

**DELHI PUBLIC SCHOOL JAMMU**  
**SESSION 2018-19**  
**QUESTION BANK CHEMISTRY**  
**SOLID STATE**

1. How does amorphous silica differ from quartz?

Ans. In amorphous silica,  $\text{SiO}_4$  tetrahedral are randomly joined to each other whereas in quartz they are linked in a regular manner.

2. Which point defect lowers the density of a crystal?

Ans. Schottky defect.

3. Why glass is called super cooled liquids?

Ans. It has tendency to flow like liquid.

4. Some of the very old glass objects appear slightly milky instead of being transparent why?

Ans. Due to crystallization.

5. What is anisotropy?

Ans. Physical properties show different values when measured along different in crystalline solids.

6. What is the coordination number of atoms? a) In FCC structure b) in bcc structure

Ans. a) 12

b) 8

7. How many lattice points are there in one cell of - a) fcc b) bcc c) simple cubic

Ans. a) 14

b) 9

c) 8

8. What are the co-ordination numbers of octahedral voids and tetrahedral voids?

Ans. 6 and 4 respectively.

9. Why common salt is sometimes yellow instead of being of being pure white?

Ans. Due to the presence of electrons in some lattice sites in place of anions these sites act as F-centres. These electrons when excited impart colour to the crystal.

10. A compound is formed by two elements X and Y. The element Y forms ccp and atoms of X occupy octahedral voids. What is formula of the compound?

Ans. No. of Y atoms be N

No. of octahedral voids N

No. of X atoms be =N

Formula XY.

11. Explain how electrical neutrality is maintained in compounds showing Frenkel and Schottky defect.

Ans. In compound showing Frenkel defect, ions just get displaced within the lattice. While in compounds showing Schottky defect, equal number of anions and Cations are removed from the lattice. Thus, electrical neutrality is maintained in both cases.

12. Calculate the number of atoms in a cubic unit cell having one atom on each corner and two atoms on each body diagonal.

Ans. 8 corner  $\times \frac{1}{8}$  atom per unit cell = 1atom

There are four body diagonals in a cubic unit cell and each has two body centre atoms. So  $4 \times 2 = 8$  atoms therefore total number of atoms per unit cell =  $1 + 8 = 9$

13. Gold crystallizes in an FCC unit cell. What is the length of a side of the cell ( $r = 0.144 \text{ nm}$ )

$r = 0.144 \text{ nm}$

Ans.  $a = 2\sqrt{2}r$

$= 2 \times 1.414 \times 0.144 \text{ nm}$

$= 0.407 \text{ nm}$

14. Classify each of the following as either a p-type or n-type semi-conductor.

a) Ge doped with In

b) B doped with Si

Ans. (a) Ge is group 14 elements and In is group 13 element. Therefore, an electron deficit hole is created. Thus semi-conductor is p-type.

(b) Since B group 13 element and Si is group 14 elements, there will be a free electron, thus it is n-type semi-conductor.

15. In terms of band theory what is the difference between a conductor, an insulator and a semi-conductor?

Ans. The energy gap between the valence band and conduction band in an insulator is very large while in a conductor, the energy gap is very small or there is overlapping between valence band and conduction band.

16.  $\text{CaCl}_2$  will introduce Schottky defect if added to AgCl crystal. Explain

Ans. Two ions will be replaced by one  $\text{Ca}^{2+}$  ions to maintain electrical neutrality. Thus a hole is created at the lattice site for every  $\text{Ca}^{2+}$  ion introduced.

## SOLUTION

Q.1. what is Van't Hoff factor?

Ans. It is the ratio of normal molecular mass to observed molecular mass. It is denoted as 'i'

$i = \text{normal m.m} / \text{observed m.m}$

= no. of particles after association or dissociation / no. of particles before

Q.2. what is the Van't Hoff factor in  $\text{K}_4[\text{Fe}(\text{CN})_6]$  and  $\text{BaCl}_2$  ?

Ans 5 and 3

Q.3. Why the molecular mass becomes abnormal?

Ans. Due to association or dissociation of solute in given solvent.

Q.4. Define molarity, how it is related with normality?

Ans.  $N = M \times \text{Basicity or acidity}$ .

Q.5. How molarity is related with percentage and density of solution?

Ans.  $M = \frac{P \times d \times 10}{M.M}$

Q.6. what role does the molecular interaction play in the solution of alcohol and water?

Ans. Positive deviation from ideal behaviour.

Q.7. what is Van't Hoff factor, how is it related with

Ans. a. degree of dissociation b. degree of association a.  $\alpha = i - 1/n - 1$  b.  $\alpha = i - 1 / 1/n - 1$

Q.8. Why NaCl is used to clear snow from roads?

Ans. It lowers f.p of water

Q.9. How many grams of KCl should be added to 1kg of water to lower its freezing point to  $-8.00^\circ\text{C}$  ( $K_f = 1.86 \text{ K kg /mol}$ )

Ans. Since KCl dissociate in water completely  $L=2$ ;

$m = \frac{8}{2 \times 1.86} = 2.15 \text{ mol/kg}$ .

Grams of KCl =  $2.15 \times 74.5 = 160.2 \text{ g/kg}$ .

Q.11. An aqueous solution of 2% non-volatile exerts a pressure of 1.004 Bar at the normal boiling point of the solvent. What is the molar mass of the solute?

Hint:  $\frac{P_0 - P}{P_0} = \frac{w_B \times M_A}{m_B \times W_A}$

$1.013 - 1.004 / 1.013 = 2 \times 18 / m_B \times 98$

$m_B = 41.35 \text{ gm/mol}$

Q 12. 2 g of benzoic acid ( $\text{C}_6\text{H}_5\text{COOH}$ ) dissolved in 25 g of benzene shows a depression in freezing point equal to 1.62 K.  $K_f$  for benzene is  $4.9 \text{ K Kg mol}^{-1}$ . What is the percentage association of acid if it forms dimer in solution? Ans. 99.2%

Q13. Osmotic pressure of a 0.0103 molar solution of an electrolyte is found to be 0.70 atm at  $27^\circ\text{C}$ . Calculate Van't Hoff factor. ( $R=0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$ ) Ans. 2.76

## ELECTROCHEMISTRY

1. What is the effect of temperature on molar conductivity?

Ans. Molar conductivity of an electrolyte increases with increase in temperature.

2. Why is it not possible to measure single electrode potential?

Ans. It is not possible to measure single electrode potential because the half-cell containing single electrode cannot exist independently, as charge cannot flow on its own in a single electrode.

3. Name the factor on which emf of a cell depends:-

Ans. Emf of a cell depends on following factor-

- Nature of reactants.
- Concentration of solution in two half cells.
- Temperature
- Pressure of gas.

4. What is the EMF of the cell when the cell reaction attains equilibrium?

Ans. Zero

5. What is the electrolyte used in a dry cell?

Ans. A paste of  $\text{NH}_4\text{Cl}$ ,  $\text{MnO}_2$  and C

6. How is cell constant calculated from conductance values?

Ans. Cell constant = specific conductance / observed conductance.

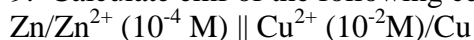
7. What flows in the internal circuit of a galvanic cell?

Ans. Ions

8. Define electrochemical series.

Ans. The arrangement of various electrodes in the decreasing or increasing order of their standard reduction potentials is called electrochemical series.

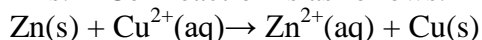
9. Calculate emf of the following cell at 298K



Given  $E^0 \text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$

$E^0 \text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$

Ans. Cell reaction is as follows.



$n=2$

$T=298 \text{ K}$

$$E_{\text{cell}} = (E^0 \text{Cu}^{2+}/\text{Cu} - E^0 \text{Zn}^{2+}/\text{Zn}) - 0.0591 \text{ V} \log \frac{[\text{Zn}^{2+}(\text{aq})]}{[\text{Cu}^{2+}(\text{aq})]}$$

$$= 0.34 \text{ V} - (-0.76) - 0.02955 \text{ V} \log 10^{-4} / 10^{-2}$$

$$= 1.10 \text{ V} - 0.02955 \text{ V} \log 10^{-2}$$

$$= 1.10 \text{ V} + 2 \times 0.02955 \text{ V}$$

$$= 1.10 \text{ V} + 0.0591 \text{ V}$$

$$= 1.1591 \text{ V}$$

10. Why an electrochemical cell stops working after sometime?

Ans. The reduction potential of an electrode depends upon the concentration of solution with which it is in contact.

As the cell works, the concentration of reactants decrease. Then according to Le chatelier's principle it will shift the equilibrium in backward direction. On the other hand if the concentration is more on the reactant side then it will shift the equilibrium in forward direction. When cell works concentration in anodic compartment in cathodic compartment decrease and hence  $E^0$  cathode will decrease. Now EMF of cell is

$$E^0_{\text{cell}} = E^0_{\text{cathode}} - E^0_{\text{anode}}$$

A decrease in  $E^0$  cathode and a corresponding increase in  $E^0$  anode will mean that EMF of the cell will decrease and will ultimately become zero i.e., cell stops working after some time.

11. Explain the term electrolysis. Discuss briefly the electrolysis of (i) molten NaCl (ii) aqueous sodium chloride solution (iii) molten lead bromide (iv) water.

12. State and explain Faraday's laws of electrolysis. What is Electrochemical equivalent?

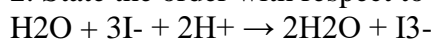
13. What do you understand by 'electrolytic conduction'? What are the factors on which electrolyte conduction depends? What is the effect of temperature on electrolytic conduction?

### CHEMICAL KINETICS

1. What are the units of its rate constant?

Ans.  $\text{Atm}^{-1/2}\text{sec}^{-1}$

2. State the order with respect to each reactant and overall reaction.

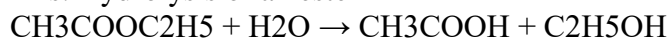


$$\text{Rate} = k [\text{H}_2\text{O}_2]^1 [\text{I}^-]^1$$

Ans. Order of reaction =  $1+1=2$

3. Give one example of pseudo first order reaction.

Ans. Hydrolysis of an ester



4. The conversion of molecules X to Y follows the second order of kinetics. If concentration of X is increased 3 times, how will it affect the rate of formation of Y.?

Ans.  $\text{Rate} = k [\text{A}]^2$

$$= k [3\text{A}]^2$$

$$= k [9\text{a}]^2$$

The rate of formation will become nine times.

5. The rate law for a reaction is  $\text{Rate} = K [\text{A}] [\text{B}]^{3/2}$

Can the reaction be an elementary process? Explain.

Ans. No, an elementary process would have a rate law with orders equal to its molecularities and therefore must be in integral form.

6. The rate of a particular reaction quadruples when the temperature changes from 293K to 313K. Calculate activation energy.

Ans.  $K_2/K_1 = 4$ ,

$$T_1 = 293\text{K} \quad T_2 = 313\text{K}$$

$$\text{Log} [K_2/K_1] = E_a [T_2 - T_1] / 19.15$$

Thus on calculating and substituting values we get.....

$$E_a = 52.86 \text{ KJ mol}^{-1}$$

7) Define Threshold energy and activation energy. How they are related?

Ans. Threshold Energy: It is the minimum amount of energy which the reactant molecules must possess for the effective collision in forming the products.

Activation Energy: It is the excess energy required by the reactants to undergo chemical reaction.

Activation energy = Threshold energy – Average kinetic energy of molecules.

### SURFACE CHEMISTRY

1. What are the physical states of dispersed phase and dispersion medium of froth?

Ans - Dispersed phase is gas, dispersion medium is liquid.

2. What is the cause of Brownian movement among colloidal particles?

Ans - Due to collision between particles.

3. Arrange the solutions: True solution, colloidal solution, suspension in decreasing order of their particles size?

Ans – Suspension > colloidal > true solution.

4. Give an example of micelles system?

Ans – Sodium stearate (C<sub>17</sub>H<sub>35</sub>COO<sup>-</sup> Na<sup>+</sup>)

5. Why is it necessary to remove CO when ammonia is obtained by Haber's process?

Ans- CO acts as poison catalyst for Haber's process therefore it will lower the activity of solution therefore it is necessary to remove when NH<sub>3</sub> obtained by Haber's process.

6. How is adsorption of a gas related to its critical temperature?

Ans- Higher the critical temperature of the gas. Greater is the ease of liquefaction.

i.e. greater Vander walls forces of attraction and hence large adsorption will occur.

7. What is meant by Shape Selective Catalyst?

Ans – On the Shape Selective Catalyst, the rate depends upon pore size of the catalyst and the shape & size of the reactant and products molecules.

8. What is difference between Sol. & Gel?

Ans – Both are colloidal solutions. Sol has solid as 'dispersed phase & liquid as dispersion medium'. While 'Gel' has liquid as dispersed phase and solid as dispersion medium.

9. Action of Soap is due to Emulsification & Micelle formation? Comment.

Ans – soaps are sodium & potassium salts of higher fatty acids.

Eg: C<sub>17</sub>H<sub>35</sub>COONa oil & Grease in dirt adhere firmly to clothing and is undisturbed by washing in tap water. Soap acts as an Emulsifying agent and brings the Greasy dirt into colloidal dispersion the hydrocarbon chain of soap molecule is soluble in oil or grease. It dissolves in grease and encapsulates. It to form micelle. The anionic ends of chain protrude from droplets and interact with water molecules, preventing coalescence of droplets.

10. Discuss the effect of pressure & temperature on the adsorption of gases on solids?

Ans – Effect of pressure on adsorption: - At constant temp the extent of adsorption of gas(x/m) in the solid increases with pressure. A graph between x/m and the pressure P of a gas at constant temp is called adsorption isotherm.

Freundlich adsorption isotherm -

i) At lower range of pressure, (x/m) is directly proportional to the applied pressure.

ii) At high pressure range, the extent of adsorption of a gas (x/m) is independent of the applied pressure i.e.

$X/m \propto p^0$

iii) At intermediate pressure range, the value of (x/m) is proportional to the fractional power of pressure i.e.

$X/m \propto p^{1/n}$

Where 1/n is fraction. Its value may be between 0 and 1  $X/m = kp^{1/n}$

$\log(x/m) = \log k + 1/n \log p$

Effect of temp on Adsorption – Adsorption is generally temp. depended. Mostly adsorption processes are exothermic and hence, adsorption decreases with increasing temp. However for an endothermic adsorption process adsorption increases with increase in Temperature.

11. Explain what is observe when

i) An electrolyte, NaCl is added to hydrate ferric oxide sol.

ii) Electric current is passed through a colloidal sol.

iii) When a beam of light is passed through a colloidal sol.

Ans – (i) The positively charged colloidal particles of Fe (OH)<sub>3</sub> get coagulated by the positively charged Cl<sup>-</sup> ions provided by NaCl.

(ii) On passing direct current, colloidal particles move towards the positively charged electrode where they lose their charge and get coagulated.

(iii) Scattering of light by the colloidal particles takes place and the path of light becomes visible (Tyndall effect).

12. Describes some features of catalysis by Zeolites?

Ans – Features of catalysis by Zeolites:-

- I) Zeolites are hydrated alumina silicates which have a three dimensional network structure containing water molecules in their pores.
- II) To use them as catalysts, they heated so that water of hydration present in the pores is lost and the pores become vacant.
- III) The size of pores varies from 260 to 740 pm. Thus, only those molecules can be adsorbed in these pores and catalysed whose size is small enough to enter these pores. Hence, they act as molecular sieves or shape selective catalysts.
- An important catalyst used in petroleum industries is zsm-5. It converts alcohols into petrol by first dehydrating them to form a mixture of hydro carbons and alcohols

13. Comment on the statement that “colloid is not a substance but state of a substance”?

Ans – The given statement is true. This is because the statement may exist as a colloid under certain conditions and as a crystalloid under certain other conditions.e.g: NaCl in water behaves as a crystalloid while in benzene, behaves as a colloid (called associated colloid). It is the size of the particles which matters i.e. the state in which the substance exist. If the size of the particles lies in the range 1nm to 1000nm it is in the colloid state.

14. Write short notes on followings:-

- Tyndall effect
- Brownian Movement
- Hardy Schulze Rule

Ans- (a) Tyndall effect-scattering of light by colloidal particles by which path of beam becomes clearly visible. This effect is known as Tyndall effect

(b) Brownian movement-zig-zag motion of colloidal particles.

(c) Hardy Schulze Law – Coagulating value of a coagulating ion is directly proportional to the charge on the ion. e.g.:  $\text{Na}^+ < \text{Ca}^{++} < \text{Al}^{3+}$  for negatively charged sol.  $\text{Cl}^- < \text{CO}_3^{2-} < \text{PO}_4^{3-} < [\text{Fe}(\text{CN})_6]^{4-}$  for positive sol.

## GENERAL PRINCIPLES AND ISOLATION OF ELEMENTS

Q.1- What is slag?

A.1- It is easily fusible material, which is formed when gangue still present in roasted ore combines with the flux.

E.g.  $\text{CaO}(\text{flux}) + \text{SiO}_2(\text{gangue}) \rightarrow \text{CaSiO}_3(\text{slag})$

Q.2- Which is better reducing agent at 983K, carbon or CO?

A.2- CO, (above 983K CO being more stable & does not act as a good reducing agent but carbon does.)

Q.3- At which temperature carbon can be used as a reducing agent for FeO?

A.3- Above 1123K, carbon can reduce FeO to Fe.

Q.4- What is the role of graphite rods in electrometallurgy of aluminium?

A.4- Graphite rods act as anode, are attacked by oxygen to form CO<sub>2</sub> and so to be replaced time to time.

Q.5- What is the role of cryolite in electrometallurgy of aluminium?

A.5- alumina cannot be fused easily because of high melting point. Dissolving of alumina in cryolite furnishes Al<sup>3+</sup> ions, which can be electrolyzed easily.

Q.6- What are depressants?

A.6- It is possible to separate two sulphide ore by adjusting proportion of oil to water in froth flotation process by using a substance known as depressant.

e.g. NaCN is used to separate ZnS and PbS.

Q.7- Copper can be extracted by hydrometallurgy but not Zn. Why?

A.7- The E<sup>0</sup> of Zn is lower than that of Cu thus Zn can displace Cu<sup>2+</sup> ion from its solution. On other hand side to displace Zn from Zn<sup>2+</sup> ion, we need a more reactive metal than it.

Q.8 Describe the method of refining of nickel.

A.8- In the Mond Process, Ni is heated in a stream of CO forming a volatile complex, which then decomposes at higher temperature to give Ni.

At 330-350K: -  $\text{Ni} + 4\text{CO} \rightarrow \text{Ni}(\text{CO})_4$

At 450-470K  $\text{Ni}(\text{CO})_4 \rightarrow \text{Ni} + 4\text{CO}$

Q.9- What is Zone Refining? Explain with example.

A.9- Zone refining is a method of obtaining a metal in very pure state. It is based on the principal that impurities are more soluble in molten state of metal than solidified state.

In this method, a rod of impure metal is moved slowly over circular heater. The portion of the metal being heated melts & forms the molten zone. As this portion of the rod moves out of heater, it solidified while the impurities pass into molten zone. The process is repeated to obtain ultrapure metal and end of rod containing impure metal cut-off.

Q.10 Write the principal of electro-refining.

A.10- In this method of purification impure metal is made Anode and pure metal is made the cathode. On passing electricity, pure metal is deposited at the cathode while the impurities dissolve in solution as anode mud. E.g. electro-refining of copper:-

At Cathode: -  $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$

At Anode: -  $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$

Q.11- Describe the method of refining of Zirconium and Titanium.

A.11- Van Arkel process is used for obtaining ultrapure metal. The impure metal is converted into volatile compound, which then decomposes electrically to get pure metal.

At 850K: -  $\text{Zr (impure)} + 2\text{I}_2 \rightarrow \text{ZrI}_4$

At 2075K:-  $\text{ZrI}_4 \rightarrow \text{Zr (pure)} + 2\text{I}_2$

Q.12:- Why copper matte is put in silica lined converter?

A.12:- Copper matte consists of  $\text{Cu}_2\text{S}$  and  $\text{FeS}$ . When blast of air is passed through molten matte in silica-lined converter,  $\text{FeS}$  present in matte is oxidized to  $\text{FeO}$ , which combines with silica to form slag. (i)  $2\text{FeS} + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{SO}_2$ , (ii)  $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$  (slag), (III)  $2\text{Cu}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$ , (IV)  $2\text{Cu}_2\text{O} + 2\text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2$

Q.13- What is meant by term chromatography?

A.13-Chromato means Colour and graphy means writing because the method was first used for separation of coloured substance. It is based on selective distribution of various constituents of a mixture between two phases, a stationary phase and a moving phase. The stationary phase can be either solid or liquid on solid support.

Q.14- Why is reduction of metal oxide easier if metal formed is in liquid state at temperature of reduction. A.10- The entropy of a substance is higher in liquid state than solid state. In the reduction of metal oxide, the entropy change will be positive if metal formed is in liquid state. Thus, the value of  $\Delta G_0$  becomes negative and reduction occurs easily.

Q.15- Explain the following:-

(i) Zinc but not copper is used for recovery of Ag from the complex  $[\text{Ag}(\text{CN})_2]^-$ .

(ii) Partial roasting of sulphide ore is done in the metallurgy of copper.

(iii) Extraction of Cu from pyrites is difficult than that from its oxide ore through reduction.

A.1- (i) Zn is more powerful reducing agent in comparison to copper. Zn is also cheaper than Cu.

(ii) Partial roasting of sulphide ore forms some oxide. This oxide then reacts with remaining sulphide ore to give copper i.e. self-reduction occurs.

$2\text{Cu}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$ ,

$2\text{Cu}_2\text{O} + 2\text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2$ .

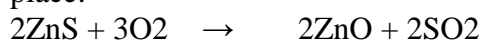
(iii) Though carbon is good reducing agent for oxide but it is poor reducing agent for sulphides. The reduction of metal sulphide does not have large negative value.

Q.16- Describe the principles of extraction of Zinc from zinc blende .

A.16- Important ores of Zn:-Zinc blende - ZnS, Calamine- ZnCO<sub>3</sub>, and Zincate – ZnO. ZnS is commercially important ore of Zn. Various stages involved in the extraction of Zn from ZnS are as following:-

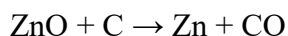
(i) Concentration of ore:-It is concentrated by Froth flotation process followed by gravity separation process.

(ii) Roasting:- The concentrated ore is roasted in presence of air. Following reactions take place:-



The mass obtained during roasting is porous and is called porous clinker.

(iii) Reduction of ZnO to Zn: - ZnO is made into bricketts with coke and clay and heated at 163K. Zn formed distills off and is collected by rapid cooling of zinc vapours.



### CHEMISTRY IN EVERYDAY LIFE

Q-1 Define the term chemotherapy?

Ans-1 Treatment of diseases using chemicals is called chemotherapy.

Q-2 why do we require artificial sweetening agents?

Ans-2 To reduce calorie intake.

Q-3 what are main constituent of Dettol?

Ans-3 Chloroxylenol & Terpinol .

Q-4 what type drug phenacetin is?

Ans-4 It is antipyretics.

Q-5 Name the drug that are used to control allergy?

Ans-5 Antihistamines.

Q-6 Why is the use of aspartame limited to cold food and drinks?

Ans-6 It is unstable at cooking temperature and decompose.

Q-7 What is tranquilizers? Give an example?

Ans-7 They are the drugs used in stress, mild severe mental disease.

Q-8 what type of drug chloramphenicol?

Ans-8 It is broad spectrum antibiotic.

Q-9 Why is biethional is added to the toilet soap?

Ans-9 It acts as antiseptics.

Q-10 what are food preservatives?

Ans-10 The substances that prevent spoilage of food due to microbial growth. eg- sodium benzoate

Q-11 Mention one important use of the following-

(i) Equanil (ii) Sucralose

Ans-1 (i) Equanil- It is a tranquilizer.

(ii) Sucralose-It is an artificial sweetener.

Q-12 Define the following and give one example-

(i) Antipyretics (ii) Antibiotics

Ans-12 (i) Antipyretics- Those drugs which reduce the temperature of feveral body are called Antipyretics.

Eg - Paracetamol

(ii) Antibiotics-The drugs which prevent the growth of other micro-organisms. Eg- Penicillin.

Q-13 Name the medicines used for the treatment of the following-

(i) Tuberculosis (ii) Typhoid

Ans. Tuberculosis- Streptomycin



Typhoid- Chlororophenicol

Q-14 what are tincture of iodine?

Ans- 2-3% iodine solution of alcohol water is called tincture of Iodine. It is a powerful antiseptics and is applied on wounds.

Q- 15 What is artificial sweetening agent? Give two examples?

Ans- The substances which give sweetening to food but don't add calorie to our body .

Eg- Saccharin, alitame.

Q-16 How is synthetic detergents better than soaps?

Ans- (i) Detergents can be used in hard water but soaps cannot be used.

(ii) Detergents have a stronger cleansing action than soaps.

Q-17 what are sulpha drugs? Give two examples?

Ans- a group of drugs which are derivatives of sulphanilamide and are used in place of antibiotics is called sulpha drugs.

Eg- sulphadizine, sulphanilamide.

Q-18 what forces are involved in holding the active sites of the enzymes? Ans-8 The forces are involved in holding the active sites of the enzymes are hydrogen bonding , ionic bonding , dipole-dipole attractions or Vander waals force of attractions.

Q-19 Describe the following giving an example in each case-

(i) Edible colours

(ii) Antifertility drugs

Ans(i) Edible colours- They are used for dyeing food. Eg- saffron is used to colour rice.

(ii) Antifertility drugs- Those drugs which control the birth of the child are called antifertility drugs.

Q-20 Give two examples of organic compounds used as antiseptics?

Ans-10 Phenol (0.2%), iodoform

Q-21 what are Biodegradable and non-biodegradable detergents? Give one example of each.

Ans-1 Detergents having straight hydrocarbon chain and are easily decomposed by micro-organisms are called Biodegradable detergents. The detergents having branched hydrocarbon chain and are not easily decomposed by micro-organisms are called Non-Biodegradable detergents.

Q-22 what are barbiturates? To which class of drugs do they belong? Give two examples.

Ans-2 Derivatives of barbituric acid are called barbiturates. They are tranquilizers. They also act as hypnotics. eg- luminal , seconal.

Q-23 what is the use of –

(i) Benadryl (ii) sodium benzoate (iii) Progesterone

Ans- (i) Antihistamines

(ii) Preservatives

(iii) Antifertility drug

Q-24 Identify the type of drug-

(i) Ofloxacin (ii) Aspirin (iii) Cimetidine

Ans- (i) Antibiotic (ii) Analgesics & Antipyretics (iii) Antihistamines & antacid

## D AND F BLOCK ELEMENTS

Q.1-Explain briefly how +2 oxidation state becomes more and more stable in the first half of the first row transition elements with increasing atomic number.

A.1-In  $M^{2+}$  ions, 3d-orbitals get occupied gradually as the atomic number increases. Since, the number of empty d-orbitals decreases, the stability of cations increases from  $Sc^{2+}$  to  $Mn^{2+}$ .  $Mn^{2+}$  is most stable as all d-orbitals are singly occupied.

Q.2- Explain why transition elements have many irregularities in their electronic configurations?

A.2-In the transition elements, there is a little difference in the energy of (n-1) d-orbitals and ns- orbitals. Thus, incoming electron can occupy either of shell. Hence, transition elements exhibit many irregularities in their electronic configurations.

Q.3-What are different oxidation states exhibited by Lanthanides?

A.3-The common stable oxidation state of lanthanides is +3. However some members also show oxidation states of +2 & +4.

Q.4-How is the variability in oxidation states of transition metals different from that of the non- transition metals? Illustrate with examples.

A.4-The transition elements use its (n-1)d, ns and np orbital and the successive oxidation states differ by unity. For example, Mn shows all the oxidation states from +2 to +7. On other hand non transition elements use its ns, np and nd orbitals and the successive oxidation states differ by two units e.g. Sn<sup>2+</sup>, Sn<sup>4+</sup> etc.

Q.5- Why do transition elements show variable oxidation states?

A.5- The transition elements show variable oxidation state due to small energy difference between (n-1) d & ns orbital as a result both (n-1)d & ns electrons take part in bond formation.

Q.6-Why are Mn<sup>2+</sup> compounds more stable than Fe<sup>2+</sup> compounds towards oxidation to +3 state?

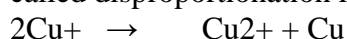
A.6-The electronic configuration of Mn<sup>2+</sup> is [Ar] 3d<sup>5</sup>, i.e. all five d-orbitals are singly occupied. Thus this is stable electronic configuration and further loss of electron requires high energy. On other hand side the electronic configuration of Fe<sup>2+</sup> is [Ar] 3d<sup>6</sup>, i.e. Loss of one electron requires low energy.

Q.7-To what extent do the electronic configuration decide the stability of oxidation state in the first series of the transition elements? Illustrate your answer with an example.

A.7-In a transition series, the oxidation state which lead to exactly half filled or completely filled orbitals are more stable. e.g. the electronic configuration of Fe is [Ar] 3d<sup>6</sup> 4s<sup>2</sup>. It shows various oxidation state but Fe(III) is more stable than Fe(II).

Q.8-What is meant by disproportionation? Give two examples.

A.8-Those reactions in which same substance undergoes oxidation as well as reduction are called disproportionation reactions. e.g.



Q.9- Which metal in the first series of transition metals exhibits +1 oxidation state most frequently and why?

A.9- Copper with configuration [Ar] 3d<sup>10</sup> 4s<sup>1</sup> exhibits +1 oxidation state. Copper loses 4s<sup>1</sup> electron easily and achieved a stable configuration 3d<sup>10</sup> by forming Cu<sup>+</sup>.

Q.10- What are inner transition elements?

A.10- The f-block elements in which the last electron accommodated on (n-2) f-subshell are called inner transition elements. These include atomic numbers 58 to 71 and from 90 to 103.

Q.11- The paramagnetic character in 3d-transition series elements increases upto Mn and then decreases. Explain why?

A.11- In the 3d-transition series as we move from Sc (21) to Mn (25) the number of unpaired electrons increases and hence paramagnetic character increases. After Mn, the pairing of electrons in the d-orbital starts and the number of unpaired electrons decreases and hence, paramagnetic character decreases.

Q.12- Comment on the statement that elements of the first transition series possess many properties different from those of heavier transition metal

A.12-The following points justify that the given statement is true:-

- (i) Ionization enthalpies of heavier transition elements are higher than the elements of 3d series. Consequently, heavier transition elements are less reactive in comparison to 3d-elements.
- (ii) Melting points of heavier transition elements are higher than 3d-elements.
- (iii) Higher oxidation states of heavier transition elements are stable whereas lower oxidation states are stable in 3d-elements.

Q.13-What are transition elements? Which d-block elements are not regarded as transition elements and why?

A.13- An element which has partially filled (n-1) d orbital is known as transition elements. Group 12 elements i.e. Zn, Cd, Hg have completely filled (n-1) d-orbital in atomic & ionic state & thus these elements are not considered as Transition Elements.

Q.14-What are interstitial compounds? Why are such compounds well known for transition metal?

A.14- Compounds of transition metal with relatively smaller non-metals are known as interstitial compounds. These compounds are well known for transition metals because size of C, N, O, and B is similar to size of interstitial voids of transition metal

Q.15-For the first row of transition metals the E<sub>0</sub> values are:-

E <sub>0</sub> values	V	Cr	Mn	Fe	Co	Ni	Cu
M <sub>2</sub> <sup>+</sup> /M	-1.18	-0.91	-1.18	-0.44	-0.28	-0.25	+0.34

Explain the irregularity in the above values.

A.15-The E<sub>0</sub> ( M<sub>2</sub><sup>+</sup>/M) values are not regular which can be explained from the irregular variation of ionization energy and sublimation energy of Mn due to half-filled orbitals.

Q.16- Decide giving reason which one of the following pairs exhibits the property indicated:

- (i) Sc<sup>3+</sup> or Cr<sup>3+</sup> exhibits paramagnetism
- (ii) V or Mn exhibits more number of oxidation states
- (iii) V<sup>4+</sup> or V<sup>5+</sup> exhibits colour

A.16- (i) Sc=[Ar] 3d<sup>1</sup>4s<sup>2</sup>; Sc<sup>3+</sup>=[Ar]; it has no unpaired electron so diamagnetic

Cr=[Ar] 3d<sup>5</sup>4s<sup>1</sup>; Cr<sup>3+</sup>=[Ar]3d<sup>3</sup>; it has three unpaired electrons paramagnetic

(ii) V=[Ar] 3d<sup>3</sup>4s<sup>2</sup> Mn=[Ar] 3d<sup>5</sup>4s<sup>2</sup> Thus V exhibit oxidation states of +2, +3, +4, +5 Whereas Mn exhibit oxidation states of +2 to +7.

(iii) V<sup>4+</sup>=[Ar] 3d<sup>1</sup> → coloured V<sup>5+</sup>=[Ar] → colourless

Q.17-(a) Describe the general trends in the following properties of the first series of the transition elements:-

- (i) Stability of +2-oxidation state
- (ii) Formation of oxometal ions
- (b) Write steps involved in the preparation of KMnO<sub>4</sub> from K<sub>2</sub>MnO<sub>4</sub>

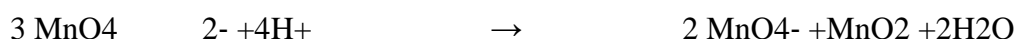
A.17- (a) i-The elements of first transition series show decreasing tendency to form divalent cation as we move left to right in the series. This trend is due to general increase in the first and second ionization energy. The greater stability of Mn<sup>2+</sup> is due to half filled d<sup>5</sup> configuration and that of zinc is due to d<sup>10</sup> configuration.

(ii) All metal except Sc from oxide of type MO which are basic. The highest oxidation number in all oxide, coincide with the group number and is attain in Sc<sub>2</sub>O<sub>3</sub> to Mn<sub>2</sub>O<sub>7</sub>. Formation of oxoanions is due to high electro negativity and small size of oxygen atom.

-(b) It takes place in two steps:-

(iii) Conversion of pyrolusite ore into potassium manganate.

(iv) Conversion of potassium manganate to potassium permanganate. Following reactions take place:-



Q.18- (a) What is lanthanide contraction? What effect does it have on the chemistry of the elements, which follow lanthanoids?

(b) The chemistry of actinoid elements is not so much smooth as that of lanthanoids. Justify these statements by giving some examples from the oxidation state of these elements.

A.18- (a) The size of Lanthanoids and its trivalent ion decreases from La to Lu. It is known as lanthanoids contraction.

Cause: - It is due to poor shielding of 4f electrons.

Consequences of lanthanide contraction: - (i) Basic strength of hydroxide decreases from  $\text{La}(\text{OH})_3$  to  $\text{Lu}(\text{OH})_3$ . (ii) Because of similar chemical properties lanthanides are difficult to separate.

(b) Lanthanoids show limited number of oxidation states i.e. +2, +3, +4 (out of which +3 is most common). This is because of a large energy gap between 4f, 5d and 6s subshell. The dominant oxidation state of actinides is also +3 but they show a number of other oxidation state also e.g. +4, +5, and +7. This is due to small energy difference between 5f, 6d and 7s orbitals.

Q.19- Give examples and suggest reasons for the following features of the transition metal chemistry:

(i) The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.

(ii) A transition metal exhibits highest oxidation state in oxides and fluorides.

(iii) Of the d4 species,  $\text{Cr}^{2+}$  is strongly reducing while manganese(III) is strongly oxidizing.

A.19-(i) The oxide of transition metals in lower oxidation states are generally basic while those in the higher oxidation states are acidic. Acidic character increases with increase in oxidation state is due to decrease in size of metal ion and increase in charge density. e.g.  $\text{MnO}$  (basic),  $\text{Mn}_3\text{O}_4$  (amphoteric),  $\text{Mn}_2\text{O}_7$  (acidic).

(ii) A transition metal exhibits higher oxidation states in oxides and fluorides because oxygen and fluorine are the most electronegative elements and thus easily can unpair electrons of metal atom.

(iii) Because oxidizing and reducing property depends on  $E^0$  value. Since  $E^0$  value of  $\text{Cr}^{3+}/\text{Cr}^{2+}$  is negative while that of  $\text{Mn}^{3+}/\text{Mn}^{2+}$  is positive, as a result  $\text{Cr}(\text{II})$  act as reducing agent and  $\text{Mn}(\text{III})$  is strong oxidizing.

Q.20-(a) What is actinides contraction? What effect does it have on the chemistry of the elements, which follow actinides?

(b) Name an important alloy, which contains some of the lanthanide metals. Mention its uses.

A.- (a) The size of actinoid and its trivalent ion decreases from Ac to Lw. It is known as actinides contraction.

Cause: - It is due to poor shielding of 5f electrons.

Consequences of actinides contraction: - (i) Basic strength of hydroxide decreases from  $\text{Ac}(\text{OH})_3$  to  $\text{Lw}(\text{OH})_3$ . (ii) Because of similar chemical properties actinides are difficult to separate.

(b) An important alloy containing lanthanoid metals is mischmetal, which contains 95% lanthanide metal and 5% Fe along with traces of S, C, Ca and Al. It is used in Mg-based alloy to produce bullets, shells and lighter flint.

Q.21-Explain giving reasons:

- (i) Transition metals and many of their compounds show paramagnetic behaviour.
- (ii) The enthalpies of atomisation of the transition metals are high.
- (iii) The transition metals generally form coloured compounds.
- (iv) Transition metals and their many compounds act as good catalyst.
- (v) Transition metals have a strong tendency to form complexes.

A.21- (i) Transition metals and many of their compounds show paramagnetic behaviour due to presence of unpaired electrons in (n-1) d orbital.

- (ii) The enthalpies of atomisation of the transition metals are high Because of large number of unpaired electrons in their atoms, they have stronger interatomic interaction and hence strong metallic bonding is present between atoms.
- (iii) The transition metals generally form coloured compounds due to presence of unpaired electrons in (n-1) d orbital & thus they can undergo d-d transition.
- (iv) Transition metals and their many compounds act as good catalyst It is due to (i) partially filled (n-1) d orbital (ii) Variable oxidation state (iii) Ability to change oxidation state frequently.
- (v) Transition metals have a strong tendency to form complexes Most of transition elements form complex compounds due to (i) small size (ii) high charge (iii) presence of vacant d-orbital of suitable energy.

Q.22- Give reasons for the following:-

- (i) Fe has higher melting point than Cu.
- (ii)  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is coloured while  $[\text{Sc}(\text{H}_2\text{O})_6]$  is colourless.
- (iii) The 4d and 5d series of transition metals have more frequent metal-metal bonding in their compound than do the 3d metals.
- (iv) Transition metals some time exhibit very low oxidation state such as +1 and 0.
- (v) Hg is not considered a transition metal.

A.22-(i) This is because Fe ( $3d^6, 4s^1$ ) has four unpaired electrons in 3d-subshell. While Cu ( $3d^{10}, 4s^1$ ) only one unpaired electron in 4s shell. Hence metallic bonding is stronger in Fe than those in Cu.

(ii) The oxidation state of Ti in  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is +3 and its configuration is  $[\text{Ar}] 3d^1$  i.e one unpaired electron and hence it is coloured. Whereas the oxidation state of Sc in  $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$  is +3 and its configuration is  $[\text{Ar}] 3d^0$  i.e no unpaired electron and hence it is colourless.

(iii) In the same group of d-block elements, the 4d and 5d transition elements are larger size than that of 3d elements. Hence, the valence electrons are less tightly held and form metal-metal bond more frequently.

(iv) +1 oxidation state is shown by elements like Cu because after loss of one electron, it acquire stable configuration. Zero oxidation state is shown in metal carbonyl, because  $\pi$ -electrons donated by CO are accepted into the empty orbital.

(v) The characteristic properties of transition metal are due to partially filled d-orbitals. Hg has completely filled d-orbital, as a result it doesn't show properties of transition metals and hence is not considered as transition metal.

Q.23-(a) write electronic configuration of element having atomic number 101.

- (b) Which element show maximum oxidation state in 3d transition series?
- (c) What is mischmetal?
- (d) Explain why  $\text{Cu}^+$  ion is not stable in aqueous solution?
- (e) Name the transition metal which is well known to exhibit +4 oxidation state?

Q.24-(a) Write the preparation of potassium dichromate from iron chromite. What happens when potassium dichromate reacts with (i) Hydrogen sulphide (ii)  $\text{FeSO}_4$ ?

(b) Why do Zr and Hf exhibit almost similar properties?

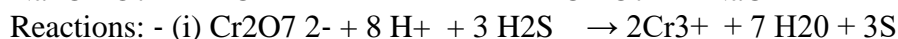
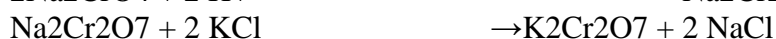
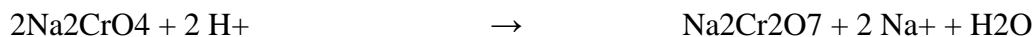
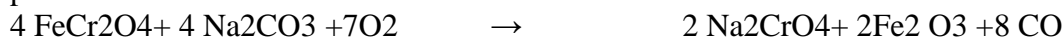
(c) Why is  $\text{La}(\text{OH})_3$  stronger base than  $\text{Lu}(\text{OH})_3$ .

Ans (a) Preparation:- It takes place in three steps-

(i) Conversion of chromite ore to sodium chromate.

(ii) Conversion of sodium chromate to sodium dichromate.

(iii) Conversion of sodium dichromate to potassium dichromate Following reaction takes place:-



(b) Because both have similar ionic size

(c) Due to lanthanoid contraction size of  $\text{La}^{3+}$  is smaller than  $\text{Lu}^{3+}$  as a result Lu-O bond will be stronger than La-O bond.

Q.24- Give reasons for the following:-

(i) Transition metals have high enthalpy of hydration.

(ii) Zn, Cd and Hg are not regarded as transition metal.

(iii) d block elements exhibit a large number of oxidation states than f block elements.

(iv) The second and third members in each group of transition element have similar atomic radii.

(v)  $\text{K}_2[\text{PtCl}_6]$  is a well known compound whereas the corresponding Ni compound is not known.

A.24-(i) Transition metal ions are smaller and have higher charge, therefore have high enthalpy of hydration.

(ii) Group 12 elements i.e. Zn, Cd, Hg have completely filled (n-1) d-orbitals in atomic & ionic state

& thus these elements are not considered as transition elements.

(iii) The difference in the energy of (n-1) d orbital and ns orbital is very small and thus both sub-shells are used for bond formation. Whereas in f block elements (n-2)f orbitals lie underneath and hence are not available for bond formation.

(iv) The second and third members in each group of transition element have similar atomic radii due to lanthanoid contraction. It arises due to poor shielding of d and f electrons.

(v) The oxidation state of Pt is +4 which is stable for Pt. The +4 oxidation state for Ni is very difficult to achieve because the sum of the first four ionization energies is very high. Hence, the corresponding Ni(II) compound is known.

## COORDINATION COMPOUNDS

1. What are ambidentate ligands? Give two examples for each.

ANS. Ambidentate ligands are ligands that can attach themselves to the central metal atom through two different atoms.

Q2. Using IUPAC norms write the formula for the following: Tetrahydroxozincate(II)

ANS.  $[\text{Zn}(\text{OH})_4]^{2-}$

Q3. Using IUPAC norms write the formula for the following: Hexaamminecobalt(III) sulphate

ANS.  $[\text{Co}(\text{NH}_3)_6]^{3+} (\text{SO}_4)_3$

Q4. Using IUPAC norms write the formula for the following: Pentaamminenitrito-O-cobalt(III)

ANS.  $[\text{Co}(\text{ONO})(\text{NH}_3)_5]^{2+}$

Q5. Using IUPAC norms write the systematic name of the following:  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$

ANS. Hexaamminecobalt(III) chloride

Q6. Using IUPAC norms write the systematic name of the following:

$[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NH}_2\text{CH}_3)]\text{Cl}$

ANS. Diamminechlorido(methylamine) platinum(II) chloride

Q7. Using IUPAC norms write the systematic name of the following:  $[\text{Co}(\text{en})_3]^{3+}$

ANS. Tris(ethane-1, 2-diammine) cobalt(III) ion

Q8. What is spectrochemical series? Explain the difference between a weak field ligand and a strong field ligand.

ANS. A spectrochemical series is the arrangement of common ligands in the increasing order of their crystal-field splitting energy (CFSE) values.

$\text{I}^- < \text{Br}^- < \text{S}^{2-} < \text{SCN}^- < \text{Cl}^- < \text{N}_3^- < \text{F}^- < \text{OH}^- < \text{C}_2\text{O}_4^{2-} < \text{H}_2\text{O} < \text{NCS}^- < \text{H}^- < \text{CN}^- < \text{NH}_3 < \text{en} < \text{SO}_3^{2-} < \text{NO}_2^- < \text{phen} < \text{CO}$

Q9.  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  is paramagnetic while  $[\text{Ni}(\text{CN})_4]^{2-}$  is diamagnetic. Explain why?

ANS. Cr is in the +3 oxidation state i.e.,  $d^3$  configuration. Also,  $\text{NH}_3$  is a weak field ligand that does not cause the pairing of the electrons in the 3d orbital.

$\text{Cr}^{3+}$ : Therefore, it undergoes  $d^2sp^3$  hybridization and the electrons in the 3d orbitals remain unpaired. Hence, it is paramagnetic in nature.

In  $[\text{Ni}(\text{CN})_4]^{2-}$ , Ni exists in the +2 oxidation state i.e.,  $d^8$  configuration.

$\text{Ni}^{2+}$ :  $\text{CN}^-$  is a strong field ligand. It causes the pairing of the 3d orbital electrons. Then,  $\text{Ni}^{2+}$  undergoes  $dsp^2$  hybridization.

Q10. A solution of  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  is green but a solution of  $[\text{Ni}(\text{CN})_4]^{2-}$  is colourless. Explain.

ANS. In  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ ,  $\text{H}_2\text{O}$  is a weak field ligand. Therefore, there are unpaired electrons in  $\text{Ni}^{2+}$ . In this complex, the d electrons from the lower energy level can be excited to the higher energy level i.e., the possibility of d-d transition is present. Hence,  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  is coloured.

In  $[\text{Ni}(\text{CN})_4]^{2-}$ , the electrons are all paired as  $\text{CN}^-$  is a strong field ligand. Therefore, d-d transition is not possible in  $[\text{Ni}(\text{CN})_4]^{2-}$ . Hence, it is colourless. As there are no unpaired electrons, it is diamagnetic.

### HALOALKANES AND HALOARENES

Q1. Why haloalkanes are more reactive than haloarenes.

Ans. In haloarenes, there is double bond character b/w carbon and halogen due to resonance effect which makes them less reactive.

(ii) In benzene, carbon being  $sp^2$  hybridised which is smaller in size than  $sp^3$  present in haloalkanes. So C-Cl bond in aryl halides is shorter and stronger.

Q2. Why do haloalkenes undergo nucleophilic substitution whereas haloarenes electrophilic substitution.

Ans. Due to more electro negative nature of halide atom in haloalkanes carbon atom becomes slightly positive and is easily attacked by nucleophilic reagents.

While in haloarenes due to resonance, carbon atom becomes slightly negative and attacked by electrophilic reagents.

Q3. When an alkyl halide is treated with ethanolic solution of KCN, the major product is alkyl cyanide whereas if alkyl halide is treated with  $\text{AgCN}$ , the major product is alkyl isocyanide.

Ans. KCN is ionic they can attach through C or N but C-C bond is strong than C-N bond. So alkyl cyanide is the major product but AgCN is covalent so more electronegative N can attach to C and forms isocyanides.

Q4. Why are the reaction of alcohol /phenol with acid chloride in the presence of pyridine ?

Ans. Because esterification reaction is reversible and presence of base (pyridine) neutralises HCl produced during reaction thus promoting forward reaction.

Q5. Explain why o-nitrophenol is more acidic than o-methoxy phenol ?

Ans. -NO<sub>2</sub> group is electron withdrawing group, e<sup>-</sup> density on O decreases and loss of H<sup>+</sup> is easy whereas -OCH<sub>3</sub> group is electron releasing group, which increases e<sup>-</sup> density on O, which makes difficult to the loss of H<sup>+</sup>, hence are less acidic.

Q6. Aryl halides cannot be prepared by the action of sodium halide in the presence H<sub>2</sub>SO<sub>4</sub>. Why?

Ans. Due to resonance the carbon-oxygen bond in phenols has partial double bond and it is stronger than carbon oxygen single bond.

Q7. Why Grignard reagent should be prepared under anhydrous conditions.?

Ans. Grignard reagent reacts with H<sub>2</sub>O to form alkanes, therefore they are prepared under anhydrous condition.

Q8. Why is Sulphuric acid not used during the reaction of alcohols with KI ?

Ans. It is because HI formed will get oxidized to I<sub>2</sub> by concentrated Sulphuric acid which is an oxidizing agent.

Q9. p-dichlorobenzene has highest m.p. than those of ortho and m-isomers.?

Ans. p-dichlorobenzene is symmetrical, fits into crystal lattice more readily and has higher melting point.

Q10. Arrange in order of boiling points.

(a) Bromobenzene, Bromoform, chloromethane, Dibromo-methane

(b) 1-chloropropane, Isopropyl chloride, 1-Chlorobutane.

Ans. (a) chloromethane < Bromobenzene < Dibromo-methane < , Bromoform

(b) , Isopropyl chloride < 1-chloropropane < 1-Chlorobutane (As branching increases, boiling point decreases)

### ALCOHOLS, PHENOLS AND ETHERS

Q 1. Explain why o-nitrophenol is more acidic than o-methoxy phenol?

Ans. Due to -R and -I effect of -NO<sub>2</sub> group, e<sup>-</sup> density on O' if O-H bond decreases and loss of H<sup>+</sup> is easy. -I effect In contrast, in o-methoxy phenol due to +R effect, -OCH<sub>3</sub> increases. e<sup>-</sup> density on O<sub>2</sub> of O-H group, and hence loss of H<sup>+</sup> is difficult. (both -ve charge repel each other)

Q2. Of benzene and phenol, which is more easily nitrated and why?

Ans. Nitration is an electrophilic substitution. The -OH group in phenol increases the electron density at ortho and para position as follows. Since phenol has higher electron density due to electron releasing nature of -OH group, compared to benzene, therefore nitration is easy in phenol than benzene.

Q3) Phenols do not give protonation reactions readily. Why?

Ans:- The lone pair on oxygen of O-H in phenol is being shared with benzene ring through resonance. Thus, lone pair is not fully present on oxygen and hence phenols do not undergo protonation reactions.

Q4) Ortho-nitrophenol is more acidic than ortho-methoxy phenol? why?

Ans:- NO<sub>2</sub> group is electron withdrawing which increases acidic character due to easily ease

Q5. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?

Ans. The molecules of Butane are held together by weak van der Waal's Forces of attraction while those of propanol are held together by stronger intermolecular hydrogen bonding.



Q6. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.

Ans. Alcohols can form hydrogen bonds with water and break the hydrogen bonds already existing between water molecules. Therefore they are soluble in water. Whereas hydrocarbons cannot form hydrogen bonds with water and hence are insoluble in water.

Q7. While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.

Ans. O-nitrophenol is steam volatile due to intramolecular hydrogen bonding and hence can be separated by steam distillation from p-nitrophenol which is not steam volatile because of inter-molecular hydrogen bonding.

Q8. Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method. Give reason.

Ans. The formation of ethers by dehydration of alcohol is a bimolecular reaction (SN)<sub>2</sub> involving the attack of an alcohol molecule on a protonated alcohol molecule. In the method, the alkyl group should be unhindered. In case of secondary or tertiary alcohols, the alkyl group is hindered. As a result, elimination dominates substitution.

Q9. What is meant by hydroboration-oxidation reaction? Illustrate it with an example.

Ans. Diborane (BH<sub>3</sub>)<sub>2</sub> reacts with alkenes to give trialkyl boranes as addition product. This is oxidised to alcohol by hydrogen peroxide in the presence of aqueous sodium hydroxide.

Q10. Write chemical reaction for the preparation of phenol from chlorobenzene.

Ans. Chlorobenzene is fused with NaOH at 623K and 320 atmospheric pressure. Phenol is obtained by acidification of sodium phenoxide so produced.

Q11. How is aspirin (Acetylsalicylic acid) prepared from salicylic acid?

Ans. Acetylation of salicylic acid produces aspirin.

Q12. Which out of propan-1-ol and propan-2-ol is stronger acid?

Ans. Propan-1-ol is stronger acid than propan-2-ol. The acidic strength of alcohols is in the order 1<sup>o</sup>>2<sup>o</sup>>3<sup>o</sup>.

Q13. What is denaturation of an alcohol?

Ans. The commercial alcohol is made unfit for drinking by mixing in it some copper sulphate (to give it a colour) and pyridine (a foul smelling liquid). It is known as denaturation of alcohol.

Q12. Give IUPAC name of CH<sub>3</sub>OCH<sub>2</sub>OCH<sub>3</sub>

ANS. Dimethoxymethane

Q13. Diethyl ether does not react with sodium. Explain.

Ans. Diethyl ether does not contain any active hydrogen.

Q14. Give two reactions that show the acidic nature of phenol. Compare acidity of phenol with that of ethanol.

Ans. The acidic nature of phenol can be represented by the following two reactions: (i)

Phenol reacts with sodium to give sodium phenoxide, liberating H<sub>2</sub>.

(ii) Phenol reacts with sodium hydroxide to give sodium phenoxide and water as by-products

The acidity of phenol is more than that of ethanol. This is because after losing a proton, the phenoxide ion undergoes resonance and gets stabilized whereas ethoxide ion does not.

Q15. How does phenol react with dilute and conc. HNO<sub>3</sub> ?

Ans. (i) With dilute nitric acid at low temperature (298 K), phenol yields a mixture of ortho and para nitrophenols. (ii) With concentrated nitric acid, phenol is converted to 2,4,6-trinitrophenol. The product is commonly known as picric acid.

Q16. How does phenol react with Br<sub>2</sub> in CS<sub>2</sub> and Bromine water?

Ans. (i) When the reaction is carried out in solvents of low polarity such as CHCl<sub>3</sub> or CS<sub>2</sub> and at low temperature, monobromophenols are formed.

(iii) When phenol is treated with bromine water, 2,4,6-tribromophenol is formed as white precipitate.

### BIOMOLECULES

Q.1. Which functional groups are present in monosaccharides?

Ans -  $\text{—OH}$  and  $\text{—CHO}$  or  $\text{—OH}$  and  $\text{>CO}$

Q2 – Name an aldopentose, aldohexose and ketohexose.

Ans – Ribose, glucose and fructose respectively.

Q3 – What is animal starch?

Ans – Glycogen.

Q4 – Which types of bonds are present in a protein molecule?

Ans – Peptide bonds, hydrogen bonds, sulphide bonds, ionic bonds etc.

Q5 – Which  $\alpha$ -helix or  $\beta$ -helix is more stable?

Ans –  $\alpha$ -helix is right handed and is more stable due to intermolecular H bonding between first and fourth amino acid.

Q6 – The sequence of bases in one strand of DNA is TACGGACA. What is the sequence of bases of complementary strand of DNA.

Ans – ATGCCTGT.

Q7 – Name the vitamin whose deficiency causes rickets?

Ans – Vitamin D.

Q8 – Name the purines present in DNA.

Ans – Adenine and guanine.

Q9 – Give an example of

(a) water soluble (b) fat soluble is

Ans – (a) Vitamin C (b) Vitamin D.

Q10 – Name a protein which is insoluble in water.

Ans – Keratin

Q11 – Name polysaccharides that make up starch and what is the difference between them.

Ans – Amylose which is linear polymer of  $\alpha$ -glucose and amylopectin which is branched polymer of  $\alpha$ -glucose. Amylose is water soluble whereas amylopectin is water insoluble.

Q12 – What are anomers?

Ans – Monosaccharides which differ only in the orientation of the  $\text{—OH}$  group at C-1. e.g.,  $\alpha$ -glucose and  $\beta$ -glucose.

Q13 – Where does the water present in the egg go after boiling the egg?

Ans – On boiling during denaturation process water gets adsorbed/absorbed in the denatured proteins.

Q14 – Write two main functions of carbohydrates in plants.

Ans – (i) structural material (ii) reserved food material.

Q15 – What do you understand by glycosidic linkage?

Ans – During condensation of two monosaccharides, a water molecule is given out and two monosaccharides get linked together by an oxide or ethereal linkage ( $\text{—O—}$ ) called as glycosidic linkage.

Q16 – What are essential and non essential amino acid? Give two examples of each type.

Ans – Essential amino acids are those which are not produced in our body. e.g., valine, leucine. Non-essential amino acids are those which are produced by our body. e.g., glycine and alanine.

Q17 – How do you explain the amphoteric behaviour of amino acids?

Ans – Amino acids have both acidic as well as basic group and they react both with acids as well as bases, therefore they are amphoteric in nature.

Q18 – What is the difference between a nucleoside and a nucleotide?

Ans - Nucleoside = sugar + base

Nucleotide = sugar + base + phosphoric acid

Q19 – What is invert sugar?

Ans – An equimolar aqueous solution of glucose and fructose is called invert sugar.

Q20 – Give reactions with support cyclic structure of glucose.

Ans – (a) Glucose does not give 2,4-DNP test, Schiff's test and sodium hydrogen sulphide test.

(b) The pentaacetate of glucose does not react with  $\text{NH}_2\text{OH}$  indicating absence of free  $\text{—CHO}$  group.

(c) Glucose exists in two crystalline form  $\alpha$  and  $\beta$ .

Q21 – Define with example

(a) Isoelectric point (b) Mutarotation (c) Transcription

Ans –

(a) Isoelectric point – the pH at which there is no net migration of any ion towards electrode. e.g, amino acids have isoelectric point at  $\text{pH} = 5.5\text{--}6.3$  (b) Mutarotation - it is spontaneous change in optical rotation when an optically active substance is dissolved in water. e.g,  $\alpha$ -glucose when dissolved in water changes its optical rotation from  $111^\circ$  to  $52.5^\circ$ .

(c) Transcription – it is process by which m-RNA is generated from DNA. e.g, if DNA has base sequence ATACA then m-RNA has base sequence TATCGT.

Q22 – What happens when glucose reacts with

(a) HI (b)  $\text{HNO}_3$  (c)  $\text{Br}_2$  water

Ans –

(a)  $\text{C}_6\text{H}_{12}\text{O}_6 + \text{HI} \text{-----} \rightarrow \text{n-hexane } \text{C}_6\text{H}_{14}$

(b)  $\text{C}_6\text{H}_{12}\text{O}_6 + \text{HNO}_3 \text{-----} \rightarrow \text{saccharic acid}$

(c)  $\text{C}_6\text{H}_{12}\text{O}_6 + \text{Br}_2 \text{ water -----} \rightarrow \text{gluconic acid}$

Q23 – Differentiate primary, secondary and tertiary structure of protein.

Ans – In primary structure specific sequence of amino acid are present joined by covalent bonds.

-secondary structure is responsible for the shape of a protein.  $\alpha$ -helix and  $\beta$ -pleated in which polypeptide chains have peptide bonds.

-tertiary structure represents overall folding of polypeptide chain and give rise to the fibrous or globular molecular shape.

## **POLYMER**

1. Arrange the following polymers in increasing order of their intermolecular forces.

(i) Nylon 6,6, Buna-S, Polythene.

(ii) Nylon 6, Neoprene, Polyvinyl chloride

Ans. (i) Buna-S < Polythene < Nylon 6,6

(ii) Neoprene < Polyvinyl chloride < Nylon 6.

2. Classify the following as addition and condensation polymers: Terylene, Bakelite, Polyvinyl chloride, Polythene.

Ans. (i) addition polymers : Polyvinyl chloride, Polythene.

(ii) condensation polymers: Terylene, Bakelite.

3. What is a biodegradable polymer? Give an example of a biodegradable aliphatic polyester.

Ans. Polymers which disintegrate by themselves over a period of time due to environmental degradation by bacteria, etc. are called biodegradable polymers. e.g. PHBV

4. How can you differentiate between addition and condensation polymerization

Ans. In addition polymerization the molecules of the same monomer or different monomers add together on a large scale to form a polymer. The monomers used are unsaturated compounds, e.g., alkenes, alkadienes and their derivatives.

Condensation polymerisation generally involves a repetitive condensation reaction between two bi-functional monomers. These polycondensation reactions may result in the loss of some simple molecules as water, alcohol, etc., and lead to the formation of high molecular mass condensation polymers. e.g., Nylon 6,6.

5. What is meant by PTFE? Give its popular name.

Ans. Polytetrafluoroethylene. It is called Teflon.

6. Write chemical name of (Ziegler-Natta catalyst).

Ans: Triethylaluminium and titanium tetrachloride

7. Write down the two differences between thermoplastic and thermosetting plastic and examples.

Ans: Thermoplastics are the linear or slightly branched long chain molecules capable of repeatedly softening on heating and hardening on cooling.

These polymers possess intermolecular forces of attraction intermediate between elastomers and fibres. Some common thermoplastics are polythene, polystyrene, polyvinyls, etc.

Thermosetting plastic polymers are cross linked or heavily branched molecules, which on heating undergo extensive cross linking in moulds and again become infusible.

These cannot be reused. Some common examples are bakelite, urea-formaldehyde resins, etc.

8. Differentiate Novolac and Bakelite on the basis of structure.

Ans: A linear product of Phenol - formaldehyde polymer is Novolac,

used in paints. Novolac on heating with formaldehyde undergoes cross linking to form an infusible solid mass called bakelite. It is used for making combs, phonograph records, electrical switches and handles of various utensils.

9. Distinguish between the terms homopolymer and copolymer and give an example of each.

Ans: The addition polymers formed by the polymerisation of a single monomeric species are known as homopolymers, e.g., polythene.

The polymers made by addition polymerisation from two different monomers are termed as copolymers, e.g., Buna-S, Buna-N, etc.

10. How will you differentiate between LDP and HDP?

Ans: Low density polythene: It is obtained by the polymerisation of ethene under high pressure of 1000 to 2000 atmospheres at a temperature of 350 K to 570 K in the presence of traces of dioxygen or a peroxide initiator (catalyst).

Low density polythene is chemically inert and tough but flexible and a poor conductor of electricity. e.g., squeeze bottles, toys and flexible pipes.

High density polythene: It is formed when addition polymerisation of ethene takes place in a hydrocarbon solvent in the presence of a catalyst Ziegler-Natta catalyst at a temperature of 333 K to 343 K and under a pressure of 6-7 atmospheres.

HDP consists of linear molecules and has a high density due to close packing. It is more tougher and harder. It is used for manufacturing buckets, dustbins, bottles, pipes, etc.

11. Write the names of monomers of the following polymers:

(i) Nylon 6,6 (ii) Neoprene (iii) Buna-N

Ans. (i) hexamethylenediamine and adipic acid.

(ii) chloroprene.

(iii) 1,3-butadiene and acrylonitrile.

12. How are polymers classified on the basis of structure?

Ans. On the basis of structure, the polymers are classified as below:

- (i) Linear polymers such as polythene, polyvinyl chloride, HDP etc.
- (ii) Branched chain polymers such as low density polythene, LDP, etc.
- (iii) Cross linked polymers such as bakelite, melamine, etc.

13. Write the monomers of the following polymers:

- (i) Buna-N (ii) Teflon (iii) Neoprene.

Ans. (i) 1, 3 – butadiene and acrylonitrile (ii) tetrafluoroethene (iii) chloroprene.

14. Write use of each orlon and Nylon-6.

Ans: use of orlon is clothing as a substitute for wool & for Nylon-6. use of Nylon-6 is as fabrics