Question Set 3

DEFINITIONS AND EXPLANATIONS

Q. Define / Explain the following terms : ***(1 or 2 marks each)***

[**Note :** Question on definitions may be asked separately or may be incorporated in the questions of short or long answers. Each definition is for 1 mark.]

Chapter 1. Solid State

(1) Unit cell.

Ans. 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) Isomorphism.

Ans. A phenomenon in which two or more crystalline substances show same crystalline structure is called isomorphism and the crystals are said to be isomorphous. For example, K_2SO_4 and K_2SeO_4.

(3) Anisotropy.

Ans. The ability of crystalline solids to change their physical properties when measured in different directions is called anisotropy.

(4) Covalent network crystals.

Ans. The crystals in which the constituent particles are atoms linked by covalent bonds forming a continuous network are called covalent network crystals. For example, diamond, quartz.

(5) Packing efficiency.

Ans. It is the percentage of total space in the unit cell occupied by the constituent particles like atoms, ions or molecules of the crystal.

(6) Isotropy.

Ans. The ability of amorphous solids to exhibit identical physical properties even though measured in different directions is called isotropy.

(7) Coordination number.

Ans. The number of the closest neighbouring constituent particles like atoms, ions or molecules which are in contact with a particular particle or an atom in the crystal lattice is called coordination number of that particle.

In the crystal lattice all atoms may have same or different coordination numbers.

(8) Schottky defect.

Ans. In case of ionic solids, the vacancies are produced due to absence of cations and anions and these defects are called Schottky defects.

(9) Frenkel defect.

Ans. This defect arises when an ion of an ionic compound is missing from its regular site and occupies interstitial vacant position between the lattice points.

(10) Write the consequences of Schottky defect with reasons. ***(March '22)***

Ans. Consequences of Schottky defect :

(1) Since the number of ions (cations and anions) decreases but volume remains unchanged, the density of a substance decreases.

(2) As the number of missing cations and anions is equal, the electrical neutrality of the compound remains same.

(3) This defect arises in ionic crystals like NaCl, AgBr, KCl, etc.

(11) Distinguish between Schottky and Frenkel defect. ***(July '22)***

Ans.

Schottky defect	Frenkel defect
1. This defect arises in ionic solids due to missing of equal number of cations and anions.	1. This defect arises when an ion of ionic compound is missing from its regular position.
2. There arises vacancies due to cations and anions.	2. There arises vacancies due to one kind of ions.
3. Interstitial positions remain vacant.	3. Interstitial positions are occupied by one kind of ion.
4. This defect arises due to high coordination number of anion.	4. This arises due to a large difference between sizes of cations and anion.
5. This defect arises in NaCl, KCl, etc.	5. This defect arises in ZnS, AgCl, etc.

(12) Colligative property.

Ans. The property of a solution which depends on the total number of particles of the solute (molecules, ions) present in the solution and does not depend on the nature or chemical composition of solute particles is called colligative property of the solution.

(13) Vapour pressure.

Ans. The pressure exerted by the vapour of a liquid (or solid) when it is in equilibrium with the liquid (or solid) phase at a constant temperature is called the vapour pressure of the liquid (or solid).

(14) Molal elevation constant.

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

(15) Osmosis. ***(March '22)***

Ans. It is defined as a spontaneous unidirectional flow of the solvent molecules from a pure solvent or a dilute solution to the more concentrated solution through a semipermeable membrane.

(16) Osmotic pressure. ***(July '22)***

Ans. The osmotic pressure is defined as the excess mechanical pressure required to be applied to a solution separated by a semipermeable membrane from pure solvent or a dilute solution to prevent the osmosis or free passage of the solvent molecules at a given temperature.

(17) Isotonic solutions. ***(March '22)***

Ans. The solutions having the same osmotic pressure at a given temperature are called isotonic solutions.

(18) Freezing point.

Ans. The freezing point of a liquid is defined as the temperature at which the solid coexists in the equilibrium with the liquid and the vapour pressures of the liquid and the solid are equal.

(19) Boiling point.

Ans. The boiling point of a liquid is defined as the temperature at which the vapour pressure of the liquid becomes equal to the external pressure, i.e. the atmospheric pressure (1 atm), e.g. the boiling point of water at 1 atm is 373 K.

(20) Ebullioscopic constant. ***(July '22)***

Ans. It is defined as the elevation in boiling point, produced by dissolving one mole of a solute in 1 kg (or 1000 gram) of a solvent
(i.e. 1 molal solution).

Chapter 3. Ionic Equilibria

(21) Lewis acid.

Ans. According to Lewis theory, an acid is a substance which can accept a pair of electrons. For example, BF_3.

(22) pH.

Ans. The negative logarithm, to the base 10, of the molar concentration of hydrogen ions, H^+ is known as the pH of a solution.

$\text{pH} = -\log_{10}[H^+]$

(23) Ionic product of water.

Ans. It is defined as the product of molar concentrations of hydronium ions (or hydrogen ions) and hydroxyl ions at equilibrium in pure water at constant temperature.

It is represented as,

$K_w = [H_3O^+] \times [OH^-]$ At 25 °C, $K_w = 1 \times 10^{-14}$.

(24) Hydrolysis.

Ans. A reaction in which the cations or anions or both the ions of a salt react with water to produce acidity or basicity or sometimes neutrality is called hydrolysis.

(25) Buffer solution.

Ans. It is defined as a solution which resists the change in pH even after the addition of a small amount of a strong acid or a strong base or on dilution or on addition of water.

(26) Solubility product.

Ans. The product of equilibrium concentrations of the constituent ions raised to the power equal to their respective coefficients in the balanced equilibrium expression for the saturated solution of sparingly soluble electrolyte (like salt) at a given temperature is called solubility product.

(27) Common ion effect.

Ans. The suppression of the degree of dissociation of a weak electrolyte by the addition of a strong electrolyte having an ion in common with the weak electrolyte is called common ion effect. For example, – CH_3COOH and CH_3COONa have common ion CH_3COO^-.

(28) pOH.

Ans. The negative logarithm, to the base 10, of the molar concentration of hydroxyl ions, OH^- is known as the pOH of a solution.

$pOH = -\log_{10}[OH^-]$.

Chapter 4. Chemical Thermodynamics

(29) Closed system.

Ans. It is defined as a system which can exchange only energy but not the matter with its surroundings, e.g. a closed vessel containing hot water so that only heat is lost to the surroundings and not the matter.

(30) Intensive property. ***(Sept. '21)***

Ans. It is defined as a property of a system whose magnitude is independent of the amount of matter present in the system.

(31) Enthalpy of sublimation. ***(Sept. '21)***

Ans. The enthalpy change or the amount of heat absorbed that accompanies the sublimation of one mole of a solid directly into its vapour at constant temperature and pressure is called enthalpy of sublimation.

(32) Isothermal process.

Ans. It is defined as a process in which the temperature of the system remains constant throughout the change of a state of the system.

In this, $\Delta T = 0$.

(33) Enthalpy (H).

Ans. It is defined as the total energy of a system consisting of internal energy (U) and pressure-volume ($P \times V$) type of energy, i.e. enthalpy represents the sum of internal energy U and product PV energy. It is denoted by H and is represented as

$$\underset{\text{enthalpy}}{H} = \underset{\text{internal energy}}{U} + \underset{P\text{-}V\text{ energy}}{PV}$$

(34) Enthalpy of fusion.

Ans. The enthalpy change that accompanies the fusion of one mole of a solid into a liquid at constant temperature and pressure is called enthalpy of fusion.

For example,

$$H_2O_{(s)} \xrightarrow{1\text{ atm, }273\text{ K}} H_2O_{(l)} \quad \Delta_{fus}H = 6.01\ \text{kJ mol}^{-1}$$

(35) Thermodynamic standard state of a substance.

Ans. The thermodynamic standard state of a substance (compound) is the most stable physical state of it at 298 K and 1 atmosphere (or 1 bar). The enthalpy of the substance in the standard state is represented as $\Delta_f H^0$.

(36) Bond enthalpy (or Bond energy).

Ans. The enthalpy change or amount of heat energy required to break one mole of particular covalent bonds of gaseous molecules forming free gaseous atoms or radicals at constant temperature (298 K) and pressure (1 atmosphere) is called bond enthalpy or bond energy. For example, bond enthalpy of H_2 is 436.4 kJ mol^{-1}.

(37) Entropy.

Ans. Being a state function and thermodynamic function it is defined as entropy change (ΔS) of a system in a process which is equal to the amount of heat transferred in a reversible manner (Q_{rev}) divided by the absolute temperature (T), at which the heat is absorbed. Thus,

$$\text{Entropy change} = \frac{\text{Heat transferred reversibly}}{\text{Absolute temperature of heat transfer}}$$

$$\therefore\ \Delta S = \frac{Q_{rev}}{T}.$$

Chapter 5. Electrochemistry

(38) 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.

(39) Specific conductance or **conductivity.**

Ans. It is the conductance of a conductor that is 1 m in length and 1 m^2 in cross section area in SI units. (In C.G.S. units, it is the resistance of a conductor that is 1 cm in length and 1 cm^2 in cross section area.) It is the conductance of a conductor of volume 1 m^3 (or in C.G.S. units, the volume of 1 cm^3).

(40) Molar conductivity.

Ans. It is defined as a conductance of a volume of the solution containing ions from one mole of an electrolyte when placed between two parallel plate electrodes 1 cm apart and of large area, sufficient to accommodate the whole solution between them, at constant temperature. It is denoted by $\wedge_m$.

(41) Faraday.

Ans. It is defined as the quantity of the electric charge on one mole of electrons. It has value, $1\,F = 96500$ C/mol.

(42) Electrode potential.

Ans. It is defined as the difference of electrical potential established due to electrode half reaction between metal electrode and the solution around it at equilibrium at constant temperature.

(43) Standard electrode potential.

Ans. It is defined as the difference of electrical potential between metal electrode and the solution around it at equilibrium when all the substances involved in the electrode reaction are in their standard states of unit activity or concentration at constant temperature.

(44) Electrochemical series or **electromotive series.**

Ans. It is defined as the arrangement in a series of electrodes of elements (metal or non-metal in contact with their ions) with the electrode half reactions in the decreasing order of their standard reduction potentials.

(45) Reference electrode. ***(March '22)***

Ans. A reference electrode is defined as an electrode whose potential is arbitrarily taken as zero or is accurately known.

Chapter 6. Chemical Kinetics

(46) Rate law (or differential rate law).

Ans. It is defined as an experimentally determined mathematical equation which expresses the rate of a chemical reaction in terms of molar concentrations of the reactants which influence the rate of the reaction.

For example, for a reaction, $A + B \rightarrow$ Products

By rate law, Rate $= R = k[A] \times [B]$

where k is a rate constant and [A] and [B] are molar concentrations of the reactants A and B respectively.

(47) Rate constant.

Ans. The rate constant of a chemical reaction is defined as the rate of the chemical reaction when the concentration (or active masses) of each reactant has unit value, i.e. 1 mol dm^{-3} in the case of solution and the pressure is 1 atm in case of gases, e.g. for a reaction, A → products, Rate $R = k[A]$.

If $[A] = 1$ mol dm^{-3}, then $k = R$.

(48) Order of a chemical reaction.

Ans. The order of a chemical reaction is defined as the number of molecules (or atoms) whose concentrations influence the rate of the chemical reaction.

OR

The order of a chemical reaction is defined as the sum of the powers (or exponents) to which the concentration terms of the reactants are raised in the rate law expression for the given reaction.

(49) Explain pseudo-first order reaction with suitable example.

(Sept. '21; March '22)

Ans. Pseudo-first order reaction : A reaction which has higher order true rate law but experimentally found to behave as first order is called pseudo-first order reaction.

Explanation : Consider an acid hydrolysis reaction of an ester like methyl acetate.

$$CH_3COOCH_{3(aq)} + H_2O_{(l)} \xrightarrow{H^+_{(aq)}} CH_3COOH_{(aq)} + CH_3OH_{(aq)}$$

Since the reaction involves two substances, ester and water, it is a bimolecular reaction and the true rate law should be,

$\text{Rate} = k' [CH_3COOCH_3] \times [H_2O]$

Hence the reaction is expected to follow second order kinetics. However experimentally it is found that the reaction follows first order kinetics.

This is because solvent water being in a large excess, its concentration remains constant. Hence, $[H_2O] = \text{constant} = k''$

$$\begin{aligned}\text{Rate} &= k' [CH_3COOCH_3] \times [H_2O]\\ &= k' [CH_3COOCH_3] \times k''\\ &= k' \times k'' \times [CH_3COOCH_3]\end{aligned}$$

If $k' \times k'' = k$, then $\text{Rate} = k [CH_3COOCH_3]$.

This indicates that second order true rate law is forced into first order rate law. Therefore this bimolecular reaction which appears of second order is called pseudo-first order reaction.

(50) Define half life of first order reaction. ***(March '22)***

Ans. The time required to reduce the concentration of a reactant of first order reaction to half of the initial value is called half life of the reaction.

Chapter 7. Elements of Groups 16, 17 and 18

(51) *p*-block elements.

Ans. The elements in which the differentiating electron (last filling electron) enters the *p*-orbital of the outermost shell of the atoms are called *p*-block elements. The elements of groups 16, 17 and 18 are *p*-block elements.

(52) Interhalogen compounds.

Ans. The compounds obtained from two different halogens are called interhalogen compounds. For example, ClF_3, BrF_3, ICl, etc.

(53) Ozone umbrella.

Ans. The stratopheric pool of ozone which is a layer above earth's surface and protects from harmful high energetic ultraviolet (UV) rays is called ozone umbrella or ozonosphere.

(54) Explain the trends in the following atomic properties of group 16 elements.

(i) Atomic radii (ii) Ionisation enthalpy (iii) Electronegativity (iv) Electron gain enthalpy. ***(March '22)***

Ans. (i) Atomic and ionic radii : In groups 16, 17, 18 the atomic and ionic radii increase down the group, due to increase in the number of quantum shells.

Across a period atomic or ionic radii decrease due to increase in effective nuclear charge.

(ii) Ionisation enthalpy :

(1) The elements of groups 16, 17 and 18 have a high ionisation enthalpy.

(2) In groups 16, 17, 18 the ionisation enthalpy decreases down the group due to increase in atomic size.

(iii) Electronegativity : In groups 16, 17, 18 the electronegativity decreases down the group.

(iv) Electron gain enthalpy :

(1) In groups 16 and 17 the electron gain enthalpy becomes less negative down the group.

(2) Group 18 elements have large positive electron gain enthalpy.

(55) What is the action of chlorine on the following :
(i) NH_3 (excess), (ii) phosphorous? ***(July '22)***

Ans. (i) $\underset{\text{(excess)}}{8NH_3} + 3Cl_2 \longrightarrow 6NH_4Cl + N_2$

(ii) $P_4 + 6Cl_2 \longrightarrow 4PCl_3$

$P_4 + 10Cl_2 \longrightarrow 4PCl_5$

Chapter 8. Transition and Inner Transition Elements

(56) *d*-block elements.

Ans. *d*-block elements are defined as the elements in which the differentiating electron enters *d*-orbital of the penultimate shell, i.e. $(n-1)$ *d*-orbital where '*n*' is the last shell.

The general electronic configuration can be represented as, $(n-1)d^{1-10}, ns^{1-2}$

(57) Leaching.

Ans. It is a (chemical) process used in the concentration of an ore by extracting soluble material from an insoluble solid by dissolving in a suitable solvent. This method is used in the concentration process of ores of Al, Ag, Au, etc.

(58) *f*-block elements.

Ans. Elements in which the differentiating electron enters into the pre-penultimate shell, the $(n-2)$ *f*-orbital are known as *f*-block elements.

The general electronic configuration is $(n-2)f^{1-14}, (n-1)d^{0-1}ns^2$.

(59) Define mineral. ***(Sept. '21)***

Ans. Mineral : They are naturally occurring chemical substances in the earth's crust containing metal in free state or in combined form and obtainable from mining are called minerals. For example, haematite Fe_2O_3, galena PbS, etc.

(60) Lanthanoids.

Ans. The series of fourteen elements from $_{58}Ce$ to $_{71}Lu$ in which a differentiating electron enters $4f$ sub-shell and follows lanthanum is called lanthanoid series and the elements are called lanthanoids.

Their general electronic configuration is $[Xe]\ 4f^{1-14}5d^{0-1}\ 6s^2$.

(61) Actinoids.

Ans. The series of fourteen elements from $_{90}Th$ to $_{103}Lr$ which follow actinium ($_{89}Ac$) and in which differentiating electrons are progressively filled in $5f$-orbitals in prepenultimate shell are called actinoids.

Their general electronic configuration is, $[Rn]^{86}\ 5f^{1-14}6d^{0-1}\ 7s^2$.

(62) Iron exhibits $+2$ and $+3$ oxidation states. Write their electronic configuration. Which will be more stable? Why? *(Sept. '21)*

Ans. The electronic configuration of Fe^{2+} and Fe^{3+} :

Fe^{2+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

Fe^{3+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

Due to loss of two electrons from the $4s$-orbital and one electron from $3d$-orbital, iron attains 3^+ oxidation state. Since in Fe^{3+}, the $3d$-orbital is half filled, it gets extra stability, hence Fe^{3+} is more stable than Fe^{2+}.

(63) Write the molecular formula of the following minerals :

(i) Chalcopyrite (ii) Calamine. *(July '22)*

Ans. (i) Chalcopyrite : $CuFeS_2$.

(ii) Calamine : $ZnCO_3$.

Chapter 9. Coordination Compounds

(64) Coordination compound.

Ans. It consists of a central metal ion or atom surrounded by atoms, molecules or anions called ligands by coordinate bonds,
e.g., cisplatin $Pt(NH_3)_2Cl_2$, $[Cu(NH_3)_4]SO_4$.

(65) Coordination sphere.

Ans. A coordination entity consisting of a central metal atom or ion and the coordinating groups like neutral molecules or anions (ligands) written inside a square bracket is together called coordination sphere. This is a discrete structural unit. The ionisable groups (generally ions) called counter ions are written outside the bracket.

For example, in the coordination compound $K_4[Fe(CN)_6]$, the coordination sphere is $[Fe(CN)_6]^{4-}$ while K^+ represents counter ion.

(66) Ligands.

Ans. 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+}.

(67) Explain monodentate and ambidentate ligands with example. ***(March '22)***

Ans. Monodentate or unidentate ligand : A ligand molecule or an ion which has only one donor atom with a lone pair of electrons forming only one coordinate bond with metal atom or ion in the complex is called monodentate or unidentate ligand. For example, NH_3, Cl^-, OH^-, H_2O, etc.

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, NO_2^- which has two donor atoms N and O forming a coordinate bond, $M \leftarrow ONO$ (nitrito) or $M \leftarrow NO_2$ (nitro).

(68) Write IUPAC name of $[Fe(CO)_5]$ complex. ***(Sept. '21)***

Ans. Pentacarbonyl iron(o).

(69) Homoleptic complex.

Ans. The complexes in which the central metal atom or ion is attached to one kind of donor groups (ligands) are called homoleptic complexes. E.g. $[Co(NH_3)_6]^{3+}$. In this complex, Co^{3+} ion is attached to six identical donor groups like NH_3.

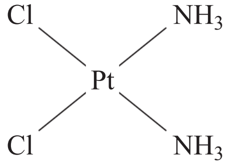
(70) Heteroleptic complex.

Ans. The complexes in which central metal atom or ion is attached to more than one kind of donor groups (ligands) are called heteroleptic complexes. E.g. $[Co(NH_3)_4Cl_2]^+$. In this complex, Co^{3+} ion is attached to two kinds of ligands, namely four NH_3 and two Cl^-.

(71) *Cis*- and *trans*- isomers.

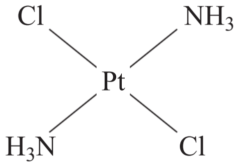
Ans. (1) *Cis*-isomer : A heteroleptic coordination compound in which two similar ligands are arranged adjacent to each other is called *cis*-isomer.

For example, *Cis*-Diamminedichloroplatinum (II)



(2) *Trans*-isomer : A heteroleptic coordination compound in which two similar ligands are arranged diagonally opposite to each other is called *trans*-isomer.

For example, *Trans*-Diamminedichloroplatinum (II)



(72) Coordination number.

Ans. The number of (monodentate) ligands which are directly bonded by coordinate bonds to central metal atom or ion in a coordination compound is called coordination number (CN) of the metal atom or ion.

(73) Coordination isomerism.

Ans. The phenomenon of isomerism in the ionic coordination compounds having the same molecular formula but different complex ions involving the interchange of ligands between cationic and anionic entities of different metal ions is called coordination isomerism.

(74) Hydrate isomerism.

Ans. The phenomenon of isomerism in the coordination compounds arising due to the exchange of H_2O molecules inside the coordination sphere and outer sphere of the complex is known as hydrate isomerism.

Chapter 10. Halogen Derivatives

(75) Plane polarized light.

Ans. A light having oscillations only in one plane perpendicular to direction of propagation of light is known as plane polarized light.

(76) Chiral carbon atom.

Ans. A carbon which is attached to four different atoms or groups is called chiral carbon atom.

(77) Racemic mixture or Racemate.

Ans. A mixture containing equimolar quantities of dextro (*d*) and laevo (*l*) optical isomers which is optically inactive due to external compensation is called a racemic mixture or racemate.

It is represented as (*dl*) or ($\pm$).

(78) Dextrorotatory substance or *d*-Isomer.

Ans. An optically active substance (or isomer) which rotates the plane of a plane polarized light to the right hand side (RHS) is called dextrorotatory substance (or isomer) and denoted by *d* or ($+$) sign.

(79) Laevorotatory substance or *l*-Isomer.

Ans. An optically active substance (or isomer) which rotates the plane of a plane polarized light to the left hand side (LHS) is called laevorotatory substance (or isomer) and denoted by *l* or ($-$) sign.

Chapter 11. Alcohols, Phenols and Ethers

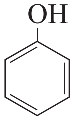
(80) Alcohols.

Ans. Alcohols are the hydroxy derivatives of hydrocarbons in which one or more hydrogen atoms are replaced by hydroxyl group.

Examples : CH_3-OH (methyl alcohol), CH_3-CH_2-OH (ethyl alcohol).

(81) Phenol.

Ans. The hydroxy derivative of benzene in which the OH group is directly attached to benzene ring is called phenol.



Chapter 12. Aldehydes, Ketones and Carboxylic Acids

(82) Aliphatic aldehydes.

Ans. The compounds in which the $-CHO$ group (formyl group or aldehyde group) is attached directly to sp^3-hybridized carbon atom that is saturated carbon atom are called aliphatic aldehydes.

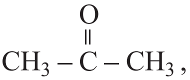
(Exception : Formaldehyde, $H-CHO$ is also classified as aliphatic aldehyde though $-CHO$ group is not attached to any carbon).

For example : CH_3-CHO (Acetaldehyde) CH_3-CH_2-CHO (Propionaldehyde)

(83) Aliphatic ketones.

Ans. The compounds in which $>C=O$ group is attached to two alkyl groups are called aliphatic ketones.

Examples :



$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$,

Acetone

$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_3$

Ethyl methyl ketone

(84) Aliphatic carboxylic acids.

Ans. The organic compounds in which carboxyl ($-COOH$) group is bonded to an alkyl group are called aliphatic carboxylic acids or fatty acids. (Exception : Formic acid, $H-COOH$ is also classified as aliphatic carboxylic acid though $-COOH$ group is not attached to any carbon).

For example : $H_3C-COOH$ (Acetic acid) H_3C-CH_2-COOH (Propionic acid)

(85) Aldol condensation.

Ans. When aldehydes or ketones containing $\alpha-H$ atoms are warmed with a dilute base or dilute acid, two molecules of them undergo self condensation to give β-hydroxy aldehyde (aldol) or β-hydroxy ketone (ketol) respectively.

Chapter 13. Amines

(86) Amines.

Ans. The alkyl or aryl derivatives of ammonia in which one, two or all the three hydrogen atoms attached to nitrogen are replaced by same or different alkyl or aryl groups are called amines. *OR*

Amines are nitrogen containing organic compounds having basic character.

Example, methyl amine : CH_3-NH_2.

Chapter 14. Biomolecules

(87) Biomolecules.

Ans. The lifeless, complex organic molecules which combine in a specific manner to produce life or control biological reactions are called biomolecules.

Examples : Carbohydrates, lipids (fats and oils), nucleic acids, enzymes.

(88) Carbohydrates.

Ans. Carbohydrates are optically active polyhydroxy aldehydes or polyhydroxy ketones or the compounds which on hydrolysis produce polyhydroxy aldehydes or polyhydroxy ketones.

Examples : Glucose, sucrose, fructose.

(89) Oligosaccharides.

Ans. An oligosaccharide is a carbohydrate (sugar) which on hydrolysis gives two or more monosaccharide units.

(90) Proteins.

Ans. Chemically proteins are polyamides which are high molecular weight polymers of the monomer units, i.e. α-amino acids. *OR*

It can also be defined as proteins are the biopolymers of a large number of α-amino acids and they are naturally occurring polymeric nitrogenous organic compounds containing 16% nitrogen and peptide linkages (– CO – NH –).

(91) Denaturation of proteins. ***(July '22)***

Ans. The process by which the molecular shape of protein changes without breaking the amide/peptide bonds that form the primary structure is called denaturation. *OR*

Protein gets easily precipitated. It is an irreversible change and the process is called denaturation of proteins.

(92) Nucleotide. ***(Sept. '21)***

Ans. Nucleotide are monophosphates of nucleosides. It contains all three basic components of nucleic acids, i.e. a pentose sugar, a phosphoric acid and a nitrogeneous base.

(93) Peptide bond.

Ans. Proteins are the polymers of α-amino acids and they are connected to each other. The bond that connects α-amino acids to each other is called peptide bond (peptide linkage, – CONH –).

(94) Nucleic acids.

Ans. Nucleic acids are unbranched polymers of repeating monomers, i.e. nucleotides. In other words, nucleic acids have a polynucleotide structure which in turn consists of a base, a pentose sugar and phosphate moiety.

OR

Nucleic acids are bimolecules which are found in the nuclei of all living cells in the form of nucleo proteins or chromosomes.

(Nucleoproteins = Proteins + Nucleic acid) (prosthetic group)

Chapter 15. Introduction to Polymer Chemistry

(95) Polymers.

Ans. Polymers are high molecular mass macromolecules ($10^3 - 10^7$ u) and consists of repeating units of monomers.

(96) Condensation polymer.

Ans. The polymers formed by the repeated condensation reaction between polyfunctional monomers with the elimination of some molecules such as water, hydrochloric acid, methanol, ammonia are called condensation polymers. e.g. Nylon-6,6.

(97) Copolymer.

Ans. A polymer made from two or more different monomer units is called a copolymer.

Examples : Nylon-6, 6, Buna-S, Buna-N, etc.

(98) Addition polymer.

Ans. The polymer formed by the repeated addition of a large number of monomers like alkenes without loss of any small molecules are called addition polymers.

Examples : $\underset{\text{ethene}}{nCH_2 = CH_2} \longrightarrow \underset{\text{polyethene}}{\left[CH_2 - CH_2 \right]_n}$

(99) Biodegradable polymers.

Ans. Polymers which are affected by microbes or disintegrate by themselves after a certain period of time due to environmental degradation are called biodegradable polymers.

Examples : PHBV, i.e. Polyhydroxy butyrate – CO-β-hydroxy valerate Dextron, Nylon-2-nylon-6.

(100) Homopolymer.

Ans. A polymer made from only one type of repeating unit of one monomer is called homopolymer. Examples : Polythene, PVC, Nylon-6.

(101) Elastomers. ***(July '22)***

Ans. Polymers in which the intermolecular forces of attraction between the polymer chains are the weakest. When polymer is stretched, it has ability to stretch and when the strain is relieved it returns to its original position.

(102) Ring opening polymerization.

Ans. The process of formation of polymers from cyclic compounds (like lactams, cyclic ethers, etc.) by ring opening is called ring opening polymerization.

Example : Polymerization of ∈-caprolactam.

Chapter 16. Green Chemistry and Nanochemistry

(103) Green chemistry. ***(March '22; July '22)***

Ans. Green chemistry is the use of chemistry for pollution prevention and it designs the use of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

(104) Nanoscience.

Ans. The study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales where properties differ significantly from those at a larger scale is called nanoscience.

(105) Nanotechnology. ***(July '22)***

Ans. The design, characterization, production and application of structures, device and system by controlling shape and size at nanometer scale is called nanotechnology.

(106) Nanomaterial.

Ans. A material having structural components with at least one dimension in the nanometer scale that is 1–100 nm is called the nanomaterial. Nanomaterials are larger than single atoms but smaller than bacteria and cells.

(107) Nanochemistry. ***(July '22)***

Ans. It is the combination of chemistry and nanoscience. It deals with designing and synthesis of materials of nanoscale with different size and shape, structure and composition and their organization into functional architectures.