B. 2
C. 3 D. 5

Q.84 Greater the wavelength associated with the photon: ETEA (2022)
A. Greater is its energy B. Smaller is its energy
C. Its energy will be variable D. Its energy will remains constant

Q.85 Photon of which of the following series will have largest wavelength? ETEA (2022)
A. Bracket series B. Pfund series
C. Balmer series D. Paschan series

Q.86 The equation $\bar{\upsilon} = R_h\left[\frac{1}{2^2} - \frac{1}{n^2}\right]$ where n > 2 is the equation of H-spectrum for: DUHS (2022)
A. Pashen series B. Pfund series
C. Bracket series D. Lyman series
E. Balmar series

Q.87 The quantum number allows following orbitals in N-shell. DUHS (2022)
A. s - orbital B. s, p, d & f orbital
C. s & p orbital D. All options correct

Q.88 If four balloons are filled with different gases, which gas containing balloon will delate first? BMU (2022)
A. Helium B. Oxygen
C. Hydrogen D. Nitrogen

Q.89 Which concept was introduced by the scientist Bohr? BMU (2022)
A. Energy levels B. Orbitals
C. Sub-orbits D. Sub-energy levels

Q.90 What is the electronic configuration of C? BMU (2022)
A. $1s^2,2s^2,2p^2$ B. $1s^2,2s^2,2p^4$
C. $1s^2,2s^2,2p^6,3s^2$ D. $1s^2,2s^2,2p^6,3s^2,3p^3$

Q.91 Why do electrons have opposite spins. When they are in the same orbital? BMU (2022)
A. This condition reduces friction
B. This condition creates more energy
C. This condition results in zero magnetism and removes the charge of the electron
D. This condition results in less repulsion and opposite magnetic fields

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Q.92 With the increase in the value of principal quantum number "n" the size of the s-orbitals? BMU (2022)

A. Decrease B. Increase
C. May or may not remain the same D. Remain the same

Q.93 Maximum electrons that can be placed in p subshell are: NUMS (2022)

A. 2 B. 10
C. 6 D. 14

Q.94 Apply (n+*l*) rule and calculate which of the following orbital has maximum energy? NUMS (2022)

A. 4s B. 2d
C. 2p D. 3s

Q.95 The mass of electron is: NUMS (2022)

A. 1836 times more than mass of proton
B. 1836 times less than mass of proton
C. 1836 times more than mass of neutron
D. 1836 time more than mass of hydrogen atom

Q.96 The shape of an orbital is determined by which quantum number? NUMS (2022)

A. n B. m
C. *l* D. s

Q.97 Proton number of $_{11}Na^{23}$ is: NUMS (2022)

A. 23 B. 12
C. 11 D. 34

Q.98 The electronic configuration for degenerate orbitals is explained by:

A. Aufbau's Principle B. (n + *l*) Rule
C. Hund's Rule D. Pauli's Exclusion Principle

Q.99 What is the proton (Atomic Number) of an element that has four unpaired electrons in its ground state? UHS (2023)

A. 6 B. 22
C. 14 D. 26

Q.100 When 6d orbital is filled, the entering electron goes into? UHS (2023)

A. 7f B. 7d
C. 7p D. 7s

Q.101 Which of the following orbital will be filled first than 4p? SZABMU (2023)

A. 4s B. 2p
C. 3d D. 1s

Q.102 If value of azimuthal quantum number is 1 then value of m will range from: SZABMU (2023)

A. -1 to 1 B. -1 to 2
C. -1 to 3 D. -1 to 4

Q.103 The dumbbell like orbitals can move in how many directions? SZABMU (2023)

A. 7 B. 5
C. 1 D. 3

Q.104 The relationship between quantum number n and *l* is: SZABMU (2023)

A. n = *l*-1 B. *l* = n-2
C. *l* = n-1 D. n = *l*-2

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Q.105 The number of orientations of a sub-shell for which n = 4 and l = 3 will be: ETEA (2023)

A. 5
B. 3
C. 7
D. 1

Q.106 Photon of the lowest wavelength is related to: ETEA (2023)

A. Balmer series
B. Pfund series
C. Bracket series
D. Paschen series

Q.107 The maximum e/m ratio for positive rays is obtained when the discharge tube contains: ETEA (2023)

A. He
B. N_2
C. Ne
D. H_2

Q.108 The correct sequence of electronic configuration is: ETEA (2023)

A. 4p 5s 4d 5p 6s 4f 5d
B. 4p 4s 4d 5p 6s 4f 6d
C. 4p 4s 4d 5p 5s 4f 5d
D. 4p 3s 4d 5p 6s 4f 5d

Q.109 Radius of first orbit of hydrogen is 0.53Å. Which orbit has a radius of 4.77Å? DUHS (2023)

A. First
B. Second
C. Third
D. Fourth

Q.110 Which of the following has only one orientation in space, in the magnetic field? DUHS (2023)

A. p orbital
B. s orbital
C. d orbital
D. f orbital

Q.111 What's the mass of one proton? DUHS (2023)

A. Equal to 1836 electron
B. Equal to positron
C. Equal to electron
D. Equal to 1836 neutron

Q.112 What is the quantum number for the unpaired electron of chlorin atom (n, l, m)? BUMHS (2023)

A. 2.1.0
B. 2.1.1
C. 3.1.1
D. 3.0.0

Q.113 Which statement about a 4d orbital is correct? BUMHS (2023)

A. It is at a higher energy level than a 4p orbital but has the same shape
B. It is occupied by one electron in an isolated Zn atom
C. It can hold a maximum of 10 electrons
D. It has highest energy of orbitals with principal quantum number four

Q.114 Which of the following is not true about canal rays? BUMHS (2023)

A. 1.6726×10^{-27} kg
B. 9.54×10^{7} C/kg
C. Show deflection under electric & magnetic fields
D. Do not cause mechanical motion

Q.115 Why do electrons have opposite spins when they are in the same orbital? BUMHS (2023)

A. This condition reduces friction
B. This condition creates more energy
C. This condition results in zero magnetism and removes the charge of the electron
D. This condition results in less repulsion and opposite magnetic fields

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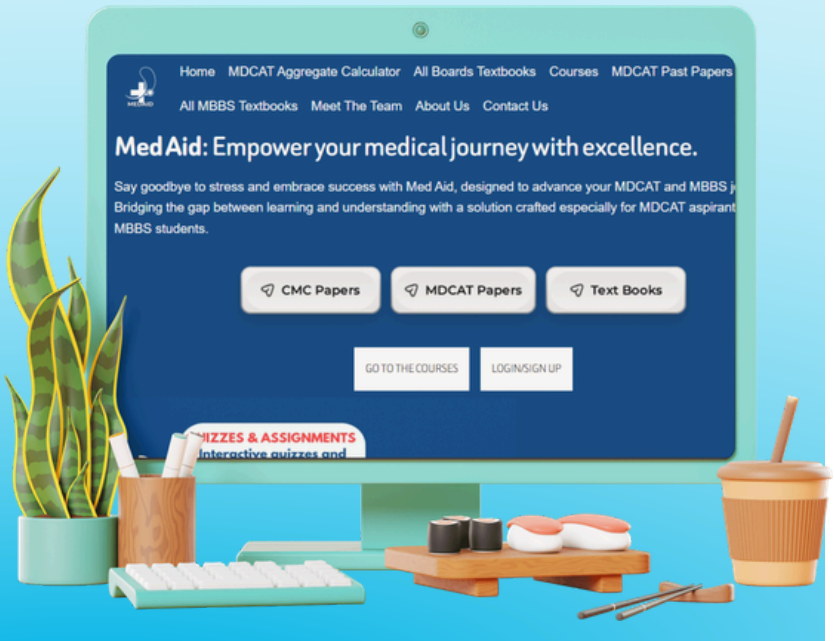

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Q.116 The amount of energy associated with quantum of radiation of directly proportional to: NUMS (2023)

A. Photon
B. Wavelength
C. Frequency
D. Velocity

Q.117 If value of azimuthal quantum number is 2 then total values of magnetic quantum number will be: NUMS (2023)

A. 03
B. 05
C. 07
D. 10

Q.118 Total number of directions of f-orbitals in space are: NUMS (2023)

A. 05
B. 03
C. 07
D. 06

Q.119 Which of the following quantum number is not obtained from Schrodinger Wave equation? NUMS (2023)

A. Principal Quantum Number
B. Spin Quantum Number
C. Azimuthal Quantum Number
D. Magnetic Quantum Number

Q.120 The electronic configuration for degenerate orbitals is explained by: NUMS (2023)

A. Aufbau Principle
B. n + l rule
C. Hund's rule
D. Pauli exclusion principle

Q.121 The p orbital has UHS (2024)

A. 2 lobes
B. 3 lobes
C. 4 lobes
D. 5 lobes

Q.122 Which of the following electronic configuration is correct for carbon? UHS (2024)

A. $1s^2 2s^2 2p^3$
B. $1s^2 2s^2 2p^4$
C. $1s^2 2s^2 2p^2$
D. $1s^2 2s^2 2p^1$

Q.123 The e/m ratio of proton is _____ that of an electron. SZABMU (2024)

A. 1837 times greater than
B. Equal to
C. Greater than
D. Smaller than

Q.124 How many electrons will be accommodated in sub-shell with Azimuthal quantum number $\ell = 2$? SZABMU (2024)

A. 2
B. 6
C. 10
D. 12

Q.125 Which of the following element will show electronic configuration of outermost shell like ns^2, np^5? SZABMU (2024)

A. C
B. Cl
C. S
D. Si

Q.126 Electronic configuration of $_{23}Na^{11}$ is (Deleted) SZABMU-RC (2024)

A. $[Ne]3s^1$
B. $[Ne]3s^2$
C. $[Ne]3s^0$
D. $[Ne]3s^2 3p$

Q.127 Which of the following sub-shell does not exist? ETEA (2024)

A. 1p
B. 1s
C. 5d
D. 6f

Q.128 The splitting of spectral lines in magnetic field is ETEA (2024)

A. Auf-Bau principle
B. Pauli's exclusion principle
C. Stark effect
D. Zeeman effect

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Q.129 "In an orbital of an atom, no two electrons can have the same set of four quantum numbers, at least one quantum number must be different." This statement is: DUHS (2024)

A. Aufbau principle
B. Pauli's exclusion principle
C. Hund's rule
D. Wiswesser rule

Q.130 Maximum number of electrons in a given sub-shell are calculated by: (Wrong) DUHS (2024)

A. n^2
B. $2(n+1)$
C. $2n^2$
D. $2l+1$

Q.131 The neutron was discovered by (Out of syllabus) DUHS (2024)

A. Max Planck
B. Chadwick
C. J.J. Thomson
D. Goldstein

Q.132 The charge of electron is: DUHS (2024)

A. $1.602 \times 10^{-16}C$
B. $1.602 \times 10^{-19}C$
C. $1.602 \times 10^{-17}C$
D. $1.602 \times 10^{-18}C$

Q.133 Which statement is not correct for cathode rays? BMU (2024)

A. Cathode rays consist of moving material particles
B. Cathode rays have definite velocity
C. Cathode rays have definite velocity
D. Cathode rays travel with the velocity of light

Q.134 An electron in an atom is completely describe by its _____ quantum numbers BMU (2024)

A. Eight
B. Six
C. Five
D. Four

Q.135 One picometer (pm) = ? BMU (2024)

A. 10^{-6} m
B. 10^{-8} m
C. 10^{-10} m
D. 10^{-12} m

Q.136 The only group of lines occurring in the visible region of the hydrogen spectrum is labelled as the BMU (2024)

A. Paschen series
B. Pfund series
C. Balmer series
D. Lyman series

Q.137 Select the correct one NUMS (2024)

A. Only electrons of atoms get shuffled during chemical reaction
B. All the sub-atomic particles of an atom take part in chemical reaction
C. Protons of an atom spearhead chemical reaction
D. Protons and neutrons of an atom collectively make chemical reactions possible

Q.138 The value of "l" for 4p orbital is: NUMS (2024)

A. 0
B. 1
C. 2
D. 3

Q.139 The element having the electronic configuration of noble gas notation (Kr) $5s^2 4d^6$ is: NUMS (2024)

A. $_{38}Sr$
B. $_{44}Ru$
C. $_{46}Pd$
D. $_{40}Zr$

Q.140 Choose the allowed sets of quantum numbers from the following: NUMS (2024)

A. n = 3, l = 2, m = 0, s = + 1/2
B. n = 3, l = 3, m = 0, s = - 1/2
C. n = 4, l = 3, m = 4, s = + 1/2
D. n = 4, l = 2, m = 4, s = -1/2

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ANSWER KEY

PRACTICE EXERCISE

1	D	11	C	21	B	31	B	41	B
2	A	12	C	22	C	32	A	42	C
3	B	13	C	23	B	33	B	43	A
4	B	14	D	24	B	34	B	44	C
5	A	15	D	25	A	35	C	45	B
6	B	16	C	26	C	36	D		
7	A	17	A	27	B	37	B		
8	A	18	B	28	A	38	B		
9	A	19	C	29	C	39	C		
10	B	20	D	30	D	40	D		

PAST PAPER MCQ'S

46	D	56	A	66	C	76	D	86	B	96	C	106	A	116	C	126	A	136	C
47	C	57	C	67	D	77	B	87	B	97	C	107	D	117	B	127	A	137	A
48	C	58	C	68	C	78	A	88	C	98	C	108	A	118	C	128	D	138	B
49	D	59	C	69	A	79	D	89	A	99	C	109	C	119	B	129	B	139	B
50	C	60	B	70	B	80	B	90	A	100	C	110	B	120	C	130	D	140	A
51	A	61	B	71	D	81	B	91	D	101	A	111	A	121	A	131	B		
52	A	62	C	72	B	82	C	92	B	102	A	112	C	122	C	132	B		
53	D	63	C	73	B	83	B	93	C	103	C	113	C	123	D	133	D		
54	D	64	C	74	C	84	B	94	A	104	C	114	D	124	C	134	D		
55	B	65	B	75	C	85	B	95	B	105	C	115	D	125	B	135	D		

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EXPLANATORY NOTES

Q.11 Mass of proton is 1.6726×10^{-27} kg.

Q.12 Protons are positively charged particles which show deflection towards cathode in electric field.

Q.13 Positive rays are produced by bombardment of cathode rays on gas molecules in dischage tube.

Q.14 At low pressure (0.01 torr) there is large spaces between gas molecules and there will be less hinderance for cathode rays to travel from cathode to anode.

Q.15 Positive rays produce flashes upon ZnS plate.

Q.16 According to Planck's quantum theory, $E \alpha \nu$ or $E = h\nu$ or $E = \frac{hc}{\lambda}$ or $E = hc\bar{\nu}$

Q.17 Velocity of photon is independent of wavelength $c = \nu \times \lambda$
Product of frequency and wavelength remains constant quantity because of inverse relationship between frequency and wavelength.

Q.18 According to Planck's quantum theory, there is no continuous emission or absorption of energy.

Q.19 Different forms of Planck's theory are,
$E = h\nu$ or $E = hc\bar{\nu}$ or $E = hc/\lambda$

Q.20 Quantum number which is not derived from Schrodinger wave equation is spin quantum number. It was given by Uhlenbeck and Goudsmith.

Q.21 Nodal plane is the area where the probability of finding of electron is zero

Q.22 d-subshell has five degenerate orbitals with sausage shape or doubly dumb-bell.



Q.23 For 3p subshell quantum number values are $n = 3$; $\ell = 1$

Azimuthal Q. number	Sub-shell	Shapes
$\ell = 0$	s-subshell	Spherical
$\ell = 1$	p-subshell	dumb-bell
$\ell = 2$	d-subshell	double dumb-bell or sausage
$\ell = 3$	f-subshell	complicated

Q.24 Number of electrons in a subshell $= 2(2\ell + 1)$

Sub-shell	Value of ℓ	Electrons
s	$\ell = 0$	2
p	$\ell = 1$	6
d	$\ell = 2$	10
f	$\ell = 3$	14

Q.25 Energy of subshell $\propto (n+\ell)$
$1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p < 6s < 4f$

Q.26 For d-subshell, $\ell = 2$ so,
$d_{xy}(m = -2)$, $d_{yz}(m = -1)$, $d_{zx}(m = +1)$, $d_{x^2-y^2}(m = +2)$ and $d_{z^2}(m = 0)$.

Q.27 Energy of subshell $\propto (n + \ell)$,
Energy order $s < p < d < f$

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Q.28 Copper $_{29}[Ar]4s^1 3d^2_{xy} 3d^2_{yz} 3d^2_{xz} 3d^2_{x^2-y^2} 3d^2_{z^2}$ so set of quantum number values is
$n = 4,\ \ell = 0,\ m = 0,\ s = +1/2$

Q.29 dz^2 orbital is bi-lobed with a collar.



Q.30 $_{19}K^{+1} \rightarrow$ 18 electrons, $_{15}P^{-3} \rightarrow$ 18 electrons, $_{16}S^{-2} \rightarrow$ 18 electrons, $_{14}Si^{-4} \rightarrow$ 18 electrons

Q.31 M shell = 3rd shell, by given configuration, $3s \rightarrow 2e^{-1}$, $3p \rightarrow 6e^{-1}$, $3d \rightarrow 6e^{-1}$
$_{26}Fe = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^6$
So, number of electrons in M shell are 14.

Q.32 This configuration represents ground state electronic configuration of nitrogen atom

Q.33 Electronic configuration of $_{29}Cu = [Ar]\ 4s^1, 3d^{10}$

Q.34 $Ar \rightarrow$ 18 electrons, $Ti^{+4} \rightarrow$ (22-4)18 electrons, so both are iso-electronic

Q.35 $_{24}Cr = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$
$_{29}Cu = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$
Both have seven electrons in s-subshll

Q.36 In degenerate orbitals, electrons go one by one with same spin rather than to go same orbital with opposite spin.

Q.37 Half-filled and completely filled orbitals are relatively more stable than partially filled orbitals.

Q.38 $_{15}P = 1s^2, 2s^2, 2p^6, 3s^2, 3p^3$, Phosphorous has 5-electrons in valance shell. To complete its octet, it needs 3 electrons

Q.39 In neutral atom, atomic number is the number of electrons around the nucleus, "Z" has 16 electrons, so atomic number is 16 that is for sulphur. $_{16}S = {}_{10}[Ne]3s^2 3p^2_x 3p^1_y 3p^1_z$

Q.40 Each d-orbital has four lobes except dz^2 which has two lobes with collar, so
Number of lobes in d subshell = $(4 \times 4) + 2 = 18$.



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Q.41 According to Pauli's exclusion principle, it is impossible for two electrons residing in the same orbital of poly-electron atom to have same values of four quantum numbers.

Q.42 If more than one degenerate orbitals are available then electrons go one by one with same spin

Q.43 The value of e/m of positive rays is inversely proportional to molar mass of gas. Hydrogen has least mass so has highest e/m value.

Q.44 Energy of subshell is directly proportional to (n + l) value, if (n + l) value for two orbitals is same then energy depends upon "n" value. Greater the value of "n" greater will be the energy of subshell/orbital.

Q.45 No. of orbitals in a subshell = (2l +1)
No. of electrons in a subshell = 2(2l +1)

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.46 Magnetic quantum number explains orientation and degeneracy of orbitals. So, it is called as orientation quantum number.

Q.47 Energy of subshell is directly proportional to (n + l) value, if (n + l) value for two orbitals is same then energy depends upon "n" value. Greater the value of "n" greater the energy (4s = 4 + 0 = 4), (4p = 4 + 1 = 5), (3d = 3 + 2 = 5).

Q.48 With increase in the value of principal quantum number "n", the size and energy of orbitals increases.

Q.49 Cl atom has 7 electrons in valance shell and Cl^{-1} has 8 electrons in the valance shell.

Q.50 By using (n+ l) rule (5s = 5 + 0 = 5), (3d = 3 + 2 = 5), (3p = 3 + 1 = 4) and (4s = 4 + 0 = 4) so the correct order is 5s > 3d > 4s > 3p.

Q.51 In neutral atom, No. of electrons are always equal to No. of protons.

- If "As" has 33 protons and 30 electrons then it means "As" loses 3 electrons, so it will carry +3 charge (As^{+3}).
- If "Ga" has 31 protons and 28 electrons then it means "Ga" loses 3 electrons, so it will carry +3 charge (Ga^{+3}).
- If "Ca" has 20 protons and 20 electrons then it means "Ca" does not lose any electron, so it will carry no net charge (Ca^{0}).

Q.52 By using (n+ l) rule (4s = 4 + 0 = 4), (4p = 4 + 1 = 5), (4d = 4 + 2 = 6) and (4f = 4 + 3 = 7) so the correct order is 4s < 4p < 4d < 4f.

Q.53 Electronic configuration of Neon is $1s^2, 2s^2, 2p^6$
Na = $1s^2, 2s^2, 2p^6, 3s^1$ and $Na^{+1} = 1s^2, 2s^2, 2p^6, 3s^0$
F = $1s^2, 2s^2, 2p^5$ and $F^{-1} = 1s^2, 2s^2, 2p^6$

Q.54 No. of neutrons can be find out by using formula,
N = A – Z = 66 – 30 = 36

Q.55 Maximum No. of electrons in a shell can be find out by using $2n^2$ formula. For example, if n = 3 then $2(3)^2 = 18$ electrons.

Q.56 Atomic number of Ga has 31 electrons, it means Ga has 31 protons and 31 electrons but in +3 oxidation state it loses 3 electrons, so Ga^{+3} has 28 electrons.

Q.57 $^{33}_{16}S^{-2}$ has 18 electrons. Atomic No. of Sulphur is 16, so it has 16 protons.
No. of neutrons = A – Z = 33 – 16 = 17 N.

Q.58 Isotopes having same atomic number and different atomic mass.
Isobar having same atomic mass and different atomic number.
Isotones having same number of neutron.

Q.59 p-orbital has dumb-bell shape.

Q.60 $_{24}Cr = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$

Q.61 No. of electrons in a subshell = 2(2l +1).

Q.62 $_{19}K = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$

Q.63 Spherically symmetrical orbitals means s-subshell. So, $_4Be = 1s^2, 2s^2$.

Q.64 $_{17}Cl = 1s^2, 2s^2, 2p^6, 3s^2, 3p^5$, last electron of Cl atom present in 3p, so value of principal quantum number is 3 and data azimuthal quantum number is 1.

Q.65 $_{24}Cr = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$ and $_{29}Cu = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$ in given options, $_{29}Cu$ is correct one.

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Q.66 Magnetic quantum number explains the orientation of orbitals in three-dimensional space.

Q.67 $_{24}Cr = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$

Q.68 Azimuthal quantum no. $l = n-1$
If $n = 1, 2, 3, 4, \ldots$ Then $l = 0, 1, 2, 3, \ldots$

Q.69 Quantum No. values for 2p-orbitals are $n = 2, l = 1$.

Q.70 $Na = 1s^2, 2s^2, 2p^6, 3s^1$ and $_{24}Cr = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$

Q.71 Greater the mass, lesser the e/m value charge is directly proportional to e/m value and mass inversely proportional to e/m value.

Q.72 M-shell is third shell ($n = 3$) which contains three subshell s, p and d.

Q.73 Number of electrons in subshell $= 2(2l+1)$
Number of electrons in f-subshell $=2(2(3)+1) =2(7)= 14\ \bar{e}s$.

Q.74 $n + l$ value for $5d = 5+2 = 7$.

Q.75 According to Pauli's exclusion principle each electron in an atom must have its on unique set of quantum numbers.

Q.76 According to Schrodinger's the probability of finding an electron at certain position is possible.

Q.77 H_2 is lightest gas among given options and have minimum mass with maximum e/m value for positive rays.

Q.78 $_{18}Ar = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

Q.79 $_{26}Fe = [Ar]$ 4s: [⇅] 3d: [⇅ | ↑ | ↑ | ↑ | ↑]

Q.80 Principal quantum number is represented by n.

Q.81 Azimuthal quantum number explains the shapes of sub-shells.

Q.82 Hund's rule is used to explain electronic configuration for degenerate orbitals.

Q.83 Maximum number of electrons which can be placed in an orbital of any subshell are two.

Q.84 $E = \frac{hc}{\lambda}$, wavelength of photon is inversely proportional to the energy.

Q.85 Pfund series lie I.R region.

Q.86 For balmer series $n_1 = 2$ and $n_2 = 3, 4, 5, 6 \ldots\ldots \infty$.

Q.87 N-shell is fourth shell ($n = 4$), therefore, it contains s, p, d and f subshells.

Q.88 Hydrogen is lightest gas among given options.

Q.89 Bohr's introduce the term orbit which is known as energy levels.

Q.90 $_6C^{12} = 1s^2, 2s^2, 2p^2$

Q.91 Electrons in same orbital have opposite spin due to less repulsion and opposite magnetic field

Q.92 Size of orbital $\propto$ value of n

Q.93 Number of electrons in subshell $= 2(2l + 1)$
Number of electrons in p-subshell $=2(2(1) + 1) =2(3)= 6$

Q.94 Energy of subshell $\propto (n + l)$ value

Q.95 The mass of electron is 1836 times less than mass of proton.

Q.96 Azimuthal quantum number (l) explain the shapes of orbitals.

Q.97 Proton number is also called atomic number. The proton number of sodium is 11.

Q.98 Hund's rule is applicable to explain electronic configuration for degenerate orbital.

Q.99 $_{26}Fe = [Ar]$ 4s: [↑] 3d: [↑ | ↑ | ↑ | ↑ | ↑]

Q.100 According to $(n+l)$ rule, 7p comes after 6d.

Q.101 According to $(n+l)$ rule, 4p has $n+l = 4 +1 =5$ and $45 = n + l =4 + 0 = 4$
If an orbital has lower $(n + l)$ value comes before.

Q.102 For $l = 1$ $m = -1, o, + 1$.

Q.103 p-orbital has dumb-bell shape it has three space orientations.

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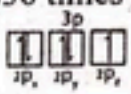
Q.104 $l = n - 1$ (maximum value of l).
Q.105 The number of orientations of 4f subshell is given by $2l + 1 = 2(3) + 1 = 7$.
Q.106 Lowest wavelength is for Lyman then Balmer then upto so on.
Q.107 $\frac{e}{m}$ value is inversely proportional to mass.
Q.108 According to $(n + l)$ rule, correct sequence is $4p < 5s < 4d < 5p < 6s < 4f < 5d$
Q.109 $r_n = 0.53Å \times n_2$, $r_3 = 0.53\ Å \times 9 = 4.77\ Å$.
Q.110 s = orbital has only one space orientation.
Q.111 Mass of a proton is 1836 times the mass of electron.
Q.112 $Cl = 1s^2, 2s^2, 2p^6, 3s^2,$  for $3p_z$, $n = 3$, $l = 1$, $m = +1$.
Q.113 d-orbital contain maximum ten electrons.
Q.114 Canal rays can cause mechanical motion like cathode rays.
Q.115 Electrons in same orbital have opposite spin due to less repulsion and opposite magnetic field.
Q.116 According to Planck equation $E = h\upsilon$ and $E \propto \upsilon$.
Q.117 For $l = 2$, $m = 0, \pm 1, \pm 2$.
Q.118 f-orbital has seven space orientations.
Q.119 Spin quantum number is not obtained from Schrodinger wave equation.
Q.120 Hund's rule explains electronic configuration of degenerate orbitals.
Q.121 A p-orbital has two lobes 
Q.122 $_6C = 1s^2, 2s^2, 2p^2$
Q.123 $\frac{e}{m}$ value is directly proportional to charge, inversely proportional to mass.
Q.124 Electrons $= 2(2l+1) = 2\ [2(2)+1] = 10$ electrons.
Q.125 ns^2, np^5 shows general electronic configuration of VII-A. That has seven valance electrons.
Q.126 $^{23}_{11}Na = 2s^2, 2s^2, 2p^6, 3s^1$ or $[Ne]3s^1$
Q.127 In 1p, $n = 1$ and $l = 1$ and $\neq l$, K-shall only contain s-subshell.
Q.128 According to Zeeman effect when excited atom of hydrogen is placed in magnetic field spectral lines seems to be splitted into close lines.
Q.129 According to Pauli's exclusion principal in the same orbital of a poly-electron atom for two electrons residing in the same orbital of a poly-electron atom to have the same value of four quantum numbers.
Q.130 The correct answer is not given. The number of electrons in a subshell can be calculated by using the given formula. **Number of electron is a subshell = 2 (2l + l)**
Q.131 Neutrons were discovered by Chadwick in 1932.
Q.132 Charge on electron is 1.6022×10^{-19} C
Q.133 Cathode rays, which are streams of electrons, do travel at a speed close to but less than speed of light.
Q.134 An electron in an atom is completely described by its four quantum numbers.
Q.135 1 pm = 10^{-12}m.
Q.136 Balmer series lies in visible region of spectrum.
Q.137 During a chemical reaction only electrons are shuffled.
Q.138 For 4p, $n = 4$, $l = 1$ for p-subshell.
Q.139 $_{44}Ru = [K_r]5s^2, 4d^6$
Q.140 $n > l$, $n \neq l$, $l \geq m$.

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Topic 3 GASES

PAST PAPER MCQ'S

Q.51 All the collisions between the particles of gases are elastic in nature. What is meant by "Elastic Collisions"? MDCAT (2019)

A. The velocity of the molecules changes
B. No change in mass during the collisions
C. No change in the kinetic energy (no change in total energy)
D. No change in potential energy during the Collisions

Q.52 Which one of the following expressions represent the Avogadro law? MDCAT (2010)

A. V= RnT/P (When T and n are constant)
B. V= RnT/P (When T and P are constant)
C. V= RnT/P (When P and n are constant)
D. V= RP/nT (When T, P and n are constant)

Q.53 The root mean square velocity of gases is inversely proportional to square root of their: MDCAT (2010)

A. Temperature
B. Pressure
C. Molar mass
D. Volume

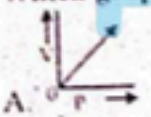
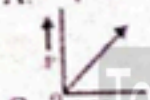
Q.54 The number of molecules in 22.4 dm^3 of H_2 gas at 0°C and 1 atm are: MDCAT (2012)

A. 60.2×10^{23}
B. 6.02×10^{25}
C. 6.02×10^{23}
D. 6.02×10^{22}

Q.55 There are four gases H_2, He, N_2 and CO_2 at 0°C. Which gas shows greater non-ideal behavior? MDCAT (2013)

A. He
B. H_2
C. CO_2
D. N_2

Q.56 Which graph represents Boyle's law? MDCAT (2015)

A. 
B. 
C. 
D. 

Q.57 Identify the value of R at STP. MDCAT (2017)

A. 8.314 atm dm^{-3} mol^{-1}
B. 0.0821 atm dm^3 K^{-1} mol^{-1}
C. 0.0821 cal K^{-1} mol^{-1}
D. 8.314 cal K^{-1} mol^{-1}

Q.58 In the equation $\left(P + \frac{n^2a}{V^2}\right)(V - nb) = RT$, 'b' represents the: MDCAT (2017)

A. Excluded volume
B. Actual volume
C. Excluded pressure
D. Excluded volume per mole

Q.59 Gas is enclosed in a container of 20 cm^3 with the moving piston. According to kinetic theory of gases, what is the effect on freely moving molecules of the gas if temperature is increased from 20°C to 100°C? MDCAT (2018)

A. Colliding capability of molecule will become lower
B. Pressure will become one half
C. Temperature has no effect on freely moving molecules
D. Volume will be increased

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Q.60 Which of the following is the correct equation to calculate relative molecular mass of a gas? MDCAT (2018)

A. $M = mPRT/V$ B. $M = mPR/VT$
C. $M = PV/mRT$ D. $M = mRT/PV$

Q.61 Which of the statement is applicable for both ideal and real gases molecules? SET (2019)

A. Have no forces of attraction
B. Collisions between the molecules is elastic
C. Molecules are in random movement
D. The actual volume of gas is negligible as compared to the volume of gas

Q.62 At absolute zero the molecules of hydrogen gas will have: ETEA (2016)

A. Only translational motion B. Only vibrational motion
C. Only rotational motion D. All the motion are ceased

Q.63 According to the general gas equation, density of an ideal gas depends upon: NMDCAT (2020)

A. Pressure B. Temperature
C. Molar mass of the gas D. All of the above

Q.64 The actual volume of gas molecules is considered negligible at following pressures. NMDCAT (2020)

A. 2 atm B. 4 atm
C. 6 atm D. 8 atm

Q.65 PV/nRT for an ideal gas is called: PMC (2021)

A. Expansion factor B. Depression factor
C. Compressibility factor D. Diffusion factor

Q.66 212 degree Fahrenheit is expressed in Kelvin as: PMC (2021)

A. 373 B. 273
C. 173 D. 0

Q.67 When temperature increases, isotherm moves? PMC (2021)

A. Away from both axis B. Toward x axis
C. Toward y axis D. Remains at same position

Q.68 General gas equation is also known as: PMC (2021)

A. Vander walls equation B. Ideal gas equation
C. Non-ideal gas equation D. Vant-hoff equation

Q.69 A gaseous mixture contains 9.6% NH_3, 22.6% N_2 and 67.8% H_2 gases. If the total pressure is 50atm, then the partial pressure of H_2 is: UHS (2022)

A. $67.8 \times 100/50$ B. $50 \times 100/100$
C. $67.8 \times 50/100$ D. $67.8 + 50/100$

Q.70 If we want to raise the temperature of one mole of an ideal gas by 1K, we have to provide how much amount of energy? UHS (2022)

A. 0.0821J B. 0.0821Kj
C. $8.314 dm^3$ atm D. $0.0821 dm^3$ atm

Q.71 The process of heat flow between hotter and colder gases remains continued until all the molecules have equal: UHS (2022)

A. Average translational K.E B. Average rotational K.E
C. Average translational P.E D. Average vibrational K.E

Q.72 Air is a mixture of gases. The molecules of air do not settle down due to: SZABMU (2022)

A. Different molar mass B. Non polar nature of gases
C. Presence of dust particles in air D. Elastic collision of gas molecules

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.73 **Collision shown by gases involve the following:** SZABMU (202

A. No energy change
B. No pressure change
C. Small energy change
D. Large energy change

.74 **According to Charles law volume of gas reduce to zero at:** SZABMU (202

A. -12°C
B. -0°C
C. -273.15°C
D. -210°C

Q.75 **Which of the following shows marked deviation from ideal behaviour at a given temperature and pressure?** ETEA (202

A. CO_2
B. He
C. N_2
D. H_2

Q.76 **The kinetic molecular theory of gases explains:** DUHS (202

A. Mass number
B. Atoms number
C. The behavior of gases
D. Electron
E. Neutrons

Q.77 **The comparison of rate of diffusion of H_2 & O_2 is in the ratio of:** DUHS (202

A. 2:1
B. 1:4
C. 3:2
D. 4:1
E. 1:2

Q.78 **Gases deviate from ideal behavior more:** DUHS (202

A. Gases do not deviate from ideal behavior
B. Both temperature & pressure low
C. Both temperature & pressure high
D. At high pressure & low temperature
E. At low pressure & high temperature

Q.79 **Ideal gas equation helps to calculate the following property of ideal gas except:** BMU (202

A. Pressure
B. Density
C. Moles
D. Molarity

Q.80 **The volume of a given mass of a gas according to Charle's law should be zero at:** BMU (202

A. -273°C
B. 273°C
C. 100°C
D. 25°C

Q.81 **Which of the following represents equation for ideal gas?** NUMS (202

A. PV=nRT
B. P=nRT
C. PT=nRv
D. T=npv/R

Q.82 **How should the condition be changed to prevent the value of a given gas fro expanding when its mass is increased?** NUMS (202

A. Temperature is lowered & pressure is increased
B. Temperature is increased & pressure is lowered
C. Temperature & pressure both are lowered
D. Temperature & pressure both are increased

Q.83 **Which variable mentioned in ideal gas is assumed to be constant in other gas laws?** NUMS (202

A. Volume
B. Pressure
C. Temperature
D. Number of moles

Q.84 **Which of the following molecules will show a higher rate of evaporation?** NUMS (202

A. Acetone
B. Water
C. Ethanol
D. Ethylene glycol

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Q.85 Which one of the following gases has the lowest density under room conditions? UHS (2023)

A. Neon
B. Nitrogen
C. Oxygen
D. Fluorine

Q.86 The process of heat flow between hotter and colder gases remains continued until all the molecules have equal: UHS (2023)

A. Average translational kinetic energy
B. Average rotational kinetic energy
C. Average translational potential energy
D. Average vibrational kinetic energy

Q.87 Intermolecular forces between molecules of ideal gas are: SZABMU (2023)

A. Very strong
B. Very weak
C. Zero
D. Moderately strong

Q.88 The real gases show deviation from ideal behaviour at: SZABMU (2023)

A. Low temperature and low-pressure
B. High temperature and high pressure
C. Low temperature and high-pressure
D. High temperature and low pressure

Q.89 1 atm of pressure is equal to all of the following except: ETEA (2023)

A. 760 cm Hg
B. 760 mm Hg
C. 760 torr
D. 101325 Pa

Q.90 The volume of a given mass of an ideal gas at certain pressure is x at constant temperature. What will be its volume when the pressure is reduced to half? ETEA (2023)

A. $\frac{8}{2}$
B. 2x
C. 4x
D. $\frac{2}{4}$

Q.91 Graph of volume versus total pressure at constant temperature is: DUHS (2023)

A. A straight-line
B. First a curve and then a straight line
C. First a straight line & then a curve line
D. Non-linear

Q.92 1 atm of nitrogen is at 25°C, its pressure has increased to 2 atm at 50°C. Volume will change from 1dm³ to: DUHS (2023)

A. 0.542 dm^3
B. 2 dm^3
C. 3 dm^3
D. 4 dm^3

Q.93 Which of the following temperatures is referred to as the absolute zero? DUHS (2023)

A. -273.16 °C
B. -273.16 K
C. 0 °C
D. 32 °F

Q.94 A set of postulates that explain the behavior of ideal gases is called: BUMHS (2023)

A. Bohr theory
B. Kinetic molecular theory of gases
C. Rutherford theory
D. Dalton's theory

Q.95 Air at sea level is dense. This is practical application of. BUMHS (2023)

A. Boyle's law
B. Charle's law
C. Avogadro's law
D. Dalton's law

Q.96 The idea that molecules in gases are in constant movement is called: NUMS (2023)

A. Kinetic theory of gases
B. Crystal field theory
C. Molecular orbital theory
D. Transition state theory

Q.97 The SI unit for pressure is: NUMS (2023)

A. mm of Hg
B. Pascal
C. Bar
D. Torr

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Q.98 If both temperature and volume of gas are doubled, the pressure: NUMS (2023)
A. Cannot be predicted
B. Is reduced to 1/2
C. Remains unchanged
D. Is doubled

Q.99 Intermolecular forces between molecules of ideal gas are: UHS (2024)
A. Strong
B. Moderate
C. Weak
D. Absent

Q.100 The correct ideal gas equation is: UHS (2024)
A. qV=nRT
B. PV=nRT
C. gV=nRT
D. yV=nRT

Q.101 The real gases show deviation from ideal behaviour at: UHS (2024)
A. Low temperature and low pressure
B. High temperature and high pressure
C. Low temperature and high pressure
D. High temperature and low pressure

Q.102 Which of the following law helps to calculate the absolute temperature? SZABMU (2024)
A. Avogadro's Law
B. Boyle's Law
C. Charle's Law
D. Dalton's Law

Q.103 Formula for partial pressure calculation of any component in mixture of gases is_____. (Out of syllabus) SZABMU (2024)
A. Pi = Pt / Xi
B. Pi = Pt + Xi
C. Pi = Pt R
D. Pi = Pt Xi

Q.104 The S.I unit of R in general gas equation is: SZABMU-RC (2024)
A. 8.3143 NmK^{-1} mol^{-1}
B. 0.0821 dm^3 atom $mol^{-1}K^{-1}$
C. 8.3143 J mol^{-1} K^{-1}
D. 0.0821 dm^3 torr $K^{-1}mol^{-1}$

Q.105 $PV = \frac{1}{3}mNc^{-2}$ is called: SZABMU-RC (2024)
A. Ideal gas equation
B. Vander walls equation
C. Kinetic equation
D. Henderson equation

Q.106 When the pressure of a gas is plotted against volume at constant temperature curve obtained is known as: SZABMU-RC (2024)
A. Isobar
B. Isotherm
C. Isochoric
D. Isotonic

Q.107 Which variable mentioned in ideal gas is assumed to be constant in other gas laws? SZABMU-RC (2024)
A. Volume
B. Temperature
C. Pressure
D. Number of moles

Q.108 According to Charle's, at 0K (-273.15°C), the volume of a gas should be: DUHS (2024)
A. -2
B. zero
C. -1
D. + 2

Q.109 Collection of gas over water is an example of: (Out of Syllabus) DUHS (2024)
A. Boyle's law
B. Avogadro's law
C. Dalton's law
D. Graham's law

Q.110 Low atmospheric pressure system is called: (Out of Syllabus) DUHS (2024)
A. Diffusion
B. Depression
C. Effusion
D. Contraction

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Q.111 Inter molecular repulsive forces in gases are due to: BMU (2024)
A. Ionic bonding
B. Vander Waal's forces
C. Dipoles
D. Covalent bonding

Q.112 5 calories are equivalent to joule. BMU (2024)
A. 4.184
B. 10.26
C. 20.92
D. 25.65

Q.113 Which of the following is NOT the state of matter? BMU (2024)
A. Plasma
B. Liquids
C. Gases
D. Ether

Q.114 Conversion of Fahrenheit to Celsius scale by: BMU (2024)
A. °C=5/9(°F+32)
B. °C=9/5(°F-32)
C. °C=5/9(°F-32)
D. °C=9/5(°F+32)

Q.115 The relationship between the absolute temperature and the velocities of the gas molecules is given by: NUMS (2024)
A. $C_{rms}=\sqrt{3RT/M}$
B. PV = nRT
C. $V=\sqrt{2E_k/m}$
D. $PV = 1/3mN\bar{c}^2$

ANSWER KEY

PRACTICE EXERCISE

1	C	11	C	21	C	31	D	41	B
2	A	12	B	22	A	32	A	42	C
3	B	13	C	23	D	33	A	43	D
4	D	14	C	24	A	34	C	44	C
5	C	15	A	25	C	35	D	45	C
6	C	16	A	26	C	36	B	46	A
7	B	17	B	27	B	37	D	47	C
8	C	18	D	28	B	38	D	48	C
9	C	19	C	29	C	39	C	49	D
10	A	20	D	30	D	40	D	50	B

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51	C	61	C	71	A	81	A	91	D	101	C	111	B
52	B	62	D	72	D	82	A	92	A	102	C	112	C
53	C	63	D	73	A	83	D	93	A	103	D	113	D
54	C	64	A	74	C	84	A	94	B	104	A	114	C
55	C	65	C	75	A	85	A	95	A	105	C	115	A
56	C	66	A	76	C	86	A	96	A	106	B		
57	B	67	A	77	D	87	C	97	B	107	D		
58	D	68	B	78	D	88	C	98	C	108	B		
59	D	69	C	79	D	89	A	99	D	109	C		
60	D	70	D	80	A	90	B	100	B	110	C		

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EXPLANATORY NOTES

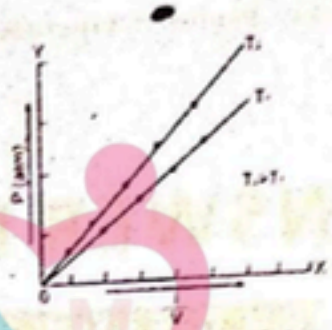
Q.11

$$P_1V_1 = P_2V_2$$
$$1 \times V = 3 \times V_2$$
$$\frac{V}{3} = V_2$$

Q.12

$d = \frac{PM}{RT}$ at low temperature and high-pressure density will be *maximum*.

Q.13



Q.14 The equation to know the volumes of the gas at various temperatures is,

$$V_t = V_o\left(1 + \frac{t°C}{273}\right)$$

Where, V_t = Volume of gas at temperature t.
V_o = Volume of gas at 0°C.
t = Temperature on Celsius scale.

Q.15 A mono-atomic substance can store energy only in the form of translational motion.

Q.16



Q.17 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ If both temperature and volume of a gas are doubled, the pressure remains unchanged because $V \propto 1/P$ and $V \propto T$.

Q.18 All of the following are the form of general gas equation

- $PV = nRT$ (for "n" number of moles)
- $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
- $PV = RT$ (for 1 mole of gas)

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Q.19 According to Charle's law, the volume of the given mass of a gas is directly proportional to the absolute (Kelvin) temperature at constant pressure.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{10}{273} = \frac{30}{T_2}$$

$$T_2 = \frac{30 \times 273}{10}$$

$$T_2 = 819\ K$$

Q.20 Equal volumes of all the ideal gases at same temperature and pressure contain equal number of moles and molecules.

$V \propto n$ (where P and T are constant)

$V = nk$

Both 0.5 mole of NO and 16 g (0.5 mole) O_2 have same number of moles. Therefore, they have equal volume at STP

Q.21 Ideal gas can't be liquefied because there is no intermolecular forces.

Q.22 $E_k \propto T$

$T_1 = 27°c = 300\ K$, $T_2 = 327°c = 600\ K$

When temperature is doubled, K.E becomes double.

Q.23 $R = 8.3143\ Nm.mol^{-1}.K^{-1}$

$1Nm = 10^7\ erg$

Hence, $8.134 \times 10^7\ erg.\ mol^{-1}.K^{-1}$

Q.24 In gases and liquids, temperature is the measure of average translational kinetic energies of molecules.

Q.25 Molar volume is maximum when temperature is high and pressure is low.

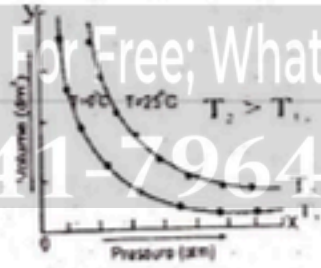
$V \alpha 1/P$ and $V \alpha T$

Q.26 8g of methane (0.5 mole) and 2g of hydrogen (1 mole) will occupy total volume

$1.5\times$ molar volume $= 1.5 \times 22.4 = 33.6\ dm^3$

Q.27 Gases have translational, vibrational and also rotational motion.

Q.28



Q.29 1.01325 Bar = 1 atm

0.101325 Bar = 0.1 atm.

Q.30 P = F / A. Dimensions of the pressure are the same as that of force per unit volume.

Q.31 At high pressure, molecules come closer to each other and inter-molecular attractions become significant.

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Q.32 Ideality of a gas will be more if,
- Less IMF
- Non-polar
- Small size
- Smaller mass
- Small values of 'a' and 'b' (Van der Waal's Constants)

Q.33 According to Charle's law, volume increases with the increase in temperature at constant pressure. ($V \propto T$).

Q.34 The product of PV (pressure volume work) of a gas has unit of work i.e. J (Joule)

Q.35 A real gas behaves like an ideal gas at high temperature and low pressure.

Q.36 Absolute temperature of a gas is directly proportional to average translational K.E

Q.37 An ideal gas can't be liquefied because forces between its molecules are negligible

Q.38 The compressibility factor 'Z' for an ideal gas is equal to one $\left(z = \frac{PV}{nRT} = 1\right)$

Q.39 $R = 0.0821 \text{ atm dm}^3\text{mol}^{-1}\text{K}^{-1}$

Q.40 In a closed container, by increasing temperature there will be no change in the quantity (number of moles) of the gas.

Q.41 A pressure of a gas is due to Molecular impacts against the walls of vessel.

Q.42 $Z = \frac{PV}{RT}$ (for 1 mole of a gas).

Q.43 $C_{rms} = \sqrt{\frac{3RT}{M}}$ or $\sqrt{\frac{3PV}{M}}$ The correct order is $Cl_2 < SO_2 < O_2 < N_2$

Cl_2 as maximum molar mass therefore it has lowest r.m.s velocity.

Q.44 Critical temperature for different gases is different and depends upon size of molecule, shape of molecule and intermolecular attractions.

Q.45
$$P = an^2/V^2$$
$$a = PV^2/n^2$$
$$a = \frac{Nm^{-2} \times (m^3)^2}{(mol)^2}$$
$$a = Nm^{-2}.sm^6.mol^{-2}$$
$$a = Nm^{+4}mol^{-2}$$

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Q.46 The highest temperature at which a substance can exist as a liquid is called its critical temperature.

Q.47 Very very small values of Van der Waal's constant in his equation for a particular gas show that least attractive forces are present among the molecules of the gas.

Q.48 $b = 4 V_m$
Where, V_m is the actual volume of gas molecules.

Q.49 "a" is a constant of proportionality and is called co-efficient of attraction or attraction per unit volume. It has a constant value for a particular real gas. Ammonia has hydrogen bonding (strong IMF).

Q.50 The average kinetic energy of the gas molecules is directly proportional to its absolute temperature.

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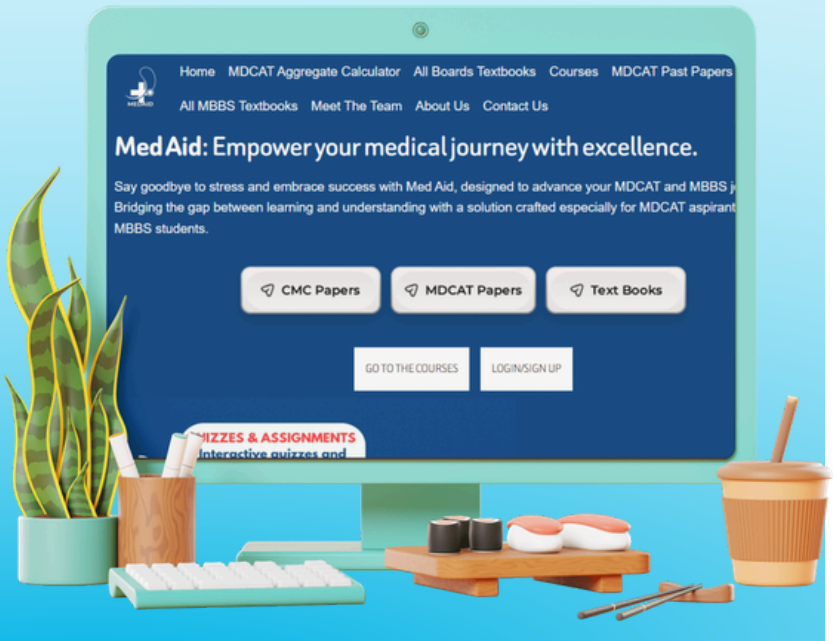

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EXPLANATORY NOTES

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Q.51 When the particles of gas collide, they do not loss or gain any kinetic energy, which means that their total energy do not change so it is elastic collision.

Q.52 $V = RnT/P$

$V = (RT/P)\, n$

$V = (\text{constant})\, n$ (If temperature and pressure are kept constant)

$V \propto n$ (Avogadro's Law)

Q.53

$$C_{rms} = \sqrt{\frac{3RT}{M}}$$

$$C_{rms} \propto \sqrt{\frac{1}{M}}$$

Q.54 At STP one mole hydrogen gas (H_2) has 22.414dm^3 volume and has 6.02×10^{23} molecules.

Q.55 Due to large size of CO_2 molecule, it shows greater intermolecular force and show most non-ideal behavior.

The order of non-ideality is: $He < H_2 < N_2 < CO_2$

Q.56 Following are the different graphs of Boyle's law.



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Q.57 At STP following are the values of R in different units:

0.0821 atm dm^3 K^{-1} mol^{-1}

8.31 Nm K^{-1} mol^{-1}

8.31 J K^{-1} mol^{-1}

7.989 cal K^{-1} mol^{-1}

Q.58 In Van der Waal's equation for real gases, b represents excluded volume per mole.

Q.59 At constant pressure, by increasing temperature, volume of gas increases.

Q.60 The correct formula to calculate the relative molecular mass of a gas is,

$$M = \frac{mRT}{PV}$$

Q.61 The molecules of both ideal and non-ideal gas move randomly.

Q.62 At zero kelvin (absolute zero) molecular motion of gases ceases.

Q.63 Density of a gas depends upon pressure(P), temperature(T), molecular mass(M) and ideal gas constant R.

$$d = \frac{PM}{RT}$$

Q.64 At low pressure, actual volume of gas molecule is negligible.

Q.65 PV/nRT for an ideal gas is called compressibility factor. Compressibility factor for ideal gases is equal to one $\left(z = \frac{PV}{nRT} = 1\right)$.

Q.66

$$\frac{°F-32}{180} = \frac{K-273}{100}$$

$$\frac{212-32}{180} = \frac{K-273}{100}$$

$$\frac{180}{180} = \frac{K-273}{100}$$

$$1 = \frac{K-273}{100}$$

$$100 = K-273$$

$$K = 100+273 = 373$$

Q.67 By increasing temperature volume of gas increases and isotherm moves away from both axis.

Q.68 General gas equation is also known as ideal gas equation because it is applicable for ideal gases.

Q.69

$$P_{H_2} = \frac{\%\text{ of } H_2 \times P_{atm}}{100}$$

$$P_{H_2} = \frac{67.8 \times 50}{100}$$

Q.70 As value of R at STP is 0.0821 atm. $dm^3K^{-1}mol^{-1}$.

Q.71 K.E $\propto$ Temperature

Q.72 Molecule of air do not settle down due to elastic collision of gas molecules.

Q.73 According the KMT collision among gas molecule are perfectly elastic.

Q.74 According to $V_t = V.\left(1+\frac{t°c}{273}\right)$ at absolute zero (–273.15°C) the volume of gas would become zero.

Q.75 Due to larger size of CO_2 and stronger intermolecular forces.

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Q.76 KMT of gases explain the Behaviour of gases.

Q.77
$$\frac{r_{H_2}}{r_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{H_2}}}$$
$$= \sqrt{\frac{32}{2}}$$
$$= \sqrt{\frac{16}{1}}$$
$$r_{H_2} : r_{O_2} = 4:1$$

Q.78 At high pressure and low-pressure force of attraction becomes significant.

Q.79 According to PV = nRT, pressure, density, number of moles can be calculated but molarity can not be calculated from above equation

Q.80 According to $V_t = V_\circ\left(1+\frac{t}{273}\right)$ at absolute zero (–273.15°C) the volume of gas would become zero.

Q.81 PV = nRT is ideal gas equation.

Q.82 $V \propto T$ and $V \propto \frac{1}{P}$

Q.83 Number of moles remains constant for gas laws.

Q.84 Rate of evaporation $\propto \frac{1}{\text{Boiling Point}} \propto \frac{1}{\text{IMF}}$

Q.85 $d = \frac{PM}{RT}$

Order of density of gases

$Ne < N_2 < O_2 < F_2$

Q.86 Heat flow between hotter and colder gases is due to the difference in temperature. The temperature of gasses is due to translational motion. If average translational K.E becomes equal, the temperature equalizes and heat flow stops.

Q.87 Ideal gases have negligible forces of attractions among the gas molecules. (postulate of KMT).

Q.88 Gases show ideal behaviour at low pressure and high temperature, and show non-ideal behaviour at high pressure and low temperature.

Q.89 1atm = 760 mmHg = 76 cmHg = 760 torr = 101325 Pa.

Q.90 Given data $V_1 = X$, $V = ?$, $P_1 = 1$, $P_2 = ½$

Required equation,

$P_1V_1 = P_2V_2$

$$V_2 = \frac{P_1V_1}{P_2} = \frac{1\times X}{1/2} = 2X$$

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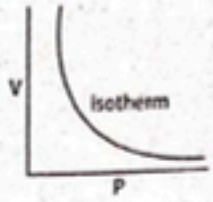
91 Graph of volume on y-axis versus pressure on x-axis at constant temperature is non-linear (curve). This is called isotherm as temperature is constant.



92 Given data,

$P_1 = 1atm$, $P_2 = 2atm$, $V_1 = 1dm_3$, $V_2 = ?$, $T_1 = 25°C + 273 = 298K$, $T_2 = 50°C + 273 = 323K$

Required equation,

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{1\times1}{298K} = \frac{2\times V_2}{323K}$$

$$V_2 = 0.542dm^3$$

Q.93 Absolute zero = 0K = –273.16°C = –459°F.

Q.94 KMT of gases explains the ideal behaviour of gases.

Q.95 At sea level atmospheric pressure is maximum, so air has minimum volume according to Boyle's law ($V \propto 1/P$). and density $\propto \frac{1}{vol.}$.

Q.96 Behaviour of gases is explained by kinetic theory of gases.

Q.97 S.I unit of pressure is pascal (pa).

Q.98 $PV = nRT \Rightarrow P = \frac{nRT}{V} \Rightarrow$ if T becomes 2T then V becomes 2V then

$P = \frac{nR2T}{2V} = P = \frac{nRT}{V}$ remain same.

Q.99 According to postulates of KMT, there are no forces of attractions among gas molecules.

Q.100 Ideal gas equation is PV=nRT.

Q.101 The real gases show deviation from ideal behaviour at low temperature and high pressure.

Q.102 According to Charle's law. $V_t = V_o\left(1+\frac{t}{273}\right)$. So, at –273°C,

$$V_t = V_o\left(1+\frac{-273}{273}\right)$$

$$V_t = V_o(1-1)$$

$$-273 = 0$$

At –273°C volume of gas becomes zero, so, it is absolute zero (derived by using Charle's law).

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Q.103 Partial pressure of a gas in the mixture can be calculated by multiplying mole fraction of that gas with total pressure.

Q.104 Value of R in S.I unit is 8.3143 $NmK^{-1}mol^{-1}$.

Q.105 $PV=\frac{1}{3}mN\overline{C^2}$ is kinetic equation.

Q.106 Isotherm: 'iso' mean same and "therm" means heat. Graph plotted at constant temperature is called isotherm.

Q.107 Number of moles of a gas is constant in gas laws (like Boyle's law and Charles's law).

Q.108 According to $V_t=V_\circ\left(1+\frac{t°c}{273}\right)$ at absolute zero (–273.15°C) the volume of gas would become zero.

Q.109 One of the applications of Dalton's law of partial pressure is to find partial pressure of dry gas which is collected over water.

$P_{moist\ gas}=P_{dry}+$ P water vapours

$P_{moist\ gas}=P_{dry}+$ Aqueous tension

$P_{dry}=P_{moist\ gas}-$ Aqueous tension

Q.110 Intermolecular attractive and repulsive forces are called van der Waals forces.

Q.111 1 Cal = 4. 18 J

5 Cal = 5 × 4.184 = 20.92

Q.112 States of matter are gas, liquid, solid and plasma.

Q.113

°F to °C

$°C=\frac{5}{9}(°F-32)$

Q.114 Root mean square velocity:

$Crms=\sqrt{\frac{3RT}{M}}$

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Topic 4 LIQUIDS

PRACTICE EXERCISE

Q.1 Water has maximum density at _____.
A. 277K
B. 300K
C. 123K
D. 200K

Q.2 Hydrogen bonding is not responsible for the properties of _____.
A. Ice
B. HF
C. DNA
D. HCl

Q.3 Which of the following has lowest vapour pressure at room temperature ?
A. Dimethyl ether
B. Ethanol
C. Water
D. Glycerol

Q.4 Which of the following molecules should be more volatile ?
A. HF
B. HCl
C. HBr
D. HI

Q.5 The boiling point of water at 23.7 torr pressure is _____.
A. 30°C
B. 25°C
C. 98°C
D. 52°C

Q.6 How much times the strength of Hydrogen bonding is less than covalent bond?
A. 5 Times
B. 10 Times
C. 15 Times
D. 20 Times

Q.7 Which relation is correct on the basis strength of intermolecular forces?
A. $CH_3OH > H_2O > HCl$
B. $HCl > H_2O > CH_3OH$
C. $CH_3OH > HCl > H_2O$
D. $H_2O > CH_3OH > HCl$

Q.8 The factor that does not controls the vapour pressure of liquid is _____.
A. Temperature
B. Surface area
C. Intermolecular forces
D. Nature of liquid

Q.9 Which of following do not show hydrogen bonding?
A. Ice
B. HF
C. Ammonia
D. H_2SO_4

Q.10 The volatile behavior should be maximum for _____.
A. HF
B. HBr
C. HCl
D. HI

Q.11 $CHCl_3$ exist in liquid state due to:
A. Dipole-dipole and London dispersion forces
B. Dipole induced dipole forces
C. Dipole–dipole forces
D. Hydrogen bonding

Q.12 The highest boiling point among the following is for:
A. NH_3
B. Br_2
C. $CHCl_3$
D. Xe

Q.13 In NH_3, dominant Van der Waal's force among following is:
A. London dispersion forces
B. Dipole induced dipole forces
C. Dipole–dipole forces
D. Hydrogen bonding

Q.14 Liquids have no definite shape; it is because:
A. The molecules of liquid are in constant motion by sliding over each other
B. The intermolecular forces of liquids are weaker than gases
C. The liquid molecules have kinetic energy less than solids
D. All statements are correct

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Q.15 **Propanone is miscible in water due to:**
A. Both are polar molecules
B. Hydrogen bonding between them
C. Dipole-dipole attraction between them
D. All of these

Q.16 **Strong dipole-dipole forces among the liquid molecules are responsible for:**
A. Very high heat of vaporization
B. Very low boiling point
C. Very low heat of vaporization
D. All are correct

Q.17 **Which one of the following arrangements usually represents the correct order of increasing interactions?**
A. Hydrogen bonding, London forces, Dipole – Dipole
B. London force, Hydrogen bonding, Dipole – Dipole
C. London forces, Dipole – Dipole, Hydrogen bonding
D. Dipole – Dipole, London forces, Hydrogen bonding

Q.18 **Which of the following has strongest intermolecular forces of attraction?**
A. Hydrogen(H_2)
B. Chlorine (Cl_2)
C. Iodine (I_2)
D. Methane (CH_4)

Q.19 **The forces which are present between the ions and water molecules are known as:**
A. Dipole-induced dipole forces
B. Ion-dipole forces
C. Dipole-dipole forces
D. London-dispersion forces

Q.20 **Forces of attraction, which may be present between all kinds of atoms and molecules are:**
A. Hydrogen bonding
B. Dipole-dipole forces
C. London dispersion forces
D. Dipole-induced dipole

Q.21 **The attractive forces between the partial positive end of one molecule and partial negative end of other molecule are called:**
A. Dipole-dipole forces
B. Ion dipole-dipole forces
C. London dispersion forces
D. Debye forces

Q.22 **Liquid gets the shape of the container when it is poured into it. Which one of the following reasons justifies it?**
A. Liquid do not have definite shape
B. Liquid do not have definite volume
C. Liquid is highly compressible
D. Liquid molecules can slide over each other

Q.23 **Nature of bonding affects the properties like:**
A. Solubility
B. Melting, boiling points and isomerism
C. Reaction kinetics
D. All of these

Q.24 **Vapour pressure of water is 4.579 torr at 0°C and 9.209 torr at 10°C, so increase in vapour pressure from 0°C to 10°C is 4.630 torr. What will be the change in vapour pressure from 90°C to 100°C?**
A. 4.630 torr
B. < 4.630 torr
C. > 4.630 torr
D. V.P remain same at all Temperature

Q.25 **Which of the following has highest vapour pressure?**
A. Water
B. Mercury
C. Glycerol
D. Isopentane

Q.26 **The boiling point of water would be highest at:**
A. Murree
B. Gawadar
C. Mount everest
D. Siachin

Q.27 **Which one is false for evaporation?**
A. Surface phenomenon
B. Continuous
C. Exothermic
D. Causes cooling

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Q.28 Vapour pressure of water at 100°C is:
A. 55 mmHg
B. 760 mmHg
C. 355 mmHg
D. 1489 mmHg

Q.29 The conversion of vapours back into their liquid state is called:
A. Crystallization
B. Evaporation
C. Vapourization
D. Condensation

Q.30 Which one of the following has highest volatility?
A. Diethyl ether
B. Ethyl alcohol
C. Water
D. Ethylene glycol

Q.31 In order to mention the boiling point of water at 110°C, the external pressure should be:
A. Between 760 torr and 1200 torr
B. Between 200 torr and 760 torr
C. 765 torr
D. Any value of pressure

Q.32 The boiling point increases down the zero-group elements due to:
A. Ion dipole forces
B. London forces
C. Hydrogen bonding
D. Dipole-dipole forces

Q.33 If we provide very high amount of heat to a liquid its boiling point will:
A. Increase
B. Remains constant
C. Decrease
D. There will be no boiling

Q.34 Evaporation is designated as a cooling process because of the reason:
A. It is a surface phenomenon
B. It is exothermic process
C. High energy molecules leave behind the low energy molecules and cause cooling
D. All of the above

Q.35 Vapour pressure of a liquid depends upon the following:
A. Surface area and temperature only
B. Volume of the liquid
C. Humidity of the liquid in the air
D. Temperature and the inter-molecular forces

Q.36 At 1 atm pressure, a liquid (I) has the boiling point less than a liquid (II), what can we predict about both the liquids?
A. Liquid (I) has high vapour pressure than the liquid (II)
B. Liquid (I) has the weak intermolecular forces of attraction than the liquid (II)
C. Liquid (I) is more volatile than the liquid (II)
D. All of the above

Q.37 The distillation of a solution under reduced pressure is called:
A. Fractional distillation
B. Distillation
C. Destructive distillation
D. Vacuum distillation

Q.38 A pressure cooker reduces cooking time because:
A. Large flame is used
B. Boiling point of water rises
C. Heat is uniformly distributed
D. Vapour pressure of liquid decreases

Q.39 Molar heat of vaporization of water is:
A. 40.6 kJ mol^{-1}
B. 140.6 kJ mol^{-1}
C. 14.6 kJ mol^{-1}
D. Zero

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Q.40 **Rate of evaporation of a liquid depends upon:**
A. Surface area of liquid
B. Temperature
C. Inter molecular forces
D. All of these

Q.41 **Which one of the following would cause severe burning?**
A. Boiling water at 90°C
B. Steam at 100°C
C. Boiling water at 80°C
D. Water at 20°C

Q.42 **The boiling point of a liquid is that temperature at which:**
A. The vapour pressure of the liquid becomes equal to the atmospheric pressure
B. The vapour pressure of the liquid becomes less than the atmospheric pressure
C. The vapour pressure of the liquid becomes greater than the atmospheric pressure
D. The vapour pressure of the liquid becomes equal to intermolecular forces of liquid molecule

Q.43 **The strength of hydrogen bonding is:**
A. 20 times less than a covalent bond
B. 20 times less than an ionic bond
C. 20 times more than a covalent bond
D. 20 times more than an ionic bond

Q.44 **When ammonia is dissolved in water, number of hydrogen bonds formed by ammonia?**
A. 1
B. 2
C. 4
D. 3

Q.45 **Lower alcohols are soluble in water because:**
A. Intermolecular hydrogen bonding
B. Dipole induced dipoles
C. Low electro-negativity difference between C and H
D. All of the above

Q.46 **The strongest H-bond is:**
A. F---H
B. O---H
C. N----H
D. O----F

Q.47 **When two ice cubes are passed over each other, they united. This is due to:**
A. Covalent attraction
B. Ionic bond formation
C. Hydrogen bond formation
D. Metallic bond formation

Q.48 **Which of the following can form hydrogen bonding among its molecules more prominently?**



A. CH_3OH
B. CH_3-C-CH_3
C. $CHCl_3$
D. All of these

Q.49 **Hydrogen bonding is involved in:**
A. Solubility
B. Cleansing action of detergents
C. Biological molecules
D. All

Q.50 **When water freezes at 0°C its density decreases due to?**
A. Change of bond angles
B. Cubic structure of ice
C. Empty space present in the structure of ice
D. Change of bond length

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Topic 4 LIQUIDS

PAST PAPER MCQ'S

Q.51 Correct order of boiling points of the given liquids is: MDCAT (2012)

A. $H_2O > HF > HCl > NH_3$ B. $H_2O > HF > NH_3 > HCl$

C. $HF > H_2O > HCl > NH_3$ D. $HF > H_2O > NH_3 > HCl$

Q.52 At 1489 mmHg, water will boil at: NUMS (2019)

A. 120C° B. 110C°

C. 100C° D. 90C°

Q.53 Ice is less dense than water at: MDCAT (2014)

A. 0°C B. 4°C

C. -4°C D. 2°C

Q.54 In crystal lattice of ice, each O-atom of water molecule is attached to: MDCAT (2014)

A. Four H-atoms B. Two H-atoms

C. One H-atom D. Three H-atoms

Q.55 What is reason that the ice at 0°C occupies more volume than water? MDCAT (2017)

A. Empty spaces B. Intermolecular forces

C. Ionic bond D. Debye forces

Q.56 Water has maximum density at: NUMS (2019)

A. -4°C B. 1°C

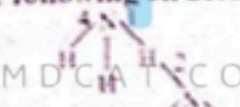
C. 0°C D. 4°C

Q.57 DNA molecule is double stranded, in which two chains of DNA are twisted around each other by: MDCAT (2011)

A. Hydrogen bonds B. Van der Waal's forces

C. Covalent bonds D. Dative bonds

Q.58 Which line in the following structure represents hydrogen bonding? MDCAT (2017)



A. 1 B. 2

C. 3 D. 4

Q.59 Which of the following substances exhibits hydrogen bonding? MDCAT (2019)

A. H_2S B. HI

C. NH_3 D. SiH_4

Q.60 In 'H-F' bond, electronegativity difference is 2.0. What is the type of this bond? MDCAT (2012)

A. Polar covalent bond B. pi (π) bond

C. Non-polar covalent bond D. Co-ordinate covalent bond

Q.61 Boiling point of water is higher than petrol, because intermolecular forces in water are: MDCAT (2011)

A. Weaker than petrol B. Stronger than petrol

C. Same as in petrol D. Negligible

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Q.62 Metallic conduction involves the relatively free movement of their---------- throughout the metallic lattice: MDCAT (2010)

A. Atoms
B. Electrons
C. Ions
D. Molecules

Q.63 Which type of force is present in gasoline? MDCAT (2010)

A. Dipole-dipole forces
B. Hydrogen bonding
C. Dipole-induced dipole forces
D. London dispersion forces

Q.64 Which one of the following hydrogen bond is stronger than others? MDCAT (2015)

A. $N^{\delta-} - H^{\delta+} \cdots\cdots N^{\delta-} - H^{\delta+}$
B. $O^{\delta-} - H^{\delta+} \cdots\cdots O^{\delta-} - H^{\delta+}$
C. $F^{\delta-} - H^{\delta+} \cdots\cdots F^{\delta-} - H^{\delta+}$
D. $N^{\delta-} - H^{\delta+} \cdots\cdots O^{\delta-} - H^{\delta+}$

Q.65 An inter molecular force of attraction X is relatively stronger than the other inter molecular forces, it stabilizes ∝-helix and β-pleated sheets of proteins. The double helical structure of DNA is also stabilized by this force of attraction. Identify X. MDCAT (2019)

A. Dipole-dipole attraction
B. Hydrogen bonding
C. Ionic interactions
D. van der Waal's Forces

Q.66 At higher altitude, the boiling point of water is less than 100°C, this is because of: ETEA (2019)

A. Higher atmospheric pressure
B. Weak hydrogen bonding
C. No change in atmospheric pressure
D. Lower atmospheric pressure

Q.67 Steam causes severe burns than boiling water. It is due to: ETEA (2019)

A. Absence of hydrogen bonding
B. High latent heat of vaporization
C. Freely moving molecules
D. Statement is incorrect

Q.68 According to Watson and Crick's model of DNA, the DNA molecule consists of a double helix. What type of forces are responsible to keep two strands of DNA together? MDCAT (2019)

A. Hydrogen bonding
B. van der Waal's forces
C. Ionic bonding
D. Dipole-induces dipole forces

Q.69 CO_2 and SO_2 both are tri-atomic molecules but heat of vaporization of SO_2 is greater than that of CO_2 due to: NMDCAT (2020)

A. High electronegativity of S
B. Greater size of SO_2
C. SO_2 is polar and CO_2 is non-polar
D. SO_2 is more acidic than CO_2

Q.70 Which of the following has the lowest vapor pressure at 20°C?. NMDCAT (2020)

A. Diethyl ether
B. Chloroform
C. Carbon tetrachloride
D. Water

Q.71 Which of the following is not a molecular solid? NMDCAT (2020)

A. Bromine
B. Sulphur
C. Phosphorus
D. Carbon dioxide

Q.72 In which of the following water evaporate earlier: PMC (2021)

A. Cup
B. Saucepan
C. Glass
D. Small bowl

Q.73 Which instrument is used to measure the vapor pressure of a liquid? PMC (2021)

A. Barometer
B. Manometer
C. Thermometer
D. Sphygmometer

Q.74 Which of the following has highest vapour pressure? PMC (2021)

A. Diethyl ether
B. Ethanol
C. Water
D. Ethylene glycol

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Q.75 At 0°C, what is the physical state of water? PMC (2021)
A. Ice B. Liquid
C. Vapour D. Both ice and liquid

Q.76 In liquid, with the change in dipole-dipole forces, there is a change in some physical properties. Select the property which is not affected by the strength of dipole-dipole forces? UHS (2022)
A. B.Pt. B. Heat of sublimation
C. Heat of vaporization D. Moles

Q.77 Which of the following factor does not affect the magnitude of V.P? UHS (2022)
A. Amount of liquid B. Size of molecule
C. Temperature of liquid D. Intermolecular forces

Q.78 When 2 ice cubes are pressed over each other they unite to form one cube due to: SZABMU (2022)
A. Dipole-dipole attraction B. Covalent attraction
C. Van Der Waal's forces D. H-bonding

Q.79 The strongest hydrogen bond is present in: SZABMU (2022)
A. H_2S B. HF
C. H_2O D. NH_3

Q.80 Which of the following has highest surface tension? SZABMU (2022)
A. Benzene B. Alcohols
C. Ether D. Water

Q.81 Ice floats on the surface of water due to: SZABMU (2022)
A. Large bond length B. Cubic structure of ice
C. Weak intermolecular forces D. Empty spaces in the structure of ice

Q.82 Which of the following has highest boiling point? SZABMU (2022)
A. C_4H_{10} B. C_6H_{14}
C. $C_{10}H_{22}$ D. C_3H_8

Q.83 Exceptionally low acidic strength of HF is due to: ETEA (2022)
A. Strong polar bond between H & F B. Smaller size of fluorine
C. More electronegativity of fluorine D. Strong hydrogen bonding

Q.84 Which of the following compounds has lowest boiling point? ETEA (2022)
A. Water B. Ethanol
C. Hydrogen sulphide D. Acetic acid

Q.85 A pressure cooker reduces cooking time because: ETEA (2022)
A. A large heat is used B. Heat is more evenly distributed
C. The higher pressure softens food inside D. The boiling point of water rises inside

Q.86 In which of the following molecule hydrogen bond is not present? ETEA (2022)
A. H_2O B. HF
C. CH_4 D. NH_3

Q.87 The distillation carried out under reduced pressure is called: DUHS (2022)
A. Steam distillation B. Simple distillation
C. Fractional distillation D. Vacuum distillation

Q.88 Viscosity is the measure of:
A. Volume B. Resistance in the flow of a liquid
C. Fluidity of liquid D. Mass
E. Density

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Q.89 The two crystals $NaNO_3$ & $CaCO_3$ are both trigonal they are: DUHS (2022)
A. Isomers
B. Polymorphs
C. Allotropes
D. Enantiomers
E. Isomorphs

Q.90 Falling drop of liquid is spherical due to its: DUHS (2022)
A. Evaporation on exposure
B. Surface tension
C. Atomic structure
D. Viscosity
E. Vapor pressure

Q.91 Viscosity of liquid decreases with an increase in: BMU (2022)
A. Molecular mass
B. Temperature
C. Atmosphere pressure
D. Intermolecular forces

Q.92 The boiling point of compound is mostly raised by: NUMS (2022)
A. Dipole-induced dipole interaction
B. London dispersion forces
C. Intra molecular H - bonding
D. Inter molecular H - bonding

Q.93 Which of the following statement explains solubility of ionic substance in water? NUMS (2022)
A. Water molar mass is 18.02
B. Water molecule is polar
C. Water forms dative bonding
D. Water has high density

Q.94 Which of the following factor does not affect the magnitude of V.P? UHS (2023)
A. Amount of liquid
B. Size of molecule
C. Temperature of liquid
D. Intermolecular forces

Q.95 Which is not a property of liquid? UHS (2023)
A. Osmotic pressure
B. Freezing point
C. Diffusion
D. Melting

Q.96 Which of the following has the lowest vapour pressure at 20°C? SZABMU (2023)
A. Diethyl ether
B. Chloroform
C. Carbon tetrachloride
D. Water

Q.97 The force of attraction among H_2 molecules in solid H_2 are: SZABMU (2023)
A. Hydrogen bonds
B. Covalent bonds
C. Co-ordinate covalent bonds
D. Van der Waal's Forces

Q.98 Which of the following molecules are soft and have weak intermolecular forces? SZABMU (2023)
A. H_2O
B. I_2
C. Sugar
D. Graphite

Q.99 Compounds having lowest boiling point is: ETEA (2023)
A. Carbon tetrachloride
B. Ethyl alcohol
C. Benzene
D. Acetic acid

Q.100 Which of the following can form hydrogen bonding with each other? ETEA (2023)
A. Methanal & Ethanal
B. Propanone & ethyl methyl ketone
C. 3° Amine & H_2O
D. Acetone & Acetaldehyde

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Q.101 Water rises in capillary tube because of: DUHS (2023)
A. Cohesive force & adhesive forces are same
B. Adhesive forces of molecules exceed cohesive force
C. Cohesive force is greater than adhesive force
D. Cohesive force and adhesive force to explain the property in the above question is irrelevant

Q.102 Which of the following influences the variation of temperature at which boiling of liquid takes place? DUHS (2023)
A. Outside pressure
B. Outside temperature
C. Volume of container
D. Amount of liquid

Q.103 At room temperature, Glycerin bools at 290°C. What is the boiling point of Glycerin under vacuum distillation at 50 torr? BUMHS (2023)
A. 320°C
B. 310°C
C. 300°C
D. 210°C

Q.104 The polar part of the soap and detergents dissolve in water molecules due to: BUMHS (2023)
A. Dipole – dipole forces
B. Dipole – induced dipole forces
C. Hydrogen bonding
D. London dispersion forces

Q.105 What is the fact due to which the branching decreases boiling point? BUMHS (2023)
A. As branching increases the attractive forces between molecules
B. As branching increases it decreases attractive forces
C. As branching increases it increases surface area for making attractive forces
D. As branching increases it decreases the surface area for attractive forces

Q.106 Vapour pressure is independent of which factor? NUMS (2023)
A. Temperature
B. Intermolecular forces
C. Density of liquid
D. Surface area of liquid

Q.107 The boiling point of ether is less as compared to alcohols and phenols due to: NUMS (2023)
A. Functional group
B. Intermolecular forces
C. Nature of alkyl groups
D. Isomerism

Q.108 When 2 ice cubes are pressed over each other they unite to form on cube due to: (NUMS-2023)
A. Dipole-dipole attraction
B. Covalent attraction
C. Van Der Waal's forces
D. H – bonding

Q.109 Which type of forces exist between Iodine molecules? UHS (2024)
A. Dipole-dipole forces
B. Dipole-induced dipole forces
C. Instantaneous dipole-induced dipole forces
D. Non-polar forces

Q.110 In order to boil water at 110°C, external pressure should be UHS (2024)
A. 200-760 torr
B. 760-1200 torr
C. 665-670 torr
D. 660-700 torr

Q.111 Which one of the following do not have tendency to form hydrogen bonding? UHS (2024)
A. Ammonia
B. Ethyl alcohol
C. Carboxylic acid
D. Hydrocarbon

Q.112 Boiling point of a liquid is a temperature at which: UHS (2024)
A. Surface tension is greater than the atmospheric pressure
B. Viscosity is less than the atmospheric pressure
C. Vapour pressure equals the atmospheric pressure
D. Viscosity equals the atmospheric pressure

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Q.113 Water is liquid at room temperature as compared to ammonia and hydrogen disulphide due to presence of _____. SZABMU (2024)

A. Co-ordinate covalent bond
B. Hydrogen bond
C. Ionic bond
D. Metallic bond

Q.114 For boiling point, vapor pressure of liquid does not depend upon _____. SZABMU (2024)

A. Amount of liquid
B. External atmospheric pressure
C. Intermolecular forces
D. Type of bond

Q.115 Which one of the following noble gases will have highest boiling point? SZABMU (2024)

A. Kr
B. Ar
C. Ne
D. He

Q.116 The compound which exhibits highest vapour pressure is: SZABMU-RC (2024)

A. Water
B. HF
C. Petrol
D. Acetic acid

Q.117 Molar heat of vaporization of water is: ETEA (2024)

A. 40.7 cal/mol
B. 40.7 J/mol
C. 40.7 kcal/mol
D. 40.7 kJ/mol

Q.118 Distillation under very reduced pressure is distillation: ETEA (2024)

A. Destructive
B. Fractional
C. Steam
D. Vacuum

Q.119 Which of the following possesses the weakest London dispersion forces? DUHS (2024)

A. F_2
B. Br_2
C. Cl_2
D. I_2

Q.120 Which of the following liquids show maximum surface tension? (Out of syllabus) DUHS (2024)

A. Water
B. Mercury
C. Ethyl alcohol
D. Chloroform

Q.121 Which of the following is not a result of capillary action? BMU (2024)

A. Rise of water from soil to plant
B. Absorption of water ran cotton
C. Movement of blood in veins
D. spreading of ink on blotting paper

Q.122 The maximum polarizability is exhibited in: NUMS (2024)

A. C_6H_{14}
B. C_3H_6
C. C_5H_{12}
D. C_2H_6

Q.123 If the external pressure is reduced to half, the boiling point of Ethanol will be: NUMS (2024)

A. Greater than 78°C
B. Less than 78°C
C. Equal to 78°C
D. Reduced to half

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ANSWER KEY

PRACTICE EXERCISE

1	A	11	C	21	A	31	A	41	B
2	D	12	C	22	A	32	B	42	A
3	D	13	D	23	D	33	B	43	A
4	B	14	A	24	C	34	C	44	A
5	B	15	D	25	D	35	D	45	A
6	D	16	A	26	B	36	D	46	C
7	D	17	C	27	C	37	D	47	A
8	B	18	C	28	B	38	B	48	D
9	D	19	B	29	D	39	A	49	C
10	C	20	C	30	A	40	D	50	C

PAST PAPER MCQ'S

51	B	61	B	71	A	81	D	91	B	101	B	111	D	121	C
52	A	62	B	72	B	82	C	92	D	102	A	112	C	122	A
53	A	63	D	73	B	83	D	93	B	103	D	113	B	123	B
54	A	64	C	74	A	84	C	94	A	104	C	114	A		
55	A	65	B	75	D	85	D	95	D	105	D	115	A		
56	D	66	D	76	D	86	C	96	D	106	D	116	C		
57	A	67	B	77	A	87	D	97	D	107	B	117	D		
58	B	68	A	78	D	88	B	98	B	108	D	118	D		
59	C	69	C	79	B	89	E	99	A	109	C	119	A		
60	A	70	D	80	D	90	B	100	C	110	B	120	B		

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EXPLANATORY NOTES

Q.11 $CHCl_3$ is a polar molecule which have dipole - dipole forces.

Q.12 IMF ↑, V.P ↓, B.pt ↑.
$CHCl_3$ has greater intermolecular forces.

Q.13 Hydrogen bonding is present in F, O, N.
When hydrogen is bonded with highly E.N. element like F, O and N, hydrogen bonding is dominant in such compounds.

Q.14 Constant state of random motion in molecules of liquids and gases do not allow a definite shape.

Q.15 Both propanone and water are polar molecules. Therefore, they are miscible with each other. They can form hydrogen bond also.

Q.16 IMF ↑ Heat of vaporization ↓.

Q.17 Generally, the order of increasing interactions is:
London forces < Debye forces < Dipole – Dipole < Hydrogen bonding

Q.18 Molar mass ↑, polarizability ↑, L.D.F ↑.

Q.19 The forces which are present between the ions and water molecules are known as ion- dipole forces.

Q.20 Force of attraction present between all kind of atoms and molecules are known as London dispersion forces.

Q.21 The attractive forces between the partial positive end of one molecule and partial negative end of other molecule are called dipole-dipole forces.

Q.22 Due to presence of random motion liquid has no definite shape.

Q.23 Nature of bounding affects the physical as well as chemical properties of compounds.

Q.24 Vapor pressure depends on temperature, at higher temperature greater vapor pressure is observed. Change in vapour pressure from 90° to 100° is greater change in V.P. from 0° to 10°C.

Q.25 Vapour pressure is inversely proportional to intermolecular forces. Iso-pentane has weakest forces of attraction.

Name of compound	Vapour pressure at 20°C (torr)
Isopentane	580
Ethyl ether	442.2
Chloroform	170
Carbon Tetrachloride	87
Water	17.54
Mercury	0.012
Glycerol	0.00016

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Q.26 Boiling point of liquid ↑, External pressure ↑.
The boiling point of water would be highest at Gawadar.

Q.27 **Evaporation:**

- is a surface phenomenon.
- is a continuous process.
- continues at all temperatures.
- is cooling process.
- endothermic process.

Q.28 Vapour pressure of water at difference temperature is given in the table

Temperature (°B)	Vapour Pressure (Torr)
0	4.579
10	9.209
20	17.54
30	31.82
37	47.07
40	55.32
50	92.51
60	149.4
70	233.7
80	355.1
90	527.0
100	760.0

Q.29 The conversion of vapours back into their liquid state is called condensation.

Q.30 The correct option is Diethyl ether because:
LDF ↓, V.P ↑, Volatility ↑.

Q.31 Boiling point of liquid ↑, External pressure ↑.

Q.32 Down the group:
Molar mass ↑, polarizability ↑, LDF ↑, Boiling point ↑.

Q.33 At boiling point, on supply of further amount of heat, no change in temperature is observed because extra amount of heat just changes the liquid into vapor phase.

Q.34 Evaporation is designated as a cooling process because of high energy molecules leave behind the low energy molecules and cause cooling.

Q.35 Vapour pressure of a liquid depends upon nature of liquid, temperature and the inter molecular forces. Vapour pressure $\propto$ T and V.P $\propto$ 1/ IMF

Q.36 B.pt ↓, IMF ↑, V.P ↓, Volatility ↑.

Q.37 The distillation of a solution under reduced pressure is called vacuum distillation

Q.38 A pressure cooker reduces cooking time because boiling point of water rises. Boiling point ↑, External pressure ↑.

Q.39 Molar heat of vapourization of water is 40.6 kJ mol^{-1}.

Q.40 Rate of evaporation of a liquid depends on surface area of liquid, inter molecular forces and temperature

Q.41 Steam contains higher potential energy because of extra heat which is absorbed by water molecules during boiling to overcome intermolecular force.

Q.42 The boiling point of a liquid is that temperature at which the vapour pressure of the liquid becomes equal to the atmospheric pressure.

Q.43 The strength of hydrogen bonding is 20 times less than a covalent bond.

Q.44 Number of hydrogen bonds per molecule are:
NH_3----- 1 H- bond per molecule.
HF----- 1 H- bond per molecule.
H_2O-----2 H- bond per molecule.

Q.45 Hydrogen bonding decreases as the length of chain increases.

Q.46 Strength of H – bond ↑, Electronegative difference ↑.

Q.47 Ice (water) has strong hydrogen bonding due to which ice cubes unite to form single larger ice cube.

Q.48 CH_3OH has hydrogen bonding as prominent intermolecular force

Q.49 Solubility, cleansing action of detergents and biological molecules are the application of hydrogen bonding.

Q.50 When water freezes at 0°C, its density decreases due to empty spaces present in the structure of ice and volume increases by 9 %.

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 Greater the strength of IMF, greater will be the boiling point. B.Pt. of H_2O and HF is greater than that of HCl. As, H_2O and HF and NH_3 show hydrogen bonding and HCl have simple dipole-dipole force.

Compound	IMF	Boiling Point (°C)
H_2O	H-Bonding	100
HF	H-Bonding	19.5
NH_3	H-Bonding	-33
HCl	Dipole-Dipole force	-85

Q.52

Boiling Point of Water		
External Pressure (mmHg)	Boiling Point (°C)	
23.7	25	Room Temperature
323	69	At Mount Everest
700	98	At Murree
760	100	At sea level
1489	120	In Pressure Cooker

Q.53 Water has maximum density at 4°C. When temperature of water decreases its density increases. At 0°C ice is less denser than water.

Q.54 In structure of ice, one oxygen atom is trapped between 4 hydrogen atoms among which two hydrogen atoms are covalently bounded and other two forms hydrogen bonds.



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Q.55 Due to empty spaces present within the lattice of ice, ice occupies 9% more volume than liquid water.

Q.56 Water has maximum density at 4°C. Above and below this temperature, density of water decreases.

Q.57 Hydrogen bond is present between two chains of DNA structure.

Q.58 Hydrogen bond in ammonia molecule is present between nitrogen atom of one molecule and hydrogen atom of another molecule.

Q.59 Three elements F, O and N which are highly electronegative forms hydrogen bond with hydrogen. Hydrogen bonding is found in HF, NH_3 and H_2O.

Q.60 In HF, a highly polar covalent bond is present between H and F atom.

Q.61 Water has stronger IMF (Hydrogen bond) whereas petrol has weaker intermolecular force (LDF).

Q.62 Metallic conduction is due to flow of free electrons in metallic lattice.

Q.63 Gasoline is mixture of different hydrocarbons. London dispersion forces are present in it.

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Q.64 Hydrogen bond is strongest between $F^{\delta-}$ and $H^{\delta+}$ atom due to high electronegativity difference.

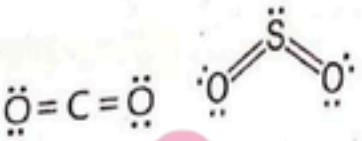
Q.65 Hydrogen Bonding is present in DNA and protein structure.

Q.66 B.Pt. ∝ External Pressure
At higher altitude, atmospheric pressure decreases which results in decrease in B.Pt.

Q.67 Steam has high latent heat of vaporization due to which it can severely burn skin than boiling water. Boiling water has maximum temperature of 100°C whereas steam can have temperature more than 100°C.

Q.68 Hydrogen bonding is responsible to keep two strands of DNA together.

Q.69 CO_2 is non-polar, it has zero dipole moment and weak IMF. So, it has low B.Pt. Whereas SO_2 is polar nfolecule with dipole moment 1.62D. So, it has relatively strong IMF and high B.Pt.



Q.70 IMF ↑, V.P ↓, B.P ↑.
Water has strong IMF and it has lowest vapor pressure.

Q.71 Br_2 is liquid at room temperature.

Q.72 In saucepan the water will evaporate earlier as it has the largest surface area among all the given options

Q.73 Manometer is used to measure the vapour pressure of a liquid

Q.74 Diethyl ether will have the highest vapour pressure because it has the weakest intermolecular forces among the given liquids

Q.75 As 0°C is the melting points of ice as well the freezing point of water therefore at 0°C water will exist in both forms i.e. solid and liquid

Q.76 Thermodynamic properties of a liquid depend upon the strength of intermolecular forces. As moles of a liquid is not a thermodynamic property. So, it will not depend upon the strength of dipole-dipole forces.

Q.77 Vapour pressure of a liquid is independent of amount of liquids, surface area and size of the container.

Q.78 In ice, hydrogen bonding is present which is responsible for the joining of ice cubes.

Q.79 The strongest hydrogen bond is present in HF due to the highest electronegativity difference between the hydrogen and fluorine.

Q.80 Surface tension of a liquid depends upon the strength of intermolecular forces. As the water has the strongest intermolecular forces. Therefore, it will have the highest surface tension.

Q.81 Ice does float on water because it has lesser density as compared to water which is due to the presence of empty spaces in the structure of ice.

Q.82 As decane has the strongest intermolecular forces. So, it will have the highest boiling point.

Q.83 Unusually, acidic strength of HF is due to the presence of strong hydrogen bonding present in HF molecules which makes difficult the removal of hydrogen.

Q.84 Hydrogen sulphide has the lowest boiling point due to presence of weaker intermolecular forces.

Q.85 Pressure cooker reduces the cooking time because in pressure cooker the boiling point of water increases due to the increase in external atmospheric pressure.

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Q.86 In methane molecules hydrogen bonding is not present due to the absence of partially positively charged hydrogen and highly electronegative element (N, O, F).
Q.87 Definition of vacuum distillation.
Q.88 Definition of viscosity.
Q.89 Different substances having same crystalline form are called isomorphs of each other.
Q.90 As the surface tension in the liquids minimize their surface area, therefore, a falling drop of liquid takes the shape of a sphere.
Q.91 Viscosity of liquid decreases with an increase in temperature because increase in temp. decreases the strength in intermolecular forces and increases the molecular motion. Thus, decreases the resistance to flow.
Q.92 As the strongest intermolecular force is the intermolecular hydrogen bonding. So, if it is present in a liquid, it will raise the boiling point maximum.
Q.93 Polarity of water is the reason why ionic compounds are soluble in water.
Q.94 Vapour pressure independent of amount of liquid.
Q.95 Melting is the property of solid.
Q.96 Polar liquids have low vapour pressure due to strong IMF.
Q.97 van der Waal's forces are present in between non-polar molecules.
Q.98 I_2 molecules have weak LDF which make it relatively soft.
Q.99 Non-polar and small sized molecules have weak LDF and low boiling point.
Q.100 Partial positive hydrogen and most electronegative atom, both should be present.
Q.101 Capillary action is responsible for water movement.
Q.102 Boiling point (definition).
Q.103 Boiling point $\propto$ external pressure.
Q.104 Polar part of soap form H-bonding with water molecules.
Q.105 Attractive forces decrease due to branching.
Q.106 Vapour pressure independent on surface area of liquid or container.
Q.107 Weak IMF in ether.
Q.108 H_2O molecules can form H-bonding.
Q.109 London's forces are present between non-polar molecules.
Q.110 Boiling point $\propto$ external pressure.
Q.111 Hydrogen carbon bond are non-polar in nature.
Q.112 The temperature at which vapour pressure (internal pressure) of liquid becomes equal to external pressure is called boiling point.
Q.113 IMF are strong in water molecule.
Q.114 Vapour pressure independent of amount of liquid.
Q.115 Boiling point of noble gases increases down the group due to large size and strong IMF.
Q.116 Due to weak IMF.
Q.117 Molar heat of vaporization of water.
Q.118 Boiling of liquid at low temperature by reducing external pressure is known as vacuum distillation.
Q.119 Small size molecules have weak London dispersion forces.
Q.120 Surface tension $\propto$ IMF.
Q.121 Capillary action is not responsible for blood movement in veins.
Q.122 Polarizability $\propto$ size of molecules.
Q.123 There is a direct relation between boiling point and external pressure. But boiling point does not varies regularly by changing the external pressure.

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Topic 5

SOLIDS

PRACTICE EXERCISE

Q.1 **In water, total number of electrons involved in hydrogen bonding per H_2O molecule:**

A. 2 B. 5

C. 3 D. 4

Q.2 **Which of following is non crystalline solid pair?**

A. Wood and Glass B. Glass and Glucose

C. NaCl and Glucose D. NaCl and Glass

Q.3 **Which of following is not exist as molecular solid?**

A. Ice B. Iodine

C. Phosphorus D. Graphite

Q.4 **Which of following not able to show allotropy?**

A. Fluorine B. Tin

C. Sulphur D. C

Q.5 **Every point in crystal lattice of ice represents_____.**

A. O-atoms B. H-atoms

C. Hydrogen bonds D. Water molecular

Q.6 **Which of the following is not a feature of solids?**

A. Rigidity B. Fluidity

C. Definite shape D. Both A and C

Q.7 **Which substance have ability to conduct electricity in solid state?**

A. Diamond B. Graphite

C. NaCl D. None of these

Q.8 **Which ionic solid has high value of lattice energy?**

A. KCl B. CsCl

C. NaCl D. RbCl

Q.9 **Which of the following is not a characteristic of amorphous solid?**

A. Show isotropy B. Tendency to show irregular cleavages

C. Having crystallites D. Sharp melting points

Q.10 **The phenomena in which element exist in more than one crystalline form is _____.**

A. Anisotropy B. Isomorphism

C. Allotropy D. Polymorphism

Q.11 **Transition temperature is shown by which of the following pairs?**

A. Isomorph and polymorph B. Allotrope and polymorph

C. Isomorph and allotrope D. All of these

Q.12 **Lattice energy decreases with the increase in size of ion because oppositely charged ions:**

A. Have close packing B. Have low empty spaces

C. Becomes less tight D. Have strong electrostatic forces

Q.13 **Ionic solids are characterized by:**

A. Low melting point B. Good conductivity in solid state

C. High vapour pressure D. Solubility in polar solvent

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Q.14 Which solids are called true solids?
A. Metallic
B. Amorphous
C. Crystalline
D. Vitreous

Q.15 Which ionic solid has lowest lattice energy?
A. LiCl
B. NaCl
C. KCl
D. CsCl

Q.16 Which of the following intermolecular forces are present in solid iodine?
A. Dipole – dipole forces
B. London dispersion forces
C. Hydrogen bonding
D. Debye forces

Q.17 Which of the following is not amorphous solid?
A. Glass
B. Table salt
C. Glue
D. Rubber

Q.18 Transition temperature of sulphur is:
A. 13.2°C
B. 128°C
C. 95.5°C
D. 32.02°C

Q.19 Which of the following is isotropic property?
A. Refractive index
B. Coefficient of thermal expansion
C. Cleavage
D. Metallic conduction

Q.20 When an element exist in more than one crystalline forms, it is known as:
A. Anisotropy
B. Isomorphism
C. Allotropy
D. Polymorphism

Q.21 A solid may be made up of:
A. Atoms
B. Ions
C. Molecules
D. All of these

Q.22 Which one has the highest melting point and boiling point?
A. Ionic crystal
B. Molecular crystal
C. Covalent crystal
D. Metallic crystal

Q.23 In a crystal, the atoms are located at the position of:
A. Zero P.E.
B. Infinite P.E.
C. Minimum P.E.
D. Maximum P.E.

Q.24 Which of the following is anisotropic?
A. Hydrogen
B. Quartz
C. Water
D. Rubber

Q.25 Crystalline part of otherwise amorphous solids are known as:
A. Allotrope
B. Crystallites
C. Isomorph
D. Polymorph

Q.26 Coinage metals are Cu, Ag & Au and they have _____ crystal system.
A. Cubic
B. Hexagonal
C. Tetragonal
D. Trigonal

Q.27 In crystal structure of NaCl, the arrangement of Cl^- ions is:
A. Face centered cubic
B. Body centered cubic
C. Simple Cubic
D. Hexagonal

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Q.28 In a crystal lattice the correct sequence of bond angles is:

A. $bc = \alpha$, $ca = \beta$, $ab = \gamma$
B. $bc = \beta$, $ca = \alpha$, $ab = \gamma$
C. $\propto$
D. All are possible

Q.29 Total unit cell dimensions are:

A. Seven
B. Fourteen
C. Six
D. Thirty-two

Q.30 Cubic crystal system has the following unit cell dimensions:

A. $a = b = c$ and $\alpha = \beta = \gamma = 90°$
B. $a = b \neq c$ and $\alpha = \beta = \gamma = 90°$
C. $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$
D. $a = b \neq c$ and $\alpha = \beta = 90°, \gamma = 120°$

Q.31 The crystalline form of white Tin is:

A. Cubic
B. Hexagonal
C. Tetragonal
D. Both A and C

Q.32 Molecular crystals are:

A. Hard
B. Very hard
C. Soft
D. Always polar

Q.33 The crystals formed due to London forces of interaction are:

A. Ionic
B. Molecular
C. Covalent
D. Metallic

Q.34 The number of Cl^- ions per unit cell of a simple cubic lattice at the corner is / are:

A. 1
B. 3
C. 4
D. 6

Q.35 Which is incorrect about structure of iodine?

A. Face-centered cubic
B. Metallic appearance
C. $I - I_{(g)} > I - I_{(s)}$ Bond length
D. $I - I_{(g)} < I - I_{(s)}$ Bond length

Q.36 The coordination number of each ion in NaCl is:

A. 4
B. 8
C. 6
D. 10

Q.37 The best conductors of electricity are:

A. Ionic solids
B. Metallic solids
C. Molecular solids
D. Covalent solids

Q.38 Independent molecule of NaCl may exist in:

A. Solid phase
B. Molten phase
C. Liquid phase
D. Vapour phase

Q.39 Which of the following is an example of polar molecular solid?

A. Naphthalene
B. Dry ice
C. Iodine
D. Sugar

Q.40 Solid CO_2 (Dry ice) is an example of _____ crystals.

A. Covalent
B. Ionic
C. Metallic
D. Molecular

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Topic 5 SOLIDS

PAST PAPER MCQ'S

Q.41 The coordination number of Na^+ in NaCl crystal is: MDCAT (2010)
A. 8 B. 4
C. 2 D. 6

Q.42 In the structure of NaCl, each sodium ion is surrounded by chloride ions: MDCAT (2013)
A. 4 B. 6
C. 5 D. 8

Q.43 Which one the following have highest lattice energy? NUMS (2019)
A. NaCl B. KCl
C. KBr D. LiCl

Q.44 Electrical conductivity of graphite is greater in one direction than in other due to: MDCAT (2016)
A. Isomorphism B. Anisotropy
C. Cleavage plane D. Symmetry

Q.45 In diamond each of the four outer electrons on every carbon atom is involved in covalent bonding. This means that there are no free electrons available. Which of the following property is explained by this statement? SET (2019)
A. Diamond does not conduct heat and electricity
B. Diamond is very hard
C. Diamond has high refractive index
D. Diamond cuts diamond

Q.46 Graphite is one of the allotropic form of Carbon. It is: ETEA (2016)
A. Isotropic B. Anisotropic
C. Good conductor of electricity D. Both B and C

Q.47 Substance that has sharp melting point in the following is: ETEA (2019)
A. Gemstone C. Coal tar
B. Glass D. Diamond

Q.48 The lattice energy is also called as: NMDCAT (2020)
A. Energy of affinity B. Bond energy
C. Crystal energy D. Potential energy

Q.49 Shape of iodine unit cell. PMC (2021)
A. Orthorhombic B. Hexagonal
C. Tetragonal D. Cubic

Q.50 Properties due to change of direction are called_____. PMC (2021)
A. Isotropic properties B. Anisotropy
C. Symmetry D. Cleavage plane

Q.51 Current in electrolysis is carried through: PMC (2021)
A. Free electrons B. Positive ions
C. Negative ions D. Both B and C

Q.52 The smallest part of the crystal lattice has all the properties of the entire crystal this is called: PMC (2021)
A. Unit B. Unit cell
C. Unit crystal D. All of these

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Q.53 A small building block which belongs to whole information about crystal structure is called? UHS (2022)

A. Cell
B. Crystal lattice
C. Unit cell
D. Crystal unit

Q.54 Which type of solid is called as atomic solid? UHS (2022)

A. Covalent solids
B. Ionic solids
C. Metallic solids
D. Molecular solids

Q.55 The molecules of iodine (I_2) form the: SZABMU (2022)

A. Molecular crystals
B. Covalent crystals
C. Lonic crystals
D. Metalic crystals

Q.56 Which of the following ionic compounds has the highest value of lattice energy? ETEA (2022)

A. NaF
B. LiCl
C. NaI
D. KI

Q.57 Which one of the following is the example of polar molecular solids? ETEA (2022)

A. Ice
B. Iodine
C. Copper
D. Phosphorous

Q.58 Which one of the following pairs of compounds is not isomorphic in nature? ETEA (2022)

A. NaF and MgO
B. KNO_3 and $NaNO_3$
C. ZnO and CdS
D. $AgNO_3$ and KNO_3

Q.59 Small diffusion in solid is due to: DUHS (2022)

A. Very fast motion of its particles
B. Vibrational motion of its particles
C. Rotational motion of its particles
D. Translational motion of its particles
E. Diffusion into solid is not present

Q.60 Amorphous solids? BMU (2022)

A. Have prefect arrangement of atoms
B. Have sharp Melting point
C. Can possesses small regions of orderly arrangement of atoms
D. Undergo clean cleavage when cut with knife

Q.61 Which one of the following is not a crystalline solid? BMU (2022)

A. Copper sulphate
B. Sugar
C. NaCl
D. Rubber

Q.62 Nature of diamond as solid is NUMS (2022)

A. Covalent
B. Molecular
C. Ionic
D. Metallic

Q.63 Which one of the following is as light as a feather and as strong as iron? NUMS (2022)

A. Graphite
B. Mercury
C. Graphene
D. Diamond

Q.64 In anisotropic crystals which property do not change with the change in direction of crystalline structure? UHS (2023)

A. Electrical conductance
B. Thermal conductance
C. Molar mass
D. Refractive index

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Q.65 In metals, why electric conductivity decreases with the increases of temperature? UHS (2023)

A. Because electron movement decrease with the increase of temperature
B. Because metal ions oscillations hinder electron movement
C. Because electron direction changes at high temperature
D. Because they pass heat current through collision of electrons

Q.66 Which of the following information we obtain from the Lattice energy? SZABMU (2023)

A. It helps while explaining the structure of the ionic compound
B. It explains bonding in the covalent compound
C. It explains properties of the metallic compounds
D. It explains the structure of the molecular compounds

Q.67 Which of the following solids have strong metallic bond? SZABMU (2023)

A. Potassium B. Phosphorus
C. Calcium D. Sulphur

Q.68 All of the following crystal systems have $\beta=\gamma=90^{\circ}$ except: ETEA (2023)

A. Cubic B. Orthorhombic
C. Tetragonal D. Rhombohedral

Q.69 Crystal having orthorhombic crystal system is: ETEA (2023)

A. $PbCrO_4$ B. $BaSO_4$
C. ZnO D. $K_2Cr_2O_2$

Q.70 Which of the following is a covalent crystal? DUHS (2023)

A. NaCl B. KI
C. $MgBr_2$ D. Diamond

Q.71 The nature of attraction which holds molecular crystal is: DUHS (2023)

A. Ionic B. Hydrogen bond
C. Covalent bond D. Van Der Waals force

Q.72 The system in which three angles and axes are unequal is called? BUMHS (2023)

A. Cubic system B. Triclinic system
C. Orthorhombic system D. Trigonal system

Q.73 Which one of the following have no cleavage plane? BUMHS (2023)

A. Graphite B. NaCl crystals
C. Copper crystals D. Ice

Q.74 Which statement correctly describes the structure of sodium chloride crystal? NUMS (2023)

A. Each sodium ion is surrounded by six chloride ions and each chloride ions surrounded by 6 sodium ions
B. The crystal is face centered cubic structure
C. Each sodium ion is surrounded by 3 chloride ions and each chloride ion surrounded by sodium ions
D. Intermolecular forces are present between two oppositely charges ions

Q.75 The greater Lattice energy is shown by: NUMS (2023)

A. NaCl B. NaBr
C. NaI D. NaF

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Q.76 Thermal conductivity of metals is due to: NUMS (2023)
A. Layered structure of metals
B. Freely moving electrons
C. Loosely hold metal atoms
D. Vibrational movement of metals

Q.77 Co-ordination number of Na is: NUMS (2023)
A. 10
B. 9
C. 8
D. 12

Q.78 Whenever the crystalline solids are broken they do so along definite planes known as: UHS (2024)
A. Cleavage plane
B. Refractory planes
C. Sagittal planes
D. Coronal planes

Q.79 One of the following is NOT an example of amorphous solids: UHS (2024)
A. Plastics
B. Glass
C. Glucose
D. Rubber

Q.80 In graphite the carbon atoms are arranged in which of the following structure? UHS (2024)
A. Rhombic
B. Hexagonal
C. Tetragonal
D. Trigonal

Q.81 Which of the following is an example of molecular solid? SZABMU (2024)
A. Al_3N_2
B. $CO_{2(s)}$
C. CsF
D. NaCl

Q.82 NaCl is an example of _____ arrangement of crystal lattice. SZABMU (2024)
A. Monoclinic
B. Octahedral
C. Tetrahedral
D. Triangular

Q.83 Identify the pair of solids having molecular nature: SZABMU-RC (2024)
A. C, CO_2
B. S_8, I_2
C. NaCl, C
D. CO_2, KCl

Q.84 Ag_2SO_4 and Na_2SO_4 are the SZABMU- RC (2024)
A. Polymorphs
B. Isomorphs
C. Allotropes
D. Anisotropes

Q.85 Which one of the following is a non-polar molecular solid? SZABMU-RC (2024)
A. CO_2
B. SiC
C. MgO
D. Ice

Q.86 The shape of NaCl according to its radius ratio is: SZABMU-RC (2024)
A. Octahedral
B. Body centered cubic
C. Tetrahedral
D. Triangular

Q.87 The example of metallic solid is: ETEA (2024)
A. B
B. C
C. Cu
D. Si

Q.88 When a crystalline substance conducts current in one direction but not through other directions of the crystal, this property is: ETEA (2024)
A. Allotropy
B. Anisotropy
C. Isomorphism
D. Polymorphism

Q.89 Dry ice is the example of: DUHS (2024)
A. Molecular solid
B. Metallic solid
C. Covalent solid
D. Ionic solid

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Q.90 **It is an example of a crystalline solid:** DUHS (2024)
A. Plastics B. Charcoal
C. Glass D. Alum

Q.91 **Electrically diamond is a:** BMU (2024)
A. Good conductor B. Non-conductor
C. Semiconductor D. None of the given options

Q.92 **The term 'Transition temperature' is use for the temperature:** BMU (2024)
A. At which one crystalline form of a substance changes into another
B. At which liquid crystals are formed in a liquid
C. Within which the habit of a crystal remains the same
D. Showing a sharp change in the anisotropic properties of a crystal

Q.93 **Iodine is a poor conductor of electricity because of:** NUMS (2024)
A. Face centered cubic structure B. Body centered cubic structure
C. Tetragonal structure D. Hexagonal structure

Q.94 **Predict the shape of CsCI having radius ratio of 0.93** NUMS (2024)
A. Tetrahedral B. Octahedral
C. Body centered cubic D. Hexagonal

ANSWER KEY

PRACTICE EXERCISE

1	D	11	B	21	D	31	C
2	A	12	C	22	C	32	C
3	D	13	D	23	C	33	B
4	A	14	C	24	B	34	A
5	D	15	D	25	B	35	C
6	B	16	B	26	A	36	C
7	B	17	B	27	A	37	B
8	C	18	C	28	A	38	D
9	D	19	D	29	C	39	D
10	C	20	C	30	A	40	D

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PAST PAPER MCQ'S

41	D	51	D	61	D	71	D	81	B	91	B
42	B	52	B	62	A	72	B	82	B	92	A
43	D	53	C	63	C	73	C	83	B	93	A
44	B	54	A	64	C	74	A	84	B	94	C
45	A	55	A	65	B	75	D	85	A		
46	D	56	A	66	A	76	B	86	A		
47	D	57	A	67	C	77	C	87	C		
48	C	58	D	68	D	78	A	88	B		
49	D	59	E	69	B	79	C	89	A		
50	B	60	C	70	D	80	B	90	D		

EXPLANATORY NOTES

Q.11 Polymorphs and allotrope are different crystalline forms of compounds and elements respectively. Therefore, transition temperature is shown by them.

Q.12 Lattice energy is inversely proportional to atomic/ion size.
Lattice energy $\propto$ Charge/Size ratio.

Q.13 Solubility is based on the principle, "like dissolves like"

Q.14 Only crystalline solids show all the properties of true solids.

Q.15 Lattice energy depends on charge to size ratio. Greater the charge to size ratio, greater is lattice energy.

Q.16 Solid iodine is non-polar and have LDF.

Q.17 Table salt is NaCl which is a crystalline solid.

Q.18 Rhombic sulphur $\xrightleftharpoons{95.5^\circ C}$ Monoclinic sulphur

Q.19 Anisotropy is directional property while isotropy is a non-directional property. Hence, metallic conduction is isotropic

Q.20 When an element exists in more than one crystalline form, it is known as allotropy

Q.21 A solid may be made up of atoms (covalent solid), molecules (molecular solid) and ions (ionic solid).

Q.22 Covalent crystals may have network structure. Therefore, they have high melting and boiling points.

Q.23 Crystal is a stable geometrical shape in which atoms, molecules or ions are located at the position of minimum potential energy.

Q.24 Quartz is a crystalline solid and have anisotropic property.

Q.25 Crystalline part of otherwise amorphous solids is known as crystallites.

Q.26 Cu, Ag and Au have cubic crystal system.

Q.27 NaCl has FCC crystalline structure.

Q.28 The angle "α" is between the lengths "b" and "c", the angle "β" is between the sides "a" and "c" and angle "γ" is between sides "a" and "b".

Q.29 There are three-unit cell lengths a, b and c and three-unit cell angels ("α", "β", "γ").

Q.30 Cubic crystal system, $a = b = c$ $\alpha = \beta = \gamma = 90^\circ$
Examples: Fe, Cu, Ag, Au, NaCl, NaBr, Diamond

Q.31 Tetragonal $a = b \neq c$ $\alpha = \beta = \gamma = 90^\circ$
Examples: Sn, SnO_2, MnO_2, NH_4Br

Q.32 Molecular crystal is formed due to intermolecular forces which are not very strong. Therefore, they are soft.

Q.33 Molecular solids are formed due to LDF or hydrogen bonding.

Q.34 A unit cell gets a total share of Cl^- ion at eight corners $= 8 \times \frac{1}{8} = 1$

Q.35 I-I bond distance in solid iodine is 271.5 pm and it is appreciably longer than in gaseous iodine (266.6pm).

Q.36 In NaCl, each Na^+ ion surrounded by six Cl^- ions and each Cl^- ion is surrounded by six Na^+ ions. So, co-ordination number of each ion in NaCl is 6.

Q.37 Metallic solids have delocalized electrons due to which they can conduct electricity.

Q.38 Independent molecule of NaCl may exist in only vapour phase.

Q.39 Sugar is a polar molecule and have hydrogen bonding.

Q.40 Dry ice is an example of molecular solid (Non-polar molecular solid).

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.41 In lattice structure of NaCl, each Na^+ ion is surrounded by six Cl^- ions and vice versa. So, coordination number of Na^+ is 6.

Q.42 In NaCl, each Na^+ ion is surrounded by six Cl^- ions.

Q.43 LiCl has maximum lattice energy as it has small sized Li^+ ion. Smaller the size, greater will be lattice energy.

$$\text{Lattice Energy} \propto \frac{\text{Charge}}{\text{Size}} \propto \text{Charge density}$$

Q.44 Graphite shows anisotropy in electrical conductance which means that graphite is conductor in one direction only (parallel to layer structure).

Q.45 In diamond, each carbon atom is sp^3 hybridized and no free electron is available. Due to unavailability of free electrons, diamond is non-conductor of electricity.

Q.46 Each carbon atom is sp^2 hybridized and one electron is available for conduction. But graphite shows property of anisotropy due to which it is conductor in one direction only.

Q.47 Crystalline solids have sharp melting point. Diamond is an example of crystalline solid.

Q.48 Lattice energy is also known as crystal energy.

Q.49 Because the structure of iodine is face-centered cubic.

Q.50 That's how we define the anisotropy.

Q.51 Electrolysis takes place in electrolytic cell and in electrolytic cell both electrodes and electrolytes are present. Conduction in electrodes takes place through the electrons while conduction in electrolyte takes place through the ions.

Q.52 Unit cell is the smallest part of crystal possess all the characteristics of the crystal

Q.53 Unit cell is the smallest part of crystal possess all the characteristics of the crystal

Q.54 Covalent solids are also called atomic solids because their structural particles are neutral atoms.

Q.55 As iodine (I_2) can exist in the form of a molecule therefore, it will form a molecular crystal.

Q.56 Na^+ and F^- both has the smallest ionic size among all the other options. Therefore, NaF has the maximum lattice energy.

Q.57 Ice is the solid form of water. As water is a polar molecule. So, the ice will be a polar molecular solid.

Q.58 $AgNO_3$ and KNO_3 are not isomorphs of each other despite having the same atomic ratio due to their different crystalline structures.

Q.59 Diffusion is not present in solids due to the absence of translational motion.

Q.60 Crystallites are parts in the amorphous solids where the arrangement of particles is regular.

Q.61 Because, in rubber the arrangement of particles is not regular.

Q.62 Because, in the structure of diamond carbon atoms are attached through the covalent bonds.

Q.63 Graphene has a single layer of carbon atoms arranged in a hexagonal lattice structure, forming a tow-dimensional (2D) material with exceptional mechanical, electrical and thermal properties.

Q.64 Molar mass is not an anisotropic property

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Q.65 K.E ∝ Temperature, by increasing temperature, metal cations vibrate and cause hindrance for the moment of electrons.

Q.66 Lattice energy $\propto \frac{\text{Charge}}{\text{Size}}$, it is related with charge and size of ions. So, it explains structure of ionic compounds.

Q.67 "P" and "S" are non-metal, among "K" and "C", calcium has smaller size and more mobile electrons, so it has strong metallic bond.

Q.68 For rhombohedral system $\beta = \gamma \neq 90°$.

Q.69 $BaSO_4$ has orthorhombic crystal system.

Q.70 Diamond is made up of carbon atoms held together by covalent bonds.

Q.71 Molecular crystals are made up of molecules which are held together by van der Waal's forces.

Q.72 In triclinic system $a \neq b \neq c$ and $\propto \neq \beta \neq \gamma$.

Q.73 Because of properties of copper crystals remain same in all directions.

Q.74 In NaCl crystal, each Na^+ ion is surrounded by six Cl^- ions and each Cl^- ion is surrounded by six Na^+ ions.

Q.75 Keeping cation same, lattice energy increases by decreasing size of anion.

Q.76 Thermal conductivity of metals is due to freely moving electrons.

Q.77 Definition of coordination number. Na has coordination number 6.

Q.78 Crystalline solids are broken along definite fames known as cleavage planes.

Q.79 Glucose is not an amorphous solid.

Q.80 In graphite the carbon atoms are arranged in hexagonal structure.

Q.81 Solid CO_2 (dry ice) is an example of molecular solids.

Q.82 NaCl is an example of octahedral arrangement of crystal lattice. (coordination number = 6)

Q.83 S_8, I_2 are molecular solids.

Q.84 Ag_2SO_4 and Na_2SO_4 isomorphs, they have same atomic ratio and structure of anions.

Q.85 CO_2 (solid) is a non-polar molecular solid.

Q.86 According to radius ratio, the shape of NaCl is octahedral $\left(\frac{r+}{r-} = 0.52\right)$.

Q.87 Cu is metallic solid.

Q.88 Properties which depend upon direction are anisotropic proportion and this phenomenon is called anisotropy.

Q.89 Dry ice (solid CO_2) is made up of molecules, so it is an example of molecular solids.

Q.90 Alum is an example of crystalline solids, white glass, plastic and charcoal are amorphous solids.

Q.91 Electrically dimond is non-conductor due to absence of free electrons.

Q.92 Transition temperature is that temperature at which one crystalline form of a substance changes to another.

Q.93 Iodine is a poor conductor of electricity and it has face centered cubic structure.

Q.94 The shape of CsCl is body centered cubic because its radius ratio is 0.93 (greater than 0.732)

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Topic 6

CHEMICAL EQUILIBRIUM

PRACTICE EXERCISE

Q.1 For this reaction $N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$, the relation between K_p and K_c is ____

A. $K_p > K_c$ B. $K_p = K_c$
C. $K_p < K_c$ D. Unpredictable

Q.2 The chemical reaction in which product formed are non-reactive then the reactants is _____

A. Backward reaction B. Forward reaction
C. Irreversible reaction D. Reversible reaction

Q.3 When no of moles of reactant are greater then no of moles of product , then Kp has value :

A. Equal to Kc B. Less than Kc
C. Greater than Kc D. None of these

Q.4 When the value of Kc of reaction is very small , it shows that

A. Reaction is at the start B. Reaction at the end
C. Very little forward reaction D. Reaction is at equilibrium

Q.5 Kc values of decomposition are given suggest which oxide of nitrogen is most stable

A. NO, $Kc = 10^{30}$ B. N_2O_5, $Kc = 10^{34}$
C. NO_2, $Kc = 10^{6}$ D. N_2O, $Kc = 10^{20}$

Q.6 Haber's process operates at 450^0C , if it is carried out at 200^0C then

A. Ammonia yield doubled B. No need of catalyst at this temperature
C. Rate of reaction very slow D. All of above

Q.7 The statement that is false about Kc is _____

A. Unaffected by ΔV B. Unaffected by ΔC
C. Unaffected by ΔP D. Unaffected by ΔT

Q.8 The solubility AgI in NaI solution is less than that in pure water _____

A. AgI form complex with NaI B. Temperature of solution decreases
C. Because of common ion effect D. None of above

Q.9 $N_2 + 3H_2 \rightleftharpoons 2NH_3$; Then which statement is correct about this reaction?

A. $Kp < Kc$ B. $Kp > Kc$
C. $Kp = Kc$ D. None

Q.10 The addition of NaCl in AgCl solution decreases its solubility but why

A. Due to K_{sp} of AgCl increases B. Due to Ksp of AgCl becomes unsaturated
C. Due to common ion effect of Cl^{-1} ion D. None of these

Q.11 At equilibrium, the concentration of reactants and products are:

A. Constant B. Different
C. Maximum D. Equal

Q.12 Statement which describes a reversible reaction?

A. Both forward and reverse reaction does not occur simultaneously
B. Both forward and reverse reaction occur simultaneously but under different conditions
C. Both forward and reverse reaction occur simultaneously at the same time under same condition
D. Forward and reverse reaction takes place at different time and different conditions

Q.13 For a homogeneous reaction $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$

The units of equilibrium constant:

A. $Conc.^{+2}$ B. $Conc.^{+1}$
C. $Conc.^{-1}$ D. No units

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Q.14 One mole of HI was sealed in a tube heated at 440°C till equilibrium is reached, HI was found to be 50% dissociated, K_c for the reaction is:

A. 1
B. 0.25
C. 0.5
D. 0.625

Q.15 For what value of K_c, forward reaction is almost completed.

A. $K_c = 10^{-30}$
B. $K_c = 10^{30}$
C. $K_c = 1$
D. $K_c = 0$

Q.16 1 mole of ethyl alcohol was treated with one mole of acetic acid at 25°C. $\frac{2}{3}$rd of acid changes into ester at equilibrium. The equilibrium constant of the reaction will be:

A. 1
B. 2
C. 3
D. 4

Q.17 At equilibrium, concentration of SO_2 is 2M, O_2 is 2M and SO_3 is 4M. $2SO_2 + O_2 \rightleftharpoons 2SO_3$. What will be the Kc value of given reaction?

A. 0.2
B. 2
C. 4
D. 8

Q.18 In a reaction $CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$, $\Delta H° = -92kJ/mol$. Concentration of hydrogen, carbon monoxide and methanol become constant at equilibrium, what will happen?

A. Reaction become faster
B. Reaction become slow
C. Equilibrium state disturbs
D. Equilibrium state remains undisturbed

Q.19 If Kc value is very small then equilibrium position will shift:

A. Towards left
B. Towards right
C. Remains unchanged
D. It is always constant value

Q.20 The equilibrium expression for a reaction is $Kc = \frac{X^2}{V(a-X)}$, what is true for this reaction?

A. Increase of pressure favoured forward reaction
B. Decrease of pressure favoured forward reaction
C. Decrease of pressure favoured backward reaction
D. Increase in volume favoured backward reaction

Q.21 For the reaction $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$. The equilibrium constant changes with:

A. Total pressure
B. Catalyst
C. Concentration of H_2 and I_2
D. Temperature

Q.22 Correct relationship between K_c and K_p can be written as:

A. $K_p = K_c (R)^{\Delta n}$
B. $K_p = K_c (RT)^{\Delta n}$
C. $K_c = K_p (RT)^{\Delta n}$
D. $K_p = K_c (R/N)^{\Delta n}$

Q.23 For the given reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$:

A. $K_p > K_c$
B. $K_p = K_c$
C. $K_p < K_c$
D. $K_p = K_c = 0$

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Q.24 For the reaction $H_2 + I_2 \rightleftharpoons 2HI$. Equilibrium concentration of H_2, I_2 and HI are 8, 3 and 24mol/dm^3 respectively. K_c of the reaction is:

A. 24 B. 1
C. 26 D. 9

Q.25 For the following reaction in the gaseous phase; $CO + \frac{1}{2}O_2 \rightleftharpoons CO_2$, $\frac{Kc}{Kp}$ is:

A. $(RT)^{\frac{1}{2}}$ B. $(RT)^{-\frac{1}{2}}$
C. RT D. RT^{-1}

Q.26 In the reaction $A_{2(g)} + 4B_{2(g)} \rightleftharpoons 2AB_{4(g)}$ such that ΔH is negative, the formation of $AB_{4(g)}$ will be favoured at:

A. Low temperature and high-pressure B. Low temperature and low pressure
C. High temperature and low-pressure D. High temperature and high pressure

Q.27 $N_2 + 3H_2 \rightleftharpoons 2NH_3$ $\Delta H = -41.02 kJ/mol$

Forward reaction is favoured by:

A. Adding NH_3 at equilibrium B. Adding catalyst
C. Decreasing temperature D. Decreasing concentration of H_2

Q.28 In a given system, water and ice are in equilibrium, if the pressure is applied to the system then?

A. More ice is formed
B. Amount of ice and water will remain the same
C. More ice is melted
D. Both A. and B.

Q.29 If the temperature is increased for following reaction, then it will go in:

$N_2 + 3H_2 \rightleftharpoons 2NH_3$ $\Delta H = -Ve$

A. Forward direction B. Reverse direction
C. Remain constant D. Cannot be predicted

Q.30 In Haber process, equilibrium mixture contains _____ NH_3 by volume.

A. 20% B. 70%
C. 55% D. 35%

Q.31 Catalyst used in Haber's process for manufacturing of NH_3 is:

A. Fe(MgO, Al_2O, SiO_2) B. Al_2O_3
C. MgO D. SiO_2

Q.32 Basic buffer solution is:

A. HF / NaF B. H_2CO_3 / Na_2CO_3
C. $(COOH)_2$ / $(COONa)_2$ D. NH_4OH/NH_4Cl

Q.33 Buffer action can be explained by all except:

A. Common ion effect B. Law of mass action
C. Le-Chatelier's principle D. Solubility product

Q.34 A basic buffer solution can be prepared by mixing:

A. Strong acid and its salt with weak base B. Weak base and its salt with strong acid
C. Strong base and its salt with weak acid D. Weak acid and its salt with strong base

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Q.35 The pH of ideal buffer is:
A. 10 B. Less than 7
C. 7 D. 0

Q.36 A certain buffer solution contains equal conc. of X^-p and HX. Ka for HX is 10^{-8}. The pH of buffer is:
A. 3 B. 8
C. 11 D. 14

Q.37 Which Henderson equation is not correct?
A. $pH = pKa + \log\frac{[salt]}{[acid]}$ B. $pH = pKa - \log\frac{[acid]}{[salt]}$
C. $pH = pKa - \log\frac{[salt]}{[acid]}$ D. $pKa = pH - \log\frac{[salt]}{[acid]}$

Q.38 For acidic buffer, pH < pKa if:
A. [salt] = [acid] B. [salt] > [acid]
C. [salt] < [acid] D. [salt] > [base]

Q.39 When HCl gas is passed through saturated solution of rock salt, the solubility of NaCl:
A. Increases B. Decreases
C. May increase or decrease D. None of these

Q.40 An excess of silver nitrate is added to the aqueous barium chloride and the precipitate is removed by filtration. What are the main ions in the filtrate?
A. Ag^+ and NO_3^- only B. Ag^+ and NO_3^- and Ba^{+2}only
C. NO_3^- and Ba^{+2}only D. Cl^- and NO_3^- and Ba^{+2}only

Q.41 Ionization of $KClO_3$ is suppressed by:
A. Increasing temperature B. Adding $NaNO_3$
C. Adding KCl D. Decreasing temperature

Q.42 If ionic product is equal to K_{sp} then the solution is:
A. Unsaturated B. Supersaturated
C. Ideal D. Saturated

Q.43 The solubility product is only applicable for those substance whose molar concentrations is
A. Equal to 0.1M B. Equal to or Less than 0.01
C. Equal to 1 D. Greater than 0.1

Q.44 In a saturated solution of AgCl, the molar concentration of Ag^+ and Cl^- is 1.0×10^{-5} M each. What is the value of Ksp?
A. 1.0×10^{-5} B. 1.0×10^{-15}
C. 0.1×10^{-5} D. 1.0×10^{-10}

Q.45 The molar solubility of sparingly soluble salt AB_3 is "S" mol/dm^3, the corresponding solubility product K_{sp} is given in term of K_{sp} by the reaction:
A. $S = \left(\frac{K_{sp}}{128}\right)^{1/4}$ B. $S = \left(27K_{sp}\right)^{\frac{1}{3}}$
C. $S = \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}$ D. $S = \left(\frac{K_{sp}}{81}\right)^{\frac{1}{4}}$

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Topic 6 CHEMICAL EQUILIBRIUM

PAST PAPER MCQ'S

Q.46 Units of Kc for the following reaction is: $H_2 + I_2 \rightarrow 2HI$ MDCAT (2010)

A. mol^2dm^{-6}
B. No unit
C. $moldm^{-3}$
D. $mol^{-2}dm^6$

Q.47 If in AgCl solution, some salt of NaCl is added, AgCl will be precipitated due to: MDCAT (2011)

A. Solubility
B. Electrolyte
C. Un saturation effect
D. Common ion effect

Q.48 Formation of NH_3 is reversible and exothermic process, what will happen on cooling? MDCAT (2012)

A. More reactant will form
B. More H_2 will be formed
C. More N_2 will be formed
D. More product (NH_3) will be formed

Q.49 A buffer solution is that which resists/minimizes the change in MDCAT (2012)

A. pOH
B. pK_a
C. pH
D. pK_b

Q.50 The chemical substance, when dissolved in water, gives "H^+" is called: MDCAT (2013)

A. Neutral
B. Base
C. Acid
D. Amphoteric

Q.51 The 'pH' of our blood is: MDCAT (2013)

A. 6.7 - 8
B. 7.5
C. 7.9
D. 7.35 – 7.4

Q.52 The value of equilibrium constant Kc for the reaction $2HF_{(g)} \rightleftharpoons H_{2(g)} + F_{2(g)}$ is 10^{-13} at 2000°C. Calculate the value of K_p for this reaction MDCAT (2014)

A. 2×10^{-13}
B. 186×10^{-13}
C. 10^{-13}
D. 3.48×10^{-9}

Q.53 What will be the pH of a solution of NaOH with a concentration of 10^{-3} M? MDCAT (2014)

A. 3
B. 11
C. 14
D. 7

Q.54 During the manufacture of nitric acid, nitric oxide is oxidized to nitrogen dioxide. This reaction is given as:

$$2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)} \quad DH = -114kJ/mol$$

According to Le Chatelier's Principle: MDCAT (2015)

A. Reaction must not be temperature dependent
B. Reaction must be carried out at room temperature
C. Reaction must be carried out at low temperature
D. Reaction must be carried out at high temperature

Q.55 What is the correct relation between pH and pKa? MDCAT (2015)

A. $pH = pKa + \log\left[\frac{Acid}{Base}\right]$
B. $pH = pKa - \log\left[\frac{Base}{Acid}\right]$
C. $pH = pKa - \log\left[\frac{Acid}{Base}\right]$
D. $pKa = pH + \log\left[\frac{Base}{Acid}\right]$

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Q.56 Which one of the following is the correct representation for k_{sp}? MDCAT (2015)

$$AgCl \rightleftharpoons Ag^{+} + Cl^{-}$$

A. $K_{sp} = \frac{[AgCl]}{[Ag^{+1}][Cl^{-1}]}$ B. $K_{sp} = \frac{[Ag^{+1}][Cl^{-1}]}{[AgCl]}$

C. $K_{sp} = [Ag^{+1}][Cl^{-1}]$ D. $K_{sp} = [AgCl]$

Q.57 Human blood maintains its pH between: MDCAT (2016)

A. 6.50 – 7.00 B. 7.50 – 7.55

C. 7.20 – 7.25 D. 7.35 – 7.40

Q.58 Value of K_{sp} for $PbSO_4$ system at 25°C is equal to: MDCAT (2016)

A. 1.6×10^{-5} mol^2dm^{-6} B. 1.6×10^{-8} mol^2dm^{-6}

C. 1.6×10^{-6} mol^2 dm^{-6} D. 1.6×10^{-7} mol^2dm^{-6}

Q.59 For which of the following equilibrium reaction, K_c has no units? MDCAT (2017)

A. $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ B. $CO_{(g)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$

C. $SO_{2(g)} + 2O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ D. $2NO_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$

Q.60 Consider the following reversible reaction;

$$CH_3-CH_2-OH_{(l)} + CH_3-\overset{O}{\overset{\|}{C}}-O-H \rightleftharpoons CH_3-CH_2-O-\overset{O}{\overset{\|}{C}}-CH_{3(l)} + H_2O_{(l)}$$

Initial concentration;

$(CH_3CH_2OH) = 1mol$ $\left(CH_3-CH_2-O-\overset{O}{\overset{\|}{C}}-CH_3\right) = 0mol$

$(CH_3COOH) = 1mol$ $(H_2O) = 0mol$

Equilibrium concentration;

$(CH_3CH_2OH) = 0.333mol$ $\left(CH_3-CH_2-O-\overset{O}{\overset{\|}{C}}-CH_3\right) = 0.666mol$

$(CH_3COOH) = 0.333mol$ $(H_2O) = 0.666mol$

$K_c = 4$ at 100°C

What are new equilibrium concentrations of all species if 1 mole of each of CH_3CH_2OH and CH_3COOH are added to this equilibrium mixture? (Apply Le-Chateller's Principle) (Temperature remained same) MDCAT (2017)

A. $(CH_3COOH) = 0.333mol$ $(CH_3COOC_2H_5) = 1.666mol$
$(C_2H_5OH) = 1.333mol$ $(H_2O) = 0.666mol$

B. $(CH_3COOH) = 1.333mol$ $(CH_3COOC_2H_5) = 0.666mol$
$(C_2H_5OH) = 0.333mol$ $(H_2O) = 1.666mol$

C. $(CH_3COOH) = 0.666mol$ $(CH_3COOC_2H_5) = 1.333mol$
$(C_2H_5OH) = 0.666mol$ $(H_2O) = 1.333mol$

D. $(CH_3COOH) = 0.333mol$ $(CH_3COOC_2H_5) = 1.333mol$
$(C_2H_5OH) = 0.333mol$ $(H_2O) = 1.333mol$

Q.61 $Ca(OH)_2$ **is sparingly soluble having solubility product value 6.5×10^{-6}. What will be its solubility?** MDCAT (2017)

A. 2.75×10^{-2} B. 1.17×10^{-2}

C. 2.75×10^{2} D. 3.63×10^{3}

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Q.62 The product of the concentrations of each ion in saturated solution of a sparingly soluble sal: at 298K raised to the power of their relative concentrations is: MDCAT (2018)

A. K_{sp} B. K_b
C. K_a D. K_w

Q.63 Which of the following factors affect a reversible chemical reaction in accordance with the Le-Chatelier's principle?

A. Pressure
B. Temperature
C. Concentration
D. Pressure, concentration and temperature

Q.64 Which one of the following factors does not affect the equilibrium position? SET (2019)

A. Catalyst
B. Concentration of reactants and product
C. Temperature
D. Pressure

Q.65 The Kc Unit for the reaction $N_{2(g)}+3H_{2(g)}\rightarrow 2NH_{3(g)}$ is: NUMS (2019)

A. $mole^{-1}dm^{+6}$ B. $mole^{-2}dm^{+3}$
C. $mole^{-2}dm^{+6}$ D. $mole^{-1}dm^{+3}$

Q.66 Which one of the following bases has highest K_b value? NUMS (2019)

A. NH_4OH B. NaOH
C. $Ca(OH)_2$ D. CH_3NH_2

Q.67 What is the pH of 0.1M of HCl? SET (2019)

A. 1 B.0.1
C. 0.01 D. –1

Q.68 The pka values of CH_3COOH is 4.74, the pH of equimolar solution of acetic acid and sodium acetate is: NUMS (2019)

A. 13.0 B. 7.2
C. 4.79 D. 4.74

Q.69 Precipitation occurs when the product of ionic concentration is? NUMS (2019)

A. Greater than Ksp B. Less than Ksp
C. Equal to Ksp D. Equal to unity

Q.70 $K_p = K_c(RT)$ in the equation if $\Delta n < 0$ then: ETEA (2016)

A. $K_p = K_c$ B. $K_p < K_c$
C. $K_p > K_c$ D. $K_p < 0$

Q.71 pK_a values of some acids are given below; choose the weaker acid? ETEA (2016)

A. $HClO_4(-10)$ B. HBr(–9)
C. $H_2SO_4(-3)$ D. HCl(–7)

Q.72 Consider the reversible reaction. $N_2 + 2NH_3 \rightleftharpoons 2NH_3 + Heat$

The yield of NH_3 will be maximum at ETEA (2019)

A. High temperature and low pressure B. High temperature and high pressure
C. Low temperature and low pressure D. Low temperature and high pressure

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Q.73 Ice and water is in equilibrium with each other. By increasing the pressure the equilibrium will shift in ETEA (2019)

A. Forward
B. Reverse
C. To all system at equilibrium
D. None of the above

Q.74 For an equilibrium reaction; MDCAT (2019)

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

The forward reaction is exothermic, increase in temperature shifts the equilibrium position towards left because:

A. The concentrations of SO_3, SO_2 and O_2 increase as the temperature increases
B. The concentrations of SO_2 and O_2 increase and concentration of SO_3 decreases as the temperature increases
C. The concentrations of SO_2 and O_2 decrease and concentration of SO_3 increases as the temperature increases
D. The concentrations of SO_2 and O_2 increase and concentration of SO_3 stays same as the temperature increases

Q.75 Which of the following reaction has greater K_p than K_c ($K_p > K_c$)? NMDCAT (2020)

A. $2\,NO + Cl_2 \rightleftharpoons 2\,NOCl$
B. $2\,SO_2 + O_2 \rightleftharpoons 2\,SO_3$
C. $2\,NOCl \rightleftharpoons 2\,NO + Cl_2$
D. $N_2 + 3H_2 \rightleftharpoons 2\,NH_3$

Q.76 The equation $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ represents: NMDCAT (2020)

A. Contact process
B. Haber's process
C. Solvay's process
D. Avogadro's law

Q.77 For a gaseous phase reaction, when number of moles of reactants and products are equal: NMDCAT (2020)

A. The values of K_p and K_c are different
B. The value of K_p is greater that K_c
C. The value of K_c is greater that K_c
D. The value of K_p and K_c are the same

Q.78 Purification of table salt (NaCl) by passing HCl gas through its saturated aqueous solution is an example of NMDCAT (2020)

A. Law of mass action
B. Hess's law
C. Common ion effect
D. Henry's law

Q.79 $H_2 + I_2 \rightleftharpoons 2HI$. Relation between K_p and K_c for this reaction is: PMC (2021)

A. $K_p = K_c/RT$
B. $K_p = K_c$
C. $K_c = K_p/RT$
D. $K_p = K_c(RT)^{-1}$

Q.80 According to Le-Chatelier's principle, exothermic reactions are favored by: PMC (2021)

A. Increase in pressure
B. Increase in volume
C. Decrease in temperature
D. All of these

Q.81 The equilibrium constant is always written as a ratio of: PMC (2021)

A. Reactants over products
B. Product over reactants
C. Product times reactants
D. None of these

Q.82 Manufacturing of Ammonia by Haber's process is an: PMC (2021)

A. Endothermic reaction
B. Irreversible
C. Exothermic reaction
D. Slow

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Q.83 The decrease in solubility of the salt in a solution that already contains an ion common to that salt is known as: UHS (2022)
A. Le-Chatelier's principle B. Solubility product
C. Common ion effect D. Ksp

Q.84 The precipitation occurs if the ionic concentration is: UHS (2022)
A. Less than Ksp B. More than Ksp
C. Equal to Ksp D. Present in any amount

Q.85 One can estimate the direction in which equilibrium will shift with the help of: UHS (2022)
A. Le-Chatelier's principle B. Law of mass action
C. Hess's law D. Law of heat of formation

Q.86 For the chemical reaction; SZABMU (2022)

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$$

We can maximize the yield of NH_3:
A. By increasing the temperature
B. By decreasing the pressure
C. By increasing the volume of the reaction vessel
D. By continuous withdrawal of ammonia after intervals

Q.87 The high pressure of 200 atm in Haber process is used for: SZABMU (2022)
A. Better yield B. Lower yield
C. Lower rate D. Cost decrease

Q.88 By which of the following factors equilibrium state is attained earlier? SZABMU (2022)
A. Temperature B. Pressure
C. Concertation D. Catalyst

Q.89 Which of the following is not the use of the Buffer solution? SZABMU (2022)
A. Used for the calibration of pH meters B. Used to preserve biological specimen
C. Maintain the pH of the human blood D. Predict the concentration of a substance

Q.90 Buffer capacity is maximum when both components have: ETEA (2022)
A. High concentration B. Equal concentration
C. Low concentration D. High and equal concentration

Q.91 If solubility product (Ksp) value is large the salt in water is: ETEA (2022)
A. More soluble B. Less soluble
C. Moderately soluble D. No concentration

Q.92 The value of solubility products depends only on_____. ETEA (2022)
A. Temperature B. Solvent
C. Pressure D. Catalyst

Q.93 In exothermic reaction, by decreasing the temperature, equilibrium constant: DUHS (2022)
A. Same B. Sometimes decreases or increases
C. Reaction moves backward D. Decreases
E. Increases

Q.94 At equilibrium in a reversible reaction: DUHS (2022)
A. The rate of backward reaction > rate of forward reaction
B. The rate of forward reaction > rate of backward reaction
C. The rate at forward reaction is same as the rate of backward reaction.
D. The concentration of reactants & products becomes constant & the rate of forward reaction is same as the rate of backward reaction
E. The concentration of reactant & products becomes constant

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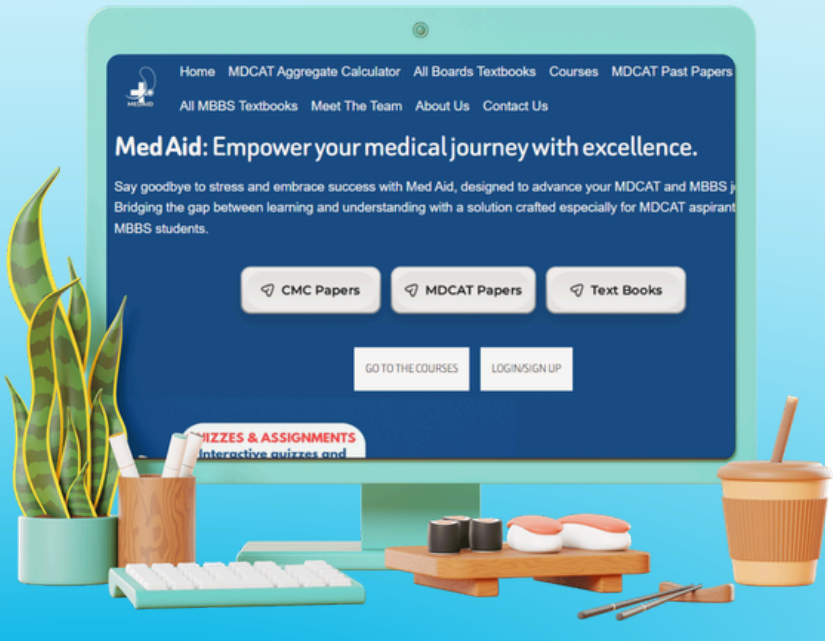

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Q.95 The solubility product K_{sp} predicts whether: DUHS (2022)
A. Diffusion B. Solubility
C. Precipitation will take place or not D. Boiling point
E. Melting point

Q.96 The precipitation occurs, if the ionic concentration is: BMU (2022)
A. Less than K_{sp} B. More than K_{sp}
C. Equal to K_{sp} D. Present in any amount

Q.97 Why a reaction is reversible? BMU (2022)
A. Reactants are reactive B. Products are reactive
C. Reactants are stable D. Products are stable

Q.98 Acetic acid is weak acid than sulphuric acid because of which of the following reasons? BMU (2022)
A. It decomposes on increasing temperature B. It has less degree of ionization
C. It has –COOH group D. It has more inductive effect

Q.99 The pH of human blood is: NUMS (2022)
A. 7.35 to 7.45 B. 6.35 to 7.45
C. 8.35 to 8.45 D. 5.57 to 6.57

Q.100 Which term describes a solution in which dissolved solute is in equilibrium with undissolved solute? NUMS (2022)
A. Dilute B. Unsaturated
C. Saturated D. Supersaturated

Q.101 What is the ultimate fate of reversible reaction? UHS (2023)
A. Completion of reaction
B. Complete consumption of reactants
C. Complete consumption of products
D. A state when there is no net concentration change

Q.102 In reversible reaction, when product is removed, the equilibrium shift towards the: UHS (2023)
A. Reactant side B. Product side
C. Both side one by one D. No effect

Q.103 One can estimate the direction in which equilibrium will shift with the help of: UHS (2023)
A. Le Chatelier's principle B. law of mass action
C. Mess's law D. Law of heat of formation

Q.104 $N_2 + 3H_2 \rightleftharpoons 2NH_3$ $(\Delta H = -92.5)$ SZABMU (2023)
A. Low temperature B. High temperature
C. Continuous removal NH_3 D. Continuous addition of NH_3

Q.105 What is not true about the Le-Chatelier's principle? SZABMU (2023)
A. Allow to predict the change in concentration on system at equilibrium
B. Allow to predict the change in reaction rate on system at equilibrium
C. Allow to predict the change in pressure on system at equilibrium
D. Allow to predict the change in temperature on system at equilibrium

Q.106 For a gaseous phase reaction, when number of moles of reactant and product are equal: SZABMU (2023)
A. The values of K_p and K_c are different B. The value of K_p is greater that K_c
C. The value of K_c is greater than K_p D. The values of K_p and K_c are the same

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Q.107 Haber's process is used for the synthesis of ammonia. The optimum temperature for the Haber process is: ETEA (2023)
A. 35 – 50°C
B. 130 – 150°C
C. 400 – 450°C
D. 500 – 600°C

Q.108 If ionic product is less than K_{sp} then: ETEA (2023)
A. Solution will be saturated
B. Precipitation will occur
C. Solution will be super saturated
D. No precipitation will occur

Q.109 For $\Delta n = 0$ ETEA (2023)
A. $K_p = K_n$
B. $K_p \neq K_n$
C. $K_p > K_n$
D. $K_p < K_n$

Q.110 Which of the following reactions has same value of Kc & K_P? DUHS (2023)
A. $N_2 + 3H_2 \rightarrow 2NH_3$
B. $PCl_5 + PCl_3 \rightarrow Cl_2$
C. $H_2 + I_2 \rightarrow 2HI$
D. $2SO_2 + O_2 \rightarrow 2SO_3$

Q.111 Which of the following conditions required for maximum yield of ammonia through Haber's process? DUHS (2023)
A. Increasing temperature
B. Decreasing concentration of reactant
C. Decreasing pressure
D. Decreasing temperature

Q.112 Which of the following is true for reversible reaction at equilibrium? DUHS (2023)
A. The rate of forward reaction is greater than backward reaction
B. The rate of forward reaction is lesser than backward reaction
C. The rate of backward reaction is equal to forward reaction
D. The rate of backward reaction is greater than forward reaction

Q.113 The solubility of $KClO_3$ is decreased by adding BUMHS (2023)
A. KCl
B. $KClO_3$
C. H_2O
D. Not effected

Q.114 The equilibrium stage that is not affected by temperature is called? BUMHS (2023)
A. Static equilibrium
B. Natural equilibrium
C. Dynamic equilibrium
D. Unstable equilibrium

Q.115 Temperature increase in an exothermic reversible reaction, shift the equilibrium to: BUMHS (2023)
A. Product side
B. Reactant side
C. Remains unchanged
D. Increase in both

Q.116 The high pressure of 200 atm in Haber's process is used for: NUMS (2023)
A. Better yield
B. Lower yield
C. Lower rate
D. Coast decrease

Q.117 By which of the following factors equilibrium state is attained earlier? NUMS (2023)
A. Temperature
B. Pressure
C. Concentration
D. Catalyst

Q.118 The principle that states if a stress is applied to a system at equilibrium the system nullify the effect of stress as far as possible is: UHS (2024)
A. Haber's
B. Le-Chatelier's
C. Boyle's
D. Charle's

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Q.119 Identify the correct option required for the maximum yield of ammonia in Haber's process: UHS (2024)

A. High pressure low temperature continual removal of ammonia
B. Low pressure low temperature continual removal of ammonia
C. High pressure high temperature continual removal of ammonia
D. High pressure low temperature continual addition of ammonia

Q.120 Consider the following reaction in the equilibrium and tell addition of which will turn the cloudy solution into clear solution? UHS (2024)

$BiCl_3 + H_2O \rightleftharpoons BiOCl + 2HCl$

A. $BiCl_3$ B. H_2O
C. $BiOCl$ D. HCl

Q.121 In endothermic reaction, the heat content of the UHS (2024)

A. Reactants and products is equal B. Reactants is more than that of products
C. Products is more than that of reactants D. Reactants & products will not change

Q.122 Chemical equilibrium given below will shift to backward direction by _____. SZABMU (2024)

$2NO + O_2 \rightleftharpoons 2NO_2 + Heat$

A. Decreasing pressure and increasing temperature
B. Decreasing the temperature
C. Decreasing the temperature
D. Increasing the pressure

Q.123 Which of the following mixture will constitute the buffer solution? SZABMU (2024)

$$6CO_2 + 6H_2O \xrightarrow{sunlight} C_6H_{12}O_6 + 6O_2$$

A. Acetic acid & sodium acetate B. Acetic acid & ammonia
C. Acetic acid and ammonium acetate D. Ammonia & ammonium acetate

Q.124 According to law of mass action, $K_p > K_c$ when reaction occurs with _____. SZABMU (2024)

A. Decrease in volume on product side B. Increase in volume on product side
C. Increase in volume on reactant side D. Simultaneous increase and decrease

Q.125 What will be the molarity of HCl solution with pH=4? (Out of syllabus) SZABMU (2024)

A. 0.0001 B. 0.0004
C. 0.004 D. 4

Q.126 If weak acid is diluted with water, then H^+ ions concentration will _____. (Out of syllabus) SZABMU (2024)

A. Decrease B. Gradually decreases then increase
C. Increase D. Remain same

Q.127 The pH of human blood is SZABMU-RC (2024)

A. 7.35 to 7.45 B. 8.35 to 8.45
C. 6.35 to 7.45 D. 5.57 to 6.57

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Q.128 Maximum yield of ammonia can be obtained by SZABMU-RC (2024)
A. Low temperature, high pressure
B. Low temperature, low pressure
C. High temperature, high pressure
D. High temperature, low pressure

Q.129 Which of the following factor will disturb chemical equilibrium in a given reaction? SZABMU-RC (2024)

$2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)} \Delta H° = +ive$

1. Change in concentration
2. Change in temperature
3. Change in pressure
4. change in volume

A. 1, 2
B. 3
C. 2, 3
D. 3, 4

Q.130 The pK_a, of n-propyl amine is ETEA (2024)
A. 3.24
B. 3.28
C. 3.32
D. 3.35

Q.131 Forward reaction is the one that ETEA (2024)
A. Is very slow at the beginning of the reaction
B. Reacts to form reactants
C. Speeds up gradually and at equilibrium its rate becomes constant
D. Takes place from left to right as given in chemical equation

Q.132 In the production of SO_3, from SO_2 and Oxygen, the yield of SO_3, is increased by ETEA (2024)
A. Adding a catalyst
B. Adding more SO_2
C. Increasing temperature
D. Removing oxygen

Q.133 Consider $N_2 + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ $\Delta H = -92.46 kJ/mol$ The optimum temperature, (°C. to produce ammonia is ETEA (2024)
A. 0
B. 450
C. 5000
D. Constant temperature

Q.134 The unit of Kc for the system $PCl_5 \rightarrow PCl_3 + Cl_2$ is ETEA (2024)
A. dm^3/mol
B. mol/dm^3
C. mol/dm^2
D. mol/dm^6

Q.135 The equilibrium of this reaction would not be affected by an increase in pressure DUHS (2024)
A. $2SO_2 + O_2 \rightleftharpoons 2SO_3$
B. $N_2 + O_2 \rightleftharpoons 2NO$
C. $2NO + Cl_2 \rightleftharpoons 2NOCl$
D. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

Q.136 The pH value of human blood is: DUHS (2024)
A. 7.8
B. 7.35
C. 7.33
D. 6.62

Q.137 The term "active mass" used in the Law of Mass Action means: DUHS (2024)
A. Number of moles per dm^3
B. Number of moles per litter
C. Gram per dm3
D. Number of moles

Q.138 Conjugated acid NH_3 is DUHS (2024)
A. NH_4^+
B. NH
C. NH_2
D. NH_2

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Q.139 According to Raoult's law, the relative lowering of vapor pressure is equal to: (Out of syllabus) DUHS (2024)

A. Mole fraction of solute
B. Mole fraction of solvent
C. Molarity
D. Molality

Q.140 A colloidal solution of liquid into liquid is known as: (Out of syllabus) DUHS (2024)

A. Solid foam
B. Foam
C. Fog
D. Emulsion

Q.141 Le-Chatelier's principle does not give the information of effect of the following on equilibrium. BMU (2024)

A. Time
B. Pressure
C. Temperature
D. Concentration

Q.142 Equilibrium constant has no units, if the number of moles of product are BMU (2024)

A. Less than reactants
B. More than reactants
C. Equal to reactants
D. Half of reactants

Q.143 The sum of pH and pOH for pure water at 25°C is BMU (2024)

A. 10^{14}
B. 10^{-14}
C. 14
D. 25

Q.144 Suppose the following system has reached equilibrium at a certain temperature

$$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$$

Adding N_2O_4 to the system will BMU (2024)

A. Start forward reaction
B. Start reverse reaction
C. Not disturb equilibrium
D. Raise the temperature of system

Q.145 The solubility of PbS at 25°C is 4.0×10^{-28} Then ionic concentration will be: NUMS (2024)

A. 4×10^{-14}
B. 2×10^{-14}
C. 1×10^{-14}
D. 3.0×10^{-10}

Q.146 What conditions should be applied to minimize the leftover reactants in ammonia synthesis? NUMS (2024)

A. 200 atm, 500°C
B. 400 atm, 200°C
C. 100 atm, 400°C
D. 200 atm, 400°C

Q.147 Select the buffer solution having highest pH: NUMS (2024)

A. 0.1M CH_3COOH, 0.01M CH_3COO^-
B. 0.1M CH_3COOH, 0.05M CH_3COO^-
C. 0.1M CH_3COOH, 0.10M CH_3COO^-
D. 0.1M CH_3COOH, 0.15M CH_3COO^-

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ANSWER KEY

PRACTICE EXERCISE

1	B	11	A	21	D	31	A	41	C
2	C	12	C	22	B	32	D	42	D
3	B	13	B	23	A	33	D	43	B
4	C	14	B	24	A	34	B	44	D
5	C	15	B	25	A	35	C	45	C
6	C	16	D	26	A	36	B		
7	D	17	B	27	C	37	C		
8	C	18	D	28	C	38	C		
9	A	19	A	29	B	39	B		
10	C	20	B	30	D	40	B		

PAST PAPER MCQ'S

46	B	56	C	66	B	76	B	86	D	96	B	106	D	116	A	126	A	136	B	146	D
47	D	57	D	67	A	77	D	87	A	97	B	107	C	117	D	127	A	137	A	147	D
48	D	58	B	68	D	78	C	88	D	98	B	108	D	118	B	128	A	138	A		
49	C	59	B	69	A	79	B	89	D	99	A	109	A	119	A	129	A	139	A		
50	C	60	C	70	B	80	C	90	B	100	C	110	C	120	D	130	C	140	A		
51	D	61	B	71	C	81	B	91	A	101	D	111	D	121	C	131	D	141	A		
52	C	62	A	72	D	82	C	92	A	102	B	112	C	122	A	132	B	142	C		
53	B	63	D	73	A	83	C	93	E	103	A	113	A	123	A	133	B	143	C		
54	C	64	A	74	B	84	B	94	D	104	D	114	C	124	B	134	B	144	A		
55	C	65	C	75	C	85	A	95	C	105	B	115	B	125	A	135	B	145	B		

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EXPLANATORY NOTES

Q.11 At dynamic equilibrium;

- Rate of forward reaction (R_f) = Rate of backward reaction (R_b)
- Concentration of reactant and product becomes constants.

It means at equilibrium, concentration of reactant and product does not change with time. No matter, how much long reaction proceed.

Q.12 In dynamic equilibrium, both forward and reverse reaction takes place simultaneously because conditions applied favour both forward and reverse reaction.

Q.13 $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$

$$\Delta n = n_P - n_R$$
$$= 10 - 9$$
$$\Delta n = +1$$

For unit of K_c,

$$K_c = (\text{conc})^{\Delta n}$$
$$K_c = (\text{conc})^{+1} = \text{mol dm}^{-3} = \text{mol L}^{-1}$$

Q.14 $2HI \rightleftharpoons H_2 + I_2$

2 mol 1 mol 1 mol
1 mol 0.5 mol 0.5 mol

According to statement HI was found to be 50% dissociated.

0.50 mol 0.25 mol 0.25 mol

$$Kc = \frac{[H_2][I_2]}{[HI]^2} = \frac{(0.25)(0.25)}{(0.50)^2} \frac{1}{4} = 0.25 \text{ mole}$$

Q.15 If the Kc value is very high, reaction is more favourable in forward direction.

Q.16

$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

1	1	0	0	t = 0
$1-\frac{2}{3}$	$1-\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	t = eq.
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	

$$Kc = \frac{[CH_3COOC_2H_5][H_2O]}{[CH_3COOH][C_2H_5OH]} \quad Kc = \frac{\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)}{\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)} = 4$$

Q.17

$$Kc = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{(4)^2}{(2)^2(2)} = \frac{16}{8} = 2$$

Q.18 Concentration of reactant and product become constant.
It means, at equilibrium, concentration of reactants and products do not change with time. No matter how much long reaction proceed.

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Q.19 If Kc is very small it means forward reaction is just started. Products are less stable, reactants are more stable and equilibrium position is shifted towards left side.

Q.20 If volume factor is in denominator of K_c expression, it means, mole (volume) of product are more than mole (volume) of reactant. According to Le-Chatelier's principle, increases in pressure move reaction in direction in which volume is less. So, less pressure favours the forward reaction.

Q.21

$$K_c = \frac{K_f}{K_r}$$

Equilibrium constant (Kc) is ratio of K_f and K_r. Its value is only changed by change in temperature. Change in temperature (ΔT) changes both equilibrium constant (K_c) as well as equilibrium state / position (Q_c).

Q.22 $K_p = K_c(RT)^{\Delta n}$, $K_p = K_x(RT/V)^{\Delta n}$, $K_p = K_n\left(\frac{P}{N}\right)^{\Delta n}$

Q.23

- If $\Delta n = +ve$ then $K_p > K_c$
- If $\Delta n = -ve$ then $K_p < K_c$
- If $\Delta n = 0$ then $K_p = K_c$

and

$$\Delta n = n_P - n_R$$

for $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

$$\Delta n = 2 - 1$$

$\Delta n = 1$

As, Δn is +ve. So, $K_p > K_c$

Q.24

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(24)^2}{(8)(3)}$$

$$= \frac{24 \times 24}{24} = 24$$

Q.25 $CO + \frac{1}{2}O_2 \rightleftharpoons CO_2$

$$\Delta n = n_P - n_R = 1 - \frac{3}{2} = -\frac{1}{2}$$

$$K_p = K_c(RT)^{\Delta n} = K_c(RT)^{-\frac{1}{2}}$$

$$K_p = \frac{K_c}{(RT)^{\frac{1}{2}}} = (RT)^{\frac{1}{2}} = \frac{K_c}{K_p}$$

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Q.26

$$A_{2(g)} + 4B_{2(g)} \rightleftharpoons 2AB_{4(g)} \qquad \Delta H = -Ve$$

According to Le-Chatelier's principle, for exothermic reaction;

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

Increase in pressure move reaction in direction in which volume in less. Because reactant have more volume than product so increase in pressure favours forward reaction.

Q.27

According to Le-Chatelier's principle, for exothermic reaction

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

Q.28

Ice $\rightleftharpoons$ liquid water

According to Le-Chatelier's principle, increase in pressure move reaction in direction in which volume is less. Ice has 9% more volume than liquid water. So, increase in pressure will convert ice (more volume) into liquid water (less volume). So, by increasing pressure ice starts to melt.

Q.29 According to Le-Chatelier's principle, For exothermic reaction;

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

If temperature is increased, then yield of product become less. It means reaction move in reverse direction.

Q.30 The equilibrium mixture has 35% by volume of NH_3.

- Nearly 13% of all nitrogen fixation on earth is accomplished through Haber's process.
- About 80% of NH_3 is used for the production of fertilizers.

Q.31 Optimum conditions for the reasonable yield of ammonia:

(i) Temperature around 673K (400°C)

(ii) Pressure about 200-300atm.

(iii) Pieces of iron crystals embedded in fused mixture of MgO, Al_2O_3 and SiO_2.

Q.32 Basic buffer is the mixture of weak base and salt of it with strong acid.
NH_4OH is weak base and NH_4Cl is salt of strong acid (HCl).

Q.33 There is no role of solubility product in buffer action.

Q.34 NH_4OH is weak base and NH_4Cl is salt of strong acid (HCl). It is an example of basic buffer.

Q.35 If the pH of buffer is 7 then it is called neutral buffer which is ideal.

Q.36 $pKa = -\log K_a$

$pKa = -\log 10^{-8}$

$pKa = 8\log 10$

$= 8(1) = 8$

$$pH = pKa + \log\left[\frac{\text{Salt}}{\text{Acid}}\right] = 8 + \log\frac{1}{1} = 8 + 0 = 8$$

If concentration of salt and acid is equal, then buffer solution has pH = pKa. Such buffer is called best buffer.

Q.37 The Henderson equation can be written as given below:

$$pH = pKa + \log\frac{[salt]}{[acid]}$$

$$pH = pKa - \log\frac{[acid]}{[salt]}$$

$$Pka = pH - \log\frac{[salt]}{[acid]}$$

Q.38 For acidic buffer,

- pH will be less than pKa, if [salt] < [acid]
- pH will be greater than pK_a, if [salt] > [acid]
- pH will be equal to pK_a, if [salt] = [acid]

Q.39

$$NaCl \rightleftharpoons Na^+ + Cl^-$$

$$HCl \rightleftharpoons H^+ + Cl^-$$

Due to common ion effect, solubility and ionization of NaCl decreases.

Q.40

$$2AgNO_3 + BaCl_2 \longrightarrow 2AgCl + Ba^{+2} + NO_3^-$$

If $AgNO_3$ is in excess then filterate contains Ba^{+2}, NO_3^- and Ag^+. AgCl forms whites ppt, removed by filtration. $BaCl_2$ is consumed completely as compared to $AgNO_3$.

Q.41

$$KClO_3 \rightleftharpoons K^+ + ClO_3^-$$

$$KCl \rightleftharpoons K^+ + Cl^-$$

The solubility of less soluble salt $KClO_3$ in water is suppressed by addition of more soluble salt KCl due to common ion effect.

Q.42 According to solubility product

- If ionic product = K_{sp}, then solution is saturated.
- If ionic product < K_{sp}, then solution is unsaturated.
- If ionic product > K_{sp}, then solution is supersaturated.

Q.43 The solubility product is applicable for sparingly soluble salt whose concentration is equal to or less than $0.01 moldm^{-3}$.

Q.44 c

$$AgCl \rightleftharpoons Ag^+ + Cl^-$$

$$K_{sp} = [Ag^+][Cl^-]$$

$$= (1\times10^{-5})\times(1\times10^{-5})$$

$$= 1\times10^{-10}$$

Q.45 $AB_3 \rightleftharpoons A^{+3} + 3B^{-1}$

s s 3s

For a compound having four ions;

$K_{sp} = [A^{+3}].[B^{-1}]^3$

$K_{sp} = (s).(3s)^3$

$K_{sp} = 27s^4$

$s = (K_{sp}/27)^{1/4}$

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.46 $H_2 + I_2 \rightleftharpoons 2HI$

For unit of K_c:

$K_c = (moldm^{-3})^{\Delta n}$

$\Delta n = n_P - n_R$

$= 2 - 2 = 0$

So, for this reaction Kc has no unit.

Q.47 Due to common ion effect, strong electrolyte will suppress the ionization of weak electrolytes. Solubility decrease and it will precipitate out.

Q.48 In case of exothermic reactions, when we decrease temperature, then reaction will be favourable toward forward direction and in Haber's process more NH_3 will be formed.

Q.49 Buffer solutions resist the change in pH.

Q.50 Acid gives proton "H^{+}" in water.

Q.51 pH of human blood is 7.35– 7.40.

Q.52 $Kp = Kc\,(RT)^{\Delta n}$

$2HF \rightleftharpoons H_2 + F_2$

For given reaction $\Delta n = 0$

So, $Kp = Kc\,(RT)^{0} = Kp = Kc$, So, $Kp = 10^{-13}$

Q.53

$NaOH \longrightarrow Na^{+} + OH^{-1}$

$10^{-3}M \longrightarrow 10^{-3}M$

$pOH = -\log[OH^{-}] = -(-3)(-\log 10)\ pOH = (+3)(1) = 3$

As, we know that,

$pH + pOH = 14$

$pH = 14 - pOH$

$pH = 14 - 3 = 11$

Q.54 $2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)} \quad \Delta H = -114 kJ/mol$

Because reaction is exothermic. So, it must be carried out at law temperature.

Q.55

$$pH = pKa + \log\frac{[salt]}{[Acid]} \quad \text{or} \quad pH = PKa + \log\frac{[Base]}{[Acid]}$$

$$pH = pKa - \log\frac{[Acid]}{[Salt]} \quad \text{or} \quad pH = pKa - \log\frac{[Acid]}{[Base]}$$

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Q.56 $Ksp = [cation]^{x}[Anion]^{y}$ for $AgCl \rightleftharpoons Ag^{+1} + Cl^{-1}$

so, $Ksp = [Ag^{+1}][Cl^{-1}]$

Q.57 pH of Human blood is 7.35–7.40

Q.58 Ksp value of $BaSO_4$ at 25°C is 1.6×10^{-8} mol^2dm^{-6}.

Q.59 Unit of Kc = $(moldm^{-3})^{\Delta n}$

a. $N_2 + 3H_2 \rightleftharpoons 2NH_3$ $\quad Kc = (moldm^{-3})^{-2} = mol^{-2}dm^{+6}$

b. $CO + H_2O \rightleftharpoons CO_2 + H_2$ $\quad Kc = (moldm^{-3})^{0} = No.Unit.$

c. $SO_2 + 2O_2 \rightleftharpoons 2SO_3$ $\quad Kc = (moldm^{-3})^{-1} = mol^{-1}dm^{+3}$

d. $2NO_2 + O_2 \rightleftharpoons 2NO$ $\quad Kc = -(moldm^{-3})^{-1} = mol^{-1}dm^{+3}$

Q.60 As the Kc value is constant so, by doubling the concentration it will remain same and concentration of all reactants and products will also be doubled.

Q.61 For AB_2 type salt, we use ksp = $4s^3$

$Ca(OH)_2 \rightleftharpoons Ca^{2+}_{(aq)} + 2OH^-_{(aq)}$

$Ca(OH)_2 \rightleftharpoons 0 \quad + \quad 0$ (Initial stage)

$Ca(OH)_2 \rightleftharpoons S \quad + \quad 2S$ (Equilibrium stage)

The $K_{sp} = 6.5\times10^{-6}$

The concentration of OH^- is double the concentration of Ca^{2+}, So;

$K_{sp} = [Ca^{2+}][OH^-]^2 = S \times (2S)^2$

$4S^3 = 6.5\times10^{-6}$

So, $S = \left(\frac{6.5\times10^{-6}}{4}\right) = (1.625\times10^{-6})^{1/3}$

$S = (1.625)^{1/3} \times 10^{-2} = 1.175 \times 10^{-2}$

Q.62 Solubility product is defined as the product of concentration of each ion in saturated solution of a sparingly soluble salt at 25°C or 298K raised to power of their relative concentration.

Q.63 Factors which effect reversible chemical reaction are; conc. pressure, volume and temperature.

Q.64 Catalyst does not affect the equilibrium position it just increase the rate of reaction.

Q.65 Unit of Kc for Haber's process is;

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

$Kc = (mol\,dm^{-3})^{\Delta n} = ? = (moldm^{-3})^{-2} = mol^{-2}dm^{+6}$

Q.66 Kb ∝ basic strength

NaOH is a very strong base, so it will have highest K_b value.

Q.67

$1HCl \rightleftharpoons 1H^+ + Cl^{-1}$

0.1 mole $\quad$ 0.1 mole

$pH = -\log[H^+] = -\log(10^{-1}) = -(-1)\log 10 = +1(1) = 1$

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Q.68 $pH = pKa + \log \frac{[salt]}{[Acid]}$

When salt and acid have equal concentration, then;

- Log1=0

So,

pH = PKa

PKa of CH_3COOH is 4.74, So, pH will be 4.74.

Q.69 When Ksp < Ionic product then Precipitation formed Ksp. Ionic product means unsaturated solution Ksp = ionic product saturated solution.

Q.70 $Kp = Kc \quad \Delta n = 0$

$Kp < Kc \quad \Delta n < 0$ *or* $\Delta n = -ive$

$Kp < Kc \quad \Delta n > 0$ *or* $\Delta n = +ive$

Q.71 Pk_a inversely related to acid strength.

pk_a value of $H_2SO_4 > HCl > HBr > HClO_4$

So, weakest acid is H_2SO_4 and strongest and acid is $HClO_4$.

Q.72 Haber's process is an exothermic process $N_2 + 3H_2 \rightleftharpoons 2NH_3$. So, low temperature is favours the forward direction.

Q.73 Ice $\rightleftharpoons$ water

Ice occupy 9% more space than water. At high pressure, empty space will decrease and reaction will move towards forward direction. At high pressure more water will be formed.

Q.74 $2SO_2 + O_2 \rightleftharpoons 2SO_3 + Heat$

Reaction is exothermic. So, at high temperature reaction will move towards backwards direction. Which mean, the concentration of SO_2 and O_2 increases and conc. of SO_3 decreases.

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Q.75 When number of moles of product are greater than number of moles of reactant then Kp > Kc

- Δn = +ve or $\Delta n > 0$ $\quad Kp > Kc$
- $\Delta n = -ve$ *or* $\Delta n < 0 \quad Kp < Kc$
- $\Delta n = 0 \Rightarrow Kp = Kc$

Q.76 $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ is the representation of Haber's process.

Q.77 When $n_P = n_R$ then $\Delta n = 0$ then Kp and Kc will have same value.

Q.78 NaCl will precipitate out due to common ion effect.

Q.79 When $n_p = n_R$ then $K_p = K_c$

Q.80 In exothermic reaction, heat is released. To favour the reaction in forward direction, temperature is to be decreased.

Q.81 $A+B \rightleftharpoons C+D$

$$Kc = \frac{[C][D]}{[A][B]} = \frac{\text{Product}}{\text{Reactant}}$$

Q.82 $N_2+3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -46.23 kJmol^{-1}$ negative enthalpy shows that, reaction is exothermic

Q.83 $$\text{Solubility} \propto \frac{1}{\text{Common ion effect}} \propto \frac{1}{\text{Precipitation}}$$

Q.84 When

- Ionic product > Ksp then solution is supper saturated.
- Ionic product < Ksp then solution is unsaturated.
- Ionic product = Ksp then solution is saturated.

Q.85 When equilibrium is disturbed then change in direction can be estimated by using Le-Chatelier's principle.

Q.86 $N_2+3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -46.23 kJmol^{-1}$

According to Le-Chatelier's principle yield of ammonia can be maximize by decreasing temperature, increasing pressure and continuous withdrawal of ammonia.

Q.87 Yield of ammonia can be maximize at optimum conditions (200 atm) pressure.

Q.88 Catalyst increase the rate of forward as well as rate of reverse reaction by decreasing the activation energy. It attains equilibrium earlier.

Q.89 Buffer solution is not used for predicting concentration of substance.

Q.90 Buffer has maximum buffer capacity when pH equal to pKa of the acid.

Q.91 Solubility $\propto K_{sp}$

Q.92 K_{sp} depends upon temperature

Q.93 For exothermic reaction, $Kc \propto \frac{1}{T}$. By increasing temperature, reverse rate will be higher as compared to forward rate.

Q.94 At state of equilibrium;

- Conc. Of reactants and products becomes constant.
- Rate of forward reaction equal to rate of reverse reaction.

Q.95

- Ionic product > Ksp then solution is supper saturated.
- Ionic product < Ksp then solution is unsaturated.
- Ionic product = Ksp then solution is saturated.

Q.96

- Ionic product > Ksp then solution is supper saturated.
- Ionic product < Ksp then solution is unsaturated.
- Ionic product = Ksp then solution is saturated.

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Q.97 When products are converted into reactant, the reaction will be reversible.

Q.98 Acid strength ∝ degree of ionization

Q.99 Human blood is natural buffer its pH is 7.35 to 7.45.

Q.100 In saturated solution, dissolved solute is in equilibrium with undissolved solute.

Q.101 Reversible reaction do not go to completion, equilibrium is established and concentration of reactants and products become constant.

Q.102 Le-Chatelier's principle says when construction of [P] is less, reaction is shifted towards product side.

Q.103 Le-Chatelier's principle help to attain equilibrium.

Q.104 Wrong question

Q.105 Le-Chatelier's principle explains effect of change in concentration, pressure and temperature on position of equilibrium.

Q.106 nP = nR

Q.107 At this temperature yield of NH_3 is maximum.

Q.108 No precipitation.

Q.109 $nP = nR, K_p K_c = K_x = K_n$

Q.110 When $nP = nR$, all equilibrium constants have qual values.

Q.111 As NH_3 synthesis is an exothermic reaction, so decre3asing temperature favors the forward reaction.

Q.112 At equilibrium $R_f = R_r$

Q.113 $KCl \rightleftharpoons K^+ + Cl^-$ Cl^- is common ion which will decrease the solubility of $KClO_3$

Q.114 Dynamic equilibrium state is not affected by temperature.

Q.115 For Exothermic reaction, increasing temperature shifts the equilibrium to backward direction.

Q.116 High Pressure makes yield better.

Q.117 Catalyst decreases energy of activation.

Q.118 This is the statement of Le-Chatelier's principle.

Q.119 High pressure, low temperature and continual removing of NH_3

Q.120 Increasing in concentration of product shift the equilibrium to backward direction. So edition of HCl will make cloudy solution, a clear one.

Q.121 As endothermic reactions proceed by absorbing heat so products are at high concentration then reactants.

Q.122 Because this is an exothermic reaction

Q.123 Acetic acid and it is a weak acid and CH_3COONa is a salt.

Q.124 When volume / No. of moles of products is greater.

Q.125

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution in dm}^3}$$

$$\text{Molarity} = \frac{\text{Mass of solute}}{\text{Mol. mass of solute}} \times \frac{1}{\text{Volume of solution in dm}^3}$$

Q.126 Concentration of H^+ ions decrease by common ion effect.

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Q.127 The pH of human blood is 7.35-7.45.

Q.128 High pressure, low temperature and continual removing of NH_3

Q.129 As $nP = nR$ so pressure and volume factors will be cancelled out.

Q.130 3.32 information.

Q.131 In a forward reaction, reactants are converted into products and proceeds from left to right.

Q.132 $2SO_2 + O_2 \rightleftharpoons 2SO_3$ ΔH= – ive

- Adding reactants
- Removing products
- Increasing pressure
- Decreasing temperature

Favor forward reaction.

Q.133 450°C → is optimum temperature.

Q.134 $= \dfrac{[PCl_3][Cl_2]}{[PCl_5]} = \dfrac{(moldm^{-3})(moldm^{-3})}{moldm^{-3}} = moldm^{-3}$

Q.135 As $nP = nR$ so pressure and volume factors will be cancelled out.

Q.136 The pH value of human blood is 7.35.

Q.137 Active mass is the number of moles / dm^3 of reactants or products.

Q.138 NH_4^+ is conjugate acid of NH_3

Q.139 The lowering of vapour is directly proportional to the mole fraction of solute".

$$\frac{\Delta p}{p^o} = x_2$$

Q.140 A colloidal solution, also known as a colloid or colloidal suspension, is a mixture where very small particles (1 nm to 500 nm) of one substance are dispersed evenly throughout another substance, but are not dissolved like in a true solution.

Q.141 Time factor is not discussed by Le-Chatelier's principle.

Q.142 When $nP = nR$, K_c has no units.

Q.143 $pH + pOH = 14$.

Q.144 Adding of reactants at equilibrium shifts the equilibrium to right and starts the forward reaction.

Q.145 $PbS \rightleftharpoons Pb^{+2} + S^{-2}$

$Ksp = 4.0 \times 10^{-28}$

$Ksp = s^2$

$\sqrt{s^2} = \sqrt{4.0 \times 10^{-28}} = 2 \times 10^{-14}$

Q.146 Information from Haber process.

Q.147 More is concentration of salt, more is pH of Buffer.

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Topic 7 REACTION KINETICS

PRACTICE EXERCISE

Q.1 A catalyst is more effective when it is in:
A. Crystal form
B. Finally, divided form
C. Lump form
D. Colloidal form

Q.2 As time approaches to zero, then average of instant rate:
A. $R_{ave} > R_{inst}$
B. $R_{inst} > R_{ave}$
C. $R_{ave} = R_{inst}$
D. None

Q.3 Which of the following method is used when reaction mixture involves ions?
A. Dilatometry
B. Polarimetry
C. Electrical conductivity
D. All of these

Q.4 In zero order reaction, the rate is independent of:
A. Surface area of product
B. Temperature
C. Concentration of reactants
D. Catalyst

Q.5 $2A+B \rightarrow$ Product. If B is in excess the order of reaction will be?
A. 2nd order
B. Pseudo 1st order
C. 1st order
D. 3rd order

Q.6 Which of following is true about activated complex?
A. Unstable
B. Has transient existence
C. Decompose immediately
D. All of above

Q.7 The energy of activation by using catalyst for a reaction is:
A. Increased
B. Decreased
C. Not-charge
D. Moderate

Q.8 The order of following reactions is:

$$CHCl_3 + Cl_2 \xrightarrow{h\nu} CCl_4 + HCl$$

A. 1.5
B. 5
C. 2.5
D. Zero

Q.9 Rusting of iron is _____ reaction:
A. Very slow
B. Fast
C. Moderate
D. Very fast

Q.10 When the change in concentration is 5×10^{-2} moldm^{-3} and time for the change is 10 seconds, the rate of reaction will be:
A. 5×10^{-2} moldm^{-3}s^{-1}
B. 5×10^{-3} moldm^{-3}s^{-1}
C. 5×10^{-1} moldm^{-3}s^{-1}
D. 5×10^{-5} moldm^{-3}s^{-1}

Q.11 Which one of the following is correct about following reaction if iron is not 100% pure?

$$2Fe + 3H_2O + O_2 \longrightarrow Fe_2O_3.3H_2O$$

A. Very fast reaction
B. Very slow reaction
C. Moderately reaction
D. Not predicted

Q.12 Which of the following reactions are usually slow?
A. Neutralization of acids and bases
B. Explosive reaction of O_2 and H_2
C. Organic substitution reaction
D. Photochemical reactions

Q.13 For a chemical reaction to occur:
A. The vessel shell be open
B. Reacting molecules should have less energy than Ea at time of collision
C. Reacting molecules must be properly oriented and energy more than or equal to Ea
D. The reacting molecules must not collide with each other

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Q.14 The increase in reaction rate as a result of increase in temperature from 10K to 100K is:
A. 512
B. 614
C. 400
D. 112

Q.15 By increasing the concentration of reactants, the rate of reaction_____.
A. Decreases
B. Increases
C. Remains constant
D. Not predicted

Q.16 Select the correct rate law from given data

[A] moles dm^{-3}	[B] moles dm^{-3}	Rate of reaction (moles $dm^{-3} sec^{-1}$)
0.1	0.1	2×10^{-5}
0.2	0.1	4×10^{-5}
0.1	0.2	4×10^{-5}
0.2	0.2	8×10^{-5}

A. Rate = $k[A][B]$
B. Rate = $k[A]^2[B]$
C. Rate = $k[A]^1[B]^2$
D. Rate = $k[A][B]^2$

Q.17 The rate of reaction involving ions can be studied by:
A. Spectrometric method
B. Dilatometric method
C. Optical rotation method
D. Electrical conductivity method

Q.18 Which method for rate determination is useful for those reaction, which involve small volume change in solutions?
A. Refractometric method
B. Dilatometric method
C. Optical rotation method
D. Spectrometric method

Q.19 Which method for rate determination is applicable to reactions in solutions, where there are changes in refractive indexes of the substance taking part in the chemical reaction?
A. Dilatometric method
B. Optical rotation method
C. Refractometric method
D. Spectrometric method

Q.20 The specific rate constant of a chemical reaction is the rate of the reaction when the concentration of the reactant is:
A. Less than unity
B. Greater than unity
C. Equal to unity
D. Equal to the concentration of 2nd order reaction

Q.21 The unit of rate constant of second order reaction is:
A. mol dm^{-3} sec^{-1}
B. sec^{-1}
C. $mol^{-2} dm^{+6}$
D. $mole^{-1} dm^{+3} sec^{-1}$

Q.22 The 2nd order reaction becomes 1st order when?
A. One of the reactants is limiting
B. One of the reactants is in large excess
C. None of the reactants is in large excess
D. Both reactants in large excess

Q.23 The half-life time for a 1st order decomposition of a substance dissolved in CCl_4 is 2.5 hours at 30°C. The amount of substance left after 10 hours if the initial weight of the substance is 160g?
A. 5g
B. 10g
C. 15g
D. 20g

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Q.24 Hydrolysis of ethyl acetate into acetic acid and ethanol in the presence of mineral acid is:
A. Fractional order reaction
B. Pseudo 1st order reaction
C. 1st order reaction
D. 2nd order reaction

Q.25 For a reaction $A + 2B \longrightarrow C$, rate is given by $Rate = k[A][B]$, hence the order of the reaction is:
A. 3
B. 2
C. 1
D. 0

Q.26 For a chemical reaction $A \longrightarrow B$, the rate of reaction doubles when the concentration of A is increased four times. The order of reaction for A is:
A. Zero
B. One
C. Two
D. Half

Q.27 What will be order of reaction if doubling the concentration of reactant increases the rate by factor 4 and tripling the concentration of reactant by a factor of 9?
A. 1
B. 2
C. 3
D. 0

Q.28 When the concentration of reactant in the reaction is increased by 8 times, the rate increased only by 2 times. The order of reaction is:
A. 1
B. $\frac{1}{3}$
C. $\frac{1}{2}$
D. 2

Q.29 The rate law of a reaction is, rate $= k[A]^2[B]$. On doubling the concentration of both A and B, the rate of reaction increases _____ time.
A. 4
B. 9
C. 8
D. 2

Q.30 For the reaction $A + B \longrightarrow C + D$, doubling the concentration of both the reactants increases the reaction rate by 8 times and doubling the initial concentration of only B simply doubles the reaction rate. The rate law for the reaction is:
A. $Rate = k[A][B]^2$
B. $Rate = k[A][B]$
C. $R = k[A]^{1/2}[B]$
D. $Rate = k[A]^2[B]$

Q.31 The rate of reaction $2X + Y \longrightarrow$ Products.
$Rate = k[X]^2[Y]$ if X in large excess, the order of reaction is:
A. 3rd
B. 2nd
C. 1st
D. 0th

Q.32 For the 1st order decomposition reaction $2N_2O_{5(g)} \rightarrow 2N_2O_{4(g)} + O_{2(g)}$ the half-life is given as:
A. $0.693/k$
B. $0.693/2k$
C. $\log 2/k$
D. $\ln 2/k$

Q.33 The half-life period of zero order reaction is equal to:
A. $\frac{0.693}{K}$
B. $\frac{a}{2K}$
C. $\frac{1}{Ka}$
D. $\frac{1.5}{Ka^2}$

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Q.34 For which of the reaction, half-life is inversely proportional to the initial concentration of the reactants?

A. Zero order
B. 1st order
C. 2nd order
D. 3rd order

Q.35 If 'a' is the initial concentration of the reactant then half-life period of the reaction of nth order is directly proportional to:

A. a^{n+1}
B. a^{1-n}
C. a^{n}
D. a^{n-1}

Q.36 For the first order reaction, half-life is 14 sec. The time requires for the initial concentration to reduce to $\frac{1}{8}^{th}$ of its value is:

A. 28s
B. 42s
C. $(14)^2$ s
D. $(14)^3$ s

Q.37 The rate constant of reaction is 3×10^{-3} moldm^{-3}sec^{-1}. The order of reaction is:

A. 1
B. 2
C. 3
D. 0

Q.38 Activation energy of a reaction:

A. Includes the average kinetic energy of the reactants
B. Is in addition to the average K.E. of the reactants
C. Is in addition to the average K.E. of the products
D. Required for effective collisions

Q.39 E_a appears as a potential energy hill between _____ for carrying out the reaction.

A. Among the reactants
B. Among the products
C. Reactants and the products
D. None of the above

Q.40 If E_f and E_r are activation energies of forward and reverse reaction. The reaction is known to be exothermic then?

A. $E_f > E_r$
B. $E_f >>> E_r$
C. $E_f < E_r$
D. $E_f = E_r$

Q.41 For an endothermic reaction $A \longrightarrow B$, an activation energy of forward reaction is 15 kcal mol^{-1} and enthalpy change of reaction is 5 kcal mol^{-1}. The activation energy for reverse reaction $B \longrightarrow A$ is:

A. 10 kcal mol^{-1}
B. 20 kcal mol^{-1}
C. 15 kcal mol^{-1}
D. Zero

Q.42 Which one is the assumption of collision theory of reaction rate:

A. During a chemical reaction the particles must collide
B. Reaction between the colliding particles can only take place if upon collision they possess the activation energy
C. Only those collisions are effective which take place in proper orientation
D. All statements are correct

Q.43 If the energy of the activated complex lies close to energy of reactants, it means that reaction is:

A. Slow
B. Exothermic
C. Endothermic
D. Exothermic and fast

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Q.44 The activation energy for a simple chemical reaction A ⟶ B is E_a in forward direction. The activation energy for reverse reaction:

A. Can be less than or more than E_a
B. Is always double of E_a
C. Is negative of E_a
D. Is always less than E_a

Q.45 When potential energy of the transition state is very high, then which one of the following results is applicable?

A. Low activation energy and fast reaction
B. Low activation energy and slow reaction
C. High activation energy and fast reaction
D. High activation energy and slow reaction

Q.46 Which of the following best explains the effects of a catalyst on the rate of a reversible reaction?

A. It decreases the rate of the reverse reaction
B. It increases the kinetic energy of the reacting mole molecules
C. It moves the equilibrium position to the right
D. It provides a new reaction path with a lower activation energy

Q.47 What is the correct relation between rate and activation energy?

A. Rate $\propto$ Ea
B. Rate = Ea
C. Rate $\propto \frac{1}{Ea}$
D. All of them

Q.48 Concentrated sugar solution under goes hydrolysis into glucose and fructose by an enzyme_____.

A. Zymase
B. Invertase
C. Maltase
D. None of these

Q.49 Which of the followings is correct about enzyme catalysts?

A. These are in pure crystalline state
B. The activity of enzyme catalyst is inhibited by poison
C. Enzyme Catalytic reaction have maximum rate at optimum temperature
D. All of these

Q.50 The reaction rate in forward direction decreases with the passage of time because:

A. Concentration of reactants decreases
B. The order of reaction changes
C. Concentration of product decreases
D. Temperature of the system changes

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Topic 7 REACTION KINETICS

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Q.51 In some reactions a product formed acts as a catalyst. This phenomenon is called: MDCAT (2012)

A. Negative catalysis
B. Heterogeneous catalysis
C. Activation of catalyst
D. Autocatalysis

Q.52 The reaction rate in forward direction decreases with the passage of time because: MDCAT (2012)

A. Concentration of reactants decreases
B. The order of reaction changes
C. Concentration of product decreases
D. Temperature of the system changes

Q.53 For the reaction, $2NO + O_2 \rightleftharpoons 2NO_2$, the rate equation for the forward reaction is: MDCAT (2014)

A. Rate = k $[NO][O_2]$
B. Rate = k $[NO_2]^2$
C. Rate = k $[NO]^2[O_2]$
D. Rate = k $[NO_2]$

Q.54 Choose the type of catalysis in the following reaction: MDCAT (2017)

$$2SO_{2(g)} \xrightleftharpoons{NO_{(g)}} 2SO_{3(g)}$$

A. Homogeneous catalysis
B. Biological catalysis
C. Heterogeneous catalysis
D. Gas catalysis

Q.55 What is the measure of activation energy in an endothermic reaction? MDCAT (2019)

A. The energy of activation of backward reaction is less than that of forward reaction.
B. The energy of activation of forward-backward reaction is same.
C. The energy of activation of backward reaction is more than that of forward reaction.
D. The energy of activation of forward reaction is less than that of backward reaction.

Q.56 If energy of activated complex is close to energy of reactants, it means that the reaction is: NUMS (2019)

A. Fast
B. Moderate
C. Slow
D. Very slow

Q.57 According to the collision theory of bimolecular reactions in gas phase, minimum amount of energy required for an effective collision is known as: MDCAT (2011)

A. Heat of reaction
B. Rate of reaction
C. Has no effect on the reaction
D. Energy of activation

Q.58 If the energy of activation of a chemical reaction is very low, the rate of that chemical reaction is observed to be very high because? MDCAT (2019)

A. Concentration of the reactants becomes irrelevant
B. Number of efficient or fruitful collisions increase
C. Reaction proceeds without any transition state
D. Molecules of the reactants move slowly

Q.59 The influence of temperature on reaction rate is predicted by: NUMS (2019)

A. Free energy charge
B. Wander Waal's equation
C. Arrhenius equation
D. Kinetic equation

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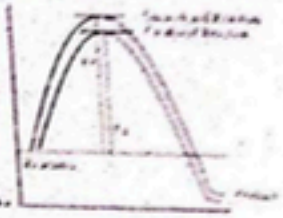
Q.60 For which change of temperature, the rate of reaction become approximately double: SET (2019)

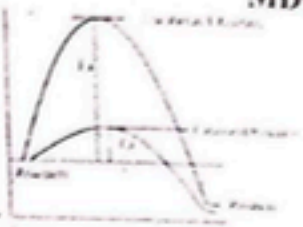
A. 293K B. 283K
C. 20°C D. 10°C

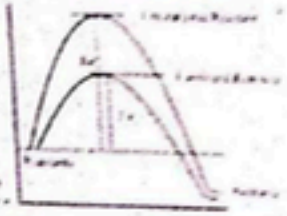
Q.61 It is experimentally found that catalyst is used to: (MDCAT 2011)

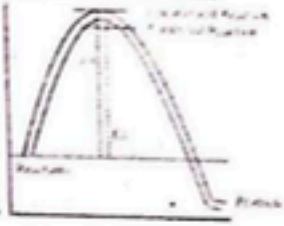
A. Lower the activation energy
B. Increase the activation energy
C. Lower the pH
D. Decrease the temperature of other reactants

Q.62 Which one of the following graphs is representation for more rapid catalyzed reaction? MDCAT (2017)

A. 

B. 

C. 

D. 

Q.63 Role of a catalyst in a chemical reaction is to: MDCAT (2018)

A. Increase rate of a reaction B. Decrease rate of a reaction
C. Decrease yield of a reaction D. Increase yield of product

Q.64 Glucose is converted into ethanol by the enzyme present in the yeast: MDCAT (2010)

A. Urease B. Zymase
C. Invertase D. Sucrase

Q.65 In zero order reaction, the rate is independent of: MDCAT (2013)

A. Concentration of the product B. Concentration of the reactant
C. Temperature of the reaction D. Surface area of the product

Q.66 $2A + B \rightarrow$ Product
If the reactant 'B' is in excess, the order of reaction with respect to 'A' in given rate law Rate = $k[A]^2[B]$ is: MDCAT (2016)

A. 2nd order reaction B. Pseudo 1st order reaction
C. 1st order reaction D. 3rd order reaction

Q.67 The rate constant 'k' is 0.693 min^{-1}. The half-life for the 1st order reaction will be: MDCAT (2016)

A. 1 min B. 0.693 min
C. 2 min D. 4 min

Q.68 Unit of K in first order Reaction is: MDCAT (2017)

A. s^{-1} B. moles dm^{-3}
C. moles dm^{-3} s^{-1} D. mol^{-1} dm^3

Q.69 Rate of first order reaction depends on: MDCAT (2017)

A. Concentration of one reactant B. Concentration of two reactants
C. Concentration of three reactants D. Independence of the initial concentration

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Q.70 The unit of rate constant is same as that of rate of reaction in: NUMS (2019)
A. First order reaction
B. Zero order reaction
C. Second order reaction
D. Third order reaction

Q.71 The decomposition of phosphorus pentachloride in the presence of moisture takes place by the following mechanism, MDCAT (2019)

$$PCl_{5(g)} + H_2O_{(g)} \rightarrow POCl_{3(g)} + 2HCl_{(aq)} \quad \text{(Slow Step)}$$
$$POCl_{3(g)} + 3H_2O_{(l)} \rightarrow H_3PO_{4(l)} + 3HCl_{(aq)} \quad \text{(Fast Step)}$$
$$PCl_{5(s)} + 4H_2O_{(l)} \rightarrow H_3PO_{4(l)} + 5HCl_{(aq)}$$

The rate equation for this reaction will be:
A. $Rate = k[PCl_5][H_2O]^4$
B. $Rate = [PCl_5][H_2O]$
C. $Rate = k[PCl_5][H_2O]$
D. $Rate = k[POCl_3][H_2O]^3$

Q.72 Rates of photo-chemical reactions do not change with the change in concentration of reactants. What is the order of such reactions? SET (2019)
A. Second order reactions
B. First order reactions
C. Pseudo first order reactions
D. Zero order reactions

Q.73 The half-life of N_2O_5 at 45°C is 24 minutes. How long will it take for sample of N_2O_5 to decay to 25% of its original concentration? MDCAT (2015)
A. 24 minutes
B. 120 minutes
C. 72 minutes
D. 48 minutes

Q.74 When the change in concentration is 6×10^{-4} moldm^{-3} and time for that change is 10 seconds, the rate of reaction will be? MDCAT (2015)
A. 6×10^{-3} moldm^{-3} sec^{-1}
B. 6×10^{-2} moldm^{-3}sec^{-1}
C. 6×10^{-4} moldm^{-3} sec^{-1}
D. 6×10^{-5} moldm^{-3}sec^{-1}

Q.75 For the first order reaction, half-life is related to the expression $t_{1/2}=0.693/k$ SET (2019)
Half- life is the:
A. Time taken for the conc. of the product to the increase to half of its original value.
B. Time taken for the concentration of the reactant, to fall to half of its products value.
C. Time taken for the concentration of the reactant to fall to half of its original value
D. Time taken for the concentration of the reactant to fall to quarter of its original value

Q.76 The rate of reaction involving ions can be studied by which method? MDCAT (2010)
A. Dilatometric
B. Electrical conductivity
C. Refractrometric
D. Optical rotation

Q.77 If the reactants or product of a chemical reaction can absorb ultraviolet, visible or infra-red radiation then the rate of a chemical reaction can best be measured by which one of the following methods? MDCAT (2014)
A. Chemical method
B. Graphical method
C. Spectrometry
D. Differential method

Q.78 If concentration time graph of a reactant indicates a constant half-life, then the order reaction with respect the reactant is: MDCAT (2018)
A. First order
B. Zero order
C. Second order
D. Half order

Q.79 Choose the one which is not the assumption of collision theory of reaction rate: ETEA (2016)
A. For chemical reaction to occur molecule / particles must colloids
B. For reacting particles must possess a certain minimum amount of energy
C. Every collision is not productive
D. For hydrogen molecule formation from atoms require specific orientation

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Q.80 For exothermic reversible reaction activation energy for forward direction depends upon: ETEA (2019)

A. Temperature
B. Nature of reactant
C. Nature of product
D. Both A and B

Q.81 What is the measure of activation energy is an endothermic reaction? MDCAT (2019)

A. The energy of activation of backward reaction is less than that of forward reaction
B. The energy of activation of forward-backward reaction is same
C. The energy of activation of backward reaction is more than that of forward reaction
D. The energy of activation of forward reaction is less than that of backward reaction

Q.82 The unit of the rate constant is the same as that of the rate of reaction in: NMDCAT (2020)

A. Zero order reaction
B. First order reaction
C. Second order reaction
D. Third order reaction

Q.83 The study of rates of chemical reactions and the factors that affect the rates of chemical reactions is known as: NMDCAT (2020)

A. Thermodynamics
B. Stoichiometry
C. Electrochemistry
D. Chemical kinetics

Q.84 For which reaction, $A_{(g)} \longrightarrow$ product NMDCAT (2020)

When the concentration of $A_{(g)}$ doubles, the rate of reaction increased four folds, which means it is:

A. Negative order of reaction
B. 1st order reaction
C. Zero order of reaction
D. 2nd order reaction

Q.85 For which of the following order of the reaction, rate of reaction is inversely proportional to the concentration reaction? NMDCAT (2020)

A. 1st order reaction
B. 2nd order reaction
C. Negative order of reaction
D. Zero order of reaction

Q.86 Catalyst can: PMC (2021)

A. Increase rate of reaction
B. Increase conc of reactant
C. Increase conc of product
D. Decrease rate of reaction

Q.87 Energy required to start a reaction is called ____. PMC (2021)

A. Ionization energy
B. Activation energy
C. Bond energy
D. Lattice energy

Q.88 Rate = $k[NO_2]$, the order of this reaction is: PMC (2021)

A. Zero
B. Three
C. Two
D. One

Q.89 When rate of reaction is measured by the amount of radiation absorbed, it is called: PMC (2021)

A. Optical rotation method
B. Electrical conductivity method
C. Refractometry method
D. Spectrometry

Q.90 What is the overall order of this rate equation? Rate = $k[H_2][NO_2]^2$ UHS (2022)

A. 1
B. 3
C. 2
D. 4

Q.91 The catalysis in which the catalyst and the reactants are in the same phase is known: UHS (2022)

A. Heterogeneous catalysis
B. Homogeneous catalysis
C. Slow
D. Fast

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Q.92 What is incorrect about activated complex? SZABMU (2022)

A. It is a high energy specie
B. It is a stable specie
C. It is an unstable specie
D. Potential energy is maximum at activated complex state

Q.93 The unit of rate constant is the same as that of the rate of reaction in which of the following order of reaction: SZABMU (2022)

A. Zero
B. First
C. Second
D. Third

Q.94 If a reaction is first order with respect to a reactant then the rate will be if concentration of reactant is doubled: SZABMU (2022)

A. Doubled
B. Halved
C. One fourth
D. Quadrupled

Q.95 The unit of rate constant K is $dm^3 mole^{-1} s^{-1}$ for a chemical reaction, the order of reaction is: ETEA (2022)

A. 1
B. 3
C. 0
D. 2

Q.96 One mole of a reactant reacts with a rate of 0.6 mol $dm^{-3} s^{-1}$. What is the rate constant of this reaction if reaction is first order? ETEA (2022)

A. 1 s^{-1}
B. 0.3 s^{-1}
C. 0.6 s^{-1}
C. 0.9 s^{-1}

Q.97 The thermal decomposition of nitrogen pentaoxide in gaseous state follows. Which one of the following order of reaction? $N_2O_{5(g)} \xrightarrow{heat} N_2O_{4(g)} + \frac{1}{2} O_{2(g)}$ ETEA (2022)

A. First order
B. Second order
C. Fractional order
D. Third order

Q.98 Rate of reaction increases by the addition of catalyst because: DUHS (2022)

A. Catalyst reacts with reactant
B. Catalyst reacts with product
C. Energy of activation decreases
D. Energy of activation Increases
E. Energy of activation remain same

Q.99 Reaction, $H_2 + Cl_2 \longrightarrow 2HCl$ is a: DUHS (2022)

A. Second order
B. Frist order
C. Half order
D. Third order
E. Zero order

Q.100 A solution which does not tend to varies in pH is called? BMU (2022)

A. Acidic solution
B. Buffer solution
C. Bases Solution
D. Super saturated solution

Q.101 What a catalyst work by? BMU (2022)

A. Increasing the frequency of collisions
B. Increasing the proportion of particles with energy greater than the activation energy
C. Increasing the activation energy.
D. Increasing the concentration

Q.102 Rate of reaction when the reactant's concentration is taken as unity is called? BMU (2022)

A. Arrhenius constant
B. Ideal rate constant
C. Molecularity
D. Specific rate constant

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Q.103 Rate of any reaction depends upon: NUMS (2022)
A. Temperature B. Pressure
C. Concentration D. Rate constant

Q.104 What is "NOT TRUE" about rate of a reaction? NUMS (2022)
A. Concentration of reactants does not affect the rate of a reaction
B. Surface area of reactants affects rate of reaction
C. Concentration affects rate of reaction
D. Catalyst affects rate of a reaction

Q.105 The rate of reaction between two specific time intervals is called? UHS (2023)
A. Instantaneous rate of reaction B. Rate of reaction
C. Average rate of reaction D. Initial rate

Q.106 How will be the rate of reaction, if the slope of the curve is greater near the start of the reaction? UHS (2023)
A. Constant B. Equilibrium
C. Greater D. Lesser

Q.107 The rate constant "k" in the rate equation is the rate of reaction when the concentration of each of the reactant is: SZABMU (2023)
A. 1 M B. 2 M
C.3 M D. 4 M

Q.108 The rate of reaction: SZABMU (2023)
A. Increases as the reaction proceeds
B. Decreases as the reaction proceeds
C. Remains the same as the reaction proceeds
D. Remains the same initially and then increases

Q.109 Reaction that follows third order kinetics is: ETEA (2023)
A. Decomposition of nitrogen dioxide B. Decomposition of hydrogen iodide
C. Gas phase oxidation of nitric oxide D. Formation of hydrogen iodide

Q.110 As compared to exothermic reaction, formation of activated complex in endothermic reaction requires: ETEA (2023)
A. Greater Ea B. Smaller Ea
C. Equal Ea D. No Ea

Q.111 What is the order of reaction if the unit of K is sec^{-1}? DUHS (2023)
A. One B. Two
C. Three D. Zero

Q.112 Which of the following best describes the ionic reactions of inorganic compounds? DUHS (2023)
A. Very slow B. Moderate slow
C. Very fast D. Not occurs

Q.113 In which method the rate of reaction involving ions can be studied? BUMHS (2023)
A. Electrical conductivity method B. Optical rotation method
C. Refractometric method D. Spectrometry

Q.114 Which order of reaction obeys the expression $t_{½} = \frac{1}{ka}$? BUMHS (2023)
A. Zero B. First
C. Second D. Third

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Q.115 When temperature of reacting gases is raised by 10 K, reaction rate will increase to: NUMS (2023)

A. Double
B. Three times
C. Four times
D. Five times

Q.116 The minimum amount of energy required by the colliding particles for effective collision is called: NUMS (2023)

A. Activation energy
B. Lattice energy
C. Bond energy
D. Hydration energy

Q.117 When nitric oxide reacts with ozone, the order of reaction will be: NUMS (2023)

A. 2nd
B. 3rd
C. 1st
D. Zero

Q.118 Identify the correct formula to calculate rate of reaction: UHS (2024)

A. Change in concentration of substance ÷Time taken for the change
B. Time taken for the change ÷ Change in concentration of substance
C. Time taken for the change ÷ Change in concentration of substance × 100
D. Time taken for the change × Change in concentration of substance

Q.119 Consider the hypothetical equation: UHS (2024)
$aA + bB \leftrightarrow cC + Dd$ Which of the following represents correct rate equation?

A. Rate = $k[A][B]$
B. Rate = $k[A]^a[B]^b$
C. Rate = $k[A]^a$
D. Rate = $k[B]^2$

Q.120 If a reaction rate does not change with concentration then it is? UHS (2024)

A. 3rd order
B. 2nd order
C. 1st order
D. Zero order

Q.121 Which of the following is CORRECT Arrhenius equation? UHS (2024)

A. $K=Ae^{-Ea/QT}$
B. $K=Ae^{-Ea/RT}$
C. $K=Ae^{-Ea/ST}$
D. $K=Ae^{-Ea/UT}$

Q.122 Which of the following is the unit of rate of reaction? SZABMU (2024)

A. $(mol\text{-}dm^3)^{-1}s^{-1}$
B. $mol(dm^3)s^{-1}$
C. $mol(dm^3)^{-1}s$
D. $mol(dm^3)^{-1}s^{-1}$

Q.123 Consider a reaction of A into B, if K value is $3x10^{-12}$ at 200°C then what will be the value of K at 250°C? SZABMU (2024)

A. $K = 9 \times 10^{-3}s^{-1}$
B. $K = 12 \times 10^{-3}s^{-1}$
C. $K = 6 \times 10^{-12}s^{-1}$
D. $K = 15 \times 10^{-12}s^{-1}$

Q.124 If half-life of a chemical reaction is 30 minutes, how much time is required for its 87.5% completion? SZABMU (2024)

A. 30 min
B. 60 min
C. 90 min
D. 120 min

Q.125 The study of rates of chemical reactions and the factors that affect the rates of chemical reactions is known as: SZABMU (2024)

A. Thermodynamics
B. Stoichiometry
C. Electrochemistry
D. Chemical kinetics

Q.126 Decomposition of ammonia on heated tungsten is an example of: SZABMU-RC (2024)

A. Pseudo firs order reaction
B. First order reaction
C. Zero order reaction
D. Second order reaction

Q.127 For a first order reaction A → B, the rate constant is 0.0458 s^1. Calculate rate of the reaction if the concentration of reactant is 0.35mol dm^{-3}: ETEA (2024)

A. 0.012 mol dm^3 s
B. 0.014 mol dm^3 s^{-1}
C. 0.016 mol dm^{-3} s^{-1}
D. 0.018 mol dm^3 s

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Q.128 A reaction is first order with respect to A and second order with respect to B, the rate equation is: ETEA (2024)

A. Rate = k [A]
B. Rate = k [A] [B]
C. Rate = k [A] [B]
D. Rate = k [A] $[B]^2$

Q.129 The unit of rate constant for the first order reaction is: DUHS (2024)

A. ConC.s^{-1}
B. M^2s^{-1}
C. s^{-1}
D. $M^{-1}s^{-1}$

Q.130 The formation of hydrogen gas can be increased by reacting which Zn sample with IM HCl solution? NUMS (2024)

A. 1g Zn Rod
B. 1g Zn Pallets
C. 1g Zn Ribbon
D. 1g Zn Powder

ANSWER KEY

PRACTICE EXERCISE

1	B	11	B	21	D	31	C	41	A
2	C	12	C	22	B	32	A	42	D
3	C	13	C	23	B	33	B	43	D
4	C	14	A	24	B	34	C	44	A
5	A	15	B	25	B	35	B	45	D
6	D	16	A	26	D	36	B	46	D
7	B	17	D	27	B	37	D	47	C
8	A	18	B	28	B	38	D	48	B
9	A	19	C	29	C	39	C	49	D
10	B	20	C	30	D	40	C	50	A

PAST PAPER QUESTIONS

51	D	61	A	71	C	81	A	91	B	101	B	111	A	121	B
52	A	62	B	72	D	82	A	92	B	102	D	112	C	122	D
53	C	63	A	73	D	83	D	93	A	103	A	113	A	123	D
54	A	64	B	74	D	84	D	94	A	104	A	114	C	124	C
55	A	65	B	75	C	85	C	95	D	105	C	115	A	125	D
56	A	66	A	76	B	86	A	96	C	106	C	116	A	126	C
57	D	67	A	77	C	87	B	97	A	107	A	117	A	127	C
58	B	68	A	78	A	88	D	98	C	108	B	118	A	128	D
59	C	69	A	79	D	89	D	99	E	109	C	119	B	129	D
60	D	70	B	80	D	90	B	100	B	110	A	120	D	130	D

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EXPLANATORY NOTES

Q.11 It is rusting of iron so it is very slow process.

Q.12 Orgnanic subsitution reactions involve covalent bond breaking. Therefore, these are slow reaction for example hydrolysis of ester.

Q.13 The amount of energy required for effective collisions is called activation energy. This energy which is required for effective collision along with proper orientation.

Q.14 Temperature increases from 10k to 100k is 90k which is 9 interval of 10k

$$\text{Rate increases} = (2)^{\text{No of intervals of 10k}}$$

$$\text{Rate increases} = (2)^{9} = 512$$

Q.15 By increasing the concentration of reactants, number of effective collisions increases. So, rate of reaction increases.

Q.16 Rate is directly proportional to concentration of A and concentration of B, so, it is 2nd order reaciton. Rate = K [A][B]

Q.17 The rate of reactions which involve ions is measured by the electrical conductivity method.

Q.18 Dilatometirc method is applicable for the measurement of rate of those reactions which involve small volume change in the solutions.

Q.19 Refractometric method is applicable to reactions in solutions where there are changes in refractive indices of the substances taking part in the chemical reactions.

Q.20 The rate of reaction when the concentrations of reactants are unity is called Specific rate constant or velocity constant.

As we know that.

$$\text{Rate of reaction} = k[A]^a[B]^b$$

$$\text{Suppose } [A] = [B] = 1 \text{ moles/dm}^3$$

$$\text{Rate of reaction} = k[1]^a[1]^b$$

$$\text{Rate of reaction} = k \text{ (since, } [1]^a[1]^b = 1)$$

Q.21 For second order reaction, the units of rate constants k are given by:

$$k = (\text{concentration})^{1-n}(\text{time})^{-1}$$

$$\text{Units of } n = 2$$

$$\text{For second order, } k = (\text{mole/dm}^3)^{1-2}(s)^{-1}$$

$$\text{Units of } k = (\text{mole/dm}^3)^{-1}\, s^{-1}$$

$$\text{Units of } k = \text{moles}^{-1}\, \text{dm}^3\, s^{-1}$$

$$\text{Units of } k = \text{dm}^3\, \text{moles}^{-1}\, s^{-1}$$

Q.22 The substance taken in small amount controls the rate and the order is noted with respect to that substance. If the conc. of any reactant is taken in excess it will not involve in rate determination step.

Q.23 $$\text{Number of half-life} = \frac{\text{Total time}}{\text{Half-life}} = \frac{10}{2.5} = 4$$

$160g \rightarrow 80g \rightarrow 40g \rightarrow 20g \rightarrow 10g$

After 4 half-life, 10g left behind.

Q.24 In hydrolysis of ester, water is in large excess. Therefore, it is pseudo 1st order reaciton.

Q.25 Rate = k[A][B]

the sum of the exponents of concentration terms in given rate law equation is two.

Q.26 $\text{Rate} = [A]^n = 2 = [4]^n$, $2 = 2^{2n}$, $1 = 2n$, $n = \frac{1}{2}$

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Q.27 For 2nd order reaction

$$\text{Rate} = k[A]^2 = k[2]^2 = 4$$

$$\text{Rate} = k[3]^2 = 9$$

Q.28 $\text{Rate} = [A]^n = 2 = [8]^n$, $2 = 2^{3n}$, $1 = 3n$, $n = \frac{1}{3}$

Q.29 $\text{Rate} = [A]^2[B] = (2)^2(2) = 4 \times 2 = 8$

Q.30 It is overall 3rd order reaction. With respect to A, it is 2nd order reaction with respect to B is 1st order reaction.

Q.31 "X" is in large excess, so rate of reaction is independent to the concentration of "X" and is directly proportional to the concentration of "Y". It is 1st order reaciton with respect to "Y".

Q.32 $\left[t_{1/2}\right]_1 = \frac{0.693}{k}$

Q.33 For zero order reaction, half-life period is directly proportional to the initial concentration of reactants.

Q.34

$$\left[t_{1/2}\right]_n \propto \frac{1}{a^{n-1}}$$

$$\left[t_{1/2}\right]_2 \propto \frac{1}{a^{2-1}}$$

$$\left[t_{1/2}\right]_2 \propto \frac{1}{a}$$

Q.35

$$\left[t_{1/2}\right]_n \propto \frac{1}{a^{n-1}}$$

$$\left[t_{1/2}\right]_n \propto a^{-(n-1)}$$

$$\left[t_{1/2}\right]_n \propto a^{1-n}$$

Q.36 After three half-life, concentraiton of reactant is reduced to $\frac{1}{8}$th.

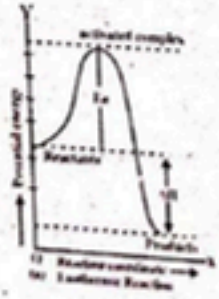
Total time = half-life × Number of half-life
= 14sec × 3 = 42 sec

Q.37 The unit of rate constant in given statement is $moldm^{-3}sec^{-1}$, which shows it is zero order reaction. $K = (moldm^3)^{1-n}\,s^{-1}$

Q.38 The minimum amount of energy required by colliding molecules for effective collision is called activation energy.

Q.39 Potential energy of activated complex is higher than that of reactants and products.

Q.40



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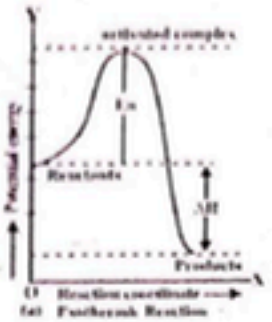
Q.41 $Ea_r = Ea_f - \Delta H = 15 - (+5) = 10$

Q.42 All the given statements are correct (during a chemical reaction the particles must collide, reaction between the colliding particles can only take place if upon collision they possess the activation energy and only those collisions are effective which take place in proper orientation)

Q.43



Q.44

- For exothermic reaction, energy of activation for forward reaction is less than the Energy of activation for backward reaction.
- For endothermic reaction, energy of activation for forward reaction is greater than the energy of activation for backward reaction.

Q.45 Ea ∝ P.E of activated complex

Rate of reaciton $\propto \frac{1}{E_a}$

Q.46



Catalyzed and uncatalyzed reaction

- Catalyzed reaction (.....)
- Uncatalyzed reaction (——)

Q.47 Rate of reaciton is inversly proportional to the activaiton energy. By lowering the activaiton energy, reaction rate will be increased.

Q.48 $C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{fructose}}{C_6H_{12}O_6} + \underset{\text{glucose}}{C_6H_{12}O_6}$

Q.49 All are the correct characteristics of enzym catalysts.

Q.50 By decreasing the concentration of reactants, effective collisions also decreases. Hence, rate of reetion decreases.

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 If product formed act as catalyst is called auto-catalyst and reaction is called auto-catalysis.

Q.52 According to law of mass action, rate of reaction is directly proportional to product of active masses of reactants. During reaction, active masses or concentration of reactant decreases. That is why, rate in forward direction decreases with decrease in concentration of reactants.

Q.53 According to given reaction, reaction is 2nd order with respect to "NO" and 1st order with respect to "O_2" So, overall rate equation is,

Rate = $[NO]^2[O_2]$

Q.54 If reactant and catalyst are in same phase then it is called homogeneous catalysis. In given lead chamber process, reactant and catalyst (NO) are in same gaseous phase, so it is homogeneous catalysis.

Q.55 For endothermic reaction, activation energy of forward reaction (E_f) is more than activation energy of reverse reaction (E_r).

Q.56 If energy of activated complex is close to energy of reactants then reaction is fast, spontaneous and exothermic.

Q.57 Minimum amount of energy in addition to average kinetic energy is called activation energy. OR Minimum amount of energy which must be possessed by reactants to convert into products is called activation energy. OR Minimum amount of energy required for an effective collision is called activation energy.

Q.58 Rate of reaction is directly proportional to no. of effective collisions and inversely proportional to activation energy. If activation energy is very low then no. of effective collision would increase and rate of reaction would be very high.

Q.59 Influence of temperature on reaction rate is predicted by Arrhenius equation. According to Arrhenius equation,

Rate $\propto$ temperature

Rate $\propto$ 1/Ea

Q.60 Rate of reaction become double for every 10 °C / 10 K rise in temperature.

Q.61 A positive catalyst increases rate of reaction, decreases activation energy, decreases equilibrium time and changes mechanism of reaction.

Q.62 Rate of reaction is inversely proportional to activation energy. Lower the activation energy, higher the rate of reaction.

Q.63 A positive catalyst increases rate of reaction, decreases activation energy, decreases equilibrium time and changes mechanism of reaction

Q.64 Enzyme which hydrolyses urea into NH_3 and CO_2 is urease. Glucose into ethanol is zymase. Sucrose into glucose and fructose is invertase.

Q.65 In zero order reaction, rate of reaction is directly proportional to zero power of concentration of reactant or rate of reaction is independent of concentration of reactants.

Q.66 Experimental rate equation is called rate law. According to rate law equation, order is 2nd with respect to "A" while order is zero with respect to "B". Order of reaction is zero with respect to excess reactant. So, overall order of reaction is 2nd.

Q.67 Half life of 1st order reaction is given as;

$(t_{1/2})_1 = 0.693 / k = 0.693 / 0.693 = 1$ min

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Q.68 Unit of rate constt. "k" = $(moldm^{-3})^{1-n}s^{-1}$

Q.69 For 1st order reaction, rate of reaction is directly proportional to first power of concentration of reactants.

Q.70 For zero order reaction, rate constt "k" has same unit as rate of reaction. Rate of reaction has unit of $moldm^{-3}s^{-1}$.
Unit of rate constt. "k" = $(moldm^{-3})^{1-n}s^{-1}$

Q.71 Slow step of reaction is called rate determining step and determine the rate of whole reaction.

Q.72 All photochemical reactions are zero order reactions.

Q.73 Suppose N_2O_5;

$$100g \xrightarrow{t_{\frac{1}{2}}} 50g \xrightarrow{t_{\frac{1}{2}}} 25g$$

total time for decay = No. of Half lives × Half lifes time = $2 \times 24 = 48$ min

Q.74

$$Rate = \frac{\Delta C}{\Delta t} = \frac{6\times10^{-4}}{10} = 6\times10^{-5}\, mol\, dm^{-3}s^{-1}$$

Q.75 Half-life is the time in which 50% reactants are converted into products.

Q.76 Reaction which involve ions, their rate of reaction can be measured by electrical conductivity method.
Change in electrical conductivity $\propto$ rate of reaction.

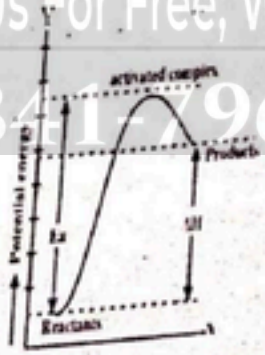
Q.77 If reactant or product absorb UV/Vis, IR radiations, their rate of reaction can be measured by spectrometric method

Q.78 $t_{1/2}$ of 1st order reaction is independent of initial concentration of reactant. So, in concentration time graph, reactant indicates a constant half-life.

Q.79 According to collision theory of reaction rate, molecules of all species must collide effectively. For effective collision, molecule must have same orientation and sufficient energy.

Q.80 Ea depends on nature of reactant. Elements of group (I, II) and (VI, VII) have low ionization energy and high electron affinity respectively. So, they are known as reactive elements.

Q.81 For endothermic reaction, $E_f > E_r$



Q.82 For zero order reaction, rate equation is;

$$Rate = k[A]^0$$

$$Rate = k$$

$$mol\, dm^{-3}s^{-1} = k$$

Hence, for zero order reaction, rate constant 'k' has same unit as rate of reaction.

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Q.83 Reaction kinetics deals with rate of reaction, factor affecting rate of reaction, mechanism of reaction and order of reaction.

Q.84

$$Rate = [A]^n \Rightarrow 4 = [2]^n \Rightarrow 2^2 = 2^n$$

If bases are same then exponent are also equal. So, n = 2.

Q.85 Rate of reaction is inversely proportional to concentration of reactant for negative order reaction.

Q.86 Catalyst increases the rate of reaction by decreasing the activation energy.

Q.87 Amount of energy which is required to start the reaction is called activation energy.

Q.88 Sum of the exponents of concentration terms in rate law equation is called order of reaction. From given rate law, order of reaction is one.

Q.89 When amount of radiation absorbed, then rate of reaction is measured by spectrometry

Q.90 Sum of the exponents of concentration terms in rate law equation is called order of reaction. From given rate law order is three.

Q.91 When catalyst and reactants are in same phase then catalysis is homogeneous.

Q.92 Activated complex is high energy specie, it is unstable specie, its potential energy is maximum.

Q.93 Unit of $K = \left(moledm^{-3}\right)^{1-n} Sec^{-1}$. Rate constant for zero order and rate of reaction have same units (moles $dm^{-3}Sec^{-1}$).

Q.94 For first order reaction, by doubling the concentration of reactant rate increases two times.

Q.95 Unit of $K = \left(moledm^{-3}\right)^{1-n} Sec^{-1}$. The units of "K" for 2nd order reaction is mol $^1dm^{+3}Sec^{-1}$.

Q.96 For first order reaction
rate = $k[A]^1 \Rightarrow 0.6 = k[1] \Rightarrow k = 0.6$

Q.97 Thermal decomposition of $N_2O_{5(g)}$ is first order reaction because its half-life is independent to its initial concentration.

Q.98 Catalyst increases the rate of reaction by decreasing the activation energy.

Q.99 Reaction of H_2 with Cl_2 to form HCl is photochemical reaction. Therefore, it is zero order reaction.

Q.100 Buffer solution is that solution which resist the change in pH when small amount of acid or base is added.

- Catalyst increases the proportion of particles with energy greater than activation energy.
- Catalyst decreases activation energy by changing the way of reaction.

Q.101 When concentration of reactants is unity then rate of reaction is equal to rate constant which is also called specific rate constant.

Q.102 Rate of reaction $\propto$ Temperature.

Q.103 Rate of reaction depends upon concentration of reactant, surface area of reactant, light, temperature and catalyst.

Q.104 The rate of reaction between two specific time intervals is called average rate of reaction.

Q.105 A steeper slope near the start of the reaction indicates a faster change in concentration over time.

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Q.106 Suppose, $A + B \rightarrow C$

Then,

$Rate = k[A][B]$ and $[A] = [B] = 1M$

$Rate = k[1][1]$

$Rate = k$

Q.107 Because reactant concentration decreases, leading to fewer effective collisions between particles.

Q.108 Because its rate depends on the concentrations of two NO molecules and one O_2 molecules.

$Rate = k[NO]^2[O_2]$

$Order = 2+1=3$

Q.109 Gas phase oxidation of nitric oxide follows the 3rd order kinetics.

$$2NO + O_2 \longrightarrow 2NO_2$$

$$Rate = k[NO]^2[O_2]$$

$$Order = 2+1=3$$

Q.110 For 1st order reaction (n=1)

Formula: $\left(\frac{moldm^{-3}}{Sec}\right)^{1-n} = (moldm^{-3})^{1-1} Sec^{-1} = Sec^{-1}$

Q.111 Ionic reactions are very fast.

Q.112 Electrical conductivity method is used to determine the rate of reaction, when Reaction mixture is involved ion.

Q.113 The deduce the expression of half-life,

$$\left[t_{\frac{1}{2}}\right] \propto \frac{1}{a^{n-1}}$$

$$\left[t_{\frac{1}{2}}\right] \propto \frac{1}{a^{2-1}} \Rightarrow \left[t_{\frac{1}{2}}\right] = \frac{1}{ka}$$

Q.114 When the temperature of reacting gases is raised by 10K, reaction rate will increase to double.

Q.115 The minimum amount of energy required by the colliding particles for effective collision is called activation energy.

Q.116 Because the rate of reaction depends on the concentration of the molecule of both nitric oxide and ozone.

$$Rate = k[NO]^1[O_3]^1$$

$$Order = 1+1=2$$

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Q.117 rate of reaction $= \frac{\text{change in concentration of substance}}{\text{time taken for the change}}$

Q.118 $\text{Rate}=k[A]^{x}[B]^{y}$

Rate law equation expresses the relationship between the reaction rate and the concentrations of all reactants on which rate depends.

Q.119 The reaction which is entirely independents of the molar concentration of reactants is called zero order reaction.

Q.120 Arrhenius equation $K = Ae^{\frac{-Ea}{RT}}$

Q.121 $\text{Rate} = \frac{\Delta x}{\Delta t} = \frac{\text{moldm}^{-3}}{\text{Sec}} = \text{moldm}^{-3}\text{Sec}^{-1}$

Q.122 Total time = No. of half life × half life period

$=3\times30=90$

Q.123

Q.124 Chemical kinetics is the study of rates of chemical reactions and the factors that affect the rates of reactions.

Q.125 It is a zero-order reaction because the reaction occurs on a catalyst's surface and the rate becomes independent of the conc. Of ammonia.

Q.126 $\text{Rate}=K[A]$

$=0.0458s^{-1}\times(0.35\text{moldm}^{-3})$

$=0.016\text{moldm}^{-3}\text{sec}^{-1}$

Q.127 In the rate law equation, a power of 1 on concentration indicates a 1st order reaction while a power of 2 indicates a second order reaction.

Q.128 For 1st order reaction (n=1)

Formula: $(\text{moldm}^{-3})^{1-n}\ \text{Sec}^{-1}$

Q.129 Powdered zinc has large surface area that's why rate of reaction increases.

As,

Rate of reaction $\propto$ surface area of catalyst.

Q.130 Catalyst in finally divided form (Powder) have greater surface area and high catalytic power as compare to rod, pallets and ribbon.

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Topic 8 THERMOCHEMISTRY AND ENERGETICS OF CHEMICAL REACTIONS

PRACTICE EXERCISE

Q.1 **ΔH will be greater than ΔE when:**
A. $n_P < n_R$
B. $n_P > n_R$
C. $n_P \approx n_R$
D. $n_P = n_R$

Q.2 **Which of following factor affect heat of reaction?**
A. Nature of reactants
B. Allotropic forms of elements
C. Enthalpies of solution
D. All of these

Q.3 **The thing under argumentation is:**
A. System
B. Surrounding
C. Boundary
D. None

Q.4 **In reaction between Zn and $CuSO_4$ solution the surrounding is:**
A. Flask
B. Air outside flask
C. $Zn + CuSO_4$
D. Both A and B

Q.5 **Which of following is not a state function?**
A. Volume
B. Enthalpy
C. Heat
D. Internal energy

Q.6 **For liquids and solids:**
A. $\Delta H \approx \Delta E$
B. $\Delta H > \Delta E$
C. $\Delta H < \Delta E$
D. $\Delta H \neq \Delta E$

Q.7 **First law of thermodynamics at constant volume is:**
A. $\Delta E = q + w$
B. $\Delta E = q - w$
C. $\Delta E = q_v$
D. $\Delta E = q_p$

Q.8 **Which one of the following has non-zero enthalpy?**
A. $K_{(s)}$
B. $Br_{2(l)}$
C. $F_{2(g)}$
D. $I_{2(g)}$

Q.9 $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)}$ $\Delta H = +ve$ **in this reaction ΔH will be called?**
A. Enthalpy of atomization
B. Enthalpy of neutralization
C. Enthalpy of Formation
D. Enthalpy of decomposition

Q.10 **Which statement is true about state function?**
A. Macroscopic property
B. Path independent
C. Change can be measured directly
D. All of these

Q.11 **Thermodynamics does NOT deal with:**
A. Heat of reaction
B. Spontaneity of reaction
C. Rate of reaction
D. Entropy of reaction

Q.12 **If an endothermic reaction is allowed to take place very rapidly in air, the temperature of the surrounding air will:**
A. Remains constant
B. Increase
C. Decrease
D. Either increase or decrease

Q.13 **The exothermic process is:**
A. Evaporation
B. Sublimation
C. Respiration
D. Boiling

Q.14 **A process, which takes place on its own without any outside assistance, is termed as:**
A. Isothermal process
B. Spontaneous
C. Non-spontaneous
D. Adiabatic process

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Q.15 The work done by expansion of gas against constant pressure is:

A. PΔV B. – PΔV
C. PV D. ΔPV

Q.16 A state function which describes together the internal energy and product of pressure and volume is called:

A. Enthalpy B. Work
C. Internal energy D. Kinetic energy

Q.17 The enthalpy of formation of a compound is:

A. Positive B. Negative
C. Either positive or negative D. None of the above

Q.18 Enthalpy is an expression for the:

A. Heat content B. Rate of reaction
C. Internal energy D. Activation energy

Q.19 Which one of the following has standard enthalpy of formation is zero?

A. $Fe_{(g)}$ B. $C_{(l)}$
C. $Cu_{(s)}$ D. $Na_{(g)}$

Q.20 Which of the following statement is correct?

A. ΔH is positive for exothermic reaction
B. ΔH is negative for endothermic reactions
C. The heat of neutralization of strong acid with strong base is always the same
D. The enthalpy of fusion is negative

Q.21 What is not correct about ΔH_f?

A. Its value gives an idea about the relative stability of reactants and the products
B. It is always negative
C. Value depends upon nature of bonds
D. Its value may be negative or positive

Q.22 Which of the following has positive value of enthalpy?

A. Neutralization B. Combustion
C. Atomization D. All of the above

Q.23 $NaOH + HCl \rightarrow NaCl + H_2O$. Enthalpy change in the above reaction is called:

A. Enthalpy of reaction B. Enthalpy of formation
C. Enthalpy of neutralization D. Enthalpy of combustion

Q.24 Enthalpy of neutralization (ΔH_n) per mole of H_2SO_4 / $Ba(OH)_2$ is:

A. $-57.4\ kJmol^{-1}$ B. $+57.4\ kJmol^{-1}$
C. $-114.8\ kJmol^{-1}$ D. $114.8 kJmol^{-1}$

Q.25 Which of the following processes has always $\Delta H = -ve$?

A. Formation of compound B. Combustion
C. Dissolution of ionic compound D. Dilution of a solution

Q.26 Heat absorbed or evolved during the chemical reaction at constant pressure is:

A. ΔH B. ΔE
C. ΔV D. ΔH+ΔE

Q.27 The change in enthalpy of a system when one mole of the substance is completely burnt in excess of air or oxygen is called:

A. Heat of reaction B. Heat of atomization
C. Heat of formation D. Heat of combustion

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Q.28 Which of the following enthalpy change may be positive or negative value?
A. ΔH_f
B. ΔH_c
C. ΔH_{sol}
D. Both A and C

Q.29 Neutralization of acid – base is:
A. Spontaneous
B. Exothermic
C. Non spontaneous
D. Both A and B

Q.30 $\Delta H°$ represent the enthalpy change at:
A. 0°C and 1 atm pressure
B. 0K and 1 atm pressure
C. 25°C and 1 atm pressure
D. 25°C and 2 atm pressure

Q.31 The enthalpy changes ΔH of a process is given by the relation:
A. $\Delta H = \Delta E + P\Delta V$
B. $\Delta H = \Delta E - \Delta nRT$
C. $\Delta E = \Delta H + \Delta P$
D. $\Delta E = \Delta H + P\Delta V$

Q.32 A system absorbs 100 kJ heat and performs 50 kJ work on the surroundings. The change in internal energy of the system is:
A. 50 kJ
B. 100 kJ
C. 150 kJ
D. 5000 kJ

Q.33 Which equation represents the atomization of iodine?
A. $\frac{1}{2}I_{2(s)} \longrightarrow I_{(l)}$
B. $\frac{1}{2}I_{2(s)} \longrightarrow I_{(g)}$
C. $I_{2(l)} \longrightarrow 2I_{(g)}$
D. $I_{2(g)} \longrightarrow 2I_{(g)}$

Q.34 The $\Delta H°_f$ of a reaction is recorded at:
A. 273 K
B. 373K
C. 298K
D. 473K

Q.35 Which of the following enthalpies is always negative?
A. Enthalpy of solution
B. Enthalpy of sublimation
C. Enthalpy of neutralization
D. Enthalpy of formation

Q.36 Which one of the following equations shows standard enthalpy of combustion?
A. $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$
B. $2CH_{4(g)} + 4O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(g)}$
C. $CH_{4(s)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$
D. $CH_{4(l)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$

Q.37 Enthalpy of a reaction can be measured by:
A. Glass calorimeter
B. Manometer
C. Barometer
D. Thermometer

Q.38 How much heat is evolved by 100 g of water when its temperature decreases from 25°C to 5°C? (heat capacity is 4.2 J/gK)
A. 84,000 J
B. – 2000/4.2 J
C. 2000/4.2 J
D. – 84,00 J

Q.39 Enthalpy of combustion of food, fuel and other compounds can be measured accurately by:
A. Glass calorimeter
B. Bomb calorimeter
C. Thermometer
D. Manometer

Q.40 Which enthalpy of reaction can-not be determined by glass calorimeter?
A. Enthalpy of formation
B. Enthalpy of neutralization
C. Enthalpy of solution
D. Enthalpy of combustion

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1 Total heat energy (q) can be calculated in a bomb calorimeter by using following formula:

A. $m \times s$
B. $c \times \Delta T$
C. $s \times \Delta T$
D. $c \times s \times \Delta T$

2 Which one of the following is applied to calculate lattice energy indirectly?

A. Born-Haber cycle
B. Bohr's theory
C. Le-Chatelier's principle
D. All of them

43 In order to determine ($\Delta H_{lattice}$) of ionic compound which is correct relationship?

A. $\Delta H_{latt} = \Delta H_f - \Delta H_x$
B. $\Delta H_{latt} = \Delta H_f + \Delta H_x$
C. $\Delta H_{latt} = \Delta H_a + \Delta H_v$
D. $\Delta H_{latt} = \Delta H_f - \Delta H_{sol}$

44 Which equation shows lattice energy for ionic compound?

A. $Na_{(s)} + \frac{1}{2}Cl_{2(g)} \rightarrow NaCl_{(s)}$
B. $Na^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow NaCl_{(aq)}$
C. $Na_{(s)} + Cl_{(g)} \rightarrow NaCl_{(s)}$
D. $Na^{+}_{(g)} + Cl^{-}_{(g)} \rightarrow NaCl_{(s)}$

Q.45 With the increase in charge to size ratio of ions, the lattice energy:

A. Remains unaffected
B. Increases
C. Decreases
D. All of these are possible

Q.46 Hess's law is analogous to:

A. Law of heat summation
B. Law of heat exchange
C. Law of increasing entropy
D. 1st law of thermodynamics

Q.47 One of the best applications of Hess's law to calculate the lattice energy of ionic compound is:

A. Measurement of enthalpy change in a calorimeter
B. Studying of first law of thermodynamics
C. Born-Haber cycle
D. Measurement of a heat of formation of a compound

Q.48 Which of the following enthalpies of formation cannot be measured directly?

A. ΔH°_{latt} for ionic compound
B. ΔH°_{f} for $CO_{(g)}$
C. ΔH°_{f} for B_2O_3
D. All of these

Q.49 The standard enthalpy changes of formation of carbon dioxide and water are -394 KJmol^{-1} and -286kJ mol^{-1} respectively, if the standard enthalpy change of combustion of propyne, C_3H_4 is -1938 KJ mol^{-1}. What is its standard enthalpy change of formation?

A. +1258 kJ mol^{-1}
B. +180 kJ mol^{-1}
C. -184 kJ mol^{-1}
D. -680 kJ mol^{-1}

Q.50 The heat of combustion of ethane (C_2H_6) is –337.0 kcal at 25°C. The heat of the reaction when 3g of ethane is burnt completely is:

A. –3.37 kcal
B. +3.37 kcal
C. –33.7 kcal
D. 33.7 kcal

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Topic 8 THERMOCHEMISTRY AND ENERGETICS OF CHEMICAL REACTIONS

PAST PAPER MCQ'S

Q.51 **A spontaneous process is:** MDCAT (2010)
A. Unidirectional and irreversible
B. Unidirectional and real
C. Irreversible and real
D. All of above

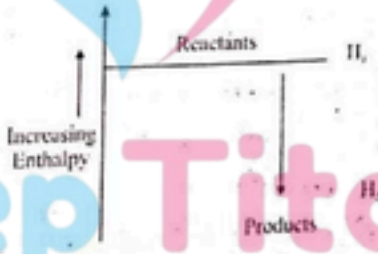
Q.52 **ΔH will be given a negative sign in:** MDCAT (2012)
A. Exothermic reactions
B. Dissociation reactions
C. Decomposition reactions
D. Endothermic reactions

Q.53 **Reactants have high energy than products in:** MDCAT (2013)
A. Endothermic reactions
B. Exothermic reactions
C. Photochemical reactions
D. Non-spontaneous reactions

Q.54 **Reaction of water with quick lime result in the rise in the temperature of the system. Using the concentration change, indicate the nature of the reaction?** MDCAT (2018)
A. Third order reaction
B. Endothermic reaction
C. Non spontaneous reaction
D. Exothermic reaction

Q.55 **Which of the following enthalpy change is always exothermic?** MDCAT (2018)
A. Enthalpy of solution
B. Enthalpy of formation
C. Enthalpy of combustion
D. Enthalpy of atomization

Q.56 **The given diagram shows the enthalpy changes during a chemical reaction:** MDCAT (2019)



This diagram represents:
A. An endothermic reaction
B. An exothermic reaction
C. A non-spontaneous process
D. An isothermic process

Q.57 **Heat of formation of MgO is given below.** $Mg+1/2O_{2(g)} \rightarrow MgO_{(s)}$ $\Delta H = -692k\ jmol^{-1}$ SET (2019)
This equation shows that:
A. The product is very stable
B. The reaction is endothermic
C. The product is highly unstable
D. The reactants are very stable

Q.58 **When one mole of gaseous hydrogen ions are dissolved in water to form infinitely dilute solution, amount of heat liberated is:** MDCAT (2010)
A. -1075kJ/mol
B. -499kJ/mol
C. -1891kJ/mol
D. -1562kJ/mol

Q.59 **In standard enthalpy of atomization heat of surrounding:** MDCAT (2011)
A. Remains same
B. Increases
C. Decreases
D. Increases then decreases

Q.60 **Heat of formation ($\Delta H°_f$) for CO_2 is:** MDCAT (2013)
A. -390 kJ/mole
B. +394 kJ/mole
C. -394 kJ/mole
D. -294 kJ/mole

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Q.61 $2H_2 + O_2 \longrightarrow 2H_2O \quad \Delta H = 205.5\,kJmol^{-1}$. What will be the enthalpy change in the above reaction? MDCAT (2014)

A. 205.5 kJ mol^{-1}
B. – 205.5 kJ mol^{-1}
C. Zero kJ mol^{-1}
D. 1 kJ mol^{-1}

Q.62 "Actual value of enthalpy change for given reaction is **-285.8 kJ mol^{-1}**" The equation that represents standard enthalpy of atomization of hydrogen is: MDCAT (2015)

A. $\frac{1}{2}H_2O_{(\ell)} \longrightarrow H_{2(g)} + \frac{1}{2}O_{(g)} \quad +218 kJmol^{-1}$

B. $\frac{1}{2}H_2O_{(\ell)} \longrightarrow H_{2(g)} + \frac{1}{2}O_{(g)} \quad -218 kJmol^{-1}$

C. $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)} \quad +218 kJmol^{-1}$

D. $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)} \quad -218 kJmol^{-1}$

Q.63 $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)} \quad \Delta H = 218 KJmol^{-1}$ MDCAT (2016)

In this reaction ΔH will be called:

A. Enthalpy of atomization
B. Enthalpy of formation
C. Enthalpy of decomposition
D. Enthalpy of the dissociation

Q.64 $Mg + \frac{1}{2}O_2 \longrightarrow MgO_{(s)} + -692 KJmol^{-1}$ at STP. MDCAT (2016)

Enthalpy of the above reaction will be called:

A. ΔH°_{at}
B. ΔH°_{sol}
C. ΔH°_{n}
D. ΔH°_{f}

Q.65 Determinate the value of Enthalpy of formation of NH_4Cl: MDCAT (2017)

A. -788 $kJmol^{-1}$
B. -692 $kJmol^{-1}$
C. -314.55 $kJmol^{-1}$
D. None of these

Q.66 Enthalpy is measured at _____: MDCAT (2017)

A. 300 K and 2 atm
B. 298 K and 1 atm
C. 300 K and 1 atm
D. 295 K and 1 atm

Q.67 Which enthalpy change is relevant in the following process? MDCAT (2019)

$Na_{(s)} \rightarrow Na_{(g)} \quad \Delta H = +108 kJmol^{-1}$

A. Enthalpy of fusion
B. Enthalpy of vaporization
C. Enthalpy of atomization
D. Enthalpy of formation

Q.68 When two moles of H_2 and one mole of O_2 react to form H_2O 484KJ heat is evolved. What is ΔH_f for one mole of H_2O? NUMS (2019)

A. –484$KJmol^{-1}$
B. –242$KJmol^{-1}$
C. –121$KJmol^{-1}$
D. +242$KJmol^{-1}$

Q.69 For a given reaction $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$ the change in enthalpy under standard conditions is called? SET (2019)

A. Standard enthalpy change of solution
B. Standard enthalpy change of hydration
C. Standard enthalpy of neutralization
D. Standard enthalpy change of formation

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Q.70 Which of the equations shows the same "twice" the enthalpy changes of neutralization as the following equation? MIXCAT (2019)

$$HCl + NaOH \rightarrow NaCl + H_2O$$

A. $H_2SO_4 + Mg(OH)_2 \rightarrow MgSO_4 + 2H_2O$
B. $NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3$
C. $MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$
D. $KOH + HCl \rightarrow KCl + H_2O$

Q.71 Lattice energy of an ionic crystal is the enthalpy of: MIXCAT (2011)

A. Combustion
B. Dissociation
C. Dissolution
D. Formation

Q.72 Combustion of graphite to form CO_2 can be done by two ways. Reactions are given as follow: MIXCAT (2012)

$C + O_2 \longrightarrow CO_2$ $\quad \Delta H = -393.7\ kJmol^{-1}$

$C + \frac{1}{2}O_2 \longrightarrow CO$ $\quad \Delta H_1 = ?$

$CO + \frac{1}{2}O_2 \longrightarrow CO_2$ $\quad \Delta H_2 = -283\ kJmol^{-1}$

A. $-676\ kJ\ mol^{-1}$
B. $+110\ kJ\ mol^{-1}$
C. $-110\ kJ\ mol^{-1}$
D. $676\ kJ\ mol^{-1}$

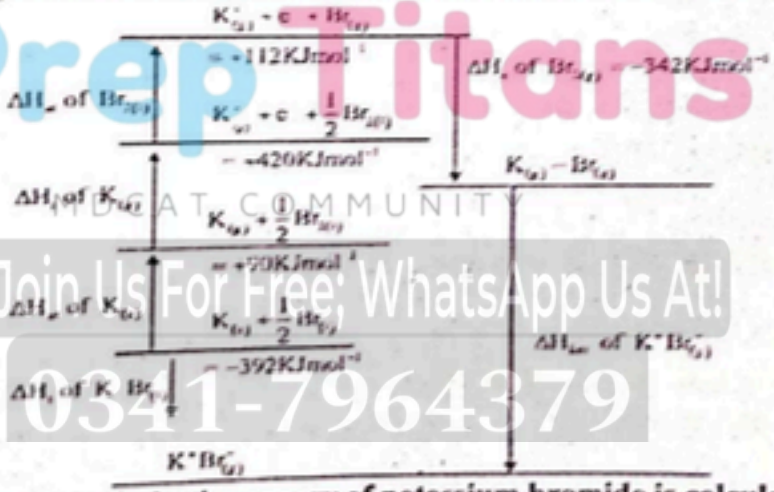
Q.73 Calculate the lattice energy of sodium chloride on the basis of Born-Haber cycle when: MIXCAT (2017)

$\Delta H_f[NaCl] = -411 KJmol^{-1}$, $\Delta H_a[Na] = +107 KJmol^{-1}$, $\Delta H_a[Cl] = +122 KJmol^{-1}$,

$\Delta H_i[Na] = +496 KJmol^{-1}$, $\Delta H_{sol}[NaCl] = -349 KJmol^{-1}$

A. 376 kJ/mole
B. -376 kJ/mole
C. +787 kJ/mole
D. -787 kJ/mole

Q.74 The given diagram is a Born-Haber cycle for the formation of KBr: SET (2019)



Using the given data, the lattice energy of potassium bromide is calculated to be:

A. $-672 kJmol^{-1}$
B. $-672 KCalmol^{-1}$
C. $-787\ kJmol^{-1}$
D. $+672\ Jmol^{-1}$

Q.75 Which one of the following is not a state function? ETEA (2019)

A. Work
B. Enthalpy
C. Internal energy
D. Pressure

Q.76 The thermal energy at constant pressure is called: NMDCAT (2020)

A. Enthalpy
B. Internal energy
C. Heat capacity
D. Work done

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Q.77 Born-Haber cycle is used to determine the lattice energies of: NMDCAT (2020)
A. Molecular solids B. Metallic solids
C. Ionic solids D. Covalent solids

Q.78 One calorie is equal to: NMDCAT (2020)
A. 4.18 KJ B. 4.18 J
C. 0.418 KJ mol^{-1} D. 0.418 KJ

Q.79 Unit of energy: PMC (2021)
A. Joule B. Kilojoule
C. Calorie D. All

Q.80 Which one of the following is not an example of state function? PMC (2021)
A. Temperature(T) B. Enthalpy(H)
C. Volume(V) D. Heat(q)

Q.81 ΔH for exothermic reaction is _____? PMC (2021)
A. More than 1 B. Positive
C. Negative D. Neutral

Q.82 Which is correct for 1st law of thermodynamics? PMC (2021)
A. $\Delta E=q+w$ B. $\lambda = h/mv$
C. $E = mC^2$ D. $P_1V_1 = P_2V_2$

Q.83 Born-Haber's cycle is used to determine the lattice energy of ionic compounds. It is the application of: UHS (2022)
– Henry's law B. Le-Chatelier's principle
C. Hess's law D. Common ion effects

Q.84 Which of the following term is state function? UHS (2022)
A. Freezing B. Sublimation
C. Decomposition D. Enthalpy

Q.85 The correct equation for the first law of thermodynamics is: SZABMU (2022)
A. $\Delta E = q + w$ B. $\Delta E = w - q$
C. $\Delta E = \Delta q - p\Delta v$ D. $\Delta E = \Delta q + p\Delta v$

Q.86 One calorie is equal to: SZABMU (2022)
A. 4.18 KJ B. 4.18 J
C. 0.418 KJ mol^{-1} D. 0.418 KJ

Q.87 The thermal energy at constant pressure is called: SZABMU (2022)
A. Enthalpy B. Internal energy
C. Heat capacity D. Work done

Q.88 A system that can exchange or transfer both matter and energy with the surroundings is: ETEA (2022)
A. Isolated system B. Closed system
C. Open system D. Adiabatic system

Q.89 The sum of all the energies of all the molecules or atoms of a substance is called its: ETEA (2022)
A. Specific heat B. Heat capacity
C. Latent heat D. Internal energy

Q.90 Which of the following elements has the same oxidation number in all of its known compounds? ETEA (2022)
A. Beryllium B. Chlorine
C. Nitrogen D. Bromine

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Q.91 The equation of the first law of thermodynamics $q = \Delta E + W$ will reduce at constant volume to: DUHS (2022)

A. $\Delta E + W$
B. $q_v = \Delta E + P\Delta V$
C. $q_v = \Delta E + W$
D. $q_v = \Delta E$
E. $q_v = P\Delta GV$

Q.92 Reaction taking place in one step or in several have same ΔH is statement of: DUHS (2022)

A. Lussac's Law of combining volume
B. Hess's law
C. Boyle's law
D. Charle's law
E. Avogadro's law

Q.93 Conversion of sodium into sodium ions is: BMU (2022)

A. Exothermic process
B. Endothermic process
C. Neutral process
D. Sublimation process

Q.94 Born-Haber cycle is used to calculate? BMU (2022)

A. Enthalpy of combustion
B. Lattice energy of covalent compounds
C. Lattice energy of ionic compounds
C. Enthalpy of ionization

Q.95 Specific heat of water is: NUMS (2022)

A. 4.18 J/g/°C
C. 6.04 J/g/°C
B. 9.82 J/g/°C
D. 8.47 J/g/°C

Q.96 Enthalpy change of combustion is exothermic because: NUMS (2022)

A. Energy released in bond breaking is greater
B. Energy released in bond making is greater
C. Energy absorbed in bond breaking is greater
D. Energy absorbed in bond making is greater

Q.97 One Calorie is equivalent to: NUMS (2022)

A. 4.184 J
C. 0.4184 J
B. 4.184 KJ
D. 0.4184 KJ

Q.98 What is the reason of energy changes in chemical reactions? USH (2023)

A. Bond formation
B. Bond breakage
C. Bond formation and breakage
D. Ionic bonds

Q.99 What is the unit of heat capacity? USH (2023)

A. JK^{-1}
B. $kJmol^{-1}$
C. kJ/K
D. kJmol

Q.100 For exothermic reaction $\Delta H°$ is written as: SZABMU (2023)

A. Zero
B. Positive
C. Negative
D. Constant

Q.101 Processes involving solids and liquids have their: ETEA (2023)

A. $\Delta H = \Delta E + P\Delta V$
B. $\Delta H = P\Delta V$
C. $\Delta H = \Delta E$
D. $\Delta H = 0$

Q.102 What is the mathematical statement of the first law of thermodynamics? DUHS (2023)

A. $\Delta E = q + w$
B. $\Delta E = -q - w$
C. $\Delta E = -q + w$
D. $\Delta E = q - w$

Q.103 What is ΔH equal to ——— according to the first law of thermodynamics? DUHS (2023)

A. $\Delta E - P\Delta V$
B. $\Delta E + P\Delta V$
C. $-\Delta E - P\Delta V$
D. $-\Delta E + P\Delta V$

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Q.104 Hess's law states the same thing as: BUMHS (2023)

A. Henry's law
B. Second law of thermodynamics
C. First law of thermodynamics
D. Second law of thermochemistry

Q.105 Which of the following is not an endothermic reaction? BUMHS (2023)

A. Combustion of methane
B. Decomposition of water
C. Dehydrogenation of ethane or ethylene
D. Conversion of graphite to diamond

Q.106 Which of the following is not a state function? NUMS (2023)

A. Pressure (P)
B. Work (W)
C. Volume (V)
D. Temperature (T)

Q.107 Equation represents which energy changes? NUMS (2023)

$$Mg^{+2}_{(g)} + O^{-2}_{(g)} \longrightarrow MgO_{(s)}$$

A. Atomization
B. Neutralization
C. Lattice energy
D. Solution

Q.108 At constant volume, the heat supplied to a system is always equal to its _____. SZABMU (2024)

A. Bond energy
B. Enthalpy change
C. Heat of sublimation
D. Internal energy change

Q.109 What will be the internal energy of a system at constant volume? SZABMU (2024)

A. $\Delta E = 0$
B. $\Delta E = q + P$
C. $\Delta E = q + P\Delta V$
D. $\Delta E = qv$

Q.110 What will be formula of work, when work is done on the system by the surrounding? SZABMU (2024)

A. $W = -P/\Delta V$
B. $W = -P\Delta V$
C. $W = P/\Delta V$
D. $W = P\Delta V$

Q.111 Who stated that enthalpy change in a chemical reaction is same whether the reaction takes place in single step or in several steps? SZABMU (2024)

A. Arrhenius' Law
B. Born Haber's Law
C. Dalton's Law
D. Hess's Law

Q.112 Which one the following is NOT an example of electrochemical cell? Out of syllabus SZABMU (2024)

A. Electrolytic cell
B. Photovoltaic cell
C. Solar cell
D. Voltic cell

Q.113 Select the exothermic reaction from the following processes: (Deleted) SZABMU-RC (2024)

A. Burning of coal
B. Melting of ice
C. Freezing of water
D. condensation of water

Q.114 Born Haber cycle is used to calculate the lattice energy of which compound? (Deleted) SZABMU-RC (2024)

A. RbBr
B. PbS
C. SO_2
D. NH_3

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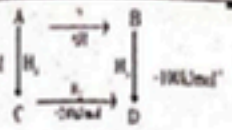
Q.115 

Calculate ΔH for the reaction:

SZABMU-RC (2024)

A. -400 KJ/mol
B. -600 KJ/mol
C. -440 KJ/mol
D. -640 KJ/mol

Q.116 One calorie is equivalent to:

SZABMU-RC (2024)

A. 4.184 J
B. 41.84 J
C. 0.4184 J
D. 0.4184 J

Q.117 Calculate the work done when 1 mole of an ideal gas expands from 15 dm^3 to 20 dm^3 against a constant external pressure of 2 atmospheres. ETEA (2024)

A. 10 atm.dm
B. -5 $atm.dm^3$
C. 5 $atm.dm^3$
D. 10 $atm.dm^3$

Q.118 When 1 mole of ice melts at 0°C and constant pressure of 1 atmosphere, 6025 J of heat is absorbed by the system. The molar volume of ice and water are 0.020 and 0.018 dm^3, respectively. Calculate ΔE. ($1dm^3.atm$-101.33J) ETEA (2024)

A. 6010.20J
B. 6015.20J
C. 6020.20.J
D. 6025.20J

Q.119 One slice of bread with a tablespoon of peanut butter on it contains 20g carbohydrate, 10g protein, and 9g fat. Calculate total energy consumed in this intake: ETEA (2024)

A. 158kcal
B. 173kcal
C. 201kcal
D. 218kcal

Q.120 ΔH can be measured indirectly by applying: ETEA (2024)

A. Avogadro's law
B. Faraday's law
C. Gas's law
D. Hess's law

Q.121 The heat of sublimation of potassium is 98kJ/mol, the heat of dissociation of bromine gas is 192.5 kJ/mol. The ionization energy of K is 414 kJ/mol. The electron affinity of Br is -334.7 kJ/mol and the heat of formation of KBr is -405.8 kJ/mol. Calculate the lattice energy of KBr. ETEA (2024)

A. –679.3
B. -669.5
C. 669.5
D. 679.3

Q.122 The decomposition of H_2O is inhibited by: DUHS (2024)

A. MnO_2
B. Ethanol
C. Glycerin
D. V_2O_5

Q.123 Volume is a: DUHS (2024)

A. Intensive property
B. Entropy
C. Path function
D. Isolated system

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Q.124 An example of an endothermic reaction is: DUHS (2024)

A. Photosynthesis
B. Synthesis of NH_3
C. Nuclear fission
D. Oxidation of sulfur gases

Q.125 The sign of heat "q" is positive for a system when: BMU (2024)

A. The temperature of system drops
B. Heat flows from surrounding to system
C. Heat flows from system to surrounding
D. No flow of heat between system to surrounding

Q.126 The change in enthalpy for the reaction: BMU (2024)

$NaOH_{(aq)} + HNO_{3(aq)} \rightleftharpoons NaNO_{3(aq)} + H_2O_{(l)}$

A. Heat of combustion
B. Heat neutralization
C. Heat of decomposition
D. Heat of formation

Q.127 Units of change in enthalpy of a system are: BMU (2024)

A. cc
B. °C
C. J
D. Pa

Q.128 Identify standard enthalpy of reaction for the following reaction: NUMS (2024)

A. $H_{2(g)} + 1/2O_{2(g)} \rightarrow H_2O_{(l)}$
B. $CO_{(g)} + 1/2O_{2(g)} \rightarrow CO_{2(g)}$
C. $2Al_{(s)} + Fe_2O_{3(s)} \rightarrow Al_2O_{3(s)} + 2Fe_{(s)}$
D. $S_{(g)} + 3/2O_{2(g)} \rightarrow SO_{3(g)}$

Q.129 Expansion takes place when a gas is evolved during a chemical reaction between marble chips and dilute HCl. Predict the energy change and work done: (Wrong) NUMS (2024)

A. w is positive, q is negative
B. w is negative, q is positive
C. q is positive, no work done
D. w is positive, q is positive

Q.130 Which of the following compound have any characteristic heat of fusion except? (Wrong) NUMS (2024)

A. NaCl
B. Aluminium oxide
C. Iron oxide
D. Silicates

Q.131 $\Delta H°$ for the sublimation of one mole of iodine from the following equations will be: (Wrong) NUMS (2024)

$H_{2(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$
$\Delta H° = 51.8$ kJ/mol
$H_{2(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$
$\Delta H° = -10.5$ kJ/mol

A. 41.3 kJ/mol
B. 62.3 kJ/mol
C. 53.5 kJ/mol
D. 36.5 kJ/mol

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ANSWER KEY

PRACTICE EXERCISE

1	B	11	C	21	D	31	A	41	B
2	D	12	C	22	C	32	A	42	A
3	A	13	C	23	C	33	B	43	A
4	D	14	B	24	A	34	C	44	D
5	C	15	B	25	B	35	C	45	B
6	A	16	A	26	A	36	A	46	D
7	C	17	C	27	D	37	A	47	C
8	D	18	A	28	D	38	D	48	D
9	A	19	C	29	D	39	B	49	C
10	D	20	C	30	C	40	D	50	C

PAST PAPER QUESTIONS

51	D	61	B	71	D	81	C	91	D	101	C	111	D	121	A	131	B
52	A	62	C	72	C	82	A	92	B	102	A	112	C	122	C		
53	B	63	A	73	D	83	C	93	B	103	B	113	A	123	C		
54	D	64	D	74	A	84	D	94	C	104	C	114	A	124	A		
55	C	65	C	75	A	85	A	95	A	105	A	115	C	125	B		
56	B	66	B	76	A	86	B	96	B	106	B	116	A	126	B		
57	A	67	C	77	C	87	A	97	A	107	C	117	D	127	C		
58	A	68	B	78	B	88	C	98	C	108	D	118	D	128	C		
59	C	69	C	79	D	89	D	99	C	109	D	119	C	129			
60	C	70	A	80	D	90	A	100	C	110	D	120	D	130	D		

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EXPLANATORY NOTES

Q.11 Thermodynamics is study of heat change during a reaction. It does not deal with rate of reaction.

Q.12 Endothermic reaction absorb heat. Heat is taken from surrounding. So, temperature of surrounding air decreases.

Q.13 Respiration involve exothermic process.

Q.14 A process which takes place on its own without any outside assistance, is known as spontaneous process.

Q.15 Work done by the system is considered negative. ($W = -P\Delta V$)

Q.16 $H = E + PV$

Q.17 Enthalpy of formation may be negative or positive.

$$Mg_{(s)} + \frac{1}{2}O_2 \longrightarrow MgO_{(s)} \qquad \Delta H°_f = -692 kJ/mol$$

$$\frac{1}{2}N_{2(g)} + O_{2(g)} \longrightarrow NO_{2(g)} \qquad \Delta H°_f = 33.18 kJ/mol$$

Q.18 Total heat content of the system is called enthalpy.

Q.19 Standard enthalpy of an element in its standerd state is zero.

Q.20 Enthalpy of neutralization is merely the heat of formation of liquid water from its ionic components.

$$H^+_{(aq)} + Cl^-_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \rightleftharpoons Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$

The main reaction that takes place during neutralization is,

$$H^+_{(aq)} + OH^-_{(aq)} \rightleftharpoons H_2O_{(l)} \qquad \Delta H_n = -57.4 \text{ kJ.mol}^{-1}$$

Enthalpy of neutralization of any strong acid and strong base is approximately the same i.e -57 .4 kJ mol^{-1}.

Q.21 The standard enthalpy of formation of a compound is the amount of heat absorbed or evolved when one mole of compound is formed from its elements under standard conditions. It may be +ve or -ve

Q.22

- Enthalpy of neutrilization & enthalpy of combustion are always negative.
- While enthalpy of atomization is always positive.

Q.23 The standard enthalpy of neutralization is the amount of heat evolved when one mole of H^+ ions from an acid react with one mole of OH^- ions from a base to form one mole of water under standard conditions i.e. 298K and one atmosphere pressure.

Q.24

$$H_2SO_4 + Ba(OH)_2 \longrightarrow BaSO_4 + 2H_2O$$

$$2H^+ + 2OH^- \longrightarrow 2H_2O \qquad q_n = -114.8 kJ$$

$$1H^+ + 1OH^- \longrightarrow 1H_2O \qquad \Delta H°n = -57.4 kJ/mol$$

Q.25 Enthalpy of combustion is always negative. While enthalpy of solution may be negative or positive.

Q.26 Heat absorbed or evolved during the chemical reaciton at constant pressure is known as enthalpy of reation. It is represnted by ΔH.

Q.27 The change in enthalpy of a system when one mole of the substance is completely burnt in excess of air or oxygen is called enthalpy of combustion.

$$C_2H_5OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)} \qquad \Delta H°_c = -1368 \text{ kJ.mol}^{-1}$$

Q.28 ΔH_f = may be +ve or -ve
ΔH_{sol} = may be +ve or -ve
ΔH_c = always -ve
ΔH_{at} = always +ve

Q.29 Enthalpy of neutrilizaiton is a spontaneous process as well as exothermic.

$$H^{+}_{(aq)} + Cl^{-}_{(aq)} + Na^{+1}_{(aq)} + OH^{-}_{(aq)} \rightleftharpoons Na^{+}_{(aq)} + Cl^{-}_{(aq)} + H_2O_{(\ell)}$$

The main reaction that takes place during neutralization is:

$$H^{+}_{(aq)} + OH^{-}_{(aq)} \rightleftharpoons H_2O_{(l)} \qquad \Delta H_n = -57.4\ kJ.mol^{-1}$$

Q.30 Standard conditions for enthalpy measurement are given below:
Temperature = 25°C (298 K), Pressure = 1atm (760 torr)

Q.31 The enthalpy changes of a process is given by following relation:
$\Delta H = \Delta E + P\Delta V$

Q.32
$\Delta E = q - w$
$= 100 - 50$ (Work done on the surrounding by system is negative).
$= 50kJ$

Q.33 The standard enthalpy of atomization of an element is the amount of heat absorbed when one mole of gaseous atoms are formed from the element under standard conditions i.e. 298K and one atmospliere pressure.

Examples:
The standard enthalpy of atomization of hydrogen is given below

(i) $\frac{1}{2} H_{2(g)} \longrightarrow H_{(g)}$ $\qquad \Delta H^{\circ}_{at} = +218 kJmol^{-1}$

(ii) $\frac{1}{2} I_{2(s)} \longrightarrow I_{(g)}$ $\qquad \Delta H_{at} = +ve$

Q.34 Standard conditions for enthalpy measurement are given below,
Temperature = 25°C (298k), Pressure = 1atm

Q.35 ΔH_f may be +ve or –ve
ΔHsol. may be +ve or –ve
ΔH_s is always positive
ΔH_n is always negative

Q.36 $CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(\ell)}$
$\Delta Hc = -21kcal$
$= -87.86kJ/mol$

Q.37 Enthalpy of reaction can be measured by glass calorimeter or bomb calrimeter.

Q.38
$$q = m \times s \times \Delta T \Rightarrow 100 \times 4.2 \times 20 = 8400 = -8400J$$
As heat released during reaction which is absorbed by H_2O.

Q.39 Enthalpyof combustion of food, fuel and other compounds can be accurately measured by bomb calorimeter
$q = c \times \Delta T$

Q.40 Enthalpy of formation, enthalpy of neutrilization and enthalpy of solution can be determind by glass calorimeter. Enthalpy of combustion can be determind by bomb calorimeter.

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Q.41 $q = c \times \Delta T$
where,
c = heat capacity
ΔT = change in temperature

Q.42 Born-Haber cycle is applied to calculate lattice energy indirectly.

Q.43 Lattice energy of ionic compound can be calculated by following formula
$\Delta H_{latt} = \Delta H_f - \Delta H_x$

Q.44 The amount of heat which is released when one mole of ionic compound is formed from gaseous ions under standard conditions is called lattice energy.
$Na^+_{(g)} + Cl^-_{(g)} \rightarrow NaCl_{(s)}$ $\Delta H_{latt} = -787 kJ/mol$

Q.45 $\Delta H_{latt} \alpha$ Charge/Size ratio

Q.46 If a chemical change takes place by several different routes, the overall energy change is the same, regardless of the route by which the chemical change occurs, provided the initial and final conditions are the same.

$$\Delta H = \Delta H_1 + \Delta H_2$$

OR

The sum of enthalpy changes in closed cyclic process is zero.

$$\sum \Delta H(\text{cycle}) = 0$$

Q.47 Born-Haber cycle is best application of Hess's law to calculate the lattic energy of ionic compounds.
$\Delta H_{latt} = \Delta H_f - \Delta H_x$

Q.48 (i) Heat of formation of Al_2O_3 and B_2O_3 cannot be measured directly. It is difficult to burn these substances completely in oxygen, as protective layer of their oxides is formed on the surface. So, for the determination of heat of formation of Al_2O_3 and B_2O_3 Hess's law is used.
(ii) Heat of formation of CO cannot be measured directly due to the formation of CO_2 with it.

Q.49

$C + O_2 \longrightarrow O_2$	$\Delta H = -394$	_____ (i)
$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$	$\Delta H = -286$	_____ (ii)
$C_3H_4 + 4O_2 \longrightarrow 3CO_2 + 2H_2O$	$\Delta H = -1938$	_____ (iii)
Required $3C + 2H_2 \longrightarrow C_3H_4$	$\Delta H = ?$	

Multiply equation (i) with 3, equation (ii) with 2
Reverse equation (iii) and adding them

$3C + 3O_2 \longrightarrow 3CO_2$	$\Delta H = -1182$
$2H_2 + O_2 \longrightarrow 2H_2O$	$\Delta H = -572$
$3CO_2 + 2H_2O \longrightarrow C_3H_4 + 4O_2$	$\Delta H = +1938$
$3C + 2H_2 \longrightarrow C_3H_4$	$\Delta H = -184$

Q.50 $C_2H_6 + \frac{1}{2}O_2 \longrightarrow 2CO_2 + 3H_2O$ $\Delta H = -337 kcal$

30g of C_2H_6 produces heat = −337kcal
3g of C_2H_6 produces heat = −33.7kcal

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 Characteristic of spontaneous reaction are

- Uni-directional
- Irreversible
- Real and naturall process

Q.52

- For a exothermic reaction,
  $\Delta H = -Ve$
- For endothermic reaction,
  $\Delta H = +Ve$

Q.53

- For exothermic reaction,
  $E_R > E_P$
- For endothermic reaction,
  $E_R < E_P$

Q.54 $CaO + H_2O \rightarrow Ca(OH)_2$, $\Delta H = -ve$

Q.55 Enthalpies that always have –ve value

- ΔH_c^o (_____)
- ΔH_n^o (_____)

If bonds formed are stronger than bonds broken then reaction will be exothermic

Q.56 According to given diagram,
$E_R > E_P$
This indicate exothermic reaction

Q.57 For exothermic reaction, product are more stable than that of reactant

Q.58 $H^{+1}_{(g)} + H_2O_{(l)} \longrightarrow H_3O^{+1}_{(aq)}$ $\Delta H = -1075 kJ/mol$

Q.59 $\Delta H_a^\circ = +Ve$
For endothermic reaction, heat of surrounding decreases while heat of system increases

Q.60 $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_f^\circ = -394 kJ/mol$

Q.61 $H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -285.8 kJ/mol$

Q.62 Enthalpy of atomization ($\Delta H°_{atm}$) is heat change when 1 mole of gaseous atoms are produced from its element under standard condition

$\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)}$ $\Delta H = +218 kJ/mol$

Q.63 ΔH_{atm}° is the heat change when 1 mole of gaseous atoms are produced from its element under standard condition

$\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)}$, $\Delta H = +218 kJ/mol$

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Q.64 ΔH_f^* is the heat change when 1 mole of product is formed from its element under standard condition, $Mg_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow MgO_{(s)}$ ΔH=-692kJ/mol

Q.65 The standard enthalpy of formation (ΔH_f) of NH4Cl is –314.5kJ/mol

$NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(s)}$

Q.66 Condition to measure standard ΔH:

Temp = 25°C / 298K

Pressure = 1 atm

Substance must be in its original physical state

Q.67 ΔH_{atm} is the heat change when 1 mole of gaseous atoms are produced from its element under standard condition.

Q.68 $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$ ΔH=-484kJ/mol

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$ ΔH = -242kJ/mol

Q.69 Heat evolved when 1 mole of H^+ from acid and 1mole of OH^{-1} ion from base to give one mole of water under standard condition is called standard enthalpy of neutralization (ΔH_n^*)

$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$ $\Delta H_n^* \leq$ -57.4kJ/mol

Q.70 If 2 mole H^+ from acid react with 2 mole of OH^{-1} from base to give 2 mole of water then ΔHn will be double (–114.8kJ)

Q.71 When one mole of ionic solid is produced from gaseous ions, then is called lattice enthalpy of formation. $X^{+1}_{(g)} + Y^{-1}_{(g)} \longrightarrow XY_{(s)}$ $\Delta H = -ve$

Q.72 According to Hess's law of constant heat summation:

$\Delta H_1 = \Delta H_2 + \Delta H_3 \Rightarrow -393.7 = \Delta H_2 - 283 \Rightarrow \Delta H_2 = -393.7 + 283 \Rightarrow$ = -110.7kJ/mol

Q.73 Lattice energy can be calculated by Born Haber's Process:

$\Delta H_l = \Delta H_f - \Delta H_x$

$= -411 - [107 + 122 + 496 - 349]$

$= -411 - 376$

$= -787 kJ / mol$

Q.74 Lattice energy can be calculated by Born Haber process

$\Delta H_l = \Delta H_f - \Delta H_x$

$\Delta H_l = -392 - [112 + 420 + 90 - 342]$

$= -392 - 280$

=-672kJ/mol

Q.75 Heat and work are not state function rather they are path function.

Q.76 $q_p = \Delta H$, Heat of reaction at constant pressure is equal to enthalpy change (ΔH).

Q.77 Born Haber cycle is application of Hess's law used to find ΔH_f^* of binary ionic compound.

Q.78 1 Cal = 4.184 J

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Q.79 Units of energy are joule, Kilojoule and Calorie.
1Cal = 4.18J

Q.80 Heat is not a state function.

Q.81 In exothermic reaction heat is evolved. ΔH is negative for exothermic reactions.

Q.82 Mathematical form of 1st law of thermic dynamics is:
$\Delta E = q + w$

Q.83 Born-Haber's cycle is used to determine the lattice energy of ionic compounds. It is an application of Hess's law.

Q.84 Enthalpy is a state function because it is independent to the path followed.

Q.85 Mathematical form of 1st law of thermic dynamics is:
$\Delta E = q + w$

Q.86 1Cal = 4.18J

Q.87 The thermal energy it constant pressure is called enthalpy:
$q_p = \Delta H$

Q.88 The system that can exchange or transfer both matter and energy with the surrounding is called open system.

Q.89 The sum of all the energies of all the molecules or atoms of a substance is called its internal energy.

Q.90 Beryllium (Be) is an element from group IIA. It does not show variable oxidation state.

Q.91 Mathematical form of 1st law of thermic dynamics is:
$\Delta E = q + w$
$\Delta E = q + P\Delta V$
at constant volume $\Delta V = 0$ Above equation becomes $\Delta E = q_v$

Q.92 According to Hesse's law reaction taking place in one step are in several steps has same ΔH.

Q.93 For the conversion of sodium atom into sodium ion energy is required so, it is endothermic process it is called enthalpy of ionization.

Q.94 Born-Haber's cycle is used to determine the lattice energy of ionic compounds. It is an application of Hess's law.

Q.95 Specific heat of water is 4.18J/g/°C.

Q.96 Enthalpy change of combustion is exothermic because energy released in bond making is greater than energy required in bond breaking.

Q.97 1Cal = 4.18j

Q.98 In chemical reaction for bond breakage energy is required to break bond in reactants while in bond formation energy is released when new bonds are formed
ΔE = (Energy required for energy required from bond breakage)-(Energy required for bond formation)
If ΔE = +ve then reaction is endothermic
ΔE = –ve then reaction is exothermic

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Q.99 Heat capacity of a body or a system is defined a quantity of heat required to change its temperature by 1 kelvin.

$q = C \times \Delta T \quad = C = \frac{q}{\Delta T} = kJK^{-1}$

Q.100 For exothermic reaction, the enthalpy of reactants is greater than enthalpy of products. So ΔH = -Ve (Due to lose of enthalpy)

Q.101 In case of liquids and solids, the change in state do not cause significant volume change i.e. $\Delta V = 0$. for such process $\Delta H \approx \Delta E$

Q.102 $\Delta E = E_2 - E_1$

$\Delta E = q + w$

Where q = amount of heat absorbed by system

w = work done

Q.103 A change in enthalpy of system can be written as

$\Delta H = \Delta E + \Delta (PV)$

$\Delta H = \Delta E + V\Delta P + P\Delta V$

Since the gas is kept at constant pressure. So

$\Delta P = 0$

Then $\Delta H = \Delta E + P\Delta V$

Q.104 Hess's law is simply an application of more fundamental law conversation of energy (1st law of thermodynamics)

Q.105

(a) Combustion of methane is exothermic process.

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)} \quad \Delta Hc = -21.0Kcal = -87.93kJ/mol$

(b) Decomposition of water is endothermic process.

$2H_2O_{(l)} \longrightarrow C_2H_4 + H_2 \quad \Delta Hc = +285.58kJ/mol$

(c) Dehydrogenation of ethane to ethylene is endothermic process

$C_2H_6 \longrightarrow C_2H_4 + H_2 \quad \Delta Hc = +137kJ/mol$

(d) Conversation of graphite to diamond is endothermic process

$C(graphite) \longrightarrow C(diamond) \quad \Delta H = 1.88kJ/mol$

Q.106 Heat and work are not state function rather they are path function

Q.107 Lattice energy is defined as energy released when 1 mole of an ionic crystalline compound is formed from its gaseous ions.

$Mg^{+2}_{(g)} + O^{-2}_{(g)} \longrightarrow MgO_{(s)}$

The equation represents the process primarily involves the release of lattice energy.

Q.108 When volume is constant $\Delta V = 0$

For such process ΔH and ΔE are approximately same $\Delta E \approx \Delta H$

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Q.109 The ΔE is given by $\Delta E = q + w$
If w is pressure-volume work, then the above expression assumes to be $\Delta E = q + P\Delta V$ –(1)
When volume of gas is constant than $\Delta V = 0$ so equation (1) will be $\Delta E = q_v$
ΔE of system at constant 'V' is equal to heat absorbed by system (q_v)

Q.110 $W = P\Delta E$
When work is done on system, the sign of w is positive
When work is done by system, the sign of w is negative

Q.111 Hess's law stated that enthalpy change in a chemical react ion is same whether the reaction takes place in single step or in several steps

Q.112 Solar cell an example of electrochemical cell

Q.113 .....

Q.114 .....

Q.115 $\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3$
$= (-540kJ/mol) + (+200kJ/mol) + (-100kJ/mol)$
$= -440kJ/mol$

Q.116 1 cal = 4.184J

Q.117 Work (w) = P × ΔV
Given
Pressure (P) = 2atm
Initial volume (V_1) = $15dm^3$
Final volume (V_2) = $20dm^3$
$\Delta V = V_2 - V_1 = 20-15 = 5dm^3$
$W = 2atm \times 5dm^3$
$W = 10atmdm^3$

Q.118 Given
Heat absorbed (q) = 6025J
Pressure (P) = 1atm
$\Delta V = V_2 - V_1 = 0.018dm^3 - 0.020dm^3$
$\Delta V = -0.002dm^3$
$P\Delta V = 1atm \times (-0.002dm^3) \times 101.33J$
$= -0.207J$
$\Delta E = q - P\Delta V = 6025 - (-0.2027)$
$\Delta E = 6025.2J$

Q.119 Carbohydrates provide 4kcal/g
Proteins provide 4kcal/g
Fats provide 9kcal/g
Carbohydrates = 20g × 4kcal/g = 80kcal
Proteins = 10g × 4kcal/g = 40 kcal
Fats = 9g × 9kcal/g = 81kcal
Total energy = 80 + 40 + 81 = 201kcal

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Q.120 Hess's law can be applied to determine ΔH indirectly

Q.121 Given

ΔH_f = -405.8kJl/mol, Electron affinity = -334.7kJ/mol

Ionization energy = 414kJ/mol

Heat of dissociation of Br_2 = 195kJ/mol

Heat of sublimation of K = 98 kJ/mol

Lattice energy = heat of formation of + ionization energy + electron affinity + heat of dissociation of Br_2 – heat of sublimation of K

= (-405.8kJ/mol) + 414kJ/mol + (-334.7kJ/mol) + 195kJ/mol – 98kJ/mol

Lattice energy = -679.3kJ/mol

Q.122 MnO_2 is a catalyst that accelerates reaction

Ethanol does not have strong effect on inhibition

Glycerin is known to inhibit decomposition of H_2O

V_2O_5 also a catalyst

Q.123 Volume is extensive property and state function.

Q.124 Photosynthesis is an endothermic reaction because plants absorb energy from sunlight to convert CO_2 and H_2O to glucose and O_2

Q.125 The sign of heat (q) is +ve for a system when system absorbs heat from its surrounding. The sign of heat (q) is negative when heat is released by system.

Q.126 The standard enthalpy of neutralization is the amount of heat evolved when 1 mole H^+ ions from acid, react with one mole of OH^- ions from base to form one mole of water.

$$NaOH_{(aq)} + HNO_{3(aq)} \rightleftharpoons NaNO_{3(aq)} + H_2O_{(l)} \quad \Delta H_n = -13.69kCal$$

Q.127 The units of change in enthalpy (ΔH) of system are

Joules (J)

Kilojoules (KJ)

Kilojoules per mole (KJ/mol)

Q.128 The best option is (C) because the enthalpy change for this reaction cannot be given any other name except enthalpy of reaction. While other options can have more than one name for standard enthalpy change. In (D) option Sulphur is not present in standard state so that there is no standard enthalpy change for this reaction.

Q.129 There is no correct answer in the options while correct answer would be w is negative, q is negative.

Q.130 All the given options are false because all the given compounds are ionic compounds. They all have characteristic heat of fusion.

Q.131 The given statement is not correct for the calculation of ΔH° for the sublimation of one mole of iodine.

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Topic 9 ELECTROCHEMISTRY

PRACTICE EXERCISE

Q.1 Oxidation state of "S" in H_2SO_4 is:

A. +2 B. +6
C. +4 D. –2

Q.2 Electrode potential of SHE arbitrarily taken in volts is:

A. 0.0V B. 1.0V
C. 0.01D D. 0.5

Q.3 The oxidation number of oxygen is _____ in OF_2:

A. –2 B. +2
C. –1 D. +1

Q.4 Stronger the oxidizing agent, greater is the:

A. Oxidation potential B. Reduction potential
C. Redox potential D. emf of cell

Q.5 In NICAD battery cathode is:

A. Cd B. $Ni(OH)_2$
C. Ni D. NiO_2

Q.6 On balancing of equation

$$K_2Cr_2O_7 + HCl \longrightarrow KCl + CrCl_3 + Cl_2 + H_2O$$

the coefficient with HCl will be?

A. 12 B. 14
C. 13 D. 16

Q.7 During space flights, astronauts obtain water from:

A. NICAD cell B. Lead accumulator
C. Fuel cell D. Alkaline Battery

Q.8 Which can replace hydrogen from dilute acidic?

A. Au B. Zn
C. Pt D. None

Q.9 In the electrolysis of $NaOH_{(aq)}$. Which product is obtained at anode?

A. H_2 B. Na
C. O_2 D. All

Q.10 In lead accumulator, cathode is made up of:

A. Pb B. Pb coated with PbO_2
C. $PbSO_4$ D. H_2SO_4

Q.11 The oxidation state of carbon-atom in glucose is:

A. +4 B. -4
C. +6 D. Zero

Q.12 Which of the following substance does sulphur exhibit its highest oxidation state?

A. S_8 B. SO_3
C. $SOCl_2$ D. $Na_2S_2O_3$

Q.13 What is the oxidation state of "O" in KO_2?

A. $-\frac{1}{2}$ B. –2
C. –1 D. –3

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Q.14 Apparent charge on an atom of an element in a molecule or ion is called oxidation number. It may be:
A. Positive
B. Zero or fraction
C. Negative
D. All of these

Q.15 Apparent charge on atom in molecule is called:
A. Valency
B. Coordination number
C. Oxidation number/state
D. Charge number

Q.16 The oxidation number of oxygen atom in OF_2 and H_2O_2:
A. −2, −1
B. +2, −1
C. −1, +2
D. +2, +1

Q.17 The element on the reactant side which has been reduced is:

$$HI + H_2SO_4 \longrightarrow I_2 + SO_2 + H_2O$$

A. H
B. I
C. S
D. O

Q.18 In redox reaction given below:

$$MnO_{2(s)} + 4H^+ \longrightarrow Mn^{+2}_{(aq)} + 2H_2O$$

A. $2e^-$ are added on LHS
B. $2e^-$ are added on RHS
C. $4e^-$ are added on LHS
D. $4e^-$ are added on RHS

Q.19 In which of the following reaction there is a transfer of the five electrons?
A. $MnO_4^{2-} \rightarrow MnO_2$
B. $CrO_4^{2-} \rightarrow Cr^{+3}$
C. $MnO_4^{1-} \rightarrow Mn^{+2}$
D. $Cr_2O_7^{-2} \rightarrow 2Cr^{+2}$

Q.20 In the reaction $H_2S + Cl_2 \rightarrow 2HCl + S$, H_2S acts as:
A. Reducing agent
B. Nitrating agent
C. Oxidizing agent
D. Sulphonating agent

Q.21 $8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$. Which one is correct about given equation?
A. $5e^-$ in R.H.S
B. $5e^-$ in L.H.S
C. $3e^-$ in R.H.S
D. $3e^-$ in L.H.S

Q.22 Which of the following reactions occur at cathode?
A. $Cu^{2+} + 2e^- \rightarrow Cu$
B. $Cu + 2e^- \rightarrow Cu^{2+}$
C. $Hg + \frac{1}{2}O_2 \rightarrow HgO$
D. $Mg + \frac{1}{2}O_2 \rightarrow MgO$

Q.23 In which of the following changes there is a transfer of two electrons:
A. $MnO_4^{2-} \longrightarrow MnO_2$
B. $MnO_4^- \longrightarrow Mn^{+2}$
C. $CrO_4^{2-} \longrightarrow Cr^{+3}$
D. $Cr_2O_7^{2-} \longrightarrow 2Cr^{+3}$

Q.24 The reactions taking place at anode and cathode are respectively:
A. Oxidation and reduction
B. Reduction and hydrolysis
C. Reduction and oxidation
D. Oxidation and hydrolysis

Q.25 The electrolysis product of molten NaCl at electrodes:
A. Na and Cl_2
B. H_2 and Cl_2
C. Na and NaOH
D. H_2, Cl_2 and NaOH

Q.26 During electrolysis of aqueous KNO_3, H_2 is produced at cathode instead of potassium due to:
A. Reduction potential of "K" is greater than hydrogen
B. Hydrogen is more reactive than potassium
C. Reduction potential of potassium is less than hydrogen
D. All of the above are possible reasons

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Q.27 **The cathodic reaction in the electrolysis of dil. H_2SO_4 with Pt electrodes:**
A. Reduction
B. Both oxidation and reduction
C. Oxidation
D. Neither oxidation nor reduction

Q.28 **The product produced at the cathode when aqueous sodium chloride is electrolyzed:**
A. H_2
B. Cl_2
C. O_2
D. Na

Q.29 **For the purification of copper, impure copper is made the _____.**
A. Cathode
B. Solution
C. Anode
D. Both A & B

Q.30 **Cell potential depends upon:**
A. Temperature
B. Concentration of ions
C. Nature of electrolyte
D. All of these

Q.31 **When an element is in contact with 1M aqueous solution of its own ions at 298K, then potential is called?**
A. Standard reduction potential
B. Standard electrode potential
C. Oxidation potential
D. Both "A" and "B"

Q.32 **The electric current obtained from galvanic cell is a result of electrons being pushed from the negative electrode, through an external wire, to positive electrode. The force with which these electrons move through the wire is called:**
A. Electromotive force
B. Electrode potential
C. Cell potential
D. Both A. and C.

Q.33 **Which is incorrect about standard electrode potential?**
A. It is the difference of potential of a cell, consisting of particular electrode and the SHE
B. The potential set up, when an electrode is in contact with one molar solution of its ions at standard conditions
C. The electrode potential of a single electrode can be measured directly
D. Both A and B

Q.34 **Which is not true about SHE?**
A. Finely divided platinum black is used as electrode
B. Temperature is kept 25°C
C. One molar solution of H_2SO_4 is used as electrolyte
D. Electrode potential of any element can be calculated by comparative method

Q.35 **The oxidation reaction that takes place in the SHE is:**
A. $H_{2(gas)} \longrightarrow 2H^+_{(aq)} + 2e^-$
B. $2H_2O_{(l)} \longrightarrow 2H_{2(g)} + O_{2(g)}$
C. $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(gas)}$
D. $2H_2O_{(l)} + 2e^- \longrightarrow OH^-_{(aq)} + H_{2(g)}$

Q.36 **The working conditions for SHE:**
A. 1atm pressure
B. 1M H^+ solution
C. 298K temperature
D. All of these

Q.37 **The potential of SHE is taken as zero which is a _____ value:**
A. Reference
B. Arbitrary
C. Exact
D. Experimental

Q.38 **The electrochemical series is based on:**
A. pH scale
B. Redox scale
C. Hydrogen scale
D. Arrhenius scale

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Q.39 SHE acts as anode when connected with Cu electrode but acts as cathode with Zn electrode. Which one is correct?
A. Zn has less reduction potential than hydrogen and Cu has more
B. Zn has high oxidizing potential than hydrogen and Cu has less
C. Zn is above in electrochemical series than hydrogen and Cu is below
D. All the above are correct

Q.40 If a salt bridge is removed from two half cells the emf of cell will be:
A. Increased
B. Decreased
C. Dropped to zero
D. Electrodes will be reversed

Q.41 The cathode has the reduction potential:
A. Less than anode
B. The same as anode
C. More than anode
D. Always zero

Q.42 $Al / Al^{+3} \| Zn^{+2} / Zn$ galvanic cell, the anode is:
A. Al
B. Zn
C. H_2
D. KCl

Q.43 Li has least reduction potential in electrochemical series. Which element has highest E°_{red}?
A. N
B. F
C. O
D. Cl

Q.44 The value of oxidation potential would be positive if it is:
A. Below SHE
B. Above SHE
C. Equal to SHE
D. Both A and B

Q.45 In the following cell representation:

$$Zn_{(s)} \left| Zn^{2+}_{(aq)} (1M) \right\| Cu^{2+}_{(aq)} (1M) \left| Cu_{(s)} \right.$$

The line || in the representation shows
A. Salt bridge
B. Molar concentration
C. Phase boundary
D. Both A and B

Q.46 The reaction which is responsible for the production of electricity in the voltaic cell is: MDCAT (2010)
A. Hydrolysis
B. Oxidation
C. Reduction
D. Redox

Q.47 In all oxidation reactions, atoms of an element in a chemical species lose electrons and increases there: MDCAT (2011)
A. Oxidation states
B. Reduction states
C. Electrode
D. Negative charges

Q.48 In $MgCl_2$, the oxidation state of Cl is: MDCAT (2012)
A. Zero
B. -2
C. +2
D. -1

Q.49 Which one of the following behaves as a redox reaction? MDCAT (2013)
A. $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$
B. $2Na + Cl_2 \rightarrow 2NaCl$
C. $2Cl^- \rightarrow Cl_2 + 2e^-$
D. $Na^+ + 1e^- \rightarrow Na$

Q.50 In SO_4^{-2} the oxidation number of sulphur is: MDCAT (2014)
A. –8
B. –6
C. +8
D. +6

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Topic 9

ELECTROCHEMISTRY

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Q.51 Study the following redox reaction: MDCAT (2016)

$$10Cl^- + 16H^+ + 2MnO_4^- \longrightarrow 5Cl_2 + 2Mn^{+2} + 8H_2O$$

Which statement is true about this reaction?

A. Manganese is oxidized from +7 to +2. B. Chlorine is reduced from zero to -1

C. Chloride ions are reduced from -1 to zero D. Manganese is reduced from +7 to +2

Q.52 In NO_3^- the oxidation number of "N" is: MDCAT (2017)

A. +5 B. +3

C. +2 D. –3

Q.53 The oxidation state of carbon in $C_2O_4^{-2}$ is: NUMS (2019)

A. +4 B. –4

C. +3 D. +2

Q.54 The value of oxidation number of chlorine in $HClO_3$ is: SET (2019)

A. +7 B. +5

C. –1 D. +3

Q.55 In voltaic cell a salt bridge is used in order to: MDCAT (2011)

A. Pass the electric current

B. Prevent the flow of ions

C. Mix solutions of two half cells

D. Allow movement of ions between two cells

Q.56 The potential difference of an electrochemical cell is measured by: MDCAT (2018)

A. Galvanometer B. Calorimeter

C. Voltmeter D. Ammeter

Q.57 In an electrochemical series, elements are arranged on the basis of: MDCAT (2010)

A. pH scale B. pKa scale

C. pOH scale D. Hydrogen scale

Q.58 The E° value of standard copper half-cell is +0.34V, measured when it is connected with SHE i.e. Standard hydrogen electrode. In this case the half reaction taking place at SHE is: MDCAT (2017)

A. $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$ B. $H_{2(g)} \longrightarrow 2H^+_{(aq)} + 2e^-$

C. $2H^+_{(aq)} + 2e^- \longrightarrow 2H_{(g)}$ D. $H_{2(g)} \longrightarrow 2H_{(g)} + 2e^-$

Q.59 The standard electrode potential of hydrogen is arbitrarily taken at 298k is _____. MDCAT (2018)

A. 1.00 volt B. 0.10 volt

C. 0.00 volt D. 10.0 volt

Q.60 Coinage metals Cu, Ag and Au are the least reactive because they have: MDCAT (2016)

A. Negative reduction potential B. Negative oxidation potential

C. Positive reduction potential D. Positive oxidation potential

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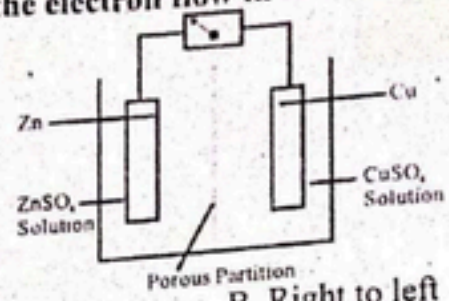
Q.61 In the figure given below, the electron flow in external circuit is from: MDCAT (2013)



A. Zinc to copper electrode
B. Right to left
C. Copper to zinc electrode
D. porous partition to zinc electrode

Q.62 Study the following facts, which of the following is correct: MDCAT (2015)

$Zn \longrightarrow Zn^{+2} + 2e^-$ $E^\circ = +0.76V$

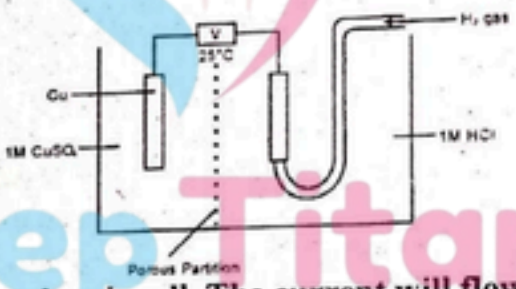
$Cu \longrightarrow Cu^{+2} + 2e^-$ $E^\circ = -0.34V$

A. $Cu + Zn^{+2} \longrightarrow Cu^{+2} + Zn$
B. $Cu^{+2} + Zn \longrightarrow Cu + Zn^{-2}$
C. $Cu^{+2} + Zn^{+2} \longrightarrow Cu + Zn$
D. $Cu^{+2} + Zn^{+2} \longrightarrow Cu + Zn^{+2}$

Q.63 Keeping in mind the electrode potential, which one of the following reactions is feasible? MDCAT (2015)

A. $Zn^{+2} + Cu \longrightarrow Cu^{+2} + Zn$
B. $Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$
C. $Zn + MgSO_4 \longrightarrow ZnSO_4 + Mg$
D. $Cd + MgSO_4 \longrightarrow CdSO_4 + Mg$

Q.64



The diagram shows a galvanic cell. The current will flow from: MDCAT (2016)

A. Hydrogen electrode to copper electrode
B. Copper electrode to hydrogen electrode
C. Hydrogen electrode to HCl solution
D. $CuSO_4$ solution to hydrogen electrode

Q.65 Stronger is the oxidizing agent, stronger is the: NUMS (2019)

A. emf of cell
B. Oxidation potential
C. Reduction potential
D. Redox potential

Q.66 Which of the following metal does not liberate hydrogen on reaction with acid? NUMS (2019)

A. Mg
B. Pt
C. Zn
D. Ca

Q.67 Which one of the following elements is the strongest reducing agent? SET (2019)

A. Chlorine
B. Sodium
C. Magnesium
D. Aluminium

Q.68 Rusting of iron metal Fe occurs when Fe gets converted into Fe_2O_3. What happen with Fe? SET (2019)

A. Fe is neutralized
B. Fe is sublimed
C. Fe is reduced
D. Fe is oxidized

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Q.69 During space flights, astronauts obtained water from: MDCAT (2017)
A. Nickel cadmium cells
B. Lead accumulator
C. Fuel Cell
D. Alkaline battery

Q.70 The electrolyte used in fuel cell is: NUMS (7 - 9)
A. KOH
B. $NaCl_{(aq)}$
C. $NaNO_3$
D. Molten NaCl

Q.71 In which of the following reaction hydrogen acts as oxidizing agent. ETEA (2016)
A. $H_2 + Cl_2 \longrightarrow 2HCl$
B. $C_2H_4 + H_2 \longrightarrow C_2H_6$
C. $2Na + H_2 \longrightarrow 2NaH$
D. $N_2 + 3H_2 \longrightarrow 2NH_3$

Q.72 Choose the true statement regarding the reaction given below: ETEA (2016)

$$2Na_{(s)} + Cl_{2(g)} \longrightarrow 2NaCl_{(s)}$$

A. Chloride is oxidized and sodium is reduced
B. Chlorine acts as an oxidizing agent and sodium as reducing agent
C. Chloride acts as a reducing agent and
D. None of the above

Q.73 A cell is constructed of the following two half cells. What is E_{cell} of the cell? ETEA (2016)

$Ag^+ + e^- \rightleftharpoons Ag + 0.80V$ $\quad$ $Al^{3+} + e^- \rightleftharpoons Al - 1.67V$

A. 2.47V
B. 0.087
C. –0.87 V
D. 5.81 V

Q.74 Which of the following is spontaneous reactions? ETEA (2016)
A. $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$
B. $2NaCl_{(s)} \longrightarrow 2Na_{(s)} + Cl_{2(g)}$
C. $Zn^{2+} + Clu \longrightarrow Zn + Cu^{2+}$
D. $2Fe(OH)_3 \longrightarrow 2Fe + 3O_2 + 3H_2$

Q.75 When zinc electrode is coupled with copper electrode in a galvanic cell: ETEA (2019)
A. Reduction takes place at zinc electrode
B. Oxidation takes place at copper electrode
C. Reduction takes place at copper electrode
D. Both A and B

Q.76 The oxidation state of nitrogen in NH_4NO_3 are: ETEA (2019)
A. –3 and 5
B. +5 and 3
C. –3 and –3
D. Zero

Q.77 Aqueous solutions of Iodine and Sodium hydroxide were mixed in a round bottom flask at 70°C. Following chemical reaction was carried out: MDCAT (2019)

$$3I_2 + 6NaOH \rightarrow NaIO_3 + NaI + H_2O$$

This reaction is termed as:
A. Free radical reaction
B. Precipitation reaction
C. Substitution reaction
D. Redox reaction

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Q.78

$Mg^{2+} + 2e^- \rightarrow Mg$ $E^\circ = -2.37V$

$Zn^{2+} + 2e^- \rightarrow Zn$ $E^\circ = -0.76V$

$2H^+ + 2e^- \rightarrow H_2$ $E^\circ = 0.000V$

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ = +0.34V$

Keeping in view the values of standard reduction potential given above, which one of the following would you select as a feasible redox chemical reaction? MDCAT (2019)

A. $2Au + 6H^+ \rightarrow 2Au^{3+} + 3H_2$
B. $2Cl^- + I_2 \rightarrow Cl_2 + 2I^-$
C. $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$
D. $Cu + Zn^{2+} \rightarrow Cu^{2+} + Zn$

Q.79 The oxidation state of "S" in the $(S_2O_3)^{-2}$ is: NMDCAT (2020)

A. +4
B. +6
C. -2
D. +2

Q.80 The common oxidation number of halogens is: NMDCAT (2020)

A. -1
B. +1
C. -2
D. 0

Q.81 During oxidation process, oxidation number of an element: NMDCAT (2020)

A. Decreases
B. Increases
C. Remains constant
D. Both "A" and "B"

Q.82 The least reactive transition metal: PMC (2021)

A. Zn
B. Sc
C. Cu
D. Au

Q.83 Which of the following is strong reducing agent? PMC (2021)

A. Li
B. F
C. Na
D. Mg

Q.84 Electrolysis of a dilute solution of NaCl results at the anode: PMC (2021)

A. Sodium
B. Chlorine
C. Hydrogen
D. Oxygen

Q.85 Which of the following is feasible reaction? PMC (2021)

A. $Pb + SnO \longrightarrow PbO + Sn$
B. $Pb + Zn \longrightarrow PbO + Zn$
C. $Zn + HCl \longrightarrow ZnCl_2 + H_2$
D. $2Ag + 2HCl \longrightarrow 2AgCl + H_2$

Q.86 An electrochemical cell is based upon which type of reaction? UHS (2022)

A. Acid-base reaction
B. Nuclear reaction
C. Redox reaction
D. Neutralization reaction

Q.87 In which of the following, Oxygen shows fractional oxidation number? UHS (2022)

A. OF_2
B. KO_2
C. Na_2O_2
D. Cl_2O_7

Q.88 Which statement correctly describes the term Standard Electrode potential? SZABMU (2022)

A. It is the electrode potential determined at room temperature and pressure
B. It is the electrode potential determined under standard condition using Hydrogen Electrode as the other electrode
C. It is the electrode potential of an element and its solution compare to zinc electrode
D. It is the potential which is measured when two half cells are connected

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Q.89 **Oxidation number of an element in free state is:** SZABMU (2022)
A. Negative
B. Positive
C. Zero
D. ±1

Q.90 **The branch of science which deals with the conversion of electrical energy into chemical energy and vice versa is called:** SZABMU (2022)
A. Electrochemistry
B. Thermochemistry
C. Stereochemistry
D. Biochemistry

Q.91 **A cathode has the reduction potential:** ETEA (2022)
A. Less than the anode
B. More than the anode
C. Same as that of anode
D. Zero

Q.92 **The stronger the reduction potential, the more difficult it is to:** ETEA (2022)
A. Reduce the compound
B. Oxidize the compound
C. Electrolyze the compound
D. Neither reduce oxides the compound

Q.93 **The electrolysis of dilute acid solution gives:** DUHS (2022)
A. Cl_2 at cathode & H_2 at anode
B. H_2 at cathode & Cl_2 at anode
C. H_2 at cathode & O_2 at anode
D. H_2 at anode & Na at cathode
E. H_2 at anode & O_2 at cathode

Q.94 **A strong electrolyte is one that _____ Completely in solution.** DUHS (2022)
A. Reacts
B. Decomposes
C. Disappears
D. Ionizes
E. Never ionizes

Q.95 **Down cell is used for the:** DUHS (2022)
A. Metallurgy of Na
B. Metallurgy of Mg
C. Metallurgy of Al
D. Metallurgy of Fe
E. Metallurgy of Ca

Q.96 **What is the oxidation number of Cl_2?** BMU (2022)
A. 0
B. +1
C. -1
D. -2

Q.97 **Which species has greater reduction potential?** BMU (2022)
A. Barium ion
B. Calcium ion
C. Magnesium ion
D. Aluminum ion

Q.98 **Potential of standard hydrogen electrode (SHE) is arbitrarily taken as:** NUMS (2022)
A. 10
B. -1
C. +1
D. Zero

Q.99 **During electrolysis, reduction always occurs at:** NUMS (2022)
A. Anode
B. SHE
C. Cathode
D. Salt bridge

Q.100 **In redox reaction of SO_2 with $KMnO_4$ in acidic medium:** ETEA (2023)
A. SO_2 oxides $KMnO_4$
B. SO_2 reduces $KMnO_4$
C. $KMnO_4$ is inert in acidic medium
D. SO_2 can't undergo redox reaction

Q.101 **Zinc displaces copper from its solution because:** ETEA (2023)
A. Atomic no. of zinc is higher than that of copper
B. Zinc has higher reduction potential than copper
C. Zinc is more soluble
D. Zinc has smaller reduction potential than copper

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Q.102 In electrochemical series, what is the electrode potential of all metals above Hydrogen? DUHS (2023)

A. Zero
B. Negative
C. Positive
D. Greater than zero

Q.103 When aqueous solution of NaCl is electrolyzed; BUMHS (2023)

A. Cl_2 is evolved at the cathode
B. H_2 is evolved at cathode
C. Na is deposited at the cathode
D. Na appears at the anode

Q.104 During electrolysis, reduction always occurs at the: NUMS (2023)

A. Anode
B. Cathode
C. SHE
D. Salt bridge

Q.105 Oxidation number of 'Mn' in $KMnO_4$ is: UHS (2024)

A. 0
B. 1
C. -7
D. 7

Q.106 Which step is irrelevant with respect to balancing of redox equations by oxidation number method? UHS (2024)

A. Split the reaction into two half reactions
B. Assign oxidation number to all the atoms involved in the equation
C. Identify the element undergoing a change in oxidation number
D. Equalize the number of electrons lost and gained

Q.107 Which of the following is NOT a correct feature of electrolytic cells? UHS (2024)

A. Reduction occurs at cathode
B. Oxidation occurs at anode
C. Alternating current source is connected to electrodes
D. Electrochemical reaction takes place

Q.108 In the reaction $Cr_2O_7^{-2} + 14H^+ \longrightarrow 2Cr^{+3} + 7H_2O$ SZABMU (2023) SZABMU (2024)

How many electrons are gained or lost by chromium atom?

A. +12 e⁻
B. +3 e⁻
C. +6 e⁻
D. -6 e⁻

Q.109 Which type of redox reaction takes place at cathode of the electrochemical cell? SZABMU-RC (2024)

A. Decomposition
B. Dissociation
C. Oxidation
D. Reduction

Q.110 During electrolysis of concentrated aqueous solution of NaCl, Which ion is NOT discharged at cathode? SZABMU-RC (2024)

A. Na^+
B. Cl^-
C. H^+
D. OH^-

Q.111 Oxidation number of an element in free state is: SZABMU-RC (2024)

A. Negative
B. Positive
C. Zero
D. 1

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Q.112 The oxidation number of oxygen in Na_2O_2 is: SZABMU-RC (2024)
A. -1 B. 2
C. -2 D. 1

Q.113 Which one of the following is a strong electrolyte in solution? ETEA (2024)
A. Acetic acid B. Ammonium hydroxide
C. Carbonic acid D. Potassium iodide

Q.114 The electrode potential of the standard hydrogen electrode is chosen as: ETEA(2024)
A. -1V B. 0V
C. 1V D. 2V

Q.115 760 torr are equal to Pascal: ETEA (2024)
A. 1 B. 76
C. 760 D. 101325

Q.116 Fuel cell is a typical galvanic cell which is based on reaction between: (Out of Syllabus) DUHS (2024)
A. Hydrogen and copper B. Methane and oxygen
C. Hydrogen and oxygen D. Nitrogen and oxygen

Q.117 Oxidation number of "Mn" in $KMnO_4$ is: BMU (2024)
A. +4 B. +5
C. +6 D. +7

Q.118 Electric current in solutions is carried by: BMU (2024)
A. Ions B. Canal rays
C. Free protons D. Free electrons

Q.119 Which of the following is used for galvanizing iron sheet? BMU (2024)
A. Tin B. Zinc
C. Aluminum D. Copper

Q.120 What change in oxidation number of Cu takes place in the following reaction? BMU (2024)

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

A. 0 to -1 B. 0 to +2
C. 0 to -2 D. 0 to +1

Q.121 Water is_____electrolyte. BMU (2024)
A. Weak electrolyte B. Strong electrolyte
C. Very strong electrolyte D. Moderate electrolyte

Q.122 Zn rod acts as cathode when coupled with magnesium electrode. This is because the reduction potential of: NUMS (2024)
A. Zn > Mg B. Fe is precipitated out
C. Cu and Fe both dissolve D. No reaction taken place

Q.123 Placing a rod of iron metal in a solution of $CuSO_4$: NUMS (2024)
A. Cu will be deposited B. Fe is precipitated out
C. Cu and Fe both dissolve D. No reaction taken place

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ANSWER KEY

PRACTICE EXERCISE

1	B	11	D	21	B	31	D	41	C
2	A	12	C	22	A	32	D	42	A
3	B	13	A	23	A	33	C	43	B
4	B	14	D	24	A	34	C	44	B
5	D	15	C	25	A	35	A	45	A
6	B	16	B	26	C	36	D		
7	C	17	C	27	A	37	B		
8	B	18	A	28	A	38	C		
9	C	19	C	29	C	39	D		
10	B	20	A	30	D	40	C		

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46	D	56	C	66	B	76	A	86	C	96	A	106	A	116	C
47	A	57	D	67	B	77	D	87	B	97	D	107	C	117	D
48	D	58	B	68	D	78	C	88	B	98	D	108	B	118	A
49	B	59	C	69	C	79	D	89	C	99	C	109	D	119	B
50	D	60	C	70	A	80	A	90	A	100	B	110	A	120	B
51	D	61	A	71	C	81	B	91	B	101	D	111	C	121	A
52	A	62	B	72	B	82	D	92	B	102	B	112	A	122	A
53	C	63	B	73	A	83	A	93	C	103	B	113	D	123	A
54	B	64	A	74	A	84	D	94	D	104	B	114	B		
55	D	65	C	75	C	85	C	95	A	105	D	115	D		

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EXPLANATORY NOTES

Q.11 Net charge on carbon in glucose is zero.

$C_6H_{12}O_6$

$6x+12+(-2)6=0 \Rightarrow 6x=0 \Rightarrow x=0$ (Let x be net oxidation state of carbon).

Q.12

S_8 : $O.S=0$

SO_2Cl_2 : $x+2(-2)+2(-1)=0$

$x-4-2=0 \Rightarrow x=+6$

SO_2 : $x+2(-2)=0$

$x=4$

$Na_2S_2O_3$: $2(+1)+2x+3(-2)=0$

$2+2x-6=0 \Rightarrow 2x-4=0$

$2x=+4 \quad x=2$

Q.13 Let x be oxidation state of "O" in KO_2

$+1+2x=0$

$2x=-1 \Rightarrow x=-\frac{1}{2}$

Q.14 Oxidation state is apparent charge on atom which may be zero, fractional, positive or negative.

Q.15 Apparent charge on atom in molecule is called oxidation number.

Q.16 **OF_2:**

$O+2(-1)=0$

$O-2=0 \Rightarrow O=+2$

H_2O_2:

$2(+1)+2O=0$

$2O=-2 \Rightarrow O=-1$

Q.17 $HI + H_2SO_4 \rightarrow I_2 + SO_2 + H_2O$. The oxidation number of sulphur is reduced from +6 to +4.

Q.18 $MnO_2 + 4H^+ \longrightarrow Mn^{+2} + 2H_2O$

$+4 \qquad +2$

In order to balance charge, 2 electrons have to be added on L.H.S.

$MnO_2 + 4H^+ + 2e^- \longrightarrow Mn^{+2} + 2H_2O$

Q.19

Reaction	Change in O.S	Transfer of es
$MnO_4^{-2} \longrightarrow MnO_2$	$+6 \longrightarrow +4$	2
$MnO_4^{-1} \longrightarrow Mn^{+2}$	$+7 \longrightarrow +2$	5
$CrO_4^{-2} \longrightarrow Cr^{+3}$	$+6 \longrightarrow +3$	3
$CrO_4^{-2} \longrightarrow Cr^{+3}$	$2(+6 \longrightarrow +3)$	3×2

Q.20 $H_2S + Cl_2 \longrightarrow 2HCl + S$ oxidation state of S changes from –2 to 0. Hence it is oxidized by Cl_2 making H_2S reducing agent at, Cl_2 is reduced to Cl^- in the form of HCl.

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Q.21 $8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$. The oxidation number of Mn in MnO_4^- is +7 and in Mn^{2+} is +2. The reduction takes place in given reaction. 5 electrons are added in L.H.S.

Q.22 Reduction takes place at cathode which is addition of electrons in the reaction.

$Cu^{2+} + 2e^- \rightarrow Cu$

Q.23 A. $MnO_4^{2-} \longrightarrow MnO_2$

oxidation number of Mn in MnO_4^{2-} is +6 and in MnO_2 is + 4. Hence, there is transfer of two electrons.

C. $CrO_4^{2-} \longrightarrow Cr^{+3}$

Oxidation number of Cr in CrO_4^{2-} is +6 and in Cr^{+3} is +3. Hence, there is transfer of 3 electrons.

B. $MnO_4^- \longrightarrow Mn^{+2}$

Oxidation number of Mn in MnO_4^- is +7 and in Mn^{2+} is +2. Hence, there is transfer of 5 electrons.

D. $Cr_2O_7^{2-} \longrightarrow 2Cr^{+3}$

Oxidation number of chromium in $Cr_2O_7^{2-}$ is +6 and in Cr^{3+} is +3. Hence, there is transfer of 3 electrons.

Q.24 Oxidation takes place at anode and reduction takes place at cathode.

Q.25 For molten NaCl,

At anode:

$2Cl^- \longrightarrow Cl_2 + 2e^-$

At cathode:

$2Na^+ + 2e^- \longrightarrow 2Na$

Net reaction:

$2NaCl \longrightarrow 2Na + Cl_2$

Q.26 Reduction potential of potassium is less than hydrogen. H^+ will be reduced instead of K^+ at cathode and hydrogen gas is produced.

$K^+ + 1e^{-1} \rightarrow K \qquad E^o = -2.92V$

$2H^{+1} + 2e^{-1} \rightarrow H_2 \qquad E^o = 0.00V$

Q.27 Electrolysis of dil. H_2SO_4 with Pt-electrode produces:

At anode: O_2 is produced (Oxidation)

At cathode: H_2 is produced (Reduction)

Q.28 For aqueous solution of NaCl, at cathode:

H_2O is reduced to H_2 as its E^*_{red} is higher than Na^+.

$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$

Q.29 Electrolytic cell is used for the purification of copper. Impure copper is make the anode and thin sheet of pure copper is make the cathode and copper sulphate solution is used as an electrolyte.

Q.30 As reduction potential of electrodes changes by change in:

i) Temperature.

ii) Concentration of ions.

iii) Nature of electrolyte.

Hence cell potential also changes.

$E^*_{cell} = E^*_{oxidation} + E^*_{reduction}$

Q.31 Standard electrode potential is measured at 298K for electrode in 1M aqueous solution of its ions.

Q.32 emf or cell potential is the force to drive electron in a circuit.

Q.33 Electrode potential is measured by comparing it with SHE.

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Q.34 Conditions for SHE:
i) Pt electrode coated with finely divided Pt black.
ii) T = 25°C = 298K.
iii) 1M = H^+ ions (1M HCl).
iv) P = 1 atm.
As one molar H_2SO_4 = 2M H^+ hence it is not correct.

Q.35 In SHE H_2 gas is oxidized to H^+ ions by loss of electron $H_{2(g)} \longrightarrow 2H_{(aq)}^{+} + 2e^-$

Q.36 Conditions for SHE:
i) Pt electrode coated with finely divided Pt black.
ii) T = 25°C = 298K.
iii) 1M = H^+ ions.
iv) P = 1 atm.

Q.37 SHE itself is a reference electrode. Hence, it E^*_{red} is taken as zero Arbitrary value i.e. without any other reference.

Q.38 ECS shows E^*_{red} value in ascending order and E^*_{red} is measured by comparing with SHE i.e. H-scale.

Q.39 In ECS, Zn has less reduction potential than hydrogen and Cu. Zn is above in ECS and Cu is below.

Q.40 Salt bridge maintain the electrical neutrality between two half cells preventing net charge accumulation which will occur. If salt bridge is removed then emf will drop to zero.

Q.41 At cathode reduction takes place hence it has greater E^*_{red} than anode.

Q.42 $Al \xrightarrow{\text{oxidation}} Al^{+3} + 3e^-$, as Al is oxidized hence it acts as anode while zinc will act as cathode and is reduced.

Q.43 Fluorine is very strong oxidizing agent and is at the bottom of ECS. Indicating its highest E^*_{red} = +2.87V

Q.44 In ECS elements above SHE has negative E^*_{red}. Hence elements with negative E^*_{red} have positive E^*_{oxi}. ($E^*_{oxi} = -E^*_{red}$)

Q.45 $Zn_{(s)} \left| Zn^{2+}_{(aq)}(1M) \right\| Cu^{2+}_{(aq)}(1M) \left| Cu_{(s)} \right.$
"|" Represents the phase boundary and "||" represents salt bridge.

Q.46 Voltaic cell converts the chemical energy into electrical energy by the help of Redox reaction where oxidation takes place at anode while reduction at cathode.

Q.47 Oxidation takes place by removal of electron and causes the increase in oxidation state.

Q.48 Oxidation state of Mg
x + (-1)2 = 0
x = +2

Q.49 When sodium reacts with chlorine sodium loses electron and get oxidized while Cl gains electron and reduces itself so both oxidation and reduction is taking place so it will be redox reaction.

Q.50 Oxidation No of S
x + (-2)4 = -2.
x = -2 +8
x = +6

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 In the reaction Mn^{+7} gains $5e^{-1}$ and get reduced to Mn^{+2}

Q.52 Oxidation No of N

$x + (-2)3 = -1$

$x = -1 + 6$

$x = +5$

Q.53 Oxidation No of C

$2x + (-2)4 = -2$

$2x = -2 + 8$

$x = +3$

Q.54 Oxidation No of Cl

$x + (-2)3 + (+1) = 0$

$x = +5$

Q.55 The function of salt bridge is to connect the two half cell to allow the passage of ions to stop the potential dropping to zero.

Q.56 Volt meter is a device that is used to measure potential.

Q.57 Electrochemical series is a series arranged on the basis of Hydrogen scale or increasing reduction potential.

Q.58 As Cu is positioned down as SHE in Electrochemical series so SHE will get oxidized and will lose electron.

Q.59 Potential of SHE is taken as arbitrarily zero.

Q.60 Coinage metal lies below Hydrogen in Electrochemical series. So, they have high value of Reduction potential.

Q.61 Flow of electron is always from anode to cathode so it will be from Zinc to Cu.

Q.62 Oxidation potential of Zn is greater than that of copper. So, zinc will get oxidized while copper will get reduced.

Q.63 As Fe lies above Cooper in ECS so it will easily replace Cu.

Q.64 In the Cell SHE will act as anode and will transfer its electron to Cu which will act as cathode.

Q.65 Reduction potential is directly proportional to oxidizing power.

Q.66 Pt is considered as a noble metal.

Q.67 Na is strongest reducing agent because it has least value of reduction potential.

Q.68 Rusting of Iron means oxidation of Iron. So, iron will get oxidized.

Q.69 One of the advantages of fuel cell is that it does not produce pollution and produces water which is utilized by Astronauts.

Q.70 Fuel cell uses KOH as an electrolyte.

Q.71 During reaction with sodium, hydrogen gains electrons and acts as a oxidizing agent.

Q.72 In the above reaction, sodium loses electrons means it is oxidized. So, Na is reducing agent while Cl gains electron so it is reduced and will act as oxidizing agent.

Q.73 $E^\circ_{cell} = E^\circ_{oxi} + E^\circ_{red}$

$E^\circ_{cell} = 0.80 + 1.67$

$E^\circ_{cell} = 2.47$

Q.74 The cell potential of Daniels Cell is 1.1V. So, it will be spontaneous reaction.

Q.75 When Cu is Coupled with Zn will be oxidized while Cu will reduce.

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Q.76 Oxidation no of N in NH_4^+ is -3 while in NO_3^{-1} it is +5

Q.77 In the reaction both oxidation and reduction takes place. So, it is redox reaction.

Q.78 Cell EMF of Mg-SHE cell is highest of all of them. So, it is most feasible reaction.

Q.79 Oxidation number of "S":

$2x + (-2)3 = -2$

$2x = -2 + 6$

$x = +2$

Q.80 Most Common oxidation state of halogen is -1

Q.81 During oxidation there is removal of electron which causes increase in oxidation state.

Q.82 Reactivity of metals in ECS $\propto \frac{1}{E^{\circ}_{Reduction}}$

Q.83 Reactivity of metals in ECS $\propto \frac{1}{E^{\circ}_{Reduction}}$.

Smaller the value of reduction potential stronger is the reducing agent

Q.84 For electrolysis of a dilute solution of NaCl at anode. $O_{2(g)}$ is evolved.

Q.85 Upper metal in ECS can replace hydrogen from an acid but lower metal cannot.

Q.86 Electrochemical cell based upon redox reaction.

Q.87

Compound	Oxidation Number of Oxygen
KO_2	-1/2
OF_2	+2
Na_2O_2	-1
Cl_2O_7	-2

Q.88 Standard electrode potential is determined under standard conditions using hydrogen electrode as a reference electrode.

Q.89 Oxidation number of an element in free state is zero.

Q.90 The branch of science which deals with the conversion of electrical energy into chemical energy and vice versa is called electrochemistry.

Q.91 Greater the value of reduction potential will act as a cathode.

Q.92 Higher the value of reduction potential more difficult it to oxidized.

Q.93 Electrolysis of dilute acid solution gives H_2 at cathode and O_2 at anode.

Q.94 Strong electrolytes ionize completely in solution.

Q.95 Down cell is used for the preparation of sodium metal.

Q.96 Oxidation number of an element in free state is zero.

Q.97 Reduction potential of elements increases down the ECS. Aluminium has lower position in ECS among others.

Q.98 Reduction potential and oxidation potential of SHE is arbitrarily taken as zero.

Q.99 During electrolysis reduction always occur as cathode while oxidation occurs at anode.

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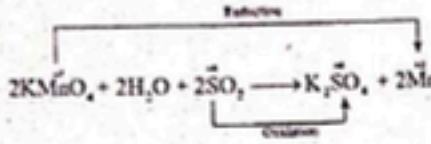
Q.100



Hence, SO_2 reduces $KMnO_4$. SO_2 acts as reducing agent.

Q.101 Cu has greater reduction potential and is easily reduced by Zn form $Cu^{+2} \longrightarrow Cu^0$.

Note: Upper metal in electrochemical series can displace tower metal from its solution.

Q.102 In electrochemical series, all metals above hydrogen have -ve reduction potential and +ve oxidation potential.

Q.103 When aqueous solution of NaCl is electrolyzed, two (Na^+, H^+), positive ions are produced, H^+ has greater reduction potential than Na^+, so, H^+ is reduced to H_2

Q.104 Cathode is negatively charged electrode, which attracts +ve ions from solution allowing them to gain es^- and undergo reduction.

Q.105 $KMnO_4$

$+1 + x + 4(-2) = 0$

$1 - 8 = 0$

$x = +7$

Q.106 In oxidation number method, redox equation is not splitted into two half-reaction.

Q.107 In electrolytic cell, DC is supplied to non-spontaneous reaction.

Q.108 Cr is converted from +6 oxidation state to Cr^{+3} by gaining 3 electrons.

Q.109 Reduction:

Cathode is negatively charged electrode, which attracts +ve ions from solution allowing then to gain es^- and undergo reduction.

Q.110 Because Na+ has least reduction potential than H^+, so, Na^+ is not discharged at cathode.

Q.111 Oxidation number of an element in free state is zero. (book-line).

Q.112 Na_2O_2

$2(+1) + 2(x) = 0$

$+2 + 2x = 0$

$2x = -2$

$x = \frac{-2}{2}$

$x = -1$

Q.113 KI is soluble ionic compound, so, it is dissociated completely into I^+ and K^+, so, at is strong electrolyte.

Q.114 Standard electrode potential of hydrogen is arbitrarily taken as zero.

Q.115 1atm = 760 torr = 101325Pa = 101.325Kpa.

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Topic 10 CHEMICAL BONDING

PRACTICE EXERCISE

Q.1 Which of the following compounds follow the octet rule?
A. BF_3 B. PCl_5
C. SF_6 D. NH_3

Q.2 Which of the following has highest ionization energy?
A. Li B. Na
C. K D. Cs

Q.3 The element having lowest electron affinity among the following is?
A. F B. Cl
C. Br D. I

Q.4 The least electronegative element among the following is:
A. Cl B. Br
C. P D. K

Q.5 Which of the following has greater bond length?
A. C–C B. N–N
C. O–O D. Cl–Cl

Q.6 Which of the following is non-polar molecule?
A. H_2 B. CO_2
C. CCl_4 D. All of these

Q.7 Bond angle in NH_3 is smaller than bond angle in:
A. BF_3 B. NF_3
C. H_2S D. PH_3

Q.8 The total number of sigma electrons is C_2H_2 are:
A. 2 B. 4
C. 6 D. 10

Q.9 During bond formation, HF molecule involve overlaps:
A. s–p B. p–p
C. s–s D. s–sp^3

Q.10 Which of the bond has highest bond energy?
A. H–H B. Si–Si
C. Cl–Cl D. Br–Br

Q.11 Which of the following has largest ionic size?
A. F^- B. O^{2-}
C. N^{3-} D. Na^+

Q.12 In a period, the atomic radii:
A. Increases B. Decreases
C. Remain same D. First decreases, then increases

Q.13 Which of the following is correct relation for atomic radius?
A. $A^- > A > A^+$ B. $A > A^+ > A^-$
C. $A^+ > A > A^-$ D. $A^- > A^+ > A$

Q.14 Ionization energy depends upon:
A. Atomic/ionic radii B. Shielding effect
C. Nature of orbital D. All of the above

Q.15 Which of the following has highest ionization energy value?
A. Li B. H
C. Be D. He

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Q.16 Greater shielding effect corresponds to _____ ionization energy value:
A. Greater
B. Zero
C. Lesser
D. Variable

Q.17 The group that has maximum 1st ionization energy values:
A. ns^1
B. ns^2
C. ns^2, np^5
D. ns^2, np^6

Q.18 Which of following group has maximum 1st electron affinity values in same period?
A. V A
B. VI A
C. VII A
D. VIII A

Q.19 Which of the following element has lowest electron affinity?
A. N
B. Cl
C. O
D. He

Q.20 An ionic compound A^+B^- is most likely to form when:
A. Ionization energy of A is high and electron affinity of B is low
B. Ionization energy of A is low and electron affinity of B is high
C. Both the ionization energy and the electron affinity of A and B are high
D. Both the ionization energy and the electron affinity of A and B are low

Q.21 Formation of ionic bond is favoured by:
A. High I. E of metal
B. Low lattice energy
C. Low E.A of nonmetal
D. Low I.E of metal

Q.22 Maximum ionic character is exhibited by:
A. NaCl
B. CsF
C. KCl
D. HF

Q.23 All of the following species have dative bond except:
A. OH^-
B. BF_4^-
C. NH_4^+
D. H_3O^+

Q.24 Co-ordinate covalent bond is present in:
A. Nitride ion
B. Chloronium ion
C. Hydronium ion
D. All of these

Q.25 The percentage of co-ordinate covalent bond present in BF_4^- and NH_4^+ respectively:
A. 25% and 33%
B. 33% each
C. 33% and 25%
D. 25% each

Q.26 If the sharing of an electron pair is unequal and the atom have an electronegativity difference of 1.4 to 1.6, what is this type of sharing called:
A. Ionic
B. Polar covalent
C. Non-polar covalent
D. Metallic

Q.27 The following molecules has linear structure except?
A. CS_2
B. CO_2
C. SO_2
D. $BeCl_2$

Q.28 Which of the following species has lone pair of electrons on central atom?
A. CH_4
B. PCl_5
C. NH_4^+
D. PCl_3

Q.29 Which pair has trigonal planar geometry?
A. NH_3, PH_3
B. BF_3, AlH_3
C. H_2O, C_2H_2
D. CO_2, SO_2

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Q.30 The shape of NH_2^- is:
A. Linear
B. Angular
C. Pyramidal
D. Tetrahedral

Q.31 Which molecular geometry is not possible for AB_4 type molecules?
A. Trigonal planar
B. Tetrahedral
C. Trigonal pyramidal
D. Angular

Q.32 The correct order of bond angles is represented in:
A. $CH_4 > H_2O > NF_3 > H_2S$
B. $H_2S > H_2O > CH_4 > NF_3$
C. $CH_4 > NF_3 > H_2O > H_2S$
D. $CH_4 > H_2S > H_2O > NF_3$

Q.33 Which of the following has perfect triangular structure?
A. CO_2
B. PH_3
C. NO
D. SO_3

Q.34 Limitation to valence bond theory (VBT) is that:
A. It doesn't address the shapes of the molecules
B. It doesn't involve the criteria of bond formation
C. It doesn't explain paramagnetic behavior of O_2
D. None of the above

Q.35 End to end overlapping of orbitals give rise to the formation of:
A. Sigma bond
B. Pi bond
C. Metallic bond
D. Co-ordinate covalent bond

Q.36 Pi bonds are formed by overlapping of:
A. Un-hybrid orbitals
B. Hybrid orbitals
C. Hybrid and un-hybrid orbitals
D. Atomic orbital and hybrid orbital

Q.37 The concept of hybridization was given to remove which of following drawbacks of VBT:
A. It does not explain Paramagnetism of O_2
B. It does not explain odd electron system
C. It could not explain tetravalency of carbon
D. All of above

Q.38 Cl_2 molecule is formed by the overlaping:
A. s-s orbital
B. p-p head on overlapping of orbitals
C. s-p orbital
D. p-p parallel overlapping of orbitals

Q.39 The process in which the orbitals of different energies and shape mix with each other to give equivalent hybrid orbitals is called:
A. Dissolution
B. Resonance
C. Hybridization
D. Ionization

Q.40 In which of following species central atom is not sp^3 hybridized:
A. NH_4^+
B. NH_2^-
C. NH_3
D. NO_3^-

Q.41 In ground state the unpaired electrons in carbon are:
A. 1
B. 3
C. 2
D. 4

Q.42 The central atom which may not follow the octet rule while forming covalent bond:
A. C
B. O
C. P
D. F

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Q.43 Which one shows high %age of the ionic character?
A. HI
B. HF
C. HCl
D. HBr

Q.44 Dipole moment gives the information about:
A. % ionic character
B. Bond angles
C. Geometry of the molecules
D. All of the above

Q.45 Bond length depends upon:
A. Hybridization on central atom
B. Nature of molecule
C. Size of central atom
D. All of these

Q.46 Choose the incorrect relationship of bond energies:
A. Br – Br > I – I
B. Cl – Cl > F – F
C. C ≡ C > N ≡ N
D. H–H > F –F

Q.47 The S.I unit of dipole moment is:
A. Debye
B. pm
C. mC
D. Both A and B

Q.48 Which of the following molecules has non-zero dipole moment?
A. CH_3Cl
B. BF_3
C. CO_2
D. CCl_4

Q.49 Maximum dipole moment is possessed by:
A. H_2O
B. H_2S
C. CO
D. CH_4

Q.50 The experimentally determined bond length of C—Cl is 176.7pm and C—C is 154pm what would be the radius of Cl atom:
A. 22.7pm
B. 99.7pm
C. 176.7pm
D. 330.7pm

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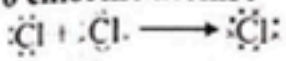
Topic 10 CHEMICAL BONDING

PAST PAPER MCQ'S

Q.51 Which one of the following is the correct dot and cross diagram of bonding between two chlorine atoms? **MDCAT (2015)**

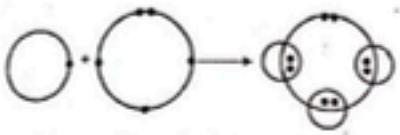
A. 

B. 

C. 

D. 

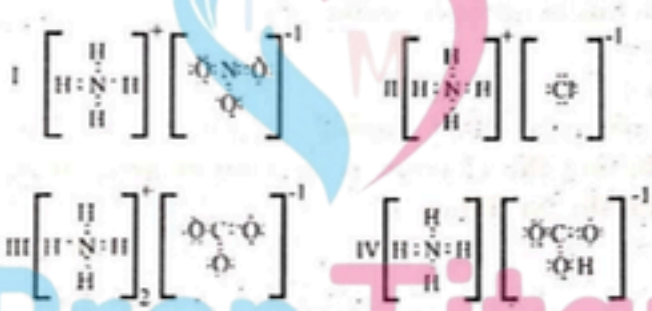
Q.52



Choose the right molecule: **MDCAT (2016)**

A. CH_3
B. H_2O
C. CO
D. NH_3

Q.53 Observe the given dot and cross structures for the following molecules or ionic species. **MDCAT (2017)**



The co-ordinate covalent bond exists between:

A. N and C atoms in structure III and IV
B. N and one H ion in all four structure
C. N and Cl atoms of structure II
D. N and N atoms of structure I

Q.54 According to Valence shell electron pair repulsion theory, the repulsive forces between the electron pairs of central atom of a molecule are in the order: **MDCAT (2013)**

A. Lone pair bond pair> Lone pair-Lone pair
B. Bond pair> Bond pair> Lone pair-Lone pair> Lone pair-Bond pair
C. Lone pair-Bond pair> Bond pair-Bond pair> Lone pair-Lone pair.
D. Lone pair-Lone pair>Lone pair-Bond pair>Bond pair-Bond pair

Q.55 What is the exact value of angle in BF_3? **MDCAT (2017)**

A. 90°
B. 104.5°
C. 119.5°
D. 120°

Q.56 Which option show all the molecules with bond angle 109.5°? **MDCAT (2018)**

A. $SiCl_4$, NH_4^+, CH_4
B. $SiCl_4$, H_2O, $BeCl_2$
C. CH_4, CCl_4, NH_3
D. CH_4, NH_4^+, PH_3

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Q.57 The structure of Xenon trioxide is shown below,



With reference to the Valence shell electron pair repulsion theory (VSEPR). The shape of XeO_3 is: MDCAT (2019)

A. Tetrahedral
B. Trigonal pyramidal
C. Bent (or angular)
D. Trigonal planar

Q.58 Which of the following sets constitutes of all the molecules and ions of non-planar geometry? MDCAT (2019)

A. $SO_2, C_2H_4, BF_3, NO_3^-$
B. $CH_4, NH_4^+, MnO_4^-, NF_3$
C. $CH \equiv CH, H_2O, BeCl_2, H_2S$
D. PH_4^+, NH_3, SO_3, Benzene

Q.59 The shape of CO_2 molecule is similar to: NUMS (2019)

A. H_2S
B. SO_2
C. $SnCl_2$
D. BeF_2

Q.60 What is the shape of ammonia NH_3 molecule? SET (2019)

A. Pyramidal
B. Linear
C. Tetrahedral
D. Trigonal planar

Q.61 The number of bonds in nitrogen molecule is: MDCAT (2010)

A. One σ and one π
B. Three σ only
C. One σ and two π
D. Two σ and one π

Q.62 When the two partially filled atomic orbital overlap in such a way that the probability of finding the electron is maximum around the line joining the two nuclei, the result is the formation of: MDCAT (2014)

A. Sigma bond
B. Hydrogen bond
C. Pi-bond
D. Metallic bond

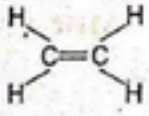
Q.63 pi- bond is formed by sideways overlap of: MDCAT (2017)

A. s-orbital
B. d-orbital
C. p-orbital
D. None of these

Q.64 The angle between un-hybridized p-orbital and three sp^2 hybrid orbitals of each carbon atom is: MDCAT (2012)

A. 120°
B. 109.5°
C. 90°
D. 180°

Q.65



Count the number of σ bonds and π bonds in the molecule: MDCAT (2016)

A. 1π and 5σ bonds
B. 3π and 3σ bonds
C. 2π and 4σ bonds
D. 6π and 6σ bonds

Q.66 Which if the following molecule has largest number of shared pair electrons? MDCAT (2018)

A. NH_3
B. CO_2
C. C_2H_4
D. N_2

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Q.67 Which one of the following molecules has sp^3 hybridization? MDCAT (2019)
A. CH_4 B. C_2H_2
C. C_2H_4 D. CO_2

Q.68 According to the Lewis Concept, ammonia is a lone pair donor, therefore easily accepts a proton to form an ammonium ion as given by an equation: SET (2019)
$NH_{3(g)} + H^+_{(aq)} \longrightarrow NH^+_{4(aq)}$
A. H–N–H bond angle decrease from 180°-109.5°
B. H–N–H bond angle decrease from 107°-104.5°
C. H–N–H bond angle increase from 107°-109.5°
D. H–N–H bond angle decrease from 109.5°-120°

Q.69 Which of the following molecule has zero dipole moment? NUMS (2019)
A. PCl_3 B. BF_3
C. NH_3 D. H_2O

Q.70 Which one of the following has zero dipole moment: MDCAT (2010)
A. NH_3 B. H_2O
C. $CHCl_3$ D. BF_3

Q.71 Among the following molecules, which one has coordinate covalent (dative) bond? SET (2019)
A. CCl_4 B. CO
C. CO_2 D. CH_4

Q.72 Which of the following molecule has zero dipole moment? NUMS (2019)
A. PCl_3 B. BF_3
C. NH_3 D. H_2O

Q.73 For formation of ionic bond, electronegatively difference should be: NUMS (2019)
A. Equal to zero B. Equal to 0.5
C. More then 1.7 D. Less than 1.7

Q.74 The ionization energy of hydrogen atom is: MDCAT (2010)
A. Zero B. 131:3kJmole
C.13.13kJ/mole D.1313kJ/mole

Q.75 The elements for which the value of ionization energy is low can: MDCAT (2011)
A. Gain electrons readily B. Gain electrons with difficulty
C. Lose electron less readily D. Lose electron readily

Q.76 Electron affinity of the atom is the energy released when: MDCAT (2018)
A. Electron is added to gaseous atom B. Electron is removed from gaseous atom
C. Covalent bond of molecule is broken D. Cov. bond is formed between the atoms

Q.77 The shielding effect of inner electron is responsible for: NUMS (2019)
A. Decreasing ionization energy
B. Having no effect on ionization energy
C. Increasing ionization energy
D. Increasing electronegativity

Q.78 What will be the shape of a molecule which contains two sigma bond pairs and one lone pair? ETEA (2016)
A. Linear B. V shape
C. Tetragonal D. Triangular

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Q.79 A molecule which contains two lone pairs and two bond pairs of electrons in valence shell of central atom, geometrical shape of molecules will be: ETEA (2019)

A. Tetrahedral
B. Trigonal pyramidal
C. Angular
D. Linear

Q.80 Fe^{+2} will from the most ionic bond with: ETEA (2019)

A. N^{-3}
B. SN^{-3}
C. P^{-3}
D. F-1

Q.81 Which of the following elements has lowest first ionization energy? ETEA (2019)

A. N
B. O
C. C
D. B

Q.82 Which one of the following elements has the largest second ionization energy? ETEA (2019)

A. O
B. F
C. Na
D. N

Q.83 Which equation relates to the fist ionization energy of bromine? ETEA (2019)

A. $Br_{(g)} \rightarrow Br^{-}_{(g)} + le^{-}$
B. $Br_{(g)} \rightarrow Br^{+}_{(g)} + le^{-}$
C. $\frac{1}{2}Br_{2(g)} \rightarrow Br^{-}_{(g)} + le^{-}$
D. $\frac{1}{2}Br_{2(g)} \rightarrow Br_{g} + le^{-}$

Q.84 The bond angle in H_2S is less than H_2O. It is due to: ETEA (2019)

A. Small size of oxygen atom
B. Greater E N of oxygen atom
C. Oxygen contain two lone pairs of electrons
D. All of the above

Q.85 In the second period of elements, although oxygen lies next to nitrogen yet its first ionization energy is lower than that of nitrogen because? MDCAT (2019)

A. In oxygen, there exists repulsion between pair of electrons present in the same orbital of valence shell
B. Oxygen is paramagnetic in character.
C. Nuclear charge of oxygen is greater than nitrogen.
D. Oxygen has higher electron affinity.

Q.86 Nitrogen has the atomic number 7. Which of the following electronic configurations is of a Nitrogen atom in ground state? MDCAT (2019)

A. $1s^2, 2s^2, 2px^1, 2py^1, 2pz^1$
B. $1s^2, 2s^2, 2py^2, 2pz^1$
C. $1s^2, 2s^2, 2px^2, 2py^1$
D. $1s^2, 2s^2, 2px^2, 2pz^1$

Q.87 Which of the following has the highest value of electronegativity? NMDCAT (2020)

A. I
B. Br
C. Cl
D. F

Q.88 Which of the following hybrid orbital have maximum s-character? NMDCAT (2020)

A. sp^3
B. sp^2
C. sp
D. dsp^2

Q.89 The first ionization energy is maximum for: NMDCAT (2020)

A. Na
B. Mg
C. Al
D. K

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Q.90 P character in sp: PMC (2021)
A. 75% B. 50%
C. 25% D. 33%

Q.91 Hybridization in ethyne: PMC (2021)
A. sp-sp B. sp^2-sp
C. sp^2-sp^2 D. sp^3–sp^3

Q.92 The geometry of AB_3 type molecule is: PMC (2021)
A. Trigonal pyramidal B. Trigonal planar
C. Trigonal bipyramidal D. Tetragonal

Q.93 Shape of H_2S: PMC (2021)
A. Angular B. Tetrahedral
C. Octahedral D. Trigonal plannar

Q.94 Which of the following element has smaller size? UHS (2022)
A. Na B. Al
C. K D. Li

Q.95 Among LiCl, $BeCl_2$, NaCl and CsCl compounds with the greatest and the least ionic character respectively are: UHS (2022)
A. LiCl and CsCl B. NaCl and LiCl
C. CsCl and NaCl D. CsCl and $BeCl_2$

Q.96 AB_4 type with no lone pairs geometry enables to form which shape of molecule? UHS (2022)
A. Trigonal B. Regular octahedron
C. Regular tetrahedron D. Regular pyramidal

Q.97 Which of the following has greatest difference of electronegativity? SZABMU (2022)
A. HF B. HCl
C. HBr D. HI

Q.98 Ionization energy decreases down the group because: SZABMU (2022)
A. Shielding remains constant B. Atomic radius remains constant
C. Proton number increases D. Atomic radius increases

Q.99 Identify the compound given below which has bond formed by overlapping of sp and p orbital: ETEA (2022)
A. $BeCl_2$ B. BF_3
C. H_2O D. NH_3

Q.100 Which of the following elements has highest ionization energy? ETEA (2022)
A. O B. C
C. N D. Be

Q.101 The shape of ammonia (NH_3) is _____. ETEA (2022)
A. Trigonal bi pyramidal B. Trigonal pyramidal
C. Trigonal planner D. Square planner

Q.102 The first ionization energy of Al is less than Mg. This is due to:
A. Electron in the $3p^3$ of Al
B. Al is less metallic than Mg
C. Mg comes first than Al
D. Ionization energy from Mg to Al decreases

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Q.103 Which one of the following elements has the largest second ionization energy? ETEA (2022)

A. K
B. Ca
C. Cl
D. Bi

Q.104 The dipole moment of CO_2 is zero because it is: DUHS (2022)

A. Angular
B. Linear
C. Triatomic
D. Pyramidal
E. CO_2 is polar

Q.105 Ethene ($H_2C = CH_2$) has hybridization of C-atom: DUHS (2022)

A. dsp^3
B. sp
C. sp^3
D. d^2sp^3
E. sp^2

Q.106 Cation & anion formed which combines to form crystal lattices: DUHS (2022)

A. Only cations is isoelectronic to nearest noble gas
B. Cation & anion both are isoelectronic to neatest noble gas
C. Cation & anion both are isoelectronic to nearest noble gas & No of electron lost by metal & No of electrons gained by nonmetal are equal
D. Only anion is isoelectronic by nearest noble gas
E. No of electrons lost by metal & no of electron gained by non-metal are equal.

Q.107 The ionization energy increases along a period in periodic table due to increase in: DUHS (2022)

A. Number of positron
B. Number of neutron
C. Nuclear charge
D. Number of electron
E. Atomic size

Q.108 During the formation of chemical bond: BMU (2022)

A. Energy decreases
B. Energy increases
C. Energy does not change
D. Energy first increases then decreases

Q.109 Bond energy is expressed in: BMU (2022)

A. KJ/ mol
B. Calories
C. Joules
D. Volt

Q.110 Which of the following is not a primary bond? BMU (2022)

A. Ionic bond
B. Hydrogen bond
C. Dative bond
D. Covalent bond

Q.111 Which of the following has NOT sp^3 hybridized carbon? BMU (2022)

A. Benzene
B. 1-Butene
C. 2-Butyne
D. 1-Pentene

Q.112 Type of hybridization of carbon in Ethene ($H_2C = CH_2$) is: NUMS (2022)

A. sp^3
B. sp
C. sp^2
D. dsp^2

Q.113 Which of the following molecule is polar? NUMS (2022)

A. CCl_4
B. CO_2
C. $AlCl_3$
D. HCl

Q.114 Electron affinity decreases down the group because: NUMS (2022)

A. Proton number increases
B. Shielding decreases
C. Atomic radius increase
D. Atomic radius decreases

Q.115 Which of the following molecule is covalent in nature? NUMS (2022)

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Q.115 Which of the following molecule is covalent in nature? NUMS (2022)
A. NaCl
B. $AlCl_3$
C. $MgCl_2$
D. KCl

Q.116 The bond energy of hydrogen in H_2 molecule is: UHS(2023)
A. 242 KJ/mol
B. 431KJ/mol
C. 436 KJ/mol
D. 346KJ/mol

Q.117 Why fluorine has less electron affinity as compared to bromine? UHS (2023)
A. Electronegativity
B. Think small electronic cloud
C. Seven electrons in outermost shell
D. Higher ionization energy

Q.118 Which of the following will have positive electron affinity? SZABMU (2023)
A. Addition of electron to (Cl)
B. Addition of electron to (Cl^-)
C. Addition of electron to (O)
D. Addition of electron to (O^{-1})

Q.119 Which of the following molecule has sp^2 hybridization? SZABMU (2023)
A. NH_3
B. BF_3
C. H_2O
D. $BeCl_2$

Q.120 Which of the following has small size? SZABMU (2023)
A. Mg
B. S
C. P
D. Na

Q.121 The molecular shape of a molecule with three bonded atoms and one lone pair electron on the central atom will be: ETEA (2023)
A. Trigonal planar
B. Tetrahedral
C. Trigonal pyramidal
D. Liner

Q.122 The bond length between double bonded carbon atoms is: ETEA (2023)
A. 1.34A°
B. 1.10A°
C. 1.54A°
D. 1.82A°

Q.123 Molecule having the highest bond energy (Experimentally) is: ETEA (2023)
A. HCl
B. HF
C. HBr
D. HI

Q.124 CO_2 & SO_2 are two compounds. Which of the following best describes these two compounds? DUHS (2023)
A. Both CO_2 & SO_2 are linear and non-polar
B. CO_2 is angular and polar SO_2 is linear and non-polar
C. CO_2 is linear and non-polar SO_2 is angular and polar
D. Both CO_2 and SO_2 are angular and polar

Q.125 Which of the following pair is iso-structural? BUMHS (2023)
A. $AlCl_3$ and CH_4
B. BF_3 and NH_3
C. $SnCl_2$ and $BeCl_2$
D. SO_3 and BF_3

Q.126 Which of the following is hybridized state of carbon atom of a carbonyl group? BUMHS (2023)
A. sp hybridized
B. sp^2 hybridized
C. sp^3 hybridized
D. dsp^2 hybridized

Q.127 Which ionic radii is the smallest one? BUMHS (2023)
A. Na^+
B. Mg^{+2}
C. Al^{+3}
D. Mg^+

Q.128 The reason of highest electronegativity value of Fluorine is: NUMS (2023)
A. Complete outermost shell
B. Ability to form negative ion
C. Existence as diatomic molecule
D. Smaller size and higher nuclear change in the respective period

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Q.129 Valance shell electron pair repulsion theory explains: NUMS (2023)
A. Bond Energy
B. Bond Length
C. Shapes and Bond Energy
D. Shapes

Q.130 Which of the following has sp^3 hybridization? NUMS (2023)
A. BF_3
B. C_2H_4
C. $BeCl_2$
D. CH_4

Q.131 The factor which is not affecting bond length is: NUMS (2023)
A. Presence of multiple bonds
B. Nature of hybridization present
C. Difference in electronegativity between the two bonded atoms
D. Ionization energies of the two bonded atoms

Q.132 Which of the following has a coordinate bond? UHS (2024)
A. NaCl
B. CaO
C. NH_3BF_3
D. H_2O

Q.133 Which of the following is NOT a feature of Valence Shell Electron Pair Repulsion theory? UHS (2024)
A. It determines the shape of molecules
B. pairs of electrons repel each other
C. It helps in understanding interaction of medicinal drug molecules
D. Only lone pairs participate in determing geometry of molecules

Q.134 Which of the following has smallest atomic radius: UHS (2024)
A. Mg
B. S
C. P
D. Na

Q.135 Diamagnetic behavior of Fluorine molecule is due to presence of _____. SZABMU (2024)
A. Paired electrons in d orbitals
B. Paired electrons in p orbitals
C. Unpaired electrons in d orbitals
D. Unpaired electrons in p orbitals

Q.136 Which one of the following molecules has zero dipole movement? SZABMU (2024)
A. Ammonia
B. Carbon dioxide
C. Hydrogen fluoride
D. Water

Q.137 Which of the following compound shows shortest C–H bond length? SZABMU-RC (2024)
A. Methane
B. Acetylene
C. Ethylene
D. Ethane

Q.138 Which one has lowest bond energy? SZABMU-RC (2024)
A. HF
B. HI
C. HBr
D. HCl

Q.139 Total number of electron pairs present in the valence shell of central atom in water are: ETEA (2024)
A. 2
B. 3
C. 4
D. 5

Q.140 Which one of the following molecules has a pyramidal structure? ETEA (2024)
A. C_2H_4
B. CH_4
C. H_2O
D. NH_3

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Q.141 Which one of the following molecules has a zero- dipole moment? ETEA (2024)
A. BF_3 B. NF_3
C. NH_3 D. H_2O

Q.142 The unhybridized p orbital in sp^2 hybridization is: ETEA (2024)
A. In the same plane B. Out of the plane
C. Parallel to sp^2 orbitals D. Perpendicular to sp^2 orbitals

Q.143 The shape of an ammonia molecule is: DUHS (2024)
A. Angular B. Tetrahedral
C. Linear D. Planar

Q.144 The paramagnetic behavior of molecules such as oxygen molecules cannot be explained by: DUHS (2024)
A. Molecular orbital theory
B. Hybridization
C. Valence bond theory
D. Valence shell electron pair repulsion theory

Q.145 The structure of primary amines is: DUHS (2024)
A. Trigonal B. Tetrahedral pyramidal
C. Planar D. Linear

Q.146 This shape is found in AX_2 when the bond angle is 180°: DUHS (2024)
A. Linear B. Bent
C. Triangle D. Tetrahedral

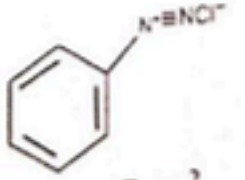
Q.147 A molecule of ethane has _____ σ bonds. BMU (2024)
A. four B. five
C. six D. seven

Q.148 In CH_3Cl, bond length of C-Cl is 176.7pm and covalent radium of Cl atom is 99.4pm, the covalent radius of carbon atom is: NUMS (2024)
A. 66.3 pm B. 276.1 pm
C. 175.4 pm D. 77.3 pm

Q.149 Correct order of decreasing electron affinities of group VII is: NUMS (2024)
A. F > Cl > Br > I B. Cl > F > Br > I
C. Cl > F > Br > I D. Cl < F < Br < I

Q.150 Predict the highest bond energy of the following single bond: NUMS (2024)
A. C - H B. C - N
C. C – O D. C - C

Q.151 Identify the type of hybridization of nitrogen in the following molecule: NUMS (2024)



A. sp B. sp^2
C. sp^3 D. dsp^2

Q.152 Trend in ionization energy of elements in increasing order will: NUMS (2024)
A. Na < Mg < Al < Si B. Mg < Na < Al < Si
C. Si < Al < Mg < Na D. Al < Si < Na < Mg

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ANSWER KEY

PRACTICE EXERCISE

1	D	11	C	21	D	31	A	41	C
2	A	12	B	22	B	32	A	42	C
3	D	13	A	23	A	33	D	43	B
4	D	14	D	24	C	34	C	44	D
5	D	15	D	25	D	35	A	45	D
6	D	16	C	26	B	36	A	46	C
7	A	17	D	27	C	37	C	47	C
8	C	18	C	28	D	38	B	48	A
9	A	19	D	29	B	39	C	49	A
10	A	20	B	30	B	40	D	50	B

PAST PAPER MCQ'S

51	B	61	C	71	B	81	D	91	A	101	B	111	A	121	C	131	D	141	A	151	A
52	D	62	A	72	B	82	C	92	B	102	D	112	C	122	A	132	C	142	D	152	A
53	B	63	C	73	C	83	B	93	A	103	A	113	D	123	B	133	D	143	B		
54	D	64	C	74	D	84	B	94	D	104	B	114	C	124	C	134	B	144	B		
55	D	65	A	75	D	85	A	95	D	105	E	115	B	125	D	135	B	145	B		
56	A	66	C	76	A	86	A	96	C	106	B	116	C	126	B	136	B	146	A		
57	B	67	A	77	A	87	D	97	A	107	C	117	B	127	C	137	B	147	D		
58	B	68	C	78	B	88	C	98	D	108	A	118	D	128	D	138	B	148	D		
59	D	69	B	79	C	89	B	99	A	109	A	119	B	129	D	139	C	149	B		
60	A	70	D	80	D	90	B	100	C	110	B	120	B	130	D	140	D	150	A		

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EXPLANATORY NOTES

Q.11 Ionic size decreases along the period form left to right. More over anions are of larger size as compare to cations. So, order of ionic radius is $N^{-3} > O^{-2} > F^{-1} > Na^{+1}$

Q.12 Atomic radius decreases along the period due to Increasing effective nuclear charge.

Q.13 $A^{3-} > A^{-} > A > A^{+} > A^{2+}$

Q.14

$$I.E \alpha \frac{1}{\text{atomic size}} \alpha \frac{1}{\text{shielding effect}} \alpha \frac{1}{\text{effective nuclear charge}}$$

It also depends on nature of orbital in this order

$$s > p > d > f$$

Q.15 Ionization energy is directly related to the stability of electronic configuration. Helium has highest value in the table

Q.16 Down the group ionization energy decreases due to increase in number of shell. Shielding effect and atomic size.

Q.17 Ionization energy is directly related to the stability of electronic configuration. ns^2, nsp^6 has already complete octet. Group VIIIA has highest I.E value among all groups

Q.18 Generally, electron affinity increases from left to right along the period and the groups VIIA elements have highest values of 1st electron affinities.

Q.19 Electron affinity is inversely to the stability of electronic configuration.

Q.20 Ionic compound is formed between the two atoms when one of them has low ionization energy and other have high electron affinity.

Q.21 Metals of group IA and IIA have low ionization energy means highly electropositive character and great tendency to form ionic bond.

Q.22 Strength of ionic character depends upon electronegativity difference. CsF as greatest electronegativity difference of 3.3 and maximum ionic character of 92 %

Q.23 Dative bond is formed when shared pair of electrons is provided by only one atom. In case of OH^- there is no donor– accepter relationship.

Q.24 Hydronium ion has two covalent bonds and one dative bond.



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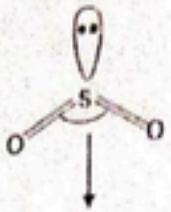
Q.25 BF_4^- and NH_4^+ both have 3 covalent bonds and 1 co-ordinate covalent bond in their structure. Hence out of total 4 bonds 1 is co-ordinate covalent and each bond have 25% co-ordinate covalent character. (%age of dative bond = 1×100/4 = 25%)

Q.26 Electronegativity difference as an index to bond nature:

- The bond between two atoms is non-polar covalent if electronegativity difference between them is zero or less than 0.5.
- The bond between two atoms is polar covalent if electronegativity difference between them is 0.5 to 1.6.
- The bond between two atoms is equally covalent and ionic if electronegativity difference is 1.7.
- The bond is ionic if E.N difference is greater than 1.7.

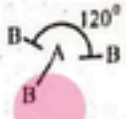
Q.27 SO_2 is AB_3 (AB_2L) type with 2 bond pairs and one lone pair



Less than 120°
Bent / angular, SO_2

Q.28 PCl_3 resembles NH_3 molecule. Both P and N belong to group VA and have one lone pair of electrons in these molecules.

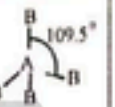
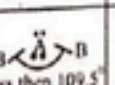
Q.29 BF_3 and AlH_3 are trigonal planar because each has three bond pairs only AB_3 type



Q.30 NH_2^{-1} is AB_4 (AB_2L_2) type with two lone pairs and two bond pairs. Its shape is bent or angular

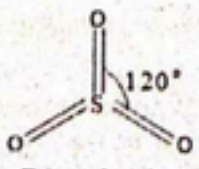


Q.31

Type	Electron Pairs			Arrangement of electron pairs	Molecular geometry	Shape	Examples
	Total	Bonding	Lone				
AB_4	4	4	0	Tetrahedral	Tetrahedral		CH_4, $SiCl_4$, CCl_4, BF_4^-, NH_4^+, SO_4^{-2}
		3	1		Trigonal pyramidal		NH_3, NF_3, PH_3
		2	2		Bent (or angular)		H_2O, H_2S

Q.32 $CH_4(109^\circ) > H_2O(104^\circ) > NF_3(102^\circ) > H_2S(92^\circ)$

Q.33 SO_3 is AB_3 type with three bond pairs only



Triangular planar

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Q.34 Paramagnetic behaviour of oxygen is explained by MOT.

Q.35 End to end overlapping of orbitals is axial overlapping and is linear which results in sigma bond.

Q.36 π-bonds are formed by parallel overlapping of un-hybrid orbitals

Q.37 VBT does not explain valencies other than ground state.

Q.38 Electronic Configuration of $_{17}Cl$ $1s^2, 2s^2, 2p^6, 3s^2, 3p^2{}_x, 3p_y{}^2, 3p_z{}^1$

Q.39 The process in which the orbitals of different energies and shape mix with each other to give equivalent hybrid orbitals is called hybridization

Q.40 In NO_3^- the central atom N is sp^2 hybridized.

Q.41 Ground state configuration of $_6C = 1s^2, 2s^2, 2p^1{}_x, 2p_y{}^1, 2p_z{}^0$

Q.42 Phosphorous can make up to five covalent bonds as in PCl_5.

Q.43 %ionic character is directly related to electronegativity difference.

Q.44 Dipole moment gives the information about:

- % ionic character
- Bond angles
- Geometry of the molecules

Q.45 Generally, B.L ∝ p character ∝ atomic radius $\propto \frac{1}{\text{Ionic character}}$

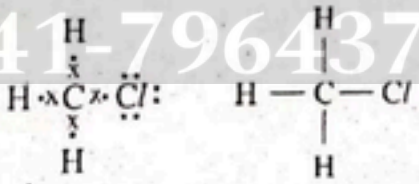
Q.46 Atomic size of N < C. so BE of N≡N = 941 kJ/mol and BE of C ≡ C = 839 kJ/mol

$$\text{Bond energy} \propto \frac{1}{\text{atomic size}}$$

Q.47 $\mu = q \times r$, q = coulumb, r = meter

The S.I unit of dipole moment is mC

Q.48 CH_3Cl is a polar molecule and has non-zero dipole moment due to polarity between C and Cl



Q.49 H_2O is most polar in given options Δ electronegativity between H and O is higher among given cases. H_2O (μ = 1.85D), CO (μ = 0.12D), H_2S (μ = 0.95D), CH_4 (μ = 0.0D).

Q.50 Bond length (BL)= $r_C + r_{Cl}$.

$$r_{Cl} = BL - r_C = 176.7 - 77 = 99.7pm$$

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EXPLANATORY NOTES

(PAST PAPER MCQ'S)

Q.51 Cl has 3 lone pair and share one electron for the formation of covalent bond.

Q.52 The structure of molecule indicates 3 bond pair and one lone pair so it must be NH_3

Q.53 In the molecule of NH_3 the nitrogen has a lone pair and shares its lone pair with Hydrogen ion.

Q.54 According to VSEPR lone pair occupies more space than bond pair so order of repulsion is **L.P-L.P > B.P-L.P > B.P – B.P**

Q.55 BF_3 belongs to AB_3 type so it will have 120° bond angle

Q.56 $SiCl_4$, NH_4^+, CH_4 all belongs to AB_4 type with no lone pair so it will have 109.5° bond angle.

Q.57 XeO_3 belongs to AB_3E system. So, it will have trigonal pyramidal geometry.

Q.58 NF_3, MnO_4^-, CH_4, NH_4 all the given species have sp^3 hybridization that's why they will have non-planar geometry.

Q.59 CO_2 and BeF_2 both have AB_2 type and linear geometry.

Q.60 Ammonia belongs to AB_3E type. It has trigonal pyramidal geometry.

Q.61 Nitrogen molecule is a triple bonded molecule it has one sigma and 2 pi bonds.

Q.62 Head on overlap always produces sigma bond while sidewise overlap produces pi bond.

Q.63 s orbital and hybrid orbital always forms sigma bond while p can form both sigma and pi bond. When it overlaps sidewise p will form pi bond.

Q.64 Un-hybrid and hybrid orbitals are always present perpendicular to one another so bond angle will be 90°

Q.65 Ethene molecule has total 5 sigma bonds (4 C-H, 1 C–C) while one pi bond.

Q.66 Ethene molecule has total 5 sigma bonds (4 C-H, 1 C-C) while one pi bond. It has maximum number of bonds as compared to others that's why it will have maximum number of shared electrons.

Q.67 In Methane Carbon atom is forming 4 Covalent bonds, for that reason it has coordination number 4 so its hybridization will be sp^3.

Q.68 When Ammonia forms ammonium ion its bond angle will be changed from 107.5° to 109.5°.

Q.69 BF_3 has no lone pairs on central atom for that reason it has zero dipole moment and is non-polar molecule.

Q.70 BF_3 has no lone pairs on central atom for that reason it has zero dipole moment and is non-polar molecule.

Q.71 CO molecule has Coordinate covalent bond. $:C \equiv \ddot{O}$

Q.72 BF_3 has no lone pairs on central atom for that reason it has zero dipole moment and is non-polar molecule.

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Q.73 Electro negativity difference as an index to bond nature:
- The bond between two atoms is non-polar covalent if electronegativity difference between them is zero or less than 0.5.
- The bond between two atoms is polar covalent if electronegativity difference between them is 0.5 to 1.6.
- The bond between two atoms is equally covalent and ionic if electronegativity difference is 1.7.
- The bond is ionic if E.N difference is greater than 1.7

Q.74 Ionization energy of Hydrogen atom is 1313.31 kj/mol

Q.75 Ionization energy is inversely proportional to ease of removal of electron. If I.E is low it can easily lose the electron.

Q.76 Electron affinity is the amount of energy released when an electron is added in gaseous atom.

Q.77 Down the group ionization energy decreases due to increase in number of shell, shielding effect and atomic size.

Q.78 PCl_3 resembles NH_3 molecule. Both P and N belong to group VA and have one lone pairs of electrons in these molecules they have trigonal pyramidal geometry.

Q.79 (AB_2E_2) type with two lone pairs and two bond pairs. Its shape is bent or angular.

Q.80 Metallic cation combines with most Electronegative atom like F^{-1} to form most ionic bond.

Q.81 Order of Ionization energy is given N > O > C > B

Q.82 Na after losing one electron gains the configuration of noble gas. Now to remove second electron from noble gas configuration requires greater amount of energy.

Q.83 Ionization energy is the amount of energy required to remove electron from gaseous isolated atom to form a gaseous cation.

Q.84 Electronegativity of O is more than S. Electronegtivity of central atom is directly proportional to bond angle, that is why H_2S has 92° while H_2O has 104.5°

Q.85 Nitrogen has $2s^2\ 2p^3$ valence shell configuration while Oxygen has $2s^2\ 2p^4$ valence shell configuration. As Nitrogen has more stable valence shell configuration that is why to remove electron from nitrogen is difficult that is why nitrogen has high Ionization energy.

Q.86 Ground state configuration of $_7N = 1s^2, 2s^2, 2p^1_x, 2p^1_y, 2p^1_z$

Q.87 Order of electronegativity is F > Cl > Br > I

Q.88 % s character in different hybridization is given
- sp^3 has 25% s character
- sp^2 has 33.3% s character
- sp has 50% s character

Q.89 Mg has most stable electronic configuration that's why it has highest ionization energy

Q.90 In sp hybridization 50% is s-character and 50% is p-character

Q.91 Hybridization = Number of sigma bonds + Number of lone pairs.

sp		2
sp^2	=	3
sp^3	=	4

Q.92 in CH ≡ CH, each carbon is sp hybridized.

Q.93 According to VSEPR theory geometry of AB_3 type molecule is trigonal planar

In H_2S, S is central atom which has two bond pair and two lone pair. It is an example of AB_2E_2. Its shape is angular or bent.

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Q.94 Li belongs to group IA and period 2

Q.95 Ionic character ∝ electronegativity difference

Q.96 According to VSEPR theory AB_4 type molecule has tetrahedral geometry

Q.97 F is more electronegative element in the periodic table therefore HF as greatest electronegativity difference among given options.

Q.98 I.E decrease down the group because shielding effect increases by increasing the atomic radius down the group.

Q.99 Hybridization = Number of sigma bonds + Number of lone pairs.

sp		2
sp^2	=	3
sp^3	=	4

$BeCl_2$ has sp hybridization, $BF_3 = sp^2$, H_2O and NH3 = sp^3

Q.100 Ionization energy increases from left to right in the period by increasing effective nuclear charge. Nitrogen has higher I.E than oxygen due to extra stability of half filled p-subshell of nitrogen.

Q.101 The shape of ammonia is trigonal pyramidal because it is example of AB_3E

Q.102 I.E of aluminium is less than that of Mg because of nature of orbitals.

Q.103 The group IA elements have highest 2nd I.E because after losing one electron they attain nearest noble gas electronic configuration.

Q.104 Dipole moment of CO_2 is zero because it is linear (O = C = O)

Q.105 In ethene ($CH_2 = CH_2$) each carbon is sp^2 hybridized

Q.106 Cation and anion combine to form a crystal lattice those are isoelectronic to nearest noble gas.

Q.107 Ionization energy increases from left to right in the period by increasing effective nuclear charge.

Q.108 During formation of chemical bond energy decreases and gain stability

Q.109 Bond energy is expressed in KJ/mol

Q.110 Hydrogen bond is internolecular force which is not primary bond.

Q.111 In benzene each carbon is sp2 hybridized

Q.112 In ethene ($CH_2 = CH_2$) each carbon is sp^2 hybridized

Q.113 Due to electronegativity difference HCl is polar molecule

Q.114 Electron affinity decreases down the group by increasing atomic size in shielding effect.

Q.115 Aluminium chloride has a covalent nature due to less electropositive character of aluminium.

Q.116 Bond energy of hydrogen molecule is $436 kJmol^{-1}$.

Q.117 Because the size of fluorine is small due to this the electronic cloud is highly compact form and leads to strong electron Repulsion and make harder to add extra electron.

Q.118 Because the second electron affinity is always endothermic due to overcoming the strong electron repulsion toward adding the 2nd incoming electron.

Q.119 The reason is its valence electronic configuration of boron [$_5B = 1s^2\ 2s^1\ 2p_x^1\ 2p_y^1\ 2p_z^0$] in excited state because one 2p orbital is empty remain unhybridized. That is why Boron show sp^2 hybridization.

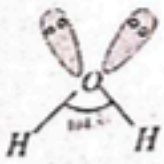
Q.120 Atomic size decreases along the period. So, Sulphur is in most high position having small size.

Q.121 According to VSEPR, this condition follow AB_3E type show geometry is tetrahedral but the shape is trigonal pyramidal.

Q.122 Because these two carbons are sp^2 hybridized and bond length is 1.34Å.
Q.123 Due to high electronegativity of fluorine and small size, the bond length in HF is small make it strong and difficult to break.
Q.124 Because in CO_2, the carbon is sp hybridized and Sulphur in SO^2 is sp^2 hybridized ... one lone pair or Sulphur responsible for angular shape and non-zero dipole moment.
Q.125 Because in both SO_3 and BF_3 hybridization is sp^2 and both follow AB_3 type that is why they are isostructural.
Q.126 Because the carbon of carbonyl group make 3-σ bonds and 1-Π bond it shows it sp^2 hybridized.
Q.127 Because the aluminum has high position charge, that is why it is very smaller in size as compare to others.
Q.128 Due to its very small size and high effective nuclear charge.
Q.129 VSEPR theory explain the shapes of molecules on the basic of lone pair and bond pair repulsion.
Q.130 Because in CH_4, the carbon has four sigma bonds represents it is sp^3 hybridized.
Q.131 Bond length is affected by hybridization, electron energy multiple bond but not an x relation the ionization energy of bonded atoms.
Q.132 $H_3N \longrightarrow BF_3$ because lone pair of nitrogen donated to boron and make coordinate covalent bond.
Q.133 ....
Q.134 The smallest atomic radius is for sulphate because it is most right position is periodic table. VSEPR theory explain the shape of molecules on the basis of both lone pair and boiling point arrangement.
Q.135 Because in F_2 molecule, all electrons are paired. So, that's way it is diamagnetic.
Q.136

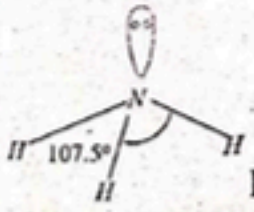
$O \rightleftarrows C \rightleftarrows O$
$\mu = 0D$ carbondioxide is symmetrical molecule.

Q.137 $HC \equiv CH$ bond length is inversely proportional in number of bonds.
Q.138 Bond energy is inversely proportional to bond length.
Q.139



the total electron pair is four because of two lone pair and two bond pair.

Q.140



In NH_3, three bond pairs are arrange in pyrimidal shape.

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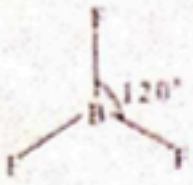
Q.141



BF_3 is symmetrical molecule.

Q.142



Because in sp^2, all hybrid orbitals arragne in plane and unhybridized p-orbital is perpendicular to this plane.

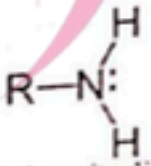
Q.143



The geomatry of ammonia moleucle is tetrahederal because in geomatry includes both (lone pair + boiling point)

Q.144 The paramagnetic behavior of O_2 molecule is just explained by MOT.

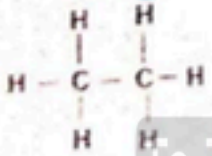
Q.145



The structure of primary amine is trigonal pyrimdial.

Q.146 In VSEPR theory, AB_2 type has linear shape

Q.147



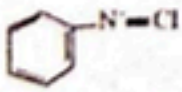
in ethane total noof σ -bond is 7.

Q.148 The bond length of C-Cl bond = 176.7pm.
The covalent radius of Cl atom = 99.4pm.
The covalent radius of C-atom = 176.7-99.4 = 77.3pm

Q.149 The correct of decreasing electron affinity in group VII-A is
Cl > F > Br > I

Q.150 The highest bond in C-H bond is $413 kJmol^{-1}$.

Q.151



In this compound, the nitrogen is sp hybridized because it make 2π bond and 2σ bond.

Q.152 Trend of ionization energy in period 3 in increasing order will be.
Na < Mg < Al < Si

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Topic 11 s AND p BLOCK ELEMENTS

PRACTICE EXERCISE

Q.1 The total number of s-block elements are
A. 10 B. 12
C. 13 D. 14

Q.2 Which of the following ion has largest radius?
A. I^{1-} B. F^{1-}
C. Cl^{1-} D. Br^{1-}

Q.3 Which of the following is non-conductor of electricity?
A. Na B. Mg
C. Al D. P

Q.4 Which of the following has lowest boiling point?
A. F_2 B. Cl_2
C. Br_2 D. I_2

Q.5 Which of the following alkali metal form super oxide?
A. K B. Rb
C. Cs D. All of these

Q.6 Which of the following metal reacts with water to form hydroxide and H_2
A. Na B. Ca
C. Li D. All of these

Q.7 The alkaline earth metal having least density is
A. Be B. Mg
C. Ca D. Sr

Q.8 The acidic oxide among the following is
A. Na_2O B. MgO
C. Al_2O_3 D. SO_3

Q.9 Which of the following chloride of 3rd period element is ionic in nature?
A. $SiCl_4$ B. PCl_3
C. S_2Cl_2 D. NaCl

Q.10 Which of the following alkali metal has highest melting point?
A. Li B. Na
C. K D. K

Q.11 Which of the following represent elements in order of decreasing atomic size?
A. F, Cl, Br B. Li, Be, B
C. S, P, Si D. Be, Mg, Ca

Q.12 Which of the following will remain constant along the period
A. Atomic size B. Atomic number
C. Shell number D. Ionization energy

Q.13 The correct order of atomic radii is
A. F < K < Na < Li B. F < Li < Na < K
C. Li < Na < K < F D. Na < K < Li < F

Q.14 Increase in atomic size down the group is due to
A. Addition of shells B. Shielding effect.
C. Inert pair effect D. Both A. and B.

Q.15 Atomic radius of fluorine is only larger than _____ in its period
A. Li B. O
C. N D. Ne

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Q.16 Which one of the following is smallest in size?
A. Na^+ B. O^{2-}
C. F^- D. N^{3-}

Q.17 Consider the iso-electronic species, K^+, S^{2-}, Cl^- and Ca^{2+}, the radii of the ion decrease as
A. $Ca^{+2} > Cl^- > K^+ > S^{2-}$ B. $K^+ > Cl^- > Ca^{2+} > S^{2-}$
C. $Cl^- > K^+ > S^{2-} > Ca^{2+}$ D. $S^{2-} > Cl^- > K^+ > Ca^{2+}$

Q.18 The radius of fluorine atom is 72pm and that of the fluoride ion (F^-) is _____
A. 72pm B. 44pm
C. 133pm D. 36pm

Q.19 One of the following species is iso-electronic with Ca^{2+}. Which is that
A. Sr^{2+} B. Na
C. Ar D. Mg^{2+}

Q.20 The radii of H, H^+ and H^- are in the order of
A. $H^+ > H > H^-$ B. $H > H^- > H^+$
C. $H^- > H > H^+$ D. $H > H^+ > H$

Q.21 The ionization energy of an element is
A. The energy released when an electron is added to an atom of the element
B. The same as the electron affinity of element
C. Equal in magnitude but of opposite sign to the electron affinity of the element
D. The energy required to remove the outermost electron of an atom of the element

Q.22 The 1st ionization energy of metal is lower and 2nd ionization energy is very high, it indicates that group number is
A. IA B. IIA
C. IIIA D. IVA

Q.23 The greater 1st ionization energy would be associated with which of the following configuration
A. $1s^2\ 2s^2\ 2p^6\ 3s^1$ B. $1s^2\ 2s^2\ 2p^3$
C. $1s^2\ 2s^2\ 2p^5$ D. $1s^2\ 2s^2\ 2p^6$

Q.24 Which one of the following series is arranged in order of increasing value
A. The first ionization energies of: Oxygen, Fluorine, Neon
B. The radii of: H^- ion, H atom, H^+ ion
C. The electro negativities of: Chlorine, Bromine, Iodine
D. The boiling points of: Iodine, Bromine, Chlorine

Q.25 In the periodic table, the ionization energy of elements decreases from top to bottom because of
A. Increase in atomic size B. Decrease in electronegativity
C. Decrease in shielding effect D. Increase in density

Q.26 In the following, the element with the highest ionization energy is
A. [Ne] $3s^2\ 3p^1$ B. [Ne] $3s^2\ 3p^2$
C. [Ne] $3s^2\ 3p^3$ D. [Ne] $3s^2\ 3p^4$

Q.27 The unit of ionization energy is
A. Joule B. Calorie
C. KJ/mol D. KJ

Q.28 Which of the following is NOT true about electronegativity
A. Metal has EN value less than 2 B. It has no unit
C. With increase in O.S, EN decreases D. It determines the polarity of molecule

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Q.29 The power of an atom to attract shared pair of electrons towards itself in a molecule is called
A. Electron Affinity
B. Electronegativity
C. Ionization Potential
D. Hydration Energy

Q.30 Which one of the following elements has greater electronegativity value
A. N
B. Br
C. O
D. C

Q.31 Which of the following periodic properties has no unit
A. Electron Affinity
B. Electronegativity
C. Ionization Potential
D. Hydration Energy

Q.32 Which statement is correct
A. Loss of valence electron may lead to loss of valence shell
B. Radius of isoelectronic ions decreases left to right in 3rd period
C. Anionic radius increase with magnitude of negative charge
D. All of these

Q.33 Which of the following element has greater negative first electron affinity (EA_1)
A. C
B. Li
C. B
D. Be

Q.34 Which of the following group of elements have positive 1st electron affinity
A. IA
B. VIA
C. IIA
D. VIIA

Q.35 Which of the following halogens has comparatively smaller first electron affinity
A. F
B. I
C. Br
D. Cl

Q.36 Melting points of group IIA elements are considerably higher than those of group IA elements because
A. Size of IIA is greater than IA
B. I.E of IIA is higher than IA
C. I.E of IIA is less than IA
D. IIA provide more binding electron

Q.37 The lowest melting point among these four elements is of
A. Be
B. Ca
C. Mg
D. Sr

Q.38 The highest melting point among these elements is of
A. Nitrogen
B. Fluorine
C. Oxygen
D. Neon

Q.39 Generally, the melting point decreases from VA to VIII A along the period but with exception of
A. Phosphorous
B. Chlorine
C. Sulphur
D. Argon

Q.40 Among the given elements of period 3, the highest value of melting point is observed in case of
A. Mg
B. Si
C. Al
D. P

Q.41 Correct order of melting point of group II A elements
A. Be > Mg > Ca
B. Ca > Be > Mg
C. Mg > Be > Ca
D. Be > Ca > Mg

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Q.42 In which group melting and boiling point decreases down the group

A. IA
B. VIIA
C. VIIIA
D. VA

Q.43 The element which has boiling point less than 0°C is

A. Beryllium
B. Carbon
C. Boron
D. Nitrogen

Q.44 Which of the following is incorrect information

A. Metals have free electrons in the valence shell
B. Electrical conductivity of metals increases with the increase of temperature
C. Metalloids are poor conductors of electricity
D. Non-metals have atomic conductance usually less than 10^{-10} ohm^{-1}

Q.45 Which of the following group of elements have extra ordinary high value of electrical conductivity

A. IA
B. IB
C. IIA
D. VIIA

Q.46 Which one of the following alkali metals forms only normal oxide when it reacts with O_2

A. Lithium
B. Sodium
C. Potassium
D. Rubidium

Q.47 The elements of group I-A react violently with water and make the solution

A. Neutral
B. Amphoteric
C. Acidic
D. Alkaline

Q.48 What is the nature of reaction $Li_2O + H_2O \longrightarrow 2LiOH_{(aq)}$

A. Decomposition
B. Acid-base
C. Redox
D. All of these

Q.49 Which of the following metal can form peroxide with Oxygen

A. Ba
B. Li
C. Mg
D. All of these

Q.50 Which one of the following doesn't react with water even at red hot temperature

A. Be
B. Mg
C. Ca
D. Ba

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Topic 11 s AND p BLOCK ELEMENTS

PAST PAPER MCQ'S

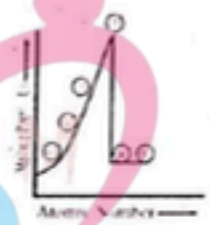
Q.51 Energy required to remove an electron from gaseous neutral atom is: MDCAT (2010)

A. Electron affinity
B. Lattice energy
C. Ionization energy
D. Crystal energy

Q.52 The elements for which the value of ionization energy is low can MDCAT (2011)

A. Gain electrons readily
C. Lose electron less readily
B. Gain electrons with difficulty
D. Lose electron readily

Q.53 The diagram below is a plot of melting points of elements of second period against their atomic numbers. Lithium and fluorine are placed at the extreme ends of the plot. On the basis of melting points where would you place carbon among the empty slots on the plot? MDCAT (2011)



A. 1
B. 4
C. 2
D. 3

Q.54 Which one remains same along a period? MDCAT (2012)

A. Atomic radius
B. Number of shells (orbits)
C. Melting point
D. Electrical conductivity

Q.55 More the ionization energy of an element MDCAT (2012)

A. More the electro positivity
B. Less the metallic character
C. More the reducing power
D. Bigger the atomic radius

Q.56 Along a period, atomic radius decreases. This gradual decrease in radius is due to: MDCAT (2013)

A. Increase in number of shells
B. Increase in number of protons in the nucleus
C. Melting and boiling points first decrease then increase
D. Melting and boiling points first increase then decrease

Q.57 What is the trend of melting and boiling points of the elements of short periods as we move from left to right in a periodic table? MDCAT (2013)

A. Melting and boiling points decrease gradually
B. Melting and boiling points first decrease then increase
C. Melting and boiling points increase gradually
D. Melting and boiling points first increase then decrease

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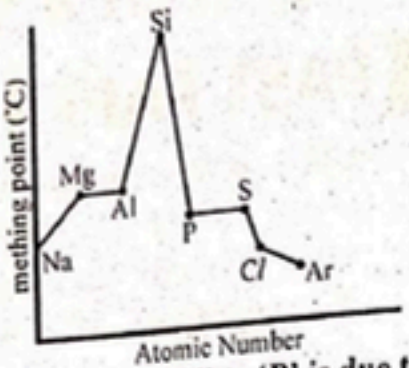
Q.58 The trends in melting points of the elements of 3rd period are depicted in figure below MDCAT (2014)



The sharp decreases observed from 'Si' to 'P' is due to

A. Decrease in atomic radius from 'Si' to 'P'
B. Change in bonding and structure of two elements
C. Different densities of two elements
D. Increase in electron density from 'Si' to 'P'

Q.59 Arrange the following elements according to the trends of ionization energies C, N, Ne, B MDCAT (2014)

A. Ne < N < C < B
B. B < C < N < Ne
C. B < N < C < Ne
D. Ne < B < C < N

Q.60 Keeping in view the size of atoms, which order is correct? MDCAT (2015)

A. N > C
B. Ar > Cl
C. P > Si
D. Li > Be

Q.61 Which one of the following will have the smallest radius? MDCAT (2015)

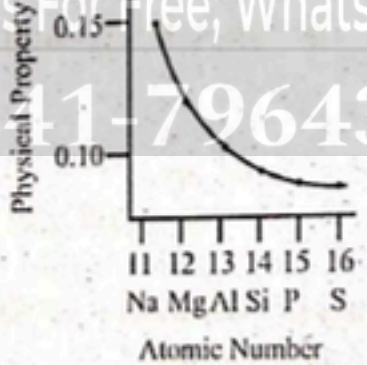
A. Al^{+3}
B. Mg^{+2}
C. Si^{+4}
D. Na^{+1}

Q.62 The ionic radius of fluoride ion is: MDCAT (2016)

A. 72 pm
B. 136 pm
C. 95 pm
D. 157 pm

"Actual value of ionic radius of fluoride ion is 133 pm"

Q.63 Following graph shows a physical property along the period 3 elements. Which physical property is MDCAT (2017)



A. Electron affinity
B. Non-metallic character
C. Atomic radius
D. Melting point up to group IVA

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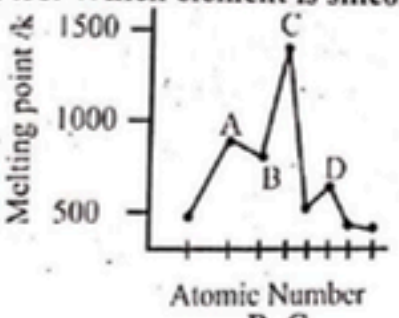
Q.64 The following sketch shows the melting point of eight elements with consecutive atomic numbers. Which element is silicon? MDCAT (2017)



A. A
B. C
C. B
D. D

Q.65 Ionic radius along the period decreases due to: MDCAT (2017)
A. Addition of a new shell
B. High Ionization energy
C. Increase in nuclear charge
D. Decrease in nuclear charge

Q.66 Down the group acid-base behavior of metallic oxides of group 2 elements changes to MDCAT (2018)
A. More basic
B. No change
C. Less basic
D. More acidic

Q.67 In period 2 and period 3 maximum melting point shown by elements MDCAT (2018)
A. Lithium and sodium
B. Carbon and silicon
C. Neon and argon
D. Nitrogen and phosphorous

Q.68 The following sketch show the variation in a physical property of third period elements against their number:



What physical property is plotted in this sketch? MDCAT (2018)
A. Ionic radius
B. Melting point
C. Ionization energy
D. Atomic radius

Q.69 The strongest acid among the following is: MDCAT (2010)
A. HF
B. HBr
C. HCl
D. HI

Q.70 When the elements of group II-A are exposed to air, they quickly become coated with layer of oxide. What is the purpose of this oxide layer MDCAT (2011)
A. The oxide layer exposes the metal to atmospheric attack
B. The oxide layer increases the reactivity of metal
C. The oxide layer protects the metal from further attack
D. No layer forms

Q.71 Alkaline earth metal hydroxides decompose on heating. Which of the following reactions is a correct representation of this decomposition? MDCAT (2012)
A. $M(OH)_{2(s)} \longrightarrow MO_{(s)} + H_2O_{(l)}$
B. $2MOH_{(s)} \longrightarrow 2MO_{(s)} + H_2(g)$
C. $MOH_{(s)} \longrightarrow M_2O_{(s)} + H_2O_{(l)}$
D. $4MOH_{(s)} \longrightarrow 4M_{(s)} + H_2O_{(l)} + O_{2(s)}$

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Q.72 Melting points of group II-A elements are higher than those of group I-A because: MDCAT (2016)

A. Atoms of II-A elements have smaller size
B. II-A elements are more reactive
C. Atoms of II-A elements provide two binding electrons
D. I-A elements have smaller atomic radius

Q.73 Among the following, which one is least reactive metal: MDCAT (2017)

A. Mg B. Na
C. Ca D. Be

Q.74 Melting point of Na & Mg decreases down the group due to: MDCAT (2017)

A. Strong electronegativity B. Increment in size
C. Strong attractive forces D. High ionization energy

"This is actual question given in MDCAT but statement of this question should be "Melting point of Na & Mg **"GROUP"** decreases down the group due to"

Q.75 Which element has the highest electron affinity among halogens? SET (2019)

A. F B. I
C. Cl D. Br

Q.76 Which one of the following properties decreases across the third period of elements in the periodic table? SET (2019)

A. Electronegatively B. Ability to act as reducing agent
C. Ionization energy D. Melting and boiling points

Q.77 In the 3rd period of the periodic table which of following property is decreasing consistently? SET (2019)

A. Electrical conductivity B. Ionization energy
C. Melting point D. Atomic radius

Q.78 In the third period of elements, there lies element "X" which is metallic in nature and it can reduce chlorine gas rapidly. To which group of elements does "X" belong? (SET 2019)

A. IIA B. VIIA
C. IVA D. IA

Q.79 The hydration energy of Mg^{2+} is less than NUMS (2019)

A. Na^{+1} B. Ca^{2}
C. Li^{+1} D. Al^{3+}

Q.80 Which alkaline earth metal makes peroxides? NUMS (2019)

A. Ba B. Be
C. Mg D. Ca

Q.81 Lithium reacts with air to form ETEA (2016)

A. Li_2O B. Li_3N
C. $Li_2O_2 + Li_2CO_3$ D. Both A and B

Q.82 How many elements are there in the 3 period of periodic table? ETEA (2019)

A. 18 B. 8
C. 32 D. 10

Q.83 Which oxides of "K" contain more oxygen than is normal oxide? ETEA (2019)

A. Peroxide B. Super oxide
C. Both contain equal quantity D. None of the above

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Q.84 **Modern periodic table is arranged in ascending order of?** MDCAT (2019)
A. Atomic mass
B. Mass number
C. Nucleon number
D. Proton number

Q.85 **Ionization energy decrease down the group from top to bottom due to:** MDCAT (2019)
A. Decrease in atomic size
B. Increase in atomic mass
C. Increase in shielding effect of the intervening electrons
D. Increase in proton number

Q.86 **Oxidation number of particular element can be directly or indirectly inferred from its:** MDCAT (2019)
A. Physical state
B. Group number
C. Atomic size
D. Atomic mass

Q.87 **Potassium, Rubidium, Cesium reacts with oxygen to form which types of oxides?** NMDCAT (2020)
A. Peroxide
B. Superoxide
C. Suboxide
D. Normal oxide

Q.88 **Magnesium reacts with nitrogen to form** NMDCAT (2020)
A. Mg_2N_2
B. Mg_3N_2
C. MgN_2
D. MgN

Q.89 **Densities of alkali metals are low due to** NMDCAT (2020)
A. Weak intermolecular forces
B. Large atomic volume
C. Smaller size
D. ns^1 configuration

Q.90 **Addition of second electron to a uni-negative ion always_____?** PMC (2021)
A. An endothermic process
B. An exothermic process
C. Neutral process
D. Energy wasted

Q.91 **In periodic table, the period number tells the** PMC (2021)
A. Number of shell
B. Electronic configuration
C. Metallic character
D. Photon

Q.92 **Sodium is not observed in +2 oxidation state because of its** PMC (2021)
A. High first ionization potential
B. High second ionization potential
C. High ionic radius
D. High electronegativity

Q.93 **Which of the following element has highest electronegativity?** PMC (2021)
A. Fluorine
B. Magnesium
C. Sodium
D. Bromine

Q.94 **Which statement describes the conversion of magnesium atoms to magnesium ions for ionic bond formation with chlorine?** UHS (2022)
A. The change is reduction, because there has been a gain of electrons
B. The change is oxidation, because there has been a loss of electrons
C. The change is reduction, because there has been a loss of electrons
D. The change is oxidation, because there has been a gain of electrons

Q.95 **Why dimer of $AlCl_3$ is formed** UHS (2022)
A. Al is electron rich
B. Al is having lone pair of electron
C. Al donates lone pair to form bridge
D. Al forms co-ordinate bonds with chlorine to complete its octet

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Q.96 Which group of the periodic table contain non-metals, metalloids and metals? UHS (2022)

A. IB
B. IVA
C. VIIA
D. VIA

Q.97 Which of the following sulphate compound is insoluble in water? UHS (2022)

A. $BeSO_4$
B. $MgSO_4$
C. $BaSO_4$
D. $CaSO_4$

Q.98 Carbon atoms in ethane are hybridized: SZABMU (2022)

A. sp^3
B. sp^2
C. sp
D. sp^3d

Q.99 The type of bonding in Zinc is: SZABMU (2022)

A. Ionic
B. Covalent
C. Dative
D. Metallic

Q.100 Which one of the following is semiconductor? SZABMU (2022)

A. Al
B. Si
C. P
D. Mg

Q.101 Which of the following property decreases in group 2 as we go down the group? SZABMU (2022)

A. Shielding
B. Atomic radius
C. Proton number
D. Ionization energy

Q.102 Which of the following alkali metal can form normal oxide as well as peroxide? SZABMU (2022)

A. Na
B. K
C. Li
D. Cs

Q.103 A radius greater than its parent atom is called: ETEA (2022)

A. Cationic radii
B. Atomic radii
C. Covalent radii
D. Anionic radii

Q.104 All alkaline metals are white in colour except ETEA (2022)

A. Beryllium
B. Magnesium
C. Calcium
D. Strontium

Q.105 Select the group whose elements easily lose electron. BMU (2022)

A. IA
B. VA
C. VIA
D. VIIA

Q.106 Which of the following has the least ionization potential? BMU (2022)

A. He
B. Li
C. Zn
D. N

Q.107 Which of the following hydroxide of group I is less soluble in water? BMU (2022)

A. NaOH
B. LiOH
C. KOH
D. RbOH

Q.108 The color of the Mg metal flame is? BMU (2022)

A. Blue
B. Violet
C. Yellow
D. White

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Q.109 Which of the following property increases down the group in alkali metals? NUMS (2022)
A. Ionization energy
B. Electron affinity
C. Reactivity
D. Electronegativity

Q.110 The solubility of alkaline earth metal NUMS (2022)
A. Decreases down the group
B. Increases down the group
C. Remains constant throughout the group
D. First increases then decrease down the group

Q.111 Which element has the ground state electronic configuration of $1s^2\ 2s^2\ 2p^6, 3s^2, 3p^6$? UHS (2023)
A. Ar
B. Cl
C. Na
D. S

Q.112 Which oxyacid of halogen is strong oxidizing agent? UHS (2023)
A. $HClO_4$
B. $HClO_3$
C. HClO
D. $HClO_2$

Q.113 Oxidation number of free magnesium is? UHS (2023)
A. 0
B. +1
C. +2
D. +3

Q.114 Select the metal which is extracted from bauxite? UHS (2023)
A. Al
B. Ca
C. Mg
D. Cu

Q.115 Which of the following has the highest atomic radius in its period? UHS (2023)
A. Alkaline earth metals
B. Alkali metals
C. Chalcogens
D. halogens

Q.116 The electronic configurations of some elements are given below. Recognize the element that belongs to group IIIA UHS (2023)
A. $1s^2\ 2s^2\ 2p^3$
B. $1s^2\ 2s^2\ 2p^4$
C. $1s^2\ 2s^2\ 2p^1$
D. $1s^2\ 2s^2\ 2p^2$

Q.117 All alkali metals react with chlorine gas to form white metal chlorides salt. The metal chlorides salt formed is: UHS (2023)
A. Insoluble
B. Soluble in water to give neutral solution of pH 7
C. Soluble in water to give acidic solution of pH 1
D. Soluble in water to give alkaline solution of pH 14

Q.118 Which one of them is amphoteric in nature? UHS (2023)
A. Lithium oxide
B. Beryllium oxide
C. Calcium oxide
D. Potassium oxide

Q.119 A metal reacts vigorously with cold water melting in to a ball of molten metal, moves across the surface of water giving off Hydrogen gas and burns with yellowish golden flame. What could be the identity of this metal? SZABMU (2023)
A. Potassium
B. Sodium
C. Lithium
D. Calcium

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.120 Among alkali metals which element reacts slowly with H_2O? SZABMU (2023)
A. Na
B. K
C. Rb
D. Li

.121 Which element has smaller shielding effect among the following? SZABMU (2023)
A. Mg
B. Ca
C. Rb
D. Sr

Q.122 The oxidation number of oxygen in Na_2O_2 is: SZABMU (2023)
A. -1
B. +2
C. -2
D. +1

Q.123 The melting point of sulphur is higher than that of phosphorous because: SZABMU (2023)
A. Sulphur has strong van der Waals forces
B. Sulphur has weak van der Waals forces
C. Phosphorus has strong van der Waals forces
D. Phosphorous has weak van der Waals forces

Q.124 Choose the element that forms normal oxide only: EATA (2023)
A. Li
B. Na
C. K
D. Rb

Q.125 Element whose salts do not impart color to flame test is: EATA (2023)
A. Be
B. Cs
C. Ca
D. K

Q.126 Indicate superoxide in the following: EATA (2023)
A. CaO
B. BaO_2
C. Na_2O_2
D. RbO_2

Q.127 Which one of the following is covalent in nature? EATA (2023)
A. Mg_3N_2
B. Be_3N_2
C. CaN_2
D. Ba_3N_2

Q.128 Valence shell electronic configuration of an element is $4s^2\ 4p^1$. To which group does the element belong? DUHS (2023)
A. IB
B. IIIB
C. IA
D. IIIA

Q.129 Metallic property in a group of p-block element has a trend: DUHS (2023)
A. Decrease
B. Increase
C. Remains same
D. Irregular trend

Q.130 Superoxide of group IA element (M) has formula: DUHS (2023)
A. M_2O
B. M_2O_3
C. MO_2
D. M_2O_2

Q.131 Which pair of the element markedly differ from other members of the respective groups? DUHS (2023)
A. Potassium and Calcium
B. Sodium and Magnesium
C. Cesium and Barium
D. Lithium and Beryllium

Q.132 Which of the following substance is malleable and ductile? DUHS (2023)
A. Sodium chloride
B. Copper sulphate
C. Mercury
D. Aluminum

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Q.133 The general electronic configuration of halide ions is (BUMHS-2023)
A. $ns^2.np^5$
B. $ns^2.np^6$
C. $ns^1.np^5$
D. $ns^2.np^3$

Q.134 The difference of lithium from the other alkali metals is mainly because of: UHS (2024)
A. Large radius and low charge density
B. Large radius and high charge density
C. Small radius and low charge density
D. Small radius and high charge density

Q.135 Which of the following is not Basic in nature UHS (2024)
A. Aluminium oxide
B. Potassium oxide
C. Magnesium oxide
D. Sodium oxide

Q.136 The solubility of sulphates of alkaline metals generally UHS (2024)
A. Increases down the group
B. Increase then decrease down the group
C. Decrease down the group
D. Doesn't change down the group

Q.137 Metallic character of alkaline earth metals _____ down the groups. SZABMU (2024)
A. Decreases
B. Increases
C. Gradually increases then decreases
D. Remains same

Q.138 Which of the following metal forms superoxide when reacted with oxygen? SZABMU (2024)
A. Beryllium
B. Magnesium
C. Lithium
D. Potassium

Q.139 Which of the following metal hydroxide is the strongest base? SZABMU (2024)
A. $Ca(OH)_2$
B. $Mg(OH)_2$
C. LiOH
D. NaOH

Q.140 The correct stability order of Mn^{+4} cations is _____. (Out of syllabus) SZABMU (2024)
A. $Ge^{+4} < Pb^{+4} < Sn^{+4}$
B. $Ge^{+4} > Pb^{+4} > Sn^{+4}$
C. $Ge^{+4} < Sn^{+4} < Pb^{+4}$
D. $Ge^{+4} > Sn^{+4} > Pb^{+4}$

Q.141 When potassium superoxide reacts with carbon dioxide, following products are formed SZABMU RC-(2024)
A. $K_2CO_3 + O_2$
B. $KO_2 + CO_2 + [O]$
C. $K_2CO_3 + CO_2$
D. $KO_2 + CO_2$

Q.142 The color imparted by the Li wire when subjected to flame is SZABMU RC-(2024)
A. Crimson red
B. Pale green
C. Greyish white
D. Brick red

Q.143 The trend of increasing order of densities among Group 1 elements is SZABMU RC-(2024)
A. Li, Na, K, Rb
B. Li, Na, Rb, Cs
C. Na, K, Rb, Cs
D. Cs, Rb, Na, Li

Q.144 Which of following sulphate of Group-II elements are insoluble? SZABMU RC-(2024)
A. $MgSO_4$
B. $BeSO_4$
C. $CaSO_4$
D. $BaSO_4$

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Q.145 Which of the following element is s-block element? SZABMU RC-(2024)

A. Sulphur
B. Potassium
C. Iron
D. Neon

Q.146 Electronegativity of Al is approximately equal to that of ETEA (2024)

A. B
B. Mg
C. Be
D. Na

Q.147 Third period element that initially reacts rapidly with oxygen to form a protective oxide coating that prevents further reactions is ETEA (2024)

A. Al
B. Na
C. Mg
D. Si

Q.148 The alkali metal gives a yellow color during a flame test is: DUHS (2024)

A. Ba
B. K
C. Na
D. Cs

Q.149 Oil of Vitriol refer to: DUHS (2024)

A. Caustic soda
B. Borax
C. Alum
D. Sulfuric acid

Q.150 Deficiency of ——— causes loss of weight, appetite, and taste: (Out of syllabus) DUHS (2024)

A. K
B. Fe
C. P
D. Zn

Q.151 Mostly p block elements react with ——— to form binary compounds: (Wrong) DUHS (2024)

A. Oxygen
B. Halogen
C. Water
D. Nitrogen

Q.152 Which of the following elements react rapidly with water at room temperature? (BMU-2024)

A. Cu
C. Fe
B. Na
D. Al

Q.153 Sodium nitrate ($NaNO_3$), on heating, decomposes forming (BMU-2024)

A. Na_2O and NO_2
C. Na, NO_2 and O_2
B. $NaNO_2$ and O_2
D. Na_2O_3, NO_2 and O_2

Q.154 When a metal carbonate is heated at 100°C, which of the following compound will readily decompose? NUMS (2024)

A. $BaCO_3$
B. $BeCO_3$
C. $MgCO_3$
D. $SrCO_3$

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ANSWER KEY

PRACTICE EXERCISE

1	D	11	B	21	D	31	B	41	D
2	D	12	C	22	A	32	D	42	A
3	D	13	B	23	D	33	A	43	D
4	A	14	D	24	A	34	C	44	B
5	D	15	D	25	A	35	B	45	B
6	D	16	A	26	C	36	D	46	A
7	A	17	D	27	C	37	C	47	D
8	D	18	C	28	C	38	A	48	B
9	D	19	C	29	B	39	C	49	A
10	A	20	C	30	C	40	B	50	A

PAST PAPER QUESTIONS

51	C	61	C	71	A	81	D	91	A	101	D	111	A	121	A	131	D	141	A	151	A
52	D	62	B	72	C	82	B	92	B	102	A	112	C	122	A	132	D	142	A	152	B
53	D	63	C	73	D	83	B	93	A	103	D	113	A	123	A	133	B	143	A	153	B
54	B	64	B	74	B	84	D	94	B	104	A	114	A	124	A	134	D	144	D	154	B
55	B	65	C	75	C	85	C	95	D	105	A	115	B	125	A	135	A	145	B		
56	B	66	A	76	B	86	B	96	B	106	B	116	C	126	D	136	C	146	C		
57	D	67	B	77	D	87	B	97	C	107	B	117	B	127	B	137	B	147	A		
58	B	68	B	78	D	88	B	98	A	108	D	118	B	128	D	138	D	148	C		
59	B	69	D	79	D	89	B	99	D	109	C	119	B	129	B	139	D	149	D		
60	D	70	C	80	A	90	A	100	B	110	B	120	D	130	C	140	D	150	D		

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EXPLANATORY NOTES

Q.11 Atomic size decreases from left to right in period due to increase in effective nuclear charge so from Li to B atomic size decreases

Q.12 Shell no and shielding effect remain constant along period because.

Period No. = Shell No.

Shielding effect ∝ No. of shell

Q.13 F is on the extreme right side of periodic table so has smallest size while Li, Na and K are alkali metals having large size. Their size increases down the group so correct order of atomic size is F < Li < Na < K

Q.14 Atomic size increases down the group due to

(i) Increase in no. of shell

(ii) Increase in shielding effect

(iii) Decrease in effective nuclear charge

Q.15 Atomic size decreases from left to right in period due to increase in effective nuclear charge (Z_{eff}) so correct order of atomic size is Li > N > O > F > Ne

Q.16 Ionic radius $\propto \frac{1}{\text{Magnitude of + ve charge on cation}}$

Ionic radius ∝ Magnitude of –ve charge on anion

So, order of ionic radius is $N^{-3} > O^{-2} > F^{-1} > Na^{+1}$

Q.17 Ionic radius $\propto \frac{1}{\text{Magnitude of + ve charge on cation}}$ If number of shells are constant.

Ionic radius ∝ magnitude of –ve charge on anion

So, order of ionic radius is $S^{-2} > Cl^{-1} > K^{+1} > Ca^{+2}$

Q.18 Negative ions have larger radius than the parent neutral atom

Q.19 Atomic No = No. of electrons

$_{20}Ca$ = 20 electrons,

Ca^{+2} = 20 – 2 = 18 electrons

$_{18}Ar$ = 18 electrons

Q.20 Cationic radius > Atomic radius > Anionic radius

Q.21 The ionization energy of an element is the energy required to remove the outermost electron of an isolated gaseous atom of the element.

Q.22 If there is large gap between 1st and 2nd ionization energy (I.E). It contains one valence electron and it belongs to IA group.

Q.23 $1s^2, 2s^2, 2p^6$ has highest I.E due to its complete octet (noble gas)

It is configuration of noble gas (stable configuration) so it has very high 1st I.E.

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Q.24 Ionization energy increases from left to right in period due to increase in effective nuclear charge (Z_{eff}) so, order of ionization energy is ${}_8O < {}_9F < {}_{10}Ne$

Q.25 Ionization energy decreases from top to bottom in group due to

(i) Increase in atomic size

(ii) Increase in shielding effect

(iii) Decrease in effective nuclear charge (Z_{eff})

Q.26 ${}_{10}[Ne]\ 3s^2, 3p^3$ has highest I.E due to extra stability of half-filled p-subshell (group V) This element has half filled (stable) p-orbital. So,

stability of orbital $\propto$ ionization energy

Q.27 Unit of Ionization energy is kJ/mol or ev/mol.

Q.28 With the increase of OS of elements, EN increases as it is observed along the period.

Q.29 The power of an atom to attract shared pair of electrons towards itself in a molecule is called electronegativity.

Q.30 The decreasing order of electronegativity of some important elements is

$F > O > N > Cl > Br > I > S > C > H = P$

Q.31 Electronegativity is comparative value and has no unit.

Q.32 All given statements about atomic radii are correct

Q.33 Electron affinity generally increase along the period from left to right.

$Be < Li < B < C$

Q.34 Group-IIA elements have lower or positive values of E.A due to their stable electronic configuration.

Q.35 Electron affinity decreases down the group. The correct for the halogens is

$Cl > Br > F > I$

Q.36 Melting / boiling point of metals (IA & IIA) depends on

(i) No. of binding electrons

(ii) Metallic structure

Binding energy $\propto$ no. of binding electrons

Binding energy $\propto$ melting and boiling point

Group (IIA) provide two electrons per atom for binding so have highest melting and boiling point than IA)

Q.37 Generally, in group (IIA), melting point decreases down the group so order of melting point $Be > Ca > Sr > Ba > Mg$

Abnormally, Mg has lowest melting point because of its hexagonal structure. It contains empty spaces so, less binding energy and less melting point.

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.38 London dispersion forces ∝ Size ∝ polarizability

LDF ∝ melting point

Among given options, nitrogen has large size, large polarizability and large LDF and high melting point.

.39 London dispersion forces ∝ Size ∝ polarizability

Sulphur exist in S_8 form while Phosphorous exist in P_4. Due to larger size Sulphur has high melting point than phosphorous

.40 In 3rd period, Si has highest melting point because in its crystal it provides four electron per atom for binding, so high binding energy and highest melting point

Q.41 In IA and IIA group, melting point decreases due to increases in size, less binding energy. IIA group has exceptional order Be > Ca > Sr > Ba > Mg

Q.42 In IA and II A group, melting point decreases down the group due to

(i) Increase in size

(ii) Decreases in binding energy

Q.43 N_2 exist as independent individual non-polar small molecule so has least inter – molecular forces (IMF) and lowest boiling point (boiling point of $N_2 = -196°c$.

Size ∝ Polarizability ∝ London Dispersion Forces

London Dispersion Forces ∝ boiling point

While others have giant structure, high binding energy and high boiling point

Q.44 Electrical conductivity decreases due to increase in temperature because bumping of electron increases which results in hindrance in flow of electrons.

Q.45 I-B elements are coinage metals (Cu, Au, Ag) and have high conductivity.

Q.46 Only Lithium burns in air to form normal oxide, while sodium forms peroxide and other alkali metals form superoxides. Li_2O(white solid).

$Li + O_2 \longrightarrow Li_2O$ (Lithium oxide)

Q.47 Group 1-A elements react violently with water and make the solution alkaline

$2Na + 2H_2O \longrightarrow 2NaOH + H_2$

Q.48 $\mathbf{Li_2O + H_2O \longrightarrow 2LiOH_{(aq)}}$

It is acid base reaction in which oxide ion behave as a base and water as acid.

Q.49 Only Ba from group IIA can form peroxide at high temperature

$Ba + O_2 \xrightarrow{500-600°C} BaO_2$ (Barium peroxide)

Q.50 Beryllium does not react with water even at red hot temperature due to the formation of protective oxide layer on the surface.

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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.51 According to definition the minimum amount of energy required to remove the outermost shell electron from an isolated gaseous atom to form an isolated gaseous ion is called ionization energy.

Q.52 As ionization means loss of electrons, so low IE means electron are lost easily.

Q.53 As we move across the period (left to right) the melting point increase upto group IVA and decreases after that, since C is at the top of Group IV A, So C would be placed at slot 3 in the given plot.

Q.54 The physical properties of elements change from left to right in the period, but the number of shell remains same in a particular period.

Q.55 As ionization energy is index of metallic character, so it is inversely proportional to metallic character.

Q.56 Nuclear charge is number of protons, and as electrons are added in same shell across the period, the effective nuclear charge increase which results in decrease of atomic radius.

Q.57 As melting and boiling points of elements depend on number of valence electrons and structure, so in a period (across) it first increase upto group IVA and then decreases.

Q.58 The sharp decrease observed is due to structure of Si and P. Si has three dimensional giant covalent network structure while P has only a tetra atomic molecular structure.

Q.59 The ionization energy of elements increases across the period, so elements with less atomic number have lower IE in the period (no exceptional element is given in option).

Q.60 The atomic size decreases across period and increases down the group so Li with atomic number 3 is larger then Be with atomic number 4.

Q.61 The metals after losing electron form a cation with smaller radius, the cationic radius is inversely proportional to the magnitude of positive charge, so Si^{+4} (hypothetical ion) would have smallest radius.

Q.62 Fluorine a non-metal after gaining an electron would form a negative ion (anion), and it results in increase of radius due to decrease in effective nuclear charge. So, following the values from text it is noted that actual size of F-atom is 72pm and on formation of Fluoride ion it is increased to 136pm.

Q.63 Physical properties such as IE, EA and EN increase across the period but atomic radius decrease for the same. The graph shows a decreasing trend (which is atomic radius)

Q.64 The sharp decrease observed is due to structure of Si and P. Si has three dimensional giant covalent network structure while P has only a tetra atomic molecular structure.

Q.65 Along the period, the electrons are added in the same shell, however the nuclear charge (number of protons) also increase which results in net increase in effective nuclear charge and therefore the atomic radius decrease.

Q.66 As we move down the group, ionization energy decrease and thus metallic character increase, as a result the basic character is enhanced for metallic oxides of group 2A.

Q.67 As we move across the period, the melting and boiling points increase up to group IVA therefore C in period 2 and Si in period 3 have maximum melting point.

Q.68 Physical properties such as IE, EA and EN increase across the period but atomic radius decrease for the same. However, the melting point increases upto group IVA but falls later on.

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Q.69 HI is the strongest reducing acid, as it has least bond energy. The decreasing order of acidic strength of halogen acids is HI > HBr > HCl > HF

Q.70 Group 2A elements are less reactive as on exposure to atmospheric oxygen they form a layer of oxide which protects them from further reaction and attack.

Q.71 The alkaline earth metal hydroxides have general formula of $M(OH)_2$, which on thermal decomposition from respective metal oxide and water.

For example : $Mg(OH)_{2(s)} \longrightarrow MgO_{(s)} + H_2O_{(l)}$

Q.72 As melting point depends on number of binding electrons, so across the period the number of binding electrons increase upto group IV A

Q.73 The reactivity of metals is inversely related to IE, therefore the least reactive metal is the one with smallest radii and maximum IE ie, Be here.

Q.74 As we move down the group the size increases, in case of metals increase in size causes lowering of melting point.

Q.75 Among halogens the EA is highest for Cl, whereas due to small size and repulsion by valence electrons F has lesser EA.

Q.76 As oxidation state number increases across the period, the reducing power decreases

Q.77 Across the period the size of the atom decreases gradually.

Q.78 The reducing power of metals is high in start of any period, so group I A is best.

Q.79 The hydration energy is directly related to charge and inversely to size

Q.80 In Group II-A down the group reactivity increases and thus Ba can form peroxide

Q.81 Li reacts with oxygen of air and as well as nitrogen to form oxide and nitride.

Q.82 Since period 3 is short period, it has 8 elements

Q.83 Superoxide of potassium has formula KO_2, which has more oxygen than K_2O and K_2O_2

Q.84 Modern Periodic table is arranged according to increasing number of protons called atomic number.

Q.85 One of the main factors that is responsible for the decrease in IE value is the shielding effect by intervening electrons of inner shell.

Q.86 Oxidation number is apparent charge which may be equal to valency. The valency or oxidation number is therefore can be inferred from group number.

Q.87 As reactivity increases down the group, the ability of metals of group I-A increases to form superoxide. So K, Rb and Cs can form superoxide easily.

Q.88 When magnesium is heated at high temperature, it forms MgO along with nitride having formula Mg_3N_2

Q.89 As density is defined as ratio of mass to volume, therefore as volume increase density decreases. According to periodic table group I-A is placed at the beginning of each period, so they have large atomic volume hence low density.

Q.90 Because incoming electron is repelled by already present extra electrons so to overcome repulsion energy is absorbed.

Q.91 Period number tells about number of shells.

Q.92 If there is sufficient gap between first ionization energy and second one then electron shows the valency of one.

Q.93 Fluorine has the highest electronegativity value among all elements.

Q.94 Magnesium is electro positive element and prefers to oxidize by losing electron for formation of ionic bond.

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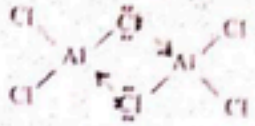
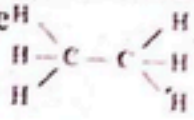
Q.95 Aluminium in form of $AlCl_3$ still have deficiency of two electrons, to complete octet aluminium will accept a pair of electron from chlorine atom of another $AlCl_3$ which result in dimer formation.



Q.96 In group IVA carbon is non-metal, silicon and germanium are metalloid, tin and lead are metals.

Q.97 Solubility of sulphates of alkaline earth metal decrease down the group.

Q.98 In Alkanes all carbons are Sp^3 hybridize



Q.99 Metallic bond is present in metals.

Q.100 Energy gap between valance bond and conductance bond is small enough for electrons to jump.

Q.101 As size of atoms increases shielding effect increases and hold of nucleus on valance electrons decrease.

Q.102 In presence of limited oxygen sodium form normal oxide and in presence of excess oxygen sodium form per oxide.

Q.103 The order of radius is as follows **Anion > Parent > Cation**.

Q.104 Beryllium has steel gray colour.

Q.105 Elements of group IA have larger size so they lose electrons easily.

Q.106 Alkali metals have low ionization potential.

Q.107 LiOH is less soluble in water due to high lattice energy.

Q.108 Colour of Mg metal flame is white.

Q.109 Moving down the group atomic size increases and tendency of atom to lose electrons increase as a result reactivity increase.

Q.110 Solubilities of alkaline earth metals $\alpha \frac{1}{\text{Ionization Energies}}$.

Q.111 $_{18}Ar = 1s^2 2s^2 2p^6 3s^2 3p^6$

Q.112 Order of oxidizing power: $HClO > HClO_2 > HClO_3 > HClO_4$. As the number of oxygen atoms increases oxidizing power decreases.

Q.113 Oxidation number of an element in free state is zero

Q.114 Bauxite $(Al_2O_3.3H_2O)$ is the ore of aluminum.

Q.115 Generally atomic radius decreases from left to right along periods.

Q.116 In a subgroup No. of valance electrons tells group number.

Q.117 Salts of alkali metal chlorine are neutral compounds. They are soluble in water, not alter the pH of water.

Q.118 Beryllium oxides behaves as both acid as well as base.

Q.119 Sodium metal vigorously reacts with water and liberate hydrogen gas and burn with yellowish golden flame.

Q.120 Lithium reacts slowly with water. As reactivity of alkali metals increases from top to bottom.

Q.121 Atomic size $\propto$ number of shells $\propto$ shielding effect.

Q.122 Na_2O_2 (sodium peroxide) oxidation state of oxygen in peroxides is –1

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Q.123 Sulphur has strong van der Waals forces than phosphorous, due to great electronegativity and other alkali metals form superoxide.

Q.124 Only lithium burns in air to form normal oxide, while sodium form peroxide.

Q.125 Beryllium does not impart color in in a flame test because its energy levels are too high to be excited by the flame.

Q.126 In super oxides, the oxidation state of oxygen is $-\frac{1}{2}$

Q.127 Beryllium nitride is covalent, while the nitrides of other elements of group IIA are ionic

Q.128 Number of valances shell electrons decides the group number.

Q.129 Metallic character $\propto$ size $\propto \frac{1}{I.E}$

Q.130 Superoxides of IA are generally represented as MO_2 i.e KO_2

Q.131 Lithium and Beryllium show peculiar behavior due to small size and charge density.

Q.132 Metals are malleable and ductile in solid form.

Q.133 General electronic configuration of halide ions is ns^2, np^6. e.g. $2p^6$ i.e $F^- = is^2, 2s^2, 2p^6$

Q.134 Lithium shows peculiar nature than other members of its group due to small size and high change density.

Q.135 Aluminum oxides are amphoteric in nature.

Q.136 The solubility of sulphates of alkaline earth metals decrease down the group generally.

Q.137 Metallic character $\propto$ atomic size of metals, as size increases down the group so metallic character increases.

Q.138 Lithium, be and magnesium forms normal oxides, potassium forms super oxide

Q.139 Sodium hydroxide is a strong base because it has high degree of ionization.

Q.140 The correct stability order is: $Ge^{+4} > Sn^{+4} > Pb^{+4}$

Q.141 $4KO_2 + 2CO_2 \rightarrow 2K_2CO_2 + 3O_2$

Q.142 Lithium gives crimson red on flame.

Q.143 Density $\propto$ mass, $Li < Na < K < Rb$ (correct order of density) as mass increases from Li to Rb.

Q.144 Solubility of sulphates of group IIA decrease down the group and finally $BaSO_4$ become insoluble.

Q.145 Potassium belong to s-black because its last valance electrons comes in s-subshell.

Q.146 Electronegativity of $Al \approx Be$ because of small size and greater nuclear attraction.

Q.147 Aluminum forms protective coating of oxides that protect it from further attack.

Q.148 Sodium gives yellow color flame during flame test.

Q.149 Sephardic acid is also called oil of vitriol.

Q.150 All leads to loss of aptite, weight loss and less of taste but Zn is the best answer.

Q.151 Mostly p-block elements react with chlorine (Halogen) to form binary compounds.

Q.152 Sodium metal reacts with water vigorously.

Q.153 $2NaNO_3 \rightarrow 2NaNO_2 + O_2$

Q.154 Stability of metal carbonates against heat increase down the group.

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Topic 12

TRANSITION ELEMENTS

PRACTICE EXERCISE

Q.1 The typical transition element is
A. Sc
B. Zn
C. Cd
D. Fe

Q.2 Which of the following cannot acts as ligands?
A. CH_3COO^{-1}
B. OH^{-1}
C. NH_3
D. NH_4^{+1}

Q.3 The electronic configuration of an element is $[Ar]4s^2, 3d^2$ its atomic number will be
A. 20
B. 22
C. 24
D. 26

Q.4 In the complex $K_4[Fe(CN)_4(H_2O)_2]$, the coordination number of central metal is
A. 2
B. 4
C. 6
D. 3

Q.5 The number of d-electrons in Zn^{2+} are
A. 6
B. 8
C. 9
D. 10

Q.6 Which of the following specie will impart colour to an aqueous solution?
A. Fe^{3+}
B. Sc^{3+}
C. Cu^{1+}
D. Zn^{2+}

Q.7 Which of the following has lowest binding energy?
A. V
B. Ti
C. Cr
D. Zn

Q.8 Which of the following has highest magnetic moment?
A. Sc^{3+}
B. Cu^{1+}
C. Mn^{2+}
D. Zn^{2+}

Q.9 d-d transition is not possible when d-subshell is
A. Empty
B. Completely filled
C. Half-filled
D. Both A and B

Q.10 d-block elements generally exhibit
A. Colour formation
B. Paramagnetism
C. Variable oxidation state
D. All of these

Q.11 Which one possesses maximum number of unpaired electrons
A. Mn^{2+}
B. Fe^{3+}
C. Cu^{2+}
D. Both A. and B.

Q.12 The location of transition elements is in between
A. Lanthanides and actinides
B. s and p block elements
C. Chalcogens and halogens
D. d and f block elements

Q.13 The correct electronic configuration of 'Cr' is
A. $[Ar]\ 3d^4 4s^2$
B. $[Ar]\ 3d^4 4s^2$

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C. [Ar] $3d^5 4s^0$ D. [Ar] $3d^5 4s^1$

Q.14 Which pair of elements has abnormal electronic configuration

A. Ti, V B. Cr, Cu

C. Cr, Mn D. Ni, Co

Q.15 The general electronic configuration of 3d series of transition elements is

A. [Ar](n–1)$d^{1-10}ns^{1-2}$ B. [Ar] (n–1)$d^{1-10}ns^2$

C. [Ar] (n–1)$d^{1-2}ns^{1-2}$ D. [Ar] (n–2)$d^{1-2}ns^{12}$

Q.16 Which of the following is a typical transition metal?

A. Sc B. Y

C. Cd D. Co

Q.17 Correct electronic configuration of Mn

A. [Ar] $3d^3 4s^2$ B. [Ar] $3d^4 4s^2$

C. [Ar] $3d4s^2$ D. [Ar] $3d^5 4s^2$

Q.18 Which of the followings has a complete d-subshell in atomic as well as cationic state

A. Sc B. Mn

C. Ti D. Zn

Q.19 The element which gains electronic configuration of a noble gas at +3 oxidation state

A. V B. Ti

C. Sc D. Cr

Q.20 At which oxidation state Cu achieves electronic configuration of Zn^{+2}

A. 0 B. +2

C. +1 D. +3

Q.21 Zinc does not show variable oxidation state, because

A. Its d-subshell is incomplete B. Its d-subshell is complete

C. It is relatively soft metal D. It has two electrons in outermost shell

Q.22 Which complex shows zero oxidation state of the transition metal

A. $[Fe(CO)_5]$ B. $K_2[Fe(CN)_6]$

C. $K_3[Fe(CN)_6]$ D. $[Cu(NH_3)_4]SO_4$

Q.23 The oxidation state of transition elements is usually

A. Variable B. Single

C. Constant D. Infinite

Q.24 The oxidation number of central metal atom in $[Ni(CO)_4]$ is

A. 0 B. 4

C. 2 D. 6

Q.25 In complex compounds, the oxidation number is written in

A. English B. Greek

C. Roman number D. Latin

Q.26 The oxidation number of Mn in $[MnO_4]^{-2}$ is

A. +7 B. -7

C. +6 D. -6

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Q.27 The highest oxidation state of manganese is
A. +7
B. –7
C. +6
D. +4

Q.28 Which two pairs show same oxidation state of iron
A. Fe_2O_3, FeO
B. $FeCl_3$, $FeSO_4$
C. $K_3[Fe(CN)_6]$, $K_4[Fe(CN)_6]$
D. $Fe_2(SO_4)_3$, Fe_2O_3

Q.29 Which of the following shows only +2 oxidation state
A. Sc
B. Zn
C. Cu
D. Co

Q.30 Which electronic configuration can have possibility of +7 oxidation state
A. $[Ar]3d^5, 4s^2$
B. $[Ar]3d^6, 4s^2$
C. $[Ar]3d^5, 4s^1$
D. $[Ar]3d^{10}, 4s^2$

Q.31 Which has same charge on central metal atom as the co-ordination sphere
A. $K_4[Fe(CN)_6]$
B. $[Co(NO_2)_3(NH_3)_3]$
C. $[Cu(NH_3)_4]SO_4$
D. $[MnCl_4]^{-2}$

Q.32 Which transition metals serves as catalyst for oxidation of alkanes
A. Zn
B. Cu
C. Hg
D. As

Q.33 Catalyst used for ammonia synthesis is
A. Cu
B. Co
C. Zn
D. Fe

Q.34 $TiCl_4$ is used as catalyst for manufacture of
A. Sulphuric acid
B. Plastics
C. Ethanol
D. Tetraethyl lead

Q.35 Which of the following compound is expected to be colored
A. Ag_2SO_4
B. $ZnCl_2$
C. MgF_2
D. CuF_2

Q.36 The colour of transition metal complexes is due to:
A. d-d transitions of electrons
B. Paramagnetic nature of transition elements
C. Ionization
D. Loss of s-electrons

Q.37 Which of the following transition metal forms colourless compounds
A. Ti
B. Cr
C. Cu
D. Zn

Q.38 Sc^{3+} has $3d^0$ configuration, its colour will be
A. Colourless
B. Purple
C. Blue
D. Green

Q.39 Number of electrons involved in d-d transition of $[Ti(H_2O)_6]^{+3}$
A. 1
B. 3

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C. 2 D. 4

Q.40 Ti^{+3} shows minimum absorption (maximum transmittance) at _____ and _____ wavelength
A. Yellow, Green B. Red, Yellow
C. Blue, Green D. Red, Blue

Q.41 d-d transition cannot be shows by
A. Cu^{+1} B. Sc^{+3}
C. Zn^{+2} D. All of the above

Q.42 The algebraic sum of the charges present on the central atom ion and the total charge on the ligands is called
A. Coordination number B. Coordination sphere
C. Oxidation number D. Charge on coordination sphere

Q.43 While assigning the name of a complex compounds, the correct order is
A. Cation, Coordination Sphere, Anion B. Coordination Sphere, Cation, Anion
C. Cation, Anion, Coordination Sphere D. Anion, Coordination Sphere, Cation

Q.44 The ability of transition elements to form complexes is due to:
A. Small size of metal ion B. Highly charged metal ion
C. Availability of empty d orbitals D. All of these

Q.45 When $K_4[Fe(CN)_6]$ is dissolved in a solution of salt, then it produces
A. Simple ions only B. Complex ions only
C. Complex ions and simple ions D. Weak acid HCN

Q.46 During the formation of complex compound the Ligands bind with central metal ion / atom by
A. Covalent bonds B. Co-ordinate covalent bond
C. Ionic bonds D. All of these

Q.47 Which one complex is more stable
A. $[Cu(H_2O)_6]^{2+}$ B. $[Pt(C_2O_4)_2]^{2-}$
C. $[CuCl_4]^{2-}$ D. All have same stability

Q.48 What is the nature of co-ordination sphere
A. Aninoic in nature B. Neutral in nature
C. Cationic in nature D. All are possible

Q.49 The geometry of $[Fe(CO)_5]$ is
A. Pyramidal B. Square planar
C. Octahedral D. Bi pyramidal

Q.50 When light is exposed to transition element, then electrons jump from lower orbitals to higher orbitals in
A. Orbitals of s-subshell B. Orbitals of d-subshell
C. Orbitals of p-subshell D. Both A. and B.

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Topic 12 TRANSITION ELEMENTS

PAST PAPER MCQ'S

Q.51 The paramagnetic character of substances is due to the presence of MDCAT (2010,2011)

A. Bond pairs of electrons
B. Lone pairs of electron
C. Unpaired electrons in the atom or molecule
D. Paired electrons in the valence shell of atoms

Q.52 Which pair of transition elements shows abnormal electronic configuration? MDCAT (2012)

A. Sc and Zn
B. Zn and Cu
C. Cu and Sc
D. Cu and Cr

Q.53 Electronic configuration of manganese (Mn) is MDCAT (2014)

A. $Mn(Ar)$ 3d: ↑ ↑ ↑ ↑ ↑ 4s: ↑↓
B. $Mn(Ar)$ 3d: ↑↓ ↑↓ ↑ ↑ ↑ 4s: ↑↓
C. $Mn(Ar)$ 3d: ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ 4s: ↑
D. $Mn(Ar)$ 3d: ↑↓ ↑↓ ↑↓ ↑ ↑ 4s: ↑

Q.54 Electronic configuration of Gold $[Au_{79}]$ is MDCAT (2015)

A. $[Xe]4f^{14}, 5d^{10}, 6s^1$
B. $[Xe]4f^{14}, 5d^9, 6s^2$
C. $[Xe]4f^{10}, 5d^{10}, 6s^2$
D. $[Xe]4f^{14}, 5d^{10}, 6s^2$

Q.55 The anomalous electronic configuration shown by chromium and copper among 3-d series of elements is due to: MDCAT (2016)

A. Colour of ions of these metals
B. Variable oxidation states of metals
C. Stability associated with this configuration
D. Complex formation tendency of metals

Q.56 Which element of 3-d series of periodic table shows the electronic configuration of $3d^8, 4s^2$? MDCAT (2016)

A. Copper
B. Zinc
C. Cobalt
D. Nickel

Q.57 Scandium has atomic number 21; which one will be its electronic configuration? MDCAT (2017)

A. $1s^2, 2s^2, 2p^6, 3s^2, 3s^6, 3d^3$
B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$
C. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 4p^1$
D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 4p^2$

Q.58 Which of the following is the electronic configuration of Cr? MDCAT (2019)

A. $[Ar]3d^5 4s^2$
B. $[Ar]3d^4 4s^2$
C. $[Ar]3d^6 4s^0$
D. $[Ar]3d^5 4s^1$

Q.59 Copper is a typical transition metal. Its atomic number is 29. In which oxidation state does it have partially filled orbital in d-subshell? MDCAT (2019)

A. Cu
B. Cu^{2+}
C. Cu^-
D. Cu^+

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Q.60 Valence electronic configuration Cu^{2+} is ^{29}Cu NUMS (2019)
A. $5d^6$ B. $3d^9$
C. $3d^8$ D. $3d^7$

Q.61 The total number of transition element is NUMS (2019)
A. 58 B. 48
C. 30 D. 25

Q.62 Oxidation state of 'Mn' in $KMnO_4$, K_2MnO_4, MnO_2 and $MnSO_4$ is in the order MDCAT (2012)
A. +7, +6, +2, +4 B. +7, +6, +4, +2
C. +6, +7, +2, +4 D. +4, +6, +7, +2

Q.63 Which one pair has the same oxidation state of 'Fe'? MDCAT (2013)
A. $FeSO_4$ and $FeCl_3$ B. $FeCl_2$ and $FeCl_3$
C. $FeSO_4$ and $FeCl_2$ D. $Fe_2(SO_4)_3$ and $FeSO_4$

Q.64 Identify the element that has maximum oxidation states: MDCAT (2017)
A. Zinc B. Vanadium
C. Chromium D. Manganese

Q.65 The geometry of complexes depends upon type of ----------taking place in the valence shell of central metal atom: MDCAT (2010)
A. Protonation B. Deprotonation
C. Hybridization D. Dissociation

Q.66 Tick the correct statement MDCAT (2011)
A. Chelates are more stable than ordinary complexes
B. Ordinary complexes are more stable than chelates
C. Monodentate ligand form chelate
D. Chelates have no ring structure

Q.67 Oxidation state of 'Fe' in $K_3[Fe(CN)_6]$ is MDCAT (2013)
A. +2 B. -6
C. -3 D. +3

Q.68 Ligands having two lone pair of electrons for donations to the central transition metal ions are known as MDCAT (2018)
A. monodentate ligand B. hexadentate ligand
C. bidentate ligand D. polydentate ligand

Q.69 The shape of $[Co(NH_3)_6]^{3+}$ complex is MDCAT (2018)
A. Square planar B. Tetrahedral
C. Linear D. Octahedral

Q.70 What are the coordination number of Fe and Cu in the following compounds $K_4[Fe(CN)_6]$, $[Cu(NH_3)_4]SO_4$ respectively SET (2019)
A. –6,–4 B. –6, +4(–6,–4)
C. +6,–4 D. +6, +4

Q.71 $[Ti(H_2O)_6]^{+3}$ transmits MDCAT (2015)
A. Yellow and red light B. Red and white light
C. Yellow and blue light D. Red and blue light

Q.72 Violet color of $[Ti(H_2O)_6]^{+3}$ ion is due to the MDCAT (2017)
A. Central metal ion B. Water molecule
C. Complex ion D. Outer anion

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Q.73 The color of transition metal complexes is due to transition of electron between
NUMS (2019)
A. p to d orbitals
B. d to d orbitals
C. p to p orbitals
D. d to p orbitals

Q.74 The octahedral geometry of complexes $\left[Co(NH_3)_6\right]^{3+}$ has hybridization
NUMS (2019)
A. sp^3d
B. spd^4
C. sp^3d^2
D. sp^2d^3

Q.75 In the complex, potassium hexacyanoferrate (III) $K_3[Fe(CN_6)]$ the coordination number of Fe is:
ETEA (2019)
A. 9
C. 3
C. 6
D. d

Q.76 Co-ordination number of $\left[Co(en)_2Cl_2\right]$ is
ETEA (2019)
A. -2
B. 6
C. 4
D. None of the above

Q.77 In 3rd series of transition elements, paramagnetic behavior is maximum for Mn^{+2} and
NMDCAT (2020)
A. Cr^{3+}
B. Ti^{3+}
C. V^{3+}
D. Zn^{2+}

Q.78 Electronic configuration of chromium (proton number 24) is:
NMDCAT (2020)
A. [Ar] $3d^4 4s^2$
B. [Ar] $3d^5 4s^2$
C. [Ar] $3d^5 4s^1$
D. [Ar] $3d^5 4s^2$

Q.79 The transition element which doesn't show variable valency is
NMDCAT (2020)
A. Cu
B. Sc
C. Zn
D. Cr

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Q.80 Which one of the following has more unpaired electrons?
PMC (2021)
A. Mn
B. Cr
C. Cu
D. Zn

Q.81 Paramagnetic behaviour of transition elements is due to presence of _____?
PMC (2021)
A. s electrons
B. Unpaired electrons
C. Paired electrons
D. Outer d electrons

Q.82 f-Block elements are called
PMC (2021)
A. Inner transition
B. Outer transition
C. Both
D. None

Q.83 $[PtCl(H_2O)_3(NH_3)_2]$ has structure
PMC (2021)
A. Octahedral
B. Tetrahedral
C. Trigonal pyramidal
D. Linear

Q.84 Which of the following complex show a tetrahedral geometry? UHS (2022)

A. $[Fe(CO)_5]$ B. $[Au(Cl)_4]^-$

C. $[Cu(CN)_4]^{-2}$ D. $[Pt(NH3)_4]^{+2}$

Q.85 In which pair, one has all unpaired d-orbitals while other have all paired d orbitals? UHS (2022)

A. Cu and Zn B. Cr and Fe

C. Cr and Cu D. Mn and Co

Q.86 The transition element which doesn't show variable valency: SZABMU (2022)

A. Cu B. Sc

C. Zn D. Cr

Q.87 The binding energy of transition metals increases upto group: SZABMU (2022)

A. II B B. IV B

C. III B D. VI B

Q.88 Which of the following ions forms most stable complex compound? ETEA (2022)

A. Cu^{+2} B. Ni^{+2}

C. Fe^{+2} D. Mn^{+2}

Q.89 What is the composition of alloy, German silver? ETEA (2022)

A. Cu + Zn + Ni B. Cu + Ag + Ni

C. Cu + Sn +Zn + Ni D. Al + Cu + Mg + Mn

Q.90 Which pair of ions have five unpaired d-electrons? BMU (2022)

A. Fe^{+2} and Mn^{+2} B. Fe^{+2} and Mn^{+3}

C. Fe^{+3} and Mn^{+3} D. Fe^{+3} and Mn^{+2}

Q.91 The outer shell electronic configuration of transition block elements is give by BMU (2022)

A. $(n-1)\,d^{1-10}\,ns^2$ B. $(n-1)\,d^{1-10}\,(n-1)s^{0-2}$

C. $(n-1)\,d^{1-10}\,ns^{0-2}$ D. $nd^{1-10}\,ns^{0-2}$

Q.92 Geometry of complexes depends upon? BMU (2022)

A. Number of ligands B. Hybridization of central metal

C. Oxidation state of central metal D. Number of chelating agents

Q.93 Which of the following transition metal show $3d^5$ configuration in its +2-oxidation state? UHS (2023)

A. Cu^{+2} B. Fe^{+2}

C. Mn^{+2} D. Zn^{+2}

Q.94 What is the proton (atomic number) of an element that has four unpaired electrons in its ground state? UHS (2023)

A. 6 B. 14

C. 22 D. 26

Q.95 Which of the following electronic configuration is correct for ^{24}Cr? UHS (2023)

A. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$ B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^4$

C. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6$ D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4f^6$

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Q.96 Which of the following is correct electronic configuration of iron (II) ion (atomic number of Fe is = 26)? UHS (2023)

A. [Ar] $4s^0, 3d^6$
B. [Ar] $4s^2, 3d^6$
C. [Ar] $4s^2, 3d^4$
D. [Ar] $4s^2, 3d^5$

Q.97 In transition elements number of unpaired electrons increase upto group number: SZABMU (2023)

A. III B and IV B
B. I B and II B
C. IV B and III B
D. V B and VI B

Q.98 The binding energy of transition elements weakens progressively upto group: SZABMU (2023)

A. III B
B. IV B
C. II B
D. V B

Q.99 Which one has one unpaired electron in the valence shell? ETEA (2023)

A. Zn^{+2}
B. Cu^{+}
C. Ti^{+3}
D. Fe^{+2}

Q.100 The oxidation number of Cobalt in the given coordination complex is: ETEA (2023)

$[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$

A. III
B. II
C. IV
D. VI

Q.101 What is the oxidation number of Mn is $KMnO_4$? DHUS (2023)

A. +2
B. +4
C. +6
D. +7

Q.102 Why do transition elements form interstitial compounds? DHUS (2023)

A. Presence of unpaired electrons
B. Transition of elements within d orbitals
C. Holes present in crystal lattice of transition elements
D. Small, highly charged ions and vacant d-orbitals of suitable energy

Q.103 The ligand, diethylene triamine is an example of? DHUS (2023)

A. Bidentate
B. Tridentate
C. Pentadentate
D. Hexadentate

Q.104 Which of the following is a bidentate ligand? BUMHS (2023)

A. Ammine
B. Hydrazine
C. Aqua
D. Carbonyl

Q.105 Group IB is called the coinage metals. Which one is not true about this group? BUMHS (2023)

A. Have powerful reducing agents
B. Have positive reduction potential
C. Cannot displace H_2 from dilute acids
D. Lies below SHE in electrochemical series

Q.106 Why do transition elements form alloys so easily? BUMHS (2023)

A. Atomic size
B. Orbital configuration
C. Very light
D. Hard elements

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Q.107 Which of the following is NOT an alloy UHS (2024)

A. Steel
B. Bronze
C. Brass
D. Graphite

Q.108 Electronic configuration of chromium (proton number 24) is: UHS (2024)

A. [Ar], $3d^4$, $4s^2$
B. [Ar], $3d^5$, $4s^1$
C. [Ar], $3d^5$, $4s^2$
D. [Ar], $3d^6$, $4s^2$

Q.109 Which of the following is NOT a property of transition elements? UHS (2024)

A. High melting points
B. Hard metals
C. Good conductors of electricity
D. Ions and compounds are colourless

Q.110 What is the range of atomic numbers of the 3d series of transition elements?

A. 20-30
B. 22-30
C. 21-30
D. 24-30

Q.111 Transition element Vanadium mostly act as _____. (Out of syllabus) SZABMU (2024)

A. Amphoteric
B. Oxidizing agent
C. Neutral
D. Reducing agent

Q.112 Cu^{2+} salt solution is blue in colour due to transition of electrons from ETEA (2024)

A. d to d orbital
B. p to p orbital
C. p to d orbital
D. s to p orbital

Q.113 Potassium ferrocyanide is which type of salt? ETEA (2024)

A. Complex
B. Mixed
C. Double
D. Normal

Q.114 Chelate means: DUHS (2024)

A. Bidentate
B. Monodentate
C. Ion
D. Crab claws

Q.115 An example of a bidentate ligand among the following is: DUHS (2024)

A. Br^-
B. $C_2O_4^{2-}$
C. CN^-
D. OH^-

Q.116 Compound attracted into a magnetic field are called BUMHS (2024)

A. Paramagnetic
B. Diamagnetic
C. Polymagnetic
D. Perymagnetic

Q.117 When potassium chromate is treated with an acid, it produces? BUMHS (2024)

A. Water
B. Sodium chloride
C. Potassium sulphate
D. Potassium dichromate

Q.118 Transition metal compounds containing unpaired electrons are BUMHS (2024)

A. Always diamagnetic
B. Attracted by the magnet
C. Not attracted by the magnet
D. Repelled by the magnet

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ANSWER KEY

PRACTICE EXERCISE

1	D	11	D	21	B	31	C	41	D
2	D	12	B	22	A	32	B	42	D
3	B	13	D	23	A	33	D	43	A
4	C	14	B	24	A	34	B	44	D
5	D	15	A	25	C	35	D	45	C
6	A	16	D	26	C	36	A	46	B
7	D	17	D	27	A	37	D	47	B
8	C	18	D	28	D	38	A	48	D
9	D	19	C	29	B	39	A	49	D
10	D	20	C	30	A	40	D	50	B

PAST PAPER MCQ'S

51	C	61	A	71	D	81	B	91	A	101	D	111	D
52	D	62	B	72	A	82	A	92	B	102	C	112	A
53	A	63	C	73	B	83	A	93	C	103	B	113	A
54	A	64	D	74	C	84	B	94	D	104	B	114	D
55	C	65	C	75	C	85	C	95	A	105	A	115	B
56	D	66	A	76	B	86	C	96	A	106	A	116	A
57	B	67	D	77	A	87	D	97	D	107	D	117	D
58	D	68	C	78	C	88	A	98	C	108	B	118	B
59	B	69	D	79	C	89	A	99	C	109	D		
60	B	70	D	80	B	90	D	100	A	110	C		

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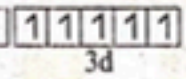
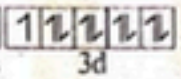
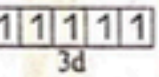
EXPLANATORY NOTES

Q.11

A. $_{25}Mn^{+2}$ $_{18}[Ar]$ 

C. $_{29}Cu^{+2}$ $_{18}[Ar]$ 

B. $_{26}Fe^{+3}$ $_{18}[Ar]$ 

Q.12 Transition element are those elements which lie between s and p – block elements and their properties are also between s and p – block elements.

Q.13 In 3d series (1st series of transition elements), two elements "Cr" and "Cu" have different electronic configuration.

$_{24}Cr$ $[Ar]\ 3d^{5}\ 4s^{1}$

$_{29}Cu$ $[Ar]\ 3d^{10}\ 4s^{1}$

Q.14 Two elements "Cr" and "Cu" have different electronic configuration.

$_{24}Cr$ $[Ar]\ 3d^{5}\ 4s^{1}$

$_{29}Cu$ $[Ar]\ 3d^{10}\ 4s^{1}$

Q.15 d – block (outer) transition elements are those in which d – subshell of penultimate shell (inner to valence shell) is in process of completion. So general electronic configuration of 3d series is $(n-1)\,d^{1-10}\,ns^{1-2}$.

Q.16 Typical transition elements show general properties (colour, paramagnetism, alloy formation etc.) of transition elements while non-typical transition element don't show general properties of transition elements. Group No. IIIB (Sc, Y, La and IIB (Zn, Cd, Hg) are non-typical transition elements while group No. (IVB, VB, VIB, VIIB, VIIIB and IB) are typical transition elements.

Q.17 Electronic configuration of Mn is $_{25}Mn$ $_{18}[Ar]\ 4s^{2}\ 3d^{5}$.

Q.18

(A) $_{21}Sc$ $_{18}[Ar]\ 4s^{2}\ 3d^{1}$

Sc^{+3} $_{18}[Ar]\ 4s^{0}\ 3d^{0}$

(B) $_{21}Ti$ $_{18}[Ar]\ 4s^{2}\ 3d^{2}$

Ti^{+3} $_{18}[Ar]\ 4s^{0}\ 3d^{1}$

(C) $_{25}Mn$ $_{18}[Ar]\ 4s^{2}\ 3d^{5}$

Mn^{+2} $_{18}[Ar]\ 4s^{0}\ 3d^{5}$

(D) $_{30}Zn$ $_{18}[Ar]\ 4s^{2}\ 3d^{10}$

Zn^{+2} $_{18}[Ar]\ 4s^{0}\ 3d^{10}$

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Q.19 $_{21}Sc$ $_{18}[Ar]\ 4s^2\ 3d^1$

$_{21}Sc^{+3}$ $_{18}[Ar]\ 4s^0\ 3d^0$

Scandium in +3 state has same electronic configuration as $_{18}Ar$.

$_{18}Ar\ 1s^2 2s^2 2p^6 3s^2 3p^6$

Q.20 Cu^{+1} $_{18}[Ar]\ 4s^0\ 3d^{10}$

Zn^{+2} $_{18}[Ar]\ 4s^0\ 3d^{10}$

Q.21 $_{30}Zn$ $_{18}[Ar]\ 4s^2\ 3d^{10}$

Zn^{+2} $_{18}[Ar]\ 4s^0\ 3d^{10}$

Q.22 $\left[\overset{0}{Fe}(CO)_5\right]$, $K_2\left[\overset{+1}{Fe}(CN)_6\right]$

C. $K_3\left[\overset{+3}{Fe}(CN)_6\right]$, $\left[\overset{+2}{Cu}(NH_3)_4\right]SO_4$

Q.23 Transition elements show variable state because in addition to s-orbital electrons, d-orbital electrons also take part in bonding.

Q.24 $\left[\overset{0}{Ni}(\overset{0}{CO})_4\right]^0$

Oxidation state on CO = 0

Overall coordination sphere has zero charge. So Ni has zero oxidation state.

Q.25 Oxidation number of central metal in the complex is written in roman number i.e.

$K_3\left[\overset{+3}{Fe}(CN)_6\right]$ Potassium Hexacyanoferrate (III)

Q.26 Oxidation no of Mn = ?

Oxidation no of O = –2

Overall charge on coordination sphere = –2

Mn + 4(–2) = –2

Mn – 8 = –2

Mn = 8 –2

Mn = +6

Q.27 Mn belongs to group (VIIB)of periodic table. So, its maximum oxidation state should be +7. Because maximum oxidation state may be equal to group no of element.

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Q.28

Oxidation state of Fe in $Fe_2(SO_4)_3$	Oxidation state of Fe in Fe_2O_3
Charge on sulphate ion = –2 2Fe +3(–2) = 0 2Fe – 6 = 0 2Fe = + 6 Fe = +3	Charge on oxygen = –2 2Fe +3(–2) = 0 2Fe – 6 = 0 2Fe = +6 Fe = +3

Q.29 "Zn" is non-typical transition element it does not show variable oxidation state. So it shows only +2 oxidation state.
i.e $Zn^{2+} = [Ar]4s^0\ 3d^{10}$

Q.30 $[Ar]\ 2d^5\ 4s^2$ is electronic configuration of Mn. It shows maximum +7 oxidation state because it belongs to group VIIB of periodic table.

Q.31 In B option CMA and coordination sphere has same charge

A. $\overset{+4}{K_4}\left[\overset{+2}{Fe}(\overset{-6}{CN})_6\right]^{-4}$

C. $\left[\overset{+2}{Cu}(\overset{0}{NH_3})_4\right]^{+2}\ \overset{-2}{SO_4}$

B. $\left[\overset{-3}{Co}(\overset{-3}{NO_2})_3(\overset{0}{NH})_3\right]^{0}$

D. $\left[\overset{+2}{Mn}\overset{-4}{Cl_4}\right]^{-2}$

Q.32 "Cu" is used as catalyst in oxidation of lower alkanes.

$$CH_4 + [O] \xrightarrow[200\ atom]{Cu/400^\circ C} CH_3 - OH\ .$$

Q.33 Finely divided "Fe" is used as a catalyst in Haber process. $Cr_2O_3 + MgO + SiO_2$ is used as promoter.

$$N_2 + 3H_2 \underset{450^\circ C/200\ atom}{\overset{Fe/MgO/Cr_2O_3/SiO_2}{\rightleftharpoons}} 2NH_3$$

Q.34 For high quality polyethylene (plastiB.), $(C_2H_5)_3Al + TiCl_4$ is used as catalyst.

$$n(CH_2 = CH_2) \xrightarrow[traces\ of\ O_2(0.1\%)\ 400^\circ C/100\ atom]{(C_2H_5)_3Al+TiCl_4} [CH_2 - CH_2]_n$$

Q.35

Copper in +2 state contain one unpaired electron so it shows d-d transition and certain colour.

Cu^{+2} $_{29}[Ar]$ ☐ (4s) ↿⇂ ↿⇂ ↿ ↿ ↿ (3d)

Q.36 Following ions of 3d-series contain no unpaired electrons. So, these don't show d-d transition and certain colour
Sc^{+3}, Ti^{+4}, V^{+5}, Cu^{+1} and Zn^{+2}

Q.37 Zinc has complete d-subshell. There is no d-d transition, therefore zinc form a colorless complex

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Q.38 $_{21}Sc$ $_{18}[Ar]\ 4s^{2}\ 3d^{1}$

Sc^{+3} $_{18}[Ar]\ 4s^{0}\ 3d^{0}$

Q.39

$$\left[\overset{+3}{Ti}(H_2O)_6^{0}\right]^{+3}$$

$_{22}Ti$ $[Ar]\ 4s^{2}\ 3d^{2}$

$_{22}Ti^{+3}$ $_{18}[Ar]\ 4s^{0}\ 3d^{1}$

Q.40 In $[Ti(H_2O)_6]^{+3}$, yellow light is absorbed while most of the red and blue lights are transmitted, therefore the solution of $[Ti(H_2O)_6]^{+3}$ ions looks violet in colour.

Q.41 Following ions of 3d-series contain no unpaired electrons. So, these don't show d-d transition and certain colour

Sc^{+3}, Ti^{+4}, Cu^{+1} and Zn^{+2}

Q.42 $[Fe(CN)_6]^{-4}$ The algebraic sum of central metal and ligand is -4. It is charge on sphere

Q.43 The correct order while naming the name of a complex compound is cation, coordination sphere and anion.

Q.44 Transition metals can form complexes because these have vacant d–orbital in which ligands can donate electron pairs.

Q.45 $K_4[Fe(CN)_6] \xrightarrow{\text{Ionization}} 4K^{+} + [Fe(CN)_6]^{-4}$

Q.46 In coordination compounds, ligands are Lewis bases and central metal atom are Lewis acid so these form coordinate covalent bond.

Q.47 Complexes formed by poly-dentate ligands are called chelates. Oxalate ion $(C_2O_4^{-2})$ is poly-dentate ligand so it will form chelates. These are stable compounds due to ring structure.

Q.48 A. Anionic coordination sphere $K_4[Fe(CN)_6]$

B. Neutral coordination sphere $[Fe(CO)_5]$

C. Cationic coordination sphere $[Cu(NH_3)_4]SO_4$

Q.49 There are five carbonyl (CO) ligands attached with central atom (Fe), so coordination no is 5. If coordination no. is 5 then geometry is Trigonal bipyramidal.

Q.50 When d-orbitals are involved in bonding, they split into two energy levels (lower and higher). Electrons present in low energy level absorb a part of visible light and jump to higher energy level. This is called d-d transition. Due to this transition, metal ion show colour.

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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.51 The paramagnetic behaviour of substance is due to presence of unpaired electrons in it.

Q.52 $_{24}Cr$ and $_{29}Cu$ is the pair of 3d series which shows abnormal behaviour in electronic configuration due to the stability of d-subshell.

Q.53 Electronic configuration of manganese $_{25}Mn$ is given below

Mn=[Ar] ↑ ↑ ↑ ↑ ↑ (3d) ↑↓ (4s) or $Mn = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^5$

Q.54 Electronic configuration of Gold $[Au_{79}]$ is $[Xe]4f^{14}, 5d^{10}, 6s^1$

Q.55 The anomalous electronic configuration is due to stability associated to their electronic configuration or stability of d-subshell because haf filled or completely filled subshell is more stable.

Q.56 The given configuration is for $_{28}Ni$. $Ni = [Ar]4s^2, 3d^8$

Q.57 $_{21}Sc = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$

Q.58 $_{24}Cr = [Ar]4s^1, 3d^5$

Q.59 $_{29}Cu = [Ar]4s^1, 3d^{10}$ and $_{29}Cu^{+2} = [Ar]4s^1, 3d^9$ or $_{29}Cu^{+2} = [Ar]$ ↑↓ ↑↓ ↑↓ ↑↓ ↑ (3d) □ (4s)

Q.60 Valence electronic configuration Cu^{2+} is $_{29}Cu^{+2} = [Ar]4s^1, 3d^9$

Q.61 There are 58 total transition elements, 40 outer transition elements (d-block) and 28 inner transition elements (f-block).

Q.62 Oxidation state of 'Mn' in $KMnO_4$, K_2MnO_4, MnO_2 and $MnSO_4$ is in the order is +7, +6, +4, +2 as given below.

$KMnO_4$	K_2MnO_4	MnO_2	$MnSO_4$
$K + Mn + 4(O) = 0$	$2K + Mn + 4(O) = 0$	$Mn + 2(O) = 0$	$Mn + (SO_4^{-2}) = 0$
$(1) + Mn + (-8) = 0$	$(2) + Mn + (-8) = 0$	$Mn + (-4) = 0$	$Mn + (-2) = 0$
$Mn + (-7) = 0$	$Mn + (-6) = 0$	$Mn = 4$	$Mn = 2$
$Mn = 7$	$Mn = 6$	$Mn = 4$	$Mn = 2$

Q.63 $FeSO_4$ and $FeCl_2$ this pair has same oxidation state which is +2.

$FeCl_2$	$FeSO_4$
$Fe + 2(Cl) = 0$	$Fe + (SO_4^{-2}) = 0$
$Fe + 2(-1) = 0$	$Fe + (-2) = 0$
$Fe + (-2) = 0$	$Fe = 2$
$Fe = 2$	$Fe = 2$

Q.64 Mn has maximum oxidation state (+7), $Mn_{25} = [Ar]4s^2, 3d^5$

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Q.65 Geometry of complexes depends upon hybridization i.e. sp^3 has tetrahedral and dsp^2 has square planer geometry.

Q.66 Chelates are more stable than ordinary complexes due to formation of 5 or 6 members cyclic structure.

Q.67 Oxidation state of Fe in $K_3[Fe(CN)_6]$ is +3, as

$$3(K) + Fe + 6(CN^{-1}) = 0$$
$$3(+1) + Fe + 6(-1) = 0$$
$$Fe + 3 + (-6) = 0$$
$$Fe + (-3) = 0$$
$$Fe = 3$$

Q.68 Ligands having two lone pair of electrons for donations to the central transition metal ions are known as bidentate ligands e.g. hydrazine and ethylenediammine.

Q.69 The shape of $[Co(NH_3)_6]^{3+}$ complex is octahedral.

Q.70 $[Fe(CN)_6],[Cu(NH_3)_4]SO_4$ in the given compounds, Fe has 6 ligands while Cu has 4 ligands so their coordination number are 6 and 4 respectively.

Q.71 $[Ti(H_2O)_6]^{+3}$ transmits red and blue light during d-d transition.

Q.72 Colours of complex compounds are due d-d transition of central metal atom or ion.

Q.73 The color of transition metal complexes is due to transition of electron between d-d orbitals.

Q.74 Octahedral geometry of given complex is due sp^3d^2 because ammonia ligand use vacant orbitals of 4d, as 3d has no vacant orbital to accommodate the ligands.

Q.75 $[K_3Fe(CN_6)]$ In this complex Fe metal ion is surrounded by 6 ligands, so its coordination number is six.

Q.76 Co-ordination number of $[Co(en)_2Cl_2]$ is six, as ethylenediammine (en) is bidentate ligand so total six electron pairs are donated to Co-metal ion.

Q.77 In the given ions Cr^{+3} and Mn^{+2} has maximum unpaired electrons so have maximum paramagnetic behaviour.

Q.78 Electronic configuration of chromium (proton number 24) is $[Ar]4s^1, 3d^5$

Q.79 Zinc (Zn) does not show variable oxidation state because of unavailability of unpaired electrons in d-subshell.

Q.80 $_{24}Cr = [Ar]\ 4s^1, 3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}, 3d^1_{x^2-y^2}, 3d^5_{z^2}$

'Cr has 6 unpaired electrons while Mn has 5. Zinc has no unpaired electrons.

Q.81 Paramagnetic behaviour α no. of unpaired electrons.

Q.82 f-block elements are called inner transition elements because (n-2)f sub-shell is under the process of electron filling while d-block elements are called outer transition element because (n-1)d sub-shell is under the process electron filling.

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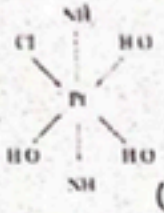
Q.83



(Octahedral)

Q.84 $[Fe(CO)_5]$ (Trigonal bipyramidal)
$[Au(Cl)_4]^-$ (Square planer)
$[Cu(CN)_4]^{-2}$ (Tetrahedral)
$[Pt(NH3)_4]^{+2}$ (Square planer)

Q.85 $_{24}Cr = [Ar]\ 4s^1, 3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}, 3d^1_{x^2-y^2}, 3d^1_{z^2}$

$_{29}Cu = [Ar]4s^1, 3d^2_{xy}, 3d^2_{yz}, 3d^2_{xz}, 3d^2_{x^2-y^2}, 3d^2_{z^2}$

Q.86 $_{30}Zn$ is a non-typical transition element with electronic configuration of $[Ar]\ 4s^2, 3d^{10}$ it does not show variable state due to completely filled d sub-shell.

Q.87 Binding energy of transition metals increases up to VIB due to strong binding, structure and unpaired electrons.

Q.88 Higher the charge density of central metal atom/ion, greater will be the stability.

Q.89 Mixture of Cu, Zn and Ni is called German silver.

$_{26}Fe^{+} = [Ar]4s, 3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}, 3d^1_{x^2-y^2}, 3d^1_{z^2}$

$_{25}Mn^{+2} = [Ar]4s, 3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}, 3d^1_{x^2-y^2}, 3d^1_{z^2}$

Q.90

Q.91 General electronic configuration of d-block elements can be written as.
$(n-1)d^{1-10}, ns^2$.

Q.92

Hybridization of central metal	Geometry
sp	Linear
sp^3	Tetrahedral
dsp^2	Square Planer
dsp^3	Trigonal bipyramidal
d^2sp^3	Octahedral

Q.93 Cu^{+2} $[Ar]3d^9 4s^0$
Fe^{+2} $[Ar]3d^6 4s^0$
Mn^{+2} $[Ar]3d^5 4s^0$
Zn^{+2} $[Ar]3d^{10} 4s^0$

Q.94 $_{26}Fe[Ar]3d^6 4s^2$

Q.95 $_{24}Cr = [Ar]3d^5 4s_1$ OR $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$

Q.96 $_{26}Fe[Ar]3d^0 4s^6$

Q.97 In transition elements number of unpaired electrons increases from left to right upto the middle (group VB and VIB) then decreases upto IIB.

Q.98 Binding energy $\propto$ number of unpaired electrons.

Q.99 Zn^{+2} $[Ar]3d^{10} 4s^0$
Cu^{+1} $[Ar]3d^{10} 4s^0$
Ti^{+3} $[Ar]3d^1 4s^0$
Fe^{+2} $[Ar]3d^6 4s^0$

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Q.100 $[Co(en)_3]_2(SO_4)_3 \longrightarrow [Co(en)_3]_2^{+6} + 3SO_4^{-2}$

$[Co(en)_3]_2^{+6}$

$[Co(en)_3]^{+3}$

As. (en) is neutral ligand

So. Co = +3

en = HN_2-CH_2-CH_2-NH_2

Q.101 $KMnO_4$

(K) + (Mn) + 4 (Oxy) = O

(+1) + Mn + 4(-2) = 0

Mn = + 7

Q.102 Interstitial compounds are formed when small non-metal atoms like H, B, N enter the interstices (Holes) present in crystal lattice of transition elements.

Q.103 $H_2\ddot{N}-CH_2-CH_2-\ddot{N}H-CH_2-CH_2-\ddot{N}H_2$ diethylenetriamine. It is tridentate ligand.

Q.104

Ammine	NH_3	Monodentate
Hydrazine	H_2N-NH_2	Bidentate
Aqua	H_2O	Monodentate
Carbonyl	CO	Monodentate

Q.105 Coinage metals (I-B) have less oxidation potential so, there are weak reducing agents.

Q.106 Transition elements form alloys because they have similarity in atomic sizes.

Q.107 Graphite is an allotrope of carbon not an alloy.

Q.108 $_{24}Cr = [Ar]3d^5 4s_1$ OR $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$

Q.109 Properties of transition elements:

(i) Have high m.pts (ii) Conductor of electricity

(iii) Hard (iv) Ions and show colour

Q.110 3d series of transition elements ranges from Sc(Z = 21) to Zn(Z = 30).

Q.111 Metals have low ionization energy and act as reducing agents.

Q.112 Colours of transition elements or their ions is due to d-d transition of electrons.

Q.113 Potassium ferrocyanide $K_4[Fe(CN)_6]$ is a complex salt complex salts have complex ion.

Q.114 Chelate means "crab claws".

Q.115 $C_2O_4^{-2}$ is bidentate ligand.

Q.116 Paramagnetic substance is attracted towards magnetic field. This is due to the presence of unpaired electrons.

Q.117 $2CrO_4^{-2} \rightleftharpoons Cr_2O_7^{-2} + H_2O$

Potassium Chromate — Potassium dichromate

If acid is added, chromate ion changes to dichromate ion.

Q.118 Paramagnetic substance is attracted towards magnetic field. This is due to the presence of unpaired electrons.

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Topic 13 FUNDAMENTAL CONCEPTS OF ORGANIC CHEMISTRY

PRACTICE EXERCISE

Q.1 For a compound to have straight chain structure it must contain

A. All primary carbons
B. All secondary carbons
C. Only primary and secondary carbon
D. Primary, secondary and tertiary carbon

Q.2 Which is true regarding alicyclic compounds?

A. At least have three carbon atoms in the rings
B. General formula C_nH_{2n}
C. May have sigma and pi bonds
D. Both A and C

Q.3 CH_2=NH belongs to

A. Amines
B. Imines
C. Acid amides
D. Nitrile

Q.4 Cyclopropane belongs to which class of organic compounds

A. Hydrocarbon
B. Alicyclic
C. Heterocyclic
D. Homocyclic

Q.5 Which of the following statement is incorrect regarding structural isomers?

A. Have same molecular formula
B. Have different structural formula
C. Have different physical properties
D. Have same physical properties

Q.6 The rotation of two carbon atoms joined by double bond is possible only if

A. pi-Bond breaks
B. Sigma bond breaks
C. pi-Bond and sigma bond break
D. pi-Bond does not break

Q.7 Urea NH_2CONH_2 and ammonium cyanate NH_4CNO are

A. Metamers
B. Position isomers
C. Functional group isomers
D. Chain isomers

Q.8 Which of the following pair show isomerism?

A. CH_2Cl_2, $CHCl_3$
B. C_2H_4, C_3H_6
C. C_6H_6, C_3H_8
D. CH_3OCH_3, C_2H_5OH

Q.9 Which of the following shows cis-trans isomerism?

A. 2-Butanol
B. 1-Butene
C. 2-Butene
D. 1-Pentene

Q.10 Which of the following represents the functional group of amide?

A. $-CONH_2$
B. -COOR
C. -CN
D. $-NH_2$

Q.11 _____ organic compound/s can be classified as acyclic

A. Isobutane
B. Isobutylene
C. Isopentyne
D. All of these

Q.12 Compounds containing ring of three or more than three carbon atom and resembling _____ compounds are called alicyclic

A. Aliphatic
B. Aromatic
C. Benzene
D. Heterocyclic

Q.13 Alicyclic hydrocarbons will not follow _____ general formula

A. C_nH_{2n}
B. C_nH_{2n-2}
C. C_nH_{2n+2}
D. C_nH_{2n-4}

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Q.14 **Cyclohexane can be classified as**
A. Carbocyclic
B. Aromatic
C. Alicyclic
D. Both A and C

Q.15 **How many secondary carbon atoms are present in Methylcylopropane**
A. 1
B. 3
C. 2
D. 0

Q.16 **Which of the following is not heterocyclic compound**
A. Naphthalene
B. Furan
C. Pyridine
D. Pyrrole

Q.17 **The aliphatic compounds are of two types**
A. Straight chain and cyclic
B. Branched chain and alicyclic
C. Straight chain and branched
D. Homocyclic and alicyclic

Q.18 **Which is not present as heteroatom in heterocyclic compounds**
A. Sulphur
B. Nitrogen
C. Oxygen
D. Chlorine

Q.19 **Which compounds is alicyclic in nature**
A. Cyclobutane
B. Iso-butane
C. n-Butane
D. Toluene

Q.20 **1st synthetic organic compound is**
A. Ammonium cyanate
B. Urea
C. Methane
D. Benzene

Q.21 **Pyridine is an example of**
A. Homocyclic compound
B. Heterocyclic compound
C. Carbocyclic compound
D. Aliphatic compound

Q.22 **Anthracene contains _____ number of fused benzene rings**
A. 1
B. 2
C. 3
D. 4

Q.23 **The isomerism in which the compounds differ with respect to functional group but have same molecular formula is called:**
A. Metamerism
B. Functional group isomerism
C. Position isomerism
D. Chain isomerism

Q.24 **Ether shows the phenomenon of:**
A. Position isomerism
B. Functional group isomerism
C. Metamerism
D. Cis trans isomerism

Q.25 **Which of the following compounds does not exhibit positional isomerism**
A. Alkynes
B. Nitroalkanes
C. Carboxylic acid
D. Alcohol

Q.26 **Total number of possible chain isomers of butylalcohol among alcohols are**
A. Four
B. Five
C. Three
D. Six

Q.27 **Alkanes do not show geometrical isomerism due to**
A. Asymmetry
B. Resonance
C. Rotation around single bond
D. Restricted rotation around doubled bond

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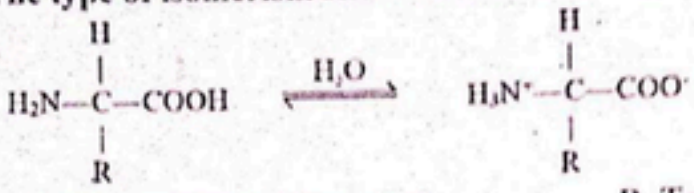
Q.28 How many esters are possible for $C_4H_8O_2$

A. 2
B. 3
C. 4
D. 5

Q.29 The type of isomerism shown in the following species is



A. Functional group isomerism
B. Tautomerism
C. Metamerism
D. Cis-trans isomerism

Q.30 Which class of compound usually cannot show positional isomerism

A. Alkanes
B. Alkene
C. Alkynes
D. Alcohol

Q.31 Which one is thioether

A. R – O – R
B. R – Se – R
C. R – S – R
D. R – Te – R

Q.32 Glycols and glycerols can be differentiated on the basis of

A. Number of carbon atom
B. Number of hydroxyl group
C. Position of hydroxyl group
D. All of these

Q.33 Which of the following is functional group of amino functional group

A. $-NH_2$
B. $\diagdown C = NH \diagup$
C. $-C \equiv N$
D. $-\overset{\overset{O}{\|}}{C}-NH_2$

Q.34 Select from the following the one which is alcohol

A. CH_3-CH_2-OH
B. CH_3COOH
C. CH_3-O-CH_3
D. CH_3-CH_2-Br

Q.35 Which one of the following class of compounds has been incorrectly matched with their general formulae

A. Phenol …… Ar –OH
B. Ketone …… R – COR
C. Carboxylic acid …… RCOOH
D. Aldehyde …… ROR

Q.36 Which of the following is an amide

A. $(NH_2)_2CO$
B. NH_2CH_3
C. $C_6H_5NH_2$
D. $N(CH_3)_3$

Q.37 sp-hybridization takes place by the mixing of orbitals

A. One 1s, one 2p
B. One 2s, three 2p
C. One 2s, two 2p
D. One 2s, one 2p

Q.38 The percentage of s character in sp^2 hybrid orbital is

A. 25%
B. 33.3%
C. 50%
D. 75%

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Q.39 The percentage of p character in sp^3 hybrid orbital is

A. 25%
B. 75%
C. 50%
D. 33%

Q.40 In sp^2-hybridization, the angle between two hybrid orbitals is

A. 120°
B. 180°
C. 109.5°
D. 90°

Q.41 In t-butyl alcohol, tertiary carbon is bonded to:

A. Two hydrogen atoms
B. Three hydrogen atoms
C. One hydrogen atom
D. No hydrogen atom

Q.42 IUPAC name of neopentane

A. 2,2- Dimethyl pentane
B. 2,3- Dimethyl pentane
C. 2,2- Dimethyl propane
D. 2,2- Dimethyl butane

Q.43 Propene and propyne have general formula

A. C_nH_{2n} and C_nH_{2n-2}
B. C_nH_{2n-2} and C_nH_{2n+2}
C. C_nH_{2n+2}
D. C_nH_{2n} and C_nH_{2n+2}

Q.44 Choose the correct name according to IUPAC nomenclature

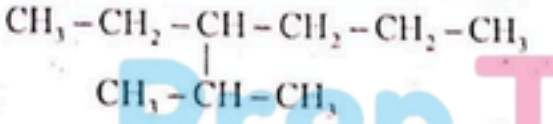
A. 2–Ethyl–3–methyl pentane
B. 3–Ethyl–2–methyl pentane
C. 3-Methyl cyclohexane
D. 3–Ethyl–4–methyl pentane

Q.45 Indicate the number of chain isomers that can be obtained from the C_6H_{14}?

A. 7
B. 6
C. 5
D. 4

Q.46 What is the IUPAC name of this structure

$$\begin{array}{l} CH_3-CH_2-CH-CH_2-CH_2-CH_3 \\ \qquad\qquad\quad | \\ \qquad\quad CH_3-CH-CH_3 \end{array}$$



A. 3–Ethyl 2–methyl hexane
B. Iso propyl hexane
C. 4–Ethyl 5–methyl hexane
D. 3–Iso propyl hexane

Q.47 The correct name of 3,5,5-Trimethylhexane is

A. 3–Ethyl 2–methyl pentane
B. 2,3–Dimethylpentane
C. 2,2,4-Trimethylhexane
D. 2,3,4-Trimethylhexane

Q.48 Which suffix is used for carboxylic acid

A. – al
B. – oic
C. – ol
D. – ene

Q.49 The IUPAC name of given compound is $CH_3CH(CH_3)CH_2Cl$

A. 1–Chloro-2–methylbutane
B. Iso-butyl chloride
C. 1–Chloro-2-methylpropane
D. 2-Chloro-2-methyl propane

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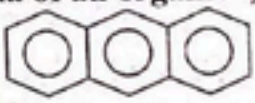
Topic 13 FUNDAMENTAL CONCEPTS OF ORGANIC CHEMISTRY

PAST PAPER MCQ'S

Q.50 Skeletal formula of an organic compound is given below



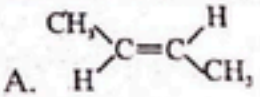
Name of this compound is

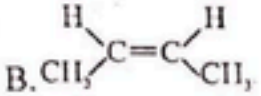
A. Naphthalene
B. Pyrene
C. Anthracene
D. Biphenyl methane

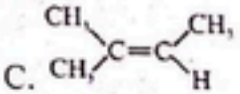
Q.51 1-chloroproane and 2-chloropropane are isomers of each other. The type of isomerism MDCAT (2011)

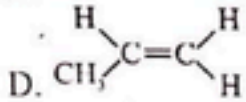
A. Cis-trans isomerism
B. Chain isomerism
C. Positional isomerism
D. Functional group isomerism

Q.52 The cis-isomerism is shown by MDCAT (2013)

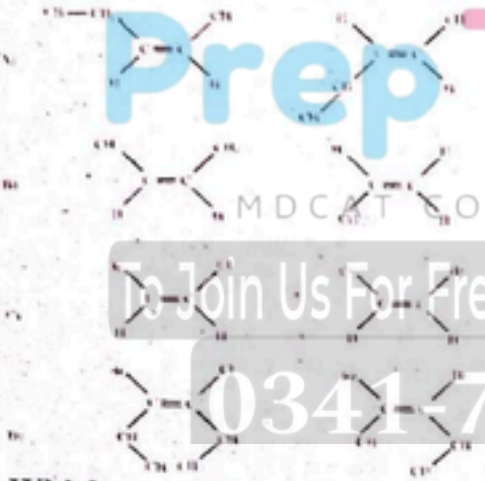
A. 

B. 

C. 

D. 

Q.53 Which one of the following pair of compound is cis and trans isomers of each other? MDCAT (2014)



Q.54 Which one of the following is a ketone? MDCAT (2014)

A. $CH_3—O—CH_2—CH_3$
B. $CH_3COCOOH$
C. $CH_3—CO—CH_2—CH_3$
D. $CH_3—CH_2CHO$

Q.55 The given three hydrocarbons are MDCAT (2015)



A. Alicyclic hydrocarbons
B. Acyclic Hydrocarbons
C. Aromatic hydrocarbons
D. Heterocyclic hydrocarbons

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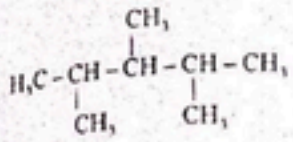
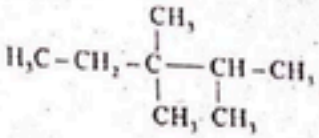
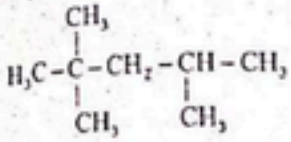
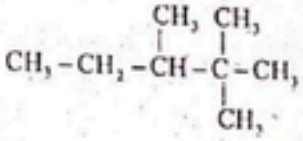
Q.56 The structural formula of 2,3,4 trimethylpentane is MDCAT (2015)

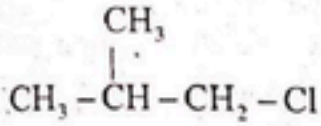
A. 

B. 

C. 

D. 

Q.57 The IUPAC name of the given compound is MDCAT (2015)



A. 1-Chloro-2-methylpropane
B. Isobutyl chloride
C. 1-Chloro-2-methylbutane
D. 2-Methyl-3-chloropropane

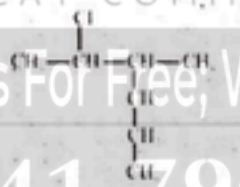
Q.58 Which one of the following pairs can be a cis-trans isomer to each other? MDCAT (2016)

A. $CHCl = CCl_2$ and $CH_2 = CH_2$
B. $CHCl = CH_2$ and $CH_2 = CHCl$
C. CH_3-CH=CH-CH_3 and H_3C-CH=CH-CH_3
D. CH_3-CH_3 and $CH_2 = CH_2$

Q.59 The type of structural isomerism which arises due to the difference in the nature of carbon chain or carbon skeleton is MDCAT (2017)

A. Chain isomerism
B. Cis-Trans isomerism
C. Position isomerism
D. Optical isomerism

Q.60 Which one of the followings is the best name according to IUPAC system for the formula given below? MDCAT (2017)



A. 4-methyl-6-chloro heptane
B. 2-chloro-3-methyl hexane
C. 2-chloro-4n propyl hexane
D. 2-chloro-4-n propyl pentane

Q.61 Cyclobutane structure is categorized under: MDCAT (2017)

A. Aromatic compounds
B. Aliphatic compounds
C. Alicyclic compounds
D. Heterocyclic compounds

Q.62 Name the compound, which shows geometric isomerism: MDCAT (2017)

A. 1-bromo-2-chloropropene
B. 2,3-dimethylpropene
C. 2-pentene
D. Both A and C

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Q.63 Which one is a functional group of carboxylic acid: MDCAT (2017)

A. $-\overset{\overset{O}{\|}}{C}-OH$

B. $-\overset{\overset{O}{\|}}{C}-$

C. $-\overset{\overset{O}{\|}}{C}-O-C$

D. None of these

Q.64 Butane molecule can have maximum no of isomers MDCAT (2018)

A. 2 B. 5

C. 4 D. 3

Q.65 Select one which is alcohol MDCAT (2018)

A. CH_3-O-CH_3 B. CH_3-CH_2-OH

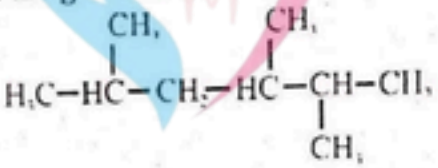
C. CH_3COOH D. CH_3-CH_2-Br

Q.66 In the following organic compound carbon atoms in all of them undergo both sp^3 and sp^2 hybridization except X, which has all sp^3 hybrid orbitals, identify X MDCAT (2018)

A. 1-Butanol B. Trans - 2 - butene

C. 2-Chloro - 2- butene D. Butanoic acid

Q.67 Have a critical look at the given structure



The IUPAC name of this compound is SET (2019)

A. 2-Methyl-4-isopropylpentane B. 2,3,5-Trimethylhexane

C. 2,4,5-Trimethylhexane D. 2-Isobutyl-3-methylbutane

Q.68 IUPAC name of Divinyl acetylene is NUMS (2019 RC)

A. 1,5- hexadiene-3-ene B. 1,5-hexadiene-3-yne

C. 3-Hexane-1,5-diyne D. 3-Hexyne-1,5-diene

Q.69 Diethyl ether and n-butanol are NUMS (2019 RC)

A. Position isomerism B. Functional isomerism

C. Chain isomerism D. Tautomerism

Q.70 The number of isomers of pentane is ETEA (2019)

A. 2 B. 4

C. 5 D. 3

Q.71 Which of the following is not the major source of organic compound? ETEA (2019)

A. Natural gas B. Petroleum

C. Coal D. Ammoniacal liqour

Q.72 $C_4H_{11}N$ gives the type of isomerism ETEA (2019)

A. Metamerism B. Optical isomerism

C. Tautomerism D. None of the above

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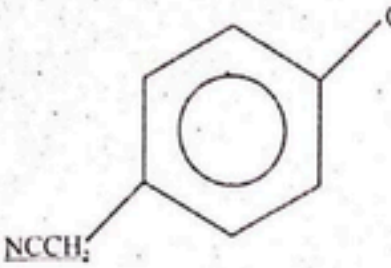
Q.73 The names of functional groups in the following compound X are; MDCAT (2019)



A. Primary alcohol, nitrile and benzene ring
B. Secondary alcohol, nitrile and aryl ring
C. Secondary alcohol, nitrile and phenol ring
D. Secondary alcohol, amine and benzene ring

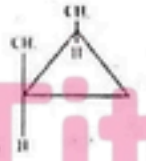
Q.74 Select the organic compound which belongs to arene family: NMDCAT (2020)

A. $CH_2 = CH_2$
B. $CH_3 - O - CH_3$
C. $CH_3 - NH_2$
D. C_6H_6

Q.75 The type of isomerism existing in a compound of molecular formula C_2H_6O is: NMDCAT (2020)

A. Functional group
B. Position
C. Chain
D. Metamerism

Q.76 Which of the following compound show geometric isomerism? NMDCAT (2020)

A. 
B. 
C. 
D. 

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Q.77 Generic formula of cycloalkane is NMDCAT (2020)

A. C_nH_{2n+2}
B. C_nH_{2n}
C. C_nH_{2n-1}
D. C_nH_{2n-2}

Q.78 In alkanes, each carbon has hybridization NMDCAT (2020)

A. sp^3
B. sp
C. sp^2
D. dsp

Q.79 Which of the following does not show metamerism? PMC (2021)

A. Ehters
B. Secondary amines
C. Ketones
D. Aldehydes

Q.80 Cyclic compounds consist of except? PMC (2021)

A. Alicyclic
B. Aromatic
C. Acyclic compounds
D. Carbocyclic compounds

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Q.81 Formula of ammonium cyanate — PMC (2021)
A. NH_4CNO B. $(NH_2)_2CO$
C. $H_2N\text{-}NH_2$ D. NH_4CN

Q.82 Formula of alkane — PMC (2021)
A. C_nH_{2n+2} B. C_nH_{2n}
C. C_nH_{2n-2} D. $C_nH_{2n+1}OH$

Q.83 In which of the following functional groups, the carbon atom is sp hybridized? UHS (2022)
A. -CHO B. -CN
C. -COOH D. -COOR

Q.84 The compounds containing R-SH functional group are known as: UHS (2022)
A. Alcohols B. Thio-ether
C. Thio-alcohols D. Nitrile

Q.85 What is the number of isomers of a hydrocarbon having a molecular formula, C_4H_8? UHS (2022)
A. 2 B. 4
C. 3 D. 5

Q.86 Homo-cyclic organic compounds are sub divided into two types namely: SZABMU (2022)
A. Alicyclic and Aromatic B. Open chain and branched chain
C. Aromatic and non-aromatic D. Anti-aromatic

Q.87 The type of isomerism arising due to shifting of proton from one atom to another in the same molecule is: SZABMU (2022)
A. Chain isomerism B. Metamerism
C. Tautomerism D. Position isomerism

Q.88 In alkanes each Carbon has hybridization: SZABMU (2022)
A. sp^3 B. sp
C. sp^2 D. dsp

Q.89 All of the following compounds are organic except: ETEA (2022)
A. KOCN B. C_2H_5OH
C. CH_3COCH_3 D. CH_3OH

Q.90 The isomers of a substance must have: ETEA (2022)
A. Same molecular mass B. Same chemical properties
C. Same structural formula D. Same functional group

Q.91 Optical activity of a compound is measure by and instrument called ETEA (2022)
A. Hydrometer B. Barometer
C. Calorimeter D. Polarimater

Q.92 The structural isomerism in which isomers are in dynamic equilibrium with each other is: ETEA (2022)
A. Chain isomerism B. Position isomerism
C. Metamerism D. tautomerism

Q.93 The first organic compound manufacture from inorganic compound was. DUHS (2022)
A. Ethyl acetate B. Urea
C. Acetic acid D. Methane
E. Acetone

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Q.94 What is the name of CH_3-CH_2-CH=CH-CH_2-CH=CH-CH_3? BMU (2022)
A. 2,3-octadiene
B. 2,4-octadiene
C. 2,5-octadiene
D. 2,5-octadyne

Q.95 Which of the following will have a meso isomer? BMU (2022)
A. 2-chlorobutane
B. 2,3-dichlorobutane
C. 2,3-dichloropentane
D. 1,2-dichlobutane

Q.96 Zwitter ions is also called? BMU (2022)
A. Double salt
B. Internal salt
C. Basic salt
D. Acidic salt

Q.97 Geometric isomerism is exhibited by: NUMS (2022)
A. Alcohol
B. Alkynes
C. Ethers
D. Alkenes

Q.98 What is vinyl alcohol and acetaldehyde? UHS (2023)
A. Position isomers
B. Chain isomers
C. Metamers
D. Tautomers

Q.99 Which of the functional group are present in ethyl acetate? UHS (2023)
A. Aldehyde group
B. Carboxyl group
C. Ester group
D. Ether group

Q.100 What is the molecular formula of pyridine molecule? UHS (2023)
A. C_6H_5N
B. C_5H_5N
C. C_5H_5NH
D. C_6H_6N

Q.101 Metamers differ from each other due to: SZABMU (2023)
A. Functional group
B. Position of functional group
C. Shifting of proton
D. Distribution of carbon atoms around the functional group

Q.102 Isomerism due to shifting of proton from one atom to another in a same molecule is known as: SZABMU (2023)
A. Metamerism
B. Tautomerism
C. Position
D. Functional

Q.103 The type of isomerism existing in a compound of molecular formula C_2H_6O is: SZABMU (2023)
A. Functional group
B. Position
C. Chain
D. Metamerism

Q.104 Identify the molecular formula of Furan: ETEA (2023)
A. C_4H_4O
B. C_3H_3O
C. C_6H_5O
D. C_4H_3O

Q.105 Pyrrole belongs to which class of compounds: ETEA (2023)
A. Hydrocarbons
B. Homocyclic
C. Alicyclic
D. Heterocyclic

Q.106 Alkoxy carbonyl functional group is present in ETEA (2023)
A. Ether
B. Aldehyde
C. Carboxylic acid
D. Ester

Q.107 Propylene glycol and trimethylene glycol are: ETEA (2023)
A. Functional group isomers
B. Metamers
C. Position isomers
D. Tautomer's

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Q.108 Organic compound are classified into: DUHS (2023)
A. Carbon compounds are non-carbon compounds
B. Open chain and closed chain compound
C. Homocyclic and heterocyclic compounds
D. Aromatic and cyclic compounds

Q.109 Which of following are the three isomers of pentane? DUHS (2023)
A. n-pentane, 2-methyl butane, 2,2-dimethyl propane
B. n-pentane, 2-methyl butane, 2,2-dimethyl butane
C. n-pentane, 3-methyl butane, 2,2-dimethyl butane
D. n-pentane, 2-methyl butane, 2,2-dimethyl propane

Q.110 Which type of isomerism can propanal and acetone exhibit? DUHS (2023)
A. Functional group isomerism
B. Chain isomerism
C. Position isomerism
D. Metamerism

Q.111 Number of primary carbon atoms present in isobutane is? BUMHS (2023)
A. One
B. Two
C. Three
D. Four

Q.112 Which functional group is characteristics of ester? BUMHS (2023)
A. R-O-R
B. R-CO-R
C. R-CO-OR
D. R-CO-OH

Q.113 The cracking method used to obtain better quality gasoline is: NUMS (2023)
A. Thermal
B. Catalytic
C. Steam
D. Radiations

Q.114 Homocyclic organic compounds are sub divided into two types namely: NUMS (2023)
A. Alicyclic and Aromatic
B. Open chain and branched chain
C. Aromatic and non-aromatic
D. Antiaromatic and anti-alicyclic

Q.115 General formula of cycloalkane is: NUMS (2023)
A. C_nH_{2n+2}
B. C_nH_{2n}
C. C_nH_{2n-1}
D. C_nH_{2n-2}

Q.116 1-Butene and 2-Butene are showing which type of isomerism? UHS (2024)
A. Functional Group
B. Metamerism
C. Position
D. Chain

Q.117 Which type of isomerism is displayed by compounds having same structural formula but different position of atoms on both sides of carbon double bond? UHS (2024)
A. Chain
B. Geometric
C. Metamerism
D. Tautomerism

Q.118 Homocyclic organic compounds are sub divided into two types namely; UHS (2024)
A. Alicyclic and Aromatic
B. Alkenes and Alkynes
C. Aromatic and Non-aromatic
D. Saturated and Unsaturated

Q.119 1-Butene and 2-Butene are showing which type of isomerism? UHS (2024)
A. Functional Group
B. Metamerism
C. Position
D. Chain

Q.120 Which type of isomerism is displayed by compounds having same structural formula but different position of atoms on both sides of carbon double bond? UHS (2024)
A. Chain
B. Geometric
C. Metamerism
D. Tautomerism

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Q.121 Homocyclic organic compounds are sub divided into two types namely: UHS (2024)
A. Alicyclic and Aromatic
B. Alkenes and Alkynes
C. Aromatic and Non-aromatic
D. Saturated and Unsaturated

Q.122 Which type of isomerism is shown by fumaric acid and maleic acid? SZABMU (2024)
A. Functional group isomers
B. Optical isomers
C. Geometrical isomers
D. Position isomers

Q.123 2-Hexanone and 3-Hexanone are best considered as SZABMU RC-(2024)
A. Metamers
B. Functional group isomers
C. Tautomers
D. Chain isomers

Q.124 Which of the following exhibits geometric isomerism SZABMU RC-(2024)
A. 1-propane
B. 2-hydroxy propanoic acid
C. Butenedioic acid
D. 2-butene

Q.125 Homo-cyclic organic compounds are sub divided into two types namely SZABMU RC-(2024)
A. Alicyclic and Aromatic
B. Aromatic and non-aromatic
C. Open chain and branched chain
D. Anti-aromatic

Q.126 Pyridine belongs to which class of organic compounds? ETEA (2024)
A. Alicyclic
B. Homocyclic
C. Heterocyclic
D. Hydrocarbon

Q.127 The number of Five-membered and six-membered rings in Bucky ball are respectively DUHS (2024)
A. 40 and 20
B. 5 and 15
C. 12 and 12
D. 14 and 14

Q.128 These hydrocarbons contain one or more double or triple bonds between the two adjacent carbon atoms in their structure DUHS (2024)
A. Alkenes and alcohol
B. Alkanes and alkyl halides
C. Alkenes and cycloalkanes
D. Alkenes and alkynes

Q.129 Urea was first synthesized by Wohler from an inorganic material named DUHS (2024)
A. Ammonium bicarbonate
B. Ammonium oxalate
C. Ammonium nitrate
D. Ammonium cyanate

Q.130 The initial discovery of natural gas in Pakistan dates back to _____ when it was in the sui area of Baluchistan (Out of syllabus) DUHS (2024)
A. 1955
B. 1956
C. 1954
D. 1952

Q.131 The early chemists never succeeded in synthesizing organic compounds and their failure led them to believe that organic compound could be manufactured BUMHS (2024)
A. with pure reagents
B. by and within living things
C. with pure organic solvents
D. at very high temperature and pressure

Q.132 Select the alkene showing geometrical isomerism NUMS (2024)
A. 3-Methyl-1-butene
B. 2,3-Dimethyl-2-butene
C. Methylcyclopentane
D. 3-Methyl-2-pentene

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ANSWER KEY

PRACTICE EXERCISE

1	C	11	D	21	B	31	C	41	D
2	D	12	A	22	C	32	D	42	C
3	B	13	C	23	B	33	A	43	A
4	B	14	D	24	C	34	A	44	B
5	D	15	C	25	C	35	D	45	C
6	A	16	A	26	A	36	A	46	D
7	C	17	C	27	C	37	D	47	C
8	D	18	D	28	C	38	B	48	B
9	C	19	A	29	B	39	B	49	C
10	A	20	B	30	A	40	A	50	C

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51	C	61	C	71	D	81	A	91	D	101	D	111	C	121	A	131	D
52	B	62	D	72	A	82	A	92	D	102	B	112	C	122	C	132	B
53	A	63	A	73	B	83	B	93	B	103	A	113	B	123	A	133	D
54	C	64	A	74	D	84	C	94	C	104	A	114	A	124	D		
55	C	65	B	75	A	85	C	95	B	105	D	115	B	125	A		
56	A	66	A	76	B	86	A	96	B	106	A	116	C	126	C		
57	A	67	B	77	B	87	C	97	D	107	C	117	B	127	C		
58	C	68	B	78	A	88	A	98	D	108	B	118	A	128	C		
59	A	69	B	79	D	89	A	99	C	109	A	119	C	129	D		
60	B	70	D	80	C	90	A	100	B	110	A	120	B	130	D		

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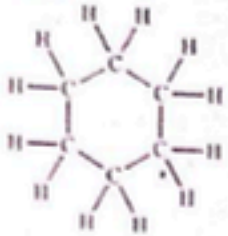
EXPLANATORY NOTES

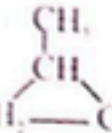
Q.11 Isobutane, isopentane and isobutylene are open chain acyclic compounds

Q.12 Carbon can form open chain (aliphatic and closed chain (alicyclic) compounds showing no aromatic character.

Q.13 C_nH_{2n+2} is valid only in case of saturated open chain hydrocarbons

Q.14 The formula of cyclohexane is following



Q.15 In methyl cyclopropane  there is one primary carbon, one tertiary carbon and two secondary carbon atoms

Q.16 The compounds which contain at least one atom other than carbon in the ring are heterocyclic compounds. The following are heterocyclic compound


Pyridine


Furan


Pyrrole


Thiophene


Naphthalene Naphthalene is homocylic

Q.17 Aliphatic or open chain compounds are further classified as straight chain and branched compounds

Q.18 In heterocyclic compounds only that heteroatom is possible which has valency of two or more. Therefore chlorine cannot be a heteroatom because it forms only one bond in order to complete its octet.

Q.19 A. Alicyclic, B. Branched hydrocarbon, C. Straight chain hydrocarbon and D. Aromatic compound

Q.20 Urea is first synthetic organic compound

$$NH_4CNO \rightleftharpoons NH_2CONH_2$$

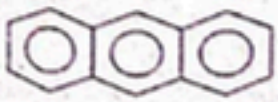
Ammonium cyanate Urea

Q.21


Pyridine

Pyridine is an example of heterocyclic compound.

Q.22


(Anthracene)

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Q.23

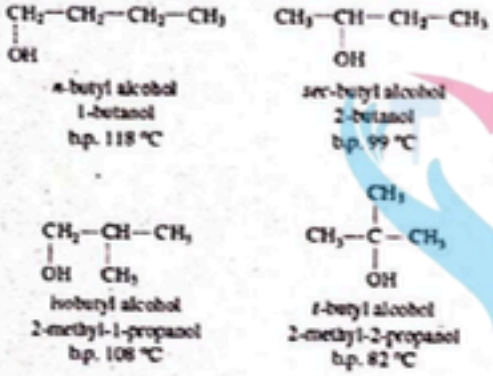
Functional group isomerism	Same molecular formula, but different functional groups	Different	propanal and propanone

Q.24

Metamerism	Unequal distribution of carbon atoms (R) on either side of functional group	Same	diethyl ether and methyl n-propyl ether

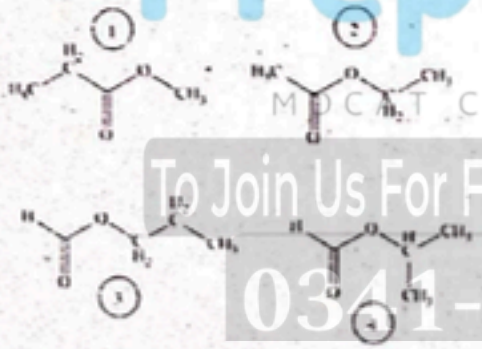
Q.25 In carboxylic acids position of functional group does not change therefore they do not show positional isomerism

Q.26



Q.27 Alkanes do not show geometrical isomerism due to free rotation around single bond

Q.28



Q.29 The shifting of proton within the molecule is called tautomerism

Q.30 In alkanes there is no functional group, therefore it can not show positional isomerism

Q.31 Thioether is similar to ether, but in place of O-atom, it has S-atom

Q.32 Structure of ethylene glycol and glycerol are given below



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Q.33

$-NH_2$ (Amino)

$>C=NH$ (Imino)

$-C\equiv N$ (Cyano)

$-\overset{\overset{O}{\|}}{C}-NH_2$ (Amide)

Q.34 Alcohols have OH-group as a functional group

Q.35 In aldehyde group, carbonyl carbon is linked with one H and one R group

$$R-\overset{\overset{O}{\|}}{C}-H$$

Q.36 Urea is organic compound which belongs to amide class

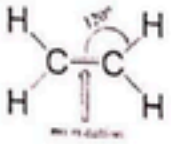
Q.37 Intermixing of one 2s and one 2p give two sp hybridized orbitals

Q.38 In sp^2 hybrid orbital

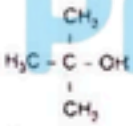
% of s character $=1/3 \times 100 = 33.3\%$

Q.39 In sp^3 % of p character $= 3/4 \times 100 = 75\%$

Q.40



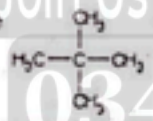
Q.41



t-Butyl Alcohol

Q.42

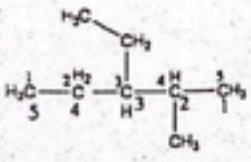
Neopentane



2,2-Dimethylpropane

Q.43 Propene is alkene which has general formula C_nH_{2n} and Propyne is alkyne with general formula C_nH_{2n-2}

Q.44



3-ethyl-2-methylpentane

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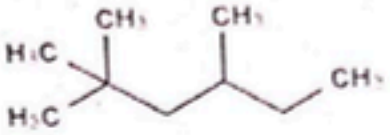
Q.45 No. of isomers of some alkanes are given

No. of carbon atoms in alkane	No. of isomers
4	2
5	3
6	5

Q.46 In some cases, isopropyl is considered as a branch in large chain hydrocarbons

Q.47



Q.48 The IUPAC name for carboxylic acid is used as alkanoic acid. The suffix is -oic

Q.49 Priority is given to functional group in nomenclature

Q.50 Aromatic compounds usually have some common name to identify them easily

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EXPLANATORY NOTES

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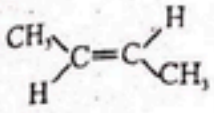
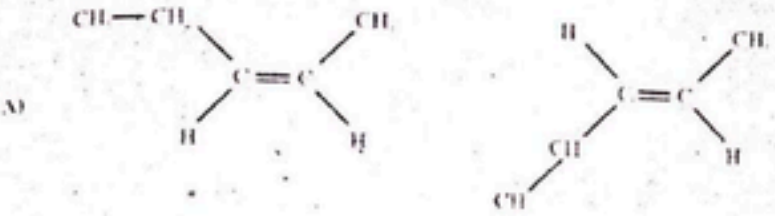
Q.51 1-chloroproane and 2-chloropropane are positional isomers of each other.

Q.52  this is trans structure and can be converted into cis form.

Q.53

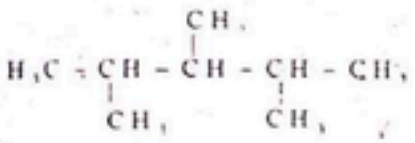


This pair shows cis-trans isomerism.

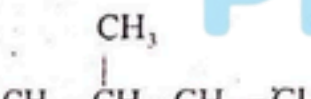
Q.54 $CH_3—CO—CH_2—CH_3$ this structure is the representation of ketone.

Q.55 The given compounds are aromatic hydrocarbon.

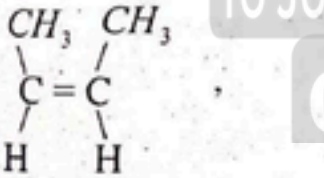
Q.56 The structural formula of 2,3,4 trimethylpentane is given below.



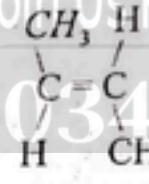
Q.57 The IUPAC name of the given compound is 1–Chloro-2-methylpropane



Q.58 The given structure show cis trans isomerism



cis-isomer



trans-isomer

Q.59 The type of structural isomerism which arises due to the difference in the nature of carbon chain or carbon skeleton is chain isomerism.

Q.60 2-chloro-3-methyl hexane is the IUPAC name of given structure.

Q.61 Cyclobutane is type of alicyclic hydrocarbons.

Q.62 1-bromo-2-chloropropene and 2,3-dimethylpropene both compounds can show geometric isomerism.

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Q.63 The correct representation of functional group of carboxylic acid is $-\overset{\overset{O}{\|}}{C}-OH$

Q.64 Butane has 2 isomers, n-butane and iso-butane.

Q.65 $CH_3–CH_2–OH$ is the structural formula of alcohol.

Q.66 In the given compounds, alcohols have all sp^3 hybrid carbons.

Q.67 2,3,5-Trimethylhexane is the IUPAC name of given compound.

Q.68 IUPAC name of divinylacetylene is 1,5- hexadiene-3-yne ($CH_2=CH-C\equiv C-CH=CH_2$)

Q.69 Diethyl ether and n-butanol are functional group isomers of each other.

Q.70 There are 3 isomers of pentane i.e. n-pentane, iso-pentane and neo-pentane.

Q.71 Ammonical liqour is not a source of organic compounds.

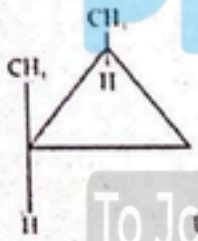
Q.72 $C_4H_{11}N$ can show metamerism ($CH_3-CH_2-NH-CH_2-CH_3$ and $CH_3-NH-CH_2-CH_2-CH_3$)

Q.73 Secondary alcohol, nitrile & aryl ring are present as functional groups in the given structure.

Q.74 C_6H_6 belongs to arene family.

Q.75 The type of isomerism existing in a compound of molecular formula C_2H_6O is functional group isomerism i.e. ethanol and dimethyl ether.

Q.76



this compound can show geometric isomerism.

Q.77 C_nH_{2n} is the general formula of cyclo alkanes as well as alkenes.

Q.78 All carbons in alkanes are sp^3 hybrid.

Q.79 Because position of functional group in aldehyde cannot be changed.

Q.80 Acyclic compounds are open chain compound they are non-cyclic.

Q.81 Formula of ammonium cyanate NH_4CNO.

Q.82 Formula of alkane C_nH_{2n+2}

Formula of alkene C_nH_{2n}

Formula of alkyne C_nH_{2n-2}

Q.83 In $-C\equiv N$ Carbon is Sp hybridized.

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Q.84 R-SH functional group is called the thio-alcohol.

Q.85 Isomers of C_4H_8 are (i) n- Butene (ii) Cis Butene (iii) Trans Butene.

Q.86 Homocyclic organic compounds have two types
(i) Alicyclic (without benzene) (ii) Aromatic (contain benzene ring)

Q.87 The type of isomerism arising due to shifting of proton from one atom to another in the same molecule is called Tautomerism.

Q.88 In alkanes each carbon is sp^3 hybridized.

Q.89 KOCN is salt and originated from inorganic compound.

Q.90 Isomers or substance have same molecular mass.

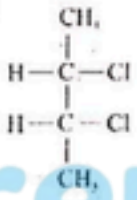
Q.91 Polarimater is used to measure the optical activity of compounds.

Q.92 Tautomerism is the structural isomerism in which isomers are in dynamic equilibrium with each other.

Q.93 Urea is the first organic compound which is manufactured from inorganic compound.

Q.94 The IUPAC name of $CH_3-CH_2-CH=CH-CH_2-CH=CH-CH_3$ is 2,5-octadiene.

Q.95 2,3-dichlorobutyne have meso isomer due to mirror image and plan of symmetry.



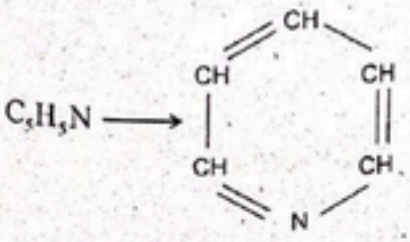
Q.96 Zwitter ion is also called internal salt.

Q.97 Alkenes show the geometric isomerism due to restricted rotation of double bond.

Q.98 The isomers having same molecular formula but different in the position of hydrogen atom are called tautomers and the phenomenon is called tautomerism.

Q.99 $CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5$ is an ester as it contains ester linkage.

Q.100 Molecular formula of the pyridine is:



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Q.101 Different distribution of carbon atom around functional group is present in metamerism.

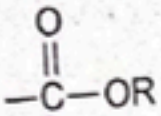
Q.102 Shifting of proton from one atom to another in some molecules is tautomerism.

Q.103 C_2H_6O show functional group isomerism because it molecular formula of ethyl alcohol and dimethyl ether with different functional group.

Q.104 Molecular formula of furan is C_4H_4O.

Q.105 Pyrrole is heterocyclic class because different atoms are present in ring

Q.106



Carbonyl and (-OR) alkoxy functional groups are present in esters.

Q.107 The compounds having same molecular formula but different position of same functional group on carbon chain are called positional isomers and the phenomenon is called position isomerism.

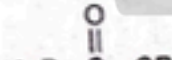
Q.108 Organic compounds are mainly classified into open chain or closed chain compounds.

Q.109



Q.110 Propanal and acetone has same molecular formula but different functional group.

Q.111 Number of primary (1°) carbon in isobutane are 3.

Q.112  is functional group of ester.

Q.113 Catalytic cracking used to obtain better quality of gasoline.

Q.114 "The compounds in which ring consists of only carbon atoms are called homocyclic or carbocyclic compounds." Homocyclic compounds are further classified as:

(a) Alicyclic compounds (b) Aromatic compounds

Q.115 General formula of cycloalkane is C_nH_{2n}.

Q.116 Same molecular formula but difference in the position of same functional group.

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Q117 The compounds which possess the same structural formula, but differ with respect to the positions of the identical groups in space are called cis-trans or geometric isomers and the phenomenon is known as cis-trans or geometric isomerism.

Q118 Homocyclic organic compounds are sub divided into two types namely Alicyclic and Aromatic.

Q119 1-Butene and 2-Butene are showing position isomerism

Q120 Isomerism is displayed by compounds having same structural formula but different position of atoms on both sides of carbon double bond called Geometric

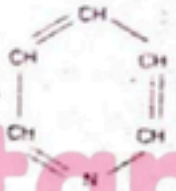
Q121 Homocyclic organic compounds are sub divided into two types namely Alicyclic and Aromatic.

Q122 Maleic acid (Cis -form) and fumaric acid (Trans-form) both are geometric isomers.

Q123 3-Hexanone and 2-Hexanone both are metamers.

Q124 2-butene show geometric isomerism because it has double bond and different groups attached to same carbon atom.

Q125 Homocyclic organic compounds are sub divided into two types namely alicyclic and aromatic compounds.

Q126 Pyridine belongs to heterocyclic compounds. $C_5H_5N \longrightarrow$ 

Q127 The number of Five–membered and six–membered rings in 12 and 12 Bucky ball are respectively

Q128 Double bond $(=)$ and triple bond $(\equiv)$ containing compounds are alkenes and alkynes.

Q129 $NH_4CNO \xrightarrow{\Delta} (NH_2)_2CO$

Q130 Natural gas is discovered in 1952 in Pakistan in the area of Sui in Balochistan.

Q131 The early chemists never succeeded in synthesizing organic compounds artificially and their failure led them to believe that organic compounds could be manufactured only by and within living things and these compounds could never be synthesized from inorganic materials in laboratory. This theory was referred to as vital force theory.

Q132 3-Methyl-2-pentene can show geometric isomerism due to it obey all conditions.

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Topic 14 CHEMISTRY OF HYDROCARBONS

PRACTICE EXERCISE

Q.1 The number of sigma and pi bonds in 2-butene are
A. $11\sigma, 1\pi$
B. $10\sigma, 2\pi$
C. $9\sigma, 2\pi$
D. $8\sigma, 3\pi$

Q.2 Which of the following compounds is more acidic?
A. CH_3Cl
B. $CH_3–C\equiv CH$
C. $CH_2=CH_2$
D. $HC\equiv CH$

Q.3 Position of double bond in alkenes can be determined by
A. Hydrogenation
B. Ozonolysis
C. Baeyer's test
D. Hydrogenolysis

Q.4 The addition of unsymmetrical reagent to an unsymmetrical alkene takes place in accordance with
A. Hund's rule
B. Octet rule
C. n + l role
D. Markovnikov's rule

Q.5 General formula of alkyl group is
A. C_nH_{2n+2}
B. C_nH_{2n+1}
C. C_nH_{2n-1}
D. C_nH_{2n-2}

Q.6 Which of the following is true for hydrogenation reaction?
A. Addition reaction
B. Exothermic reaction
C. Can be used to find number of pi-bonds
D. All are correct

Q.7 Cis-alkene is obtained from alkynes by
A. Partial hydrogenation in presence of $Na/liq.NH_3$
B. Partial hydrogenation in presence of Lindlar's catalyst
C. Complete hydrogenation in Ni
D. Both A and B

Q.8 Which of the following is true for halogenation of CH_4?
A. Extent of halogenation depends upon amount of halogen
B. Occurs in UV light or at high temperature
C. Involves free radical substitution
D. All are correct

Q.9 Sigma bonds in alkanes are
A. Very reactive
B. Stable
C. Inert
D. Both B and C

Q.10 Oxidation of benzene is possible by
A. $KMnO_4$ at 25°C
B. $K_2Cr_2O_7$ at 250°C
C. V_2O_5 at 400°C
D. Both A and B

Q.11 The extent of halogenation of alkanes depends upon the factors:
A. Intensity of UV light
B. Concentration of X_2 used
C. Temperature
D. Both A and B

Q.12 Propagation of free radical mechanism takes place by the
A. Reaction of free radical with free radical
B. Formation of two free radicals
C. Consumption as well as production of another free radical
D. Reaction between two molecules

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Q.13 The termination step in chlorination of methane in presence of diffused sun light is

A. $Cl_2 \longrightarrow 2\dot{C}l$
B. $CH_4 + \dot{C}l \longrightarrow \dot{C}H_3 + HCl$
C. $Cl_2\dot{C}H + \dot{C}l \longrightarrow HCCl_3$
D. $H_3\dot{C} + Cl_2 \longrightarrow H_3CCl + \dot{C}l$

Q.14 The most probable products are _____ when Cl_2 is supplied in very high excess to react with CH_4:

A. $CH_3Cl+HCl$
B. $CHCl_3+3HCl$
C. CH_2Cl_2+2HCl
D. CCl_4+4HCl

Q.15 Halogenation of alkane is believed to proceed through

A. Free radical substitution mechanism
B. Nucleophilic addition mechanism
C. Electrophilic substitution mechanism
D. Nucleophilic substitution mechanism

Q.16 The ease of dehydration of alcohols to produce alkenes is of the order:

A. Tertiary > Secondary > Primary
B. Primary > Secondary > Tertiary
C. Secondary < Primary < Tertiary
D. Tertiary < Secondary < Primary

Q.17 Dehydration of alcohols with conc. H_2SO_4 at 180°C gives:

A. Ethers
B. Esters
C. Alkenes
D. Alkyl halides

Q.18 Elimination of a halogen atom together with a hydrogen atom from an alkyl halide produces:

A. Alkanes
B. Alkenes
C. Alkynes
D. Alcohols

Q.19 Dehydrohalogenation of RX occurs in the presence of

A. An alcoholic base
B. An alcoholic acid
C. An alcoholic salt
D. An alcoholic Grignard reagent

Q.20 Which of the following is not used for the dehydration of alcohols?

A. P_4O_{10}
B. HNO_3
C. H_2SO_4
D. H_3PO_4

Q.21 What type of reaction occurs between ethene and hydrogen?

A. Addition
B. Neutralization
C. Dehydration
D. Oxidation

Q.22 Which of the following will decolorize bromine water?

A. 1-Pentene
B. Pentane
C. 2-Methyl-1-butene
D. Both "A" and "C"

Q.23 Which of the following test can be used for distinguishing an alkane and an alkene

A. Bromine water test
B. Hydroxylation
C. Ozonolysis
D. Both "A" and "B"

Q.24 Hydroxylation of alkenes produce

A. Diols
B. Vicinal diols
C. Geminal diols
D. Mono-ols

Q.25 The preparation of vegetable ghee involves

A. Halogenation
B. Hydrogenation
C. Hydroxylation
D. Dehydrogen

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Q.26 The test for unsaturation of organic compounds is carried out by treating alkenes with 1% dilute alkaline $KMnO_4$ solution. The colour of $KMnO_4$ is discharged with the formation of
A. Ethylene glycol
B. Vicinal glycol
C. Glyoxal
D. Oxalic acid

Q.27 In which addition reaction Markownikov's rule is not obeyed:
A. $CH_3CH = CH_2 + HCl \rightarrow$
B. $CH_3CH_2CH = CH_2 + HI \rightarrow$
C. $CH_3CH = CH_2 + HBr \rightarrow$
D. $CH_3CH = CHCH_3 + HBr \rightarrow$

Q.28 In addition of HCl to $CH_3CH = CH_2$, which one will be added first:
A. Cl^*
B. Cl^{-1}
C. H^+
D. H^*

Q.29 Which of the following is mono-ene
A. 1,3-Butadiene
B. 1-Butyne
C. 1-Butene
D. 1,2-Butadiene

Q.30 Baeyer's reagent is used in the laboratory for
A. Reduction
B. Oxidation
C. Detection of double bond
D. Detection of glucose

Q.31 The only alkyne which gives an aldehyde upon addition of water
A. Ethyne
B. Propyne
C. 1-butyne
D. 2-butyne

Q.32 Which of the following is not acidic in nature
A. Ethyne
B. Propyne
C. 1-butyne
D. 2-butyne.

Q.33 Which of the following is most reactive to give electrophilic addition reactions
A. Alkane
B. Alkene
C. Benzene
D. Alkyne

Q.34 Acetone is prepared by the hydration of
A. Ethyne
B. Propyne
C. Ethane
D. Propane

Q.35 Acetylene gives _____ precipitates with $AgNO_3$ in ammonium hydroxide solution
A. White
B. Red
C. Orange
D. Yellow

Q.36 Which of the following compound reacts with sodium to yield hydrogen gas
A. $CH_3–CH_3$
B. $CH_3–CH = CH_2$
C. $CH \equiv CH$
D. $CH_3–C \equiv C–CH_3$

Q.37 Total number of hybrid orbitals of all the carbon atoms in benzene are:
A. 3
B. 6
C. 12
D. 18

Q.38 The resonance energy of benzene is
A. –119.5kJ/mole
B. –358.5kJ/mole
C. +150.5kJ/mole
D. –208kJ/mole

Q.39 How many π electrons are there in benzene to form delocalized electronic cloud?
A. 3
B. 4
C. 8
D. 6

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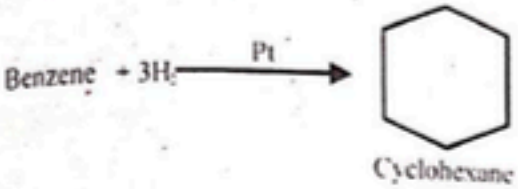
Q.40 What is required other than anhydrous $AlCl_3$, when toluene is prepared by Friedal craft reaction?
A. C_6H_6
B. $C_6H_6 + CH_3Cl$
C. $C_6H_5C_2H_5$
D. C_6H_5Cl and CH_3Cl

Q.41 Which of the following is produced by the action of CH_3Cl on benzene in presence of $AlCl_3$ followed by oxidation in the presence of acidified $KMnO_4$ give
A. Toluene
B. o-Xylene
C. m-Xylene
D. Benzoic acid

Q.42 The conversion of benzene into cyclohexane is _____
A. Exothermic process
B. Isothermic process
C. Endothermic process
D. Both A and B



Q.43 This reaction is an example of:
A. Addition reaction
B. Substitution reaction
C. Elimination reaction
D. Polymerization

Q.44 X is decolourized when alkyl benzene are readily oxidized to benzoic acid, X is
A. Aqueous $KMnO_4$ or $K_2Cr_2O_7$
B. Cold dilute alkaline $KMnO_4$ or $K_2Cr_2O_7$
C. Alcoholic $KMnO_4$ or $K_2Cr_2O_7$
D. Acidified $KMnO_4$ or $K_2Cr_2O_7$

Q.45 Benzoic acid is the only oxidation product along with formation H_2O and CO_2, of an organic compound A, when A is treated with acidified potassium dichromate, A is
A. Ethyl benzene
B. Benzoyl halide
C. Aniline
D. Benzophenone

Q.46 Benzoic acid is the main product when _____ is oxidized by acidified $K_2Cr_2O_7$
A. $C_6H_5CH_3$
B. $C_6H_5CH_2CH_2CH_3$
C. $C_6H_5CH_2CH_3$
D. All of these

Q.47 The oxidation of toluene by acidified $KMnO_4$ produces
A. Phenol
B. Benzaldehyde
C. Benzyl alcohol
D. Benzoic acid

Q.48 Most reactive compound among the following:
A. Benzene
B. Benzoic acid
C. Nitrobenzene
D. Ethyl benzene

Q.49 Which group deactivates the benzene ring?
A. $-NH_2$
B. $-CHO$
C. $-OR$
D. $-OH$

Q.50 Benzene $\xrightarrow[FeCl_3]{Cl_2}$ Y $\xrightarrow{HNO_3 + H_2SO_4}$ Z. Z in this reaction is possibly
A. Benzene
B. Chlorobenzene
C. 3-Chloronitrobenzene
D. 2-Chloronitrobenzene

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Topic 14 CHEMISTRY OF HYDROCARBONS

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Q.51 When hydrogen atom is removed from benzene, group left is called: MDCAT (2010)

A. Alkyl group
B. Phenyl group
C. Benzyl group
D. Methyl group

Q.52 The introduction of NO_2 group in the benzene ring is called nitration. The nitration of benzene takes place when it is heated with a 1:1 mixture of ----------at 50-55°C MDCAT (2010)

A. Conc. HNO_3 and Conc. H_2SO_4
B. Conc. HNO_3 and Conc. HCl
C. Conc. HNO_3 and Conc. Acetic acid
D. Conc. HNO_3 and Conc. H_3PO_4

Q.53 Ethyne molecule is formed when two carbon atoms joined together to form a sigma bond only: MDCAT (2010)

A. sp-s overlap
B. sp-sp overlap
C. sp^2-sp^2 overlap
D. 2py-2py overlap

Q.54 Hydrogenation of unsaturated oils is done by using MDCAT (2011)

A. Finely divided nickel
B. Finely divided iron
C. Vanadium pentaoxide
D. Copper

Q.55 The substitution of –H group by $-NO_2$ group in benzene is called MDCAT (2011)

A. Nitration
B. Ammonolysis
C. Sulphonation
D. Reduction of benzene

Q.56 Benzene in presence of $AlCl_3$ gives acetophenone when reacts with MDCAT (2011)

A. Acetyl chloride
B. Acetic acid
C. Ethyl benzene
D. Ethanoic acid

Q.57 In the reaction of ethene with bromine the intermediate formed is MDCAT (2012)

A. $\begin{matrix} CH_2 & & CH_2 \\ & \overset{+}{Br} & \\ CH_2 & & CH_2 \end{matrix}$
B. $\begin{matrix} CH_2 & & CH_2 \\ & Br & \end{matrix}$
C. Br
D. $CH_2 \quad CHBr$

Q.58 Ethene on polymerization, give the product polyethene, this reaction may be called as MDCAT (2012)

A. Addition
B. Substitution
C. Condensation
D. Pyrolysis

Q.59 The introduction of $R-\overset{\overset{O}{\|}}{C}$ group in benzene is called MDCAT (2012)

A. Acylation
B. Alkylation
C. Carbonyl reduction
D. Formylation

Q.60 What is the product formed when propene reacts with HBr? MDCAT (2013)

A. $CH_3-CH_2-CH_2Br$
B. $\begin{matrix} CH_2 & - & CH & - & CH_3 \\ | & & | & & \\ Br & & Br & & \end{matrix}$
C. $BrCH_2-CH=CHBr$
D. $\begin{matrix} CH_3 & - & CH & - & CH_3 \\ & & | & & \\ & & Br & & \end{matrix}$

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Q61 The introduction of an alkyl group in benzene takes place in the presence of $AlCl_3$ and: MDCAT (2013)

A. $R-\overset{O}{\overset{\|}{C}}-OH$
B. $R-\overset{O}{\overset{\|}{C}}-Cl$
C. $R-Cl$
D. $R-\overset{O}{\overset{\|}{C}}-O-$

Q62 Addition of unsymmetrical reagent to an unsymmetrical alkene is governed by: MDCAT (2014)

A. Cannizzaro's Reaction
B. Aldol condensation
C. Krichoff Rule
D. Markownikov's Rule

Q63 Order of reactivity of alkenes with hydrogen halide is MDCAT (2015)

A. HBr > HI > HCl
B. HF > HI > HCl
C. HI > HCl > HBr
D. HI > HBr > HCl

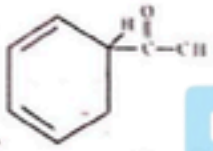
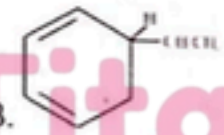
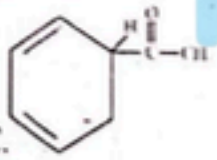
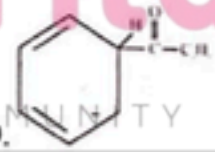
Q64 Which one of the following is a powerful electrophile used to attack on the electrons of benzene ring? MDCAT (2015)

A. $FeCl_2$
B. Cl^+
C. $FeCl_4^-$
D. Cl_2

Q65 The reaction of benzene with bromine in the presence of $FeBr_3$ follows the mechanism of _____ reaction MDCAT (2017)

A. Electrophilic addition
B. Electrophilic substitution
C. Nucleophilic substitution
D. Nucleophilic addition

Q66 Intermediate product formed when propanoyl chloride reacts with benzene is MDCAT (2017)

A. 
B. 
C. 
D. 

Q67 When benzene reacts with Acetyl chloride (CH_3COCl) in the presence of$AlCl_3$ acetophenone is formed. The electrophile in this reaction will be MDCAT (2017)

A. CH_3C^+O
B. C^+H_3
C. $AlCl_3$
D. CH_3COCl

Q68 Which of the following species are 3,5(meta directing groups when second group is introduced into the benzene ring MDCAT (2017)

I = $-NH_2$ II = $-CHO$ III = $-COOH$ IV = $-CH_3$

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

Q69 For halogenation of benzene, which reagent is used: MDCAT (2017)

A. H_2SO_4
B. HNO_3
C. $AlCl_3$
D. HCl

Q70 Chlorination and Bromination mostly uses: MDCAT (2017)

A. Radiowaves
B. Infrared radiation
C. Visible light
D. U.V light

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Q.71 Among the following, which one has electron withdrawing effect: MDCAT (2017)

A. $-NH_2$
B. -CHO
C. $-N(CH_3)_2$
D. –I

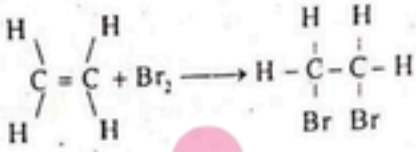
Q.72 Reaction mechanism of alkanes with halogens is known as MDCAT (2018)

A. Addition
B. Elimination
C. Free radical substitution
D. Propagation

Q.73 Which compound is obtained by the elimination of bromopropane? MDCAT (2018)

A. Butene
B. Propene
C. Ethene
D. Propane

Q.74 Bromination of alkene is shown in the following reaction. This reaction is used for: MDCAT (2018)



A. Identification of primary and secondary alcohols
B. Detection of double bond
C. Detection of aldehydes
D. Detection of ketones

Q.75 Which one of the following acts as a electrophile in the electrophilic substitution of benzene with bromine MDCAT (2018)

A. Br^+
B. $FeCl_4^-$
C. Fe^{+3}
D. Fe^{+2}

Q.76 In Friedal Craft's Chlorination of Benzene, Iron III chloride acts as a catalyst, which is the initial reaction in the generation of an electrophile? SET (2019)

A. $Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_3^-$
B. $Cl_2 + FeCl_3 \rightarrow 2Cl^+ + FeCl_2^-$
C. $Cl_2 + FeCl_3 \rightarrow Cl^- + FeCl_4^+$
D. $Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_4^-$

Q.77 Which of the options show all possible products of combustion of Butene? SET (2019)

A. $CO+CO_2+H_2O$
B. CO_2+H_2O
C. $C+CO+CO_2$
D. $C+CO+CO_2+H_2O$

Q.78 In the reaction sequence given here

$H_3C-CH_3 + Br_2 \xrightarrow{Im} A \xrightarrow{AlcKOH} B$ **The end product is an unsaturated hydrocarbon. Identify the nature of reaction in the two steps.** SET (2019)

A. Step I is a nucleophilic substitution and step II is elimination
B. Step I is addition and step II is nucleophilic substitution
C. Step I is free radical substitution and step II nucleophilic substitution
D. Step I is free radical substitution and step II is elimination

Q.79 Homolysis of a covalent bond yields a very reactive species with incomplete octet in its valence shell. What is this species? SET (2019)

A. A complex ion
B. An electrophile
C. A free radical
D. A nucleophile

Q.80 Order of reactivity of halogen toward alkane is NUMS (2019)

A. $F_2>I_2>Br_2>Cl_2$
B. $F_2>Br_2>Cl_2>I_2$
C. $F_2>Cl_2>Br_2>I_2$
D. $F_2>Cl_2>I_2>Br_2$

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Q.81 Acetone can be obtained by ozonolysis NUMS (2019)
A. 2-Batyne
B. 2-Butene
C. iso-butene
D. 1-butene

Q.82 Which catalyst is used in oxidation of benzene ring? NUMS (2019)
A. $FeBr_3$
B. V_2O_5
C. $Fe+Al_2O_3$
D. Raney Ni

Q.83 Which of the following compound react slower than benzene in electrophilic substitution reaction NUMS (2019)
A. Nitrobenzene
B. Phenol
C. Aniline
D. Toulene

Q.84 The correct order of the reactivity of hydrocarbon given below is ETEA (2016)
A. $C_2H_4 > C_2H_2 > C_6H_6$
B. $C_6H_6 > C_2H_4 > C_2H_2$
C. $C_2H_2 > C_2H_4 > C_6H_6$
D. $C_2H_2 > C_6H_6 > C_2H_4$

Q.85 Select meta directing group of the following? ETEA (2016)
A. –OH
B. $-NR_2$
C. –CN
D. –OR

Q.86 A gas decolorizes alkaline $KMnO_4$ solution but does not give any PPT with ammonical $AgNO_3$ ETEA (2019)
A. Methane
B. Ethylene
C. Ethane
D. None of the above

Q.87 An olefin "X" on ozonolysis gives $CH_3CH_2COCH_3$ and CH_3COCH_3. The IUPAC name of X is: ETEA (2019)
A. 2-Butane
B. 2-3 Di methyl-2-pentene
C. 2-Pentene
D. 1-Hexene

Q.88 Treatment of ethene with cold sulphuric acid followed by reaction with boiling water yields: MDCAT (2019)
A. Ethyne
B. Ethane
C. Ethanal
D. Ethanol

Q.89 Alkenes undergo: MDCAT (2019)
A. Nucleophilic substitution
B. Electrophilic Addition
C. Nucleophilic addition
D. Electrophilic substitution

Q.90 Which of the following molecule shows cis – trans isomers? MDCAT (2019)
A. C_2HCl_3
B. $C_2H_2Cl_2$
C. C_2H_4
D. $C_2H_2Br_2$

Q.91 In the reaction sequence: MDCAT (2019)

$$H_3C-CH_2-CH_2-Br + AlcKOH \longrightarrow C \xrightarrow[H_2O]{H_2SO_4} D$$

Product D will be
A. Mixture of methanol and ethanol
B. 2-propanol
C. 1-Propanol
D. Propanoic acid

Q.92 Which of the following reactions is used for the production of alcohols on industrial scale? MDCAT (2019)
A. Hydrohalogenation of alkenes
B. Hydration of alkenes
C. Hydroxylation of alkenes
D. Hydrogenation of alkenes

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3 Which derivative of benzene shows maximum reactivity in electrophilic substitution reactions? MDCAT (2019)
A. Benzaldehyde B. Methyl benzene
C. Benzoic acid D. Nitrobenzene

4 Electrophile in sulphonation of benzene is NMDCAT (2020)
A. HSO_4 B. H_2SO_4
C. SO_3 D. HSO_3

95 Acetophenone can be formed by which of the following reaction of benzene? NMDCAT (2020)
A. Alkylation B. Acylation
C. Halogenation D. Nitration

96 When CH_3 is attached with the benzene ring, it makes the ring: NMDCAT (2020)
A. Good electrophile B. Good nucleophile
C. Resonance hybrid D. Extraordinary stable

97 Ethene has pi bonds?
A. 1 B. 2
C. 3 D. 4

98 Benzene does not show PMC (2021)
A. Addition reactions B. Substitution receptions
C. Elimination reactions D. Oxidation reactions

99 Which of the following is marsh gas PMC (2021)
A. Methane B. Ethane
C. Propane D. Butane

Q.100 Which of the following act as electrophile during nitration of benzene? PMC (2021)
A. NO^+ B. NO_2^+
C. NO_3^+ D. HNO_2^+

Q.101 Alkyl benzene is formed when benzene is treated with an alkyl halide in the presence of anhydrous $AlCl_3$. Identify the type of reaction. UHS (2022)
A. Halogenation B. Friedel-Crafts acylation reaction
C. Friedel-Crafts alkylation reaction D. Sulphonation

Q.102 Three alternate single and double bonds in benzene are called? UHS (2022)
A. Conjugate bonds B. Co-ordinate covalent bonds
C. Fixed bonds D. Ionic bonds

Q.103 Which of the following compound is more acidic? UHS (2022)
A. Alkane B. Alkyne
C. Alkene D. Cycloalkane

Q.104 Consider the chlorination of CH_4, the attack of chlorine free radical on CH_4 form methyl free radical occurs in? UHS (2022)
A. Initiation step B. Propagation step
C. Termination step D. Last step

Q.105 The ratio of sigma to pi electrons in benzene is? UHS (2022)
A. 1:3 B. 4:1
C. 3:1 D. 1:4

Q.106 Which of the following is not oxidized by any oxidizing agent? SZABMU (2022)
A. Benzene B. Toluene
C. Ethylbenzene D. Xylene

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Q.107 The correct order of reactivity of hydrocarbons is SZABMU (2022)
A. Alkanes>Alkynes>Alkenes
B. Alkenes>Alkanes>Alkynes
C. Alkynes>Alkenes>Alkanes
D. Alkenes>Alkynes>Alkanes

Q.108 Reactivity order of halogen acid is SZABMU (2022)
A. HF > HCl > HBr > HI
B. HBr > HCl > HI
C. HCl > HBr > HI > HF
D. HI > HBr > HCl > HF

Q.109 Which of the following compounds has highest boiling point? ETEA (2022)
A. Cyclohexane
B. Cyclopentane
C. Cycloheptane
D. Cyclobutane

Q.110 Propyne reacts with aqueous sulphuric acid in the presence of $HgSO_4$ to form: ETEA (2022)
A. Acetone
B. 1-Propanol
C. 2-Propanol
D. Acetaldehyde

Q.111 The electrophile which is considered to be the active agent in the nitration of benzene is: ETEA (2022)
A. NO^+_2
B. NO^-_2
C. NO^+
D. NHO^+_2

Q.112 Isopropyl benzene is also called _____. ETEA (2022)
A. Cumene
B. Xylene
C. Toluene
D. Cresol

Q.113 Benzene is subjected to alkylation nitration & oxidation the product is: DUHS (2022)
A. o & p nitro toluene
B. m – nitro benzoic acid
C. m – nitro toluene
D. o & p nitro benzoic acid
E. o – nitro benzoic acid

Q.114 Catalytic hydrogenation of oil gives DUHS (2022)
A. Alkene
B. Alkyne
C. Soap
D. Alkyl halides
E. Fat

Q.115 Benzene also undergoes electrophilic substitution when treated with fuming sulfuric acid for several hours. The electrophile in this reaction is? BMU (2022)
A. SO_2
B. SO_3
C. SO_4
D. H_2SO_4

Q.116 Michael Faraday discovered benzene in the gas formed from? BMU (2022)
A. Destructive distillation
B. Fractional distillation
C. Steam distillation
C. Vacuum distillation

Q.117 IUPAC name of the following compounds is CH_3-$(CH_2)_3$-$C(CH_3)_3$? BMU (2022)
A. 2-methyl hexane
B. Neo-octane
C. 5,5-dimethyl pentane
D. 2,2-dimethyl hexane

Q.118 Which of the following isomer of pentane have least melting and boiling point? BMU (2022)
A. n-Pentane
B. iso-Pentane
C. neo-Pentane
D. 2-Methyl Butane

Q.119 The resonance hybrid structure of benzene is _____ KJ/mole more stable than the hypothetical 1,3,5-Cyclohexatriene. BMU (2022)
A. 358.5
B. 208
C. 150.5
D. 231.5

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Q.120 The addition reaction of 2-butene with HBr produces? UHS (2023)
A. 1-bromobutane
B. 2-bromobutane
C. 1,3-dibromobutane
D. 2,3-dibromobutane

Q.121 Under suitable conditions alkanes cannot undergo _____ reactions? UHS (2023)
A. Substitution
B. Combustion
C. Hydrogenation
D. Addition

Q.122 Alkylbenzene is formed when benzene is treated with an alkyl halide in the presence of anhydrous aluminum chloride. Identify the type of reaction. UHS (2023)
A. Halogenation
B. Friedel-Crafts acylation reaction
C. Friedel-Crafts alkylation reaction
D. Sulphonation

Q.123 When 2-bromopropane reacts with Sodium ethoxide, the major product is/are_____? UHS (2023)
A. Propane
B. Propene
C. Ethyl isopropyl ether
D. All are formed

Q.124 Propanone can be prepared from propyne by: UHS (2023)
A. Passing a mixture of propyne and steam over a catalyst, magnesium at 420°C
B. Passing a mixture of propyne and ethanol over a catalyst, zinc chromate
C. Boiling propyne with water in the presence of $HgSO_4$ and H_2SO_4
D. Treating propyne with iodine and NaOH

Q.125 Identify which method is used to prepare Alkynes? UHS (2023)
A. Dehalogenation of Vicinal Dihalides in the presence of methanol
B. Dehydration of Alcohols in the presence of Al_2O_3 at 340-450-degree centigrade
C. Dehydration of Vicinal Dihalides in the presence of strong base
D. Electrolysis of di carboxylic acid salts

Q.126 Which of the following will not give substitution reaction? SZABMU (2023)
A. $CH_3 - CH_3$
B. $CH_2 = CH_2$
C. $CH \equiv CH$
D. C_6H_6

Q.127 If both double and triple bonds are present, then ending given to the root is: SZABMU (2023)
A. enyne
B. ene
C. yne
D. ane

Q.128 Which compound is least reactive? SZABMU (2023)
A. Ethane
B. Ethene
C. Benzene
D. Ethyne

Q.129 Which one of the following is not meta directing group? ETEA (2023)
A. –COR
B. $-NO_2$
C. –CHO
D. $-NR_2$

Q.130 Identify the electrophile called as acylium ion: ETEA (2023)
A. R_3N^+
B. RCO^+
C. $RCOO^+$
D. RNO^+

Q.131 Among the following hydrocarbons which one has acidic hydrogen? ETEA (2023)
A. C_2H_6
B. C_2H_4
C. C_2H_2
D. C_3H_6

Q.132 What hybridization is present on carbon atoms in Ethyne C_2H_2? DUHS (2023)
A. sp^3
B. sp^2
C. sp
D. dsp^2

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Q.133 When benzene reacts with isopropyl chloride in the presence of $AlCl_3$ as Lewis acid, the product formed is isopropyl benzene. What is this reaction called? DUHS (2023)
A. Friedel Craft Acylation
B. Friedel Craft Alkylation
C. halogenation of benzene
D. Benzene sulphuric acid

Q.134 Benzene is subjected to (1) Alkylation (2) Nitration (3) Oxidation the product is: DUHS (2023)
A. m-nitrobenzoic acid
B. o-nitro benzoic acid and p-nitro benzoic acid
C. m-nitro toluene
D. o-nitro toluene and p-nitro toluene

Q.135 Oxidation of toluene by $KMnO_4$, the product is: DUHS (2023)
A. o-nitro toluene
B. p-nitro toluene
C. m-nitro toluene
D. Benzoic acid

Q.136 What of the following produces maleic anhydride, on oxidation of: DUHS (2023)
A. Acetylene
B. Phenol
C. Toluene
D. Benzene

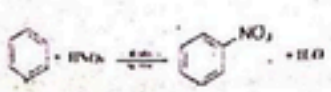
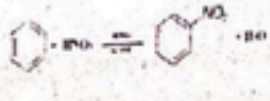
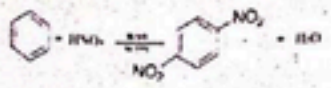
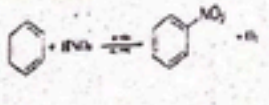
Q.137 The acylium ion has a positive charge and act as? BUMHS (2023)
A. Nucleophile
B. Electrophile
C. Carbocation
D. Carbanion

Q.138 What do we mean by term 'delocalized electrons' in benzene? BUMHS (2023)
A. Electrons that are free to move around the molecule in the pi bonding system above and below the plane of the carbon atoms in the benzene ring.
B. Electrons that are not free to move around the molecule in the pi bonding system above and below the plane of the carbon atoms in the benzene ring
C. Electrons that are free to move around the molecule in the sigma bonding system above and below the plane of the carbon atoms in the benzene ring.
D. Electrons that are free to move around the molecule in the pi bonding in the benzene ring.

Q.139 The hydrocarbon which has isolated rings and is aromatic? BUMHS (2023)
A. Phenanthrene
B. Triphenylmethane
C. Diphenylether
D. Anthracene

Q.140 Acetophenone can be formed by which of the following reaction benzene? NUMS (2023)
A. Alkylation
B. Acylation
C. Halogenation
D. Nitration

Q.141 Which of the following is an example of substituent group which release electrons to benzene ring: UHS (2024)
A. CN
B. NR_3^+
C. NH_2
D. NO_2

Q.142 Which of the following represents nitration of benzene correctly? UHS (2024)
A. 
B. 
C. 
D. 

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Q.143 In Friedel Craft acylation, an acyl group is introduced in benzene ring in the presence of catalyst: UHS (2024)

A. $AlCl_3$ B. H_2SO_4
C. Sunlight D. V_2O_5

Q.144 What will be the IUPAC name of neopentane? SZABMU (2024)

A. 2,2-Dimethypentane B. 2,2-Dimethypropane
C. 2-Methylbutane D. 3-Methylbutane

Q.145 The saturated alicyclic hydrocarbons have the general formula _____. SZABMU (2024)

A. C_nH_{2n} B. C_nH_{2n+1}
C. C_nH_{2n+2} D. C_nH_{2n-2}

Q.146 Which compound is used as a reference for calculating the extent of stability of benzene? SZABMU (2024)

A. Cyclohexane B. Cyclohexene
C. 1,3,5- Cyclohexene D. 1,3,5-Cyclohexatriene

Q.147 Which type of catalyst is used during electrophilic substitution reactions of benzene? SZABMU (2024)

A. Amphoteric B. Lewi's acid
C. Lewis's base D. Transition metals

Q.148 What is the IUPAC name of given compound? CH_3-CH=CH-CH_2-C≡CH SZABMU (2024)

A. 2-Hexen-5-yne B. 2-Hexen-6-yne
C. 4-Hexen-1-yne D. 5-Hexen-1-yne

Q.149 The common name of 1,3-dihydroxy benzene is SZABMU RC-(2024)

A. Mesitylene B. Resorcinol
C. Durene D. Anthracene

Q.150 Resonance energy of benzene is SZABMU RC-(2024)

A. 308 KJ or 55.2 Kcal/mol B. 231 KJ or 36 Kcal/mol
C. 208 KJ or 28.6 Kcal/mol D. 152 KJ or 36 Kcal/mol

Q.151 The homolytic fission of C-H bond in an alkane results ETEA (2024)

A. Alkyl free radical B. Carbanion
C. Carbocation D. Methylpropane

Q.152 Addition of HBr to isobutylene mainly gives ETEA (2024)

A. isobutyl bromide B. n-butyl bromide
C. sec-butyl bromide D. tert-butyl bromide

Q.153 The carbon atom carrying positive charge and attached to three other atoms or groups is called ETEA (2024)

A. Carbanion B. Carbene
C. Carbocation D. Oxonium

Q.154 In Friedel Craft acylation, an acyl group is introduced in benzene ring in the presence of catalyst: DUHS (2024)

A. $AlCl_3$ B. H_2SO_4
C. Sunlight D. V_2O_5

Q.155 When an unsymmetrical alkene undergoes addition reactions, the negative part of attacking reagent is added to that double-bonded carbon atom which contains: DUHS (2024)

A. Highest number of chloride atoms B. Lesser number of hydrogen atoms
C. Highest number of hydrogen atoms D. Moderate number of hydrogen atoms

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Q.156 The bond length between C-C in benzene is: DUHS (2024)
A. 1.34Å
B. 1.39Å
C. 1.56Å
D. 1.38Å

Q.157 When chlorobenzene reacts with sodium hydroxide at 350°C and 150 atmospheric pressure, it gives rise to the formation of: (out of syllabus) DUHS (2024)
A. Sodium chromate
B. Phenol
C. Sodium phenoxide
D. Sodium sulfate

Q.158 The density of benzene is (out of syllabus) DUHS (2024)
A. 0.80 g/cm^3
B. 0.88 g/cm^3
C. 0.85 g/cm^3
D. 0.08 g/cm^3

Q.159 Natural gas consist mainly of BUMHS (2024)
A. Butane
B. Propane
C. Methane
D. Ethane

Q.160 _____is regarded as the simplest and the present member of aromatic class of compounds. BUMHS (2024)
A. Methanol
B. Acetylene
C. Benzene
D. Acetic acid

Q.161 In alkane series, all the linkages between carbon atoms is _____bonds BUMHS (2024)
A. Single
B. Double
C. Triple
D. Quadruple

Q.162 Benzene when reacts with chlorine, in presence of sunlight gives additional product. i.e. BUMHS (2024)
A. HCl
B. Chloroform
C. Hexachlorobenzene
D. Polyvinylchloride (PVC.

Q.163 When a hydrogen atom of an alkane is removed, the resulting group is called_____? BUMHS (2024)
A. Aryl
B. Alkyl
C. Alkenyl
D. Phenyl

Q.164 Identify the alkene which gives only one type of aldehyde upon ozonolysis: NUMS (2024)
A. 1-Pentene
B. 2-Methyl propene
C. 2-Butene
D. 2,3-Dimethyl-2-butane

Q.165 The most readily sulphonated compound is: NUMS (2024)
A. Benzene
B. Chlorobenzene
C. Nitrobenzene
D. Toluene

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ANSWER KEY

PRACTICE EXERCISE

1	A	11	B	21	A	31	A	41	D
2	D	12	C	22	D	32	D	42	A
3	B	13	C	23	D	33	B	43	A
4	D	14	D	24	B	34	B	44	D
5	B	15	A	25	B	35	A	45	A
6	D	16	A	26	B	36	C	46	D
7	B	17	C	27	D	37	D	47	D
8	D	18	B	28	C	38	C	48	D
9	D	19	A	29	C	39	D	49	B
10	C	20	B	30	C	40	B	50	D

PAST PAPER MCQ'S

51	B	61	C	71	B	81	C	91	B	101	C	111	A	121	D	131	C	141	B	151	A	161	A
52	A	62	D	72	C	82	B	92	B	102	A	112	A	122	C	132	C	142	C	152	D	162	C
53	B	63	D	73	B	83	A	93	B	103	B	113	D	123	B	133	B	143	A	153	B	163	B
54	A	64	B	74	B	84	A	94	C	104	B	114	E	124	C	134	B	144	C	154	A	164	C
55	A	65	B	75	A	85	C	95	B	105	B	115	B	125	D	135	D	145	A	155	C	165	D
56	A	66	D	76	D	86	B	96	B	106	A	116	A	126	B	136	D	146	D	156	C		
57	A	67	A	77	D	87	B	97	A	107	D	117	D	127	B	137	B	147	C	157	C		
58	A	68	C	78	D	88	D	98	C	108	D	118	C	128	A	138	A	148	B	158	C		
59	A	69	C	79	C	89	B	99	A	109	C	119	C	129	D	139	B	149	C	159	C		
60	D	70	D	80	C	90	D	100	B	110	A	120	B	130	B	140	B	150	D	160	C		

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EXPLANATORY NOTES

Q11
$$CH_4 + X_2 \longrightarrow CH_3X + HX$$
$$CH_4 + 2X_2 \longrightarrow CH_2X_2 + 2HX$$
$$CH_4 + 3X_2 \longrightarrow CHX_3 + 3HX$$
$$CH_4 + 4X_2 \longrightarrow CX_4 + 4HX$$
Extent of halogenation depends upon amount of halogen while Intensity of UV light and temperature control the rate of reaction.

Q12 Propagation step involves
i) Attack of free radical on molecule
ii) Homolytic fission in molecule
iii) Bond formation
iv) Formation of new molecule
v) Formation of new free radical

$$R^\circ + Cl_2 \longrightarrow R - Cl + Cl^\circ$$
$$Cl^\circ + R - H \longrightarrow HCl + R^\circ$$

Q13 Termination step in free radical substitution mechanism involves
i) Attack of free radical on other free radical
ii) Bond formation
iii) Formation of a molecule

$$Cl^\circ + Cl^\circ \longrightarrow Cl_2$$
$$R^\circ + X^\circ \longrightarrow R - X$$
$$R^\circ + R^\circ \longrightarrow R - R$$

Q14 $CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$
$CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$
$CH_2Cl_2 + Cl_2 \rightarrow CHCl_3 + HCl$
$CHCl_3 + Cl_2 \rightarrow CCl_4 + HCl$

Q15 The initiation propagation and termination of halogenation of alkane involves free radicals.

Initiation step $Cl_2 \longrightarrow 2Cl^\circ$
Propagation step $Cl^\circ + CH_4 \longrightarrow HCl + CH_3^\bullet$
Termination step $CH_3^\bullet + Cl^\circ \longrightarrow CH_3Cl$

Q16 The dehydration of alcohols is an elimination reaction which involves C – O cleavage.
Ease of dehydration $\propto$ Ease of C – O cleavage $\propto$ number of β - carbon in alcohol.
3 β – C in tertiary alcohol, 2 β –C in secondary alcohol and 1 β –C in primary alcohol.
Ease of dehydration $\propto$ Ease of C – O cleavage $\propto$ Size of R in alcohol

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Q.17 Concentration H_2SO_4 180°C causes β-elimination reaction

$$C_2H_5OH \xrightarrow[180°C]{\text{conc } H_2SO_4} H_2C=CH_2 + H_2O$$

But concentration H_2SO_4 causes condensation elimination reaction at 140°C.

$$2C_2H_5OH \xrightarrow[140°C]{\text{conc } H_2SO_4} C_2H_5-O-C_2H_5$$

Q.18 This is β-elimination reaction which involves removal of X from α–C and removal of β–H from β–C.

$$-\overset{H}{\underset{|}{C}}-\overset{X}{\underset{|}{C}}- + KOH \xrightarrow{\text{alcohol}} -C=C- + KX + H_2O$$

Dehalogenation is removal of X from α–C and β–H from β–C.

Q.19 In alcoholic medium OH becomes strong base hence it attacks on β–H instead of replacing X from RX. Therefore, alkene is produced from RX by β-elimination reaction.

$$OH^- + -\overset{H}{\underset{|}{C}}-\overset{X}{\underset{|}{C}}- + KOH \xrightarrow{\text{alcohol}} -C=C- + KX + H_2O$$

Q.20 Dehydration of alcohols need dehydrating agents like concentrated H_2SO_4, P_2O_3 or P_4O_{10}, H_3PO_4 and Al_2O_3.

HNO_3 is not a dehydration agent at all.

Q.21 Ethene is an unsaturated hydrocarbon. So, it becomes saturated, reduced by the addition of hydrogen gas.

$$C_2H_4 + H_2 \xrightarrow[\Delta]{Ni} C_2H_6$$

Q.22 Bromine water ($Br_{2(aq)}$) is reddish brown in colour. It is used to detect unsaturation in hydrocarbon when any unsaturated hydrocarbon (1-Pentene / 2-Methyl-1-pentene) come across it. Bromine water is decolourized.

Q.23 Alkane is saturated hydrocarbon while alkene is an unsaturated one. The presence of unsaturation is detected by bromine water test and hydroxylation (using Baeyer's reagent). Ozonolysis is used to locate position of double bond.

Q.24

$$-C=C- + 2KMnO_4 - H_2O \xrightarrow{\text{cold}} -\overset{OH}{\underset{|}{C}}-\overset{OH}{\underset{|}{C}}- + 2MnO_2 + 2KOH$$

Q.25 Vegetable ghee is prepared from vegetable oil which is tri-ester of unsaturated fatty acids with glycerol.

The unsaturation can be vanished by hydrogenation in presence of Ni at high temperature.

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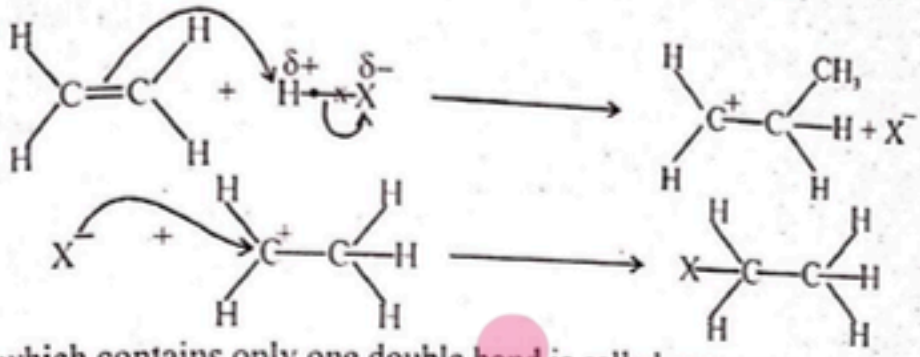
Q.26 $-C=C- + 2KMnO_4 - H_2O \xrightarrow{\text{cold}} -\underset{OH}{\overset{|}{C}} - \underset{OH}{\overset{|}{C}}- + 2MnO_2 + 2KOH$

Q.27 Markownikove's rule is obeyed by unsymmetrical alkenes. Symmetrical alkanes like $CH_3CH = CHCH_3$ having no binding to obey the rule because both doubly bonded carbon atoms have same number of hydrogen atom.

Q.28 In case of alkenes, the addition is started by the attack of electrophile.



Q.29 The alkene which contains only one double bond is called monoene.

Q.30 Alkaline $KMnO_4$ is called Baeyer's reagent which is used in the laboratory for the detection of double bond.

Q.31

$$HC \equiv CH + H_2O \xrightarrow[dil.\ H_2SO_4]{HgSO_4} CH_2 = \underset{OH}{\overset{|}{CH}}$$

Vinyl alcohol

$$\xrightarrow{\text{Molecular rearrangement}} CH_3 - \underset{O}{\overset{\|}{C}} - H$$

Acetaldehyde

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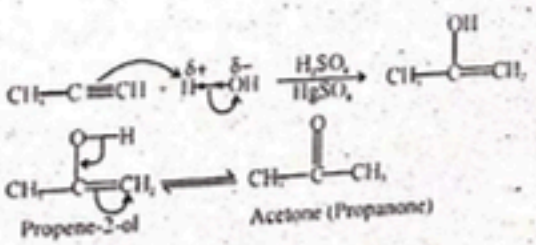
Q.32 Only terminal alkynes show the acidic character because sp hybridized carbon atoms of a terminal alkyne pulls the electrons more strongly making the attached hydrogen atom slightly acidic. 2-Butyne is not acidic because it is not terminal alkyne.

Q.33 Reactivity order of alkane, alkene and alkyne is given below

Alkene > Alkyne > Alkane

Q.34



Q.35

$$HC \equiv CH + 2AgNO_3 + 2NH_4OH \longrightarrow \underset{\text{Silver acetylide (White ppt.)}}{AgC \equiv CAg} + 2NH_4NO_3 + 2H_2O$$

Q.36

$$HC \equiv CH + 2Na \longrightarrow Na\dot{C} \equiv \dot{C}Na + H_2$$

Acetylene — Sodium acetylide

Q.37 Benzene consists of six sp^2-hybridized carbon atoms each sp^2-carbon atoms has 3 sp^2 hybrid orbital therefore the total number of hybrid orbitals in benzene would be 18.

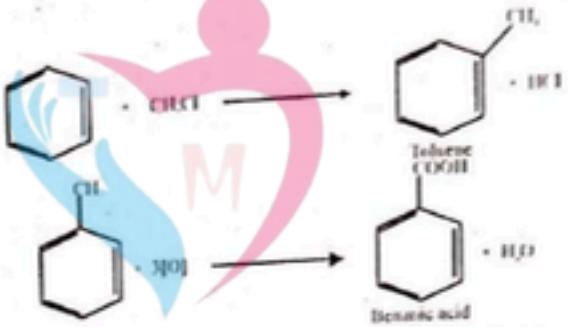
Q.38 Resonance energy of benzene is $+150.5\ kJmol^{-1}$

Q.39 In benzene all six carbon atoms are sp^2-hybridized, so each carbon atom is having one half filled un-hybrid orbital that is involved in partial overlap with adjacent un-hybrid orbitals of p to form π-electrons cloud of 6 electrons.

Q.40 In Friedal Craft's reaction $AlCl_3$ is a catalyst. It accelerates the reaction between C_6H_6 and R–X like CH_3Cl.



Q.41



$$C_6H_6 + C_6H_5COCl \xrightarrow{AlCl_3} C_6H_5 - CO - C_6H_5 + HCl$$

$$C_6H_6 + CH_3CH_2CH_2 - Cl \xrightarrow{AlCl_3} C_6H_5 - C_3H_7 + HCl$$

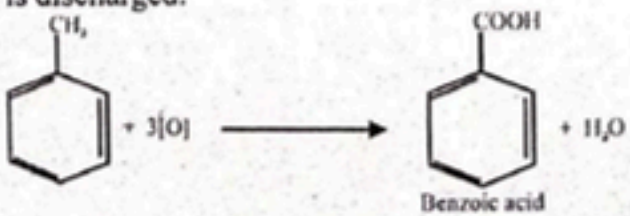
Q.42 The conversion of benzene to cyclohexane is hydrogenation. This process of hydrogenation is an exothermic as it gives out 208kJ/mol of energy.

Q.43



Theoretical value = -358.5 kJ/mole (calculated heat of hydrogenation)
Experimental value = -208.0 kJ/mole (observed heat of hydrogenation)
Difference = -150.5 kJ/mole (resonance energy)

Q.44 Alkyl benzenes are oxidized to benzoic acid by nascent oxygen which is produced by reacting purple coloured $KMnO_4$ with H_2SO_4 or orange red coloured $K_2Cr_2O_7$ during this production colour is discharged.



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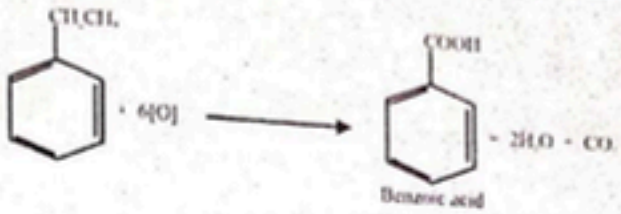
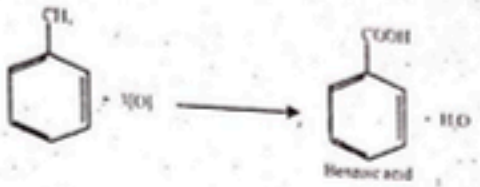
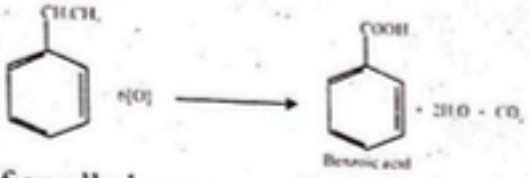
Q.45



Q.46





Whatever the length of an alkyl group may be, it gives only one carboxyl group. Moreover the colour of $KMnO_4$ is discharged. Therefore, this reaction is used as a test for alkylbenzenes.

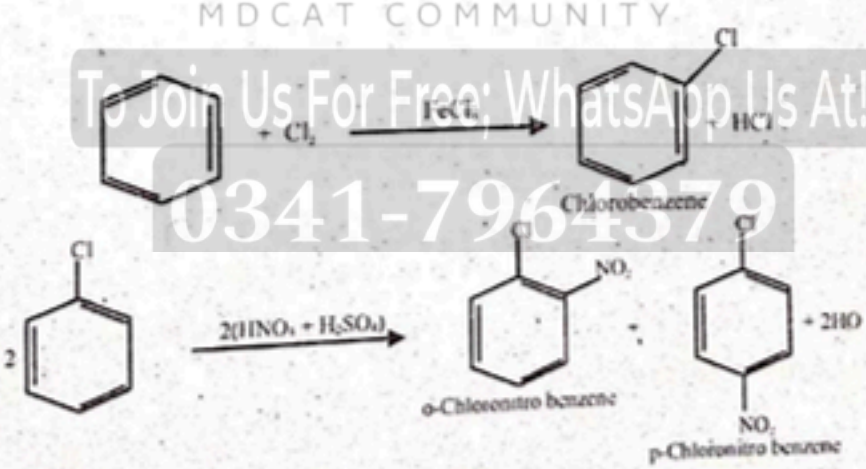
Q.47



Q.48 In ethyl benzene, ethyl group is ortho, para directing groups which activate the benzene ring.

Q.49 -CHO is meta directing group which deactivates the benzene rings While $-NH_2$, -OR and –OH activate the benzene ring.

Q.50



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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.51 When hydrogen atom is removed from benzene, group left is called phenyl group.

Q.52 Conc. HNO_3 and Conc. H_2SO_4 (nitrating mixture) is used for introduction of nitro group.

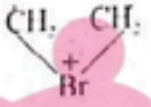
Q.53 In ethyne only sp-sp overlap gives sigma bond between carbon atoms.

Q.54 Hydrogenation of unsaturated oils is done by using finely divided Ni.

Q.55 The substitution of –H group by $-NO_2$ group in benzene is called nitration.

Q.56 Acetyl chloride and benzene reacts to give acetophenone in the presence of $AlCl_3$ catalyst.

Q.57 In the reaction of ethene with bromine the intermediate formed is brominium ion



Q.58 Ethene on polymerization, give the product polyethene, this reaction may be called as addition reaction.

Q.59 The introduction of $R-\overset{O}{\overset{\|}{C}}$ group in benzene is called Friedel craft acylytion.

Q.60 $CH_3-\underset{Br}{\underset{|}{CH}}-CH_3$ is the product formed when propene reacts with HBr folowing Markownikov's rule.

Q.61 The introduction of an alkyl group in benzene takes place in the presence of $AlCl_3$ &R-Cl

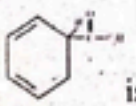
Q.62 Addition of unsymmetrical reagent to an unsymmetrical alkene is governed by markownikov's rule, according to this negative part of reagent will attach to those double bonded carbon having less number of hydrogen.

Q.63 Order of reactivity of alkenes with hydrogen halide is HI > HBr > HCl due to bond energy factor.

Q.64 Cl^+ is an electrophile which can attack strongly on benzene.

Q.65 The reaction of benzene with bromine in the presence of $FeBr_3$ follows the mechanism of electrophilic substitution reaction.

Q.66



is the intermediate form during this reaction.

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Q.67 When benzene reacts with Acetyl chloride (CH_3COCl) in the presence of $AlCl_3$ acetophenone is formed. The electrophile in this reaction will be $CH_3C^+=O$

Q.68 Aldehyde (-CHO) and carboxyl (-COOH) both are meta directing groups.

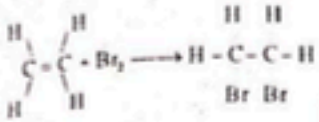
Q.69 For halogenation of benzene, $AlCl_3$ catalyst is used.

Q.70 Chlorination and Bromination mostly use U.V light.

Q.71 Aldehyde (-CHO) has electron withdrawing effect while other have electron donating.

Q.72 Reaction mechanism of alkanes with halogens is known as free radical mechanism.

Q.73 Propene is obtained by the elimination of bromopropane.

Q.74  this is used to detect the presence of double bond, in the presence of multiple bond, bromine decolourizes.

Q.75 Br^+ acts as an electrophile in the electrophilic substitution of benzene with bromine.

Q.76 $Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_4^-$ this is the first step to produce electrophile.

Q.77 $C+CO+CO_2+H_2O$ all are possible products of butene during combustion.

Q.78 Step I is free radical substitution as alkyl bromide is produced from alkane and step II is elimination as alkene is produced from alkyl halide.

Q.79 Homolysis of a covalent bond yields a very reactive free radical with incomplete octet in its valence shell.

Q.80 $F_2>Cl_2>Br_2>I_2$ is the correct order. Fluorine is most reactive non-metal which reacts with alkanes in the absence of sunlight without heating and the order decrease down the group for halogens.

Q.81 iso-butene $(CH_3)_2C=CH_2$ will give acetone along with formaldehyde upon ozonolysis.

Q.82 V_2O_5 as catalyst is used in oxidation of benzene ring which produces maleic anhydride.

Q.83 Nitrobenzene is less reactive than benzene due to presence of deactivating meta directing NO_2^+ group.

Q.84 $C_2H_4 > C_2H_2 > C_6H_6$ is the correct order. alkenes are most reactive hydrocarbons due to presence of a pi-bond, in alkyne there are 2 pi-bonds due to which bond length decreases and bond energy increases so alkynes are less reactive, while benzene is stable and least reactive due to resonance stability.

Q.85 -CN is deactivating and meta directing group.

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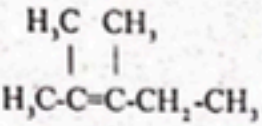
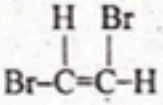
Q.86 Ethylene or ethene decolourizes the $KMnO_4$ due to presence of double bond but does not give positive tollen's test.

Q.87 
2-3 di methyl-2-pentene

This is an alkene that gives acetone and butanone upon ozonolysis.

Q.88 Treatment of ethene with cold sulphuric acid followed by reaction with boiling water yields ethanol. This is the hydration of alkene.

Q.89 Alkenes undergo electrophillic addition reaction, due to double bond it becomes electron rich (nucleophillic) and is easy breaking of pi-bond.

Q.90 
$C_2H_2Br_2$ shows cis-trans isomerism.

Q.91 $H_3C\text{-}CH_2\text{-}CH_2\text{-}Br + AlcKOH \longrightarrow C \xrightarrow[H_2O]{H_2SO_4} D$ in this reaction "D" is 2-propanol.

Q.92 Hydration of alkenes are industrially used to prepare alcohol.

Q.93 Toluene (Methylbenzene) is the most reactive due to presence of activating and ortho-para directing methyl group.

Q.94 SO_3 is the electrophile in sulphonation of benzene, the neutral but strong electrophile.

Q.95 Friedel craft acylation is used to produce the acetophenone.

Q.96 CH_3 is attached with the benzene ring, it makes the ring good nucleophile because of electron donating nature of R group.

Q.97 Ethene has one sigma and one pi bond.

Q.98 Benzene does not show elimination reactions because benzene is stable compound.

Q.99 Methane is known as marsh gas.

Q.100 NO_2^+ is used in nitration of benzene.

Q.101 In Friedel-craft alkylation reaction Alkyl benzene is formed when benzene is treated with an alkyl halide.

Q.102 Three alternate single and double bonds in benzene are called conjugate bonds.

Q.103 Alkynes are more acidic due to high % S character because of sp hybridization.

Q.104 Attack of chlorine free radical on CH_4 form methyl free radical in propagation step during chlorination.

Q.105 Ratio of sigma to pi electrons in benzene ring is 4 : 1.

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Q.106 Benzene cannot be oxidized by any oxidizing agent due to delocalized electrons which give stability to benzene.

Q.107 Order of reactivity of hydrocarbons Alkenes > Alkynes > Alkanes.

Q.108 Bond energy $\alpha \frac{1}{\text{Reactivity}}$ HI has less bond energy HF has highest bond energy.

Reactivity order of HI > HBr > HCl > HF.

Q.109 Cycloheptane has highest boiling point because boiling point is directly proportional to the number of carbon atoms.

Q.110 Propyne reacts with aqueous sulphuric acid in the presence of $HgSO_4$ to form acetone.

Q.111 NO_2^+ is active agent in nitration of benzene.

Q.112 Isopropyl benzene is also called cumene.

Q.113 Benzene is subject to alkylation then nitration then oxidation the product will be ortho para nitrobenzoic acid.

Q.114 Catalytic hydrogenation of oil gives fat.

Q.115 SO_3 is electrophile when benzene undergoes electrophilic substitution reaction when treated with fuming sulphuric acid.

Q.116 Michael Faraday discovered benzene in the gas formed from destructive distillation.

Q.117 IUPAC name of $CH_3-(CH_2)_3-C(CH_3)_3$ 2,2-dimethyl hexane

Q.118 Neo-pentane has least melting and boiling point due to small surface area and week LDF.

Q.119 150.5kj mol^{-1} is resonance energy of benzene.

Q.120 $CH_3CH=CH-CH_3 + H^{\delta+} - Br^{\delta-} \longrightarrow CH_3-\underset{\text{(2-Bromobutane)}}{\overset{\overset{Br}{|}}{CH}}-CH_2-CH_3$

Alkanes cannot undergo addition reactions because alkanes are saturated hydrocarbons in which four valencies of carbon are fully satisfied.

Q.121 In Friedel-Crafts alkylation reactions, benzene reacts with alkyl halides in the presence of anhydrous $AlCl_3$ to give alkyl benzenes.

Q.122 Sodium ethoxide ($C_2H_5O^-Na^+$) is dehydrohalogenating agent. It reacts with 2-bromopropane to give propene

$$CH_3-\overset{\overset{Br}{|}}{CH}-CH_3 \xrightarrow{C_2H_5ONa} CH_2=CH-CH_3 + HBr$$

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Q.123

$$CH_3-C\equiv CH + H^{\delta+}-OH^{\delta-} \xrightarrow[H_2SO_4]{HgSO_4} CH_3-\underset{\displaystyle OH}{\overset{\displaystyle |}{C}}=CH_2$$

$$CH_3-C(-O-H)=CH_2 \rightleftharpoons CH_3-\overset{\displaystyle O}{\overset{\displaystyle \|}{C}}-CH_3$$

Q.124 Electrolysis of unsaturated dicarboxylic acid salts give alkynes.

Q.125 $CH_2 = CH_2$ will not give substitution reactions.

Q.126 If both double and triple bonds are present, then ending given to the root is "ene".

Q.127 Ethane is less reactive

Reactivity order is: Ethene > Ethyne > Benzene > Ethane

Q.128 "$-NR_2$" is ortho and para directing group.

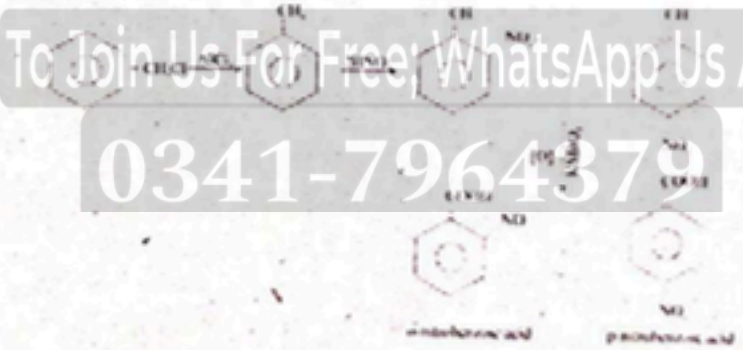
Q.129 $R-\overset{\displaystyle O}{\overset{\displaystyle \|}{C}}{}^{+}$ is electrophile called as acylium ion.

Q.130 C_2H_2 has acidic hydrogens at terminal position attached with (sp) hybridized carbon atoms $(H-C\equiv C-H)$

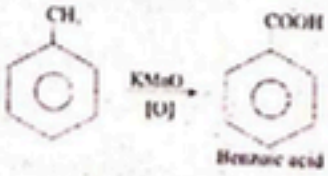
Q.131 In ethyne carbon atoms are sp hybridized.

Q.132 When benzene reacts with isopropyl chloride in the presence of $AlCl_3$ the reaction is called friedal craft alkylation.

Q.133



Q.134



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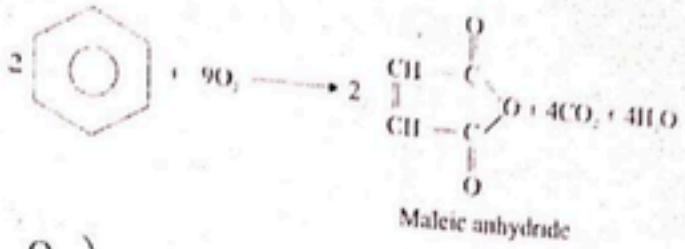
Q.135 Benzene give maleic anhydride on oxidation



Maleic anhydride

Q.136 Acylium ion $\left(R-\overset{\overset{O}{\|}}{C}^{+} \right)$ has a positive charge and acts as electrophile

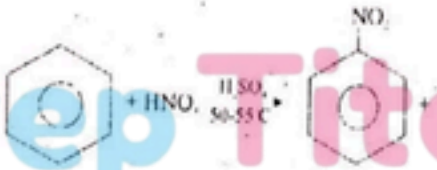
Q.137 In benzene delocalized electrons means electrons that are free to move around the molecule is the pi-bonding system above and below the plane of carbon atoms in benzene ring.

Q.138 Tri phenyl methane has isolated rings and no aromatic compound.

Q.139 Acetophenone can be formed by acylation.

Q.140 NH_2 is an electron releasing group, while CN, $^{+}NR_3$ and NO_2 are electron with withdrawing groups.

Q.141



Q.142 In Friday craft acylation $AlCl_3$ is used as catalyst.

Q.143 IUPAC name of neopentane is 2,2-Dimethylpropane.

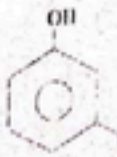
Q.144 Saturated alicyclic hydrocarbons (cyclic alkanes) have general formula C_nH_{2n}

Q.145 1,3,5-Cyclohexatriene is used as a reference for calculating the extent of stability of benzene by calculating heat of hydrogenation

Q.146 Lewis acids are used as catalyst during electrophilic substitution reactions of benzene Lewis acid reacts with reagent to produce strong electrophile

Q.147 IUPAC name of $CH_3 - CH = CH - CH_2 - C \equiv CH$ is "4-Hexen-1-yne"

Q.148 The common name of 1,3-dihydroxy benzene



is catechol

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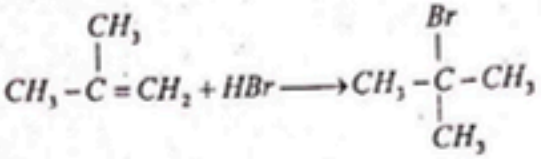
Q.149 Resonance energy of benzene is 152kJ or 36 Kcal/mol.

Q.150 Homolytic fission of "C-H" in alkane results free radical.

Q.151



Q.152 The carbon atom carrying positive charge and attached to three other atoms or groups is called carbocation. $(R)_3C^+$

Q.153 In Friedal crafts acylation "$AlCl_3$" used as catalyst.

Q.154 When unsymmetrical alkene undergoes reaction with unsymmetrical reagent, the negative part of reagent goes to that carbon which contains lesser number of H-atoms.

Q.155 The bond length between "C-C" in benzene is 1.397Å.

Q.156 Chlorobenzene + NaOH $\xrightarrow[150\text{ atm}]{350^\circ C}$ sodium phenoxide + HCl.

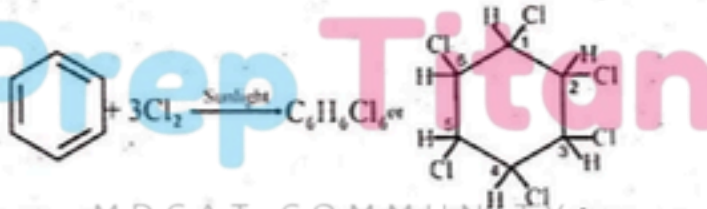
Q.157 The density of benzene is 0.88 gcm^{-3}.

Q.158 Natural gas consists mainly of CH_4

Q.159 Benzene is the simplest and parent member of aromatic compounds.

Q.160 In alkanes all the bonds between carbon atoms are single bonds.

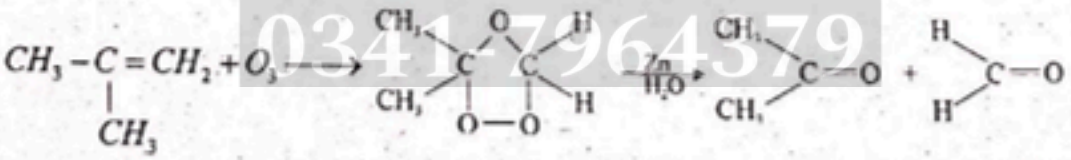
Q.161



Benzene 1,2,3,4,5,6 - Hexachlorocyclohexanee

Q.162 When H-atom is removed from alkanes, the resulting group is called alkyl group.

Q.163



Q.164 The most readily sulphonated compound is Toluene, because it contain electron releasing group which enhance reactivity of ring towards sulphonation. .

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Topic 15

ALKYL HALIDES

PRACTICE EXERCISE

Q.1 Alkyl halide can be converted into alcohol by:
A. Addition
B. Substitution
C. Elimination
D. Both B and C

Q.2 The strongest nucleophile is:
A. H_2O
B. OH^-
C. NH_3
D. All of these

Q.3 Elimination bimolecular reactions are usually obey:
A. First order kinetics
B. Second order kinetics
C. Third order kinetics
D. None

Q.4 Wurtz synthesis is useful for preparation of:
A. Alkyl halide
B. Grignard reagent
C. Alkyl benzene
D. Symmetrical alkane

Q.5 Alkyl halide react with excess of ammonia to give:
A. 1°-amine
B. 2°-amine
C. 3°-amine
D. 4°-amine

Q.6 A nucleophile can be identified by the presence of:
A. Positive rays
B. Lone pair
C. Vacent orbital
D. Incomplete octet

Q.7 For S_N2 reaction, highest reactivity is shown by:
A. RCl
B. RI
C. RF
D. RBr

Q.8 Alkyl halide, don't undergo:
A. S_N1 reactions
B. Addition reactions
C. S_N2 reactions
D. All

Q.9 Which is least stable carbanion?
A. CH_3^-
B. $CH_3 - CH_2^-$
C. $(CH_3)_2 - CH^-$
D. $(CH_3)_3 - C^-$

Q.10 Which is not a monohaloalkane?
A. 2-Chloropropane
B. 2-Bromo butane
C. 1,2-Dibromoethane
D. All of these

Q.11 Which of the following is alkyl halide?
A. CH_3Cl
B. $C_2H_4Cl_2$
C. CH_2Cl_2
D. All of these

Q.12 Which one is monohaloalkane?
A. CH_2Cl_2
B. $CH_3 — CH_3 — CH_2 — Cl$
C. $CHCl_3$
D. CCl_4

Q.13 Which of the following is primary alkyl halide?
A. Iso-propyl halide
B. Sec. butyl halide
C. Ter. butyl halide
D. Neo-pentyl halide

Q.14 Elimination bimolecular reactions involve:
A. 1st order kinetics
B. 2nd order kinetics
C. Zero order kinetics
D. None of these

Q.15 Which one among the following is not a good leaving group?
A. HSO_4^-
B. Cl^-
C. OH^-
D. Br^-

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Q.16 Alkyl halides are considered to be very reactive compounds towards nucleophile because:
A. They have an electrophilic carbon
B. They have an electrophilic carbon and a good leaving group
C. They have an electrophilic carbon and a bad leaving group
D. They have a nucleophilic carbon and a good leaving group

Q.17 Order of S_N1 reaction:
A. 1
B. 1.5
C. 2
D. 3

Q.18 Which of the following is correct about S_N1 reactions?
A. Retention of the configuration of the alkyl halide molecule
B. Unimolecular reactions
C. Reaction rate is a function of the [alkyl halide]
D. All of these

Q.19 β-elimination reactions are due to:
A. Attack of the incoming nucleophile on alpha hydrogen
B. Attack of the incoming nucleophile on beta hydrogen
C. Attack of the incoming nucleophile on beta carbon
D. Attack of incoming nucleophiles on electrophilic carbon

Q.20 Tertiary alkyl halides give:
A. S_N1 and E1 reaction
B. S_N2 and E2 reaction
C. S_N2 and E1 reaction
D. None of the above

Q.21 Which of the following is correct about S_N2 reactions?
A. Breakage of C—X and formation C—Nu bonds are simultaneous
B. Inversion of the configuration of the alkyl halide molecule
C. 2nd order kinetics
D. All of these

Q.22 Which statement is incorrect about reactivity of alkyl halides with respect to nucleophile?
A. Greater the bond energy of R-X, lesser the reactivity
B. Greater the bond polarity of R-X, greater the stability
C. Greater the bond energy of R-X, smaller the stability
D. Greater E.N difference of R- X, greater the stability

Q.23 Which statement is incorrect about nucleophilic substitution reaction?
A. Incoming nucleophile must be stronger than the leaving one
B. Leaving nucleophile must be stronger than incoming nucleophile
C. Tertiary alkyl halides generally give S_N1 reactions
D. S_N2 is a single step mechanism

Q.24 In β -Elimination the resulting product is?
A. Alcohol
B. Alkane
C. Alkyl halide
D. Alkene

Q.25 Which compound is most reactive through SN_2 mechanism?
A. CH_3-Cl
B. $CH_3-CH_2-CH_2-Cl$
C. CH_3-CH_2-Cl
D. All have same reactivity

Q.26 Thioalcohol is prepared when alkyl halide is reacted with:
A. $O\bar{H}$
B. $S\bar{H}$
C. NO_2^-
D. I^-

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Q.27 **Whether an alkyl halide follows SN1 or SN2 mechanism depends on:**
A. Steric hindrance
B. Stability of carbocation
C. Inductive effect
D. All of these

Q.28 **Tertiary butyl bromide refers to follow which mechanism during substitution reactions:**
A. S_N1
B. S_N2
C. Both A and B
D. It does not show SN reactions

Q.29 **If an nucleophile is the attacking reagent which one would be the most reactive one:**
A. R – F
B. R – Cl
C. R – Br
D. R – I

Q.30 **During S_N2 mechanism of alkyl halides C – X bond undergoes:**
A. Homolytic cleavage
B. Heterolytic cleavage
C. Sometimes homolytic, sometimes heterolytic
D. C–X bond is not cleaved in S_N2 reactions

Q.31 **Which of the following is true about R – I?**
A. They are most reactive alkyl halide for a given alkyl group
B. They show maximum boiling point for a given alkyl group
C. Cannot be prepared directly by reaction of alkanes with I_2
D. All are true

Q.32 **Which of the following reactions is not shown by R – X?**
A. Substitution reactions
B. Elimination reactions
C. Reduction
D. It shows all of above mentioned reactions

Q.33 **Most common reactions shown by alkyl halides are:**
A. Substitution
B. Elimination
C. Reduction
D. Polymerization

Q.34 **2° alkyl halides show both SN_1 and SN_2 reactions depending upon:**
A. Nature of functional group
B. Temperature
C. Nature of solvent
D. All of these

Q.35 **Ammonia reacts with excess of alkyl halide to form:**
A. 1°-amine
B. 2°-amine
C. 3°-amine
D. Mixture of 1°, 2° and 3° amines

Q.36 **The main factor which decides the reactivity of (R – X) is:**
A. C°–X bond strength
B. C – X bond polarity
C. Both C – X bond strength and polarity
D. Boiling point of the given R– X

Q.37 **Higher polarizable nucleophiles favour :**
A. Substitution reactions
B. Elimination reactions
C. Favour both substitution and elimination reactions equally
D. Cannot be predicted

Q.38 **$CH_3 - Cl \xrightarrow[KOH]{Alc.} A$. "A" product is:**
A. $CH_3 - OH$
B. $CH_3 - O - CH_3$
C. CH_4
D. No reaction will occur

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Q.39 Which among CH_3X, $R-CH_2-X$, R_2CHX, R_3CX is most reactive towards SN2 reaction?

A. R_3CX
B. RCH_2X
C. R_2CHX
D. CH_3X

Q.40 Consider the following haloalkanes:

1. CH_3F
2. CH_3Br
3. CH_3Cl
4. CH_3I

The increasing order of reactivity in SN reactions is:

A. $4 < 3 < 2 < 1$
B. $1 < 3 < 2 < 4$
C. $1 < 2 < 3 < 4$
D. $1 < 2 < 4 < 3$

Q.41 The organic chloro compound which shows complete stereo chemical inversion during S_N2 reaction is:

A. $(C_2H_5)_2CHCl$
B. $(CH_3)_3CCl$
C. $(CH_3)_2CHCl$
D. CH_3-Cl

Q.42 Second step of which of the following pair of reaction is same:

A. E_1 + SN1
B. E_2 + SN1
C. SN1 + SN2
D. None of these

Q.43 Which of the following is the most stable carbocation?

A. Secondary
B. Primary
C. Tertiary
D. All have same stability

Q.44 Which reagent is a good nucleophile?

A. NH_3
B. HBr
C. Br_2
D. BH_3

Q.45 $CH_3-CH_2-OH + Alc.NH_3 \longrightarrow$

A. $CH_3CH_2-NH_2$
B. CH_3-CH_2-H
C. $CH_2=CH_2$
D. $CH_3-CH_2-CH_3$

Q.46 Which C–X bond has highest bond energy per mole?

A. C–Br
B. C–F
C. C–Cl
D. C–I

Q.47 Rate of E_1 reaction depends upon:

A. Concentration of nucleophile
B. Concentration of substrate as well as alkyl halide
C. Concentration of substrate only
D. None of these

Q.48 An alkyl halide may be converted to alcohol by:

A. Addition
B. Addition
C. Substitution
D. Elimination

Q.49 Neutral nucleophile among the following is:

A. CN^-
B. NH_3
C. Cl^-
D. $C_2H_5O^-$

Q.50 $CH_3CH_2-Br + CN^- \longrightarrow ?$

A. CH_3CH_2-Br
B. $CH_2=CH_2$
C. CH_3CH_2-CN
D. No reaction take place

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Topic 15

ALKYL HALIDES

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Q.51 During S_N2 reaction, configuration of alkyl halide molecule: MDCAT (2010)

A. Remains same
B. Depends upon carbon atom
C. Gets inverted
D. Depends upon electronegativity of halide

Q.52 When purely alcoholic solution of sodium/potassium hydroxide and halogen alkane are refluxed an alkene is formed:

$CH_3\text{-}CH_2\text{-}Br$ (in presence of alcoholic KOH) $\rightarrow CH_2{=}CH_2$

What is the mechanism of the reaction? MDCAT (2011)

A. Elimination
B. Dehydration
C. Debromination
D. Nucleophilic substitution

Q.53 The alkaline hydrolysis of bromoethane shown below gives alcohol as the product

$CH_3 - CH_2 - Br \longrightarrow CH_2CH_2OH$

The reagent and the condition used in this reaction may be MDCAT (2012)

A. H_2O at room temperature
B. KOH is alcohol
C. Ethanol, heat
D. Dilute $NaOH_{(aq)}$, warm

Q.54 In substitution reaction, secondary halogenoalkane give/show: MDCAT (2012)

A. S_N1 mechanism
B. Both E_1 and E_2
C. S_N2 mechanism
D. Both S_N1 and S_N2

Q.55 Consider the reaction given below:



MDCAT (2013)

Which statement is true?

A. Reagent for I is KOH in alcohol
B. Reagent for II is KOH in aqueous medium
C. Reaction II is elimination
D. Reaction I is debromination

Q.56 If halogenalkanes are mixed with an excess of ethanoic ammonia and heated under pressure amine are formed. Which amine is formed in the following reaction?

$CH_3CH_2Br + NH_3 \longrightarrow$ Amine MDCAT (2014)

A. $CH_3—CH_2—NH—CH_2—CH_3$
B. $CH_3—CH_2—CH_2—NH_2$
C. $CH_3—CH_2—NH_2$
D. $H_2N—CH_2—CH_2—NH_2$

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Q.57 Consider the reaction given below:

$$CH_3-CH_2Br \xrightarrow[\text{alcohol}]{KOH} H_2C=CH_2+HBr$$

Mechanism followed by the reaction is: MDCAT (2016)

A. E2 B. S_N1

C. E1 D. S_N2

Q.58 During the S_N1 reaction, the fast reaction involves: MDCAT (2017)

A. Breakage of covalent bond B. Transition state

C. Formation of carbocation D. Attack of nucleophile

Q.59 In elimination reaction, alcoholic KOH is used. OH^- in this case will act as: MDCAT (2017)

A. Electrophile B. Leaving group

C. Base D. Acid

Q.60 Which is an intermediate compound in S_N1: MDCAT (2017)

A. Ethoxide ion B. Alkene

C. Alkyl halied D. Carbocation

Q.61 Among the alkyl halides, which always follows S_N2 mechanism: MDCAT (2017)

A. Primary alkyl halides B. Tertiary alkyl halide

C. Secondary alkyl halides D. Both A and C

Q.62 In elimination reaction, _____ is used: MDCAT (2017)

A. Acidic $K_2Cr_2O_7$ B. Acidic NaOH

C. $CuCl_2$ D. Alcoholic KOH

Q.63 Which halide ion has the capacity to act as both very good nucleophile and good leaving group in nucleophilic substitution reactions? SET (2019)

A. I^- B. Br^+

C. F^- D. Cl^-

Q.64 Which one is not nucleophile? NUMS (2019)

A. BF_3 B. NH_3

C. $-NH_2$ D. $-OR$

Q.65 Which type of alkyl halides gives SN_2 mechanism? NUMS (2019)

A. Secondary alkyl halides B. Tertiary alkyl halides

C. Vinyl halides D. Primary alkyl halides

Q.66 The compound which has the highest boiling point in the following is: ETEA (2019)

A. Methyl chloride B. Methyl iodide

C. Methyl bromide D. Both A and B

Q.67 Which product is obtained by the hydrolysis of 1–chlorobutane with the aqueous sodium hydroxide? MDCAT (2019)

A. 1-butanol B. 1-butanal

C. 1-butene D. Butanone

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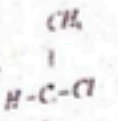
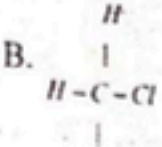
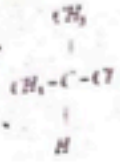
Q.68 Alkyl halides involving –C-X bond breakage and –C-Nu bond formation simultaneously would follow the mechanism: NMDCAT (2020)

A. S_N1
B. S_N2
C. E_1
D. E_2

Q.69 Secondary alkyl halide is: NMDCAT (2020)

A. 
B. 
C. 
D. CH_3Cl

Q.70 R-X on reaction with alcohols forms: NMDCAT (2020)

A. R-OH
B. ROR
C. R-X OH
D. RH

Q.71 What is the correct order of reactivity of alkyl halides? PMC (2021)

A. R-Cl>R-Br>R-F>R-I
B. R-I>R-Br>R-Cl>R-F
C. R-I>R-Cl>R-Br>R-F
D. None of these

Q.72 Same first step: PMC (2021)

A. E_1, S_N1
B. E_2, S_N2
C. E_1, S_N2
D. E_2, S_N1

Q.73 In a reaction having both alkyl halide and base, the base will attack on _____? PMC (2021)

A. Electrophilic carbon
B. Nucleophilic carbon
C. Beta-hydrogen
D. None of these

Q.74 Reaction of alkyl halide with aqueous KOH: PMC (2021)

A. Elimination
B. Substitution reaction
C. Both
D. None

Q.75 When halogen is removed from an alkyl halide a carbocation is formed, identify the most reactive carbocation? UHS (2022)

A. 1° carbocation
B. 2° carbocation
C. 3° carbocation
D. Methyl carbocation

Q.76 Freon are commonly known as? UHS (2022)

A. Refrigerant
B. A solvent
C. Insecticides
D. A fire extinguisher

Q.77 Neopentylchloride belongs to which class of alkyl halides? UHS (2022)

A. 1° R-X
B. 2° R-X
C. 3° R-X
D. 4° R-X

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Q.78 **Alkyl halides are also known as Halogen derivatives of:** SZABMU (2022)
A. Alkanes B. Alkenes
C. Alkynes D. Alcohols

Q.79 **Grignard reagent is formed when alkyl halide reacts in the presence of dry ether with:** SZABMU (2022)
A. Calcium B. Potassium
C. Sodium D. Magnesium

Q.80 **Which compound reacts most rapidly by an S_N1 mechanism?** ETEA (2022)
A. Chloromethane B. 1-chloroethane
C. 2-chloro-2-methylpropane D. 2-chloropropane

Q.81 **Which of the following alkyl halides has the highest boiling point?** ETEA (2022)
A. n-butyl iodide B. Isobutyl iodide
C. Isopropyl bromide D. n-propyl bromide

Q.82 **Which of the following will not affect the S_N1 mechanism?** ETEA (2022)
A. Nature of solvent B. Carbocation
C. Nature of nucleophile D. Carbanion

Q.83 **2- Chloropropane is heated with Na metal product is 2.3- dimethyl butane reaction is:** DUHS (2022)
A. Dehydrohalogenation B. Wurtz reaction
C. Dehydration D. Catalytic hydrogenation
E. Dehalogenation

Q.84 **Grignard reagent e.g Methyl magnesium halide reacting with Methyl halide product is:** DUHS (2022)
A. n-propyl chloride B. Butane
C. Iso-propyl chloride D. Methane
E. Ethane

Q.85 **Alkyl halide, on reaction with NaOH, product is an alkane. Mechanism of reaction is.** DUHS (2022)
A. S_N B. Elimination
C. Decomposition D. Electrophilic substitution reaction
E. Addition reaction

Q.86 **S_N1 mechanism is a.** DUHS (2022)
A. Formation of carbocation is fast step
B. Single step mechanism
C. Two step mechanism
D. Attack of nucleophile on carbocation is slow step
E. Primary alkyl halide follows S_N1 mechanism

Q.87 **The reaction of alkyl halide with lithium di-alkyl copper produce** BMU (2022)
A. Alkane B. Alkene
C. Alkyl copper D. Alkyl halide

Q.88 **Which one is not a nucleophile?** BMU (2022)
A. $C_3H_7O^-$ B. SCN^-
C. H_3C^+ D. NH_3

Q.89 **In S_N1 reactions the correct order of reactivity of alkyl halide is?** UHS (2023)
A. Primary>Secondary>tertiary B. Tertiary>Secondary>Primary
C. Secondary>Primary>tertiary D. Primary>tertiary>Secondary

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Q.90 The increasing stability order of the following compounds (1) $CH_3CH_2CH_2^+$ (2) $(CH_3)_3C^+$ (3) $CH_3CH_2^+$ are?
UHS (2023)
A. 1 > 2 > 3
B. 3 > 2 > 1
C. 2 > 3 > 1
D. 3 > 1 > 2

Q.91 Alkyl Halides involving –C–X bond breakage and –C–Nu bond formation simultaneously would follow the mechanism:
SZABMU (2023)
A. S_N1
B. S_N2
C. E_1
D. E_2

Q.92 50% inversion of configuration and 50% retention of configuration observed is characteristics of mechanism:
SZABMU (2023)
A. E_2
B. E_1
C. S_N1
D. S_N2

Q.93 Greater number of alkyl groups on substrate favours:
ETEA (2023)
A. Substitution reaction
B. Elimination reaction
C. Oxidation reaction
D. Free radical reaction

Q.94 S_N1 reactions mostly results in partial racemization. In partial racemization there is:
ETEA (2023)
A. Inversion only
B. Retention only
C. Equal inversion and retention
D. More inversion than retention

Q.95 Which of the following involve the same steps?
ETEA (2023)
A. E1 and E2
B. E1 and S_N1
C. S_N1 and S_N2
D. E2 and S_N1

Q.96 The elimination between alkyl halides and strong base takes placed by two mechanism- E_1 and E_2. How many steps are involved in each one of these?
DUHS (2023)
A. E_1 elimination is two steps & E_2 is one step
B. E_1 & E_2 both takes place in one step
C. E_1 & E_2 both takes place in two steps
D. E_1 elimination is one step & E_2 is two steps

Q.97 Which of the following is an example of tertiary alkyl halide?
DUHS (2023)
A. 2-chloro butane
B. 1-chloro methyl pentane
C. 2-bromo-3-methyl
D. 2-bromo-2-methyl butane

Q.98 Isopropyl chloride is an example of:
DUHS (2023)
A. Primary alkyl halide
B. Secondary alkyl halide
C. Tertiary alkyl halide
D. Quaternary alkyl halide

Q.99 What is the IUPAC name of chloroform?
DUHS (2023)
A. Chloro methane
B. Di chloro methane
C. Tri chloro methane
D. Tetra chloro methane

Q.100 The overall charge on transition state in S_N2, reaction is?
BUMHS (2023)
A. Negative
B. Positive
C. Neutral
D. Partially positive

Q.101 Which of the following statement is true about Grignard regent (RMgX)?
BUMHS (2023)
A. RMgX is prepared in aqueous medium
B. RMgX is prepared in ether
C. RMgX does not react with water
D. RMgX inactive in ethanol

Q.102 Identify correct ascending order of reactivity of alkyl halides:
UHS (2024)
A. Cl, Br, I, F
B. Br, I, F, Cl
C. F, Cl, Br, I
D. I. F, Cl, Br

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Q.103 Identify the correct statement related to substitution and elimination of alkyl halides: UHS (2024)

A. Strong bases cause substitution in preference to elimination
B. Role of leaving groups in elimination is similar to substitution
C. Substitution is favoured more than elimination by decreasing solvent polarity
D. Decrease in temperature will favor elimination more than substitution

Q.104 Alkyl halides involving -C-X bond breakage and -C-Nu bond formation simultaneously would follow which one of the following mechanisms: UHS (2024)

A. S_N1
B. E1
C. S_N2
D. E2

Q.105 When CO_2 reacts with propyl magnesium chloride followed by acid hydrolysis, the product formed is _____. SZABMU (2024)

A. Butanoic acid
B. Pentanoic acid
C. Ethanoic acid
D. Propanoic acid

Q.106 Unimolecular nucleophilic substitution reaction involves _____. SZABMU (2024)

A. 1st order kinetics
B. 3rd order kinetics
C. 2nd order kinetics
D. zero order kinetics

Q.107 Dehydrohalogenation of alkyl halide is carried out in presence of: ETEA (2024)

A. Alcoholic KOH
B. Conc. H_2SO_4
C. Aqueous KOH
D. Zn dust

Q.108 The rate of S_N1 mechanism depends upon: SINDH (2024)

A. Concentration of nucleophile
B. Concentration of both substrate and nucleophile
C. Polar non-polar solvent
D. Concentration of substrate only

Q.109 The procedure for the preparation of ethers in which an alcohol is first allowed to react with metallic sodium is called: BUMHS (2024)

A. Tollen's synthesis
B. Fehling's synthesis
C. Williamson's synthesis
D. Grignard's synthesis

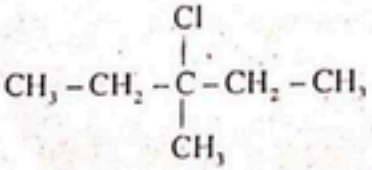
Q.110 Having knowledge of the bond energies of alkyl halides; the most reactive one is the: BUMHS (2024)

A. Iodo-compound
B. Bromo-compound
C. Chloro-compound
D. Fluro-compound

Q.111 In organic chemistry, a nucleus liking agent, rich in electrons, is defined as: BUMHS (2024)

A. A nucleotide
B. A nucleophile
C. An electrophile
D. Electron affluent

Q.112 The IUPAC name of the following compound is: BUMHS (2024)



A. Hexylchloride
B. 3-Chloromethylhexane
C. 3-Chloro-3-ethylbutane
D. 3-Chloro-3-methylpentane

Q.113 Alkyl halides can yield ethers when heated in the presence of the metallic compound: BUMHS (2024)

A. Ag_2O
B. CuO
C. Cu_2O_2
D. Fe_2O_3

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ANSWER KEY

PRACTICE EXERCISE

1	B	11	A	21	D	31	D	41	D
2	B	12	B	22	C	32	D	42	D
3	B	13	D	23	B	33	A	43	C
4	D	14	B	24	D	34	C	44	A
5	D	15	C	25	A	35	D	45	A
6	B	16	B	26	B	36	A	46	B
7	B	17	A	27	D	37	A	47	C
8	B	18	D	28	A	38	D	48	C
9	D	19	B	29	D	39	D	49	B
10	C	20	A	30	B	40	B	50	C

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51	C	61	A	71	B	81	A	91	B	101	B	111	B
52	A	62	D	72	A	82	D	92	C	102	C	112	D
53	D	63	A	73	C	83	B	93	B	103	B	113	A
54	D	64	A	74	B	84	E	94	D	104	C		
55	C	65	D	75	D	85	B	95	B	105	A		
56	C	66	B	76	A	86	C	96	A	106	A		
57	A	67	A	77	A	87	C	97	D	107	A		
58	D	68	B	78	A	88	C	98	B	108	D		
59	C	69	C	79	D	89	B	99	C	109	C		
60	D	70	B	80	C	90	C	100	A	110	A		

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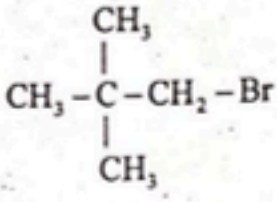
EXPLANATORY NOTES

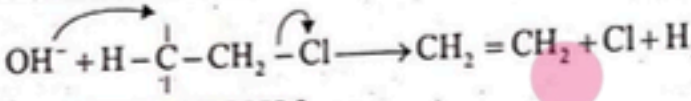
Q.11 Alkyl halides are monohalo alkanes only $C_nH_{2n+1}X$

Q.12 Monohalo alkanes have only one halogen attached to hydrocarbon chain and follow general formula $C_nH_{2n+1}X$.

Q.13 Neo-pentyl bromide is a primary alkyl halide



Q.14 A bimolecular reaction involves 2 molecules in rate determing step.



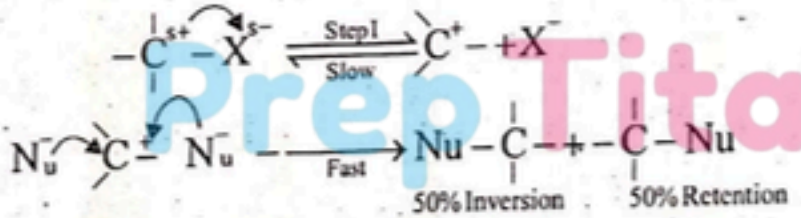
$R = K[C_2H_5Cl][OH^-]$

Order = 1+1 = 2

Q.15 OH^- is very strong nucleophile and due to its high charge to size ratio it is strongly attached to carbon and hence a poor leaving group.

Q.16 Electrophilic α-carbon of alkyl group makes it a good substrate for nucleophile attach which is aided by good leaving groups.

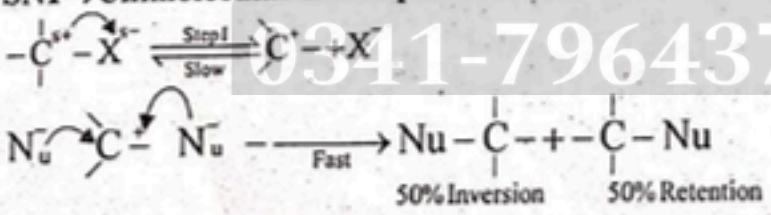
Q.17



$R = k[-\overset{|}{C}-X]$

Order = 1

Q.18 **SN1→Unimolecular nucleophilic substitution**



$R = k[-\overset{|}{C}-X]$

Order = 1

Q.19 β-Elimination involves attack of strong base (e.g. OH^-) on β-hydrogen.

Q.20 Tertiary alkyl halides can be ionized relatively easily due to stable carbocation hence giving S_N1 and E_1 mechanism in both first and the rate determing step involves ionization of R – X to R^+.

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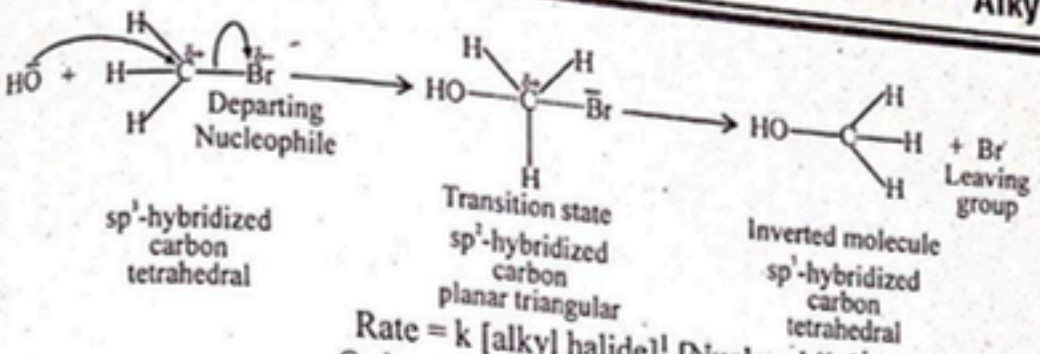
Q.21



Rate = k [alkyl halide]^1 [Nucleophile]^1

Order = 1 + 1 = 2

Q.22

Reactivity of R – X

- $\propto$ C – X bond length
- $\propto \frac{1}{\text{C – X bond energy}}$
- $\propto \frac{1}{\text{Stability}}$

So greater stability means higher B.E

Q.23 SN reactions are favoured by a good leaving and stronger incoming group.

R

- $\propto$ Strength of incoming Nu^-
- $\propto \frac{1}{\text{Strength of leaving } Nu^-}$

Q.24 β-Elimination reaction produces alkenes from alcohol or alkyl halides.

$$R-CH_2-CH_2-X \xrightarrow{\text{Koltaic}} R-CH_2=CH_2+HX$$

$$R-CH_2-CH_2-OH \xrightarrow[180^\circ C]{\text{conc } H_2SO_4} R-CH_2=CH_2+H_2O$$

(Alkene)

Q.25 Reactivity through S_N2 mechanism

$$\propto \frac{1}{\text{Size of R}^\cdot}$$

Hence the order

$CH_3X > C_2H_5 - X > C_3H_7X$

Q.26 Thioalcohol = R – SH

$$R-Br+SH^- \longrightarrow R-SH+Br^-$$

Q.27 Greater steric hinderance, greater stability of R^+ and greater inductive effect favours S_N1.

Q.28 Ter. Butyl bromide is a tertiary alkyl halide, and tertiary alkyl halides favours S_N1.

Q.29 Reactivity of $R-X \propto \frac{1}{\text{C – X bond energy}}$

Reactivity order

$R-I > R-Br > R-Cl > R-R$

Q.30 In heterolytic cleavage one of the atoms leaves with both of the shared electrons in S_N2 mechanism leaving X^- gets both electron.

$$R\text{-}X + Nu^- \rightarrow R\text{-}Nu + X^{-1}$$

Q.31 (i) Due to low bond energy reactivity is highest.
(ii) Greater polarizability of "I" increases boiling point.
(iii) R – I are highly reactive and gives reversible reaction so cannot be prepared directly.

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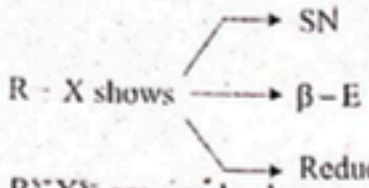
Q.32

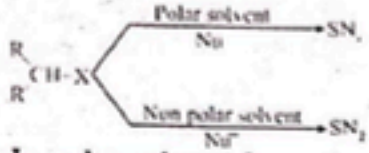


$$R-X \text{ shows} \begin{cases} \longrightarrow SN \\ \longrightarrow \beta-E \\ \longrightarrow \text{Reduction} \end{cases}$$

Q.33 $R^{s+}X^{s-}$ are good substrate for nucleophile attack of α-carbon giving mostly SN reaction.

Q.34

$$\begin{matrix} R \\ R \end{matrix}\!\!>CH-X \begin{cases} \xrightarrow[Nu]{\text{Polar solvent}} SN_1 \\ \xrightarrow[Nu^-]{\text{Non polar solvent}} SN_2 \end{cases}$$



In polar solvent formation of carbocation is favoured which allows S_N1 mechanism.

Q.35 When R – X is excess, these are enough R – X molecules to react with NH_3 and make 1°, 2° and 3° amines.

Q.36 C – X bond has to be broken in order to another Nu^- to replace X^-. So bond energy is major factor.

Q.37 Higher polarizable nucleophile gives off electron easily to electrophilic carbon favouring substitution while it does not favour elimination as it is weak base.

Q.38 KOH in alcoholic medium favour β-elimination, as CH_3-Cl lack β-hydrogen so no reaction may occur.

Q.39 Smaller the R group greater the reactivity. Reactivity order towards S_N2 $CH_3X > RCH_2X > R_2CHX > R_3CX$ increase in R – groups increases steric hindrance.

Q.40 Reactivity of $R-X \propto \dfrac{1}{\text{B.E of } C-X}$

Bond energy order

$C-F > C-Cl > C-Br > C-I$

Hence reactivity order

$CH_3F < CH_3Cl < CH_3Br < CH_3I$

Q.41 CH_3Cl gives only S_N2 reaction giving complete inversion.

Q.42 First step is same in S_N1 and E_2 i.e. ionization to form carbocation. While 2nd step is different in all S_N1, S_N2, E_1 and E_2.

Q.43 Order of stability of carbocations

Tertiary > Secondary > Primary

Stability of R^+ $\propto$ Number of β-hydrogens $\propto$ Inductive effect

Q.44 NH_3 has a lone pair to donate which makes it a good nucleophile.

Q.45 $CH_3-CH_2-Br + Alc.NH_3 \xrightarrow{S_N2} CH_3CH_2-NH_2 + HBr$

Q.46 Bond energy $\propto \dfrac{1}{B.L} \propto \Delta E.N$

Order of B.E $C-F > C-Cl > C-Br > C-I$

Q.47 For E_1 reaction R = K[R–X] unimolecular mechanism.

Q.48 $R-X + OH^-_{(aq)} \xrightarrow{SN} R-OH + X^-$

X^- is substituted by OH^-

Q.49 NH_3 has no net charge. It is nucleophile due to presence of lone pair on nitrogen atom.

Q.50 $CH_3-CH_2-Br + CN^- \xrightarrow{S_N2} CH_3-CH_2-CN + Br^-$

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EXPLANATORY NOTES

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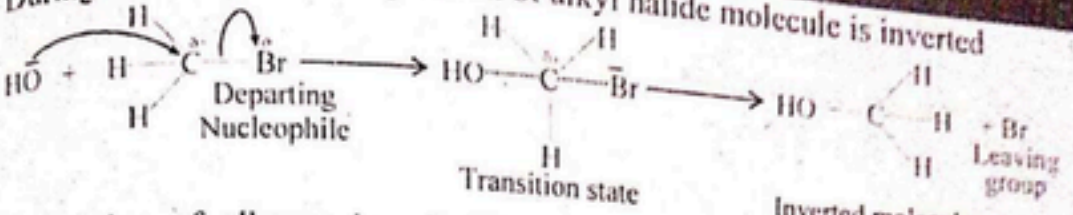
Q.51 During S_N2 reaction, configuration of alkyl halide molecule is inverted



Q.52 Production of alkenes by alkyl halides in the presence of alcohlic KOH is due to elimination mechanism.

Q.53 Alkyl halides produce alcohols under SN mechanism using aqueous solution of NaOH or KOH (slightly warmed).

Q.54 Secondary alkyl halides undergo both SN_1 and SN_2.

Q.55 Reaction I is SN reaction using aqueous KOH while reaction II is elimination using alcoholic KOH.

Q.56 Ethyl bromide gives primary amine with excess of ammonia. If R-X is in excess the mixture of primary, secondary, tertiary and quaternary amine is obtained.

Q.57 Preparation of alkene indicates the elimination mechanism while presence of primary alkyl halides indicates the E_2 mechanism.

Q.58 S_N1 mechanism is consisted of two step, 1st step is formation of carbocation which is slow while 2nd step is attack of nucleophile which is fast.

Q.59 In the elimination reaction, OH^{-1} act as a base which attacks on β-hydrogen

Q.60 Intermediate species formed during S_N1 mechanism is carbocation.

Q.61 During nucleophillic substitution reactions, primary alkyl halides always follow the S_N1 mechanism.

Q.62 In elimination reactions alcohlic KOH is used.

Q.63 Iodide ion (I^{-1}) behaves as a good leaving group as well as good nucleophile due to its larger size and high polarizibility.

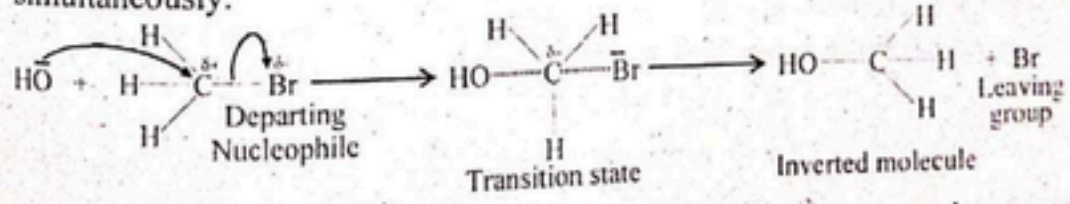
Q.64 BF_3 is an electrophile while all other are nucleophiles.

Q.65 During nucleophilic substitution reactions, primary alkyl halides always follow the S_N1 mechanism.

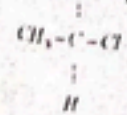
Q.66 Methyl iodide has highest boiling point due to larger size and high polarizibility of iodine.

Q.67 1–chlorobutane with the aqueous sodium hydroxide gives 1-butanol.

Q.68 During S_N2 mechanism, C-X bond breaking and C – Nu bond formation occurs simultaneously.



Q.69 CH_3 in the given compound, α-carbon contains 2 "R" groups so its secondary R-X.



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Q.70 Alkyl halides and alcohols react to form ethers.

Q.71 Reactivity of R-X $\alpha \frac{1}{\text{bond Energy}}$.

Q.72 In step one E_1 and S_N1 both involves formation of carbonium ion.

Q.73 β-Hydrogen is weekly acidic in nature.

Q.74 Aqueous KOH gives the nucleophilic substitution reaction.

(SN reaction) $R-X + \underset{\text{(monopolar)}}{\text{aqueous KOH}} \longrightarrow R-OH + KX$

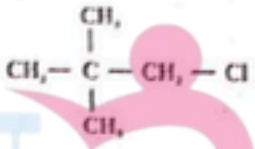
(Elimination reaction) $CH_3-CH_2-X + \underset{\text{(Ionopolar)}}{\text{alcoholic KOH}} \longrightarrow CH_2=CH_2 + KX + H_2O$

Q.75 Reactivity of carbocation $\alpha \frac{1}{\text{Stability of carbocation}}$

Stability order of carbocation is Tertiary Carbocation > Secondary Carbocation > CH_3^+

Q.76 Chloroflourocarbons such as FREON is used as refrigerant.

Q.77 Halogen bearing carbon is directly connected to just one carbon.



Q.78 Alkyl halides are derivatives of alkanes

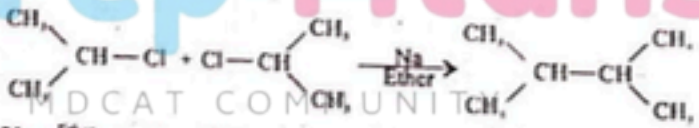
Q.79 $RX + Mg \xrightarrow{\text{Dry Ether}} \underset{\text{Grignard reagent}}{R-Mg-X}$

Q.80 As 2-Chloro-2methylpropane is tertiary alkyl halide and the order of reactivity for S_N1 is **Tertiary Alkyl halide > Secondary Alkyl halide > Primary Alkyl halide**

Q.81 Straight chain structures having more carbon atoms have strong London dispersion forces.

Q.82 S_N1 mechanism dose not involved formation of carbanion.

Q.83 In Wurtz reaction long chain alkanes are formed



Q.84 $CH_3-Mg-X + CH_3-X \xrightarrow{\text{Ether}} CH_3-CH_3 + MgX_2$

Q.85 In elimination reaction alkyl halides on reaction with NaOH produce alkanes.

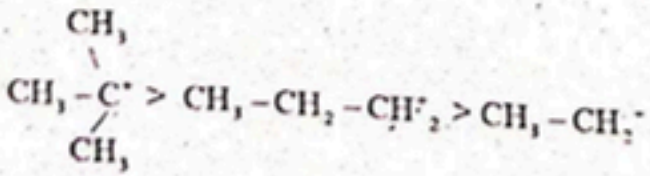
Q.86 S_N1 show double step mechanism in which 1st step is slow which involves the formation of carbocation and in 2nd step is fast step which involves the attack of nucleophile.

Q.87 In reaction of Alkyl halides with lithium di-alkyl copper, produce Alkyl copper.

Q.88 CH_3^+ is electron deficient and behaves as electrophiles.

Q.89 Intermediate involved in S_N1 is 3° carbocation and stability order of carbocations is 3°>2°>1°. Hence, correct order of reactivity of alkyl halides is 3°>2°>1°.

Q.90



Q.91 In S_N2, bond formation and bond breakage occurs simultaneously.

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Q.92 S_N1 involve 3°-carbocation which is planar structure.

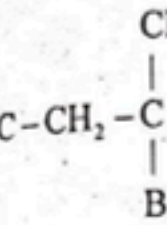
Q.93 Steric hindrance decreases substitution possibility and increases the elimination.

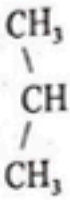
Q.94 Thus, nucleophile can attached from either.

Q.95 E1 and S_N1 are completed in two steps.

Q.96 Unimolecular elimination is a two steps reaction, while bimolecular elimination is a single step reaction.

Q.97 $H_3C-CH_2-\underset{\underset{Br}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$ – the bromine atom is attached to tertiary carbon.





Q.98 $\begin{matrix} CH_3 \\ \backslash \\ CH-Cl \\ / \\ CH_3 \end{matrix}$ the chlorine atom is attached to secondary carbon.

Q.99 The IUPAC name of chloroform is trichloromethane.

Q.100 Transition state in SN2 consists of nucleophile and alkyl halide as nucleophile carries negative charge. Hence, the overall charge on it is negative.

Q.101 Grignard reagents are prepared in neutral solvents, like ether.

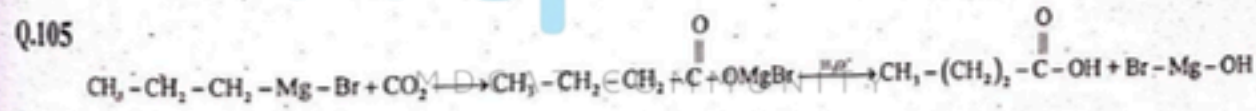
Q.102 Bond energy for R–F is maximum and for R–I is minimum. So correct order of reactivity is (RF > RCl > RBr > RI).

Q.103 Role of leaving groups in both cases is same as in substitution and elimination leaving group is removed.

Q.104 Bond formation and bond breakage occurs simultaneously in S_N2 reaction.

Q.105

$$CH_3-CH_2-CH_2-Mg-Br+CO_2 \longrightarrow CH_3-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-OMgBr \xrightarrow{H_3O^+} CH_3-(CH_2)_2-\overset{\overset{O}{\|}}{C}-OH+Br-Mg-OH$$



Q.106 Unimolecular reactions have one molecularity, i.e. one molecule is involved in rate determining step.

Q.107 Elimination reaction of alkyl halide is carried out in presence of alcoholic KOH.

Q.108 In S_N1, first step is slow ionization of substrate so rate equation involves only concentration of substrate.

Q.109 In Williamson's synthesis the first step is reaction between an alcohol and sodium metal.

Q.110 R–I has least bond energy so it is most reactive.

Q.111 A nucleophile is nucleus loving group rich in electrons.

Q.112 According to IUPAC rules, numbering can be started from either side as substituent is present at equal position and substituents are named in alphabetical order.

Q.113 Method of preparation of ether.

$$C_2H_5Br + Ag_2O \longrightarrow C_2H_5OC_2H_5 + 2AgBr$$

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Topic 16 ALCOHOLS AND PHENOLS

PRACTICE EXERCISE

Q.1 Ether is obtained by reaction of ethyl alcohol and H_2SO_4 at
A. 474K
B. 383
C. 413K
D. 273K

Q.2 Ethyl chloride converted into diethyl ether in
A. Wurtz reaction
B. Grignard reaction
C. Perkin reaction
D. Williamson synthesis

Q.3 Correct order of boiling point for compounds
CH_3-CH_2-CH_2-CH_2-OH (I)
CH_3-CH_2-CH_2-OH (II)
CH_3-CH_2-OH (III)
A. I > II > III
B. III > I > II
C. I > III > II
D. III > II > I

Q.4 Order of esterification of alcohol is
A. p > s > t
B. s > t > p
C. t > s > p
D. None of these

Q.5 Which of the following is most soluble in water?
A. Methanol
B. Ethanol
C. Propanol
D. Butanol

Q.6 HCHO reacts with CH_3-Mg-I to give
A. CH_3-CH_2-OH
B. CH_3-OH
C. CH_3-CH_2-I
D. CH_3-I

Q.7 Phenol is less acidic than
A. Butanol
B. Propanol
C. Methanol
D. None of these

Q.8 Which of the following does not give iodoform test?
A. CH_3-CH_2-OH
B. CH_3-CH_2-CH_2-CH_2-OH
C. $(CH_3)_2$-CHOH
D. CH_3COCH_3

Q.9 Organic acid without carboxylic acid group
A. Picric acid
B. Oxalic acid
C. Ascorbic acid
D. Vinegar

Q.10 Carbolic acid is
A. Acetic acid
B. Phenol
C. Acetone
D. A, B both

Q.11 Which of the following can be used for denaturation of alcohol
A. Methanol
B. Acetone
C. Pyridine
D. All of these

Q.12 Absolute alcohol is
A. 100% C_2H_5OH
B. 100% CH_3OH
C. 95% C_2H_5OH
D. 15% C_2H_5OH

Q.13 The carbon to which functional group in alcohols is attached is
A. α-Carbon
B. β-Carbon
C. Saturated carbon
D. Both A and C

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Q14 **Alcohol in which hydroxyl group is attached to carbon which is further attached to two alkyl groups is**
A. Primary alcohol
B. Tertiary alcohol
C. Secondary alcohol
D. None of these

Q15 **Isobutyl alcohol and isopentyl alcohol are**
A. Primary alcohols
B. Tertiary alcohol
C. Secondary alcohols
D. All

Q16 **Identify a tertiary alcohol**
A. 2-Pentanol
B. 2 – Methyl – 2 – butanol
C. 2,2-Dimethyl – 1 – propanol
D. 3- Methyl – 2- butanol

Q17 **Dehydration of alcohols with conc. H_2SO_4 at 180°C gives:**
A. Ethers
B. Esters
C. Alkenes
D. Alkyl halides

Q18 **Among alkenes which one produces t°-butyl alcohol on acidic hydration**
A. $(CH_3)_2 - C = CH_2$
B. $CH_3 - CH = CH - CH_3$
C. $CH_3 - CH_2 - CH = CH_2$
D. $CH_3 - CH = CH_2$

Q19 **During hydration of alkenes to form alcohols, alkenes are first dissolved in**
A. Water
B. Conc. H_2SO_4
C. Dilute H_2SO_4
D. Both B and C can be used

Q20 **Primary alcohols upon oxidation with acidified dichromate gives**
A. Aldehydes
B. Ketones
C. Branched alkenes
D. All of these

Q21 **Tertiary alcohols with acidified dichromate gives**
A. Aldehydes
B. Ketones
C. Alkenes
D. Alkynes

Q22 **Which of the following reacts with aqueous alkaline iodine:**
A. 1-Propanol
B. Ethanol
C. Methanol
D. 2-Methyl-2-propanol

Q23 **When alcohols react with Na metal, the alkoxide ion thus formed is a strong**
A. Electrophile
B. Nucleophile
C. Acid
D. Free radical

Q24 **An organic compound X is prepared by the oxidation of ethanol. This X reacts with ethanol to produce an ester, what is X likely to be:**
A. Methanoic acid
B. Ethanoic acid
C. Propanoic acid
D. Butanoic acid

Q25 **Which inorganic reagent may be used to distinguish between phenol and methanol**
A. Alkaline aqueous I_2
B. $K_2Cr_2O_7$ in dil. H_2SO_4
C. Aqueous $NaHCO_3$
D. Na metal

Q26 **$K_2Cr_2O_7/H_2SO_4$ generates**
A. O_2
B. H_2
C. [O]
D. [H]

Q27 **Esterification takes place when an alcohol reacts with**
A. Organic acid
B. Inorganic acid
C. Both organic and inorganic acids
D. Ethers

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Q.28 During preparation of ester, the bridge oxygen is from

A. Alcohol
B. Acid
C. Alcohol or acid
D. Catalyst

Q.29 Which of the following is incorrect

A. 1° alcohol oxidizes to form aldehyde which is further oxidized to carboxylic acid
B. 2° alcohol oxidizes to form ketone, which is further oxidized to carboxylic acid
C. 3° alcohol is not oxidized in presence of $K_2Cr_2O_7/H_2SO_4$
D. All are correct statements

Q.30 Alcohols react with Na metal to produce

A. R–ONa
B. H_2 gas
C. Both A and B
D. No reaction takes place

Q.31 When an alcohol reacts with PX_5, the order of reactivity of alcohol is

A. 1° > 2° > 3°
B. 3° > 2° > 1°
C. 2° > 1° > 3°
D. Both B and C are correct

Q.32 There are four alcohols P, Q, R and S with 3,2,1 and zero ∝-hydrogens which will not respond to $Na_2Cr_2O_7/H_2SO_4$

A. P
B. Q
C. R
D. S

Q.33 Alkanol + [o] $\xrightarrow{K_2Cr_2O_7+H_2SO_4}$ A $\longrightarrow$ B

The correct products are

A. $A = C_nH_{2n}O$, $B = C_nH_{2n}O_2$
B. $A = C_nH_{2n+2}O$, $B = C_nH_{2n}O_2$
C. $A = C_nH_{2n}O_2$, $B = C_nH_{2n}O$
D. $A = C_nH_{2n}O$, $B = C_nH_{2n+2}O$

Q.34 When ethanol reacts with sodium metal then

A. C—O bond breaks
B. C—C bond breaks
C. O—H bond breaks
D. C—H bond breaks

Q.35 The number of moles of diol which are required to produce one mole of hydrogen gas.

A. 1
B. 3
C. 2
D. 4

Q.36 Rasberry flavoured compound is produced by a condensation process. The process may be

A. Addition
B. Evaporation
C. Elimination
D. Esterification

Q.37 The one of the functional group isomer of alkoxy alkane reacts with alkanoic acid to produce

A. Alkyl alkanoate
B. Alkane alkanoic acid
C. Alkoxy alkanoate
D. Alkyl alkoxy alkane

Q.38 In esterification reaction, which one of the following bonds of alcohol undergoes cleavage

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A. C — H
B. C — O
C. O — H
D. C — C

Q.39 **Excess alcohol at low temperature in presence of Conc. of H_2SO_4 produces**
A. Ether
B. Organic acid
C. Ester
D. Alkene

Q.40 **Phenol reacts with aqueous bromine and decolorizes aqueous bromine forming the white precipitates of:**
A. 2, 4-Dibromophenol
B. 2-Bromophenol
C. 2, 4, 6-Tribromophenol
D. 3-Bromophenol

Q.41 **Picric acid can be prepared from phenol by**
A. Halogenation
B. Nitration
C. Oxidation
D. Sulphonation

Q.42 **Which one can be used as test for phenol**
A. $C_6H_5OH + CH_3COCl$ in the presence of aq. NaOH
B. $C_6H_5OH + HCHO$ in the presence of NaOH
C. $C_6H_5\ \bar{O}Na^+ + CH_3CH_2\ Br$
D. $C_6H_5OH + Br_2$ (excess)

Q.43 **Phenol on treatment with dil. HNO_3 at low temperature gives**
A. o-Nitrophenol
B. m-Nitrophenol
C. p-Nitrophenol
D. Both A and C

Q.44 **Phenol can be distinguished from alcohol by**
A. Tollen's reagent
B. $Br_{2(aq)}$
C. $NaHCO_3$
D. HCl

Q.45 **The reaction of carbolic acid with caustic soda is used to produce colorless product. The molecular formula of the product is**
A. C_6H_6ONa
B. C_7H_8O
C. C_6H_4OH
D. C_6H_5ONa

Q.46 **Phenol and ethanol can be distinguish by all except**
A. Iodoform test
B. Na–metal
C. Aq. Br_2
D. Lucas-reagent

Q.47 **The reaction of phenol in which ring is involved except**
A. Nitration
B. Esterification
C. Sulphonation
D. Bromination

Q.48 **What is correct order for acidity of water, phenol and ethanol**
A. $C_6H_5OH > H_2O > C_2H_5OH$
B. $H_2O > C_2H_5OH > C_6H_5OH$
C. $C_6H_5OH > C_2H_5OH > H_2O$
D. $H_2O > C_6H_5OH > C_2H_5OH$

Q.49 **Conjugation between unshared electron pair on oxygen and aromatic ring in phenoxide ion results in**
A. Shorter C – O bond distance
B. Stable base
C. Stronger acidic character
D. All of these

Q.50 **The alcohol which is more acidic in nature**
A. Methanol
B. Propanol
C. Ethanol
D. Butanol

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Topic 16 ALCOHOLS AND PHENOLS

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Q.51 Dissociation constant of phenol is: MDCAT (2010)

A. 1.2×10^{-10} B. 1.2×10^{10}

C. 1.3×10^{10} D. 1.3×10^{-10}

Q.52 Which of the following is secondary alcohol? MDCAT (2011)

A. $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-OH$ B. $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH_2-OH$

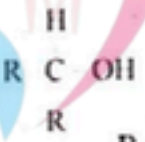
C. $CH_3-CH_2-CH_2-OH$ D. $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH_2-\underset{\displaystyle OH}{\overset{\displaystyle |}{\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}}}-CH_3$

Q.53 An alcohol is converted into an aldehyde with same number of carbon atoms in the presence of K_2CrO_4/H_2SO_4. the alcohol is MDCAT (2011)

A. $CH_2C(CH)_2OH$ B. $CH_3CH_2CH_2OH$

C. $(CH_3)_3COH$ D. $(CH_3)_2CHOH$

Q.54 The following structure is of: MDCAT (2012)



A. Secondary alcohol B. Tertiary alcohol

C. Primary alcohol D. Carboxylic acid

Q.55 Consider the following reaction

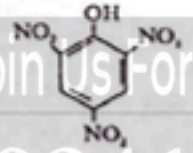
$C_2H_5OH + PCl_5 \rightarrow ?$

What product (s) may be formed? MDCAT (2013)

A. C_2H_5Cl, $POCl_3$ and HCl B. C_2H_5Cl and HCl

C. C_2H_5Cl only D. C_2H_5Cl and $POCl_3$

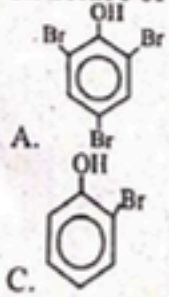
Q.56 _____ is named as MDCAT (2013,2016)



A. Nitro phenol B. Malonic acid

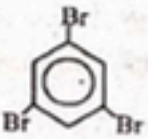
C. Benzoic acid D. Picric acid

Q.57 Aqueous phenol decolorizes bromine water to form a white precipitate. What is the structure of the white precipitate formed? MDCAT (2013)

A. 

B. 

C.

D. 

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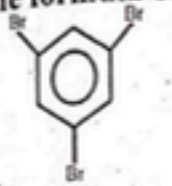
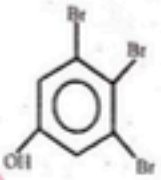
Q.58 Primary, secondary and tertiary alcohols can be identified and distinguished by MDCAT (2014)
A. Lucas test
B. Bayer's test
C. Iodoform test
D. Silver mirror test

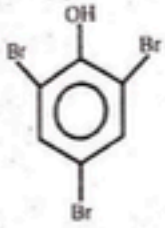
Q.59 Which one of the following groups is indicated when HCl is formed by reaction of ethanol with phosphorus pentachloride? MDCAT (2014)
A. Amino group
B. Halide group
C. Hydroxyl group
D. Hydride group

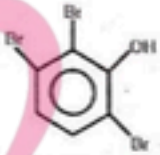
Q.60 Which one of the following alcohol is indicated by formation of yellow crystals in iodoform tests? MDCAT (2014)
A. Methanol
B. Butanol
C. Ethanol
D. Proponal

Q.61 The formula of 2, 4, 6-Tribromophenol is MDCAT (2014,2016)

A. 

B. 

C. 

D. 

Q.62 How will you distinguish between methanol and ethanol? MDCAT (2015)
A. By lucas test
B. By oxidation
C. By silver mirror test
D. By iodoform test

Q.63 Which one of the following is an appropriate indication of positive iodoform test? MDCAT (2016)
A. Formation of H_2O
B. Brick red precipitate
C. Release of H_2 gas
D. Yellow crystal

Q.64 $(CH_3)_3C\text{-}OH$ Which one of the following is proper classification of the above formula? MDCAT (2016)
A. Primary
B. Tertiary
C. Secondary
D. Polyhydric

Q.65 $C_2H_5\text{-}SO_4H \xrightarrow[Warm]{H_2O} C_2H_5\text{-}OH + H_2SO_4$ choose the correct type for this reaction from the following? MDCAT (2017)
A. Reduction
B. Hydroxylation
C. Oxidation
D. Hydration

Q.66 $CH_3-CH_2-OH + PCl_5 \longrightarrow CH_3-CH_2Cl + POCl_3 + HCl$
Formation of HCl is test for the presence of ___ in a compound MDCAT (2017)
A. Alkyl group
B. Saturated alkyl group
C. Hydroxyl group
D. Acid H^+ ion

Q.67 $C_2H_5OH + CH_3\text{-}COOH \rightleftharpoons[H_2SO_4]{}$? what will be the exact product MDCAT (2017)
A. Diethyl ether
B. Ethyl acetate
C. Methyl propyl ether
D. Butyl alcohol

Q.68 At 25°C with phenol 2-4 Dinitrophenol is formed by the reaction of: MDCAT (2017)
A. $(HNO_3+H_2SO_4)$ with benzene
B. NaOH with Benzene sulphonic acid
C. $(HNO_3+H_2SO_4)$ with phenol
D. Sodium phenoxide with HCl

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Q.69 The phenoxide ion is more stable than ethoxide ion as MDCAT (2017)
A. Lone pair on O-atom overlaps with the delocalized π-bonding system in benzene
B. Oxygen atom is directly bonded with benzene ring in phenoxide ion
C. The negative charge is localized on oxygen atom of phenoxide ion
D. The negative charge is delocalized on oxygen atom of ethoxide ion

Q.70 The acidity of phenol is due to its_____: MDCAT (2017)
A. Nature of Benzene B. Nature of phenoxide
C. Double bond in benzene ring D. Hydroxyl group

Q.71 Alcohol in which carbon atom bonded to –OH group is further attached with three alkyl group is MDCAT (2018)
A. Aromatic alcohol B. Primary alcohol
C. Secondary alcohol D. Tertiary alcohol

Q.72 Which one the following compounds is known as tertiary alcohol? MDCAT (2018)
A. 2-Methyl-1-propanol B. 2-Methyl-2-propanol
C. 2-Propanol D. 1-Propanol

Q.73 Ethanol, ethanoic acid and phenol all contain acidic functional groups, the order of the acidic strength is Ethanoic acid > Phenol > Ethanol
This is mainly due to SET (2019)
A. Electron releasing (donating) effect of ethanoic acid is greater than that of ethanol
B. Electron releasing (donating) effect of phenol is greater than that of ethanol
C. Electron with drawing effect of phenol is greater than that of ethanol
D. Electron with drawing effect of ethanoic acid is greater than that of phenol

Q.74 Distinction between ethanol and phenol can be ascertained by all except SET (2019)
A. Lucas test B. Reaction with bromine
C. Iodoform test D. Tollen's test

Q.75 Choose a primary alcohol among the following SET (2019)
A. 2-methyl-2-propanol B. 2,2-dimethyl-1-propanol
C. 2-propanol D. 3-methyl-2butanol

Q.76 Dehydration of ethanol at 180°C in the presence of conc-H_2SO_4 gives NUMS (2019)
A. Ethene B. Ethane
C. Ethyne D. Ether

Q.77 Industrially water gas is converted into methanol by using catalyst NUMS (2019)
A. $CuO + ZnO$ B. $CuO + Cr_2O_3$
C. $Al_2O_3 + ZnO$ D. $ZnO + Cr_2O_3$

Q.78 Phenol reacts with CH_3COCl to give NUMS (2019)
A. Acid B. Ester
C. Aldehyde D. Ketone

Q.79 Choose reaction that does not require $ZnCl_2$ Catalyst: ETEA (2016)
A. $CH_3CH_2OH + HCl \longrightarrow CH_3CH_2Cl + H_2O$
B. $CH_3CH_2OH + HBr \longrightarrow CH_3CH_2Br + H_2O$
C. $CH_3CH_2OH + HI \longrightarrow CH_3CH_2I + H_2O$
D. Both B & C

Q.80 Tertiary alcohols are not oxidized into carbonyl compounds because ETEA (2019)
A. They contain more alkyl group B. They have no alpha-hydrogen
C. Suitable oxidizing agent is not available D. None of the above

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Q.81 Ketones can be made by oxidation of MDCAT (2019)
A. Primary Alcohols
B. Secondary Alcohols
C. Tertiary Alcohols
D. Aldehydes

Q.82 Select the reagent X from the following choices for this conversation; MDCAT (2019)
$CH_3CH(OH)CH(CH_3)_2 \xrightarrow{\text{Reagent X}} CH_3COCH(CH_3)_2$
A. Acidified Phosphoric acid
B. Acidified Potassium dichromate (VI)
C. Acidified Potassium hydroxide
D. Acidified Oxalic acid

Q.83 IUPAC name of $C_6H_8O(CH_3)_2$ is NMDCAT (2020)
A. 2-Methyl-3-hexanone
B. 2,6-Dimethyl cyclohexanone
C. 3-Methyl cyclohexanone
D. 4-Methy l-3-hexanone

Q.84 Phenol is known as: NMDCAT (2020)
A. Carpolic acid
B. Carbonylic acid
C. Carbolic acid
D. Carbolylic acid

Q.85 Phenol is more acidic than alcohols because of the following reason NMDCAT (2020)
A. Delocalization of negative charge in the OH group
B. Delocalization of positive charge on the carbon atom in ring
C. Delocalization of negative charge in the ring
D. Delocalization of positive charge in the OH group

Q.86 The compounds which are formed by the replacement of one of the H of water by a alkyl group are called as _____? PMC (2021)
A. Ethers
B. Phenols
C. Alcohols
D. Carboxylic acids

Q.87 Which of the following does not react with bases? PMC (2021)
A. Carboxylic acids
B. Ethanol
C. Phenol
D. HCl

Q.88 Picric acid is PMC (2021)
A. Monocarboxylic
B. Dicarboxylic acid
C. Tricarboxylic acid
D. Acidic phenol

Q.89 Phenol reacts with NaOH to form PMC (2021)
A. Acid
B. Base
C. Salt
D. Ester

Q.90 What is the common name of 1, 2, 3-propantriol? UHS (2022)
A. Butyl alcohol
B. Glycol
C. Glycerol
D. Propyl alcohol

Q.91 Benzene is formed when Zn reacts with which of the following? UHS (2022)
A. Alcohol
B. Propanol
C. Butyl alcohol
D. Phenol

Q.92 When phenol reacts with formaldehyde, which of the following product is produced? UHS (2022)
A. Adduct
B. Oxonium ion
C. Hydronium ion
D. Phenoxide ion

Q.93 Which is the most suitable reagent for the conversion of $R\text{-}CH_2OH \rightarrow RCHO$? UHS (2022)
A. $KMnO_4/NaOH$
B. CrO_3
C. $K_2Cr_2O_7/H_2SO_4$(Conc.)
D. Cr_2O_4/H_2SO_4(Conc.)

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Q.94 Phenols are very reactive towards: SZABMU (2022)
A. Oxidizing agent
B. Reducing agent
C. Dehydrating agent
D. Hygroscopic agent

Q.95 Both alcohols and phenols contain: SZABMU (2022)
A. -OH group
B. -COOH group
C. $-CH_3$ group
D. -CHO group

Q.96 Which of the following compounds is most acidic? ETEA (2022)
A. Water
B. Ethanol
C. Phenol
D. Cyclohexanol

Q.97 What will be the product when phenol reacts with concentrated HNO_3? ETEA (2022)
A. Piciric acid
B. Para-Nitrophenol
C. Ortho-Nitrophenol
D. All of the above

Q.98 Bakelite is polymer of: DUHS (2022)
A. Two glucose molecules
B. Formaldehyde & acetone
C. Two amino acid molecule
D. Formaldehyde & phenol
E. Acetone & carboxylic acid

Q.99 Phenol when subjected to nitration product is: DUHS (2022)
A. o – nitro phenol
B. p – nitro phenol
C. o – nitro phenol & m – nitro phenol
D. o – nitro phenol & p – nitro phenol
E. m – nitro phenol

Q.100 Secondary alcohols have. DUHS (2022)
A. One β-C
B. Three β-C
C. No β-C
D. Two β-C
E. Four β-C

Q.101 Oxidation of primary alcohol gives: DUHS (2022)
A. Aldehyde
B. Ketone
C. Alkane
D. Alkene
E. Alkaloids

Q.102 Primary alcohol when react with a halogen acid, the product is: DUHS (2022)
A. Secondary alcohol
B. Tertiary alcohol
C. Primary alcohol
D. Primary alkyl halide
E. Secondary alkyl halide

Q.103 Benzyl alcohol $C_6H_5CH_2OH$ is a: DUHS (2022)
A. Aromatic alcohol
B. Phenol
C. Aromatic ketone
D. Aliphatic alcohol
E. Alicyclic alcohol

Q.104 Which one of the following statements is true? BMU (2022)
A. Phenol is less acidic than alcohol
B. Phenol is more acidic than HCl
C. Phenol dissolves alkalies readily
D. Phenol is more acidic than carboxylic acid

Q.105 Phenol is more reactive than benzene towards electrophilic substitution. This characteristic is due to which of the following? BMU (2022)
A. Hydrogen bonding
B. Inductive effect
C. Strong mesomeric effect
D. Weak mesomeric effect

Q.106 Which of the following is Lucas reagent? BMU (2022)
A. $AlCl_3$
B. HCl
C. $ZnCl_2$
D. Both B and C

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Q.107 Benzene can be formed from phenol in which of the following reactions? NUMS (2022)
A. Reduction with hydrogen in the presence of Ni
B. Reduction with zinc
C. Reduction with alkali
D. Reduction with acids

Q.108 Lucas test is used for the identification of NUMS (2022)
A. Alkyl halides
B. Alkene
C. Alcohols
D. Carboxylic acids

Q.109 Phenol has following characteristics and physical properties NUMS (2022)
A. Colorless crystalline solid
B. Colorless crystalline deliquescent solid
C. Colorless amorphous solid
D. Colorless amorphous deliquescent solid

Q.110 If phenol is treated with 3 moles of conc. HNO_3 in the presence of H_2SO_4 what will be the product? UHS (2023)
A. o-nitro phenol
B. p-nitro phenol
C. o-nitro phenol and p-nitro phenol
D. picric acid

Q.111 Dehydration of alcohol gives which of the following product in the presence of H_2SO_4 at 140° C? UHS (2023)
A. Acetaldehyde
B. Diethyl ether
C. Ethyl acetate
D. Ethyl chloride

Q.112 The order of reactivity of alcohol when O–H bond breaks is: SZABMU (2023)
A. Primary alcohol > secondary alcohol > tertiary alcohol
B. Secondary alcohol > tertiary alcohol > primary alcohol
C. Tertiary alcohol > secondary alcohol > Primary alcohol
D. Primary alcohol > Tertiary alcohol > Secondary alcohol

Q.113 The following functional group is the result of oxidation of alcohol SZABMU (2023)
A. Ketone / aldehyde
B. Aldehyde / alkane
C. Ketone / alkane
D. Aldehyde / acid

Q.114 Ethyl alcohol in the presence of H_2SO_4 at 170°C produces: ETEA (2023)
A. Ether
B. Ethene
C. Ester
D. Ethane

Q.115 Benzene–1,3-diols is also known as: ETEA (2023)
A. Catechol
B. Resorcinol
C. Hydroquinone
D. O-cresol

Q.116 When phenol reacts with excess of bromine in aqueous solution it results in the formation of: ETEA (2023)
A. Ortho/para bromophenol
B. Meta-bromophenol
C. 2,4,6-Tribromophenol
D. 3,5 Dibromophenol

Q.117 Which of the following reactions can be used for the conversion of ethyl alcohol into acetaldehyde? DUHS (2023)
A. Polymerization
B. Dehydrogenation
C. Esterification
D. Reduction

Q.118 Which of the following is formed, when excess of ethyl alcohol is treated with concentrated H_2SO_4 at a low temperature? DUHS (2023)
A. Diethyl ether
B. Dimethyl ether
C. Ethene
D. Acetylene

Q.119 Oxidation of secondary propyl alcohol gives: DUHS (2023)
A. Acetone
B. Acetaldehyde
C. Ethyl alcohol
D. Normal propyl alcohol

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Q.120 Methanol is prepared from carbon monoxide and hydrogen. The catalyst used for this reaction is? BUMHS (2023)

A. $ZnO + CoO_2$
B. $ZnO + CuO$
C. $ZnO + Ag_2O$
D. $Cr_2O_3 + ZnO$

Q.121 What is the reactivity state of phenols? BUMHS (2023)

A. Less reactive
B. More reactive
C. Neutral
D. Nonreactive

Q.122 Which of the following reactions differentiates alcohol from phenol? NUMS (2023)

A. Lucas test
B. Halogenations
C. Nitration
D. Iodoform test

Q.123 The order of reactivity of alcohol when C-O bond breaks is: NUMS (2023)

A. Tertiary alcohol > secondary alcohol > Primary alcohol
B. Secondary alcohol > Primary alcohol > tertiary alcohol
C. Primary alcohol > Secondary alcohol > tertiary alcohol
D. Tertiary alcohol > primary alcohol > secondary alcohol

Q.124 Which of the following alcohol can give Iodoform reaction? UHS (2024)

A. Methanol
B. 1-Propanol
C. 1-Butanol
D. Ethanol

Q.125 Which of the following is correct regarding phenol UHS (2024)

A. Phenol and water are equally acidic
B. Phenol is less acidic than water
C. Phenol is less acidic than carboxylic acid
D. Phenol is less acidic than ethanol

Q.126 When carboxylic acid is heated with alcohol in the presence of sulphuric acid, one of the following is formed UHS (2024)

A. Amides
B. Ester
C. Acyl chloride
D. Acid anhydride

Q.127 Which product is formed by the reaction of phenol with concentrated nitric acid? SZABMU (2024)

A. Adipic acid
B. Picric acid
C. m-Nitrophenol
D. p-Nitrophenol

Q.128 The anion derived by deprotonation of an alcohol acts as_____. SZABMU (2024)

A. Acidic moiety
B. Lewis acid
C. Electrophile
D. Lewis base

Q.129 The melting and boiling point of alcohols are high as compared to corresponding alkanes due to SZABMU (2024)

A. Dipole-dipole interaction
B. Ionic Interactions
C. Hydrogen bonding
D. Van der Waal interactions

Q.130 Which type of substituent will increase the acidic strength of phenols? SZABMU (2024)

A. Electron donating substituents
B. Lewis's bases
C. Electron withdrawing substituents
D. Nucleophiles

Q.131 Which product will be formed finally on the reduction of acetic acid with $LiAlH_4$? SZABMU (2024)

A. Ethanal
B. Ethanoic
C. Ethane
D. Ethanol

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Q.132 Which type of reaction will be occur, when an alcohol reacts with a carboxylic acid? SZABMU (2024)
A. Dehydration reaction
B. Esterification reaction
C. Dehydrogenation reaction
D. Reduction reaction

Q.133 Which solvent is used when alcohol reacts with thionyl chloride to form alkyl halide? SZABMU RC-(2024)
A. Zinc chloride
B. Carbon tetrachloride
C. Pyridine
D. Sulphuric acid

Q.134 Which process is used to convert alcohol into ether? SZABMU RC-(2024)
A. Oxidation
B. Condensation
C. Reduction
D. Dehydration

Q.135 Name the compound which forms phenol, when it is oxidized by atmosphere oxygen in the presence of metal catalyst? (Out of syllabus) SZABMU RC-(2024)
A. Cumene
B. Benzene
C. Toluene
D. Aniline

Q.136 IUPAC name of picric acid is SZABMU RC-(2024)
A. 2, 4, 6 tribromophenol
B. 2, 4, 6 trinitrotoluene
C. 2, 4, 6 trinitrophenol
D. 2, 4, 6 trimethylphenol

Q.137 The reaction of sodium salt of phenol with CO_2 is called (Out of syllabus) SZABMU RC-(2024)
A. Williamson Synthesis
B. Aldol reaction
C. Cannizzaro reaction
D. Kolbe Schmitt reaction

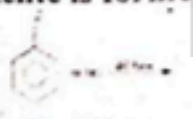
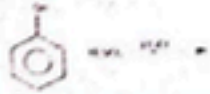
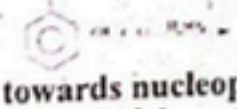
Q.138 Which of the following has the highest boiling point? ETEA (2024)
A. Ethyl alcohol
B. n-propyl alcohol
C. Isopropyl alcohol
D. tert-butyl alcohol

Q.139 The reaction of an alcohol with sodium produces ETEA (2024)
A. Aldehyde
B. Ethane
C. Alkoxide
D. Ethene

Q.140 Oxidation of secondary alcohol gives ETEA (2024)
A. Carboxylic acid
B. Ketone
C. Ether
D. Phenol

Q.141 Which of the following compound is not an alcohol BUMHS (2024)
A. CH_3OH
C. C_6H_5OH
B. C_2H_5OH
D. $C_6H_5CH_2OH$

Q.142 The concentration of rectified spirit is _____ alcohol BUMHS (2024)
A. 85%
C. 95%
B. 90%
D. 100%

Q.143 Bakelite is formed upon polymerization of NUMS (2024)
A. 
B. 
C. 
D. 

Q.144 The increasing order of reactivity of alcohols towards nucleophile is: NUMS (2024)
A. 2-methyl-2-pentanol < 3-methyl-2-pentanol < 2-methyl-1-pentanol
B. 2-methyl-2-pentanol > 3-methyl-2-pentanol > 2-methyl-1-pentanol
C. 2-methyl-1-pentanol < 3-methyl-2-pentanol < 2-methyl-2-pentanol
D. 2-methyl-1-pentanol > 3-methyl-2-pentanol < 2-methyl-2-pentanol

Q.145 The most reactive alcohol towards Lucas reagent is: NUMS (2024)
A. 2 - butanol
B. 2 – methyl -2 - butanol
C. 2-methyl-1-butanol
D. 2,2 – dimethyl – 1 – butanol

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ANSWER KEY

PRACTICE EXERCISE

1	C	11	D	21	C	31	B	41	B
2	D	12	A	22	B	32	D	42	D
3	A	13	A	23	B	33	A	43	D
4	A	14	C	24	B	34	C	44	B
5	B	15	A	25	B	35	A	45	D
6	A	16	B	26	C	36	D	46	B
7	D	17	C	27	A	37	A	47	B
8	B	18	A	28	A	38	C	48	A
9	A	19	B	29	D	39	A	49	D
10	B	20	A	30	C	40	C	50	A

PAST PAPER MCQ'S

51	D	61	C	71	D	81	B	91	D	101	A	111	B	121	A	131	D	141	C
52	A	62	D	72	B	82	B	92	A	102	D	112	A	122	B	132	B	142	C
53	B	63	D	73	D	83	B	93	D	103	A	113	A	123	A	133	C	143	A
54	A	64	B	74	D	84	C	94	A	104	C	114	B	124	D	134	B	144	C
55	A	65	D	75	B	85	C	95	A	105	C	115	B	125	C	135	A	145	B
56	D	66	C	76	A	86	C	96	C	106	D	116	C	126	B	136	C		
57	A	67	B	77	D	87	B	97	A	107	B	117	B	127	B	137	D		
58	A	68	C	78	B	88	D	98	D	108	C	118	A	128	D	138	B		
59	C	69	A	79	D	89	C	99	D	109	B	119	A	129	C	139	C		
60	C	70	B	80	B	90	C	100	D	110	D	120	D	130	C	140	B		

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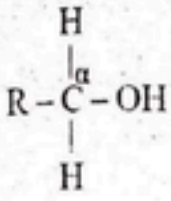
EXPLANATORY NOTES

Q.11 Methanol, acetone and pyridine all can be added to make it unfit for human consumption.

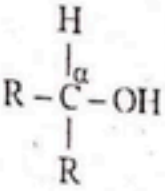
Q.12 Absolute alcohol is pure ethanol i.e. 100% ethanol.

Q.13 $-\overset{\gamma}{C}-\overset{\beta}{C}-\overset{\alpha}{C}-F.G$

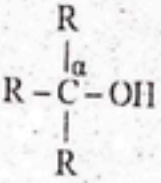
Q.14



Primary alcohol

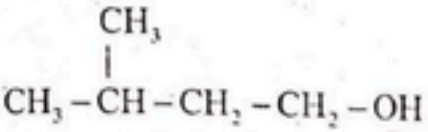


Secondary alcohol

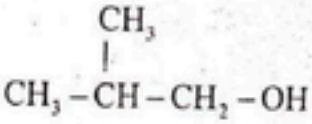


Tertiary alcohol

Q.15



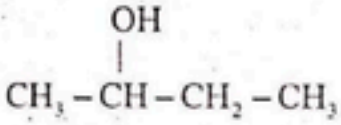
Iso-pentyl alcohol



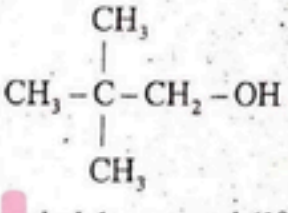
Iso-butyl alcohol

in both –OH is attached to primary carbon.

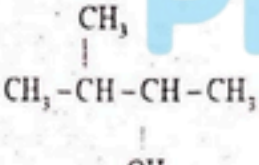
Q.16



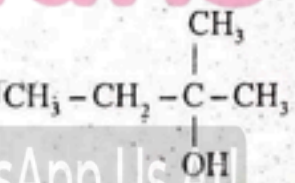
2-Pentanol (1° ROH)



2,2-Dimethyl-1-propanol (1° ROH)



3-Methyl-2-Butanol (2° ROH)

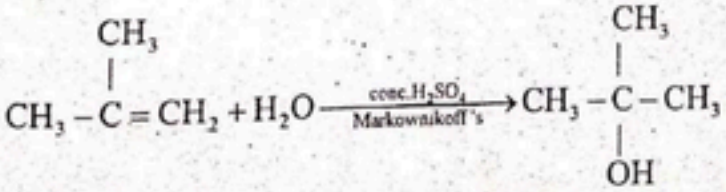


2-Methyl-2-Butanol (3° ROH)

Q.17 $CH_3-CH_2-OH \underset{180°}{\overset{conc.H_2SO_4}{\rightleftharpoons}} CH_2=CH_2+H_2O$

At high temperature β-elimination is promoted.

Q.18



Q.19

$$CH_2=CH_2+H_2SO_4 \rightleftharpoons \underset{\text{ethyl hydrogen sulphate}}{CH_3-CH_2-SO_4H} \xrightleftharpoons{H_2O(100°c)} CH_3-CH_2-OH+H_2SO_4$$

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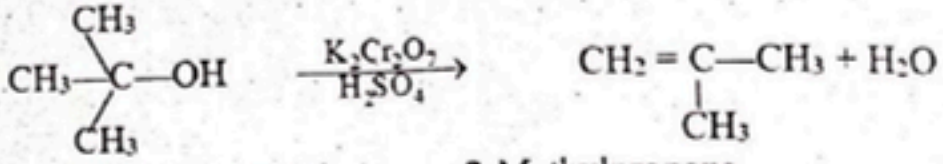
Q.20
$$R-CH_2-OH+[O]\xrightarrow{K_2Cr_2O_7/H_2SO_4}R-\overset{O}{\overset{\|}{C}}-H+H_2O$$
Alcohol — Aldehyde

Q.21 Tertiary alcohol do not undergo oxidation instead they undergo β-elimination to give alkenes.



2-Methyl-2-propanol — 2-Methylpropene

Q.22 Ethanol is the only primary alcohol to give iodoform test and in 2°-alcohol only 2-alkanols.

Q.23 $R-O^-$ is an electron rich specie hence a strong nucleophile.

Q.24
$$CH_3-CH_2-OH\xrightarrow{\text{oxidation}}CH_3-\overset{O}{\overset{\|}{C}}-H\xrightarrow{\text{oxidation}}CH_3COOH$$
Ethanol — ethanal — ethanoic acid (X)

$$CH_3COOH+C_2H_5OH\rightleftharpoons^{H_2SO_4}CH_3-CO-OC_2H_5+H_2O$$
(X) — ester

(X) = Ethanoic acid

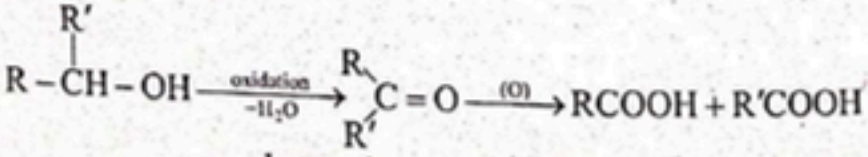
Q.25 Methanol gets oxidized by acidified $K_2Cr_2O_7$ but phenol does not.

Q.26
$$K_2Cr_2O_7+4H_2SO_4\longrightarrow K_2SO_4+Cr(SO_4)_3+4H_2O+3[O]$$

Q.27
$$RCOOH+R'OH\rightleftharpoons^{H_2SO_4}RCOOR'+H_2O$$ esterification
Organic acid — Alcohol — Ester

Q.28 –OH group of acid is replaced by RO of alcohol giving SN reaction. So, bridge oxygen comes from alcohol.

Q.29
$$R-CH_2-OH\xrightarrow[-H_2O]{\text{oxidation}}R-\overset{O}{\overset{\|}{C}}-H\xrightarrow{\text{oxidation}}RCOOH$$
acid



ketone

Tertiary Alcohol are not oxidized

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Q.30 $2ROH + 2Na \longrightarrow 2R-ONa + H_2$

Q.31 Reaction of alcohol with PX_5 is nucleophilic substitution reaction in which OH^- is replaced by X^- and C–O bond is broken hence the order $3^\circ > 2^\circ > 1^\circ$.

Q.32 Zero α-hydrogen means "S" is tertiary alcohol, hence it does not undergo oxidation.

Q.33 $\underset{}{\text{Alkanol}} \xrightarrow{\text{oxidation}} \underset{A}{\text{Aldehyde}} \xrightarrow{\text{oxidation}} \underset{B}{\text{Carboxylic acid}}$

$C_nH_{2n}O$ $\quad$ $C_nH_{2n}O_2$

Q.34 $2C_2H_5OH + 2Na \longrightarrow C_2H_5ONa + H_2$

It is replaced by Na^+ by breaking O–H bond.

Q.35 $HO-CH_2-CH_2-OH \xrightarrow{2Na} NaO-CH_2-CH_2-ONa + H_2$

Diols have 2 replaceable hydrogen.

Q.36 Esters give off particular flavours.

Isobutyl formate = Raspberry flavour.

Iso-Butyl alcohol + Formic acid $\underset{}{\overset{\text{Esterification}}{\rightleftharpoons}}$ Isobutyl formate.

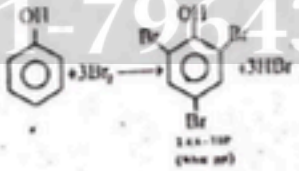
Q.37 Functional group isomer of alkoxy alkanes (ethers) is alkanol (alcohol) which reacts with alkanoic acids (carboxylic acids) to give esters (alkoxy alkanoate).

Q.38 $R-\underset{\underset{O}{\|}}{CH}-OH + HO-R' \underset{}{\overset{\text{Conc } H_2SO_4}{\rightleftharpoons}} R-\underset{\underset{O}{\|}}{C}-OR' + H_2O$

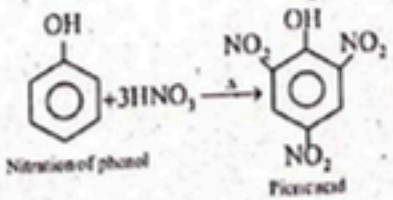
Reaction shows breakage of O–H bond in alcohol

Q.39 Low temperature favours formation of ethers by dehydration of alcohols, while high temperature favours β-elimination to form alkenes.

Q.40



Q.41



Nitration of phenol

Picric acid

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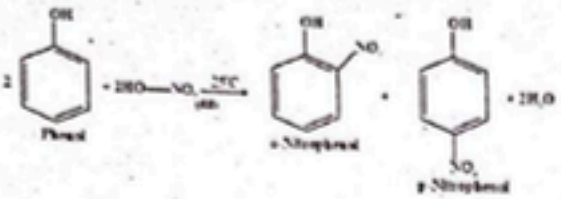
Q.42 Phenol can be tested by bromine water test, as it gives white ppt of 2,4,6-Tribromophenol.

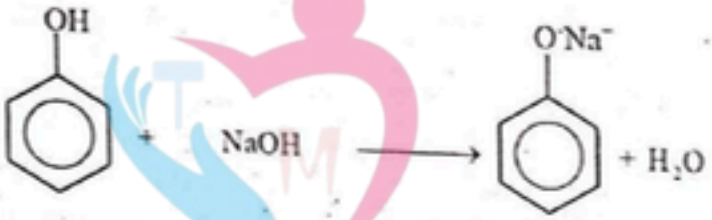
Q.43



Q.44 Both alcohols and phenol do not give Tollen's test, $NaHCO_3$ test and reaction with HCl. However, phenol reacts with Br_2, to give white ppt but alcohol does not.

Q.45

Phenol reacts with alkalis to form salts e-g:



Sodium Phenoxide

Q.46

Test	Phenol	Ethanol
Iodoform	×	✓
Br_2 water	✓	×
Na-Metal	✓	✓
Lucas-test	×	✓

Hence, Na-metal cannot distinguish between phenol and ethanol.

Q.47 Esterification is due to OH group and not the ring.

Q.48 Phenol is more acidic due to resonance in phenoxide, then comes water and alcohol is least acidic due to unstable alkoxide ion.

Q.49 Conjugation between O^- and benzene ring gives C–O bond a double bond characters that leads to

i) Shorter bond length

ii) Resonance give stability to phenoxide

iii) Stability of conjugate base $\propto$ Acidic strength

Q.50 Alcohol that gives stable alkoxide ion are more acidic stability order of $R-O^-$.

$$CH_3O^- > C_2H_5-O^- > C_3H_7O^- > C_4H_9O^-$$

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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.51 Dissociation constant (Ka) of phenol is 1.3×10^{-10}

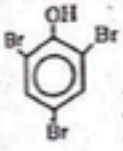
Q.52 $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-OH$ in this compound alpha carbon is attached with 2 methyl groups so it is secondary alcohol.

Q.53 Primary alcohols are converted into aldehydes by oxidizing agents, so $CH_3CH_2CH_2OH$ is the alcohol to be converted into aldehyde.

Q.54 $R-\underset{\displaystyle R}{\overset{\displaystyle H}{\overset{|}{C}}}-OH$ in this compound α-carbon is attached with 2 alkyl groups so it is secondary alcohol.

Q.55 In the given reaction, C_2H_5Cl, $POCl_3$ and HCl are obtained as a product.

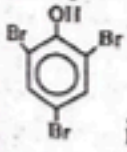
Q.56 Name of the given compound is 2,4,6-trinitrophenol or Picric acid.

Q.57  Phenol gives white ppt of 2,4,6-tribromophenol with bromine water

Q.58 Primary, secondary and tertiary alcohols are distinguished by Lucas test in which alcohols react with HCl ($ZnCl_2$ as a catalyst). In the result ter. Alcohols give oily layer immediately while pri. Alcohol gives upon heating.

Q.59 $CH_3-CH_2-OH+PCl_5 \longrightarrow CH_3-CH_2Cl+POCl_3+HCl$ in this reaction formation of HCl is the indication of OH group, which is replaced by Cl ion.

Q.60 All given alcohols are primary in nature and only ethanol is the primary alcohol which gives positive iodoform test.

Q.61  is the structure of 2,4,6-tribromophenol.

Q.62 Methanol and ethanol both are primary alcohols and can be distinguished by iodoform test which is given positively by ethanol.

Q.63 Formation of iodoform is indicated by yellow ppts.

Q.64 $(CH_3)_3C$-OH in tertiary alcohol as 3 methyl groups are attached to alpha carbon.

Q.65 C_2H_5-$SO_4H \xrightarrow[\text{Warm}]{H_2O} C_2H_5$-$OH + H_2SO_4$ this is hydration reaction.

Q.66 $CH_3-CH_2-OH+PCl_5 \longrightarrow CH_3-CH_2Cl+POCl_3+HCl$ in this reaction formation of HCl is the indication of OH group, which is replaced by Cl ion.

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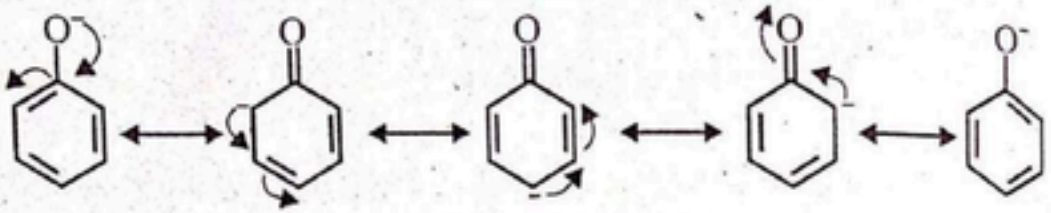
Q.67 Ethyl acetate (ester) is formed by the reaction of ethanol and acetic acid.

Q.68 At 25°C with phenol 2-4 Dinitrophenol is formed by the reaction of (HNO_3+H_2SO_4) with phenol.

Q.69 Phenoxide ion is more stable than alkoxide ion because lone pair on O-atom overlaps with delocalized π-electrons in benzene ring as shown below.



Q.70 Acidic behaviour of phenol is due to nature of phenoxide.

Q.71 Alcohol in which carbon atom bonded to –OH group is further attached with three alkyl group is tertiary alcohol, $(CH_3)_3C$-OH.

Q.72 $(CH_3)_3C$-OH, 2-methyl-2-propanol is tertiary alcohol.

Q.73 Electron with drawing effect of ethanoic acid is greater than that of phenol that is why the order of the acidic strength is Ethanoic acid > phenol > ethanol.

Q.74 Ethanol and phenol cannot be distinguished by Tollen's test because it is the test for aldehydes.

Q.75 2,2-dimethyl-1-propanol is the primary alcohol.

Q.76 Dehydration of ethanol at 180°C in the presence of conc-H_2SO_4 gives ethene while at lower temperature it will give ether.

Q.77 Industrially water gas is converted into methanol by using catalyst ZnO + Cr_2O_3

Q.78 Phenol reacts with acid halides to give ester as OH group of phenol is involved.

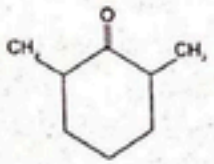
Q.79 Reaction of alcohols with HBr and HI does not require $ZnCl_2$ catalyst due to their greater reactivity than HCl.

Q.80 Tertiary alcohols are not oxidized into carbonyl compounds because they have no alpha-hydrogen.

Q.81 Ketones are obtained by the oxidation of secondary alcohols.

Q.82 Acidified Potassium dichromate (VI) is used to oxidize the secondary alcohols into ketones.

Q.83 Correct name of $C_6H_8O(CH_3)_2$ is 2,6- Dimethylcyclohexanone.



Q.84 Common name of phenol is carbolic acid.

Q.85 Delocalization of negative charge of O-atom in the ring is the reason for the strength of phenol as an acid.

Q.86 Alcohols are derivatives of water.

Q.87 Alcohol is weekly acidic in nature

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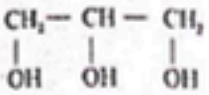
Acidic order: **Carboxylic acid > Phenol > Water > Alcohol.**

Q.88 Picric acid has acidic nature.

Q.89 Phenol reacts with NaOH to form salt because Phenol behave as acid.

Q.90 1,2,3-propantriol is also known as glycerol.



Q.91 Benzene is formed when Zinc reacts with phenol.

Q.92 When phenol reacts with formedaldehyde the product is adduct.

Q.93 Cr_2O_4/H_2SO_4(Conc.) is most suitable reagent for conversion of alcohols into aldehydes.

Q.94 Phenols are very reactive towards oxidizing agent because phenols is rich in electrons and oxidizing agents are electron deficient.

Q.95 Both alcohols and phenols contain –OH group.

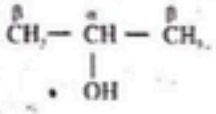
Q.96 Acidic order is **Phenol > Water > Cyclohexanone > Ethanol.**

Q.97 When phenol reacts with concentrated HNO_3 picric acid is produced.

Q.98 Bakelite is polymer of formaldehyde & Phenol.

Q.99 –OH group is ortho para directing group.

Q.100 Secondary alcohols have two β-carbons.



Q.101 Oxidation of primary alcohols gives aldehydes and oxidation of secondary alcohol gives ketones.

Q.102 Primary alcohol when react with halogen acid the product is primary alkyl halide



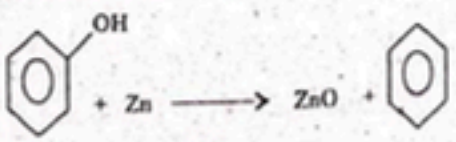
Q.103 Benzyl alcohol is aromatic alcohol.

Q.104 Phenol reacts with NaOH to form salt because here phenol is behaving and NaOH is base.

Q.105 In phenol –OH group is activator it increases the reactivity through strong mesomaric effect.

Q.106 Conc. HCl and $ZnCl_2$ are Lucas reagent.

Q.107 Benzene can be formed from phenol during reduction with Zinc.



Q.108 Lucas test is used for identification of primary, secondary and tertiary alcohols.

Q.109 Phenol is colourless, crystalline, deliquescent solid.

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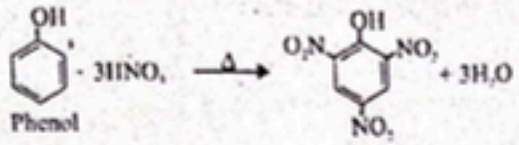
Q.110



Phenol

2,4,6-trinitrophenol
(Picric acid)

Q.111

$$2C_2H_5OH \xrightarrow[140^\circ C]{\text{conc. } H_2SO_4} C_2H_5OC_2H_5 + H_2O$$

Diethyl ether

Q.112 Primary alkoxide is more stable than secondary and tertiary alkoxide.

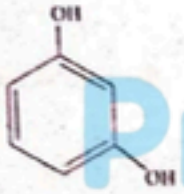
Q.113 Alcohols give aldehydes, ketones or carboxylic acids on oxidation, depending on their structure and conditions.

Q.114

$$C_2H_5OH \xrightarrow[180^\circ C]{\text{conc. } H_2SO_4} CH_2 = CH_2 + H_2O$$

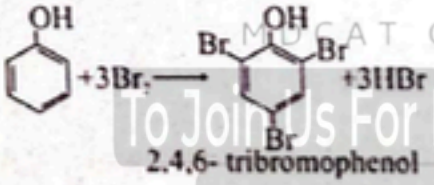
Ethene

Q.115



resorcinol

Q.116



2,4,6- tribromophenol

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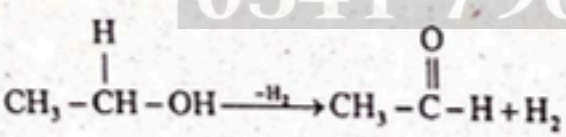
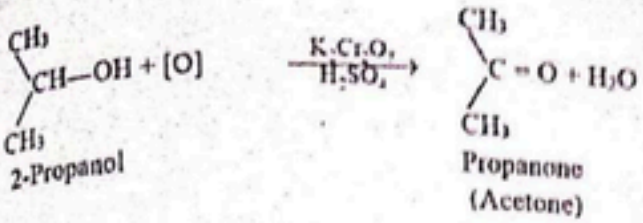
Q.117



Q.118

$$2C_2H_5OH \xrightarrow[140^\circ C]{\text{conc. } H_2SO_4} C_2H_5OC_2H_5 + H_2O$$

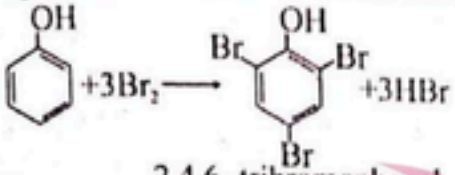
Diethyl ether

Q.119


Q.120 $CO + 2H_2 \xrightarrow[450^0C/200\ atm]{(ZnO+Cr_2O_3)} CH_3OH$

Q.121 Phenols are less reactive due to resonance stabilizer of benzene ring, which delocalizes the negative charge.

Q.122 Aqueous solution of phenol reacts with bromine water to give white ppt. of 2,4,6-tribromophenol. Alcohols not from these precipitates when react with bromine.



2,4,6- tribromophenol

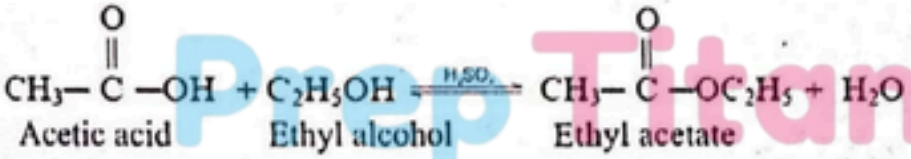
Q.123 Tertiary carbocation is more stable than that of secondary and primary.

Q.124 Alcohols having β-carbon as $-CH_3$ give iodoform reaction.

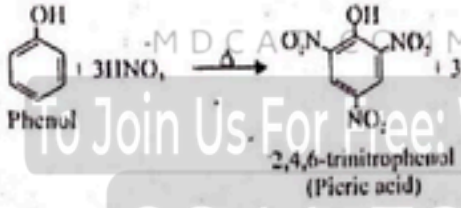
Q.125 Order of strength of acidity.

Carboxylic acid > phenol > water > alcohol

Q.126



Q.127



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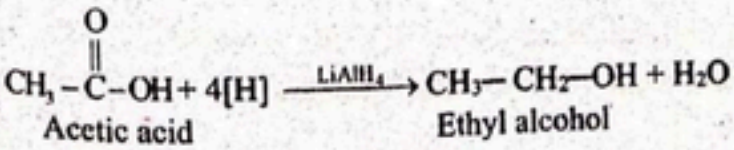
Q.128 $R-OH \longrightarrow R-O^- + H^+$
(Lewis base)

Q.129 B.P ∝ strength of intermolecular forces.

Q.130 Acidic strength of phenol ∝ Stability of phenoxide ion

Electron withdrawing substituents increases the stability of phenoxide ion

Q.131



Q.132 The reaction of alcohol with carboxylic acid in the presence of an acid is called esterification.

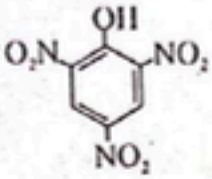
Q.133 Pyridine is used as a solvent. It is used to neutralize the reaction mixture.

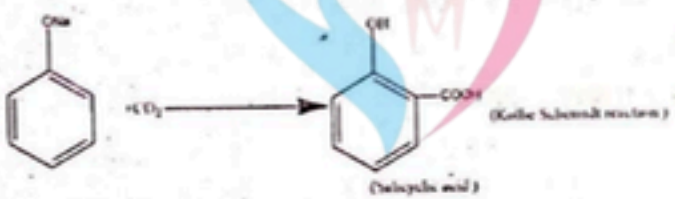
Q.134

$$2C_2H_5OH \xrightarrow[140^0C]{\text{conc. } H_2SO_4} C_2H_5OC_2H_5 + H_2O$$

Diethyl ether

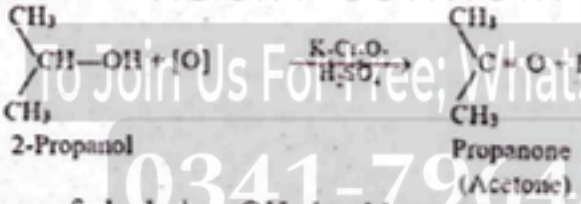
Q.135 Not in syllabus

Q.136  picric acid

Q.137 

Q.138 B.P $\propto$ strength of IMF $\propto$ No. of carbon in parent chain $\propto \frac{1}{\text{Branching}}$.

Q.139 Alkoxide ion is formed when sodium reacts with alcohol $R-OH \longrightarrow R-O^- + H^+$ (Lewis base)

Q.140 

2-Propanol — Propanone (Acetone)

Q.141 In case of alcohols, –OH should not attached with sp^2-hybridized carboin which is a part of benzene ring. So, C_6H_5OH is not an alcohol.

Q.142 95% aqeous solution of C_2H_5OH is called rectified spirit.

Q.143 Bakelite is formed upon polymerization of phenol with formaldehyde in the presence of dilute base.

Q.144 Tertiary carbocation is more stable than secondary and primary.

Q.145 Tertiary alcohls are most reactive towards Lucas reagent.

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Topic 17 ALDEHYDES AND KETONES

PRACTICE EXERCISE

Q.1 **Empirical formula for methanal is**
A. HCOOH
B. CH_2O
C. C_2H_5OH
D. Both A and B

Q.2 **_____ is a symmetrical ketone**
A. 1-Butanone
B. 2-Butanol
C. 1-Butanal
D. 3-Pentanone

Q.3 **Dry distillation of Calcium salt of acetic acid gives**
A. Acetophenone
B. Propanol
C. Propane
D. Propanone

Q.4 **Formalin incudes_____as well**
A. CO_2
B. CH_3OH
C. H_2O
D. Both B and C

Q.5 **Which type of reactions are given by carbonyl compound?**
A. Electrophilic addition
B. Nucleophilic addition
C. Condensation reaction
D. All of above

Q.6 **Which of the following is more reactive?**
A. Alkanal
B. Alkanone
C. Alkane
D. Arenes

Q.7 **Base catalyst increases _____ character of _____**
A. Electrophilic, carbonyl
B. Electrophilic, reagent
C. Nucleophilic, reagent
D. Nucleophilic, carboxylic group

Q.8 **Reduction of propanone with $NaBH_4/H_3O^+$ gives**
A. 3°-Alcohol
B. 2°-Alcohol
C. 1°- Alcohol
D. Methanal

Q.9 **One mole of ethanol on oxidation gives**
A. 1 mol of formic acid
B. 1 mol formic and 1mol acetic acid
C. 1 mol acetic acid
D. 2 mol acetic acid

Q.10 **Strong oxidizing agents are required for oxidation of**
A. Methanol
B. Propanal
C. Propanol
D. Propanone

Q.11 **Carbonyl group is bonded to _____ in ketones**
A. sp^2-hybridized oxygen atom
B. Only one hydrogen atom
C. Only one carbon atom
D. At least two carbon atoms

Q.12 **In carbonyl compounds carbonyl carbon is bonded to _____**
A. Oxygen atom through single bond
B. Oxygen atom through peptide bond
C. Oxygen atom through pi-bond
D. Oxygen atom through a double bond

Q.13 **Which of the following is correct statement regarding carbonyl compounds**
A. Carbonyl carbon contain no lone pair
B. Carbonyl oxygen contains two lone pair
C. Carbonyl group contains two lone pairs
D. All of these

Q.14 **The trigonal planar geometry is associated with**
A. Formaldehyde
B. Crotanaldehyde
C. Acetaldehyde
D. Butyraldehyde

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Q.15 Which of the following is unsymmetrical ketone

A. $(CH_3)_2CO$
B. $C_3H_7COCH_2CH_2CH_3$
C. $C_2H_5OC_2H_5$
D. $C_2H_5CO(CH_2)_2CH_3$

Q.16 Which one is aldehyde

A. Benzaldehyde
B. Crotonaldehyde
C. Ethanal
D. All of these

Q.17 Which of the following can be used for the oxidative preparation of aldehydes from alcohols

A. Pt-asbestos
B. FeO and Mo_2O_3
C. $Na_2Cr_2O_7$ and H_2SO_4
D. All of these

Q.18 Which of the following compound is oxidized to get methyl ethyl ketone

A. 2-Propanol
B. 1-Butanol
C. 2-Butanol
D. Tertiary butyl alcohol

Q.19 Formation of acetaldehyde by ethanol is known as

A. Reduction
B. Substitution
C. Oxidation
D. Elimination

Q.20 Formaldehyde is prepared by passing _____ and air over platinized asbestos catalyst at 300°C

A. Formalin vapour
B. Acetone vapour
C. Ethanol vapour
D. Methanol vapour

Q.21 Acidified sodium dichromate oxidizes ethanol to ethanal by producing

A. Molecular oxygen
B. Ozone
C. Nascent oxygen
D. Dichromate ions

Q.22 Which of the following is true regarding oxidation of an ethanol to an ethanal

A. $-CH_3$ is oxidized to CH_2–OH
B. –OH is oxidized to –CO group
C. $>CH_2$ is oxidized to –CHO group
D. $-CH_2OH$ is oxidized to –CHO

Q.23 $H\text{-}\boxed{CH_2OH} \xrightarrow[[O]]{Na_2Cr_2O_7/H_2SO_4} H\text{-}\boxed{X}$ X is

A. An aldehyde group
B. A carbonyl group
C. A hydroxyl group
D. A carboxyl group

Q.24 Acetaldehyde is purified by which method when prepared by alcohol in laboratory

A. Solidification
B. Chromatography
C. Re-distillation
D. Steam distillation

Q.25 Isobutyl alcohol on oxidation converts to a carbonyl compound A. A is

A. Butanone
B. Butanal
C. 2-Methyl propanal
D. All of the above

Q.26 Formation of yellow or orange/red precipitates with 2, 4-DNPH refers to the identification of

A. Aldehydes
B. Ketones
C. Pure alcohols only
D. Both A. and B.

Q.27 The reduction of a ketone using $NaBH_4$ gives:

A. Primary alcohol
B. Secondary alcohol
C. Tertiary alcohol
D. Phenol

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Q.28 Addition of HCN to acetaldehyde in the presence of dilute mineral acid and sodium cyanide forms

A. Formaldehyde cyanohydrin
B. Acetaldehyde cyanohydrin
C. Acetone cyanohydrins
D. Butanone cyanohydrin

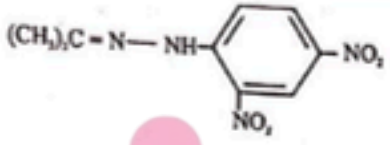
Q.29 What will be the product in following reaction?

$CH_3CH = CHCH_2COCH_3 \xrightarrow{NaBH_4} ?$

A. $CH_3CH_2CH_2CH_2COCH_3$
B. $CH_3CH = CHCH_2CH(OH)CH_3$
C. $CH_3CH_2CH_2CH_2CH(OH)CH_3$
D. All of these

Q.30 Which of the following has maximum reactivity in nucleophilic addition reactions?

A. Formaldehyde
B. Propanone
C. Acetaldehyde
D. All of these

Q.31 $X + 2,4-DNPH \xrightarrow[-H_2O]{H^+}$  , the X will be?

A. CH_3COCH_3
B. HCHO
C. CH_3CHO
D. $C_2H_5OCH_3$

Q.32 Formation of cyanohydrin from an aldehyde is an example of

A. Nucleophilic substitution
B. Electrophilic addition
C. Nucleophilic addition
D. Electrophilic substitution

Q.33 Reducing agent which attack carbonyl compound in $NaBH_4$ is

A. $\dot{H}$
B. H^-
C. H^+
D. H_2

Q.34 Catalytic reduction of acetone will produce

A. Methyl alcohol
B. Isopropyl alcohol
C. Ethyl alcohol
D. Neopentyl alcohol

Q.35 For which one of the following pairs of compounds can be distinguished by means of Tollen's tests.

A. HCHO and CH_3CHO
B. CH_3COCH_3 and $CH_3COCH_2CH_3$
C. CH_3CHO and CH_3COCH_3
D. CH_3COOH and CH_3COCH_3

Q.36 Which substance does not oxidize easily

A. CH_3CH_2CHO
B. HCHO
C. CH_3CHO
D. CH_3COCH_3

Q.37 Which one of the following set of compounds oxidize aldehydes as well as ketones

A. $CuSO_4 + NaOH +$ Citric acid
B. $AgNO_3 + NH_4OH$
C. $CuSO_4 + NaOH +$ Tartaric acid
D. $K_2Cr_2O_7 +$ Conc. H_2SO_4

Q.38 An aldehyde when boiled with Fehling solution gives brick red precipitate, red colour is due to

A. Ag
B. Cupric oxide
C. Cuprous oxide
D. Sodium carboxylate

Q.39 Strongest reducing agent that can reduce the Tollen's reagent is

A. HCHO
B. 
C. CH_3CHO
D. CH_3COCH_3

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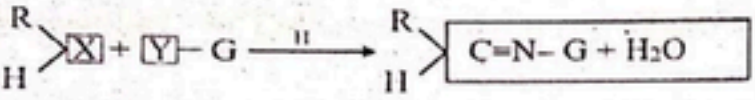
Q.40 Which of the following carbonyl compound can give aliphatic, saturated alcohol using $NaBH_4$

A. Acetophenone
B. Benzaldehyde
C. 2-Butene, 2-ol
D. 3-Methyl 2-pentanone

Q.41 Acetaldehyde gives which salt by reacting with ammonical silver nitrate

A. Sodium acetate
B. Ammonium acetate
C. No salt formed
D. Silver chloride

Q.42



X and Y in this reaction are _____ respectively

A. $-NH_2$ and $-CHO$
B. $-CHO$ and $-NH_2$
C. $> C = O$ and $-NH_2$
D. $-CH_2OH$ and $-NH_2$

Q.43 Formalin is _____% solution of formaldehyde in water

A. 10%
B. 20%
C. 40%
D. 60%

Q.44 Which of the following carbonyl compounds shows rapid reaction with sodium nitroprusside

A. Formaldehyde
B. Acetaldehyde
C. Benzaldehyde
D. Acetone

Q.45 Cannizzaro's reaction is not given by

A. Formaldehyde
B. Acetaldehyde
C. Benzaldehyde
D. Trimethyl acetaldehyde

Q.46 Which of the following do not give aldol condensation reactions

A. Formaldehyde
B. Acetaldehyde
C. Diemthyl ketone
D. Propionaldehyde

Q.47 Which of the following will not give addition reaction with $NaHSO_3$

A. HCHO
B. CH_3CHO
C. CH_3-CH_2-CHO
D. CH_3CH_2-OH

Q.48 For aldol condensation the conditions necessary

A. α-C
B. α -H
C. Basic medium
D. All of these

Q.49 Which of the following does not give aldol condensation

A. Methanal
B. Ethanal
C. Propanone
D. 2-pentanone

Q.50 Which of the following compound can be used for the separation of ethanal from the mixture of ethanal and ethanol

A. $NaHSO_3$
B. HCN
C. NH_2NH_2
D. Aldol

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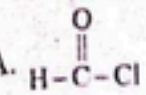
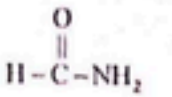
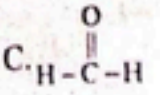
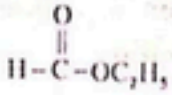
Topic 17 ALDEHYDES AND KETONES

PAST PAPER MCQ'S

Q.51 Brick red precipitate are formed when aldehyde reacts with: **MDCAT (2010)**

A. Sodium borohydride
B. Fehling solution
C. Sodium bisulphate
D. Formaldehyde

Q.52 Which of the following compounds belong to homologous series of aldehydes **MDCAT (2011)**

A. 
B. 
C. 
D. 

Q.53  in the above reaction nucleophile is **MDCAT (2011)**

A. CN^-
B. HCl
C. Cl^-
D. OH^-

Q.54 Consider the following reaction:

$$R\text{-}CHO + 2[Ag(NH_3))_2]OH \longrightarrow RCOONH_4 + 2Ag + 2NH_3 + H_2O$$

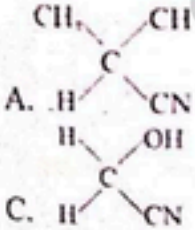
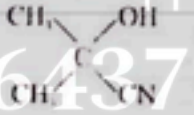
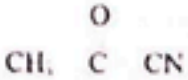
this reaction represents which of the following tests **MDCAT (2011)**

A. Fehling test
B. Benedict test
C. Ninhydrin test
D. Tollen's test

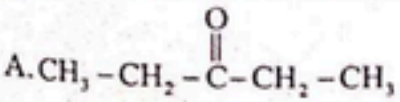
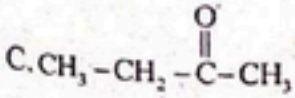
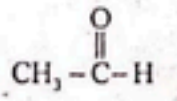
Q.55 With acidified $Na_2Cr_2O_7$, what the product will be, when secondary alcohols are oxidized in same conditions? **MDCAT (2012)**

A. Alkenes
B. Alkyl halides
C. Alkynes
D. Ketones

Q.56 Formaldehyde reacts with HCN (NaCN + HCl) to give a compound **MDCAT (2012)**

A. 
B. 
C.
D. 

Q.57 Iodoform test will not be positive with **MDCAT (2012)**

A. 
B. C_2H_5OH
C. 
D. 

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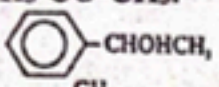
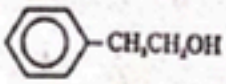
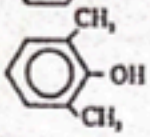
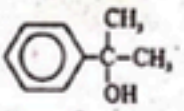
Q.58 What is the structure of alcohol which on oxidation with acidified $Na_2Cr_2O_7$ gives C_6H_5-CO-CH_3. MDCAT (2013)

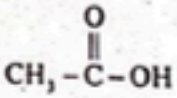
A. 

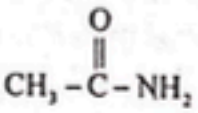
B. 

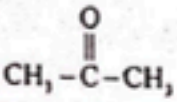
C. 

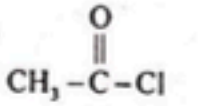
D. 

Q.59 Which of the following is the structure of a ketone? MDCAT (2013)

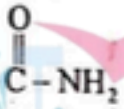
A. 

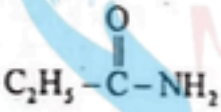
B. 

C. 

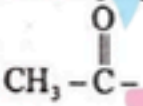
D. 

Q.60 Which group gives a yellow precipitate of triiodomethane when warmed with alkaline aqueous iodine? MDCAT (2013)

A. An amide group, 

B. Ethyl ketone group, 

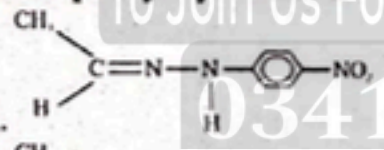
C. A primary alcohol group as in propanol, $CH_3CH_2CH_2OH$

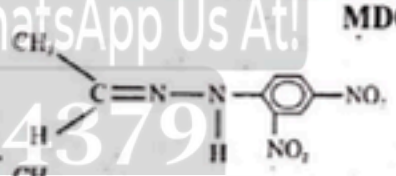
D. Methyl ketone group, 

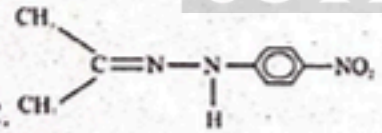
Q.61 A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilute sulphuric acid. A vigorous reaction took place. He distilled the product formed immediately. What was the product? MDCAT (2014)

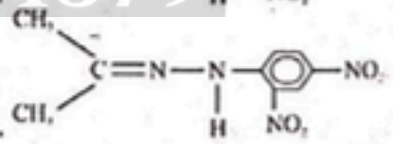
A. Acetone
B. Dimethyl ether
C. Acetic acid
D. Acetaldehyde

Q.62 The structure of formula of the product of reaction of acetone with 2, 4-dinitrophenyl hydrazine is MDCAT (2014)

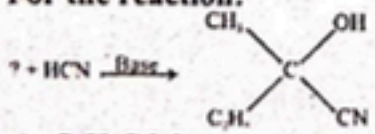
A. 

B. 

C. 

D. 

Q.63 For the reaction: MDCAT (2014)



A. $C_2H_5COCH_3$
B. CH_3COCH_3
C. $C_2H_5CH(CH_3)OH$
D. $C_2H_5CH_2CHO$

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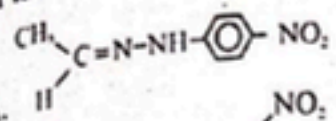
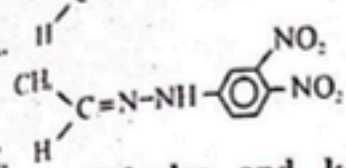
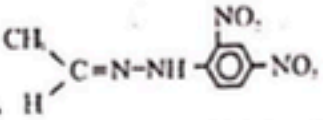
Q.64 When acetaldehyde reacts with 2,4–dinitrophenylhydrazine (2,4-DNPH), which one of the following products is formed MDCAT (2015)

A. 

B. 

C. 

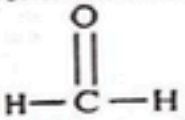
D. 

Q.65 Both aldehydes and ketones are planar to the neighborhoods of carbonyl $(\overset{\backslash}{\underset{/}{C}}=O)$ group. Which one of the following bonds is distorted towards the oxygen atoms? MDCAT (2015)

A. π bond of C and O
B. Sigma bond of C and O
C. Sigma bond of C and H
D. Sigma bond of C and C

Q.66 Which one of the following is also called silver mirror test MDCAT (2015)

A. Fehling's solution test
B. Tollen's reagent
C. Iodoform test
D. Benedict's solution tests

Q.67 

Which one of the following is IUPAC name of the above given structure? MDCAT (2016)

A. Proopanaldehyde
B. Acetaldehyde
C. Methanone
D. Methanal

Q.68 $R\text{-}CH=N\text{-}NH\text{-}C_6H_3(NO_2)_2$ It is a general formula of: MDCAT (2016)

A. 2,4 dinitrophenyl hydrazine
B. Phenyl hydrazone
C. 1,3 dinitrophenyl hydrazone
D. 2,4 dinitrophenyl hydrazone

Q.69 Which one of the following test is given by both aldehyde and ketone? MDCAT (2016)

A. Silver mirror test
B. 2,4 DNPH test
C. Fehling's solution test
D. Benedict's solution test

Q.70 In the reaction, "?" represents which one of the following products: MDCAT (2017)

$$\text{Primary Alcohol} + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} \xrightarrow{?} \xrightarrow{[O]} \text{Carboxylic Acid}$$

A. Ketone
B. Formic acid
C. Aldehyde
D. Ether

Q.71 The reaction of aldehydes and ketones with ammonia derivative $G\text{-}NH_2$ to form compounds containing the group $\overset{\backslash}{\underset{/}{C}}=N-G$ and water is known as _____ reaction. MDCAT (2017)

A. Nucleophilic addition
B. Electrophilic addition
C. Nucleophilic substitution
D. Addition Elimination

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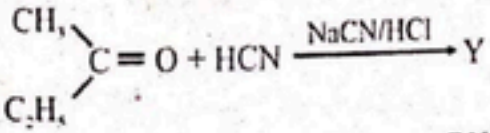
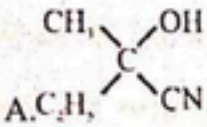
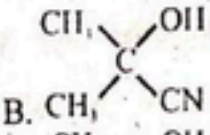
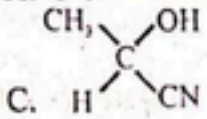
Q.72 Ethanal reacts with HCN to form cyanohydrin. It is an example of MDCAT (2017)
A. Nucleophilic addition
B. Electrophilic substitution
C. Electrophilic addition
D. Nucleophilic substitution

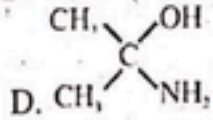
Q.73 What will be the product of the reaction given below MDCAT (2017)











Q.74 Which one of the following compounds will give iodoform test on treatment with aqueous iodine? MDCAT (2017)
A. 3-pentanone
B. Propanal
C. Propanone
D. Butanal

Q.75 2-propanal on Oxidation gives _____: MDCAT (2017)
A. Aldehyde
B. Carboxylic Acid
C. Ketone
D. Alcohol

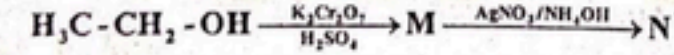
Q.76 Both aldehyde and ketones give _____: MDCAT (2017)
A. Tollen's Test
B. Benedict's solution test
C. 2,4-DNPH test
D. Sodium nitroprusside test

Q.77 Which reagent is responsible for the conversion of ketone to secondary alcohol: MDCAT (2017)
A. $NaAlH_4$
B. Al
C. $NaBH_4$
D. Red P

Q.78 To distinguish aldehyde from ketone which solution is used: MDCAT (2017)
A. Alkaline solution
B. A solution containing $K_2Cr_2O_7$
C. Fehling's solution
D. A solution containing acid only

Q.79 Identify the compound, which give iodoform test: MDCAT (2017)
A. Methanol
B. 3- Hexanol
C. Methyl ketone
D. Propionaldehyde

Q.80 Why is it necessary to distill aldehyde formed from oxidation of primary alcohol through acidified per dichromate (VI) solution or acidified sodium dichromate (VI) solution? MDCAT (2018)
A. Aldehyde formed is unstable and decompose back to original precursor i.e. primary alcohol
B. Aldehyde formed may react with primary alcohol, the original reactant
C. Aldehyde may be oxidized further to a ketone
D. Aldehyde formed may be oxidized further to carboxylic acid

Q.81 
What is the final indication in given reaction SET (2019)
A. Blue precipitate
B. Silver mirror
C. Red precipitate
D. White precipitate

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Q.82 Which of the following compounds will produce a yellow precipitate with I_2 dissolved in $NaOH_{(aq)}$? SET (2019)
A. $HCOOCH_2CH_3$
B. $CH_3CH_2CO\,CH_3$
C. CH_3OH
D. CH_3CH_2CHO

Q.83 Which of the following reagent is used to distinguish between $CH_3CH_2CHOHCH_2OH$ and $CH_3CH_2CHOHCH_2CHO$ SET (2019)
A. 2,4-DNPH (dinitrophenyl hydrazine)
B. Dilute sulfuric acid
C. Potassium maganate
D. Sodium nitroprusside

Q.84 Which one of the following reagents can be used to detect an aldehyde ? SET (2019)
A. Tetraethyl lead
B. Alcoholic KOH
C. Acidified Cu_2Cl_2
D. Tollen's reagent

Q.85 Hybridization of carbon in –CHO group is NUMS (2019)
A. sp
B. sp^2
C. sp^3
D. dsp

Q.86 Carbonyl group undergo NUMS (2019)
A. Electrophilic addition reaction
B. Nucleophilic addition reaction
C. Electrophilic substitution reaction
D. Nucleophilic substitution reaction

Q.87 The compound Aldehyde hydrazine is ETEA (2016)
A. $\frac{R}{H}>CH=N-NH_2$
B. $\frac{R}{H}>CH-NH-O-NH_2$
C. $\frac{R}{H}>CH-NG-O-NH_2$
D. $\frac{R}{H}>CH-O-N=NH$

Q.88 Which one is more reactive? ETEA (2019)
A. HCHO
B. CH_3CHO
C. $(CH_3)_2CO$
D. Have equal reactivity

Q.89 Hydration of hydrocarbon give carbonyl compound, the general formula of that hydrocarbon is ETEA (2019)
A. C_nH_{2n+2}
B. C_nH_{2n}
C. C_nH_{2n-2}
D. Both B and C

Q.90 Identification test for functional groups of organic compounds are associated with specific observations. Tollen's reagent is ammonical silver nitrate solution, which is used for the identification of a functional group X with an observation O. Identify X and O. MDCAT (2019)
A. X = Aldehyde O = red precipitate
B. X = Ketone O = Silver mirror
C. X = Aldehyde O = Silver mirror
D. X = Ketone O = grey precipitate

Q.91 Which of the following will give a positive test with Tollen's reagent? MDCAT (2019)
A. Tertiary Alcohols
B. Ketones
C. Aldehydes
D. Carboxylic Acids

Q.92 Which type of reaction takes place when a carbonyl compound is treated with a mixture of NaCN and an acid? MDCAT (2019)
A. Electrophilic addition reaction
B. Displacement reaction
C. Nucleophilic addition reaction
D. Substitution reaction

Q.93 Which of the following compounds will give a secondary alcohol after reaction with $NaBH_4$? MDCAT (2019)
A. CH_3COCH_3
B. CH_3CH_2CHO
C. CH_3CH_2COOH
D. CH_3COOCH_3

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Q.94 The common name of following aldehyde is $Cl-CH_2-CH(CH_3)-CHO$ NMDCAT (2020)

A. α-Methyl-γ-Chloro propionaldehyde
B. β-Chloro-γ-Methyl propionaldehyde
C. β-Chloro-α-Methyl propionaldehyde
D. β-Methyl-α-Chloro propionaldehyde

Q.95 Which of the following reagent is use to separate and purify carbonyl and non-carbonyl compounds? NDMCAT (2020)

A. HCN
B. $BrMgCH_2$
C. $NaHSO_3$
D. H_2O

Q.96 Secondary alcohol is the product of reduction of which carbonyl compound? NMDCAT (2020)

A. $H_3C-C(=O)-H$
B. $H_3C-C(=O)-CH_3$
C. $H-C(=O)-H$
D. $H_3C-CH_2-C(=O)-H$

Q.97 Which of the following show positive iodoform test PMC (2021)

A. Butanol
B. Acetaldehyde
C. 3-Pentanone
D. Formaldehyde

Q.98 How many carbon attached to carbonyl carbon in ketone PMC (2021)

A. 2
B. 3
C. 4
D. 1

Q.99 In aldol condensation carbanion acts as PMC (2021)

A. Acid
B. Base
C. Nucleophile
D. Electrophilic

Q.100 The carbonyl compound which is attached with at least one H atom at one side is called as _____? PMC (2021)

A. Ketones
B. Aldehydes
C. Ethers
D. Alkyl halides

Q.101 Which of the following is the correct name of $CH_3CH_2CH_2COCH_2CHO$? UHS (2022)

A.
B. 3-Oxo hexanol
C. 3-One hexanal
D. 3-Keto hexanol

Q.102 Which of the following is also called silver mirror test? UHS (2022)

A. Benedict's solution test
B. Iodoform test
C. Fehling's solution test
D.

Q.103 Catalytic reduction of aldehyde & ketone forms: SZABMU (2022)

A. Alcohol
B. Carboxylic acid
C. Alkane
D. Aldehyde

Q.104 When aldehyde reacts with 50% NaOH, this reaction is called as: SZABMU (2022)

A. 2,4-DNPH reaction
B. Aldol condensation reaction
C. Clemmensen reaction
D. Cannizarro's reaction

Q.105 Acetone reacts with hydrogen cyanide (HCN) to form a cyanohydrin. It is an example of: ETEA (2022)

A. Electrophilic addition
B. Electrophilic substitution
C. Nucleophilic substitution
D. Nucleophilic addition

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Q.106 **Benedict's solution is the combination of:** ETEA (2022)
A. $Cu(OH)_2$ + NaOH + Tartaric acid ($C_4H_6O_6$)
B. $Cu(OH)_2$ + NaOH + citric acid ($C_6H_8O_7$)
C. $Ag(NH_3)_2OH$+NaOH+H_2SO_4
D. NaCl + NaOH + Citric acid

Q.107 **Acetone gives:** DUHS (2022)
A. Fehling solution test positive
B. Silver mirror test positive
C. Lucas test positive
D. Iodoform test positive
E. Benedicts test positive

Q.108 **Aldehyde reacts with:** DUHS (2022)
A. Ketones are more easily oxidized
B. It is always difficult to oxidase aldehyde
C. Mild oxidizing agent & strong oxidizing agent both
D. Only strong oxidizing agent
E. Only mild oxidizing agent

Q.109 **Acetophenone is an.** DUHS (2022)
A. Aliphatic ketones
B. Phenol
C. Carboxylic acid
D. Aldehyde
E. Aromatic ketones

Q.110 **Addition product of formaldehyde and ethyl alcohol is:** DUHS (2022)
A. Aldehyde
B. Acetal
C. Carboxylic acid
D. Acetone
E. Ketone

Q.111 **What is the correct IUPAC name of the compound C_6H_5-CHO?** BMU (2022)
A. Benzenecarbaldehyde
B. Cyclohexanal
C. Cyclohexyl aldehyde
D. Cyclohexanecarbaldehyde

Q.112 **What is the correct order of reactivity towards nucleophilic addition?** BMU (2022)
A. Benzaldehyde>Benzophenone>Acetophenone
B. Benzophenone>Benzaldehyde>Acetophenone
C. Acetophenone>Benzaldehyde>Benzophenone
D. Benzaldehyde>Acetophenone>Benzophenone

Q.113 **Which of the following compounds will react with Tollens reagent to give metallic silver?** BMU (2022)
A. Methanal
B. Acetic Acid
C. Ethyl alcohol
D. Acetone

Q.114 **Dry heating of calcium acetate gives which of the following?** BMU (2022)
A. Acetaldehyde
B. Acetic acid
C. Acetone
D. Ethane

Q.115 **Cannizzaro's reaction is given by:** NUMS (2022)
A. Formaldehyde
B. Acetone
C. Acetaldehyde
D. Butanone

Q.116 **The identification test for Ketone is:** NUMS (2022)
A. Benedict's Solution Test
B. Fehling's Solution Test
C. Sodium Nitroprusside Test
D. Tollen's Test

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Q.117 What is the IUPAC name of diisopropyl ketone? UHS (2023)

A. 1,3-Diisopropylpropan-2-one
B. 2,4-Dimethylpentan-3-one
C. 2,4-Dimethylpentan-2-one
D. 1,3-Dimethypropan-2-one

Q.118 The appearance of a silver mirror in Tollens' test indicates the presence of which of the following? UHS (2023)

A. A ketone
B. An aldehyde
C. An acid
D. An alcohol

Q.119 The function of NaOH in Aldol condensation & Cannizzaro's reaction respectively is: SZABMU (2023)

A. Nucleophile and electrophile
B. Base and nucleophile
C. Electrophile and nucleophile
D. Nucleophile and base

Q.120 Aldehydes cannot be easily oxidized by: SZABMU (2023)

A. $K_2Cr_2O_7$
B. H_2SO_4
C. $KMnO_4$
D. HCl

Q.121 Aldehydes do not give which identification test: SZABMU (2023)

A. 2,4 – DNPH test
B. Tollen's test
C. Sodium Nitro Prusside Test
D. Fehling's Solution

Q.122 The hydrate percentage is maximum for: SZABMU (2023)

A. Propanal
B. Acetone
C. Formaldehyde
D. Acetaldehyde

Q.123 The reaction of aldehydes and ketones to alkanes in the presence of Zinc amalgam and HCl is called: ETEA (2023)

A. Clemmenson reduction
B. Williamson's synthesis
C. Wolf-Kishner reduction
D. Dow process

Q.124 Aldehyde and ketone on reaction with hydroxylamine form: ETEA (2023)

A. Hydrazine
B. Hydrazone
C. Oxime
D. Imine

Q.125 Fehling's solution works on the principle of redox reaction which results in: ETEA (2023)

A. Reduction of Aldehydes
B. Oxidation of Copper
C. Oxidation of Aldehyde
D. Oxidation of ketone

Q.126 Which of the following will give iodoform reaction on the treatment with Na_2CO_3 & I_2? DUHS (2023)

A. Methanol
B. Acetic acid
C. Acetic anhydride
D. Acetone

Q.127 Dry distillation of which of the following can be done to produce acetone? DUHS (2023)

A. Calcium acetate
B. Calcium formate
C. Ethyl acetate
D. Acetic acid

Q.128 Which of the following characteristic of carbonyl oxygen increases by base-catalyzed reacton? BUMHS (2023)

A. Amphoteric
B. Nucleophilic
C. Electrophonic
D. Electrophilic

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Q.129 **Which of the following occurs when carbonyl compounds react with HCN?** BUMHS (2023)

A. The reaction is catalysed by concentrated H_2SO_4
B. Pentan-2-one and HCN react to give a chiral product
C. The reaction is a condensation reaction
D. The reaction is nucleophilic substitution

Q.130 **sp^2 hybridized carbon atom is present in:** BUMHS (2023)

A. Methanal
B. Methanol
C. Ethanol
D. Propanol

Q.131 **$C_nH_{2n}O$ is the general formula of:** NUMS (2023)

A. Ether
B. Carboxylic acid
C. Ketones
D. Carbolic acid

Q.132 **Catalytic reduction of aldehyde & ketones forms:** NUMS (2023)

A. Alcohol
B. Carboxylic acid
C. Alkane
D. Aldehyde

Q.133 **$C_nH_{2n}O$ is the general formula of:** UHS (2024)

A. Ether
B. Ketones
C. Carboxylic acid
D. Carbolic Acid

Q.134 **The blue colour of Fehling solution is changed to red when warmed with an aldehyde due to formation of which of the following?** UHS (2024)

A. NO_2
B. AgO
C. Cu_2O
D. SO_2

Q.135 **Reaction of HCN with formaldehyde is a:** UHS (2024)

A. Nucleophilic addition reaction
B. Electrophilic addition reaction
C. Nucleophilic substitution reaction
D. Electrophilic substitution reaction

Q.136 **The correct reactivity order of the following compounds towards nucleophile is ——.** SZABMU (2024)

A. H-CO-H < H-CO-R < R-CO-R
B. H-CO-R < H-CO-H < R-CO-R
C. H-CO-H > H-CO-R > R-CO-R
D. H-CO-H < R-CO-R < H-CO-R

Q.137 **The IUPAC name of given organic compounds is** DUHS (2024)



A. γ-Chloropentanal
B. 2-Chloropentanal
C. 4-Chloropentanal
D. β-Chloropentanal

Q.138 **Reduction of aldehydes & Ketones by Zn-Hg amalgam and concentrated HCl results in conversion to an alkane, This reaction is known as** DUHS (2024)

A. Down Reduction
B. Wolf-Kishner Reduction
C. Cope Reduction
D. Clemmensen Reduction

Q.139 **Aldehydes & ketones can be converted to alkane. This reaction is called:** DUHS (2024)

A. Ozonolysis
B. Grignard –Craft reaction
C. Wolff–Kishner reaction
D. Friedel–Craft reaction

Q.140 **It is used to distinguish between primary, secondary and tertiary alcohol:** DUHS (2024)

A. Lucas test
B. Benedict Reagent
C. Grignard Reagent
D. Bloor Reagent

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Q.141 The IUPAC name for formaldehyde is BMU (2024)

A. Ethanal
B. Methanal
C. Butanal
D. Proponal

Q.142 Which one of the following statement is NOT correct BMU (2024)

A. Formaldehyde is a gas at room temperature
B. Formaldehyde is a liquid at room temperature
C. Oxidation of methyl alcohol can produce formaldehyde
D. Dry distillation of calcium formate can produce formaldehyde

Q.143 Identify the correct increasing order of reactivity of carbonyl compound towards nucleophilic addition: (Wrong) NUMS (2024)

A. $HCHO < CH_3CHO < CH_3COCH_3 < CH_3CH_2CHO$
B. $CH_3CHO < CH_3COCH_3 < CH_3CH_2CHO < HCHO$
C. $CH_3CH_2CHO < CH_3COCH_3 < HCHO < CH_3CHO$
D. $CH_3CH_2CHO < CH_3COCH_3 < CH_3CHO < HCHO$

Q.144 Compound A + I_2 + Na_2CO_3 → compound B+ RCOONa + NaI + H_2O Identify compound B (Wrong) NUMS (2024)

A. Acetone
B. Acetamide
C. Acetic acid
D. Acetic anhydride

ANSWER KEY

PRACTICE EXERCISE

1	B	11	D	21	C	31	A	41	B
2	D	12	D	22	D	32	C	42	C
3	D	13	D	23	A	33	B	43	C
4	D	14	A	24	C	34	B	44	D
5	D	15	D	25	C	35	C	45	B
6	A	16	D	26	D	36	D	46	A
7	B	17	D	27	B	37	D	47	D
8	B	18	C	28	B	38	C	48	D
9	C	19	C	29	B	39	A	49	A
10	D	20	D	30	A	40	D	50	A

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51	B	61	D	71	D	81	B	91	C	101	A	111	A	121	C	131	C	141	B
52	C	62	D	72	A	82	B	92	C	102	D	112	D	122	C	132	A	142	B
53	A	63	A	73	A	83	A	93	A	103	A	113	A	123	A	133	B	143	D
54	D	64	D	74	C	84	D	94	C	104	D	114	C	124	C	134	C	144	A
55	D	65	A	75	C	85	B	95	C	105	D	115	A	125	C	135	A		
56	C	66	B	76	C	86	B	96	B	106	B	116	C	126	D	136	C		
57	A	67	D	77	C	87	A	97	B	107	D	117	B	127	A	137	C		
58	A	68	D	78	C	88	A	98	A	108	C	118	B	128	B	138	D		
59	C	69	B	79	C	89	C	99	C	109	E	119	B	129	B	139	C		
60	D	70	C	80	D	90	C	100	B	110	B	120	D	130	A	140	A		

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EXPLANATORY NOTES

Q.11 Carbonyl compounds include aldehyde and ketones. Aldehydes have structural formula $R-\overset{O}{\overset{\|}{C}}-H$ while ketones have $R-\overset{O}{\overset{\|}{C}}-R$ or $R-\overset{O}{\overset{\|}{C}}-R'$. In ketones C=O is attached with two C-atoms or R groups

Q.12 In carbonyl compounds C-atom is attached with O-atom though double bond.

Q.13 The general structure is formula of ketone is $R-\overset{O}{\overset{\|}{C}}-R$. The carbonyl group >C = O is bonded to two alkyl groups means to C atoms

Q.14 Mostly in saturated and aliphatic carbonyl compounds the carbonyl carbon is bonded to one or two sp^3 hybridized carbon atoms but formaldehyde is bonded with 2 hydrogen atoms making trigonal planer structure (purely planer)

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ $CH_3-\overset{O}{\overset{\|}{C}}-H$ $H_2\overset{O}{\overset{\|}{C}}$ (2D)

Q.15 The unsymmetrical ketones have two different alkyl groups on either side of carbonyl group like $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$

Q.16 All compounds have –CHO group. Therefore, all the compounds are aldehydes

Q.17 $2CH_3OH+O_2 \xrightarrow[500^\circ C]{FeO,Mo_2O_3} 2HCHO+2H_2O$

$2CH_3OH+O_2 \xrightarrow[300^\circ C]{Pt\text{-}Asbestos} 2HCHO+2H_2O$

$CH_3-CH_2-OH+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} CH_3CHO+H_2O$

FeO, Mo_2O_3 and Pt-asbestos are catalysts used for air oxidation of alcohols to aldehydes while $Na_2Cr_2O_7 + H_2SO_4$ combination is used for the production of nascent oxygen which is used to oxidize alcohols to carbonyl compounds.

Q.18 Methyl ethyl ketone is a 4-C ketone. So, it requires a 4-C secondary alcohols

$H_3C-CH_2-\overset{OH}{\overset{|}{C}}H-CH_3 + [O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

Q.19 $CH_3-CH_2-OH+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} CH_3-CHO$

This reaction is involving oxidation of ethanol

Q.20 $2CH_3OH_{(g)}+O_{2(g)} \xrightarrow[300^\circ C]{Pt\text{-}Asbestos} 2HCHO_{(g)}+2H_2O_{(g)}$

Q.21 $Na_2Cr_2O_7+4H_2SO_4 \longrightarrow Na_2SO_4+Cr_2(SO_4)_3+4H_2O+3[O]$

$3C_2H_5OH+3[O] \longrightarrow 3CH_3CHO+3H_2O$

Q.22 $H_3C-\boxed{CH_2-OH}+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} H_3C-\boxed{CHO}+H_2O$

Q.23 $H-\boxed{CH_2-OH}+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} H-\boxed{CHO}+H_2O$

Aldehyde group

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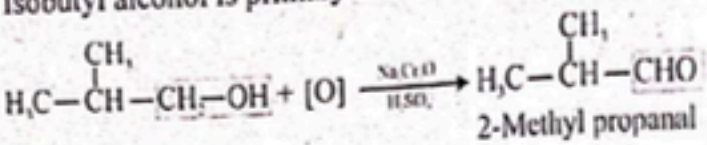
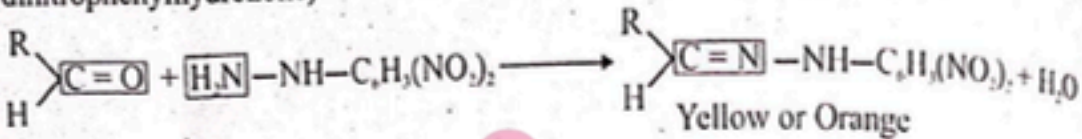
Q.24 During the oxidation of ethanol to get a acetaldehyde, acetaldehyde is immediately distilled off to avoid its oxidation. This distillate (mixture of ethanol, water and acetaldehyde) is then condensed. To get pure acetaldehyde, it is redistilled

Q.25 Isobutyl alcohol is primary alcohol



2-Methyl propanal

Q.26 The aldehydes and ketones give yellow or orange colour crystals (2,4-dinitrophenylhydrozone)



Yellow or Orange

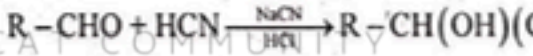


Yellow or Orange

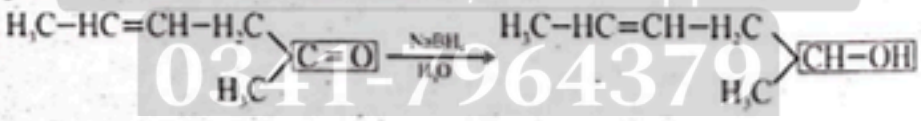
Q.27 The reduction of any ketone by $NaBH_4$, $LiAlH_4$ or H_2 (in presence of Ni / Pt / Pd catalyst) produces secondary alcohol > C = O is reduced to > CH – OH



Q.28 When HCN is added to any carbonyl compound it produces an adduct which contain both –CN group and –OH group attached to one carbon, called cyanohydrin.



Q.29 $NaBH_4$ can reduce >C = O group to >CH–OH group but cannot reduce >C=C<. So, in product >C = C< will remain intact.



Q.30

Reactivity order:

Aldehyde > Ketone

Small aldehyde > large aldehyde

Small ketone >large ketone

Unsymetrical ketone > symmetrical ketone

Aliphatic aldehyde / ketone > aromatic aldehyde / ketone

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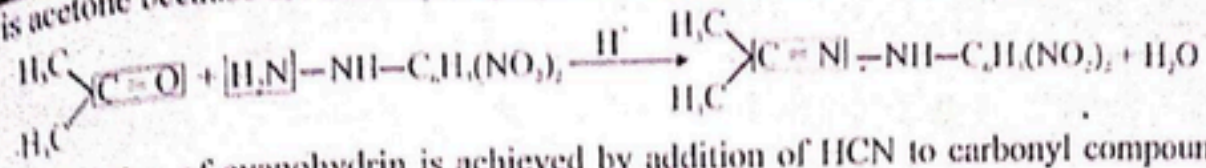
Q.31 X is acetone because 2,4 dinitrophenylhydrazone contains two $-CH_3$ groups.



Q.32 The formation of cyanohydrin is achieved by addition of HCN to carbonyl compounds. As this addition is initiated by the attack of $-CN^-$ to carbonyl carbon of carbonyl compound. Therefore, it is a nucleophilic addition reaction.

Q.33

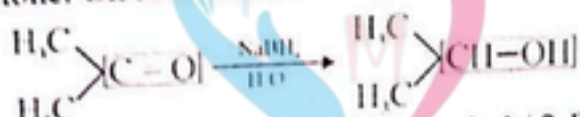
$NaBH_4 \longrightarrow Na^+ + BH_4^-$

$BH_4^- \longrightarrow BH_3 + H^-$

H^- is reducing agent because it reduces carbonyl carbon of carbonyl compound.



Q.34 Acetone is a 3–C ketone. On reduction, it will produce a 3–C secondary alcohol.



Isopropyl alcohol / 2-Propanol

Q.35 All the aliphatic aldehydes gives positive test (silver mirror formation on the inner side of test tube) while ketones don't. So, any aliphatic aldehyde can be distinguished from ketones by Tollen's test.

Q.36 Ketones are reluctant towards oxidation

Q.37 A, B, C are weak oxidizing agent, so they can oxidize aldehydes only (due to high reactivity than ketone) but not ketones but the combination of $K_2Cr_2O_7$ and H_2SO_4 produces nascent oxygen which is very strong oxidizing agent. So, it can oxidize both aldehydes and ketones.

Q.38 Fehling's solution is alkaline solution containing cupric tartarate complex ion. This cupric ion reduced to brick red coloured cuprous oxide (Cu_2O) by an aliphatic aldehyde.

Q.39 Aliphatic aldehydes are reactive than aromatic aldehydes and ketones so, a small aliphatic aldehyde can reduce Tollen's reagent

Q.40 3-Methyl-2-pentanone gives 3-Methyl-2-pentanol on reduction with $NaBH_4$

$CH_3CH_2CH(CH_3)COCH_3 \xrightarrow{NaBH_4} CH_3CH_2CH(CH_3)CH(OH)CH_3$

Q.41 $CH_3CHO + 2[Ag(NH_3)_2]OH \longrightarrow CH_3COONH_4 + 2Ag + 2NH_3 + H_2O$

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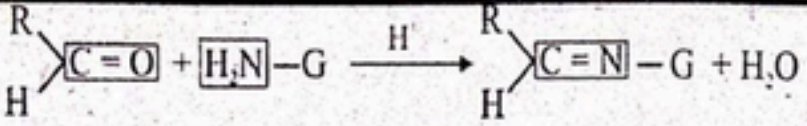
Q.42



Q.43 Formalin contains 40% formaldehyde, 8% methanol and 52% water.

Q.44 Ketones produce a wine red or orange red colour on adding alkaline sodium nitroprusside solution dropwise. Aldehydes don not give this test.

Q.45 Aldehydes that have no α-hydrogen atoms undergo cannizzaro's reaction. Acetaldehyde possess α-hydrogen therefore it does not give Cannizzaro's reaction.

Q.46 Aldehydes and ketones possessing α-hydrogen atoms react with a cold dilute solution of an alkali to form addition products known as aldols. Formaldehyde has no α-hydrogen therefore it does not give aldol condensation reaction.

Q.47 Aldehydes and small methyl ketones react with a saturated aqueous solution of sodium bisulphite to form a crystalline white precipitate of sodium bisulphite adduct. Alcohols do not react with $NaHSO_3$.

Q.48 Aldehydes and ketones possessing α-hydrogen atoms react with a cold dilute solution of an alkali to form addition products known as aldols.

Q.49 Aldehydes and ketones possessing α-hydrogen atoms react with a cold dilute solution of an alkali to form addition products known as aldols. Methanal has no α-hydrogen therefore it does not give aldol condensation reaction.

Q.50



Bisulphite addition product Acetaldehyde

This reaction is used for the separation and purification of carbonyl compounds from non-carbonyl compounds such as alcohols.

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EXPLANATORY NOTES

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Q.51 Brick red precipitate are formed when aldehyde reacts with fehling solution

Q.52 Formaldehyde (HCOH) belongs to homologous series of aldehydes.

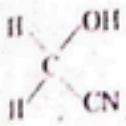
Q.53 $HCHO + HCN \longrightarrow H_2C(OH) - CN$, CN^{-1} is the nucleophile in this reaction.

Q.54 $R\text{-}CHO + 2[Ag(NH_3)_2]OH \longrightarrow RCOONH_4 + 2Ag + 2NH_3 + H_2O$

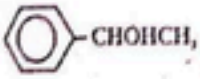
is the representation of Tollen's reagent or silver mirror test.

Q.55 Ketones are obtained during oxidation of secondary alcohols with acidified $Na_2Cr_2O_7$.

Q.56 Formaldehyde reacts with HCN (NaCN + HCl) to give



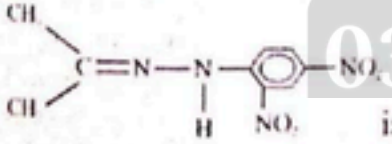
Q.57 $CH_3 - CH_2 - C(=O) - CH_2 - CH_3$ will not give positive iodoform test.

Q.58  is the oxidation product of $C_6H_5\text{-}CO\text{-}CH_3$.

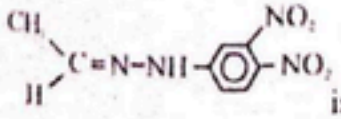
Q.59 $CH_3 - C(=O) - CH_3$ is the structure of ketone.

Q.60 Methyl ketones (CH_3CO-) give positive iodoform test.

Q.61 Ethanol gives acetic acid upon oxidation with sod dichromate, if reaction is distilled immediately then acetaldehyde is obtained.

Q.62  is obtained by the reaction of acetone and 2,4-DNPH.

Q.63 Acetone reacts with HCN to form cyanohydrin.

Q.64  is product of acetaldehyde and 2,4DNPH test.

Q.65 π bond of C and O is more distorted towards oxygen due to presence of lone pair.

Q.66 Tollen's reagent is also called silver mirror test.

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Q.67 $H-\overset{\overset{O}{\|}}{C}-H$ is aldehydic group with one carbon called methanal.

Q.68 $R\text{-}CH{=}N\text{-}NH\text{-}C_6H_3(NO_2)_2$ It is a general formula of 2,4-dinitrophenylhydrazone.

Q.69 2,4-DNPH test is given by both aldehydes and ketones.

Q.70

$$\text{Primary Alcohol} + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} ? \xrightarrow{[O]} \text{Carboxylic Acid}$$

In the given reaction "?" is aldehyde.

Q.71 The reaction of aldehydes and ketones with ammonia derivative $G\text{-}NH_2$ to form compounds containing the group $\backslash C{=}N-G$ and water is known as addition elimination reaction.

Q.72 Ethanal and HCN give ethanal cyanohydrin under the nucleophillic addition reaction.

Q.73 $C_2H_4(OH)CN$ is the final product of given reaction.

Q.74 In the given compounds, propanone will give positive iodoform test.

Q.75 2-propanol is the secondary alcohol and gives ketone upon oxidation.

Q.76 2,4-DNPH test is given by both aldehydes and ketones.

Q.77 $NaBH_4$ is used to partially reduce the ketones to get sec. alcohol

Q.78 Fehling solution is used to distinguish between aldehydes and ketones, as aldehyde gives positive fehling solution test.

Q.79 Methyl ketones gives positive iodoform test.

Q.80 Aldehydes produced during the oxidation of primary alcohols are converted to carboxylic acid if not distilled immetiatly.

Q.81 $H_3C-CH_2-OH \xrightarrow[H_2SO_4]{K_2Cr_2O_7} M \xrightarrow{Tollen's\ reagent} N$, here M is an aldehyde while N is silver mirror, as aldehydes give positive silver mirror test.

Q.82 Butanone ($CH_3\text{-}CH_2\text{-}CO\text{-}CH_3$) gives positive iodoform test.

Q.83 2,4-DNPH will give positive test with $CH_3CH_2CHOHCH_2CHO$ due to presence of aldehyde group.

Q.84 Tollen's reagent is used to distinguish or detect the aldehydes

Q.85 Carbonyl carbon in aldehydes and ketones is sp^2 hybridized.

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Q.86 Carbonyl compounds undergo nucleophillic addition reaction.

Q.87 $\begin{matrix} R \\ H \end{matrix}>CH=N-NH_2$ is the structure of aldehyde hydrazine.

Q.88 Aldehydes are more reactive than ketones, due to less steric hinderence. Formaldehyde is the most reactive among all.

Q.89 Alkynes give carbonyl compounds upon hydration having general formula C_nH_{2n-2}.

Q.90 X = Aldehydes, O = Silver mirror in the given reaction.

Q.91 Aldehydes give positive silver mirror test.

Q.92 Nucleophilic addition reaction takes place when a carbonyl compound is treated with a mixture of NaCN and an acid.

Q.93 CH_3COCH_3 will give secondary alcohol with $NaBH_4$

Q.94 β - Chloro - α - Methyl propionaldehyde is the common name of given compound.

Q.95 $NaHSO_3$ is used to separate the carbonyl compounds from others.

Q.96 $H_3C-\overset{O}{\overset{\|}{C}}-CH_3$ is ketone and give sec. alcohol upon reduction.

Q.97 From aldehydes only acetaldehyde gives iodoform test.

Q.98 In ketones carbonyl carbon is attached with carbon atoms on either side i.e two carbon atoms are attached with carbonyl carbon.

Q.99

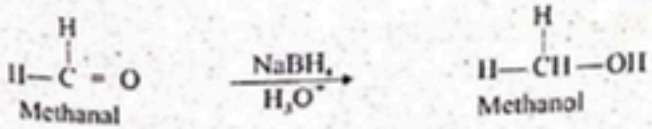


Q.100 In aldehydes formyl group $\overset{O}{\overset{\|}{(-C-H)}}$ is present.

Q.101 If formyl and carbonyl groups are present in a compound then formyl $\overset{O}{\overset{\|}{(-C-H)}}$ carbon is preferred in numbering and carbonyl carbon (ketonic group) is written as oxo group.

Q.102 $NH_4OH+AgCl$ is called Tollen's reagent it is also called silver mirror test when reacts with aldehydes.

Q.103



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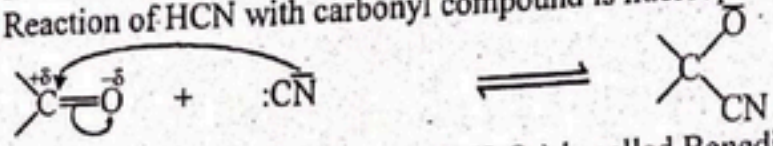
Q.104 In Cannizzaro's reaction aldehydes with no α hydrogen react with 50% NaOH.

Q.105 Reaction of HCN with carbonyl compound is nucleophilic addition reaction.

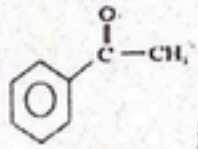


Q.106 $Cu(OH)_2$ + NaOH + citric acid ($C_6H_8O_7$) is called Benedict's solution.

Q.107 From ketones only 2-alkanones give iodoform test.

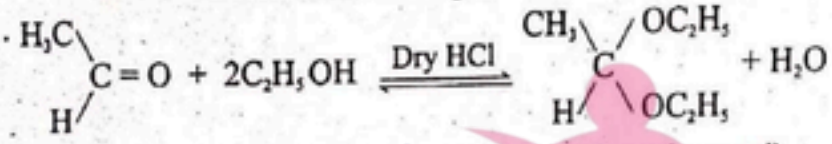
Q.108 Aldehydes are more reactive than ketones that is why it can react with both mild and strong oxidizing agents.

Q.109



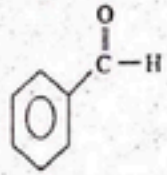
is formula of acetophenone.

Q.110

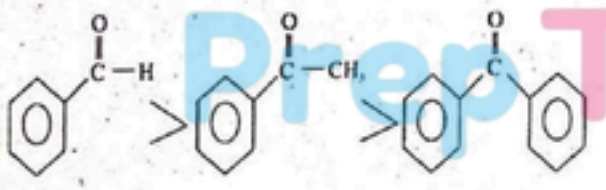


1,1-Diethoxyethane (an acetal)

Q.111



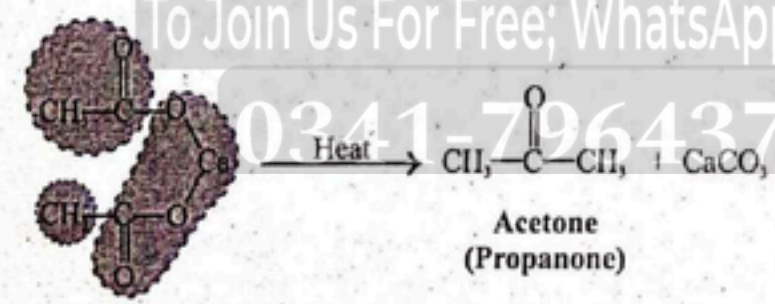
Q.112



Steric hindrance increases.

Q.113 Only aldehydes react with Tollen's reagent.

Q.114



Calcium acetate
(Calcium ethanoate)

Acetone
(Propanone)

Q.115 Aldehydes with no α hydrogen give Cannizzaro's reactions.

Q.116 Only ketones give sodium nitroprusside test.

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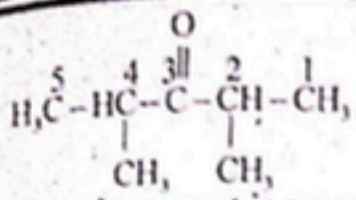
Q.117 2,4-Diemthyl pentan-3-one



Q.118 Tollen's reagent is a weak oxidizing agent and can only oxides aldehydes. Ketones, alochols or carboxylic acid do not undergo oxidation with Tollen's reagent.

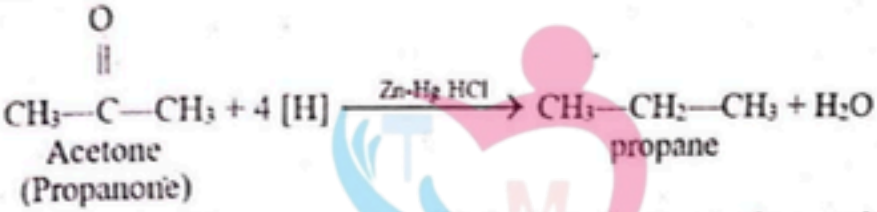
Q.119 The hydroxide ion acts as base in aldol condensation. The hydroxide ion acts as nucleophile in Cannizzaro's reaction.

Q.120 HCl is not an oxidizing agent, and it will not oxidize aldehyde.

Q.121 Aldehydes no not give sodium nitroprusside test only ketones give this test.

Q.122 Formaldehyde is the simplest aldehyde with no alkyl group attached to carbonyl carbon. Since it has two hydrogen atoms attached to carbonyl carbon, it tends to form a very stable hydrate.

Q.123 Clemmenson reduction is used to prepare alkanes from carbonyl compound, which is reduced to an alkane using zinc amalgam and HCl.



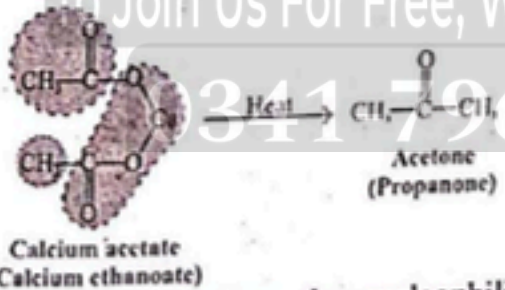
Q.124 Aldehydes and ketones react with hydroxylamine to form oximes in the presence of an acid.



Q.125 Fehling's solution works on principle of redox reaction that involves the oxidation of aldehydes to carboxylic acid and reduction of copper (II) (Cu^{+2}) ions to Copper (I) oxide (Cu_2O) which forms red precipitate.

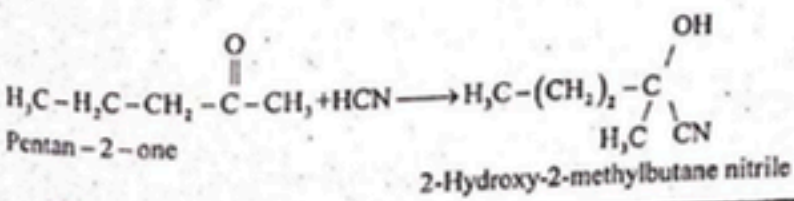
Q.126 Iodoform test is only given by methyl ketones, secondary methyl alcohols, ethanol and acetaldehyde.

Q.127



Q.128 In base catalyzed reactions the nucleophilicity of carbonyl oxygen increases due to deprotonation of oxygen atom in carbonyl group.

Q.129



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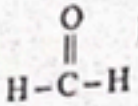
Q.130  Methanal has sp^2 hybridized carbon atom.

Q.131 The homologous series of both aldehydes and ketones have general formula $C_nH_{2n}O$.

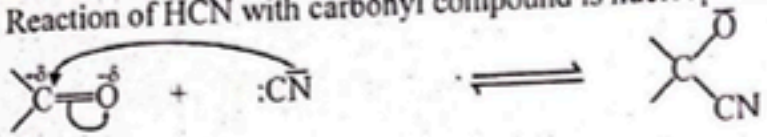
Q.132 Aldehydes and ketones can reduced to alcohols through catalytic hydrogenation in the presence of a catalyst (Pt, Pd, Ni).

Q.133 The homologous series of both aldehydes and ketones have general formula $C_nH_{2n}O$.

Q.134 $R-CHO + 2Cu(OH)_2 + NaOH \xrightarrow{\text{Tartaric acid}} R-COONa + Cu_2O + 3H_2O$

Brick red ppt

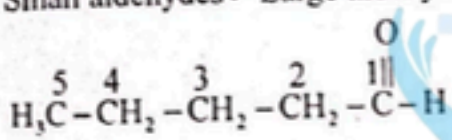
Q.135 Reaction of HCN with carbonyl compound is nucleophilic addition reaction.



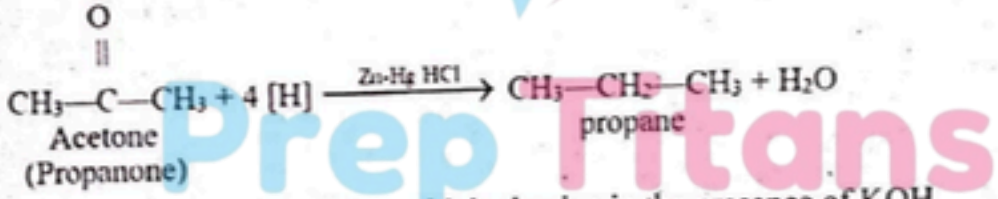
Q.136

Reactivity order of aldehydes and ketones is:

Small aldehydes > Large aldehydes > Small ketones > Large ketones

Q.137  4 – chloropentanal

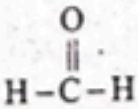
Q.138 Clemmenson reduction is used to prepare alkanes from carbonyl compound, which is reduced to an alkane using zinc amalgam and HCl,



Q.139 Aldehyde is reduced to alkane with hydrazine in the presence of KOH.



Q.140 Lucas test is a qualitative test used to differentiate between primary, secondary and tertiary alcohols.

Q.141  Methanal

Q.142 Formaldehyde is a gas at room temperature.

Q.143 There is no correct answer because the reactivity order of aldehydes and ketones is:

Small aldehydes > Large aldehydes > Small ketones > Large ketones

Q.144 The given statement is not correct while the compound A in the reaction would be acetone according to the following given equation

$$\text{Acetone} + I_2 + Na_2CO_3 \rightarrow \text{Chloroform} + CH_3COONa + NaI + H_2O$$

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Topic 18

CARBOXYLIC ACIDS

PRACTICE EXERCISE

Q.1 **Which of the following is dicarboxylic acid?**

A. Oxalic acid
B. Malonic acid
C. Benzoic acid
D. Both A and B

Q.2 **Hydrolysis of which compound yields carboxylic acid on boiling with mineral acids?**

A. Alkane
B. Alkane nitriles
C. Alkenes
D. Oxalic acid

Q.3 **In non-polar solvents carboxylic acids exist as**

A. Monocarboxylic acidic
B. Cyclic dimers
C. Cyclic trimer
D. Cyclic tetramer

Q.4 **Carboxylic acids are_____ than mineral acids**

A. Weaker
B. Stronger
C. of equal strength
D. Less soluble

Q.5 **Which of the following are used as artificial flavors?**

A. Carboxylic acids
B. Aldehydes
C. Esters
D. Amide

Q.6 **Alkanoic acids upon treatment with PCl_5, $SOCl_2$ gives**

A. Acid amide
B. Acid halides
C. Esters
D. Amines

Q.7 **Which of the following is an acid catalyzed reaction?**

A. Amide formation
B. Halide formation
C. Esterification
D. All given

Q.8 **Boiling point of which of the following carboxylic acid will be greater?**

A. Propanoic acid
B. Butanoic acid
C. Pentanoic acid
D. Methanoic acid

Q.9 **Solubility of first four members of aliphatic carboxylic acid in water is due to?**

A. Intermolecular forces (Dipole-dipole)
B. Ion-dipole forces
C. Hydrogen bonding
D. None

Q.10 **Methyl magnesium bromide upon reaction with CO_2 produces**

A. Methanoic acid
B. Ethanoic acid
C. Propanoic acid
D. Butanoic acid

Q.11 **General formula for carboxylic acid is**

A. $C_nH_{2n}O_3$
B. $C_nH_nO_2$
C. $C_nH_{2n}O_2$
D. $C_nH_{2n}O$

Q.12 **Which of the following is an unsaturated carboxylic acid**

A. Malonic acid
B. Oxalic acid
C. Succinic acid
D. Maleic acid

Q.13 **Acetic acid exists as dimer in benzene due to**

A. Presence of hydrogen at α-carbon
B. Condensation reaction
C. Presence of carboxylic group
D. Hydrogen bonding

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Q.14 An acid with unpleasant smell
A. Formic acid
B. Acetic acid
C. Propionic acid
D. Butyric acid

Q.15 Glacial acetic acid at low temperature is a
A. Semi solid
B. Ice like solid
C. Viscous liquid
D. Dilute liquids

Q.16 Which of the following is unsaturated aliphatic organic acid
A. Maleic acid
B. Terephthalic acid
C. Phthalic acid
D. Adipic acid

Q.17 Which one is carboxylic acid
A. Carbolic acid
B. Picric Acid
C. Carbonic Acid
D. Palmitic acid

Q.18 Organic acid which cannot obtained by hydrolysis of fats
A. Succinic acid
B. Acetic acid
C. Butyric acid
D. Propionic acid

Q.19 By oxidation of which compound carboxylic acid cannot be obtained.
A. 2-Methyl-2-propanol
B. 1-Butanol
C. 2-Butanol
D. 2-Propanol

Q.20 A compound is oxidized to X, by further oxidation of X if resulting compound is butyric acid, starting compound can be:
A. Butanol
B. Butanoic acid
C. Butanone
D. All of these

Q.21 Alkane nitriles on boiling with which type of acid gives organic acids
A. Organic
B. Phenol
C. Alcohol
D. Mineral acids

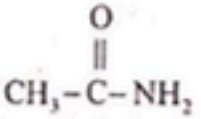
Q.22 If ethanoic acid is to be prepared by hydrolysis of alkane nitriles, which of the following can be the reagent to be hydrolyzed
A. CH_3CN
B. CH_3CH_2CN
C. HCN
D. NaCN + HCl

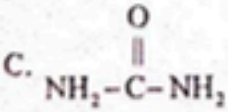
Q.23 Alkane nitriles can be prepared by treating alkyl halide with
A. Alcohol
B. Alcoholic potassium cyanide
C. Potassium chloride
D. Water

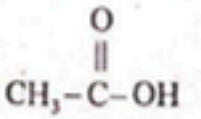
Q.24 Propanoic acid is produced from _____ on acidic hydrolysis
A. 1-propanol
B. Isopropyl cyanide
C. n-propyl cyanide
D. Ethyl cyanide

Q.25 $CH_3CN + H_2O \xrightarrow{H^+} A \xrightarrow[H_2O]{H^+} CH_3COOH$. Predict "A" among the following

A. $CH_3CH_2NH_2$

B. 

C. 

D. 

Q.26 Potassium carbonate is decomposed by acetic acid and release a gas, the nature of gas is
A. Basic
B. Neutral
C. Acidic
D. Unpredictable

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Q.27 **Which group of carboxylic acids is active for reaction with alkali metal carbonates?**
A. H-atom of R group
B. Carbonyl group
C. H-atom of OH group
D. Carboxylic group

Q.28 **Which reaction can be used in artificial juices formation with carboxylic acids**
A. Hydration
B. Esterification
C. Hydrolysis
D. Salt formation

Q.29 **The addition of ethyl alcohol in protonated acetic acid is**
A. Electrophilic substitution
B. Nucleophilic addition
C. Nucleophilic substitution
D. Oxidation

Q.30 **Benzyl alcohol and acetic acid give a compound with _____ fragrance**
A. Banana
B. Pineapple
C. Apricot
D. Jasmine

Q.31 **Ammonium acetate converts to acetamide by**
A. Cooling
B. Heating
C. Dehydration
D. Both B and C

Q.32 **Which of the following represent acid amide**
A. CH_3COONH_4
B. CH_3COCl
C. CH_3CN
D. CH_3CONH_2

Q.33 **Which sequence of groups replace OH of carboxylic acid to halides, esters and amides respectively**
A. OH, X, NH_2
B. X, OR, NH_2
C. NH_2, H, X
D. X, OR, NO_2

Q.34 **Which gas release during acid halide formation with the help of thionyl chloride and carboxylic acid**
A. CO_2
B. NO
C. SO_2
D. SO_3

Q.35 **During the formation of an acid amide from ethanoic acid, what actually happens**
A. Displacement of the –H from the acid by –Cl
B. Displacement of the –OH from the acid by $-NH_2$
C. Attachment of $-NH_2$ with the carbonyl oxygen
D. Displacement of the –H from the acid by $-NH_2$

Q.36 **Carboxylic acids react with active metals (Na, K, Ca and Mg) to form their salt and**
A. H_2O
B. CO_2 only
C. H_2O and CO_2
D. H_2 gas

Q.37 **Which pair can be used as a reactant for the preparation of acetyl chloride**
A. CH_3COOH, HCl
B. CH_3COOH, PCl_5
C. CH_3COOH, $SOCl_2$
D. Both "B" and "C"

Q.38 **For producing a carboxylic acid derivative. The reaction of nucleophile to carboxyl group is always followed by displacement of**
A. –COOH group
B. –OH group
C. H atom
D. OR

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Q.39 The work of concentrated H_2SO_4 in esterification process is as
A. Dehydrating agent and catalyst
B. Hydrolyzing agent
C. Dehydrating agent
D. Catalyst

Q.40 Which of the following is more soluble in water?
A. Ethanoic acid
B. Propanoic acid
C. Butanoic acid
D. Methanoic acid

Q.41 Which of the following is not an example of electrophilic substitution reaction
A. Reaction of CH_3COOH with Na
B. Reaction of CH_3COOH with $NaHCO_3$
C. Reaction of CH_3COOH with Na_2CO_3
D. Reaction of CH_3COOH with PCl_5

Q.42 Identify reversible reaction among the following
A. Esterification
B. Acid Halide formation
C. Acid Amide formation
D. Acid anhydride formation

Q.43 Ethyl butyrate is an ester formed by combination of _____ and butyric acid
A. Ethyl alcohol
B. Propyl alcohol
C. Butyl alcohol
D. Methyl alcohol

Q.44 By-product produced during hydrolysis of alkane nitrile in basic medium is
A. NH_3
B. $(NH_4)_2SO_4$
C. NH_4Cl
D. NH_4NO_3

Q.45 $2CH_3COOH + xCa \longrightarrow Ca(OCOCH_3)_2 + H_2O$. Calculate value of "x".
A. 1
B. 3
C. 2
D. 4

Q.46 Which of the following carboxylic acid derivative is least reactive?
A. Acyl halide
B. Acid anhydride
C. Acid amide
D. Ester

Q.47 The stronger acid among the following is
A. Cl_3CCOOH
B. $ClCH_2COOH$
C. $Cl_2CHCOOH$
D. CH_3COOH

Q.48 The strength of the organic acids and chloro substituted acids is measured by pK_a scale such that smaller value of pK_a corresponds to
A. Stronger acid
B. Weaker acid
C. Mild acid
D. Very weak acid

Q.49 Organic acids (Carboxylic acids) are considered as
A. Strong acids
B. Weak acids
C. Mild acids
D. Mineral acids

Q.50 Identify strongest conjugate base among the following
A. OH^-
B. $RCOO^-$
C. ^-OR
D. PhO^-

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Topic 18

CARBOXYLIC ACIDS

PAST PAPER MCQ'S

Q.51 Hydrolysis of cyano group by an aqueous acid results into: MDCAT (2010)
A. Acid amide
B. Cyano hydride
C. Carboxylic acid
D. Formaldehyde

Q.52 Which of the following compounds in the form of aqueous solution will produce CO_2 on reaction with sodium carbonate:` MDCAT (2010)
A. $CH_3COOC_2H_5$
B. $C_2H_5COOC_2H_5$
C. $C_2H_5COOCH_3$
D. $C_2H_5CO\text{-}OH$

Q.53 $CH_3CN + HCl \rightarrow A + B$ in presence of water in the above reaction A ans B are MDCAT (2011)
A. Acetic acid and acid amide
B. Acetic acid and methyl chloride
C. Acetic acid and ammonia
D. Acetic acid and ammonium chloride

Q.54 Consider the following reaction $CH_3COOH + Mg(metal) \rightarrow$?What product will form MDCAT (2011)
A. Magnesium formate
B. Magnesium ion
C. Magnesium acetate
D. Carboxylate ion

Q.55 $CH_3COOH + PCl_5 \rightarrow$ the products of above reaction are MDCAT (2011, 2016)
A. $CH_3COCl + POCl_2 + HCl$
B. $CH_3Cl + POCl_3 + HCl$
C. $CH_3COCl + POCl_3 + HCl$
D. $CH_3COCl + POCl_3 + H_2$

Q.56 The $-CONH_2$ group is called MDCAT (2011)
A. Amide group
B. Amino group
C. Protein linkage
D. Peptide linkage

Q.57 When $CH_3–CH_2–OH$ is oxidized in the presence of $K_2Cr_2O_7$ and H_2SO_4, the product formed is MDCAT (2012)

A. $CH_3-\overset{O}{\overset{\|}{C}}-OH$
B. $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$
C. $H-\overset{O}{\overset{\|}{C}}-OH$
D. $CH_3-\overset{O}{\overset{\|}{C}}-OCH_3$

Q.58 When ethanoyl chloride reacts with methylamine an amide is formed. What is the structure of it amide formed? MDCAT (2012)

A. $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-NH_2$
B. $CH_3-\overset{O}{\overset{\|}{C}}-NH_2$
C. $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-NHCH_3$
D. $CH_3-\overset{O}{\overset{\|}{C}}-NHCH_3$

Q.59 Relative acidic strength of alcohol, phenol, water and carboxylic acids is MDCAT (2011, 2013)
A. Carboxylic acid > Alcohol > Phenol > Water
B. Carboxylic acid > Phenol > Water > Alcohol
C. Phenol > Carboxylic acid > Alcohol > Water
D. Water > Phenol > Alcohol > Carboxylic acid

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Q.60 Methyl cyanides, on boiling with mineral acids or alkalies, yield: MDCAT (2017)

A. Butanoic acid
B. Formic acid
C. Acetic acid
D. Propanoic acid

Q.61 The formation of ester from acetic acid in presence of acid and ethanol is a: MDCAT (2013)

A. Nucleophilic addition reaction
B. Nucleophilic substation reaction
C. Electrophonic substitution reaction
D. Electrophonic addition reactio.

Q.62

$$CH_3-\overset{\overset{O}{\|}}{C}-OH+NH_3 \xrightarrow{Heat} ?$$

The final products formed are: MDCAT (2013)

A. $CH_3-\overset{\overset{O}{\|}}{C}-NH_2+CO_2$

B. $CH_3-\overset{\overset{O}{\|}}{C}-NH_2+H_2O$

C. $CH_3-\overset{\overset{O}{\|}}{C}-NH_2+H_2$

D. $CH_3-\overset{\overset{O}{\|}}{C}-NH_2+HCl$

Q.63 Ethyl butyrate and butyl butanoate are esters with the flavor of MDCAT (2014)

A. Pear
B. Pineapple
C. Banana
D. Apple

Q.64 Organic compound 'X' and 'Y' both can react with Na-metal to evolve hydrogen gas. 'X' and 'Y' if react with each other form an organic compound 'Z' which gives fruity smell. What types of compounds 'X', 'Y' and 'Z' are? MDCAT (2014)

	X	Y	Z
A.	Alcohol	Ester	Acetic Acid
B.	Alcohol	Ester	Mineral Acid
C.	Alcohol	Acetic Acid	Ester
D.	Alcohol	Mineral Acid	Ester

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Q.65 An organic acid 'z' reacts separately with sodium bicarbonate, sodium hydroxide and sodium carbonate. Which one of the following represent the structure of 'z' MDCAT (2015)

A. $HCOOC_2H_5$
B. CH_3CH_2OH
C. $CH_3-CH=CH_2$
D. H_3C-CH_2-COOH

Q.66 $CH_3COOH+CH_3CH_2OH \rightleftharpoons CH_3COOC_2H_5+H_2O$ MDCAT (2016)

Which one of the following will act as a catalyst in above reaction?

A. HNO_3
B. Acidified potassium dichromate
C. H_2SO_4
D. $SOCl_2$

Q.67 Which one of the following reaction of carboxylic acid is reversible? MDCAT (2016)

A. Esterification
B. Reaction with PCl_5
C. Salt formation
D. Reaction with $SOCl_2$

Q.68 'Ka' values of few organic acids are given.

Acid	Ka
CH_3COOH	1.85×10^{-5}
CCl_3COOH	2.3×10^{-2}
$CHCl_2COOH$	5.0×10^{-3}
$CH_2ClCOOH$	1.3×10^{-3}

The order of the acid strength is MDCAT (2016, 2017)

A. $CCl_3COOH > CHCl_2COOH > CH_2ClCOOH > CH_3COOH$
B. $CH_3COOH > CHCl_2COOH > CCl_3COOH > CH_2ClCOOH$
C. $CHCl_2COOH > CH_3COOH > CCl_3COOH > CH_2ClCOOH$
D. $CCl_3COOH > CH_3COOH > CHCl_2COOH > CH_2ClCOOH$

Q.69 **Compounds having — C ≡ N group are called** MDCAT (2017)

A. Cyano compounds
B. Nitro compounds
C. Carbon nitrogen molecules
D. Nitriles

Q.70 **Final product of hydrolysis of nitrile yield:** MDCAT (2017)

A. Ketone
B. Alcohol
C. Aldehyde
D. Carboxylic acid

Q.71 **During esterification, the bond from alcohol that breaks is between:** MDCAT (2017)

A. Carbon and Oxygen
B. Carbon and carbon
C. Oxygen and hydrogen
D. None of these

Q.72 **Identify the product X in the following reaction:** MDCAT (2017)

$$CH_3COOH + PCl_5 \xrightarrow{Yields} X + POCl_3 + HCl$$

A. CH_3COCl
B. $CH_3COCH_2Cl_2$
C. CH_3COCl_2
D. CH_2COCl_2

Q.73 $C_2H_5OH + CH_3\overset{O}{\overset{\|}{C}}-OH \rightleftharpoons CH_3\overset{O}{\overset{\|}{C}}-OC_2H_5 + H_2O$

Which of the following catalyst is used in the above reaction? MDCAT (2018)

A. Pt
B. Ni
C. Pumice stone
D. Conc. H_2SO_4

Q.74 **Which product is formed by the reaction of carboxylic acid with alcohol?** MDCAT (2018)

A. Ester
B. Aldehyde
C. Alkane
D. Ether

Q.75 **Which one will be act as a strong acid** MDCAT (2018)

A. Dichloroethanoic acid
B. Ethanoic acid
C. Trichloethanoic acid
D. Chloroethanoic acid

Q.76 **Acetyl chloride (Ethanoyl chloride) is used in the synthesis of organic compounds. It is prepared by treating acetic acid with** SET (2019)

A. $SOCl_2$
B. HCl
C. CH_3Cl
D. $ClNH_2$

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Q.77 What will be the outcome of reaction of methanol with ethanoic acid in the presence of concentrated sulphuric acid? SET (2019)
A. Propanone is formed
B. Propanoic acid formed
C. Methyl ethanoate is formed
D. Propanol is formed

Q.78 Which one of the following compounds can exist in the form of cyclic dimers? SET (2019)
A. Benzene
B. Acetals
C. Ozonide
D. A carboxylic acid

Q.79 Reagent used to reduce a carboxylic acid to an alkance is NUMS (2019)
A. Ni/H_2
B. $NaBH_4$
C. P/HI
D. $LiAlH_4$

Q.80 Which of the following is not a fatty acid? NUMS (2019)
A. Phenyl acetic acid
B. Stearic acid
C. Palmitic acid
D. Oleic acid

Q.81 Select the correct order of the acids strength? ETEA (2016)
A. $CH_3COOH > CHCl_2COOH > CH_2ClCOOH$
B. $CHCl_2COOH > CH_2ClCOOH > CH_3COOH$
C. $CH_3COOH > CHCl_2COOH > CH_2ClCOOH$
D. $CHCl_2COOH > CH_2COOH > CH_2ClCOOH$

Q.82 Which compound shows the highest boiling point? ETEA (2019)
A. CH_3COOH
B. C_2H_5OH
C. $C_2H_5-0C_2H_5$
D. $(CH_3CH_2)_3N$

Q.83 Which one is more reactive? ETEA (2019)
A. Ester
B. Acid halide
C. Amide
D. Acid anhydride

Q.84 Nitriles (RCN) on hydrolysis in the presence of a mineral acid yield: MDCAT (2019)
A. Ethers
B. Aldehydes
C. Alcohols
D. Carboxylic acids

Q.85 Carboxylic acids can be reduced into corresponding alcohols. Which of the following reagent can be used for this purpose? MDCAT (2019)
A. $K_2Cr_2O_4$
B. $LiAlH_4$
C. H_2SO_4
D. $KMnO_4$

Q.86 Which of the following reagent is required for preparation of acyl chloride (CH_3COCl) from ethanoic acid? MDCAT (2019)
A. HCl
B. PCl_5
C. CH_3Cl
D. $POCl_3$

Q.87 Which balance chemical equation show the formation of ethanoyl chloride using thionyl chloride? MDCAT (2019)
A. $CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_2 + HCl$
B. $CH_3COOH + SOCl_2 \rightarrow CH_3COCl + SO_2 + HCl$
C. $HCOOH + SOCl_2 \rightarrow HCOCl + SO_2 + HCl$
D. $CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_3 + HCl$

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Q.88 **Which of the following is the strongest acid?** NMDCAT (2020)

A. Propanoic acid
B. Flouroethanoic acid
C. Trichloroethanoic acid
D. Nitroethanoic acid

Q.89 **Hydrolysis of acyl chloride results in the formation of** NMDCAT (2020)

A. Acid anhydride
B. Carboxylic acid
C. Amides
D. Esters

Q.90 **The exact reactivity order for carboxylic acid derivatives is** NMDCAT (2020)

A. Anhydride > Acyl chloride > Ester
B. Ester > Anhydride > Acyl chloride
C. Amide > Acyl chloride > Ester
D. Acyl chloride > Anhydride > Ester

Q.91 **Number of oxygen in cyclic ring of dimer of carboxylic acid are** PMC (2021)

A. 2
B. 4
C. 5
D. 6

Q.92 **Which of the following catalyst is used for the preparation of acidic anhydrides?** PMC (2021)

A. $K_2Cr_2O_7$
B. P_2O_5
C. H^+/H_2O
D. H_2SO_4

Q.93 **Which of the following is a carboxylic acid derivative?** PMC (2021)

A. Alcohol
B. Acetic acid
C. Acyl halide
D. Methyl halide

Q.94 **Which one is weak acid** PMC (2021)

A. Acetic acid
B. Formic acid
C. Propanoic acid
D. Butanoic acid

Q.95 **Which among the following have least pH?** UHS (2022)

A. CH_3CH_2COOH
B. CH_3CCl_2COOH
C. CH_2ClCH_2COOH
D. $CH_3CH_2CH_2COOH$

Q.96 **If carboxylic acid and ketone groups >C=O are present in a chain then final name will be given as** UHS (2022)

A. Oxo, oic acid
B. One, oic acid
C. Both A and B
D. None of these

Q.97 **When carboxylic acids and dicarboxylic acids have similar molecular weights, how do their m.p compare?** UHS (2022)

A. Carboxylic acids have greater m.p
B. Dicarboxylic acids have greater m.p
C. Both have similar m.p
D. No any consistent trends exits

Q.98 **Select the correct order of relative acidic strength of phenol, alcohol, water and carboxylic acid:** SZABMU (2022)

A. Carboxylic acid > water > phenol > alcohol
B. Carboxylic acid > phenol > water > alcohol
C. Carboxylic acid > alcohol > phenol > water
D. Carboxylic acid > water > alcohol > phenol

Q.99 **Carboxylic acid reacts with alcohol to form:** SZABMU (2022)

A. Ester
B. Aldehyde

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C. Ketones D. Alkyl Halide

Q.100 Which of the following statements is false about the acid-strength of acetic acid? ETEA (2022)

A. Acetic acid is a stronger acid than monochloroacetic acid
B. Acetic acid is a stronger acid than Propionic acid.
C. Acetic acid is a weaker acid than trichloroacetic acid
D. Acetic acid is a weaker acid than formic acid

Q.101 HOOC – COOH has IUPAC name DUHS (2022)

A. Acetic acid B. Oxalic acid
C. Diethanoic acid D. Ethandioic acid
E. Benzoic acid

Q.102 Hexanoic acid is IUPAC name: DUHS (2022)

A. Adipic acid B. Propionic acid
C. Formic acid D. Caproic acid
E. Butyric acid

Q.103 Which of the functional group are present in ethyl acetate? BMU (2022)

A. Aldehyde group B. Carboxyl group
C. Ester group D. Ether group

Q.104 Carboxylic acids are water soluble because they: NUMS (2022)

A. Are more reactive B. Have low melting point
C. Have hydrogen bonding D. Have high density

Q.105 If carboxylic acid and ketone groups C=O are present in a chain, then final name will be given as UHS (2023)

A. oxo, oic acid B. one, oic acid
C. Both 1 and 2 D. None of these

Q.106 Acetic acid is weak acid than sulphuric acid because of which of the following reasons? UHS (2023)

A. It decomposes on increasing temperature B. It has less degree of ionization
C. It has –COOH group D. It has more inductive effect

Q.107 Mr. Khan mix acetic acid with thionyl chloride. Which product is obtained? UHS (2023)

A. $CH_3COCl + SO_2 + HCl$ B. $CH_3Cl + CH_3COCl$
C. $CH_3COOCH_3 + SO_2$ D. $CH_3Cl + SO_2 + HCl$

Q.108 Complete oxidation of alcohol gives which of the following? UHS (2023)

A. Aldehyde B. Alkane
C. Carboxylic acid D. Ketone

Q.109 The relative acidic strength of phenol, water, alcohol & carboxylic acid is: SZABMU (2023)

A. -COOH > H_2O > C_6H_5OH > -OH B. -COOH > C_6H_5OH > H_2O > -OH
C. -COOH > -OH > C_6H_5OH > H_2O D. -COOH > H_2O > -OH > C_6H_5OH

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Q.110 When carboxylic acids are heated with alcohol in the presence of concentration H_2SO_4, the conversion of functional group takes place from: SZABMU (2023)

A. Carboxyl to carbonyl group
B. Carboxyl group to an ester group
C. Carbonyl to carboxyl group
D. Carboxyl to hydroxyl group

Q.111 Thionyl chloride reacts with acetic acid resulting in transformation of Carboxylic group to: SZABMU (2023)

A. Acetamide
B. Acid halide
C. Alcohol
D. Ester

Q.112 Reactivity of carboxyl group is due to presence of: SZABMU (2023)

A. Hydroxyl group
B. Terminal hydrogen
C. Carbonyl group
D. Alkyl group

Q.113 In conversion of acid halides to ester, pyridine is used to: ETEA (2023)

A. Stabilize acid halides
B. Consume HCl formed in the reaction
C. Dehydrate alcohol
D. Dehydrogenate acid halides

Q.114 Number of carbon atoms in Valeric acid is: ETEA (2023)

A. 4
B. 5
C. 6
D. 7

Q.115 The IUPAC name of formyl chloride is: ETEA (2023)

A. Chloro methanoic acid
B. Chloro methane
C. Methanoyl chloride
D. Chloromethanoate

Q.116 Which of the following is formed when formaldehyde is treated with oxidizing mixture? ($H_2SO_4 + K_2Cr_2O_7$)? DUHS (2023)

A. Methanol
B. Methanoic acid
C. Acetone
D. Acetaldehyde

Q.117 What is the IUPAC name of stearic acid? DUHS (2023)

A. Hexanoic acid
B. Octadecanoic acid
C. Octanoic acid
D. Hexadecanoic acid

Q.118 Which of the following is formed when acetone is oxidized? DUHS (2023)

A. Formic acid
B. Ethanoic acid
C. Propanoic acid
D. Butyric acid

Q.119 What's the IUPAC name of α, β-dimethyl valeric acid? DUHS (2023)

A. 2,3- dimethyl hexanoic acid
B. 3,4- dimethyl hexanoic acid
C. 3,4- dimethyl pentanoic acid
D. 2,3- dimethyl pentanoic acid

Q.120 Which of the following reacts with Carboxylic Acid to form Ester? NUMS (2023)

A. Aldehyde
B. Alkyl Halide
C. Ketones
D. Alcohol

Q.121 Hydrolysis of Nitriles produces: NUMS (2023)

A. Carboxylic acid
B. Aldehydes
C. Ketones
D. Esters

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Q.122 Acetic acid is weak acid than sulphuric acid because of which of the following reasons? BUMHS (2023)

A. It decomposes on increasing temperature
B. It has less degree of ionization
C. It has -COOH group
D. It has more inductive effect

Q.123 The solubility of carboxylic acid in water gradually decreases with: BUMHS (2023)

A. Decreases in molecular mass
B. Increases in molecular mass
C. Increases the amount of acid
D. Decreases the amount of water

Q.124 Which of the following acids has the smallest dissociation constant? BUMHS (2023)

A. $CH_3CHFCOOH$
B. FCH_2CH_2COOH
C. $BrCH_2CH_2COOH$
D. $CH_3CHBrCOOH$

Q.125 Which product is formed when RMgX reacts with CO_2? BUMHS (2023)

A. Aldehyde
B. Ketone
C. Carboxylic acid
D. Ethers

Q.126 Common name of 2-Hydroxy propanoic acid is: UHS (2024)

A. Tartaric acid
C. Lactic acid
B. Phthalic acid
D. Formic acid

Q.127 Which of the following is not an amino acid UHS (2024)

A. Folic acid
C. Glutamic acid
B. Glycine
D. Lysine

Q.128 The oxidation of Methanal results in the formation of———. SZABMU (2024)

A. Acetic acid
C. Formic acid
B. Methanol
D. Propanoic acid

Q.129 The IUPAC name of Malonic acid $CH_2(COOH)_2$ is ———. SZABMU (2024)

A. 1,2-Ethanedioic
C. 1,3-Propanedioic acid
B. 1,4-Butanedioic acid
D. 1,6-Hexadecanoic acid

Q.130 Oxidation of Propanal in the presence of $K_2Cr_2O_7$ / H_2SO_4 produces SZABMU-RC (2024)

A. Propanol
C. Propanone
B. Propanoic acid
D. Propene

Q.131 Decarboxylation of carboxylic acid occurs in the presence of SZABMU-RC (2024)

A. Baking soda
C. Soda lime
B. Lime
D. Caustic soda

Q.132 The common name of pentanedioic acid SZABMU-RC (2024)

A. Glutaric acid
C. Succinic acid
B. Oxalic acid
D. Maleic acid

Q.133 On reacting acetic acid with baking soda a gas is evolved which turns lime water milky. Gas evolved is SZABMU-RC (2024)

A. Cl_2
C. H_2
B. NO_2
D. CO_2

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Q.134 Hydrolysis of Nitrile will produce SZABMU-RC (2024)
A. Ketones
B. Ester
C. Carboxylic acid
D. Aldehydes

Q.135 Ethyl acetate is an SZABMU-RC (2024)
A. Amide
B. Ester
C. Acid halide
D. Carboxylic acid

Q.136 The two functional groups present in all amino acids are SZABMU-RC (2024)
A. Carboxylic acid and amine
B. Ether and carboxylic acid
C. Ether and carboxylic acid
D. Aldehyde and carboxylic acid

Q.137 Acetic acid can be prepared by the hydrolysis of ETEA (2024)
A. Ethanal
B. Methanoic acid
C. Ethanol
D. Methyl cyanide

Q.138 It is used as a preservative and antibacterial agent in livestock feed DUHS (2024)
A. Butyric acid
B. Caproic acid
C. Formic acid
D. Propionic acid

Q.139 The carboxylic acid is stronger than: DUHS (2024)
A. PCl_5
B. HNO_3
C. H_2SO_4
D. HCl

Q.140 Total number of alpha amino acids are: (Out of syllabus) SINDH (2024)
A. 20
B. 22
C. 27
D. 25

Q.141 On heating acetic acid in the presence of P_2O_5, dehydration occurs with the formation of BMU (2024)
A. Acetamide
C. Methyl acetate
B. Octyl acetate
D. Acetic anhydride

Q.142 Select the carboxylic acid with highest melting point: NUMS (2024)
A. Ethanoic acid
B. Butanoic acid
C. Propanoic acid
D. Pentanoic acid

Q.143 Identify the following compound having shortest bond length: NUMS (2024)
A. Methyl amine
B. Formic acid
C. Formamide
D. Ethanol

Q.144 Compound X + Na_2CO_3 → compound Y + CO_2 + H_2O. (Wrong) NUMS (2024)
The compound Y is:
A. CH_2=CH–CH_2–CH_3
B. CH_3COOCH_3
C. CH_3CH_2CHO
D. CH_3CH_2COOH

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ANSWER KEY

PRACTICE EXERCISE

1	D	11	C	21	D	31	D	41	D
2	B	12	D	22	A	32	D	42	A
3	B	13	D	23	B	33	B	43	A
4	A	14	D	24	D	34	C	44	A
5	C	15	B	25	B	35	B	45	A
6	B	16	A	26	C	36	D	46	C
7	C	17	D	27	C	37	D	47	A
8	C	18	A	28	B	38	B	48	A
9	C	19	A	29	B	39	A	49	B
10	B	20	A	30	D	40	D	50	C

PAST PAPERS MCQ'S

51	C	61	B	71	C	81	B	91	B	101	D	111	B	121	A	131	C	141	D
52	D	62	B	72	A	82	A	92	B	102	D	112	C	122	B	132	A	142	A
53	D	63	B	73	D	83	B	93	C	103	C	113	B	123	B	133	D	143	B
54	C	64	C	74	A	84	D	94	D	104	C	114	B	124	C	134	C	144	D
55	C	65	D	75	C	85	B	95	B	105	A	115	C	125	C	135	B		
56	A	66	C	76	A	86	B	96	A	106	B	116	B	126	C	136	A		
57	A	67	A	77	C	87	B	97	B	107	A	117	B	127	A	137	D		
58	D	68	A	78	D	88	C	98	B	108	C	118	B	128	C	138	C		
59	B	69	D	79	C	89	B	99	A	109	B	119	D	129	C	139	A		
60	C	70	D	80	A	90	D	100	A	110	B	120	D	130	B	140	A		

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EXPLANATORY NOTES

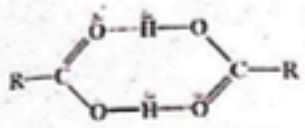
Q.11 The general formula of carboxylic acid is $C_nH_{2n}O_2$.

Q.12

$$\begin{array}{l} CH-COOH \\ \| \\ CH-COOH \end{array}$$

have double bond and have open chain structure

Q.13



Dimer of a carboxylic acid

Q.14 The first three aliphatic acids, formic acid, acetic acid, and propionic acid are colourless liquids and have a pungent smell. The next three acids C-4 to C-6 are colourless liquids with somewhat unpleasant smell.

Q.15 The pure acid freezes to an ice like solid at 17°C. Therefore, it is also called **glacial acetic acid.**

Q.16

$$\begin{array}{l} CH-COOH \\ \| \\ CH-COOH \end{array}$$

have double bond and have open chain structure. Hence its is unsaturated aliphatic acid

Q.17 Carbolic acid = Phenol
Carbonic acid = H_2CO_3
Picric acid = 2,4,6 – Trinitrophenol
Palmitic acid = Carboxylic acid

Q.18 Aliphatic monocarboxylic acid is called fatty acid. Fats on hydrolysis give saturated fatty acids. Succinic acid is a dicarboxylic acid so it is not a fatly acid

Q.19 2–Methyl –2– propanol is tertiary alcohol. So it cannot be oxidized to carboxylic acid because it does not contain α-H. Under same conditions it show elimination and give alkene

Q.20

$$CH_3-CH_2-CH_2-CH_2-OH \xrightarrow{[O]} CH_3-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-H \xrightarrow{[O]} CH_3CH_2CH_2COOH$$

Q.21 $RCN + H_2O \xrightarrow[HCl]{\text{Mineral acid}} RCOOH + NH_4Cl$

Q.22

$$CH_3CN \xrightarrow[H^+]{H_2O} CH_3-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[H^+]{H_2O} CH_3COOH$$

Q.23 $R-X + KCN \xrightarrow{\text{alcoholic}} R-CN + KX$

Q.24 $C_2H_5-CN \xrightarrow[H^+]{H_2O} CH_3CH_2COOH$

Q.25

$$CH_3-CN + H_2O \xrightarrow[H_2O]{H^+} CH_3-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[H_2O]{H^+} CH_3COOH$$

Q.26 $K_2CO_3 + 2CH_3COOH \longrightarrow 2CH_3COOK + CO_2 + H_2O$

CO_2 is evolved which is acidic in nature

Q.27 Reaction with carboxylic acid and carbonates are example of E^+– substitution

$Na + CH_3COOH \longrightarrow CH_3COONa + \frac{1}{2}H_2$, So, O – H bond break

Q.28 Artificial flavours are derived from esters and reaction between acid and alcohol is called esterification

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Q.29 Esterification is an example of Nucleophilic substitution reaction. During the mechanism when alcohol attacks through lone pair of O-atom on double bonded carbon of carboxyl group this step is called nucleophilic addition reaction

Q.30 $CH_3COOH + C_6H_5CH_2OH \overset{H^+}{\rightleftharpoons} CH_3COOCH_2C_6H_5 + H_2O$ Having jasmine fragrance.

Q.31 $CH_3COONH_4 \xrightarrow{\Delta} CH_3-CO-NH_2 + H_2O$, It is a heating and dehydration reaction

Q.32 $CH_3-CO-NH_2 \longrightarrow$ acid amide

Q.33 Acid halides $(-OH\text{ by }-X)$, Esters $(-OH\text{ by }-OR)$, Amides $(-OH\text{ by }-NH_2)$

Q.34 $CH_3COOH+SOCl_2 \longrightarrow CH_3COCl+H_2O+SO_2$

Q.35 $-OH$ replaced by $-NH_2$

Q.36 $RCOOH$ + active metal $\longrightarrow$ Salt + H_2

Q.37 $CH_3COOH+SOCl_2 \longrightarrow CH_3COCl+H_2O+SO_2$

$CH_3COOH + PCl_5 \longrightarrow CH_3COCl + POCl_3 + HCl$

$3CH_3COOH + PCl_3 \longrightarrow 3CH_3COCl + H_3PO_3$

Q.38 For Nucleophilic substitution reaction of carboxylic acid

$\longrightarrow C-O$ bond breaks

$\longrightarrow -OH$ replace by $-OR$, $-X$, $RCOO^-$ and NH_2

Q.39 Mineral acid act as catalyst and dehydrating agent during esterification

Q.40 Solubility of carboxylic acid in water decreases by increasing number of carbon atoms.

Q.41 $CH_3COOH + PCl_5 \longrightarrow CH_3-CO-Cl + POCl_3 + HCl$, In this reaction $C-O$ bond of carboxylic acid break so it is Nu substitution reaction

Q.42 $CH_3COOH + C_6H_5CH_2OH \overset{H^+}{\rightleftharpoons} CH_3COOCH_2C_6H_5 + H_2O$

Q.43 $C_2H_5-OH + HO-CO-CH_2-CH_2-CH_3 \longrightarrow C_2H_5-O-CO-CH_2-CH_2-CH_3 + H_2O$

Ethyl Butyrate

Q.44 $R-CN+H_2O \xrightarrow{OH^-} RCOOH+NH_3$

Q.45

$2CH_3COOH+Ca \longrightarrow Ca(OCOCH_3)_2 + H_2O$

Only one mole of Ca is needed

Q.46 Acid amides are least reactive (Acid halides > Acid anhydride > Ester > Amide)

Q.47 Halogens are electron withdrawing group. Greater the number of halogens, more the electron withdrawing effect, strong will be acid.

Q.48 $pK_a \propto \frac{1}{\text{acidity}}$

Q.49 Carboxylic are weak acid

Q.50

$OH^{-1} + H^+ \longrightarrow H-OH$

$\overset{-}{O}R + H^+ \longrightarrow R-OH$

$RCOO^- + H^+ \longrightarrow RCOOH$

$PhO^- + H^+ \longrightarrow PhOH$

Among these conjugate acids, alcohol is the weakest acid. If acid is weakest, strongest will be conjugate base

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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.51 Acidic hydrolysis of alkyl cyanides gives carboxylic acid as a product

$$R\text{-}C \equiv N + H_2O \xrightleftharpoons{HCl} RCOOH + NH_4Cl$$

Q.52 C_2H_5COOH (carboxylic acid) can produce CO_2 with metal carbonates and bicarbonates

$$2C_2H_5COOH + Na_2CO_3 \longrightarrow 2C_2H_5COONa + H_2O + CO_2$$

Q.53 $CH_3\text{-}C \equiv N + H_2O \xrightleftharpoons{HCl} CH_3COOH + NH_4Cl$

Q.54 The reaction between acetic acid and Mg metal will produce magnesium acetate[$(CH_3COO)_2Mg$]

Q.55 $CH_3COOH + PCl_5 \rightarrow CH_3COCl + POCl_3 + HCl$

Q.56 $-\overset{\overset{O}{\|}}{C}-NH_2$ is called as amide group

Q.57 When $CH_3–CH_2–OH$ is oxidized in the presence of $K_2Cr_2O_7$ and H_2SO_4, CH_3COOH as the product is formed

Q.58 When ethanoyl chloride reacts with methylamine an amide is formed. $CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}NHCH_3$ is the structure of product formed

$$CH_3COCl + CH_3NH_2 \rightarrow CH_3CONHCH_3$$

Q.59 Carboxylic acid > Phenol > Water > Alcohol is the correct order of relative strength of given substances due to stabilities of conjugate bases.

Q.60 Methyl cyanides, on boiling with mineral acids or alkalies, yield acetic acid or salt

Q.61 The formation of ester from acetic acid in presence of acid ethanol is nucleophillic substitution reaction.

Q.62
$$CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}OH + NH_3 \xrightarrow{Heat} CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2 + H_2O$$

Q.63 Ethyl butyrate and butyl butanoate are esters with the flavor of pineapple

Q.64 X = Alcohol, Y = Acetic acid and Z = Ester, alcohol and acid release hydrogen gas with sodium metal and both react with each other to form ester giving fruity smell.

Q.65 $CH_3\text{-}CH_2\text{-}COOH$ is a stronger acid among all given substances so can react with NaOH, Na_2CO_3 and specially $NaHCO_3$.

Q.66 $CH_3COOH + CH_3CH_2OH \xrightleftharpoons{H_2SO_4} CH_3COOC_2H_5 + H_2O$ in this reaction H_2SO_4 is used as a catalyst

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Q.67 Esterification is the reversible reaction among the derivatives of carboxylic acid

Q.68 $CCl_3COOH > CHCl_2COOH > CH_2ClCOOH > CH_3COOH$ is the correct order of acidic strength, greater the number of electrons withdrawing groups stable the conjugate base hence stronger the acid

Q.69 Compounds having $-C \equiv N$ group are called nitrile

Q.70 Final product of hydrolysis of nitrile yield carboxylic acid

$$R\text{-}C \equiv N + H_2O \underset{}{\overset{HCl}{\rightleftharpoons}} RCOOH + NH_4Cl$$

Q.71 During esterification, bond between oxygen and hydrogen is broken in case of alcohols

Q.72 $CH_3COOH + PCl_5 \xrightarrow{Yields} X + POCl_3 + HCl$, here X is CH_3COCl

Q.73 Conc. Sulphuric acid is used as a catalyst in esterification

Q.74 Ester is formed by the reaction of carboxylic acid with alcohol

$$CH_3COOH + CH_3CH_2OH \underset{}{\overset{H_2SO_4}{\rightleftharpoons}} CH_3COOC_2H_5 + H_2O$$

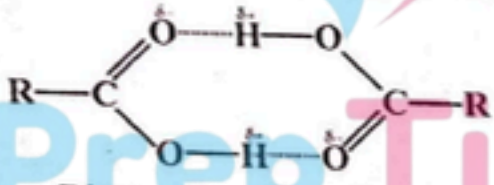
Q.75 Trichloroacetic acid is the strongest among all

$$CCl_3COOH > CHCl_2COOH > CH_2ClCOOH > CH_3COOH$$

Q.76 Acetyl chloride (ethanoyl chloride) is prepared by reacting acetic acid with $SOCl_2$

Q.77 Methyl ethanoate is formed when methanol reacts with acetic acid

Q.78 Carboxylic acid can form cyclic dimer by hydrogen bonding



Dimer of a carboxylic acid

Q.79 Carboxylic acids undergo complete reduction to form alkanes by using $HI/P_{(Red)}$.

Q.80 Aliphatic mono-carboxylic acids are known as fatty acids while Phenyl acetic acid is aromatic carboxylic acid.

Q.81 Given order is the correct $CHCl_2COOH > CH_2ClCOOH > CH_3COOH$, greater the number of electron withdrawing groups stable the conjugate base hence stronger the acid

Q.82 Acetic acid is the stronger than all given due to stronger hydrogen bonding.

Q.83 The correct order is Acid halide > Acid anhydride > Ester > Amides

Q.84 Nitriles (RCN) on hydrolysis in the presence of a mineral acid yield carboxylic acid.

$$R - C \equiv N + H_2O \underset{}{\overset{HCl}{\rightleftharpoons}} RCOOH + NH_4Cl$$

Q.85 Carboxylic acid can be partially reduced to primary alcohol by using $LiAlH_4$.

Q.86 PCl_5 is required for preparation of acyl chloride (CH_3COCl) from ethanoic acid.

Q.87 $CH_3COOH + SOCl_2 \rightarrow CH_3COCl + SO_2 + HCl$ is the balanced equation.

Q.88 Trichloroacetic acid is the strongest acid due to stronger electron withdrawing effect.

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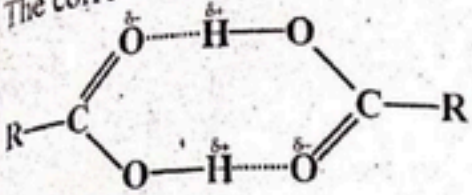
Q.89 Hydrolysis of acyl chloride results in the formation of carboxylic acid.

Q.90 The correct order is Acid halide > Acid anhydride > Ester.



Dimer of a carboxylic acid

Q.91 Number of oxygen atoms are four.

Q.92 $2CH_3-C(=O)-OH \xrightarrow{P_2O_5} CH_3-C(=O)-O-C(=O)-CH_3 + H_2O$

Q.93 $3CH_3COOH + PCl_3 \longrightarrow 3CH_3-C(=O)-Cl + H_3PO_3$

Q.94 Acidic strength decreases with increase in number of carbon atoms in carboxylic acids.

Q.95 Stronger the acid small will be the pH value due to electron with drawing effect of two chloro group attached with α carbon.

Q.96 If carboxylic acid and ketone groups >C=O are present in a chain then final name will be Oxo, oic acid.

Q.97 Dicarboxylic acids have greater melting point due to stronger I.M.F.

Q.98 Carboxylic acid > phenol > water > alcohol.

Q.99 Carboxylic acid reacts with alcohol to form an ester.

Q.100 Monochloroacetic acid is stronger acid than acetic acid due to electron with drawing effect of chloro group

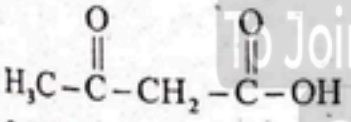
Q.101 IUPAC name of oxalic acid is ethandioic acid.

Q.102 IUPAC name of Caproic acid is Hexanoic acid (CH_3-CH_2-CH_2-CH_2-CH_2-COOH)

Q.103 Ethyl acetate is an ester (CH_3-COO-C_2H_5), ester group will be functional group.

Q.104 Carboxylic acids are water soluble due to hydrogen bonding among them.

Q.105 If carboxylic acid and ketonic groups are present in a chain then final name will be oxo, oic acid, i.e



3-Oxobutanoic acid

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Q.106 Acetic acid is less acidic than sulphuric acid because it has less degree of ionization because mineral acids are more strong then organic acids due to higher Ka value.

Q.107 $CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + HCl + SO_2$

Q.108 Complete oxidation of alcohols gives carboxylic acids i.e.

$$\underset{\text{Ethanol}}{CH_3-CH_2-OH} + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} \underset{\text{Ethanal}}{CH_3-CHO} \xrightarrow{[O]} \underset{\text{Ethanoic acid}}{CH_3-COOH}$$

Q.109 Relative acidic strength is given as $-COOH > C_6H_5OH > H_2O > R-OH$

Q.110 $CH_3COOH + C_2H_5OH \rightleftharpoons[H_2SO_4] CH_3COOC_2H_5 + H_2O$, in this reaction conversion of functional groups take place from carboxyl to ester group.

Q.111 $SOCl_2$ reacts with CH_3COOH resulting in the transformation of carboxylic group to acid halides i.e $CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + HCl + SO_2$

Q.112 In $-\overset{\overset{O}{\|}}{C}-OH$, the E^+ center is at carbon of carbonyl group.

Q.113 In the conversion of acid halides to ester, pyridine is used to consume HCl formed in the reaction i.e

$$CH_3-\overset{\overset{O}{\|}}{C}-Cl + C_2H_5-OH \xrightarrow{\text{Pyridine}} CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5 + HCl$$

Q.114 $CH_3–CH_2–CH_2–CH_2–COOH$
(Valeric acid)

Q.115 $HCOCl$ (Formyl chloride) has IUPAC name methanoyl chloride.

Q.116

$$H-\overset{\overset{O}{\|}}{C}-H + [0] \xrightarrow{K_2Cr_2O_7 + H_2SO_4} H-\overset{\overset{O}{\|}}{C}-OH$$

Formaldehyde Methanoic acid

Q.117

$$CH_3-(CH_2)_{18}-\overset{\overset{O}{\|}}{C}-OH$$

In the formula of stearic acid having IUPAC name octadecanoic acid.

Q.118

$$CH_3-\overset{\overset{O}{\|}}{C}-CH_3 + 3[O] \xrightarrow{K_2Cr_2O_7/H_2SO_4} CH_3-\overset{\overset{O}{\|}}{C}-OH + HCOOH$$

Acetone Acetic acid

Q.119

$$H_3C-\overset{\beta}{CH_2}-\overset{\alpha}{CH}(\overset{3}{CH_3})-\overset{2}{CH}(\overset{1}{CH_3})-\overset{\overset{O}{\|}}{C}-OH$$

2,3-Dimethylpentanoic acid (IUPAC)

Q.120 Alcohols react with carboxylic acid to form ester.

$$CH_3COOH + CH_3CH_2OH \rightleftharpoons[H_2SO_4] CH_3COOC_2H_5 + H_2O$$

Q.121 Hydrolysis of nitriles produces carboxylic acids.

$$CH_3COOH + CH_3CH_2OH \rightleftharpoons[H_2SO_4] CH_3COOC_2H_5 + H_2O$$

Q.122 Acetic acid is less acidic than sulphuric acid because it has less degree of ionization. Because H_2SO_4 has more stable conjugate base due to high resonance stability.

Q.123 $\text{Solublity} \propto \dfrac{1}{\text{Molecular Mass of carboxylic acid}}$, as the molecular mass and chain length increases, solubility decreases.

Q.124 $BrCH_2CH_2COOH$ is the weakest acid among the given acid, therefore has smaller dissociation constant (K_a)
Acidity of halogen substituted carboxylic acid $\propto$ E.N of halogen with same chain length of carboxylic acid.

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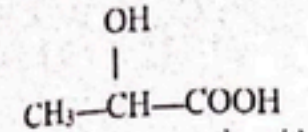
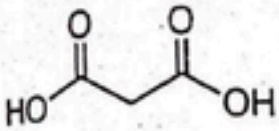
Q.125 When RMgX reacts with CO_2, then carboxylic acids are produced

$$R-MgX + \overset{\delta^-}{O}=\overset{\delta^+}{C}=\overset{\delta^-}{O} \xrightarrow{\text{dry ether}} [R-\overset{O}{\overset{\|}{C}}-\overset{-}{O}\overset{+}{M}gX] \xrightarrow[H_3O^+]{H^+} R-\overset{O}{\overset{\|}{C}}-OH + \overset{X}{\underset{OH}{Mg}}$$

Q.126

2-Hydroxypropanoic acid
(Lactic acid)

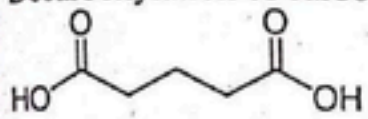
Q.127 Folic acid is not an amino acid.

Q.128 $HCHO + [O] \xrightarrow{K_2Cr_2O_7 + H_2SO_4} HCOOH$

Q.129

1,3-Propanedioic acid

Q.130 $CH_3-CH_2-CHO+[O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-CH_2-COOH$

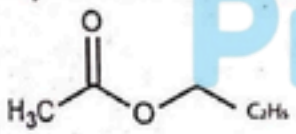
Q.131 Decarboxylation of carboxylic acid occurs in the presence of soda lime.

Q.132

Pentanedioic acid has common name glutaric acid.

Q.133 $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

Q.134 Hydrolysis of nitrile will produce carboxylic acid.

$$R\text{-}C \equiv N + H_2O \underset{}{\overset{HCl}{\rightleftharpoons}} RCOOH + NH_4Cl$$

Q.135 Ethyl acetate is an ester.


Q.136 Carboxylic acid and amino functional group are present is all amino acid.

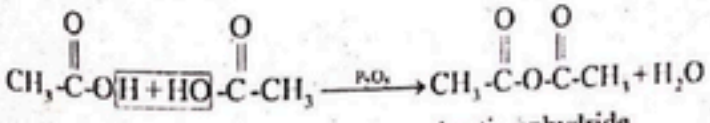
Q.137 $CH_3CN \xrightarrow{\text{Hydrolysis}} CH_3COOH$

Methylcyanide

Q.138 Formic acid used as preservative and antibacterial agent.

Q.139 Carboxylic acid is weaker acid than HNO_3, HCl, H_2SO_4

Q.140 Total number of alpha amino acids are 20.

Q.141

Acetic anhydride

Q.142 In solid state ethanoic acid molecules pack efficiently due to their small size and strong hydrogen bonding leading to higher melting point.

Q.143 Due to C = O in formic acid and absence of resonance.

Q.144 According to key "D" is right answer, but the actual reaction is

$$2CH_3CH_2COOH + Na_2CO_3 \longrightarrow 2CH_3CH_2COO^-Na^+ CO_2 + H_2O,$$

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Topic 19

MACROMOLECULES

PRACTICE EXERCISE

Q.1 **Nitrogenous compounds made up of amino acids**

A. Carbohydrates
B. Lipids
C. Proteins
D. Starch

Q.2 **Complete hydrolysis of proteins yield**

A. Nitrogen
B. Phosphorous
C. Carbohydrates
D. Amino acids

Q.3 **Prosthetic group in phosphorous protein is**

A. Amino group
B. Zwitter ion
C. Phospho group
D. Protein group

Q.4 **Most abundant protein in animal kingdom**

A. Globulins
B. Legumin
C. Collagen
D. Both A and B

Q.5 **Regular coiling of polypeptide chain due to _____ between NH and C = O groups is 2°-structure**

A. dipole-dipole forces
B. Hydrogen bonding
C. Ion dipole forces
D. Temporary interactions

Q.6 **_____is obtained by heating bones skin and tendons in water**

A. Albumin
B. Gelatin
C. Casein
D. Heamoglobin

Q.7 **Enzymes may speed up reactions upto**

A. 10^{20}
B. 10^{10}
C. 10^{15}
D. 10^{25}

Q.8 **The protein component of enzyme is called**

A. Co-factor
B. Apoenzyme
C. Protic group
D. Both B and C

Q.9 **The enzyme which acts upon sucrose is_____.**

A. Urease
B. Diastase
C. Sucrose
D. Cellulose

Q.10 **_____ is raised in heart diseases**

A. Alkaline phosphate
B. Vitamin
C. LDH-1
D. Thrombin phosphate

Q.11 **Zigzag and regular coiling of polypeptide linkage forms**

A. Primary structure
B. Secondary structure
C. Tertiary structure
D. Quaternary structure

Q.12 **The hydrogen bond in secondary structure of protein is present between**

A. O and H
B. N and H
C. C and H
D. F and H

Q.13 **Primary structure of proteins shows**

A. Folding
B. Sequence of amino acids
C. Coiling
D. It is due to hydrogen bonding

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Q.14 **Which of the following statement is false about protein**
A. Peptide bond is a covalent bond
B. It is a polyamide
C. It contain different sequence of amino acids in different proteins
D. Primary structure is due to hydrogen bonding

Q.15 **Which one of the following structure of protein is the direct consequence of hydrogen bonding**
A. Primary
B. Tertiary
C. Secondary
D. Quaternary

Q.16 **Primary structure of protein arises due to which force**
A. Hydrogen bonding
B. Covalent bond
C. Debye forces
D. Dipole-Dipole forces

Q.17 **Secondary structure of protein includes**
A. α-helix
B. β-sheets
C. 3-dimensioal folding
D. A and B

Q.18 **To what category of molecules do enzymes belong?**
A. Carbohydrates
B. Lipids
C. Nucleic acids
D. Proteins

Q.19 **Which is not present in an α-helix**
A. H–Bond
B. Disulphide linkage
C. Covalent bond
D. Amino acids

Q.20 **Which carbon of amino acids bond to nitrogen of another in peptide linkage**
A. α-Carbon
B. β Carbon
C. Side chain carbon
D. Carbonyl carbon

Q.21 **All proteins yield _____upon complete hydrolysis.**
A. Nitrogen
B. Amino acids
C. Carbon and hydrogen
D. Sulphur

Q.22 **Protein attached to some non-protein group is called**
A. Derived protein
B. Sample protein
C. Proteoses
D. Conjugated protein

Q.23 **Regular coiling or zigzagging of polypeptide through hydrogen bonding is its.**
A. Quaternary structure
B. Secondary structure
C. Tertiary structure
D. Primary structure

Q.24 **What common name can be given to lipids, proteins, carbohydrates and nucleic acid polymers**
A. Organic polymers
B. Inorganic polymers
C. Biopolymers
D. Synthetic polymers

Q.25 **Which one of the following polymers has peptide linkage in it?**
A. Terylene
B. Bakelite
C. Protein
D. Urea

Q.26 **Which factor cannot denature the protein**
A. pH change
B. Increase of temperature
C. Oxidizing condition
D. Dissolving in H_2O

Q.27 **Which of the following elements is not present in all proteins**
A. Carbon
B. Hydrogen
C. Sulphur
D. Nitrogen

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Q.28 Enzymes that catalyze the transfer of groups within molecule are called

A. Isomerases
B. Lyases
C. Transferases
D. Ligases

Q.29 Enzyme used for the treatment of blood cancer in children is

A. Cellulose
B. Urease
C. L-asperginase
D. Lactic dehydrogenase

Q.30 Enzymes from the same organism which catalyze same reaction but are chemically and physically distinct from each other are called

A. Oxidoreductases
B. Hydrolases
C. Isoenzymes
D. Isomerases

Q.31 Rate of enzymatic reaction is directly proportional to the concentration of

A. Enzyme
B. Substrate
C. Enzyme and substrate
D. Enzyme and product

Q.32 The rate of reaction is directly proportional to

A. $[Enzyme]^2$
B. $[Enzyme]^3$
C. [Enzyme]
D. $[\sqrt{[Enzyme]}]$

Q.33 The substrate binds with the enzyme at

A. Polar site
B. Cationic site
C. Active site
D. Anionic site

Q.34 Many enzymes contain a protein part and a non-protein part, the non-protein part is called_____

A. Apoenzyme
B. Coenzyme
C. Cofactors
D. Both B and C

Q.35 The group of compounds that is primarily responsible for building of body of an animal and its maintenance is called

A. Vitamin
B. Carbohydrate
C. Lipids
D. Proteins

Q.36 Which enzyme is used to catalyze the addition of ammonia, water or carbon dioxide to double bond

A. Phospho-transferase
B. Phospho-glyceromutases
C. Fumarase
D. Succinic thiokinase

Q.37 The activator for chrome oxidase is

A. Fe^{+2}
B. Zn^{+2}
C. Mg^{+2}
D. Fe^{+3}

Q.38 Thrombin is used

A. For treatment of cancer
B. Locally to stop bleeding
C. To diagnose heart disease
D. For treatment of rickets

Q.39 For the treatment of blood cancer in children ____enzyme has proved very useful

A. Thrombin
B. LDH-1
C. L-asparaginase
D. Alkaline phosphatase

Q.40 Protein part of the enzyme is called

A. Apoenzyme
B. Coenzyme
C. Cofactors
D. Holoenzyme

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Topic 19

MACROMOLECULES

PAST PAPER MCQ'S

Q.41 **Collagen and albumin are:** MDCAT (2010)
A. Derived proteins
B. Polyamide
C. Simple proteins
D. Polysaccharide

Q.42 **A polymer in which the number of amino acid residue is greater than 100 or the molecular mass is greater than 10,000 is called** MDCAT (2011)
A. Protein
B. Polypeptide
C. Dipeptide
D. Tripeptide

Q.43 **Macromolecules are described as large moelucles built up from small repeating units called** MDCAT (2012)
A. Monomers
B. Metamers
C. Isomers
D. Tautomers

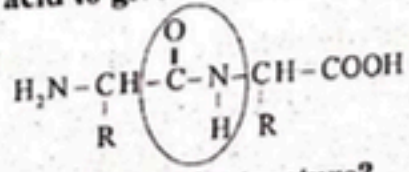
Q.44 **Phosphoprotein comes under the type of proteins** MDCAT (2017)
A. Simple protein
B. Derived protein
C. Conjugated
D. Both A & B

Q.45 **The stability in the following structure in due to the** MDCAT (2018)



A. Disulfide bridges
B. Weak vander Waal's forces
C. Presence of unpaired electron in the structure
D. Hydrogen bonding between NH group of one peptide with another peptide

Q.46 **Amino acids react with each other such that –COOH group of one amino acid reacts with the another among acid to give a condensed structure as shown below**



MDCAT (2018)

What is the name of circled part of this structure?
A. Peptide linkage
B. Azide linkage
C. Ester linkage
D. Carbide linkage

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Q.47 Role of a catalyst in a chemical reaction is to MDCAT (2018)
A. Increase rate of a reaction
B. Decrease rate of a reaction
C. Decrease yield of a reaction
D. Increase yield of product

Q.48 Glucose is converted into ethanol by the enzyme present in the yeast: MDCAT (2010)
A. Urease
B. Zymase
C. Invertase
D. Sucrase

Q.49 The proteins which give an amino acid and non-protein group on hydrolysis are known as: SET (2019)
A. Derived protein
B. Albumins
C. Conjugated simple protein
D. Conjugated protein

Q.50 The enzyme which is found in saliva, accelerates the conversion of starch into sugar is; ETEA (2019)
A. Pepsin
B. Thrombin
C. Ptyalin
D. Fumarase

Q.51 Which of the following bond is responsible for joining the amino acids in proteins? MDCAT (2019)
A. Metallic Bond
B. Di sulfide bond
C. Peptide Bond
D. Ionic Bond

Q.52 Based on the physico-chemical properties, proteins may be classified into the following types: NMDCAT (2020)
A. Simple proteins
B. Compound proteins
C. Derived proteins
D. All of the above

Q.53 Based on function, thyroxin can be classified as: NMDCAT (2020)
A. Hormonal protein
B. Structural protein
C. Transport protein
D. Genetic protein

Q.54 L-Asparaginase enzymes has been used for the treatment of: NMDCAT (2020)
A. Jaundice
B. Blood cancer
C. Rickets
D. Heat disease

Q.55 Protein is a polymer of _____? PMC (2021)
A. Nitrogen atoms
B. Amino acids
C. Glucose
D. Nitrogenous base

Q.56 Globulins protein upon hydrolysis yield amino acids or their derivatives, so they belong to which type of protein PMC (2021)
A. Derived proteins
B. Compound proteins
C. Conjugated proteins
D. Simple proteins

Q.57 Regular coiling and twisting of polypeptide chain caused by H-bonding in between NH and CO occurs _____. PMC (2021)
A. Primary structure
B. Secondary structure
C. Tertiary structure
D. Quaternary structure

Q.58 The substances which reduce the activity of enzyme action are called as _____? PMC (2021)
A. Reducers
B. Activators
C. Promotors
D. Inhibitors

Q.59 When food reaches stomach, the action of which of the following come to an end due to acidic pH? UHS (2022)
A. Lipase
B. Maltase
C. Amylase
D. Hydrolase

Q.60 Which of the following proteins acts as carrier of Cu in blood plasma? UHS (2022)
A. Haemoglobin
B. Ceruloplasmin
C. Glycoprotein
D. Histone

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Q.61 Based on function, thyroxin can be classified as SZABMU (2022)
A. Hormonal protein
B. Structural protein
C. Transport protein
D. Genetic protein

Q.62 Enzyme is a natural substance that SZABMU (2022)
A. Increases the rate of chemical reaction
B. Decreases the rate of chemical reaction
C. Has no effect on the rate of chemical reaction
D. Stops the chemical reaction

Q.63 The linear arrangement of amino acid units in proteins is called: ETEA (2022)
A. Secondary structure
B. Tertiary structure
C. Primary structure
D. Quaternary structure

Q.64 Nylon "6,6" is a: DUHS (2022)
A. Addition polymer
B. Condensation polymer of hexandioic acid & 1,6 diaminohexane
C. It is an ester
D. Condensation polymer
E. It is a carboxylic acid

Q.65 In protein amino acid molecule are linked by: DUHS (2022)
A. Glucoacidic linkage
B. Glycosidic linkage
C. Peptide linkage
D. Ethane linkage
E. Ester linkage

Q.66 Which enzyme is used for the treatment of blood cancer in children? BMU (2022)
A. Thrombin
B. L-asparaginase
C. LDH-1
D. Zymase

Q.67 The main structural feature of proteins is: BMU (2022)
A. Peptide linkage
B. Glycoside linkage
C. Ether linkage
D. Ester linkage

Q.68 Competitive inhibitors stop an enzyme from working by: UHS (2023)
A. Changing the shape of the enzyme
B. Merging with the substrate instead
C. Blocking the active site of the enzyme
D. Combining with the product of the reaction

Q.69 After the digestion & before absorption the product of the protein is: UHS (2023)
A. Amino acid and small polypeptide
B. Only Amino Acid
C. Only small polypeptide
D. Only ammonia

Q.70 The two functional groups present in all amino acids are: SZABMU (2023)
A. Carboxylic acid and amino
B. Amino and aldehyde
C. Ether and carboxylic acid
D. Aldehyde and carboxylic acid

Q.71 Enzyme is a natural substance that: SZABMU (2023)
A. Increases the rate of chemical reaction
B. Decreases the rate of chemical reaction
C. Has no effect on the rate of chemical reaction
D. Stops the chemical reaction

Q.72 The inhibition in which or inhibitor does not combine directly with the enzyme but binds to the enzyme substrate complex is called: ETEA (2023)
A. Reversible inhibition
B. Competitive inhibition
C. Non-competitive inhibition
D. Uncompetitive inhibition

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Q.73 Trypsinogen can be activated by the action of: KPK (2023)
A. Amylase B. HCl
C. Glucokinase D. Enterokinase

Q.74 Enzyme show optimum activity between 37°C to 50°C. it however works DUHS (2023)
A. Above 50°C B. Below 37°C
C. It loses activity permanently above 50°C D. It loses activity permanently below 37°C

Q.75 Which of the following is an Amino acid? DUHS (2023)
A. Benzoic acid B. Palmitic acid
C. Aspartic acid D. Aniline

Q.76 Protein content of human milk is about: BUMHS (2023)
A. 1.4 % B. 2.4 %
C. 3.4 % D. 4.4 %

Q.77 For every reaction occurring in human body there is at least one type of: BUMHS (2023)
A. Vitamin B. Enzyme
C. Protein D. Amino acid

Q.78 Based on function thyroxin can be classified as SZABMU-RC (2024)
A. Hormonal protein B. Structural protein
C. Transport protein D. Genetic protein

Q.79 Protein present in haemoglobin has _____ structure. ETEA (2024)
A. Primary B. Secondary
C. Tertiary D. Quaternary

Q.80 In competitive inhibition, the inhibitor ETEA (2024)
A. Binds with substrate B. Competes with enzyme
C. Competes with substrate D. Irreversibly binds with enzyme

Q.81 It transports oxygen from the lungs to every tissue of the body DUHS (2024)
A. Hemoglobin B. Proteins
C. Hormones D. Liquids

Q.82 Deficiency of ——— causes loss of weight, appetite, and taste: (out of syllabus) DUHS (2024)
A. K B. P
C. Fe D. Zn

Q.83 Amino acids, which are not synthesized by human body are BMU (2024)
A. Non – essential amino acids B. Essential amino acids
C. Dietary amino acids D. Synthetic amino acids

Q.84 The polymer formed single type of monomer is called BMU (2024)
A. Terpolymer B. Copolymer
C. Homopolymer D. Thermosetting polymer

Q.85 The lipids which have _____ compound is called steroids BMU (2024)
A. Benzene B. Tetracyclic
C. Cyclopentane D. Phenanthrene

Q.86 Which of the following food product has lower energy per gram? BMU (2024)
A. Milk B. ghee
C. Butter D. Glucose

Q.87 The non-protein part of enzyme is called BMU (2024)
A. Activator B. Co-enzyme
C. Substrate D. Apoenzyme

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ANSWER KEY

PRACTICE EXERCISE

1	C	11	B	21	B	31	B
2	D	12	A	22	D	32	D
3	C	13	B	23	B	33	C
4	D	14	D	24	C	34	D
5	A	15	C	25	B	35	D
6	B	16	B	26	D	36	B
7	A	17	D	27	C	37	A
8	B	18	D	28	A	38	B
9	C	19	B	29	C	39	C
10	C	20	D	30	C	40	A

PAST PAPERS MCQ'S

41	C	51	C	61	A	71	A	81	A
42	A	52	D	62	A	72	D	82	B
43	A	53	A	63	C	73	D	83	B
44	C	54	B	64	B	74	C	84	C
45	D	55	B	65	C	75	C	85	B
46	A	56	D	66	B	76	B	86	D
47	A	57	B	67	A	77	B	87	B
48	B	58	D	68	C	78	A		
49	D	59	C	69	A	79	D		
50	C	60	B	70	A	80	B		

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EXPLANATORY NOTES

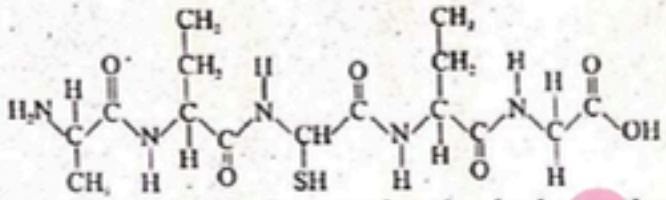
Q.11 The secondary structure of a protein is a regular coiling or zigzagging of polypeptide chains caused by hydrogen bonding between NH and C = O groups of amino acids near each other in the chains.

Q.12

$$>C=\overset{\delta-}{O}---\overset{\delta+}{H}-NH$$

Q.13 A linear sequence of amino acids in a chain is referred as primary structure.

Q.14



Primary structure does not involve hydrogen bonding.

Q.15 α -Helix and β -sheets (secondary structure) are due to hydrogen bonding.

Q.16 Amino acids are joined in primary structure by covalent bond,.

Q.17

$$2^{\circ}\text{Structure} \begin{cases} \rightarrow \alpha-\text{helix} \\ \rightarrow \beta-\text{sheets} \end{cases}$$

Q.18 Enzymes belong to proteins.

Q.19 Disulphide linkage are present in tertiary structures of proteins.

Q.20 Peptide linkage is between –COOH and $-NH_2$ groups.

Q.21 High molecular weight organic molecules which yield amino acids upon complete hydrolysis are called proteins. They are the **polymers of amino acids.**

Q.22 In these molecules the protein is attached or conjugated to some non-protein groups which are called **prosthetic groups.**

Example: Phospho-proteins are conjugated with phosphoric acid. Lipoproteins are conjugated with lipid substances like lecithin, cholesterol and fatty acids.

Q.23 The secondary structure of a protein is a regular coiling or zigzagging of polypeptide chains caused by hydrogen bonding between NH and C = O groups of amino acids near each other in the chains.

Q.24 Most biologically important substances are organic compounds (Biopolymers) built up from skeleton of carbon atoms. Many of them are very large molecules and most of these are polymers. The four major classes of organic compounds in living cells are carbohydrates, lipids, proteins and nucleic acids.

Q.25

$$n\,HO-\underset{\text{adipic acid}}{\underset{\|}{\overset{O}{C}}-(CH_2)_4-\overset{O}{\underset{\|}{C}}-OH} + n\,H_2N-(CH_2)_6-NH_2 \xrightarrow[-n\,H_2O]{\text{heat}} \underset{\text{nylon 6,6}}{\left[-\overset{O}{\underset{\|}{C}}-(CH_2)_4-\overset{O}{\underset{\|}{C}}-HN-(CH_2)_6-NH-\right]_n}$$

Q.26 The deformation or disruption of protein structure under specific conditions is called denaturation of proteins. Denaturation occurs by

- Heat change
- pH change
- Under strong oxidizing or reducing conditions.

Q.27 All proteins contain the elements carbon, hydrogen, oxygen and nitrogen except sulphur.

Q.28 Isomerases

These enzymes catalyze the transfer of groups within molecules to yield isomeric forms of the substrate, for example phospho-glyceromutases.

Q.29 L-asparaginase has proved very useful in the treatment of blood cancer in children.

Q.30 Isoenzymes

- These are the enzymes from the same organisms which catalyze the same reaction but are chemically and physically distinct from each other.

Example: α-amylase β-amylase.

Q.31 The rate of an enzymatic reaction is directly proportional to the concentration of the substrate.

Q.32 The rate of reaction is also directly proportional to the square root of the concentration of enzyme.

Q.33 Each enzyme molecule possesses a region known as **active site** and the substrate binds itself with this active site.

Q.34 The protein component of the enzyme is called **apo-enzyme** and the non-protein component is called the **co-enzyme**. The co-enzyme is also known as co-factor.

Q.35 The group of compounds that is primarily responsible for building of body of an animal and its maintenance is called protein.

Q.36 **Lyases**

These enzymes catalyze the addition of ammonia, water or carbon dioxide to double bonds or removal of these to form double bond.

Q.37

- Important inorganic co-factors alongwith their respective enzymes include
- Fe^{2}+ (chrome oxidase)
- Zn^{2}+ (carbonic anhydrase)
- Mg^{2}+ (glucose 6-phosphatase), etc.

Many enzymes contain vitamins as their co-factors.

Q.38

Alkaline phosphatase is raised in rickets obstructive jaundice.

(ii) Lactic dehydrogenase or LDH-1 is raised in heart diseases.

- Many enzymes have proved very useful as drugs.

Example: Thrombin is used locally to stop bleeding.

- Many enzymes are used for cancer treatment.

Example: L-asparaginase has proved very useful in the treatment of blood cancer in children.

Q.39 L-asparaginase has proved very useful in the treatment of blood cancer in children.

Q.40 The protein component of the enzyme is called **apo-enzyme** and the non-protein component is called the **co-enzyme**. The co-enzyme is also known as co-factor.

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EXPLANATORY NOTES

(PAST PAPER QUESTIONS)

Q.41 Collagen and albumin are simple proteins

Q.42 A polymer in which the number of amino acid residue is greater than 100 or the molecular mass is greater than 10,000 is called proteins

Q.43 Macromolecules are described as large molecules built up from small repeating units called monomers

Q.44 Phosphoprotein comes under the type of conjugated proteins

Q.45 The stability in the given structure in due to the hydrogen bonding between NH group of one peptide and carbonyl (C = O) of another peptide residue

Q.46 The bond between COOH and NH_2 is called peptide bond

Q.47 Catalyst is used to increase the rate of a chemical reaction

Q.48 Zymase enzyme is used to convert glucose into ethanol

Q.49 The proteins which give an amino acid and non-protein group on hydrolysis are known as conjugated protein

Q.50 Ptyalin is found in saliva to accelerates the conversion of starch into sugar

Q.51 Peptide bond is responsible for joining the amino acids in proteins

Q.52 Types of proteins on the basis of physico-chemical properties are three:

- Simple proteins
- Compound proteins
- Derived proteins

Q.53 Thyroxin can be classified as hormonal protein

Q.54 L-Asparaginase enzymes has been used for the treatment of blood cancer

Q.55 Proteins are nitrogenous compounds made up of a variable number of amino acids.

Q.56 Simple proteins are those proteins which yield only amino acids or their derivatives on hydrolysis.

Q.57 The secondary structure of protein is a regular coiling of zigzagging of polypeptide chains caused by hydrogen bonding between NH and C = O groups of amino acids near each other in the chains.

Q.58 The substances which reduce the activity of enzyme action are called inhibitors.

Q.59 Amylase

Q.60 Ceruloplasmin proteins act as carrier of Cu in blood plasma.

Q.61 Many proteins have specialized functions some proteins act as hormones which have regulatory function for example; insulin, thyroxine.

Q.62 Enzyme is a natural substance (biological catalyst) that increase the rate of chemical reaction.

Q.63 The linear arrangement of amino acid units in proteins in called primary structure.

Q.64 The monomers of Nylon-6,6 are Adpic acid (Hexandioic acid) & 1,6 diaminohexane.

Q.65 Two amino acids linked with each other by peptide linkage.

Q.66 L-asparaginase is used for treatment of blood cancer.

Q.67 Proteins have peptide linkage.

Q.68 Because the inhibitor's attach with active site of enzyme and block it for the substance attachment and cease the enzyme activity.

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Q.69 After digestion, the big chain of protein break into small chain's of party peptide and amino acid that can easily, absorb by small intestine.

Q.70
NH_2 – Amino group
|
R – C – H
|
COOH – Carboxylic group

Q.71 Enzyme is proteinaceous natural substance present in living organism that help to increase the rate of chemical reaction.

Q.72 In this inhibition, the inhibitor binds with enzyme substrate complex not with free enzyme and prevent. The product formation called non-competitive inhibition.

Q.73 Trypsinogen can be activated by action of enterokinase.

Q.74 Due to denaturation of protein above 50°C, the activity of enzyme permanently lost.

Q.75 Aspartic acid is an amino acid which is acidic in nature.

Q.76 Protein content of human milk is 2.4%.

Q.77 Because the enzyme are highly specific in their activity.

Q.78 Thyroxin is hormone that is derived from amino acid called tyrosine.

Q.79 The structure of protein is hemoglobin is quaternary in nature.

Q.80 Competitive inhibition is interruption of a chemical pathway owing to one chemical substance inhibiting the effect of another by competing with it for binding or bonding.

Q.81 Hemoglobin transfer oxygen from lungs to every tissue of the body.

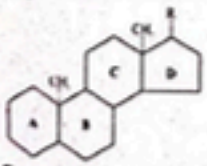
Q.82

- Deficiency of K cause muscle weakness fatigue.
- Deficiency of Fe cause pole skin, Dizziness brittle nails etc.
- Deficiency of P cause lose of weight, appetite and taste.
- Deficiency of Zn cause hair lose, skin rashes, diarrhea etc.

Q.83 Amino acid which synthesized by body are called non-essential amino acids, e.g. glycine, proline etc.
Amino acid which cannot synthesized by body are called essential amino acids, e.g. valine, histidine etc.

Q.84 Homopolymer; formed by single type of monomer.
Co-polymer; formed by two type of monomers.
Ter-polymer; formed by three type of monomers.

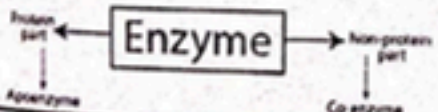
Q.85 Lipids are naturally organic compounds of animal and plants origin.



Steroid nucleus

Q.86 Milk < glucose < Butter < Ghee

Q.87 0.6 Kcal/g 4 Kcal/g 7 Kcal/g 9 Kcal/g



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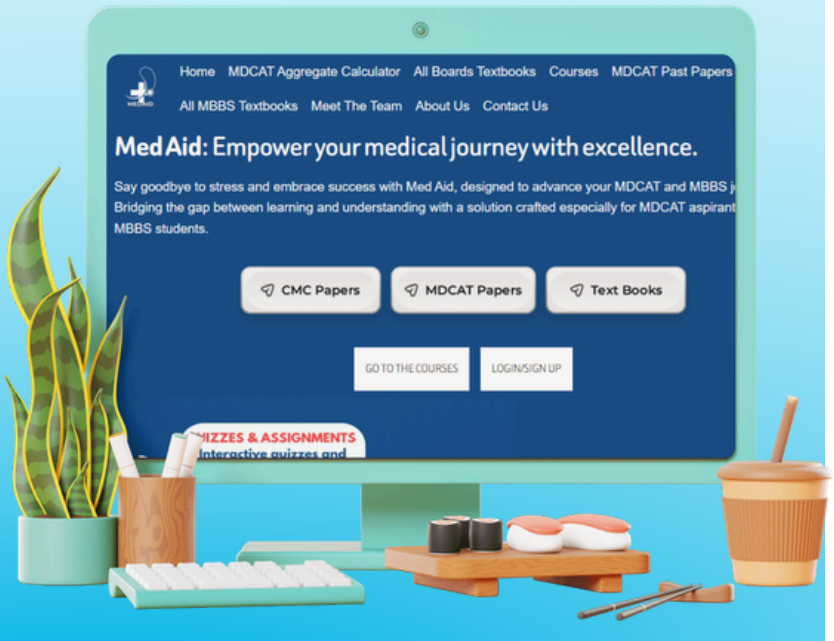

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