Question Set 2

VERY SHORT ANSWER QUESTIONS

Q. Answer the following : *(1 mark each)*

[**Note :** There are eight very short answer type questions in question 2 of Section – A of the question paper. Each question carries one mark. There will be seven theory questions and one simple numerical.]

Chapter 1. Solid State

Q. 1. What is polymorphism ?

Ans. Polymorphism : A phenomenon in which when a single substance crystallises in two or more forms under different conditions of solidification is called polymorphism and the substance is called polymorphous. For example, calcite and oragonite are two forms of $CaCO_3$.

Q. 2. What are the types of particles in each of the four main classes of crystalline solids ?

Ans. The smallest constituents or particles of various solids are atoms, ions or molecules.

Q. 3. What are molecular crystals ?

Ans. The crystals in which the constituent particles are molecules (or unbonded single atoms) of the same substance held together by intermolecular forces of attraction. For example, solidified Cl_2, CO_2, etc.

Q. 4. What is crystal lattice (space lattice) ?

Ans. Crystal lattice (space lattice) : A regular arrangement of the constituent particles (atoms, ions or molecules) of a crystalline solid having similar environment in three dimensional space is called crystal lattice or space lattice.

Q. 5. What is a unit cell ?

Ans. (1) **Unit cell :** It is the smallest repeating structural unit of a crystalline solid (or crystal lattice) which when repeated in different directions produces the crystalline solid (lattice).

(2) The unit cell possesses all the characteristics of the crystalline solid.

Q. 6. Mention two properties that are common to both hcp and ccp lattices.

Ans. In hcp and ccp crystal lattices coordination number is 12 and packing efficiency is 74%.

Q. 7. What is the coordination number of atoms in simple cubic crystal lattice? ***(Sept. '21)***

Ans. 6.

Q. 8. A solid is hard, brittle and electrically non-conductor. Its melt conducts electricity. What type of solid is it?

Ans. A solid crystalline electrolyte like NaCl is hard, brittle and electrically nonconductor. But its melt conducts electricity.

Q. 9. Explain metal deficiency defect with example. ***(March '22)***

Ans. Metal deficiency defect : This defect arises in compounds of metal which show variable oxidation states. In some metal crystals, positive metal ions are missing from their regular lattice sites. The extra negative charge is balanced by cations of the same metal with higher oxidation state than that of missing cation at site.

Consider a crystal of NiO. When one Ni^{2+} is missed from its lattice point, it creates a vacant site.

The deficiency of two positive charges is compensated by two Ni^{3+} ions at other lattice points of Ni^{2+} ions and the composition of NiO crystal becomes $Ni_{0.97}O_{1.0}$.

Chapter 2. Solutions

Q. 10. Explain relative lowering of vapour pressure.

Ans. Relative lowering of vapour pressure : If P_0 and P are the respective vapour pressures of a pure liquid (solvent) and the solution containing a nonvolatile solute then $P < P_0$. Hence, $P_0 - P$ represents the lowering of the vapour pressure due to addition of a nonvolatile solute.

$\therefore$ Relative lowering of vapour pressure $= \dfrac{P_0 - P}{P_0} = \dfrac{\Delta P}{P_0}$.

Q. 11. Why does the solubility of gases in liquids depend upon pressure?

Ans. (1) Since the gases are highly compressible, their solubility in liquids is highly influenced by pressure changes.

(2) As the external pressure increases, the solubility of the gases increases at constant temperature.

Q. 12. What is point defect ?

Ans. Point defect : The defect or imperfection produced in the arrangement of a point like constituent particle, e.g. an atom or an ion or a molecule in the crystalline structure is called point defect.

The point defects are classified as follows :

(1) Vacancy defect. (2) Interstitial defect. (3) Impurity defect.

Q. 13. What are hypotonic solutions ?

Ans. Hypotonic solutions : When two solutions have different osmotic pressures, then the solution having lower osmotic pressure is said to be a hypotonic solution with respect to the other solution.

Q. 14. Give an example of an ideal solution.

Ans. A liquid mixture of benzene and toluene which have nearly identical physical properties and intermolecular forces forms an ideal solution.

Q. 15. What are the units of molal elevation constant ?

Ans. Molal elevation constant, K_b has units K kg mol^{-1} (or °C kg mol^{-1}).

Therefore, molal elevation constant is the elevation in boiling point produced by 1 molal solution of a nonvolatile solute.

Q. 16. What is cryoscopic constant (or molal depression constant)?

Ans. Molal depression constant : It is defined as the depression in freezing point, produced by dissolving one mole of a solute in 1 kg (or 1000 g) of a solvent (i.e. 1 molal solution).

Chapter 3. Ionic Equilibria

Q. 17. Write a reaction in which water acts as a base.

Ans. $\underset{\text{Base}_1}{H_2O_{(l)}} + \underset{\text{Acid}_2}{HCl} \rightleftharpoons \underset{\text{Acid}_1}{H_3O^+} + \underset{\text{Base}_2}{Cl^-}$

Since water accepts a proton, it acts as a base.

Q. 18. If pH of a solution is 2, what is the concentration of OH^- in the solution?

Ans. $pH + pOH = 14$

$\therefore\ pOH = 14 - pH = 14 - 2 = 12$

$\therefore\ [OH^-] = \text{Antilog } -12.0 = 1 \times 10^{-12}$ M.

Q. 19. What is a nature of a solution of a salt of weak acid and strong base?

Ans. The solution of a salt of weak acid and strong base is basic in nature. For example, a solution of NaCN.

Q. 20. What a buffer solution consists of ?

Ans. (i) An acidic buffer solution consists of a weak acid and its salt of a strong base. For example, ($CH_3COOH + CH_3COONa$).

(ii) A basic buffer solution consists of a weak base and its salt of a strong acid. For example, ($NH_4OH + NH_4Cl$).

Q. 21. Mention the common ion present in the following solutions :

(a) A solution containing CH_3COOH and CH_3COONa

(b) A solution containing NH_4OH and NH_4Cl.

Ans. (a) A solution containing CH_3COOH and CH_3COONa has a common ion CH_3COO^-.

(b) A solution containing NH_4OH and NH_4Cl has a common ion $NH_4{}^+$.

Q. 22. Write the relationship between molar solubility and solubility product for Ag_2CrO_4.

Ans. $Ag_2CrO_{4(s)} \rightleftharpoons 2Ag_{(aq)}{}^+ + CrO_{(aq)}{}^{2-}$

$x = 2 \qquad y = 1$

$K_{sp} = [Ag^+]^2 \times [CrO_4{}^{2-}] = x^2 \times y \times (S)^{2+1} = 2^2 \times 1^1 \times S^3$

$K_{sp} = 4S^3$

$\therefore\ S = \left(\frac{K_{sp}}{4}\right)^{1/3}$.

Chapter 4. Chemical Thermodynamics

Q. 23. What is an intensive property? Give an example.

Ans. Intensive property : It is a property of a system whose magnitude is independent of the amount of matter present in the system. For example, viscosity.

Q. 24. Explain an adiabatic process.

Ans. Adiabatic process : It is a process in which there is no exchange of heat energy between the system and its surroundings. Hence, $q = 0$.

(a) An adiabatic process is carried out in an isolated system.

(b) In this process, temperature and internal energy of a system change, $\Delta T \neq 0$, $\Delta U \neq 0$.

Q. 25. Classify the following properties as intensive or extensive :

(i) Density, (ii) Energy.

Ans. Intensive property : (i) Density

Extensive property : (ii) Energy.

Chapter 5. Electrochemistry

Q. 26. What is a cell constant ?

Ans. Cell constant of a conductivity cell is defined as the ratio of the distance between the electrodes divided by the area of cross section of the electrodes.

Q. 27. What is specific conductance or conductivity ?

Ans. The reciprocal of specific resistance or resistivity is called specific conductance or conductivity.

It is the conductance of a conductor that is 1 m in length and 1 m^2 in cross section area in SI units.

Q. 28. A conductivity cell has two electrodes 20 mm apart and of cross section area 1.8 cm^2. Find the cell constant.

Solution : Given : Distance between two electrodes $= l = 20$ mm

$= 2$ cm

Cross section area $= a = 1.8$ cm^2

Cell constant $= b = ?$

$$b = \frac{l}{a} = \frac{2}{1.8} = 1.111 \text{ cm}^{-1}$$

Ans. Cell constant $=$ **1.111 cm^{-1}**.

Q. 29. Write a relation between molar conductivity and conductivity of solution. ***(July '22)***

Ans. A relation between molar conductivity $\wedge_m$ and conductivity κ is

$$\wedge_m = \frac{1000\ \kappa}{C}.$$

Q. 30. Write unit of cell constant. ***(Sept. '21)***

Ans. Unit of cell constant :

(i) In SI unit : m^{-1}

(ii) In c.g.s. unit : cm^{-1}

Q. 31. Write the value of $\frac{2.303\ RT}{F}$ in Nernst equation.

(Sept. '21)

Ans. 0.0592

Q. 32. Write cell representation of standard hydrogen electrode.

(July '22)

Ans. The standard hydrogen electrode is represented as,

$H^+(1\ M)\ |\ H_2\ (g,\ 1\ atm)\ |\ Pt$

Q. 33. What are the functions of salt bridge? ***(March '22)***

Ans. The functions of a salt bridge are :

(1) It maintains the electrical contact between the two electrode solutions of the half cells.

(2) It prevents the mixing of electrode solutions.

(3) It maintains the electrical neutrality in both the solutions of two half cells by a flow of ions.

(4) It eliminates the liquid junction potential.

Q. 34. Identify the strongest and the weakest oxidising agents from the electrochemical series.

Ans. From the electrochemical series,

(a) The strongest oxidising agent is fluorine since it has the highest standard reduction potential ($E^0_{F_2/F^-} = +2.87$ V).

(b) The weakest oxidising agent (or the strongest reducing agent) is lithium since it has the lowest standard reduction potential,

($E^0_{Li^+/Li} = -3.045$ V).

Chapter 6. Chemical Kinetics

Q. 35. Write the expressions for rates of reaction for :

$$2N_2O_{5(g)} \longrightarrow 4NO_{2(g)} + O_{2(g)}\ ?$$

Ans. For the given reaction,

$$\text{Rate of reaction} = R = -\frac{1}{2}\frac{d[N_2O_5]}{dt}$$

$$= +\frac{1}{4}\frac{d[NO_2]}{dt}$$

$$= +\frac{d[O_2]}{dt}$$

Q. 36. What are the units of rate constant of a first order reaction?

Ans. The units of rate constant (k) for the first order reaction are *per time* (or s^{-1}).

Q. 37. Identify the molecularity of following elementary reaction :

$\mathbf{NO_{(g)} + O_{3(g)} \longrightarrow NO_{3(g)} + O_{(g)}}$ ***(March '22)***

Ans. Molecularity is 2.

Q. 38. Give two examples of a first order reaction.

Ans. The examples of first order reaction are :

(1) Decomposition of H_2O_2 :

$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$ Rate $= k[H_2O_2]$

(2) Decomposition of N_2O_5 :

$2N_2O_{5(g)} \longrightarrow 4NO_{2(g)} + O_{2(g)}$ Rate $= k[N_2O_5]$

Q. 39. The reaction, $\mathbf{CHCl_{3(g)} + Cl_{2(g)} \longrightarrow CCl_{4(g)} + HCl_{(g)}}$ is first order in $\mathbf{CHCl_3}$ and $\frac{1}{2}$ order in $\mathbf{Cl_2}$. Write the rate law and overall order of reaction.

Ans. Since the reaction is first order in $CHCl_3$ and $\frac{1}{2}$ order in Cl_2, the rate law for the reaction will be, Rate $= k[CHCl_3] \times [Cl_2]^{\frac{1}{2}}$

The overall order (n) of the reaction will be, $n = 1 + \frac{1}{2} = \frac{3}{2}$.

Chapter 7. Elements of Groups 16, 17 and 18

Q. 40. Explain the trend in electron gain enthalpy of group 17 elements.

Ans. Electron gain enthalpy ($\Delta_{eg}H$) :

(i) The halogens have the highest negative values for electron gain enthalpy.

(ii) Electron gain enthalpies of halogens are negative indicating release of energy.

(iii) Since halogens have outer valence electronic configuration, $ns^2\ np^5$, they have strong tendency to accept an electron to complete an octet and acquire electronic configuration of the nearest inert elements.

(iv) The variation in electron gain enthalpy is in the order of, Cl > F > Br > I.

Q. 41. Draw the structure of sulphurous acid. ***(Sept. '21)***

Ans. Sulphurous acid (H_2SO_3) : $H-O-\overset{\overset{O}{\|}}{S}-OH$.

Q. 42. What is the action of selenium on magnesium metal? ***(March '22)***

Ans. $Mg + Se \longrightarrow MgSe$.

Q. 43. What is the action of bromine on magnesium metal?

Ans. Bromine reacts instantly with magnesium metal to give magnesium bromide.

$$Mg_{(s)} + Br_{2(l)} \longrightarrow \underset{\text{magnesium bromide}}{MgBr_{2(s)}}$$

Q. 44. What are the uses of helium? ***(Sept. '21)***

Ans. Uses of helium (He) :

(i) A mixture of helium (85%) and oxygen (15%) is used for filling balloons.

(ii) A mixture of helium and oxygen is also used for respiration by sea divers instead of air because helium is less soluble in blood than nitrogen under high pressure. It is also used for treatment of asthma.

(iii) Helium is used in producing inert atmosphere in metallurgical operations and welding of metals.

(iv) Liquid helium is used in producing low temperature required for research.

(v) Helium is also used in producing lasers in low temperature gas thermometry.

(vi) It is used in magnetic resonance imaging.

(vii) It is used as a shielding gas for arc welding.

(viii) It is used in supersonic wind tunnels.

(ix) Helium nucleus is used as a bombarding particle for disintegration of atoms.

Q. 45. Write the name of interhalogen compound of chlorine which has square pyramidal structure. ***(Sept. '21)***

Ans. Chlorine pental fluoride, ClF_5.

Q. 46. Explain laboratory preparation of ozone.

Ans. (i) When a slow dry stream of oxygen is passed through a silent electric discharge, oxygen is converted into ozone (about 10%). The mixture is called ozonised oxygen.

$$3O_2 \xrightarrow{\text{electric discharge}} 2O_3 \quad \Delta H = +142 \text{ kJ}$$

(ii) It is an endothermic reaction.

(iii) Silent electric discharge prevents the decomposition of ozone.

Q. 47. Write chemical equation for preparation of sulphur dioxide from sulphur. ***(March '22)***

Ans. $S_{(s)} + O_{2(g)} \xrightarrow{\Delta} SO_{2(g)}$.

Q. 48. Write uses of sulphur. ***(March '22)***

Ans. Uses : (i) In the preparation of SO_2 and H_2SO_4.

(ii) In the manufacture of rubber.

Q. 49. What are interhalogen compounds? ***(July '22)***

Ans. Interhalogen compounds : Compounds formed by the combination of atoms of two different halogens are called interhalogen compounds. In an interhalogen compound, of the two halogen atoms, one atom is more electropositive than the other. The interhalogen compound is regarded as the halide of the more electropositive halogen.

For example, ClF, BrF_3, ICl.

Q. 50. What is the action of heat on $KClO_3$?

Ans. Potassium chlorate in the presence of manganese dioxide on heating decomposes to form potassium chloride and oxygen.

$$2KClO_3 \xrightarrow[MnO_2]{\Delta} 2KCl + 3O_{2(g)}.$$

Q. 51. Give disproportionation reaction of BrF.

Ans. $5BrF \longrightarrow 2Br_2 + BrF_5$.

Q. 52. Explain ICl is more reactive than I_2.

Ans. (i) In interhalogen compound ICl and I_2 the atoms are bonded by covalent bonds.

(ii) The covalent bond between dissimilar atoms, I and Cl atoms in ICl is weaker than between similar atoms in I_2.

(iii) Therefore, the bond dissociation enthalpy of ICl bond is less than that of I_2 bond.

Hence, ICl is more reactive than I_2.

Q. 53. Write two uses of neon. ***(July '22)***

Ans. Uses of neon (Ne) :

(i) Neon is used in the production of neon discharge lamps and signs by filling Ne in glass discharge tubes.

(ii) Neon signs are visible from a long distance and also have high penetrating power in mist or fog.

(iii) A mixture of neon and helium is used in voltage stabilizers and current rectifiers.

(iv) Neon is also used in the production of lasers and fluorescent tubes.

Chapter 8. Transition and Inner Transition Elements

Q. 54. Write the name of the alloy used in Fischer Tropsch process in the synthesis of gasoline. ***(March '22)***

Ans. Alloy used in Fischer Tropsch process is Cobalt-thorium (Co-Th).

Q. 55. Write probable electronic configuration of copper ?

Ans. Copper ($_{29}$Cu) has electronic configuration,

$_{29}$Cu (Expected) : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$

(Observed) : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$.

Q. 56. What is meant by 'shielding of electrons' in an atom ?

Ans. The inner shell electrons in an atom screen or shield the outermost electron from nuclear attraction. This effect is called shielding effect.

The magnitude of shielding effect depends upon the number of inner electrons.

Q. 57. Write chemical composition of Zieglar-Natta catalyst.

(July '22)

Ans. Triethylaluminium and Titanium tetrachloride

$(C_2H_5)_3Al + TiCl_4$.

Q. 58. What is hydrometallurgy?

Ans. Hydrometallurgy : It is a process of extraction of metals by converting their ores into aqueous solutions of metal compounds and reducing them by suitable reducing agents.

Q. 59. Write chemical composition of haematite?

(Sept. '21; March '22)

Ans. Haematite : Fe_2O_3.

Q. 60. What are ferrous alloys?

Ans. Ferrous alloys : In ferrous alloys, atoms of other elements are distributed randomly in crystal lattice of iron in the mixture. As the percentage of iron is more in these alloys, they are termed as ferrous alloys.

For example, nickel steel, chromium steel, stainless steel (All steels have about 2% carbon).

Q. 61. What is meant by lanthanoid contraction?

Ans. Lanthanoid contraction : The gradual decrease in atomic and ionic radii of lanthanoids with the increase in atomic number is called lanthanoid contraction.

Chapter 9. Coordination Compounds

Q. 62. What is a coordination compound?

Ans. Coordination compound : This is a compound which consists of a central metal atom or metal ion linked by coordinate covalent bonds to a number of oppositely charged ions (anions), or neutral molecules (ligands) and exhibits the properties different than the properties of constituents of the compound. For example, $K_4[Fe(CN)_6]$, $[Co(NH_3)_6]Cl_3$, etc.

$K_4[Fe(CN)_6] \longrightarrow 4K^+ + [Fe(CN)_6]^{4-}$

Q. 63. What are ligands? *OR* **Define ligand.**

Ans. Ligands : The neutral molecules or negatively charged anions (or rarely positive ions) which are bonded by coordinate bonds to the central metal atom or metal ion in a coordination compound are called ligands or donor groups. For example, in $[Cu(CN)_4]^{2-}$, four CN^- ions are ligands coordinated to central metal ion Cu^{2+}.

Q. 64. What is an ambidentate ligand?

Ans. Ambidentate ligand : A ligand molecule or an ion which has two or more donor atoms, however in the formation of a complex, only one donor atom is attached to the metal atom or an ion is called ambidentate ligand. For example, N_2^- which has two donor atoms N and O forming a coordinate bond, M ← ONO (nitrito) or M ← NO_2 (nitro).

Q. 65. Write the name of isomerism in the following complexes : $[Cu(NH_3)_4]$ $[PtCl_4]$ and $[Pt(NH_3)_4]$ $[CuCl_4]$. *(March '22)*

Ans. They are coordinate isomers.

Q. 66. What is the IUPAC name of $Na_3[CO(NO_2)_6]$?

Ans. $Na_3[CO(NO_2)_6]$: Sodium hexanitrocobaltate.

Q. 67. Write the formula of Pentaamine carbonato cobalt(III) chloride.

Ans. Pentaamine carbonato cobalt(III) chloride :

$[Co(NH_3)_5CO_3]Cl$.

Q. 68. What are bidentate ligands? Give one example.

(Sept. '21)

Ans. Bidentate ligand : This ligand has two donor atoms in the molecule or ion. For example, ethylenediamine. $H_2N-(CH_2)_2-NH_2$.

Q. 69. Calculate effective atomic number of Co^{3+} in $[Co(NH_3)_6]^{3+}$ complex ? *(July '22)*

Ans. For the complex, Co has

$Z = 27$; Number of electrons lost $= X = 3$

$Y = 12$

$EAN = Z - X + Y$

$= 27 - 3 + 12$

$= 36$ (Kr)

Chapter 10. Halogen Derivatives

Q. 70. Alkyl halide is immiscible with water. Explain.

Ans. Alkyl halide is polar and it is insoluble in water because alkyl halide is not able to form hydrogen bonds with water.

Q. 71. Which is a tertiary alkyl halide in the following ? Explain with reasons.

(a) $CH_3-(CH_2)_2-CHCl-CH_3$ **(b) $(CH_3)_3Cl$**

(c) $CH_3-CH_2-CCl_2-CH_3$ **(d) $(CH_3)_3C-CHBr_2$**

Ans. (b)$(CH_3)_3Cl$ is a tertiary alkyl halide, $\left[\begin{array}{c} CH_3 \\ | \\ CH_3-C-Cl \\ | \\ CH_3 \end{array}\right]$ since Cl is attached to a tertiary carbon atom which is attached to three carbon atoms.

Q. 72. What is the product in the following reaction :

$$C_6H_5-CH=CH_2+HBr \xrightarrow{\text{Peroxide}} A?$$

Ans. $C_6H_5-CH=CH_2+HBr \xrightarrow{\text{Peroxide}} C_6H_5-CH_2-CH_2Br$

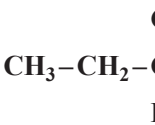
Phenyl ethene — l-Bromo-2-phenyl ethane

Q. 73. Compound A (C_4H_8) on treatment with hydrogen gives compound B which is optically inactive. What is structure of A?

Ans. The structure of $A = CH_3-CH_2-CH=CH_2$

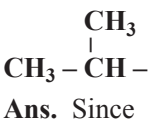
But-1-ene

Q. 74. Choose the member that will react faster than the following pairs by S_N1 mechanism.



2-Iodo-2-methylbutane

OR



2-Iodo-3-methylbutane.

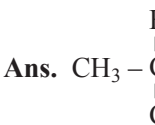
Ans. Since 2-Iodo-2-methylbutane is a tertiary alkyl halide, it undergoes S_N1 reaction faster than 2-Iodo-3-methylbutane.

Q. 75. How many optical isomers are possible for $C_5H_{11}Cl$?

Ans. The number of optical isomers : 3.

Q. 76. Write the structure of tert-alkyl halide having molecular formula $C_5H_{11}Br$.

Ans.

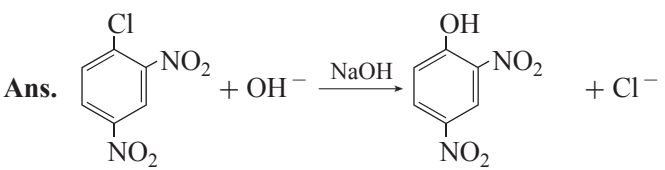


Q. 77. By which mechanism $(C_6H_5)_2CHCl$ will undergo hydrolysis?

Ans. Since $(C_6H_5)_2CHCl$ can form were stable carbocation, it will undergo hydrolysis by SN^1 mechanism.

Q. 78. What is the action of aqueous NaOH on 1-chloro-2, 4-dinitrobenzene?

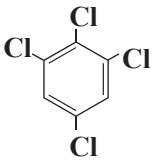
Ans.



Q. 79. What is the chemical name of freon ?

Ans. The chemical name of freon is Dichlorodifinoromethane.

Q. 80. Write IUPAC name of



Ans. IUPAC name : 1, 2, 4, 6 tetrachlorobenzene.

Q. 81. Write the product formed when alkyl halide reacts with silver nitrite. ***(March '22)***

Ans. The product is ($R\text{-}NO_2$) nitroalkane.

Chapter 11. Alcohols, Phenols and Ethers

Q. 82. Identify C in the following reaction :

$$\text{Ethanol} \xrightarrow{PBr_3} A \xrightarrow{\text{alc. KOH}} B \xrightarrow[\text{(ii) } H_2SO_4\Delta]{\text{(i) } H_2SO_4 \text{ R.T}} C$$

Ans. $C = CH_3 - CH_2 - OH$

ethanol

Q. 83. Hydroboration-oxidation of propene gives ..... .

Ans. *n*-Propyl alcohol ($CH_3 - CH_2 - CH_2 - OH$)

Q. 84. Write the IUPAC name of alcohol having molecular formula $C_4H_{10}O$ which is resistant towards oxidation.

Ans.

$$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - OH$$

2-methylpropan-2-ol

Q. 85. Write the structure of optically active alcohol having molecular formula $C_4H_{10}O$.

Ans.

$$CH_3 - \underset{\displaystyle OH}{\overset{\displaystyle CH_2 - CH_3}{\overset{|}{\underset{|}{C}}}} - H$$

butan-2-ol

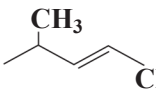
Q. 86. Write name of the electrophile used in Kolbe's reaction.

Ans. Electrophile : Carbon dioxide ($O = C = O$).

Q. 87. Which positions are occupied by $-NO_2$ group during nitration of carbolic acid ?

Ans. -*o*-(ortho) and -*p*-(para) positions are occupied by $-NO_2$ group during nitration of carbolic acid.

Q. 88. Write the structure of aldehyde that yields



Ans. The structure of aldehyde : $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH-CHO$.

Q. 89. Name a metamer of diethyl ether.

Ans. The metamer of diethyl ether is 1-methoxy propane.

Q. 90. Explain functional isomerism in ethers.

Ans. Functional isomerism : An ether and a monohydric alcohol containing same numbers of carbon atoms are functional isomers.

Example : CH_3-O-CH_3 dimethyl ether and CH_3-CH_2-OH ethyl alcohol are the functional isomers.

Q. 91. The product formed in the reaction of reverse of dehydration of alcohol is .....

Ans. The product formed in the reaction of reverse of dehydration of alcohol is alkene.

Q. 92. Name an ether which is free from moisture and alcohol.

Ans. The ether which is free from moisture and alcohol is absolute ether.

Q. 93. Name a compound which has similar geometry to ether.

Ans. A compound which has similar geometry to ether is water.

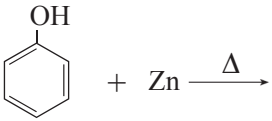
Q. 94. State the constituents of natalite.

Ans. The constituents of natalite are diethyl ether and ethanol.

Q. 95. Which of the following is more volatile : *o*-nitrophenol or *p*-nitrophenol ?

Ans. The isomer *o*-nitrophenol with lower boiling point is more volatile.

Q. 96. Predict the expected product in the following reaction :



Ans. The expected product is benzene  .

Q. 97. Ether is a good solvent for Grignard reagent. Which property makes it a good solvent ?

Ans. Ether has a low polarity, this property makes it a good solvent.

Q. 98. The C–O–C bond angle in dimethyl ether is …… .

Ans. The C–O–C bond angle in dimethyl ether is **110°**.

Q. 99. Write the name of reaction during conversion of phenol to salicylic acid. ***(July '22)***

Ans. Kolbe reaction.

Chapter 12. Aldehydes, Ketones and Carboxylic Acids

Q. 100. Name the compound used in synthetic lemonade.

Ans. The compound used as synthetic lemonade is citric acid.

Q. 101. Is phenyl acetic acid an aromatic carboxylic acid ?

Ans. Phenyl acetic acid is not an aromatic carboxylic acid.

Q. 102. Write reaction showing conversion of ethane nitrile into ethanol.

Ans. $\underset{\text{ethane nitrile}}{CH_3 - CN} + 2H_2O + HCl \xrightarrow{\Delta} \underset{\text{ethanoic acid}}{CH_3 - \overset{\overset{O}{\|}}{C} - OH} + NH_4Cl$

$\underset{\text{ethanoic acid}}{CH_3 - COOH} \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } LiAlH_4, \text{ ether}} \underset{\text{ethanol}}{CH_3 - CH_2 - OH}$

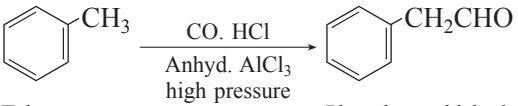
Q. 103. Predict the product of the following reaction :

$$\mathbf{CH_3 - CH_2 - COOCH_3 \xrightarrow[H_3O^+]{LiAlH\ (iBu)2}}$$

Ans. $CH_3 - CH_2 - COOCH_3 \xrightarrow[H_3O^+]{LiAlH\ (iBu)2} \underset{\text{propanal}}{CH_3 - CH_2 - CHO}$

Q. 104. Name the product obtained by reacting toluene with carbon monoxide and hydrogen chloride in presence of anhydrous aluminium chloride.

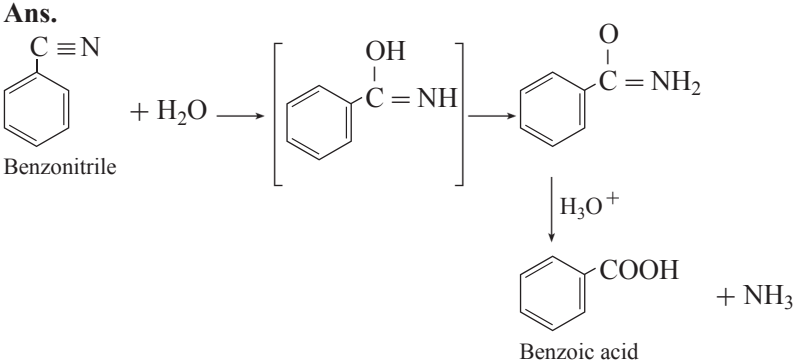
Ans.



Toluene — Phenyl acetaldehyde

Q. 105. Write reaction showing conversion of benzonitrile into benzoic acid.

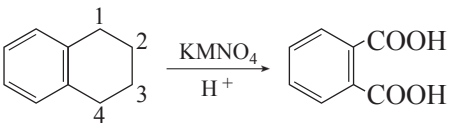
Ans.



Benzonitrile — Benzoic acid

Q. 106. Name the product obtained by the oxidation of 1, 2, 3, 4-tetrahydronaphthalene with acidified $KMnO_4$.

Ans.



1, 2, 3, 4-tetrahydro-naphthalene — Phthalic acid (Benzene 1, 2-dicarboxylic acid)

Q. 107. What is formalin ?

Ans. The aqueous solution of formaldehyde (40%) is known as formalin.

Q. 108. Arrange the following compounds in the increasing order of their boiling points :

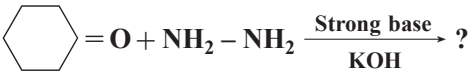
Formaldehyde, ethane, methyl alcohol.

Ans. Ethane, formaldehyde, methyl alcohol.

Q. 109. Acetic acid is prepared from methyl magnesium bromide and dry ice in presence of dry ether. Name the compound which serves not only reagent but also as cooling agent in the reaction.

Ans. The cooling agent used in the above reaction is dry ice (O = C = O).

Q. 110. Predict the expected product in the following reaction :



Ans. The expected product is  (Cyclohexane).

Q. 111. How will you convert benzene to acetophenone ?

Ans.

Benzene Acetophenone

Q. 112. Which is the stronger acid in the following pair :

$CH_3 - CH_2 - COOH$ and $NC - CH_2 - COOH$?

Ans. $NC - CH_2 - COOH$ is the stronger acid than $CH_3 - CH_2 - COOH$.

Q. 113. Name the compound which reacts with formaldehyde to produce ethyl alcohol.

Ans. The compound which reacts with formaldehyde to produce ethyl alcohol is methyl magnesium iodide.

Q. 114. Write the name of reagent used during conversion of acetaldehyde to acedaldehyde cyanohydrin. ***(Sept. '21)***

Ans. The reagent used during conversion of acetaldehyde to acetaldehyde cyanohydrin is HCN.

Q. 115. Write the name of product formed, when acetone is treated with 2,4-dinitrophenyl hydrazine. ***(March '22)***

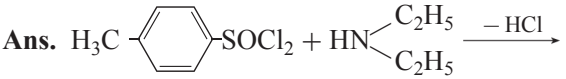
Ans. The product is 2,4-dinitrophenyl hydrazone.

Q. 116. Write the IUPAC name of α-methylpropionic acid.

(July '22)

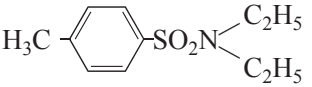
Ans. IUPAC name : 2-Methylpropanoic acid.

Q. 117. Write reaction of *p*-toluene sulphonyl chloride with diethyl amine.

Ans. 

p-toluene sulphonyl chloride

diethyl amine



N,N-diethyl-*p*-toluene sulphonamide

Q. 118. How many moles of methylbromide are required to convert ethanamine to N,N-dimethyl ethanamine ?

Ans. 2 moles of methylbromide are required to convert ethanamine to N,N-dimethyl ethanamine.

Q. 119. Which amide does produce ethanamine by Hoffmann bromamide degradation reaction ?

Ans. Propanamide ($CH_3 - CH_2 - CONH_2$) produces ethanamine by Hoffmann bromamide degradation reaction.

Q. 120. Write the order of basicity of aliphatic alkyl amine in gaseous state.

Ans. The order of basicity of aliphatic alkyl amines in the gaseous follows the order :

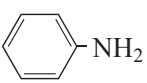
tertiary amine > secondary amine > primary amine > NH_3.

Q. 121. Why are aliphatic amines are stronger bases than ammonia ?

Ans. The alkyl group tends to increase the electron density on the nitrogen atom. As a result, amines can donate the lone pair of electrons on nitrogen more easily than ammonia. Hence, aliphatic amines are stronger bases than ammonia.

Q. 122. Predict the product of the following reaction :

Nitrobenzene $\xrightarrow{Sn/conc.\ HCl}$?

Ans. The product is aniline : 

Q. 123. Write the IUPAC name of benzyl amine.

Ans. The IUPAC name of benzyl amine is Phenylmethanamine.

Q. 124. Arrange the following amines in an increasing order of boiling points : *n*-propyl amine, ethyl methyl amine, trimethyl amine.

Ans. Amines in an increasing order of boiling points : trimethyl amine, ethyl methyl amine, *n*-propyl amine.

Q. 125. Write the balanced chemical equations for action of dil. H_2SO_4 on diethyl amine.

Ans. $2(C_2H_5)_2NH + H_2SO_4 \longrightarrow [(C_2H_5)_2\overset{+}{N}H_2]_2\ SO_4^{2-}$.

Diethyl amine — diethylammonium sulphate

Q. 126. Arrange the following amines in the increasing order of their $_pK_b$ values :

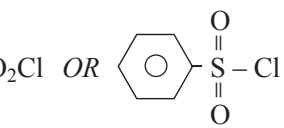
Aniline, cyclohexyl amine, 4-nitroaniline.

Ans. Cyclohexyl amine ($_pK_b$ 3.34), aniline ($_pK_b$ 9.13), 4-nitroaniline ($_pK_b$ 12.99)

Q. 127. Can aniline react with a Lewis acid ?

Ans. Aniline reacts with a Lewis acid, forms salt.

Q. 128. Write the formula of Hinsberg's reagent. *(July '22)*

Ans. Hinsberg's reagent : $C_6H_5SO_2Cl$ *OR* 

Chapter 14. Biomolecules

Q. 129. How is glucose stored in the animal body ?

Ans. Glucose is stored in the form of glycogen in the animal body.

Q. 130. Write other term used for carbohydrates.

Ans. Carbohydrates are often termed as saccharides or sugars.

Q. 131. How many moles of acetic anhydride will be required to form glucose penta acetate from 1 mole of glucose ?

Ans. 10 moles of acetic anhydride.

Q. 132. What are reducing sugars ?

Ans. Reducing sugars : Carbohydrates which reduce Fehling's solution to red ppt of Cu_2O or Tollen's reagent to shining metallic silver are called reducing sugars. All monosaccharides and oligosaccharides except sucrose are reducing sugars.

Q. 133. What are non-reducing sugars ?

Ans. Non-reducing sugars : Carbohydrates which do not reduce Fehling's solution and Tollen's reagent are called non-reducing sugars. E.g. sucrose.

Q. 134. Give an example each of reducing and non-reducing sugars.

Ans. Reducing sugars : Maltose or lactose.

Non-reducing sugars : Sucrose.

Q. 135. Name the linkage which joins two monosaccharide units through oxygen atom.

Ans. The linkage which joins two monosaccharide units through oxygen atom is called glycosidic linkage.

Q. 136. Name the sugar present in DNA.

Ans. The sugar present in DNA is deoxyribose.

Q. 137. A nucleotide from DNA containing thymine is hydrolysed. What are the products formed ?

Ans. When nucleotide from DNA containing thymine is hydrolysed, 2-deoxy-D-ribose, thymine and phosphoric acid is obtained.

Q. 138. How is zwitter ion formed ?

Ans. In aqueous solution, the carboxyl group loses a proton while the amino group accepts it, as a result, a dipolar or zwitter ion is formed.

Q. 139. Name the amino acids which are synthesized in the body.

Ans. The amino acids which are synthesized in the body are called non-essential amino acids. Examples : Glutamic acid, serine.

Q. 140. Name the sugar present in RNA. ***(Sept. '21)***

Ans. The sugar present in RNA is D-ribose.

Chapter 15. Introduction to Polymer Chemistry

Q. 141. Which catalyst is used in the preparation of dacron ?

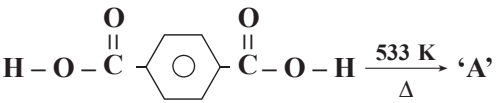
Ans. Zinc acetate and antimony trioxide is used as catalyst in the preparation of dacron.

Q. 142. Write the monomer unit of teflon.

Ans. Monomer unit of teflon : Tetrafluoroethene ($F_2C = CF_2$).

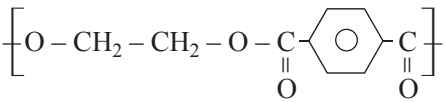
Q. 143. Identify 'A' and 'B' in the following reactions :

(a) $HO - CH_2 - CH_2 - OH +$

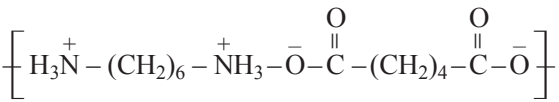


(b) $H_2N - (CH_2)_6 - NH_2 + HOOC - (CH_2)_4COOH \xrightarrow[533\ K]{N_2}$ **'B'**

Ans. (A)



(B)



Nylon salt

Q. 144. Write examples of addition polymers and condensation polymers.

Ans. Addition polymers : Polyvinyl chloride, polythene.

Condensation polymers : Bakelite, terylene, Nylon-66.

Q. 145. Name some chain growth polymers.

Ans. Chain growth polymers : Polythene, polyacrylonitrile and polyvinyl chloride.

Q. 146. Define : Synthetic fibres.

Ans. The man-made fibres prepared by polymerization of one monomer or copolymerization of two or more monomers are called synthetic fibres.

Q. 147. Give one example each of copolymer and homopolymer.

Ans. Homopolymer : PVC, Nylon-6.

Copolymer : Terylene, Buna-S.

Q. 148. What type of intermolecular force leads to high density polymer ?

Ans. High density polymers have low degree of branching along the hydrocarbon chain. The molecules are closely packed together during crystallization. This closer packing means that the van der Waals attraction between the chains are greater and so the plastic (high density polymer) is stronger and has a melting point.

Q. 149. Arrange the polymers in increasing order of their intermolecular forces :

Nylon-6,6, Polythene, Buna-S.

Ans. The increasing order of their intermolecular forces of attraction follows the order :

Buna-S, Polythene, Nylon-6,6.

Q. 150. Write the name and structure of the monomer units of butyl rubber.

Ans. The monomer units of butyl rubber : Isobutylene

$CH_2 = \overset{CH_3}{\overset{|}{C}} - CH_3$ and isoprene $CH_2 = \overset{CH_3}{\overset{|}{C}} - CH = CH_2$

Q. 151. Write the structure of monomer used in the preparation of $\left[\text{CH}_2 - \text{CH} = \overset{\text{Cl}}{\overset{|}{\text{C}}} - \text{CH}_2 \right]_n$.

Ans. The structure of monomer : $CH_2 = CH = \overset{Cl}{\overset{|}{C}} - CH_2$.

Q. 152. Which of the two is a copolymer PVC or PHBV?

Ans. The copolymer is PHBV.

Q. 153. Write the name of biodegradable polyamide copolymer. ***(March '22)***

Ans. The biodegradable polyamide copolymer is PHBV, i.e. Polyhydroxy butyrate-CO-β-hydroxy valerate.

Q. 154. Write the name of monomer used for preparation of Nylon-6. ***(July '22)***

Ans. The monomer used for the preparation of Nylon-6 is $\in$-caprolactam.

Chapter 16. Green Chemistry and Nanochemistry

Q. 155. Write the formula to calculate % atom economy.

Ans.

$$\% \text{ atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100.$$

Q. 156. Name the γ-isomer of BHC.

Ans. Lindane.

Q. 157. Ridhima wants to detect structure of surface of materials. Name the technique she has to use.

Ans. Scanning electron microscopy (SEM).

Q. 158. Which nanomaterial is used for tyres of car to increase the life of tyres ? ***(Sept. '21)***

Ans. Carbon black.

Q. 159. Name the scientist who discovered scanning tunneling microscopy (STM) in 1980.

Ans. Gerd Binning and Heinrich Rohrer (Nobel prize 1986).

Q. 160. 1 nm = ... m ?

Ans. 1 nm = 10^9 m.

Q. 161. How many principles does green chemistry have ?

Ans. Twelve.

Q. 162. Which principle of green chemistry has its perspective largely towards petrochemicals ?

Ans. Use of renewable feedstocks.

Q. 163. Name the chemical which leachs out of plastic packaging materials.

Ans. Phthalate.

Q. 164. Name the materials having structural components with at least one dimension in the nanometer scale.

Ans. Nanomaterials.

Q. 165. Name the class of nanomaterial, i.e. nanotubes, fibres, nanowires belong to.

Ans. Two dimensions are in the nanoscale.

Q. 166. Name the nanoparticles used in sunscreen.

Ans. Zinc oxide (ZnO) and Titanium dioxide (TiO_2).

Q. 167. Name the technique used to analyse particle size, crystal structure and geometry of a nanoparticle.

Ans. X-ray diffraction (XRD).

Q. 168. Name the analytical technique used to study the morphology (structure of surface) of a material..

Ans. Scanning electron microscopy (SEM).

Q. 169. Which are the sectors that are revolutionalized by nanoparticles ?

Ans. Electronics, energy sector and medical fields.

Q. 170. What are the disadvantages of nanotechnology ?

Ans. Nano pollution and lung damage.