

CHAPTER 1: SOLID STATE

1 MARKS QUESTIONS

Q.1. The edge length of a unit cell having molecular weight 75g/mol is 5 \AA which crystallizes in bcc lattice. If the density is 2g/cc then find the radius of the metal atom.

A.1. $r = 216.5 \text{ pm}$

Q.2. Potassium crystallizes in bcc lattice. Calculate the approximate number of unit cell in 1 gm of potassium. (atomic mass of K = 39)

A.2. 7.72×10^{21}

Q.3. A compound is formed by two elements M & N. The element N forms ccp & atoms of M occupy $\frac{1}{3}$ rd of tetrahedral voids. What is the formula of the compound?

A.3. M_2N_3

Q.4. A unit cell consists of a cube in which there are atoms A at the corners and atoms B at the face centers. Two A atoms are missing from the two corners of a unit cell. What is the formula of the compound?

A.4. AB_4

Q.5. Analysis shows that nickel oxide has formula Ni_{0.98}O_{1.00}. What fraction of nickel exist as Ni²⁺ and Ni³⁺.

A.5. Ni²⁺ = 96% Ni³⁺ = 4%

Q.6. If NaCl is doped with 10^{-3} mol % of SrCl₂. What is the concentration of cation vacancy?

A.6. $10^{-3} / 100 \text{ mol} = 10^{-5} \times 6.022 \times 10^{23} = 6.022 \times 10^{18}$

Q.7. Under what conditions will sodium chloride conduct electricity

A.7. molten state or in aq. Solution

Q.8. Name the binding force in each of the following.

(a) Molecular (b) Ionic (c) Covalent (d) Metallic.

A.8. (a) vanderwaals forces (b) electrostatic (c) covalent bond (d) metallic bond

Q.9. Differentiate between anisotropy & isotropy by giving examples.

A.9. Substances show different properties in different direction & the reverse

Q.10. Derive the relationship between edge length and radius of atom in fcc unit cell.

A.10. $a = 2.2^{1/2} r$

Solid State

2 Marks questions

Short Answer Type I .

Q.1:- Why does ZnO appear golden yellow on heating ?

Q.2:- Differentiate Schottky and Frenkel defect.

Q.3:- Explain the following -

(i) F-Centre

(ii) Doping

Q.4:- Differentiate crystalline and amorphous solid.

Q.5:- Why does the window glasses of the old buildings look milky ?

Q.6:- Explain the with suitable examples -

(i) 13 - 15 Compounds

(ii) 12 - 16 Compounds

Q.7:- Under which situations can an amorphous substance change to crystalline form ?

Q.8:- A Cubic solid is made of two elements P and Q atoms of Q are at the corners of the cube and P at the centre. What is the formula of the compound ? What are the co-ordination numbers of P and Q /

Q.9:- Calculate packing efficiency for F.C.C. crystal lattice.

Q.10:- Explain Schottky defect with diagram.

UNIT 1 THE SOLID STATE
SHORT ANSWER TYPE QUESTIONS (2 MARKS)

Q-1. What are F-centers? Why are the solids containing the F-centers paramagnetic?

A-1. The free electrons trapped in the anion vacancies are termed as the F-centers. The solids containing the F-centers are paramagnetic because the electrons occupying the vacant sites are unpaired.

Q-2 A unit cell consists of a cube in which there are anions at each corner and one at the center of the unit cell. The cations are at the center of each face. How many A) cations and B) anions make up the unit cell? C) What is the simplest formula of the compound?

A-2. A) The cation at the center of each face is shared by two unit cells.
Hence no. of cations = $6 \times \frac{1}{2} = 3$

B) The anion at each corner is shared by 8 unit cells. The anion at the center is not shared by any other unit cell.

Hence no. of anions = $8 \times \frac{1}{8} + 1 = 2$

C) Since there are 3 cations and 2 anions the simplest formula of the compound is A_3B_2 .

Q-3. Excess of potassium in the KCl makes the crystal appear violet. Explain why?

A-3. When KCl is heated in an atmosphere of K metal vapour, the metal K deposits on the surface of the KCl crystal. The chloride ions diffuse into the surface and combine with K atoms. The electrons produced by the ionization of the K atoms then diffuse into the crystals and are then trapped in the anion vacancies called F-centers. The excess of the K in KCl makes the crystal appear violet.

Q-4. The two ions A^+ and B^- have radii 88 and 200 pm respectively. In the close packed crystal of compound AB, predict the coordination number of A.

A-4. In the close-packed arrangement, A^+ will be in the interstices of the close-packed arrangement of B^-

Radius of cation = 88 pm

Radius of anion = 200 pm

Radius ratio = $r^+/r^- = 88\text{pm}/200\text{pm} = 0.44$

Since the radius ratio lies between 0.414—0.732, the ion A^+ MUST OCCUPY THE OCTAHEDRAL SITE. Hence the coordination no. of A^+ is 6.

Q-5. A solid AB has NaCl structure. If the radius of the cation A^+ is 140 pm calculate the maximum possible values of the radius of anion B^- .

A-5. Radius ratio = $r^+/r^- = 0.414$

$$\begin{aligned} \text{OR } 140/r_B &= 0.414 \\ \text{SO } r_B &= 140/0.414 \\ &= 338 \text{ pm} \end{aligned}$$

Q-6. Copper crystallises in face-centred cubic lattice and has a density of 8.930 g mol^{-3} at 293 K. Calculate the edge length of unit cell. [At. mass of Cu = 63.5 a.m.u, Avogadro's constant $N_A = 6.02 \times 10^{23}$].

Ans6. Density = Mass of unit cell/Volume of unit cell
 $8.93 = (4 \times 63.5)/(a^3 \times 6.02 \times 10^{23})$.
 $a^3 = 47.24 \times 10^{-24}$
 $a = 3.6 \times 10^{-8} \text{ cm.} = 360 \text{ pm.}$

Q7. The edge length of NaCl unit cell is 500 pm. What is the density of NaCl in g/cm^3 ?
 $[N_A = 6.02 \times 10^{23}, \text{Na} = 23.0, \text{Cl} = 35.5 \text{ a.m.u.}]$

Ans7. $d = (4 \times 58.5)/[6.02 \times 10^{23} \times (500 \times 10^{-10})^3]$
 $= 3.12 \text{ g/cm}^3$.

Q.-8 Addition of CdCl_2 to the crystal of AgCl will produce schottky defect, but the same is not produced when NaCl crystal are added, Why ?

Ans. The replacement of one Ag^+ ion with Cd^{2+} ion necessitates the removal of other Ag^+ ion from the lattice to maintain the electrical neutrality of the crystal. But in case of NaCl , Na^+ and Ag^+ both are monovalent.

Q.9 Ferromagnetic and Ferrimagnetic substances become paramagnetic upon heating . Why ?

Ans. The temperature at which they are changed into paramagnetic is called curie temperature. This is because the realignment of electrons spin or their magnetic moments which are now oriented in one particular direction.

Q.10 Explain the term 'dislocations' in relation to the crystal.

Ans. The defects which result from improper orientation of planes with respect to one-another in the crystal are called dislocations.

Q.11 Sodium metal is quite soft whereas NaCl crystals are quite hard. Why?

Ans. In sodium metal, atoms are held together by weak metallic bond but in NaCl crystal Na⁺ and Cl ions are held together by strong ionic bonds.

Q.12 Diamond and solid rhombic sulphur both are covalent solids but latter has very low. M.P. Why ?

Ans. Diamond is three dimensional net work covalent solid with strong inter atomic forces where as sulphur consists of packered ring structure (S₈) in which atoms are held together by weak vander waal forces.

Q13. An element of atomic mass 98.5 g mol⁻¹ occurs n FCC structure. If its unit cell edge length is 500 pm and its density is 5.22 g cm⁻³, what will be the value of Avogadro's constant?

$$\text{Ans13. } N = (4 \times 98.5) / [5.22 \times (500 \times 10^{-10})^3] \\ = 6.023 \times 10^{23}.$$

Q14. Cr has mono atomic body-centred cubic structure. Its cell edge is 400 pm. What is its density? [Atomic mass of Cr = 52 g mol⁻¹, N_A = 6.023 x 10²³]

$$\text{Ans14. } d = (2 \times 52) / [6.023 \times 10^{23} (400 \times 10^{-10})^3] \\ = (2 \times 52 \times 10) / (6.023 \times 64) = 2.697 \text{ g cm}^{-3}.$$

Q15. The edge length of the unit cell is 408 pm. Its density is 10.6 g cm⁻³ predict whether the metal X is body-centred or face centred or simple cubic. [Molar mass of metal X = 107.9 g, N_A = 6.023 x 10²³]

$$\text{Ans16. } Z = (d \times N \times a^3) / M \\ = [10.6 \times 6.023 \times 10^{23} \times (408 \times 10^{-10})^3] / 107.9 = 4 \\ \text{Therefore it is a f.c.c. crystal.}$$

Q17. The unit cell of an element of atomic mass 96 and density 10.3 g cm⁻³ is a cube with edge length of 314 pm. Find the structure of the crystal lattice. (Simple cubic, FCC or BCC). [N_A = 6.023 x 10²³]

Ans17. $Z = \frac{(d \times N \times a^3)}{M}$
 $= \frac{[10.3 \times 6.023 \times 10^{23} \times (314 \times 10^{-10})^3]}{96} = 2$
 Therefore it is a BCC crystal

Question Bank

Solutions

2 Marks Questions

1. Why do we observe abnormal colligative properties?

Ans: Because of –

- (i) Association of particles of solute after dissolution. It decrease number of particles of solute so as the value of colligative property.
- (ii) Dissociation of particles of solute after dissolution. It increases number of particles of solute so as the value of colligative property.

2. What kind of solutions can't be separated by distillation and why? Explain with example.

Ans: Constant boiling liquids/azeotropes can't be separated by distillation because at a certain composition vapour pressures of both of them become same and they boil simultaneously. As aq. solution of 20.1% HCL and 68% HNO₃ can not be made more concentrated by distillation.

3. 'Henry's Law is special case of Raoult's Law. Explain how?

Ans: According to Raoult's Law-

$$P_1 = P_1^\circ \chi_1$$

According to Henry's Law-

$$P = K_H \chi_g$$

As vapour pressure of liquid increases with increase in mole fraction of it in solution as mole fraction of gas in solution increases with increase in pressure of the gas. In this condition K_H can be taken equivalent to P_1° .

4. Arrange in increasing order of boiling points-

- (a) 1 m solution of NaCl
- (b) 1 m solution of glucose
- (c) 1 m solution of K₄[Fe(CN)₆]
- (d) 1 m solution of K₂Cr₂O₇

Ans: on the basis of values of Van't Hoff Factors-

1m solutions of Glucose (i = 1) < NaCl (i = 2) < K₂Cr₂O₇(i = 3) < K₄[Fe(CN)₆] (i = 5)

5. The solubility of Ba(OH)₂.H₂O at 298 K is 5.6 g per 100 g of water. What is the molality of OH⁻ ions in saturated solution?

Ans: $m = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute} \times \text{Mass of Solvent(g)}} \times 1000$

$$m(\text{Ba(OH)}_2 \cdot \text{H}_2\text{O}) = \frac{5.6 \times 1000}{189 \times 94.4} = 0.314 \text{ m}$$

$$m(\text{OH}^-) = 2 \times m(\text{Ba}(\text{OH})_2 \cdot \text{H}_2\text{O}) = 0.314 \times 2 = \mathbf{0.628 \text{ m}}$$

6. What mass of 68% H_2SO_4 will be required to make 2L solution of 5M molarity?

$$\text{Ans: Mass of } \text{H}_2\text{SO}_4 \text{ in 5M solution} = M \times \text{MM} \times V (\text{L}) = 5 \times 98 \times 2 = 980 \text{ g}$$

$$68 \text{ g of } \text{H}_2\text{SO}_4 = 100 \text{ g of 68\% } \text{H}_2\text{SO}_4$$

$$980 \text{ g of } \text{H}_2\text{SO}_4 = 100 \times 980 / 68 = \mathbf{1441.18 \text{ g}} \text{ of 68\% } \text{H}_2\text{SO}_4$$

7. A solution containing 18 g of non volatile solute in 200 g of water, freezes at 270.07 K. calculate molar mass of the solute.

$$\text{Ans: } \Delta T_f = T_f - T_f^\circ = 273.15 - 270.07 = 3.08 \text{ K}$$

$$M_2 = K_f \times W_2 \times 1000 / \Delta T_f \times W_1 = 1.86 \times 18 \times 1000 / 3.08 \times 200 = \mathbf{54.35 \text{ g/mol}}$$

8. If Van't Hoff factor for CH_3COOH is 0.56, calculate observed molar mass of it. Also predict whether the solute is associated or dissociated?

$$\text{Ans: observed molar mass} = \text{calculated molar mass} / i = 60 / 0.56 =$$

$$107.14 \text{ g/mol. Value of}$$

'i' is lesser than 1, hence solute is associated.

9. A solution of urea in water has boiling point of 373.328 K. calculate the freezing point of same solution.

$$\text{Ans: } \Delta T_b / \Delta T_f = K_b / K_f = 0.178 \times 1.86 / 0.52 = 0.6367 \text{ K}$$

$$T_f = \mathbf{-0.6367 \text{ K}}$$

10. 0.1 mole of CH_3COOH , dissolved in 1 Kg of a solvent, shows depression in freezing point equal to 02.56 K. what is the order of polymerization?

$$\text{Ans: } i = \Delta T_f / K_f \times m = 02.56 \times 1.86 \times 0.1 = 0.476$$

Order of polymerization is approx. 0.5, which means dimerization takes place.

SOLUTIONS

Question bank

02 Marks - Questions

1. Differentiate between molarity and molality. What is the effect of change in temperature of a solution on molarity and molality ?

Ans. Molarity is defined as the ratio no. Of moles of solute to the volume of solution in litres.

Molality is defined as the no. Of moles of solute in 1 Kg of solvent.

On changing temp. molarity changes as volume changes but molality remains unaffected as mass of solvent remains unchanged on changing temp.

2. H_2SO_4 used in lead storage battery is 38% by mass and has a density of 1.30 g cm^{-3} . Calculate its molarity.

Ans. moles of $\text{H}_2\text{SO}_4 = 38/98 = .387$

Volume of solution = mass/density

$$= 100/1.30 = 76.92 \text{ ml}$$

Molarity = moles of H_2SO_4 / volume of solution

$$= .387 \times 1000 / 76.92$$

$$= 5.013 \text{ M}$$

3. If N_2 gas is bubbled through water at 293 K, how many millimoles of N_2 gas would dissolve in 1 litre of water? Assume that N_2 exerts a partial pressure of 0.987 bar. Given that Henry's law constant for N_2 at 293 K is 76.48 kbar ?

Ans. $P = K_H x$

$x = P / K_H$

$$= .987 / 76.48 \times 1000$$

$$= .0000129053$$

SOLUTIONS

Question bank

$$\text{Moles of water} = 1000/18 = 55.5$$

$$xN_2 = n \text{ of } N_2 / n \text{ of } N_2 + n \text{ of } H_2O$$

$$.0000129053 = x/x + 55.5$$

Neglecting x from denominator we get

$$X = .000716$$

Or no. Of millimoles of $N_2 = .716$ millimoles.

4. Write two differences between ideal and non-ideal solutions.

Ans. IDEAL SOLUTION

NON IDEAL SOLUTION

1) It obeys Raoult's Law.

1) It does not obey Raoult's Law.

2) $P_{\text{solution}} = P_A + P_B$

2) P_{solution} is not equal to $P_A + P_B$.

3) $\Delta H_{\text{mixing}} = 0$

3) ΔH_{mixing} is not equal to 0.

4) $\Delta V_{\text{mixing}} = 0$

4) ΔV_{mixing} is not equal to 0.

5. Define the freezing point. Why the freezing point of a solvent gets lowered on dissolving a non-volatile solute into it?

Ans. Freezing point of a solution is defined as the temperature at which the vapour pressure of its liquid phase becomes equal to the vapour pressure of its solid phase. When a non-volatile solute is added to a volatile solvent its vapour pressure decreases and it would become equal to that of solid solvent at lower temperature. Hence its freezing point gets depressed.

6. The vapour pressure of water is 12.3 kPa at 300K. Calculate the V.P. of 1 molal solution of a non-volatile solute in it.

$$\text{Ans. No. Of moles of water} = 1000/18 = 55.5$$

$$\text{Mole fraction of solute} = 1/1 + 55.5 = 0.0177$$

$$X_{\text{solute}} = P_A^\circ - P_s / P_A^\circ$$

SOLUTIONS

Question bank

$$.0177 = 12.3 - P_s / 12.3$$

$$\text{Or } P_s = 12.08 \text{ KPa.}$$

7. Calculate the mass of Urea required in making 2.5 Kg of 0.25 molal aqueous solution.

$$\text{Ans. moles of Urea} = 0.25$$

$$\text{Molar mass of Urea} = 60$$

$$\text{Mass of Urea} = 0.25 \times 60 = 15 \text{ g}$$

$$\text{Mass of solvent} = 1000 \text{ g}$$

$$\text{Mass of solution} = 15 + 1000 = 1015 \text{ g}$$

$$1015 \text{ g of solution has } = 15 \text{ g of Urea}$$

$$\text{Hence } 2500 \text{ g of aqueous solution has } = 15 / 1015 \times 2500 \text{ g of urea}$$

$$= 36.95 \text{ g.}$$

8. Determine the osmotic pressure of a solution prepared by dissolving 2.5mg of K_2SO_4 in 2L of water at 25C, assuming that it is completely dissociated.

$$\text{Ans. } \pi = i w R T / M V$$

$$i \text{ of } \text{K}_2\text{SO}_4 = 3$$

$$w = .025 \text{ g}$$

$$R = .0821 \text{ L atm/K/mole}$$

$$T = 298 \text{ K}$$

$$M \text{ of } \text{K}_2\text{SO}_4 = 174$$

$$V = 2 \text{ L}$$

$$\pi = 3 \times .025 \times .0821 \times 298 / 174 \times 2$$

SOLUTIONS

Question bank

$$=.00527\text{Atm.}$$

9. A 1 molal aqueous solution of trichloroacetic acid is heated to its boiling point. The solution has B.P. Of 100.18 degree Celsius. Determine the Van't Hoff factor for trichloroacetic acid. K_b for water = 0.512 K Kg /mole.

$$\text{Ans. } \Delta T_b = i K_b m$$

$$100.18 - 100 = i \times 0.512 \times 1$$

$$i = .18 / .512 = 0.35.$$

10. Henry's law constant for the solution of methane in benzene is 4.27 x 100000 mm of Hg. Calculate the solubility of methane in benzene at 298K under 760 mm of Hg.

$$\text{Ans. According to Henry's law } P = K_H X$$

$$\text{Hence } X = P / K_H$$

$$= 760 / 4.27 \times 100000$$

$$=.00178.$$

CHAPTER 3. SOLUTION

Short answer type questions (2 marks)

Q.11 Why is benzene insoluble in water but soluble in toluene ?

Ans. Benzene is non polar, therefore insoluble in water (polar solvent) where as it is soluble in toluene which is non-polar solvent i.e. non polar compounds are soluble in nonpolar solvents and polar compounds are soluble in polar solvents.

Q.12 A solution containing 18g of non-volatile solute in 200g of water freezes at 272.07 K . Calculate the molecular mass of solute ?

Ans. $\Delta T_f = 273 - 272.07 = 0.93$

$$\Delta T_f = \frac{K_f \times W_B \times 1000}{M_B \times W_A}$$

$$\Rightarrow 0.93 = \frac{1.86 \times 18 \times 1000}{M_B \times 200}$$

$$M_B = 180 \text{ g mol}^{-1}$$

Q.13 Calculate molality of glucose solution containing 2.82 g of glucose in 30 g of water ? [Atomic mass of C = 12, H = 1, O = 16]

Ans $m = \frac{W_B \times 1000}{M_B \times W_A \text{ in grams}}$
 $= \frac{2.82 \times 1000}{180 \times 30}$
 $= 0.52 \text{ mol/kg}$

$$[\text{M. wt. of } C_6H_{12}O_6 = 6 \times 12 + 12 \times 1 + 6 \times 16 = 180]$$

Q. 14 2.46 g of NaOH(molar mass 40 a.m.u.) are dissolved in water and solution is made to 100 cm³ . Calculate molarity of solution ?

Ans . $M = \frac{W_B \times 100}{M_B \times \text{Vol. of solution in mL}}$
 $= \frac{2.46 \times 1000}{40 \times 100} = 0.615 \text{ mol L}^{-1}$

Q.15 Conc. H₂SO₄ has a density 1.9 g/mL and is 99% H₂SO₄ by mass. Calculate the molarity of H₂SO₄ ?

Ans. $V = \frac{M}{d} = 100/1.9 \text{ g cm}^{-3}$

$$M = \frac{W_B \times 1000}{M_B \times \text{Vol. of solution in cm}^3}$$

$$= \frac{99 \times 1000}{98 \times 100/1.9} = 19.19 \text{ molL}^{-1}$$

Q.16 Calculate the mass of non-volatile solute (molecular mass 40) which should be dissolved in 114 g octane to its vapour pressure to 80 % ?

$$\begin{aligned} \text{Ans. } \frac{P_A^0 - P_A}{P_A^0} &= x_B \Rightarrow \frac{100 - 80}{100} = \frac{W_B/M_B}{W_A/M_A} \\ &\Rightarrow \frac{20}{100} = \frac{W_B \times 114}{40 \times 114} \\ \Rightarrow W_B &= \frac{40 \times 20}{100} = 8\text{g} \end{aligned}$$

Q.17 State Henry's Law and mention its two important applications ?

Ans . Henry's Law states that the solubility of a gas in liquid is directly proportional to the partial pressure of the gas.

Applications:-

- 1) In deep sea diving.
- 2) In aerated water e.g. soft drinks.

Q.18 Why do gases nearly always tend to be less soluble in liquids as the temperature is raised ?

Ans. As the temperature of gaseous solution in liquid increase the kinetic energy of molecules escape out from solution and show low solubility at high temperature.

Q.19 What role does the molecular interaction play in solution of alcohol and water?

Ans. In alcohol and water solution interaction between alcohol and water molecules show inter molecular hydrogen bonding but it is weaker than water – water and alcohol – alcohol hydrogen bonding.

Q20. Why CaCl₂ is used to clear snow from roads on hill stations ?

Ans. CaCl₂ is used to clear snow from roads on hill stations because it causes depression in freezing point ,so snow melts into liquid state. Water flows easily and roads get cleared.

TOPIC -ELECTROCHEMISTRY

2 Mark Question

Q.1. Why the variations of equivalent conductance on dilution of a strong electrolyte differ from that of a weak electrolyte?

Ans- In strong electrolytes, the increase in equivalent conductance is due to weakening of the ion-ion interaction on dilution which increases ionic mobility as a result of solvation effect. On the other hand in weak electrolytes the increase in equivalent conductance is also due to increases in degree of dissociation of weak electrolyte with dilution.

Q.2. Through Li^+ is smaller in size than Cs^+ , the equivalent conductance of Li^+ is lower than that of Cs^+ . Why

Ans- Being smaller in size Li^+ ions in solution are highly hydrated as compared with larger Cs^+ ions in solution. Consequently $\text{Li}^+(\text{H}_2\text{O})_n$ is bigger in size than $\text{Cs}^+(\text{H}_2\text{O})_n$ and hence are less mobile. Equivalent conductance of Li^+ ions in solution is therefore less than as compared with that of Cs^+ ions.

Q.3.: Iron may be protected from rusting by coating with zinc or tin. By referring to the electrode potentials given explain why zinc protects iron effectively than tin once the protective coating has been scratched.

$$E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}; E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.44\text{V}; E_{\text{Sn}^{2+}/\text{Sn}}^0 = -0.14\text{V}$$

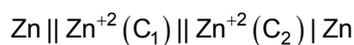
OR

Why galvanisation of iron is preferred over tinning?

Ans - Standard reduction potential of zinc is less than that of iron. Therefore, even if some surface of iron gets exposed by the scratching of protective surface, zinc acts as anode and iron acts as cathode. As such iron cannot get rusted. But in case of tin its standard reduction potential is more than that of iron. As such one the tin coating gets scratched, iron begins to acts as anode while tin acts as cathode. Consequently electrochemical cell is set up and iron begins to get rusted rapidly.

Q.5. What are concentration cells?

Ans- These are those cells in which there is no resultant chemical reaction due to the fact that the reaction occurring in one half cell is exactly reversed in other cell.



The electrical energy arises because of transfer of a substance from the solution of higher concentration around one electrode to that of lower concentration around the other electrode.

cises 6: How many hours does it take to reduce 3 mol of Fe^{3+} to Fe^{2+} with 2.00 amp current

Ans- . 40.2 hours

Exercises 7: The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^3 \text{ ohm}$. Calculate the resistivity, conductivity and molar conductivity.

Ans- 87.135 r cm, $0.01148 \text{ S cm}^{-1}$, $229.6 \text{ S cm}^2 \text{ mol}^{-1}$.

Q. 8: The molar conductance of NaOH, NaCl and BaCl_2 at infinite dilution are 2.481×10^{-2} , 1.265×10^{-2} and $2.800 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$ respectively. Calculate molar conductivity of $\text{Ba}(\text{OH})_2$.

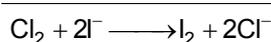
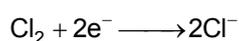
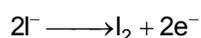
Ans- $5.232 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$

Q.9.. Why is a salt bridge not necessary in lead storage cell?

Sol. In lead storage cell, the oxidant (PbO_2), reduction (Pb) and their redox product (PbSO_4) are solids. Thus half cells need not to be in separate vessels; also they have common electrolyte solution of 40% of H_2SO_4 .

Q.10. Colour of KI solution containing starch turns blue when Cl_2 water is added. Explain.

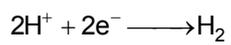
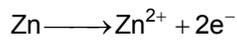
Sol. Chlorine is placed below iodine in electrochemical series having higher E_{Red}^0 and thus undergoes reduction whereas I^- undergoes oxidation.



The I_2 so formed gets absorbed in starch to give blue colour.

Q.11. Why will Ag not react with dil. H_2SO_4 whereas zinc reacts?

Sol. Ag is placed lower than hydrogen in electrochemical series having higher E_{red}^0 and thus reduction of Ag^+ occurs in place of H^+ whereas Zn being above H in the series will be oxidised to Zn^{2+} and H^+ will be reduced to H_2 .



ELECTROCHEMISTRY

2 Marks

(Q.1) Calculate molar conductivity of solution of MgCl_2 at infinite dilution from the given data.

$$\lambda_{\text{Mg}^{2+}} = 107.12 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$$

$$\lambda_{\text{Cl}^-} = 76.34 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$$

(Ans)



$$\begin{aligned}\lambda_m^\infty(\text{MgCl}_2) &= \lambda^\infty(\text{Mg}^{2+}) + 2\lambda^\infty\text{Cl}^- \\ &= 107.12 + 2 \times 76.34 \\ &= 107.12 + 152.68 \\ &= 259.8 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}\end{aligned}$$

(Q.2) When 3 ampere of electricity is passed for 45 minutes 2.0 g of metal is deposited. Find equivalent weight of metal.

(Ans) $Q = I \times t$

$$= 3 \times 45 \times 60 = 8100 \text{ C}$$

8100 C of electricity deposits 2.0 g of metal

$$96500 \text{ C of electricity deposits} = (2.0/8100) \times 96500$$

$$= 23.82 \text{ g of metal}$$

Eq. Wt. of metal is 23.82 g.

(Q.3) Find the value of equilibrium constant from the following data-

$$E_{\text{cell}}^\circ = 0.295 \text{ V}, T = 25^\circ\text{C}, n = 2$$

(Ans)

$$E_{\text{cell}}^\circ = \frac{0.0591}{n} \log K$$

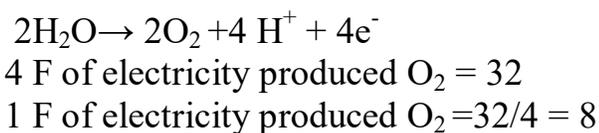
$$\text{Or } 0.295 = \frac{0.0591}{2} \log K$$

$$\log K = \frac{0.295}{0.0295} = 10$$

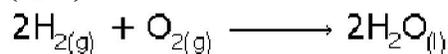
$$K = 10^{10}$$

(Q4) How many grams of oxygen will be produced at STP on passing 1 F of electricity from water?

(Ans)



(Q.5) Find emf of H₂-O₂ fuel cell from the following data –



$$\Delta G_f^\circ \text{H}_2\text{O} = -235 \text{ kJ mol}^{-1}$$

(Ans)

$$\Delta G_f^\circ = -235 \text{ kJ mol}^{-1} = -235 \times 10^3 \text{ mol}^{-1}$$

$$= \Delta G_f^\circ = -nFE_{\text{cell}}^\circ$$

$$E_{\text{cell}}^\circ = \frac{\Delta G^\circ}{-nF} = \frac{-235 \times 10^3}{-2 \times 96500}$$

$$= 1.218 \text{ V}$$

(Q.6) The emf of Zn – Cu cell is 1.1 V at 298 K. Calculate equilibrium constant of reaction.

(Ans)



$$\therefore n = 2$$

$$E^\circ = \frac{0.0591}{n} \log K$$

$$\text{or, } 1.1 = \frac{0.0591}{2} \log K$$

$$\text{or } \log K = \frac{1.1 \times 2}{0.0591} = 37.22$$

$$K = \text{Antilog } 37.22 = 1.68 \times 10^{37}$$

(Q.7) Calculate standard free energy change for the following chemical reaction –



$$\text{Cd}^{2+}/\text{Cd} = E^\circ = -0.40 \text{ V}, \text{Ag}^+/\text{Ag} = 0.80 \text{ V}$$

(Ans)

It is clear from E° data that Ag is anode and Cu is Cathode.

$$E_{\text{cell}}^\circ = E_c^\circ - E_A^\circ$$

$$= 0.80 - (-0.40)$$

$$= 1.20 \text{ V}$$

$$n = 2$$

$$\Delta G = -nE^\circ F$$

$$= -2 \times 1.20 \times 96500$$

$$= -231600 \text{ J} = -231.6 \text{ kJ}$$

(Q.8) Calculate mass of copper deposited when a current of 0.3 ampere is passed in aq solution of copper sulphate for two hour.

(Ans) Equivalent wt. of Cu = At.Wt./Valency

$$= 63.5 / 2 = 31.75$$

$$Z \text{ for Cu} = 31.75 / 96500$$

$$= 3.29 \times 10^{-4} \text{ gC}^{-1}$$

$$W = Z I t = 3.29 \times 10^{-4} \times 0.3 \times 2 \times 3600 = 0.7106 \text{ g.}$$

(Q9) Calculate the number of coulombs required to deposit 7.25g of Al.

(Ans)



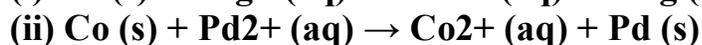
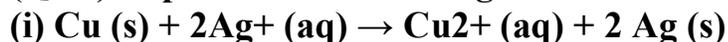
27g (= 1 mole) of Al is deposited by = 3 moles of e^-

Charge required to deposit 27g of Al = $3 \times 96500 \text{ C}$

$$\therefore \text{Charge required to deposit 7.25g of Al} = \frac{3 \times 96500}{27} \times 7.25$$

$$= 77736.11 \text{ C.}$$

(Q.10) Represent the following cell reactions as galvanic cell -



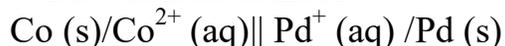
(Ans) (i) In this reaction copper is oxidized to Cu^{2+}

Cu will act as anode. Ag^+ is reduced to Ag during reaction. Ag will act as cathode.

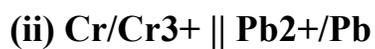
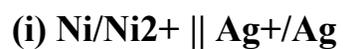


(ii) In this reaction cobalt is oxidized and Pd is reduced. So, Co acts as anode and

Pd acts as cathode.



(Q.11) Write the half cell reaction and net cell reaction for following electrodes -



(Ans)

(i)



(ii)



ELECTROCHEMISTRY

2 marks question.

Q.1. Give an example of a fuel cell and write the cathode and anode reaction for it.

Ans. The cell which converts combustion energy to fuel in to electricity.

Exe. methane and hydrogen can be used as fuel



Q.2. How many moles of mercury will be produced by electrolyzing 1.0M $\text{Hg}(\text{NO}_3)_2$ solution with a current of 2.00 A for three hours?

Ans. $\text{Hg}(\text{NO}_3)_2 = 200.6\text{g}$

Q.3. Suggest a list of metals that are extracted electrolytically.

Ans. Metals that are on the top of the reactivity series such as sodium, potassium, calcium, lithium are extracted electrolytically.

Q.4. Can you store copper sulphate solution in a zinc pot?

Ans. Zinc is more reactive than copper. Therefore zinc can displace copper from its salt solution. so it can not possible.

Q.5. How do you determine the standard electrode potential of the system Mg^{2+}/Mg .

Ans. It can be measured with respect to standard hydrogen electrode.

Q.6.) Calculate mass of copper deposited when a current of 0.3 ampere is passed in aq solution of copper sulphate for two hours.

(Ans) Equivalent wt. of Cu = At. Wt./Valency = $63.5 / 2 = 31.75$

$$Z \text{ for Cu} = 31.75 / 96500 = 3.29 \times 10^{-4} \text{ gC}^{-1}$$

$$W = Z I t = 3.29 \times 10^{-4} \times 0.3 \times 2 \times 3600 = 0.7106 \text{ g.}$$

Q.7. Calculate the equilibrium constant of the reaction: $\text{Cu}(s) + 2\text{Ag}^+(aq) = \text{Cu}^{2+}(aq) + 2\text{Ag}(s)$

$$E^\circ \text{ cell} = 0.46 \text{ V}$$

$$\text{Ans. } E^\circ \text{ cell} = 0.059 / 2 \log K_C = 0.46 \text{ V}$$

$$\text{Or } \log K_C = 0.46 \times 2 / 0.059 = 15.6$$

$$K_C = 3.92 \times 10^{15}$$

Q.8. Arrange the following metals in the order in which they displace each other from the solution of their salts

Al, Cu, Fe, Mg

Ans. $\text{Cu} < \text{Fe} < \text{Al} < \text{Mg}$

Q.9. Why does the conductivity of a solution decrease with dilution.

Ans. Because number of ions decreases per unit volume

Q.10. How much electricity is required in coulomb for the oxidation of

i) 1 mol of H_2O to O_2

ii) 1 mol of FeO to Fe_2O_3

Ans. i) 2F ii) 1F

Chapter 4 chemical kinetics

1 marks questions

2 marks questions

Q1. Identify the reaction order from each of the following rate constants:

a) $k = 2.3 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$

b) $k = 3 \times 10^{-4} \text{ s}^{-1}$

ans:- a) Second order b) First order

Q2. A reaction is second order with respect to a reactant. How is the rate of the reaction affected if the concentration of the reactant is:-

i) Doubled

ii) Reduced to $\frac{1}{2}$.

Ans:- Rate = $K [A]^2$

(i) When concentration of reactant is doubled the rate becomes 4 times.

(ii) When concentration of reactant is reduced to $\frac{1}{2}$ the rate becomes $\frac{1}{4}$ times

Q3:- a) Elementary reaction, b) Order of reaction.

Ans:- a. Elementary reaction- the reaction which completes in one step.

b. ORDER OF REACTION- The sum of powers to which the concentrations terms are raised in a rate law expression is called order of reactions.

Q4:- . A first order reaction is found to have rate constant,

$$k = 5.5 \times 10^{-14} \text{ s}^{-1} \text{ Find the half life of the reaction?}$$

Ans:- $t_{1/2} = 0.693/K$

$$= 0.693/5.5 \times 10^{-14}$$

$$= 1.26 \times 10^{13} \text{ Sec}$$

Q5:- *A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when (i) the concentration of B alone is increased to three times (ii) the concentrations of A as well as B are doubled?*

Ans:- Rate = $[A][B]^2$

i) New rate = 9 Rate

ii) New Rate = 8 rate

Q6:- In a reaction, $2A \rightarrow \text{Products}$, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes. Calculate the rate during this interval?

Ans:- Average rate = $-\frac{1}{2} \frac{\Delta[A]}{\Delta t}$

$$= -\frac{1}{2} \frac{[A]_2 - [A]_1}{t_2 - t_1}$$

$$= -\frac{1}{2} \frac{0.4 - 0.5}{10}$$

$$= -\frac{1}{2} \frac{-0.1}{10}$$

$$= 0.005 \text{ mol L}^{-1} \text{ min}^{-1}$$

$$= 5 \times 10^{-3} \text{ M min}^{-1}$$

Q7:- A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 3 g?

Ans:- From the question, we can write down the following information:

Initial amount = 5 g

Final concentration = 3 g

Rate constant = $1.15 \times 10^{-3} \text{ s}^{-1}$

We know that for a 1st order reaction,

$$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{1.15 \times 10^{-3}} \log \frac{5}{3}$$

$$= \frac{2.303}{1.15 \times 10^{-3}} \times 0.2219$$

$$= 444.38 \text{ s}$$

$$= 444 \text{ s (approx)}$$

Q8:- Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

Ans:- We know that for a 1st order reaction,

$$t_{1/2} = \frac{0.693}{k}$$

It is given that $t_{1/2} = 60 \text{ min}$

$$\therefore k = \frac{0.693}{t_{1/2}}$$

$$= \frac{0.693}{60}$$

$$= 0.01155 \text{ min}^{-1}$$

$$= 1.155 \text{ min}^{-1}$$

Or $k = 1.925 \times 10^{-4} \text{ s}^{-1}$

Q9:- For a first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction.

Ans:- For a first order reaction, the time required for 99% completion is

$$\begin{aligned} t_1 &= \frac{2.303}{k} \log \frac{100}{100-99} \\ &= \frac{2.303}{k} \log 100 \\ &= 2 \times \frac{2.303}{k} \end{aligned}$$

For a first order reaction, the time required for 90% completion is

$$\begin{aligned} t_2 &= \frac{2.303}{k} \log \frac{100}{100-90} \\ &= \frac{2.303}{k} \log 10 \\ &= \frac{2.303}{k} \end{aligned}$$

Therefore, $t_1 = 2t_2$

Hence, the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of the reaction.

Q10:- A first order reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$.

Ans:- For a first order reaction,

$$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$\begin{aligned} k &= \frac{2.303}{40 \text{ min}} \log \frac{100}{100-30} \\ &= \frac{2.303}{40 \text{ min}} \log \frac{10}{7} \\ &= 8.918 \times 10^{-3} \text{ min}^{-1} \end{aligned}$$

Therefore, $t_{1/2}$ of the decomposition reaction is

$$t_{1/2} = \frac{0.693}{k}$$
$$= \frac{0.693}{8.918 \times 10^{-3}} \text{ min}$$

= 77.7 min (approximately)

Chapter 4 chemical kinetics

2 marks questions

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Therefore, $t_1 = 2t_2$

Hence, the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of the reaction.

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Ans:- For a first order reaction,

$$\begin{aligned} t &= \frac{2.303}{k} \log \frac{[R]_0}{[R]} \\ k &= \frac{2.303}{40 \text{ min}} \log \frac{100}{100-30} \\ &= \frac{2.303}{40 \text{ min}} \log \frac{10}{7} \\ &= 8.918 \times 10^{-3} \text{ min}^{-1} \end{aligned}$$

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$$= \frac{0.693}{8.918 \times 10^{-3}} \text{ min}$$

= 77.7 min (approximately)

CHEMICAL KINETICS

(2 MARKS QUESTIONS)

1. What is (i) Rate law expression? (ii) Rate determining step?
2. (i) This reaction is of first order and rate constant of reaction is $5.7 \times 10^{-3} \text{ s}^{-1}$. Find the value of $t^{1/2}$.
3. Define (i) Activation energy (ii) Collision freq
4. For a reaction $A \rightarrow B$, the rate of reaction doubles when concentration of A is increased by 4. What is the order of reaction?
5. Time required to decompose SO_2Cl_2 to half of its initial amount is 1 hour. If the decomposition is a first order reaction, calculate the rate constant of the reaction.
6. The conversion of molecules from A to B follows second order kinetics. If the concentration of A is increased to five times, how will it affect the rate of formation of B?
7. The rate of decomposition of N_2O_5 is $2.4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ when $[\text{N}_2\text{O}_5]$ is 0.36 M. What is the rate law and value of k for this first order reaction?
8. In a first order reaction, 75% of reactants disappeared in 1.386 hrs. Calculate the rate constant of the reaction.
9. Rate of formation of product for second order reaction is $9.5 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}$
10. The initial concentration of reactant was found to be 0.01 mol/L.
 - a) Write rate law for second order reaction.
 - b) Calculate the rate constant for the given second order reaction.
10. What do you understand by effective collision? What are the factors affecting the Effective collision?

SURFACE CHEMISTRY		
2 MARKS QUESTIONS		
1	a) How would you explain the selectivity of catalyst? b) Name the catalyst in the manufacture of sulphuric acid and give its function?	2
ANS	a) On the basis of pore size of the catalyst and size of reactant and products b) V ₂ O ₅ accelerates the rate of reaction by the formation of an activated complex with reactants.	
2	a) How would you differentiate adsorption and absorption? b) Why is it necessary to remove CO when ammonia is obtained by Haber's process?	2
ANS	a) Adsorption is a surface phenomena while absorption is bulk phenomena. b) CO acts as poison catalyst for Haber's process and lowers the activity of solution therefore it is necessary to remove when NH ₃ obtained by Haber's process.	
3	How is adsorption of a gas related to its critical temperature? Give reason.	2
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.	
4	What is meant by Shape Selective Catalysis?	2
ANS	In the Shape Selective Catalysis, the rate depends upon pore size of the catalyst and the shape & size of the reactant and products molecules.	
5	Explain the following:- i) Delta formation ii) Some medicines are given in colloidal form	2
ANS	i) Soil particles in river water is a colloid and is precipitated by electrolytes of sea water and river stream splits in two streams and so on. ii) In medicines colloidal form have larger surface area and are effectively absorbed.	
6	Comment on the statement that "colloid is not a substance but state of a substance"?	2
ANS	Given statement is true. This is because the substance may exist as 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 lies in the range 1nm to 1000nm it is in the colloid state.	
7	What is demulsification ? Give two methods of demulsification ?	2
ANS	Separating an emulsion in constituent liquids. Heating and freezing.	
8	Name the types of emulsion .Which of these is less stable and how are these stabilized ?	2
ANS	W/O and O/W type. O/W type are less stable .By adding an emulsifying agent like soap detergent etc.	
9	a) Why does sky look blue? b) How alum removes suspended impurities?	2
ANS	a) Dust particles along with water particles scatter blue light maximum. b) Ions Alum neutralize the charge of colloidal soil particles and precipitates.	
10	a) Name two food articles which are colloids . b) What is demulsification ? Name two demulsifiers .	2
ANS	a) Ice cream , Butter ,milk etc. b) The process of separation of the constituent liquids of an emulsion is called demulsification .Demulsification can be done by centrifuging or boiling .	

SURFACE CHEMISTRY

2 MARK QUESTIONS

Q1. Name the types of emulsion. Which of these is less stable and how are these stabilized?

Ans. W/O and O/W type. O/W type is less stable. By adding an emulsifying agent like soap detergent etc.

Q2. What is a multimolecular colloid? Give two examples?

Ans. Colloidal particles are formed by aggregation of a large number of atoms or molecules.

Examples - Gold sol and Sulphur sol.

Q3. What is a hydrophilic colloid? How are these colloids prepared?

Ans. Colloids whose dispersion medium is water and the particles of the dispersed phase have attraction towards water,

These are prepared by mixing the dispersed phase with water.

Q4. How is adsorption of a gas related to its critical temperature? Give reason.

Ans. Higher the critical temperature of the gas, greater is the ease of liquefaction, i.e. greater Vander Waals forces of attraction and hence large adsorption will occur.

Q5. What happens when

(i) A beam of light is passed through As_2S_3 sol

(ii) KCl is added to $Fe(OH)_3$ sol

Ans. (i) The path of the light becomes visible due to Tyndall effect

(ii) $Fe(OH)_3$ gets coagulated

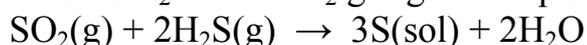
Q6. What is demulsification? Give two methods of demulsification?

Ans. Separating an emulsion into constituent liquids.

Heating and freezing.

Q7. Give the preparation of sulphur sol & gold sol.

Ans. Oxidation of H_2S with SO_2 gas gives sulphur sol.



By reduction of auric chloride by formaldehyde gives gold sol.



Q8. Account for the following

(i) $\text{Fe}(\text{OH})_3$ sol is positively charged

(ii) The extent of physical adsorption decrease with rise in temperature

Ans. (i) A deep red sol of $\text{Fe}(\text{OH})_3$ is obtained by the hydrolysis of FeCl_3 . The sol particles are positively charged because of preferential adsorption of Fe^{3+} ions

(ii) Adsorption is an exothermic process. So the rate of physical adsorption decreases with the rise in temperature in accordance with the Le-Chatlier principle.

Q9. Name two industrial heterogeneous catalytic processes.

Ans. Haber's process for the manufacture of ammonia, iron is used as catalyst.

Contact process for the manufacture of sulphuric acid, V_2O_5 is used as catalyst.

Q10. What is electro dialysis?

Ans The process of dialysis used for the purification of colloids can be accelerated by applying an electric field. The oppositely charged ions of the electrolyte present in the colloids migrate towards the respective electrodes easily

SURFACE CHEMISTRY

2 Marks:

1. What do you mean by activity & selectivity of catalyst?

Ans. Activity of solids: The ability of a catalyst to increase the rate of reaction.

Selectivity of catalyst: It is the ability of a catalyst to direct a reaction to yield a particular reaction.

2. What is Hardy Schulze rule? Which of the following electrolyte will coagulate most easily to positively charged colloid & why? Na_3PO_4 , NaCl , Na_2SO_4

Ans Coagulating value of a coagulating ion is directly proportional to the charge on the ion.

Na_3PO_4 will coagulate a positively charged colloid most easily because it has most negative valence

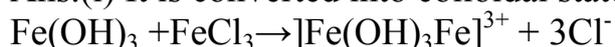
3. What is demulsification? Name two demulsifier.

Ans. The process of separation of the constituent liquids of an emulsion is called demulsification. It can be done by boiling or Centrifuging.

4.(i) What happens when a freshly precipitated ferric hydroxide is shaken with water containing a small quantity of FeCl_3 ?

(ii) Why is a finely divided substance more effective as an adsorbent?

Ans.(i) It is converted into colloidal state



(ii) Greater the surface area greater is the adsorption.

5. What is shape selective catalyst?

Ans. The catalytic reaction that depends upon the pore size of the catalyst and also the size of reactant and product molecules is called shape selective catalysis.

e.g. Zeolites are good shape selective catalyst.

6. What are the factors which influence the adsorption of a gas on a solid?

Ans: (i) The nature of gas (ii) Surface area of adsorbent

(iii) Pressure (iii) Temperature (v) Activation of adsorbent

7. (i) How does BF_3 act as a catalyst in industrial process?

(ii) Give an example of shape selective catalysis.

Ans: (i) BF_3 in an electron deficient compound.

(ii) ZSM-5

8. Write the dispersed phase & dispersion medium of the following colloids.

(i) Cheese (ii) Fog

Ans: (i) Cheese: Dispersed phase: Liquid Dispersion medium: solid

(ii) Fog : Dispersed phase: Liquid Dispersion medium: Gas

9. Differentiate between Lyophobic & Lyophilic colloids? (Any Two)

Ans –

Lyophilic colloids	Lyophobic colloids
These are easily formed by direct mixing. Reversible.	These are easily formed by Special method. Irreversible.

These are very stable.	These are unstable.
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10. Explain the cleansing action of soap.

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

Eg: $C_{17}H_{35}COONa$ 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 form micelle. The anionic ends of chain protrude from droplets and interact with water molecules, preventing coalescence of droplets.

METALLURGY

SHORT ANSWER TYPE QUESTION

(2 marks)

Q.1 Describe the method of refining of nickel.

A.1- 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.2- What is Zone Refining? Explain with example.

A.2- Zone refining is a method of obtaining a metal in very pure state. It is based on the principle 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 solidifies while the impurities pass into molten zone. The process is repeated to obtain ultrapure metal and end of rod containing impure metal cutoff.

Q.3 Write the principle of electro-refining.

A.3- 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.4- Write difference between calcinations and roasting.

Q.5- Describe the method of refining of Zirconium and Titanium.

A.5- 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: $\text{Zr (impure)} + 2\text{I}_2 \rightarrow \text{ZrI}_4$

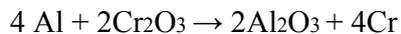
At 2075K: $\text{ZrI}_4 \rightarrow \text{Zr (pure)} + 2\text{I}_2$

Q.6- Out of C & CO, which is better reducing agent for ZnO?

A.6- Since free energy of formation of CO from C is lower at temperature above 1120K while that of CO₂ from carbon is lower above 1323K than free energy of formation of ZnO. However, the free energy of formation of CO₂ from CO is always higher than that of ZnO. Hence, C is better reducing agent of ZnO.

Q.7- The value of $\Delta_f G_0$ for Cr₂O₃ is -540kJ/mole & that of Al₂O₃ is -827kJ/mole. Is the reduction of Cr₂O₃ possible with aluminium?

A.7- The desired conversion is



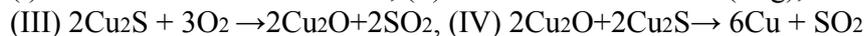
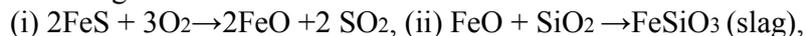
It is obtained by addition of following two reactions:-



Therefore, ΔG_0 for desired reaction is $-827+540=-287$, as a result reduction is possible.

Q.8:- Why copper matte is put in silica lined converter?

A.8:- Copper matte consists of Cu₂S and FeS. When blast of air is passed through molten matte in silica-lined converter, FeS present in matte is oxidized to FeO, which combines with silica to form slag.



Q.9- What is meant by term chromatography?

A.9-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.10-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 ΔG_0 becomes negative and reduction occurs easily.

METALLURGY

2 Marks Questions

1. Write the principle of Vapour phase refining.
Ans. In this method, the metal is converted into its volatile compound and collected elsewhere. It is then decomposed to give pure metal.
2. Give an example of zone refining of metals.
Ans. This method is very useful for producing semiconductor and other metals of very high purity, e.g., germanium, silicon, boron, gallium and indium.
3. The extraction of gold by leaching with NaCN involves both oxidation and reduction. Justify giving chemical equations.
Ans. Oxidation:- $4\text{Au(s)} + 8\text{CN}^{\ominus}(\text{aq}) + 2\text{H}_2\text{O}(\text{aq}) + \text{O}_2(\text{g}) \rightarrow 4[\text{Au}(\text{CN})_2]^{-}(\text{aq}) + 4\text{OH}^{-}(\text{aq})$
Reduction:- $2[\text{Au}(\text{CN})_2]^{-}(\text{aq}) + \text{Zn(s)} \rightarrow 2\text{Au(s)} + [\text{Zn}(\text{CN})_4]^{2-}(\text{aq})$
4. Why is the reduction of a metal oxide easier if the metal formed is in liquid state at the temperature of reduction?
Ans. The entropy is higher if the metal is in liquid state than when it is in solid state. The value of entropy change (ΔS) of the reduction process is more on +ve side when the metal formed is in liquid state and the metal oxide being reduced is in solid state. Thus the value of ΔG^0 becomes more on negative side and the reduction becomes easier.
5. Write all the reactions involved in the extraction of aluminium from bauxite ore.
Ans. Leaching of bauxite ore:-
 $\text{Al}_2\text{O}_3(\text{s}) + 2\text{NaOH}(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{Na}[\text{Al}(\text{OH})_4](\text{aq})$
 $2\text{Na}[\text{Al}(\text{OH})_4](\text{aq}) + \text{CO}_2(\text{g}) \rightarrow \text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s}) + 2\text{NaHCO}_3(\text{aq})$
 $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s}) \xrightarrow{-1470 \text{ K}} \text{Al}_2\text{O}_3(\text{s}) + x\text{H}_2\text{O}(\text{g})$
Electrolytic reduction:-
Cathode: $\text{Al}^{3+}(\text{melt}) + 3\text{e}^{-} \rightarrow \text{Al}(\text{l})$
Anode: $\text{C}(\text{s}) + \text{O}^{2-}(\text{melt}) \rightarrow \text{CO}(\text{g}) + 2\text{e}^{-}$
 $\text{C}(\text{s}) + 2\text{O}^{2-}(\text{melt}) \rightarrow \text{CO}_2(\text{g}) + 4\text{e}^{-}$
6. Write the chemical reactions involved in the extraction of silver from silver ore.
Ans. $4\text{Ag(s)} + 8\text{CN}^{-}(\text{aq}) + 2\text{H}_2\text{O}(\text{aq}) + \text{O}_2(\text{g}) \rightarrow 4[\text{Ag}(\text{CN})_2]^{-}(\text{aq}) + 4\text{OH}^{-}(\text{aq})$
 $2[\text{Ag}(\text{CN})_2]^{-}(\text{aq}) + \text{Zn(s)} \rightarrow 2\text{Ag(s)} + [\text{Zn}(\text{CN})_4]^{2-}(\text{aq})$
7. Out of molten NaCl and aqueous NaCl, which is used for the extraction of sodium and why?
Ans. Molten NaCl is preferred because Molten NaCl on electrolysis gives sodium but aqueous NaCl produces NaOH instead of Sodium.
8. (i) What is the role of silica in the extraction of copper?
(ii) How is cast iron different from pig iron?
Ans. (i) Silica act as flux to remove basic impurities of FeO



(ii) Cast iron is different from pig iron and is made by melting pig iron with scrap iron and coke using hot air blast. It has slightly lower carbon content (about 3%) and is extremely hard and brittle.

9. (i) How is wrought iron different from steel?

(ii) Why is copper matte put in silica lined converter?

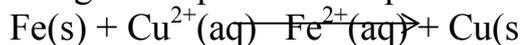
Ans. (i) Wrought iron or malleable iron is the purest form of commercial iron and is prepared from cast iron by oxidising impurities in a reverberatory furnace lined with haematite. This

haematite oxidises carbon to carbon monoxide: $\text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 2 \text{Fe} + 3 \text{CO}$ whereas steel is an alloy of iron and carbon

(ii) Iron oxide 'slags off' as iron silicate $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$

10. Copper can be extracted by hydrometallurgy but not zinc. Explain?

Ans. E^0 (standard reduction potential) of Zn and Fe both are lower than that of copper. So both can displace copper from salt solution of copper. But being a cheaper iron scrap is used in hydrometallurgy of Copper.



HALOGEN FAMILY

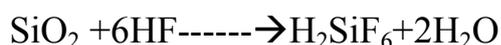
Two Marks Questions

1. Iodine forms I^{3-} but F_2 does not form F^{3-} ions .why?

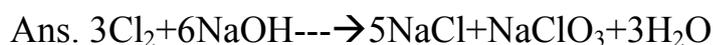
Ans. Due to the presence of vacant d-orbitals , I_2 accepts electrons from I^- ions to form I^{3-} ions , but because of absence of d-orbitals F_2 does not accept electrons from F^- ions to form F^{3-} ions.

2. Why is HF acid stored in wax coated glass bottles?

Ans. This is because HF does not attack wax but reacts with glass. It dissolves SiO_2 present in glass forming hydrofluorosilicic acid.



3. Write the balanced chemical equation for the reaction of Cl_2 with hot and concentrated NaOH .Is this reaction a disproportionation reaction? Justify:



4. Halogens have maximum negative electron gain enthalpy in the respective periods of the periodic table. Why?

Ans: Halogens have the smallest size in their respective periods and therefore high effective nuclear charge. As a consequence, they readily accept one electron to acquire noble gas electronic configuration.

5. Although electron gain enthalpy of fluorine is less negative as compared to chlorine, fluorine is a stronger oxidizing agent than chlorine. Why?

Ans: It is due to (i) low enthalpy of dissociation of F-F bond
(ii) high hydration enthalpy of F^-

6. Fluorine exhibits only -1 oxidation state whereas other halogens exhibit $+1$, $+3$, $+5$ and $+7$ oxidation states also. Explain.

Ans: Fluorine is the most electronegative element and cannot exhibit any Positive oxidation state. Other halogens have *d* orbitals and therefore, can expand their octets and show $+1$, $+3$, $+5$ and $+7$ oxidation states also.

7. Considering the parameters such as bond dissociation enthalpy, electron gain enthalpy and hydration enthalpy, compare the oxidizing power of F_2 and Cl_2 .

Ans: Oxidizing power depends on bond dissociation enthalpy, electron gain enthalpy and hydration enthalpy out of these Fluorine has more hydration Enthalpy and less bond dissociation energy that can compensate high negative enthalpy of Chlorine .

8. Give two examples to show the anomalous behavior of fluorine.

Ans: Most of the reactions of fluorine are exothermic (due to the small and strong bond formed by it with other elements). It forms only one oxoacid while other halogens form a number of oxoacids. Hydrogen fluoride is a liquid (b.p. 293 K) due to strong hydrogen bonding. Other hydrogen halides are gases.

9. Sea is the greatest source of some halogens. Comment.

Ans: Various minerals of halogens from soil are soluble in river water hence sea gets large amount of halogens in the dissolved form.

10. Write the balanced chemical equation for the reaction of Cl_2 with hot and Concentrated NaOH . Is this reaction a disproportionation reaction? Justify.

Ans: $3\text{Cl}_2 + 6\text{NaOH} \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$

Yes, chlorine from zero oxidation state is changed to -1 and $+5$ oxidation states.

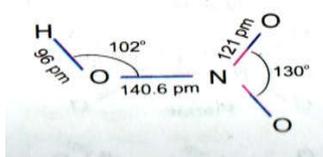
Nitrogen Family

Two Marks Questions

1. Which chemical compound is formed in the ring test of NO_3^- ions?

Ans. $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ is formed which is penta-aquanitrosyl iron (II) sulphate.

2. Draw the structure of nitric acid in gaseous state?



Ans.

3. Why does NO_2 dimerise? Explain.

Ans. NO_2 contains an odd number of valence electrons. It behaves as a typical molecule. In the liquid and solid state, it dimerises to form a stable N_2O_4 molecule, with an even number of electrons. Therefore, NO_2 is paramagnetic, while N_2O_4 is diamagnetic in which two unpaired electrons get paired.

4. (i) Ammonia is a good complexing agent. Give reason.

(ii) In group 15 elements, the bond angle H-M-H decreases in the following order NH_3

(107.8°), PH_3 (93.6°), AsH_3 (91.8°).

Ans. (i) Ammonia has a lone pair of electrons; therefore, it is a good complexing agent.

(ii) With the increase in the size of group 15 elements, as bond length increases, the bond pair-bond pair repulsion decreases. Therefore, the angle H-M-H decreases from NH_3 to AsH_3 .

5. Explain the following:-

(i) Nitrogen exists as a diatomic molecule, whereas phosphorous exists as a tetraatomic molecule.

(ii) NF_3 is an exothermic compound, but NCl_3 is an endothermic compound.

Ans. (i) N-N single bond is very weak due to its small size

(ii) F is highly electronegative and N-F bond energy is higher than N-Cl bond energy.

6. PCl_3 gives fumes in moisture; why?

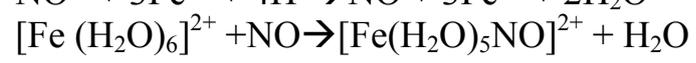
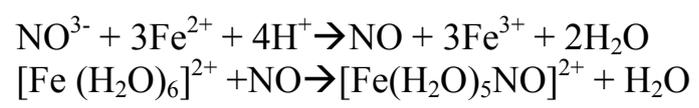
Ans. It is hydrolysed in moisture and forms fumes of HCl.



7. Explain the chemistry behind the brown ring test for detection of nitrate ions.

Ans. The brown ring test for nitrate ions depends on the ability of Fe^{2+} to reduce nitrates to

nitric oxide, which reacts with Fe^{2+} to form a brown coloured complex.



NOBLE GASES

Two marks questions

Q1 Why are the elements of group 18 are known as noble gases?

Ans Little reactivity due to completely filled valence shell.

Q2 Noble gases have very low boiling points. Why?

Ans. Weak dispersion forces .

Q3 Helium does not form any chemical compound.

Ans Very high Ionisation enthalpy.

Q4 Among noble gases only Xe forms established compounds.

Ans. Low Ionisation enthalpy.

Q5 Why is helium used in diving apparatus?

Ans. Very low solubility in blood.

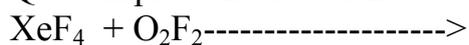
Q6 Why has it been difficult to study the chemistry of radon?

Ans. Radioactive element.

Q7 Why do noble gases have comparatively large atomic size?

Ans They have van der Waals radii.

Q8 Complete the reactions:



Ans. a) $\text{XeF}^+\text{PF}_6^-$ (b) XeF_6 and O_2

Q9 List one use of each Ne and Ar.

Ans Ne- Discharge tubes. Ar- Filling electric bulbs.

Q10 Write the geometry of XeF_4 and XeF_2 .

Ans. Square planar and linear respectively.

Oxygen family

2 MARKS QUESTIONS (OXYGEN FAMILY)

1) Why is SF₆ much less reactive than SF₄?

Ans1) In SF₆ the six fluorine atoms surround S and protect sulphur from attack by reagents to such an extent that even thermodynamically favourable reactions like hydrolysis do not occur. On the other hand SF₄, sulphur is not strictly protected because it is surrounded by only four F atoms. Hence it is reactive.

2) Write the order of thermal stability of the hydrides of group 16 elements.

Ans2) H₂O > H₂S > H₂Se > H₂Te

3) Sulphur in vapour state shows paramagnetic character. Why?

Ans3) In vapour state sulphur partly exists as S₂ molecule which has two unpaired electrons in the antibonding π^* orbitals like O₂ and, hence, exhibits paramagnetism.

4) Why is H₂S more acidic than H₂Te?

Ans 4) In H₂Te the size of the central Te atom is more than that of sulphur in H₂S and therefore, the distance between the central atom and hydrogen (Te-H) is more than that of S-H. As a result, a large bond length and bond dissociation enthalpy of Te-H is less than that of S-H and bond cleavage of Te-H bond is easy therefore H₂Te is more acidic than H₂S.

5) SF₆ is known but SCl₆ is not known. Give reason.

Ans5) Fluorine is highly electronegative and can easily cause the promotion of electrons from the filled to the vacant 3d orbitals. However, chlorine is less electronegative, even less than that of sulphur therefore it cannot cause the promotion of electrons. Thus SF₆ is known but SCl₆ is not known.

6) What is the transition temperature for allotropic forms of sulphur?

Ans 6) It is a temperature at which both the allotropes of sulphur are stable; 369K is called transition.

7) SO_3 has zero dipole moment .why?

Ans 7) In the gaseous state SO_3 has been planar triangular structure with O-S-O bond angle of 120 degree is therefore the individual S-O dipole moment cancel each other and resultant dipole moment is zero.

8) Ozone is thermodynamically is unstable. Explain?

Ans 8) Ozone is thermodynamically unstable with respect to oxygen because it results in Liberation of heat ΔH is negative and increase in entropy ΔS is positive these two factors reinforce each other, resulting negative ΔG for the conversion into oxygen.

9) How ozone reacts with i) KI ii) PbS

Ans :9) i) $2\text{KI} + \text{H}_2\text{O} + \text{O}_3 \rightarrow 2\text{KOH} + \text{I}_2 + \text{O}_2$

ii) Lead sulphide to lead sulphate. $4\text{O}_3 + \text{PbS} \rightarrow 4\text{O}_2 + \text{PbSO}_4$

10) On heating copper turning with concentrated sulphuric acid, a colourless gas with pungent smell is evolved which decolourises acidified KMnO_4 solution. Identify the gas.

Ans10) SO_2 .

INNER TRANSITION ELEMENTS

(TWO MARKS QUESTIONS)

1. What is lanthanide contraction? How does it affect the chemistry of elements, which follow lanthanoids?

Ans. Decrease in atomic / ionic radii across lanthanoid series with increase in atomic number.

Due to lanthanoid contraction the atomic/ionic radii 5d Series elements decrease. Consequently the properties of 4d and 5d series elements become similar.

2. Comment on the following:

i) Zr and Hf have similar sizes

ii) Actinones show greater no. of oxidation state than Lanthanones

ans. i) As a consequence of Lanthanoid contraction Zr and Hf have similar sizes.

ii) As energies of 5f, 6d and 7s are comparable therefore electrons can easily be promoted from lower to higher orbital, hence more no. of oxidation states are shown.

3. What are inner transition elements? Decide which of the following atomic numbers are atomic numbers of inner transition elements : 29, 59, 74, 95, 102, 104.

Ans- lanthanoids and actinoids are called inner transition elements because inner f orbitals are progressively filled. $z = 58$ to 71 are lanthanoids, $z = 90$ to 103 are actinoids, so atomic no. 59, 95, 102 belong to inner transition elements.

4. The chemistry of actinoid is not smooth as that of the lanthanoids. Justify this statement by giving some examples from the oxidation state of these elements.

Ans: lanthanoids exhibit +2, +3, +4 oxidation state out of these +3 is most common. Lanthanoids show +3 oxidation state.

Transition Element (d BLOCK Elements)

(Two Marks Questions)

Q.1 What do you mean by Lanthanoid contraction?

Ans- The regular and steady decrease in atomic as well as in ionic radii due to poor shielding of 4f electrons is known as Lanthanoid contraction.

Q.2 While making an aqueous solution of FeCl_3 reagent in laboratory, some HCl solution is also added to it. Why?

Ans- HCl is added to prevent hydrolysis of FeCl_3 .

Q.3 Why is $\text{K}_2\text{Cr}_2\text{O}_7$ generally preferred over $\text{Na}_2\text{Cr}_2\text{O}_7$ in volumetric analysis although both are oxidizing agents?

Ans- Because $\text{Na}_2\text{Cr}_2\text{O}_7$ is hygroscopic (absorbs moisture) whereas $\text{K}_2\text{Cr}_2\text{O}_7$ is not.

Q.4 Out of Cr^{2+} and Cr^{3+} which one is stable in aqueous solution?

Ans- Cr^{3+} is more stable in aqueous solution due to higher hydration energy which is due to smaller size and higher charge.

Q.5 Zn, Cd, Hg are volatile metals. Explain.

Ans- Due to weak metallic bonding owing to their bigger atomic size and completely filled d-orbitals. Therefore they have low M.P and B.P.

Q.6 Sc forms no coloured compound, yet it is regarded as a transition element.

Ans- Sc has completely filled d-orbitals ($3d^1 4s^2$). It does not form any coloured ion due to absence of any unpaired electrons in Sc^{3+} .

Q.7 Transition elements tend to be unreactive with increase in atomic number in the series.

Ans- Reactivity decreases with increase in atomic number due to decrease in size and increase in ionization enthalpy. Added to this they form a layer of oxide which makes them passive.

Q.8 The 4d and 5d series of transition metals have more frequent metal-metal bonding in their compounds than in 3d metals.

Ans- Due to similar size as a result of lanthanoid contraction. Hence they have higher enthalpy of atomization.

Q.9 Os forms a +8 oxidation state compound with oxygen but no such compound with fluorine. Explain this behavior.

Ans- This is because there is space around the Os atom for four bonded oxygen atoms and not for eight fluorine atoms.

Q.10 Why do transition metals form alloys?

Ans- Due to almost similar sizes one can substitute others. Examples- stainless steel (Fe, Cr, Ni), brass (Cu-Zn), bronze (Cu-Sn).

Transition elements

2 Marks Questions

Q.1 Calculate the magnetic moment of a divalent ions in aqueous solution if its atomic no. is 25.

A1. Magnetic moment = $\sqrt{n(n+2)}$; In Mn^{2+} , $n = 5$, so Magnetic moment = $\sqrt{5(5+2)}$
= $\sqrt{35} = 5.9BM$

Q.2 In the series Sc (Z=21) to Zn (Z=30), the enthalpy of atomization of zinc the lowest, why?

A2. $Zn = [Ar]3d^{10}4s^2$; as all the electrons in d orbitals are paired.

Q.3 Why are Mn^{2+} compound more stable than Fe^{2+} towards oxidation to their +3 state?

A3. Mn^{2+} has stable configuration and does not easily change into Mn^{3+} .

Q.4 In what way is the electronic configuration of the transition elements different from that of the non-transition elements?

A3. electronic configuration of the transition elements = $(n-1)d^{1-10}ns^{1-2}$

. electronic configuration of the non transition elements = ns^{1-2} and ns^2np^{1-6}

Q.5 Predict which of the following will be coloured in aqueous solution Cu^+ , Sc^{3+} , Mn^{2+} , Fe^{3+} , Give reason for each .

A5. Mn^{2+} , Fe^{3+} , As both have 5 unpaired electrons in d orbital, so d-d transition will take place.

Q.6 Calculate the number of unpaired electrons in following gaseous ions: Mn^{3+} , Cr^{3+} , V^{3+} and Ti^{3+} .

A6. : $Mn^{3+} = 4$, $Cr^{3+} = 3$, $V^{3+} = 2$ and $Ti^{3+} = 1$.

Q.7 What are interstitial compounds why are such compounds well known for transition metals?

A7. Interstitial compounds are those in which small atoms occupy the interstitial voids in crystal lattice. Such compounds are well known for transition metals due to variable oxidation state.

Q.8 How is the variability in oxidation states of transition metals different from that of the non-transition metals?

A8. The variability in oxidation states of transition metals is different from that of the non-transition metals due to the participation of (n-1)d and ns e⁻s in bond formation, while non-transition metals lose s e⁻s, so do not show variable oxidation state.

Q.9 Why does a transition metal form alloys with other transition metals easily?

A9. Transition metals form alloys with other transition metals easily due to almost similar atomic radii, they can mutually substitute their positions.

Q.10 Write down the number of 3d electrons in each of the following ions Ni²⁺, Cu²⁺, Co²⁺, Fe³⁺.

A10. Ni²⁺ = 8, Cu²⁺ = 9, Co²⁺ = 7, Fe³⁺ = 5.

COORDINATION CHEMISTRY

2 MARKS QUESTIONS

Q.1. Name the isomerism shown by $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and also write its other isomers.

Ans. Hydrate or Solvate isomerism. Its other isomers are as follows-



Q.2. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless. Why?

Ans. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured because Ti^{3+} has one electron so that d-d transition takes place while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless because Sc^{3+} has no d-electron, so no d-d transition takes place.

Q.3. Give two biological importance of coordination compounds.

Ans. (i) Chlorophyll is a coordination compound of Mg and it is indispensable for photosynthesis in plants.

(ii) Vitamin B₁₂ is a coordination compound of Co and it prevents anemia.

Q.4. (a) Why are low spin tetrahedral complexes not formed?

(b) How many EDTA ligands are required to make an octahedral coordination compound with Ca^{2+} ion and why?

Ans. (a) Because for tetrahedral complexes the crystal field stabilization energy is lower than pairing energy. $\Delta_t < P$.

(b) One EDTA ligand because it is hexadentate ligand

Q.5. (i) What is the shape and hybridisation of a coordination compound if its coordination number is 6?

(ii) What type of hybridisation and spin is shown by octahedral complex having weak ligand ?

Ans. (i) Octahedral shape, d^2sp^3 or sp^3d^2 hybridisation

(ii) sp^3d^2 hybridisation and high spin complex .

Q.6. Write all the isomers of $[\text{Co}(\text{NH}_3)_5(\text{SCN})]\text{Cl}$.

Ans. $[\text{Co}(\text{NH}_3)_5(\text{SCN})]\text{Cl}$, $[\text{Co}(\text{NH}_3)_5(\text{NCS})]\text{Cl}$,

$[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SCN}$, $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{NCS}$

Q.7. What is synergic effect ?

Ans. In metal carbonyl compounds CO ligands donate its electron pairs in

vacant d orbital of metal through sigma bond and metal also donate

its electron in vacant antibonding orbital of CO ligand, this is known

as synergic effect .

Q.8. Assign primary and secondary valencies of metal in the $\text{PdCl}_2 \cdot 4\text{NH}_3$

Or $[\text{Pd}(\text{NH}_3)_4]\text{Cl}_2$.

Ans-Primary valency of metal is 2 as the charge on it is +2 .

Secondary valency of the metal is 4 as there are four ligands around it in the co-ordination polyhedron .

Q.9.(a) What type of hybridisation is shown by a coordination compound

having one bidentate ligand and 6 coordination number ?

(b) What type of isomerism is shown by coordinate compound having ambidentate ligands ?

Ans. (a) Optical isomerism

(b) Linkage isomerism

Q.10-What are the factors responsible for the stability of coordination
Compounds ?

Ans. (i) Small size and high charge of central metal

(ii) more basic nature of ligand

COORDINATION CHEMISTRY

2 MARKS QUESTIONS

Q.1. Name the isomerism shown by $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and also write its other isomers.

Ans. Hydrate or Solvate isomerism. Its other isomers are as follows-



Q.2. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless. Why?

Ans. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured because Ti^{3+} has one electron so that d-d transition takes place while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless because Sc^{3+} has no d-electron, so no d-d transition takes place.

Q.3. Give two biological importance of coordination compounds.

Ans. (i) Chlorophyll is a coordination compound of Mg and it is indispensable for photosynthesis in plants.

(ii) Vitamin B₁₂ is a coordination compound of Co and it prevents anemia.

Q.4. (a) Why are low spin tetrahedral complexes not formed?

(b) How many EDTA ligands are required to make an octahedral coordination compound with Ca^{2+} ion and why?

Ans. (a) Because for tetrahedral complexes the crystal field stabilization energy is lower than pairing energy. $\Delta_t < P$.

(b) One EDTA ligand because it is hexadentate ligand

Q.5. (i) What is the shape and hybridisation of a coordination compound if its coordination number is 6?

(ii) What type of hybridisation and spin is shown by an octahedral complex having weak ligands?

Ans.(i) Octahedral shape , d^2sp^3 or sp^3d^2 hybridisation

(ii) sp^3d^2 hybridisation and high spin complex .

Q.6. Write all the isomers of $[Co (NH_3)_5 (SCN)]Cl$.

Ans . $[Co (NH_3)_5 (SCN)]Cl$, $[Co (NH_3)_5 (NCS)]Cl$,

$[Co (NH_3)_5 Cl]SCN$, $[Co (NH_3)_5 Cl]NCS$

Q.7. What is synergic effect ?

Ans . In metal carbonyl compounds CO ligands donate it's electron pairs in vacant d orbital of metal through sigma bond and metal also donate

It's electron in vacant antibonding orbital of CO ligand , this is known as synergic effect .

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Compounds ?

Ans. (i) Small size and high charge of central metal

(ii) more basic nature of ligand

ALKYL HALIDES AND HALOARENES

2 MARK QUESTION-

Q.1. Write the equation for the name reaction in which--

(i) Iodoalkane is prepared

(ii) Fluoroalkane is prepared

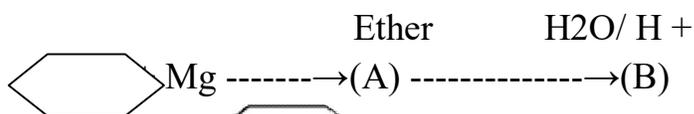
Ans. :(i) Finkelstein reaction-



(ii) Swarts reaction –



Q.2. Identify 'A' and 'B' in the following reaction –



Ans. (A)  MgBr

(B) 

Q.3. In the following pairs of halogen compounds, which compound undergo faster S_N1 reaction ?

(a) Br and Br



(b)



Br

Ans. (a)

Br

(b)



Br

Q.4. Define the following-

(i) Racemic mixture

(ii) Chirality

Ans. (i) A mixture containing two enantiomers in equal proportions will have zero optical rotation, are called as racemic mixture (or) racemic modification

(ii) The property of a molecule of being non-superimposable on its mirror image is known as Chirality

Q.5. Arrange each set of compounds in order of increasing boiling point-

(a) Bromomethane, Bromoform, Chloromethane, Dibromomethane

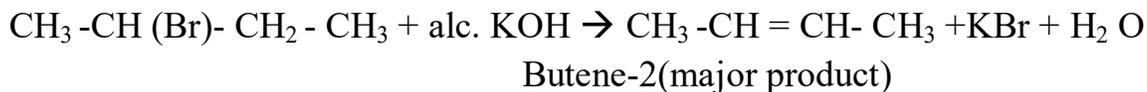
(b) 1-Chloropropane, Isopropylchloride, 1-Chlorobutane

Ans. (a) Chloromethane < Bromomethane < Dibromomethane < Bromoform

(b) Isopropylchloride < 1-Chloropropane < 1-Chlorobutane

Q.6. What is Saytzafrule ? Give example

Ans. . During dehydrohalogenation of alkyl halide, formation of such alkene is preferred which has more number of alkyl group with doubly bonded carbon atom .(More symmetrical alkene)



Q.7. Write two differences between S_N1 and S_N2 reaction .

Ans. .(i) S_N1 is given by tert. alkyl halide while S_N2 is given by pri. alkyl halide.

(ii) S_N1 is due to presence of steric hindrance and S_N2 is due to lack of steric hindrance.

Q.8. Write the name of two polyhalogens compounds with their uses.

Ans. : Chloroform-anesthatic

Iodoform-antiseptic

Q.9. Draw the isomers of Chlorobutane

Ans. CH₃-CH₂-CH₂-CH₂-Cl, CH₃-CH(CH₃)-CH₂-Cl,

CH₃-CH(Cl)-CH₂-CH₃, (CH₃)₃C-Cl

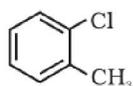
Q.10. Write the name of 2 name reactions in which chloroform is used .

Ans. Carbylamine reaction , Reimer Tiemann reaction

ALKYL HALIDES AND HALOARENES

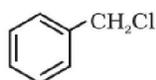
2 Marks Questions

1. Write IUPAC names of



1-Chloro-2-methylbenzene

or



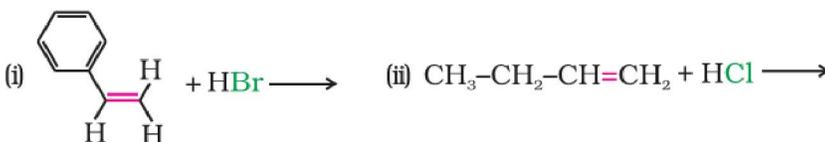
2-Chlorotoluene

Ans:

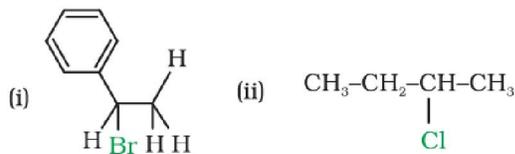
Chlorophenylmethane

2.

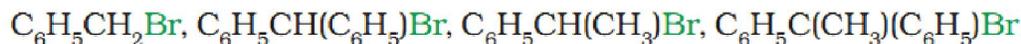
Write the products of the following reactions:



Ans:



3. Predict the order of reactivity of the following compounds in $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions:



Ans:

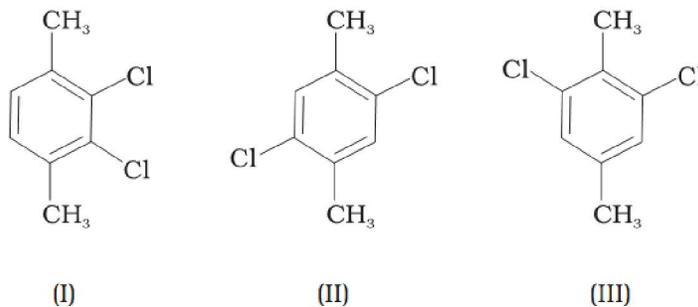


Of the two secondary bromides, the carbocation intermediate obtained from $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ is more stable than obtained from $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ because it is stabilised by two phenyl groups due to resonance. Therefore, the former bromide is more reactive than the latter in $\text{S}_{\text{N}}1$ reactions. A phenyl group is bulkier than a methyl group. Therefore, $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ is less reactive than $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ in $\text{S}_{\text{N}}2$ reactions.

4. Why does NO_2 group show its effect only at ortho- and para- positions and not at meta- position during nucleophilic substitution reaction?

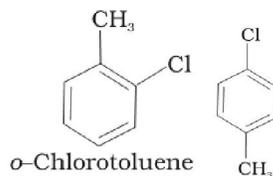
Ans: The presence of nitro group at ortho- and para-positions withdraws the electron density from the benzene ring and thus facilitates the attack of the nucleophile on haloarene. The carbanion thus formed is stabilised through resonance. The negative charge appears at ortho- and para- positions with respect to the halogen substituent is stabilised by $-\text{NO}_2$ group while in case of meta-nitrobenzene, none of the resonating structures bear the negative charge on carbon atom bearing the $-\text{NO}_2$ group. Therefore, the presence of nitro group at meta-position does not stabilise the negative charge and no effect on reactivity is observed by the presence of $-\text{NO}_2$ group at meta-position.

5. Which of the following compounds will have the highest melting point and why?



Ans: II, due to symmetry of para-positions; it fits into crystal lattice better than other isomers.

6. Write the structures and names of the compounds formed when compound 'A' with molecular formula, C_7H_8 is treated with Cl_2 in the presence of FeCl_3 .



Ans: *o*- and *p*- chloro toluene.

7. Chlorobenzene is less reactive towards nucleophilic substitution reaction. Give two reasons.

Ans.

Chlorobenzene is less reactive towards nucleophilic substitution due to –

1. Resonance, C-Cl bond acquires a partial double bond character and becomes stronger than a single bond.

2. sp^2 hybridisation in C of C-X bond, the carbon becomes more electronegative and

holds the electron pair of C-X bond more tightly decreasing the bond length.

8.(i) Phenol cannot be converted to chlorobenzene by reacting with HCl. Why?

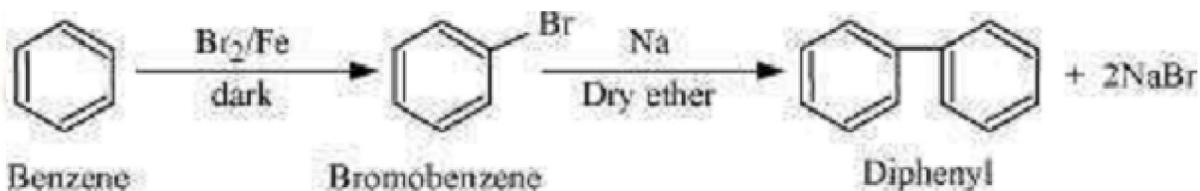
Ans.

In phenol, due to resonance, the carbon-oxygen bond has a partial double bond character and is difficult to break being stronger than a single bond. Therefore it can

not be converted to chlorobenzene by reacting with HCl.

(ii) How will you convert Benzene to biphenyl?

Ans:



9. Give reasons: (i) C-Cl bond length in chlorobenzene is shorter than C-Cl bond length

in CH₃-Cl. (ii) The dipole moment of chlorobenzene is lower than that of cyclohexyl

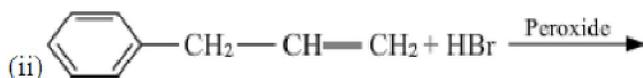
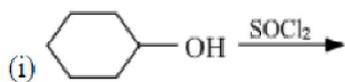
chloride

Ans: Ans.

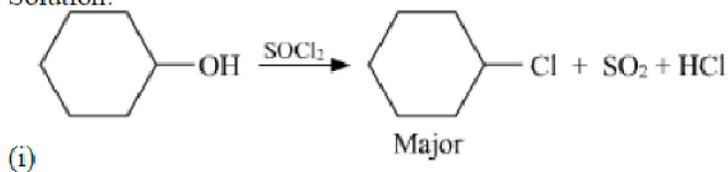
(i) In chlorobenzene each carbon atom is sp² hybridised. Due to resonance there is a partial double bond character, so bond length is short.

(ii) In chlorobenzene carbon to which chlorine is attached is sp² hybridised and is more electronegative than the corresponding carbon in cyclohexyl chloride which is sp³ hybridised.

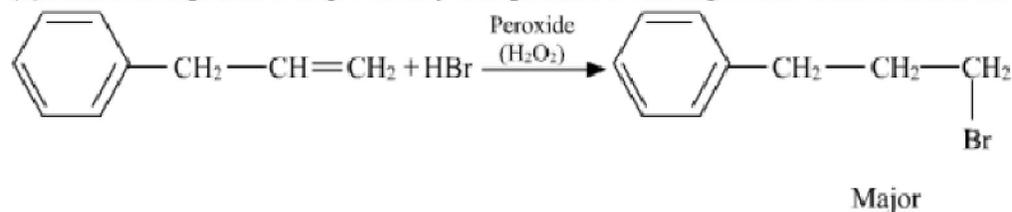
10. Draw the structure of major monohalo product in each of the following reactions :



Solution:



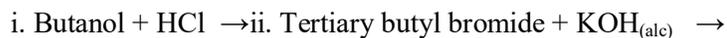
(ii) Addition in presence of peroxide yields product according to anti-Markovnikov rule of addition.



ALCOHOLS

2-Marks

Q.1- Predict the products of the following reactions



Ansi. CH₃CH₂CH₂CH₂Cl + H₂O ii. 2-methylbromide + KBr + H₂O

Q.2-1% ethanol should be added to chloroform sample while storing. Why?

Ans : Chloroform forms phosgene gas(poisonous)on atmospheric oxidation.Ethanol reacts with phosgene to give harmless diethyl carbonate. $\text{COCl}_2 + 2\text{C}_2\text{H}_5\text{OH} \rightarrow (\text{C}_2\text{H}_5)_2\text{CO}_3 + 2\text{HCl}$

Q.3- Alcohols acts as weak bases. Why?

Ans. Due to the presence of lone pair of electron on alcoholic oxygen, alcohol can accept a proton and hence act as a weak



Q.4-Cyclohexanol is more soluble in water than 1-Hexanol.Explain.

Ans.This is due to the reason that in Cyclohexanol, due to compact size of hydrocarbon part, it readily forms H-bond with water but in 1-hexanol, this is slightly hindered by the bulky alkyl group.

Q.5- Give chemical test to distinguish between Butan-2-ol and 2-methylpropan-2-ol

Ans. Lucas test: butan-2-ol react with Lucas reagent and milkiess appears within 5 min. but 2-methylpropan-2-ol react with the same to give milkiess immediately.

Q.5- Suggest a reason for the large difference in the boiling points of butanol and Butanal, although they have same solubility in water.

Ans. This is due to presence of intermolecular hydrogen bonding in butanol which is lacking in butanal.

Q.6- How is tert-butyl alcohol obtained from acetone?

Ans. By treating acetone with Grignard's reagent



Q.7- a. How does methanol in drinking alcohol cause problem?

Ans.Methyl alcohol is easily oxidized to formaldehyde and then to formic acid. Which may cause blindness and death.

Q.8- Give IUPAC names of the product(s) formed in the following reactions:

i. catalytic reduction of butanal ii. Hydration of propene in the presence of dil. Sulphuric acid

Ans i. Butan-1-ol ii. 2-Methylpropan-2-ol

Q.9- What is denaturation of 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.

Q.10- Name any two uses of ethanol.

Ans: i. In blending with Petrol.

ii. As solvent in cough syrups.

ETHERS

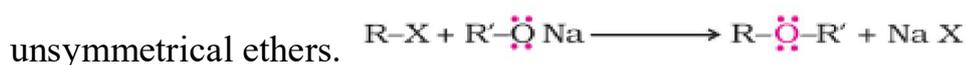
2-Marks

1- Ethers are cleaved by acids not by bases. Why?

Ans. The C-O-C bond in ethers is very strong. The addition of acid shall protonate the oxygen atom as a result, the attack by nucleophiles as Br⁻ /I⁻ on the less hindered alkyl group makes the process facile.

2- Explain Williamson synthesis

Ans. Williamson synthesis: This reaction is used for the synthesis of symmetrical and



3- Why is preparation of ethers by acid catalyzed dehydration of 2° and 3° Alcohols not a suitable method?

Ans. (a) Because it is accompanied by the formation of alkenes and is not a suitable method for the preparation of ether from acid catalyzed dehydration of 2° and 3° alcohol, as this reaction involves SN² mechanism, but dehydration of 2° and 3° alcohol, it follows SN¹ due to steric hindrance and tend to form alkenes preferably.

4- Ethers possess a net dipole moment even if they are symmetrical in structure. Explain

Ans.) because of greater electro negativity of O, C-O bond is polar in nature, there is a net dipole moment of the molecule and in spite of having symmetrical structure, it has net moment.

5- Why are Grignard reagents soluble in ether but not in benzene ?

Ans. Grignard reagents form co-ordination complexes with ether but not benzene since the former has lone pair of electrons but the later does not.

6- Di-tert butyl ether cannot be made by Williamson's synthesis. Explain why ?

Ans. To prepare di tert-butyl ether by Williamson's synthesis, we need tert-butyl bromide and Sodium tertiary butoxide. Since tert-butyl bromide being 3°-alkyl halide prefers to undergo elimination rather than substitution, therefore the product obtained is isobutylene rather than ditertiary butyl ether.

7- How will you account for the following? Ethers possess a net dipole moment even if they are symmetrical in structure.

Ans. Because of greater electro-negativity of O-atom than carbon, C-O bonds are polar. C-O bonds are inclined to each other at an angle of 110°(or more), two dipoles do not cancel out each other.

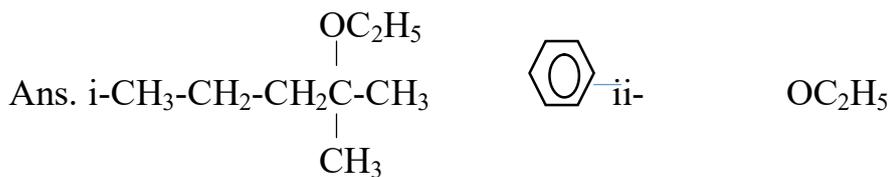
8- Arrange the following in order of increasing boiling points. State reason.

(i) CH₃CH₂CH₂CH₂OH, (ii) CH₃CH₂CH₂CH₃, (iii) CH₃CH₂OCH₂CH₃, (iv) CH₃CH₂CH₂CHO

Ans. (ii) < (iii) < (iv) < (i)

Reason : This is due to the reason that there is increase in the magnitude of intermolecular forces in this order, as polarity of C-O bond is increasing, its tendency to form H-bond also increases and hence boiling point which depend on the intermolecular forces also increases.

9-Write the structures of 2-methyl-2-ethoxy pentane and phenetol



10-Give a chemical test to distinguish between

(i) Ether and an Alcohol (ii) Ether and Phenol

Ans. (i) Alcohols give positive Lucas Test but ethers are not or any other.

(ii) Phenol gives positive neutral FeCl_3 Test but ethers not or any other.

TOPIC: PHENOL

Two Marks Questions(Short Ques-Ans)

1. What is neutral ferric chloride? Where is it used?

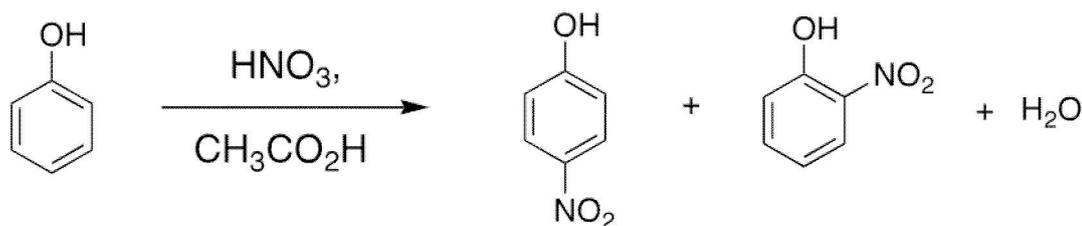
Ans: Ferric chloride (aq) is acidic in nature it is neutralized by adding ammonium hydroxide in drop wise manner. It is used to detect phenols.

2 Write equations of the following:

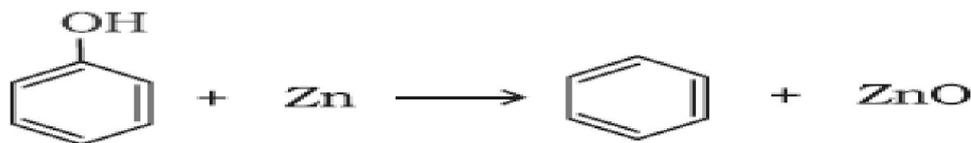
(i) Phenol with dil. nitric acid at 298 K.

(ii) Phenol with zinc.

Ans: (i) Phenol reacts with dil. HNO_3 at 298 K forming O-nitrophenol and p nitrophenol respectively



(ii)



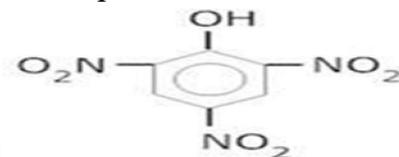
3. Give two reactions that show acidic nature of phenol.

Ans: Reaction (1) $\text{C}_6\text{H}_5\text{OH} + \text{Na} \longrightarrow \text{C}_6\text{H}_5\text{ONa} + \text{H}_2$

(2) $\text{C}_6\text{H}_5\text{OH} + \text{NaOH} \longrightarrow \text{C}_6\text{H}_5\text{ONa} + \text{H}_2\text{O}$

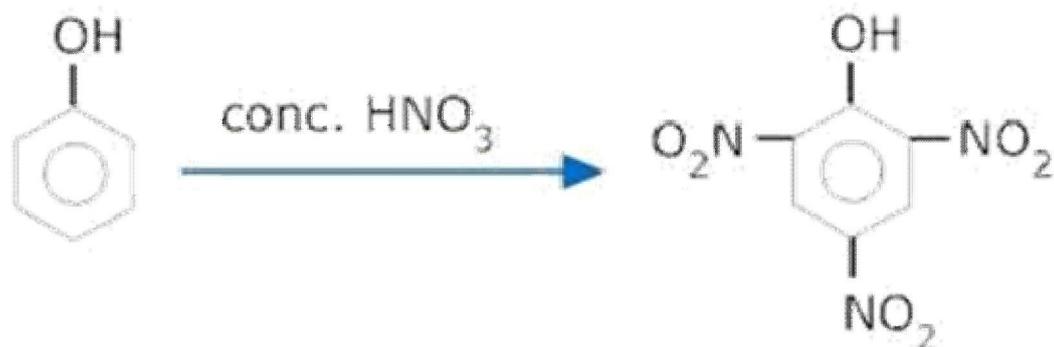
These two reactions prove that phenol is acidic.

4 What is Picric acid? How is it prepared from phenol?



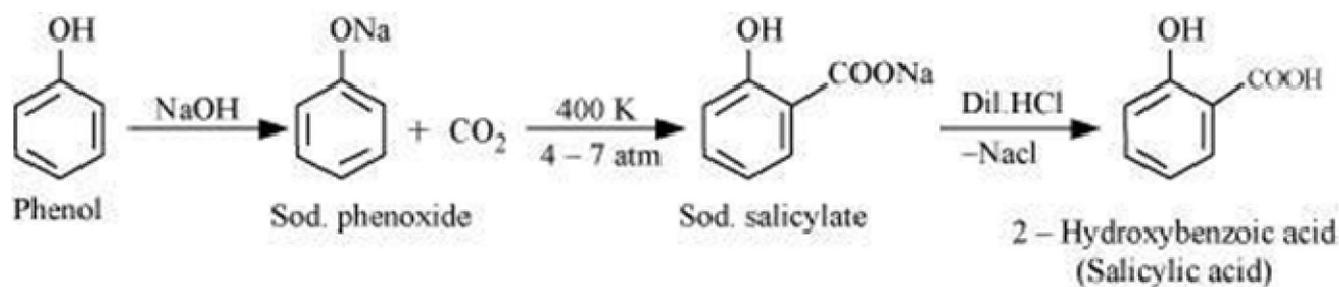
Ans: .Picric acid is 2,4,6 – trinitrophenol

Phenol reacts with concentrated nitric acid forming picric acid or 2, 4, 6trinitro phenol

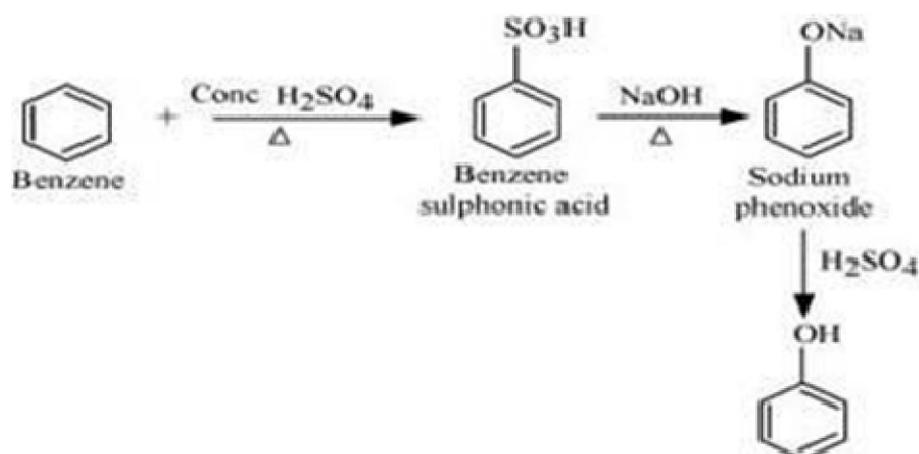


5. Write the equations involved in the following reactions:

(i) Reimer-Tiemann reaction (ii) Kolbe's reaction

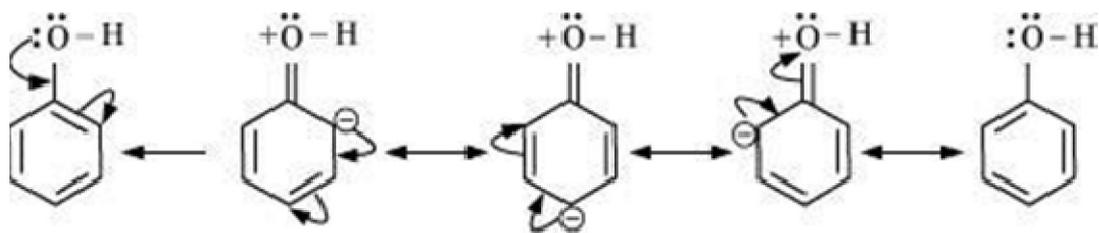


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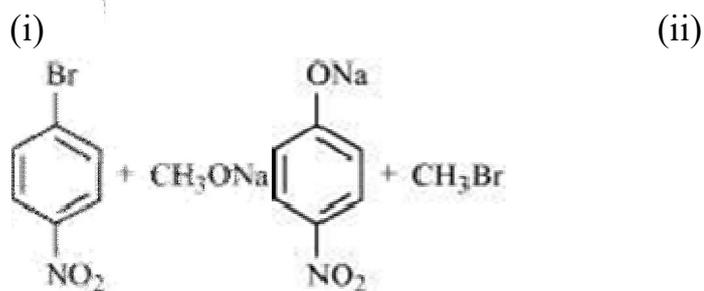
7. Explain how does the $-\text{OH}$ group attached to a carbon of benzene ring activate it towards electrophilic substitution?

Ans. The $-\text{OH}$ group is an electron-donating group. Thus, it increases the electron density in the benzene ring as shown in the given resonance structure of phenol.

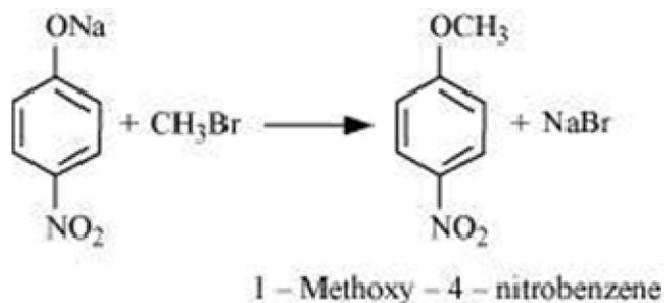


As a result, the benzene ring is activated towards electrophilic substitution.

8. Which of the following is an appropriate set of reactants for the preparation of 1-methoxy-4-nitrobenzene and why?



Ans: Set (ii) is an appropriate set of reactants for the preparation of 1-methoxy-4-nitrobenzene.



In set (i), sodium methoxide CH_3OH is a strong nucleophile as well as a strong base. Hence, an elimination reaction predominates over a substitution reaction.

9. Give reason

(i) o-nitrophenol is separated by steam distillation whereas p-nitrophenol not.

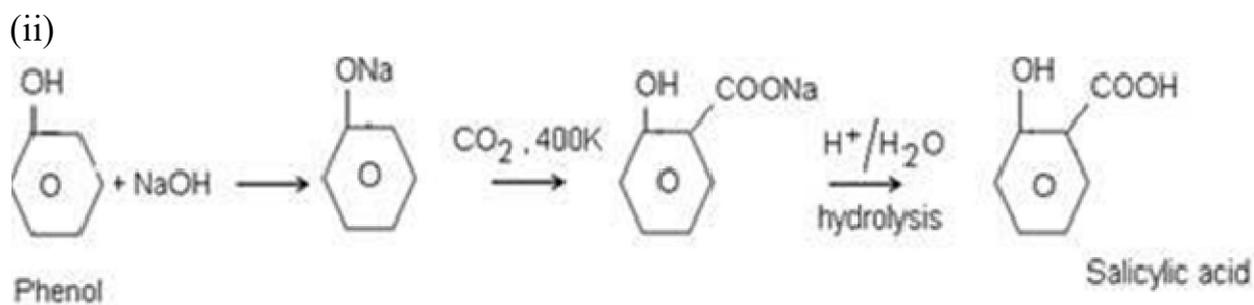
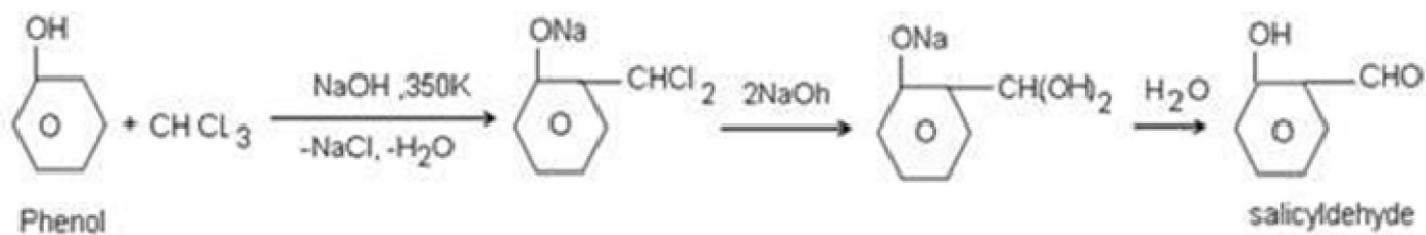
(ii) Lower alcohols are soluble in water.

Ans)(I) Due to the formation of intra hydrogen bonding in o-nitrophenol

(ii) Due to the formation of hydrogen bonds with water molecules.

10. 10. Bring the following conversion: (i) Phenol to Salicylaldehyde

(ii) Phenol to salicylic acid



Aldehyde and Ketone

2 Mark Questions :-

Q1. Give Fehling solution test for identification of aldehyde group (only equations). Name the aldehyde which does not give Fehling's soln. test



(Reddish brown ppt.)

Benzaldehyde does not give Fehling soln. test.

(Aromatic aldehydes do not give this test.)

Q2. Which of the following acid shown here would you expect to be stronger?

CH_3COOH or FCH_2COOH

Ans. FCH_2COOH is stronger acid than CH_3COOH . Due to -I effect of Fluorine electron density is low in the O—H bond and greater stability of FCH_2COO^- ion over CH_3COO^- ion.

Q3. Although phenoxide ion has more no. of resonating structures than carboxylate ion, even though carboxylic acid is a stronger acid why?

Ans. The phenoxide ion has non-equivalent resonance structures in which -ve charge is on less electronegative C atom and +ve charge is on more electronegative O-atom. Carboxylate ion has equivalent resonance structure in which -ve charge is delocalized on two electronegative O-atoms hence resonance is more effective.

So Carboxylic acid is stronger acid.

Q4. Explain why ketones are less reactive towards nucleophilic addition reactions than aldehydes.

Ans. Ketones are less reactive due to following reasons

(i) +I effect: The alkyl group in ketones due to their e^- releasing character decreases the electrophilicity or +ve charge on c-atom and thus reduces its reactivity.

(ii) Steric hindrance: Due to steric hindrance in ketones, they are less reactive.

Q5. Give the structural formula of

(a) 2-hydroxy butanal

(b) Acetophenone

Ans. (a) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CHO}$

(b) $\text{C}_6\text{H}_5\text{COCH}_3$

AMINES- Question Bank Amines

.2 Marks Questions

- 1) Give the chemical tests to distinguish between the following pairs of compounds:
 - i) Ethylamine and Aniline
 - ii) Aniline and Benzylamine

- 2) Identify A and B in each of the following:
 - i) $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{NaCN}} \text{A} \xrightarrow{\text{Ni/H}_2} \text{B}$
 - ii) $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[2]{\text{NaNO}_2/\text{HCl}} \text{A} \xrightarrow[2]{\text{C}_6\text{H}_5\text{NH}/\text{OH}^-} \text{B}$

- 3) Give the chemical tests to distinguish between the following pairs of compounds:
 - i) Methylamine and Dimethylamine
 - ii) Aniline and N-Methylaniline

- 4) Describe the following giving the relevant chemical equation in each case:
 - i) Carbylamine reaction
 - ii) Hoffmann's bromamide reaction

- 5) Illustrate the following reactions giving equation in each case:
 - i) Gabriel phthalimide synthesis
 - ii) Coupling reaction

- 6) Complete the following :
 - i) $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- + \text{CH}_3\text{CH}_2\text{OH} \longrightarrow$
 - ii) $\text{RCONH}_2 \xrightarrow[2]{\text{LiAlH}_4/\text{H}_2\text{O}}$

- 7) In the following cases rearrange the compounds as directed:
 - i) In decreasing order of basic strength: Aniline, p-nitroaniline, p-toluidine
 - ii) In increasing order of pK_b values:
 $\text{C}_6\text{H}_5\text{NH}_2, \text{C}_6\text{H}_5\text{NHCH}_3, (\text{C}_6\text{H}_5)_2\text{NH}, \text{C}_2\text{H}_5\text{NH}_2, (\text{C}_2\text{H}_5)_2\text{NH}$

- 8) Explain by chemical equations :
 - i) Gattermann reaction
 - ii) Sandmeyer reaction

- 9) Show the mechanism of acylation of ethylamine and write the IUPAC name of the product formed.

10 Draw the resonating structures of aniline.

Answers of 2 Marks Questions

- 1) i) These can be distinguished by azodye test.
Aniline forms azo dye while ethylamine does not form dye.



Benzenediazonium
chloride

Phenol

p-Hydroxyazobenzene
(Orange dye)



ii) These can be distinguished by azodye test.

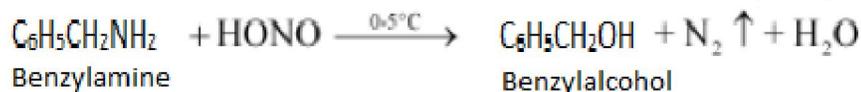
Aniline forms azo dye while benzylamine does not form dye



Benzenediazonium
chloride

Phenol

p-Hydroxyazobenzene
(Orange dye)

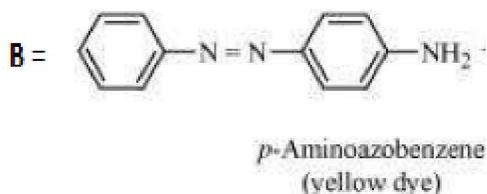


Benzylamine

Benzylalcohol

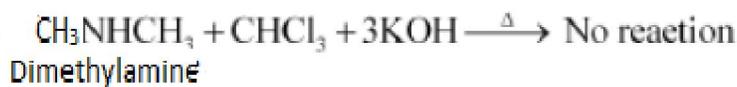
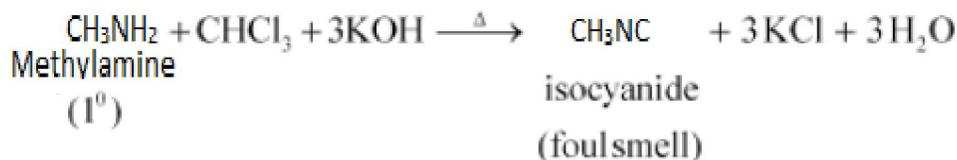
2) i) A = CH₃CH₂CN, B = CH₃CH₂CH₂NH₂

ii) A = C₆H₅N₂Cl⁻,



3) i) These can be distinguished by carbylamine test.

Methylamine gives this test whereas Dimethylamine does not.



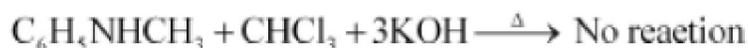
ii) These can be distinguished by carbylamine test.

Aniline gives this test whereas N-Methylaniline does not.



Aniline (1°)

isocyanide
(foulsmell)

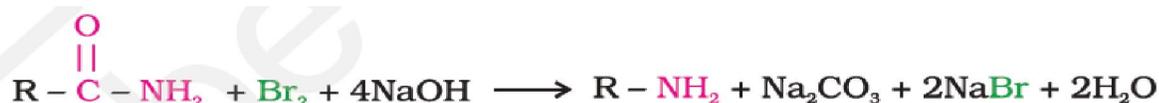


N-Methylaniline

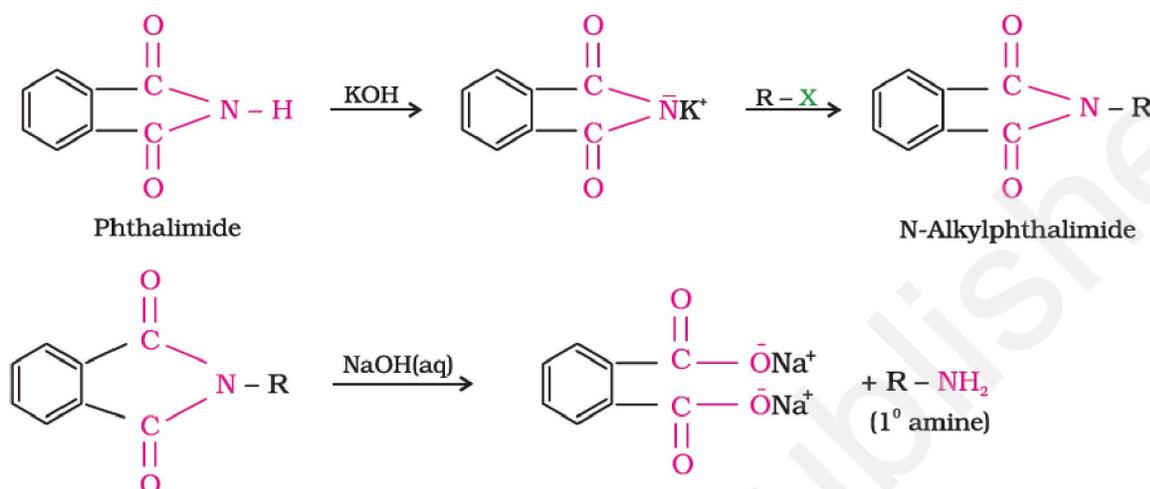
4i) Carbylamine Reaction: Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide form isocyanides or carbylamines, having unpleasant smell.



ii) Hoffmann Bromamide Reaction: This is a method for preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide.



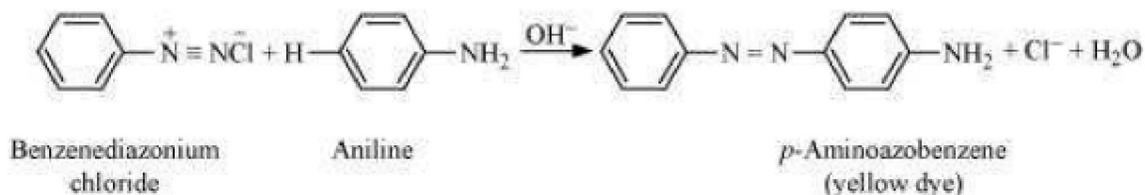
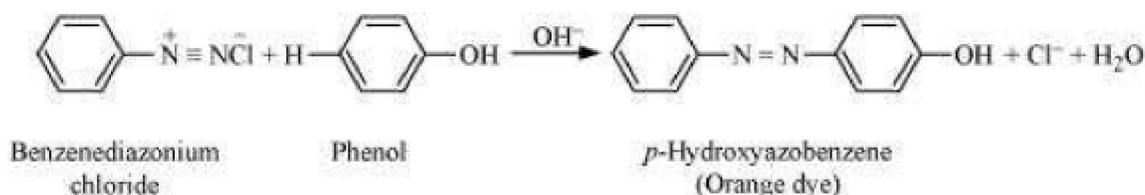
5) i) Gabriel Phthalimide Reaction: This method is used for the preparation of primary amines from phthalimide.



ii) Coupling Reaction:

The reaction of joining two aromatic rings through $-\text{N}=\text{N}-$ is known as coupling reaction.

Arenediazonium salts react with phenols or aromatic amines to form coloured azo compounds.



6) i) $\text{C}_6\text{H}_6 + \text{N}_2 + \text{CH}_3\text{CHO} + \text{HCl}$

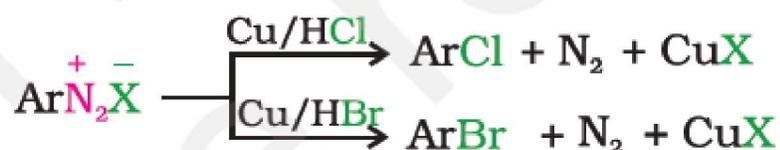
ii) R-CH₂NH₂

7) i) p-toluidine, Aniline, p-nitroaniline

ii) (C₂H₅)₂NH, C₂H₅NH₂, C₆H₅NHCH₃, C₆H₅NH₂, (C₆H₅)₂NH

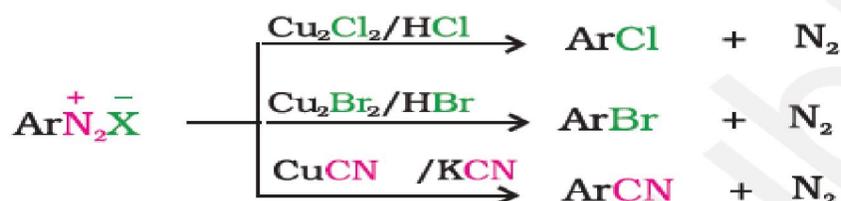
8) i) Gatterman reaction:

In this reaction, chlorine or bromine or cyanide can also be introduced in the benzene ring by treating the diazonium salt solution with corresponding halogen acid in the presence of copper powder.

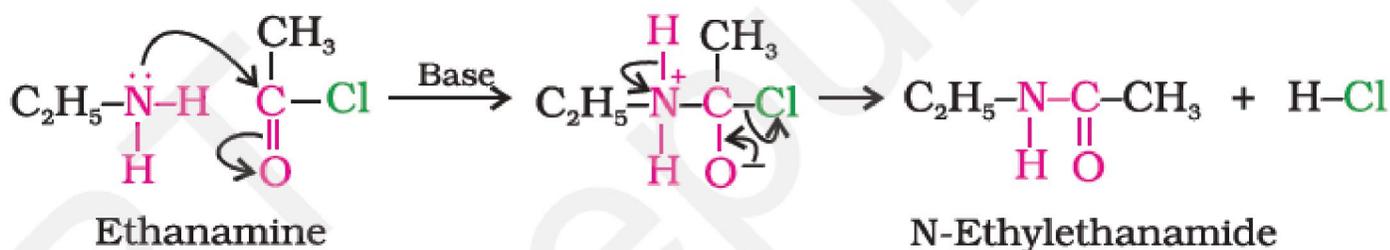


ii) Sandmeyer reaction:

In this reaction, chlorine or bromine or cyanide can also be introduced in the benzene ring by treating the diazonium salt solution with corresponding halogen acid in the presence of copper(I) ion.



9)



ALDEHYDE

VERY SHORT ANSWER QUESTIONS

SHORT ANSWER TYPE QUESTION

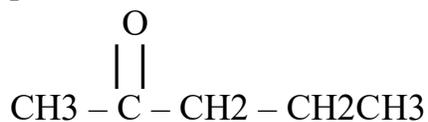
(2 Marks)

Q.11 Why does methanal not give aldol condensation while ethanal gives?

Ans. This is because only those compounds which have α -hydrogen atoms can undergo aldol reaction. Ethanal possesses α -hydrogen and undergoes aldol condensation. Methanal has no alpha hydrogen atoms hence does not undergo aldol condensation.

Q12 An organic compound 'A' has the molecular formula $C_5H_{10}O$. It does not reduce Fehling's solution but forms a bisulphite compound. It also gives positive Iodoform test. What are possible structure of 'A'? Explain your reasoning.

Ans. It does not reduce Fehling's solution but forms bisulphite compound so it is a ketone therefore it gives positive iodoform test therefore it is methyl ketone. The possible structure is



13. Give the reasons for the following:

(a) Why is the oxidation of toluene to benzaldehyde with CrO_3 carried out in the presence of acetic anhydride?

Ans. If acetic anhydride is not used we will get benzoic acid. Acetic anhydride used to prevent oxidation of benzaldehyde to benzoic acid.

(b) Why do aldehydes have lower boiling point than corresponding alcohols?

Ans. Aldehydes have lower boiling point as they are not associated with intermolecular H-bonding whereas alcohols are associated with intermolecular H-bonding.

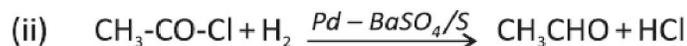
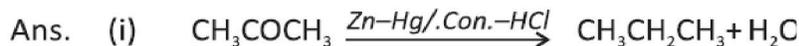
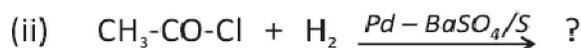
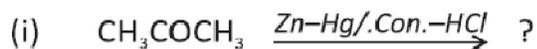
14. Why pH of reaction should be carefully controlled while preparing ammonia derivatives of carbonyl compound?

Ans. In strongly acidic medium ammonia derivatives being basic will react with acids and will not react with carbonyl compound. In basic medium, OH^- will attack carbonyl group.

So the pH of a reaction should be carefully controlled.

15.

Write the products of the following reactions



16. Distinguish between the following:-

(a) Benzo phenone and acetophenone

(b) Ethanal and propanal

Ans. (a) Benzophenone It doesn't give iodoform test

Acetophenone It gives iodoform test

(b) Ethanal It gives Iodoform test

gives

Propanal It doesn't give iodoform test

17. Give the reasons:

(i) Aldehydes are more reactive than ketones when undergo nucleophilic addition reaction?

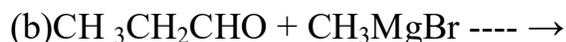
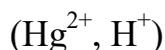
Ans (a) + I effect:- The alkyl group in Ketones due to their e-releasing character decrease the +ve charge on C-Atom and thus reduce its reactivity.

(b) Steric hindrance :- Due to steric hindrance in ketones they are less reactive.

(ii) There are two-NH₂ groups in semi carbazide. However only one is involved in formation of semi carbazones.

Ans. Due to resonance one NH₂ group undergoes or involved in resonance and hence can't participate in the formation of semicarbazone. Lone pair of another NH₂ group is not involved in resonance and is available for nucleophilic attack

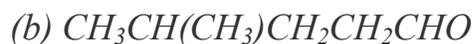
18. Write the main products of the following reactions:



Ans. (A) CH_3CHO



(19) Name the following compounds according to IUPAC system of nomenclature:



Ans. (a) But-2-en-1-al

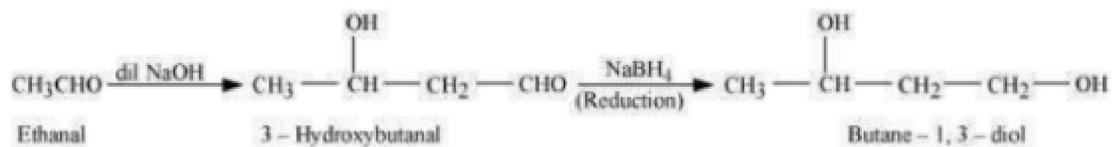
(b) 4-methylpentanal

20. How will you convert ethanal into the following compounds?

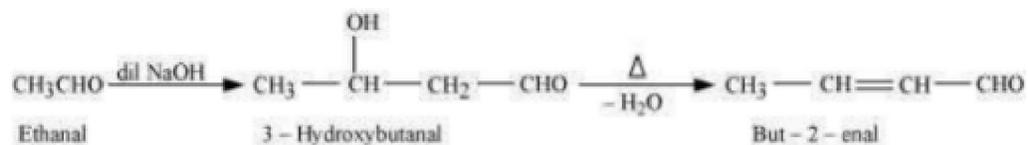
(i) Butane-1, 3-diol

(ii) But-2-enal

Ans. (a)



(b)



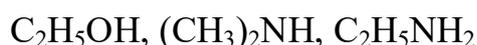
AMINES(PREPARATION & PHYSICAL PROPERTIES)

2 MARK QUESTION (10)

1. It is difficult to prepare pure amines by ammonolysis of alkylhalides.

Ans: The process of ammonolysis yields a mixture of primary, secondary, tertiary amines and quaternary salts. The separation of these amines is a very complicated process and difficult. Therefore it is difficult to prepare pure amines by ammonolysis of alkyl halides.

2. Arrange the following in increasing order of boiling point with explanation:



Ans: $(\text{CH}_3)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{OH}$, with increasing hydrogen bonding.

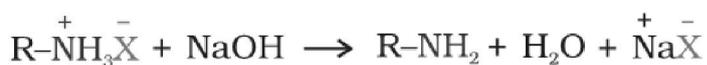
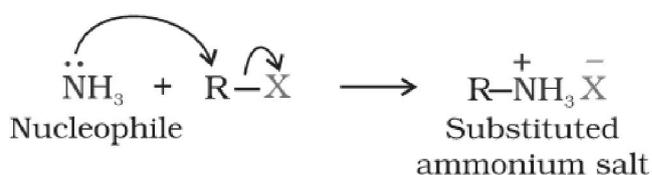
3. Arrange the following in increasing order of solubility in water:



Ans: $\text{C}_6\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2$

4. What is ammonolysis reaction?

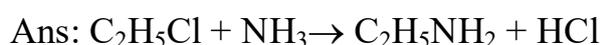
Ans: The process of cleavage of the C–X bond by ammonia molecule is known as ammonolysis.



5. Write the reactivity order of alkyl halide for ammonolysis.

Ans: The order of reactivity is $\text{RI} > \text{RBr} > \text{RCl} > \text{RF}$

6. Write chemical equations for reaction of ethanolic NH_3 with $\text{C}_2\text{H}_5\text{Cl}$.



7. Benzenediazonium salt is more stable than primary aliphatic diazonium salt.

Why?

Ans: The stability of arenediazonium is due to the resonance of diazo group with benzene ring.

8. What is diazotization?

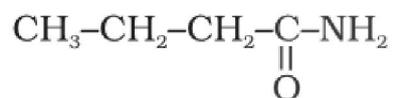
Ans: The conversion of primary aromatic amines into diazonium salts in presence of nitrous acid at 273-278K is known as diazotisation.

9. Why benzenediazonium salt is stored at very low temperature?

Ans: This is because benzenediazonium salt is stable in cold but it decomposes easily in the dry state on little warming.

10. Write structure and IUPAC name of the amide which gives propanamine by Hoffmann bromamide reaction.

Ans: Butanamide



TOPIC CARBOHYDRATE QUESTION BANK

QUESTION OF 2 MARKS AND ANSWERS

1. State two main functions of carbohydrate ? Name two carbohydrate which are act as biofuel.

Answer- Carbohydrate act as biofuel to provide energy for functioning of living organisms. They act as constituent of cell walls. Two carbohydrates are starch and glycogen act as biofuel.

2. Define the following terms : (i) Polysaccharides (ii) Glycosidic bond

Answer- (i) Carbohydrates which yield a large no. of monosaccharide units on hydrolysis are called polysaccharide.

(ii) It is a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage or bond.

3. How do you explain the presence of an aldehyde group in @ glucose molecule ?

Answer- Glucose reacts with hydroxyl amine to form an oxime, this reaction confirms the presence of a carbonyl group in glucose.

4. Write two main fuctions of carbohydrates in plants.

Answer- 1. Structural material for cell walls- The polysaccharide cellulose act as the chief structural material for the cell wall. 2. Reserve food material- The polysaccharide starch is the major reserve food material in the plants.

5. Write two main test which could not explain straight chain structure.

Answer- (i) It dose not give Schiff's test. (ii) IT dose not form the hydrogensulphite addition product with NaHSO_3 .

6. Glucose or Sucrose are soluble in water but cyclohexan or benzene are insoluble in water explain.

Answer- Glucose contains 5 $-\text{OH}$ group and sucrose contain 8 $-\text{OH}$ group. These $-\text{OH}$ group form H-bond with water, Because of this extensive intermolecular H-bonding glucose and sucrose soluble in water, on the other hand benzene and cyclohexane do not form H bond and insoluble in water.

7. What is basic structural difference between starch and cellulose ?

Answer- Strach is a polymer of @ D glucose and consist of two components amylose and amylopactein. Amylose is a long unbranched

chain with 200-1000 @ D-(+)- glucose units held by C1-C4 glycosidic linkage.

Cellulose- Cellulose is linear polymer of β - glucose which are joined by glycosidic linkage between C1 of one glucose unit and C4 of the next glucose unit.

8. Explain what is meant by following:

1. Oligosaccharide
2. Glycosidic linkage

Answer- 1. Oligosaccharide- Carbohydrate which on hydrolysis give 2 to 10 molecules of monosaccharide are called oligosaccharide. e.g. sucrose.

2. Glycosidic linkage- It is a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage or bond.

9. What are the hydrolysis products of a. Sucrose b. Lactose

Answer- a. Glucose and fructose b. Glucose and galactose

NUCLEIC ACIDS

(2 Marks Questions)

1. "The two strands in DNA are not identical but are complementary". Explain.

Answer In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other.

2. What is the difference between a nucleoside and a nucleotide?

Answer A nucleoside is formed by the attachment of a base to position of sugar.

Nucleoside = Sugar + Base

A nucleotide is formed by all the three basic components of nucleic acids (i.e., pentose sugar, phosphoric acid, and base) .

Nucleotide = Sugar + Base + Phosphoric acid

3 . Write the sequence of bases on m-RNA strand and complementary strand synthesized from strand of DNA having sequence : A G C G A T T C

sequence of bases on m-RNA strand-U C G C U A A G

sequence of bases on DNA strand:T C G C T A A G

4. Write the important functional difference between DNA and RNA

Ans functions of DNA – DNA maintains the identity of different species of organisms over millions of years . DNA is a chemical basis of heredity .

RNA—Protein synthesis

5. What is DNA finger printing? Explain its significance in medical science.

Ans Every person has own fingerprints . These occurs at the tip of the fingers , likewise a sequence of bases of DNA is also unique for the person and information regarding this is called DNA fingerprinting been used for identification of criminals

Q 6. Name the nitrogenous bases present in DNA?

Ans. Adenine , Guanine , Thymine and cytosine.

Q 7. Give any two structural difference between DNA and RNA?

1. DNA molecules contains β -D-2 deoxyribose.	RNA molecules contains β -D-ribose.
2. DNA contains uracil (U). It does not contain thymine (T). ie ATGC	RNA contains thymine (T). It does not contain uracil (U). ie AUGC

Q 8. Name the nitrogenous base which is present in DNA but not in RNA? Name the corresponding base with which it pairs.

Ans. Thymine. It pairs with Adenine.

Q 9. Name the nitrogenous base which is present in RNA but not in DNA? To which class does it belong?

Ans. Uracil. It belongs to Pyrimidines.

Q 10. How many H-bonds are present between A and T and G and C?

Ans: Two between A&T , three between G&C.

TOPIC- PROTEIN AND VITAMINS

TWO MARKS QUESTIONS

Q1 Write difference between globular and fibrous protein?

Ans-

Globular Protein	Fibrous protein
1) Globular proteins are soluble in water 2) These protein can be digested easily by human body.	1)Fibrous proteins are insoluble in water 2) These protein cannot be digested by human body.

Q2 Explain primary structure of protein?

Ans-Protein may have one or more polypeptide chain, each polypeptide in a protein has amino acid linked with each other in a specific sequence and it is this sequence of amino acid is said to be the primary structure of protein.

Q3 Differentiate between essential and nonessential amino acid?

Ans-

Essential amino acid	Non-essential amino acid
1) These amino acid cannot be synthesised in our body 2) These amino acid are required to be taken from the outside source.	1)These amino acid easily synthesised in our body 2)These amino acid are not required to be taken from the outside source

Q4 What is denaturation of protein?

Ans-When protein is heated at high temperature or there is change in pH than it loses its natural property this called denaturation of protein.

Q5 What are water soluble and fat soluble vitamins?

Ans-Water soluble vitamins are those vitamins which are soluble in water while vitamins which are soluble in oil or fat are called as fat soluble vitamins.

Q6 Explain α -helix structure of protein?

Ans- α -helix structure of protein arises due to the regular folding of the polypeptide chain due to H-bonding between $-\text{CO}-$ and $-\text{NH}-$ groups of peptide bond, in α -helix structure twisting of polypeptide chain occurs into a right handed screw(helix).

Q7 Explain hyper vitaminosis and give example?

Ans-Excess of any vitamin in the body gives some side effect called as hypervitaminosis

Example-Vitamin –A excess causes headache and vomiting.

Q8 Explain amphoteric behaviour of amino acid?

Ans-Amino acid have –COOH and –NH₂ group in the same molecule in water – COOH group losses its proton and –NH₂ group accepts proton give rise to dipolar molecule i.e.zwitterionhence it is amphoteric.

Q9 Name the disease caused by the deficiency of Vitamin B₆ Vitamin C and Vitamin-E?

Ans- Deficiency of Vitamin B₆ causes convulsion Vitamin C –scurvy and Vitamin-E muscular weakness.

Q10 Write 2 functions of vitamin-D?

Ans-The 2 main function of vitamin-D are-

- 1) To maintain plasma levels of calcium (essential for neuromuscular activity) and phosphate levels:
- 2) Increase Ca absorption in the intestine,

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.

Classify these polymers on the basis of structure: bakelite, melamine, polythene, LDP, polyvinylchloride, HDP.

Q.7. Explain the function of sulphur in vulcanisation of rubber? Discuss the two main purpose of vulcanization of rubber

Ans: Sulphur introduces sulphur bridges. So it increases tensile strength, elasticity and resistance to abrasion etc.

(i) It makes the rubber hard.

(ii) It is more elastic.

(iii) It has more wear and tear resistance.

Q.8. What is addition or chain growth polymerization? Give eg.

Ans. In addition polymerisation, the molecules of the same monomer or different monomer add together on a large scale to form an addition polymer. eg. PVC or Polythene

Q.9 Give two difference between natural and synthetic polymers ?

Ans. polymers found in plants and animals are termed as natural polymers.

They are high molecular mass macromolecules .

The examples are proteins ,nucleic acid ,cellulose ,starch and natural rubber

Man made high molecular mass macro molecules are termed as synthetic polymers .

These include synthetic rubbers , fibers and plastics the examples are buna-s(synthetic rubber) ,

nylon 6-6 (synthetic fiber) and polythene (synthetic plastic)

Q.10 . a) What does 6,6 mean in Nylon 6,6 ? State any two uses of it?

Ans. The term 6,6 refers to the number of carbons in monomeric unit i.e. hexamethylenediamine---6 carbons and adipic acid---6 carbon. It is used in making sheets, bristles of brushes and in textile industries.

Topic- Addition Polymers]

2 mark question-

Q1-How is PTFE prepared? Give its two uses.

Q2-What is the monomer of orlon? Give its one use.

Q3-Write the difference between Buna-N and Buna-S.

Q4-(i)Classify the following as addition and condensation polymers.

Teeylene,Bakelite.Polyvinyl chloride , Polythene.

(ii) Give an example of elastomers.

Q5-(a) Give an example of thermosetting and thermo-plastic polymers.

(b) Write the names and structures of the monomers of the following polymers:

(i) PVC (Polyvinyl chloride) (ii) Polystyrene

Q6-What is zeiglar Natta Catalyst ? Write its use.

Q7- Differentiate between chain growth and step growth.

Q8-Arrange the following polymers in increasing order of their intermolecular forces.

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

(ii) Nylon 6,Neoprene<Polyvinyl chloride.

Q9- Describe main difference between thermosetting and thermoplastic polymers.

Q10(i)- Which rubber is found in bubble gums?

(ii) Which polymer is used in making raincoats?

CHAPTER 16 Chemistry in everyday life

2 MARKS QUESTIONS

1. What is tincture of iodine and what is it used for?

Ans Tincture of iodine is 2-3% solution of iodine in ethyl alcohol-water mixture. It is an antiseptic drug

2. What are tranquilizers? Give two examples?

Ans They are the chemicals used in stress, mild, severe mental disease. for example equanil and seconal

3.. What are artificial sweetening agents? Give two examples?

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

Eg- Saccharin, alitame

4. Distinguish between drug and medicine.

Ans 1. Drug: Chemicals of low molecular mass which interact with macromolecular targets and produce a biological response. Ex. Paracetamol.

2. Medicine: Drugs which cure diseases i.e. which cause therapeutic biological response . Ex. Equanil

5. Describe two types of analgesics with an example for each.

Ans Non-narcotic/non-addictive analgesics: Analgesics which relieve pain without causing unconsciousness or without inducing sleep. Ex. Aspirin.

Narcotic drugs: Analgesics which relieve severe pain by causing unconsciousness or inducing sleep. Ex. Heroin

6. What for all can aspirin be used? What is its insignificance?

Ans Aspirin can be used to inhibit synthesis of prostaglandins which stimulate inflammation in the tissue and cause pain, to relieve pain due to arthritis, as an antipyretic to prevent platelet coagulation, to prevent heart attack.

There are some complications in using aspirin it is toxic to liver some times causes bleeding from stomach wall and gastric irritant.

7. How is a disease caused?

Ans A breach (failure) defence mechanism allows the pathogen to reach tissues and this causes infection. Invasion and multiplication of an organism in the infected host causes disease due to destruction of normal cell metabolism. In addition toxins produced by microbes may adversely affect the tissues or organs of the host.

8. Give a point of difference between a bactericidal and bacteriostatic with an example each.

Ans 1. **Bactericidal:** antibiotics which kill organisms in the body Ex. Penicillin

2.Bacteriostatic: antibiotics which inhibit the growth of microorganisms in the body. Ex. Tetracycline.

9. Describe broad spectrum antibiotics and narrow spectrum antibiotics with an example each.

Ans Broad spectrum antibiotics: Antibiotics which are effective against several different microorganisms and thus capable of curing several infections .

Ex. Tetracycline.

Narrow spectrum antibiotics: Antibiotics which are effective only against limited number of types of harmful microorganisms. Ex. Penicillin.

10 Antibiotic therapy is nothing but “setting one thief against another”. Explain.

Ans Chemical substances produced by micro organisms (bacteria, fungi and mould) that inhibit the growth or even destroy micro organisms are called antibiotics.

Ex. Penicillin

Antibiotics themselves are product of microbial growth and hence it is nothing but setting one thief against another