

## CHEMISTRY TEAM

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ions?

22. In corundum oxide ions form  $hcp$  and  $Al^{3+}$  occupy two third of octahedral voids. Determine the formula of corundum. (Ans :  $Al_2O_3$ )
23. What are stoichiometric defects?
24. Define the term 'dislocation' in relation to crystals.
25. Why is Frenkel defect not found in pure alkali metal halides?
26. Define F-centres.
27. Which point defect is observed in a crystal when a vacancy is created by an atom or ion missing from a lattice site?
28. Why are the solids containing F-Centres Paramagnetic?
29. Name the crystal defect produced when  $NaCl$  crystal is doped with  $MgCl_2$ .
30. What type of stoichiometric defect is shown by (i)  $ZnS$  and (ii)  $CsCl$ ?
31. Define the term point defects.
32. Define the term 'doping.'
33. Although pure silicon is an insulator then how does it behaves as a semiconductor on heating.
34. Name the crystal defect which lowers the density of an ionic crystal.
35. What makes the crystal of  $KCl$  appear sometimes violet?
36. Which point defect in crystal does not alter the density of the relevant solid?
37. In a  $p$ -type semiconductor the current is said to move through holes. Explain.
38. Mention the effect of increasing temperature on the conductivity of semiconductors.
39.  $Fe_3O_4$  Ferrimagnetic at room temperature but becomes paramagnetic when heated at 850 K?

### SA (I) Type Questions (2 Marks)

1. List four main characteristic properties of the solids.
2. (a) What is meant by the term crystallinity of a solid?  
(b) Why is quartz regarded as a crystalline solid while glass is an amorphous solid?
3. List four distinctions between crystalline and amorphous solids.
4. Give reasons for  
(a) Ionic solids are hard and brittle.  
(b) Copper is malleable and ductile.

example.

20. Explain the terms :-
  - (a) Intrinsic semiconductors
  - (b) Extrinsic semiconductor
21. Pure silicon is an insulator. Silicon doped with phosphorus is a semiconductor. Silicon doped with gallium is also a semiconductor. What is the difference between the two types?
22. (a) What is the origin of magnetic moments associated with electrons in atoms?  
(b) Distinguish between paramagnetism and diamagnetism.
23. Calculate the efficiency (Percentage of volume occupied and unoccupied) of packing in case of a metal crystal for simple cubic.

### **SA (II) Type Questions (3 Marks)**

1. Write the relationship between atomic radius ( $r$ ) and edge length ( $a$ ) of cubic unit cell for
  - (a) Simple cubic unit cell
  - (b) Body centred cubic unit cell
  - (c) Face centred cubic unit cell
2. Write and explain three differences between consequences of schottky and Frenkel defects under the heads :-
  - (a) Effect on density
  - (b) Effect on electrical conductivity
  - (c) Effect on stability of the crystal.
3. Account for the following :-
  - (a) Zinc oxide on heating turns yellow.
  - (b) Schottky defect decreases the density of a crystal.
  - (c) Non-stoichiometric sodium chloride is yellow in colour.
4. What is a semiconductor? Describe the two main types of semiconductors on the basis of their conductance mechanism.
5. Explain the following :-
  - (a) Ferromagnetism and Ferrimagnetism

Calculate the density of unit cell.

(Ans :  $6.23 \text{ g/cm}^3$ )

8. ★ A metal crystallises in fcc lattice with edge length 0.556 nm. Calculate the density of metal if there are :-

(a) 0.1% Frenkel defect (b) 0.1% Schottky defect

(Ans : (a)  $1.5458 \text{ g/cm}^3$  (b)  $1.5443 \text{ g/cm}^3$ )

9. Analysis shows that a metal oxide has the empirical formula  $M_{0.96}O$ . Calculate the percentage of  $M^{2+}$  and  $M^{3+}$  ions in this crystal. (Ans :  $M^{2+} = 91.7\%$ ,  $M^{3+} = 8.3\%$ )

10.  $AgCl$  is doped with  $10^{-2} \text{ mol\%}$  of  $CdCl_2$ , find the concentration of cation vacancies.

(Ans :  $6.02 \times 10^{19}$ )

11. A metallic element has a body central cubic lattice. Edge length of unit cell is  $2.88 \times 10^{-8}$  cm. The density of the metal is  $7.20 \text{ gcm}^{-3}$ .

Calculate :-

(a) The volume of unit cell.

(b) Mass of unit cell

(c) Number of atoms in 100 g of metal.

(Ans : (a)  $2.39 \times 10^{-23} \text{ cm}^3$  (b)  $1.72 \times 10^{-22} \text{ g}$ , (c)  $1.162 \times 10^{24}$  atoms)

12. Iron has a bcc unit cell with a cell edge of 286.65 pm. The density of iron is  $7.87 \text{ g cm}^{-3}$ . Use the information to calculate Avogadro's number. (Atomic mass of  $Fe = 56 \text{ g mol}^{-1}$ )

(Ans :  $6.04 \times 10^{23} \text{ mol}^{-1}$ )

13.  $KF$  has  $NaCl$  structure. It's density is  $2.48 \text{ g/cm}^3$ . Calculate edge length of crystal lattice. (Given  $K = 39 \text{ g mol}^{-1}$ ,  $F = 19 \text{ g mol}^{-1}$  and  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$ )

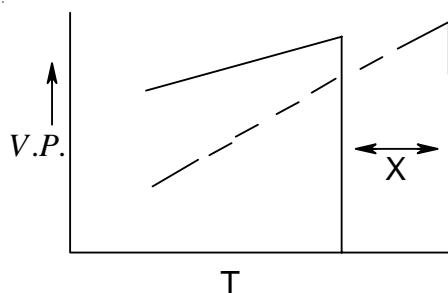
(Ans : 538 pm)

14. Molybdenum has atomic mass  $96 \text{ g mol}^{-1}$  with density  $10.3 \text{ g/cm}^3$ . The edge length of unit cell is 314 pm. Determine lattice structure whether simple cubic, bcc or fcc. (Given  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$ )

(Ans :  $z = 2$ , bcc type)

volatile hydrocarbon are used as lubricants. Why?

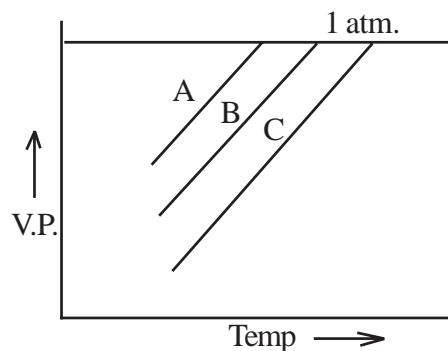
22. ★ Addition of  $HgI_2$  to  $KI$  (aq.) shows an increase in vapour pressure. Why?
23. What will happen to the boiling point of the solution on mixing two miscible liquids showing negative deviation from Raoult's law.
24. When 50 mL of ethanol and 50 mL of water are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Justify.
25. Liquid 'Y' has higher vapour pressure than 'X'. Which of them will have higher boiling point?
26. Which type of deviation is shown by the solution formed by mixing cyclohexane and ethanol?
27. ★ The phase diagram for pure solvent and the solution containing non-volatile solute are recorded below. The quantity indicated by 'X' in the figure is .



28. A and B liquids on mixing produce a warm solution. Which type of deviation from Raoult's law is there?
29. Define cryoscopic constant.
30. Mention the unit of ebullioscopic constant.
31. If  $k_f$  for water is  $1.86 \text{ k kg mol}^{-1}$ . What is the freezing point of 0.1 molal solution?
32. Name the component that separate first when salt solution is frozen.
33. Define osmotic pressure.
34. What is reverse osmosis? Give one large scale use of it.
35. What is the value of Van't Hoff factor ( $i$ ) for  $Na_2SO_4 \cdot 10H_2O$ ? **(Ans :  $i = 3$ )**
36. Define colligative properties.
37. Which colligative property should be measured for (i) thermally unstable compound (ii) compound having very low solubility at room temperature.
38. What is the value of Van't Hoff factor ( $i$ ), if some molecule undergoes dimerisation.

( $i = 0.5$ )

16. ★ The vapour pressure curves for the same non-volatile solute in the same solvent are shown. The curves are parallel to each other and do not intersect. What is the correct order of the concentrations of the solutions.



**SA (II) Type Question (3 Marks)**

- Define molarity and molality. Write two points of difference between molarity and molality of a solution.
- State and explain Henry's law.
  - If  $O_2$  is bubbled through water at 393 K, how many millimoles of  $O_2$  gas would be dissolved in 1L of water? Assume that  $O_2$  exerts a pressure of 0.95 bar.  
(Given  $K_H$  for  $H_2O = 46.82$  bar at 393 K)
- Explain the following :-
  - Aquatic species are more comfortable in cold water rather than warm water.
  - To avoid bends scuba divers use air diluted with helium.
  - Cold drink bottles are sealed under high pressure.
- Why should a solution of a non-volatile solute boil at a higher temperature? Explain with the help of a diagram. Derive the relationship between molar mass and elevation in boiling point.
- Account for the following :-
  - $CaCl_2$  is used to clear snow from roads on hill stations.
  - Ethylene glycol is used as antifreeze solution in radiators of vehicles in cold countries.
  - The freezing point depression of 0.1 M  $NaCl$  is nearly twice that of 0.1 M glucose solution.
- Why do colligative properties of an electrolyte solution of a given concentration are found to be larger than those of a non electrolyte solution of the same concentration.
- Give reasons for the following :-
  - RBC swell up and finally burst when placed in 0.1%  $NaCl$  solution.
  - When fruits and vegetables that have been dried are placed in water, they slowly

(c) Calculate the amount of ice that will separate out on cooling solution containing 50 g of ethylene glycol in 200 g  $H_2O$  to  $-9.3^\circ C$ . ( $K_f$  for water =  $1.86 K kg mol^{-1}$ )

(Ans : 38.71 g)

5. (a) Explain how molecular mass of a solute can be determined by osmotic pressure.  
(b) What is the molar concentration of particles in human blood if the osmotic pressure is 7.2 atm at normal body temperature of  $37^\circ C$ ? (Ans : 0.283M)

### Numerical Problems :-

1. Calculate the mass percentage of benzene ( $C_6H_6$ ) and carbon tetrachloride ( $CCl_4$ ), if 22 g of benzene is dissolved in 122 g of carbon tetrachloride.

(Ans : ( $C_6H_6$ )=15.3%,  $CCl_4$  = 84.7%)

2. Calculate the molarity of a solution prepared by mixing 2.5 L of 0.5 M urea solution and 500 mL of 2 M urea solution. (Ans : 0.75 M)

3. The mole fraction of  $CH_3OH$  in an aqueous solution is 0.02 and density  $0.994 g cm^{-3}$ . Determine the molality and molarity. (Ans : 1.13 m, 1.08 M)

4. 200 mL of calcium chloride solution contains  $3.011 \times 10^{22} Cl^-$  ions. Calculate the molarity of the solution. Assume that calcium chloride is completely ionised.

(Ans : 0.125 M)

5.  $6 \times 10^{-3} g$  oxygen is dissolved per kg of sea water. Calculate the ppm of oxygen in sea water. (Ans : 6 ppm)

6. The solubility of oxygen in water is  $1.35 \times 10^{-3} mol L^{-1}$  at  $20^\circ C$  and 1 atm pressure. Calculate the concentration of oxygen at  $20^\circ C$  and 0.2 atm. pressure.

(Ans :  $1.7 \times 10^{-3} mol L^{-1}$ )

7. Two liquids X and Y on mixing form an ideal solution. The vapour pressure of the solution containing 3 mole of X and 1 mol of Y is 550 mm Hg. But when 4 mole of X and 1 mole of Y are mixed, the vapour pressure of solution thus formed is 560 mm Hg. What will be the vapour pressure of pure X and pure Y at this temperature?

(Ans : X = 600 mm Hg, Y = 400 mm of Hg)

8. An aqueous solution containing 3.12 g of Barium Chloride in 250 g of water is found to be boil at  $100.0832^\circ C$ . Calculate the degree of dissociation of Barium Chloride. (Given : Molar Mass  $BaCl_2 = 208 g mol^{-1}$ ,  $K_b$  for water = 0.52 K/m). (Ans : 83.3%)

9. The degree of dissociation of  $Ca(NO_3)_2$  in a dilute aqueous solution, containing 7.0 g

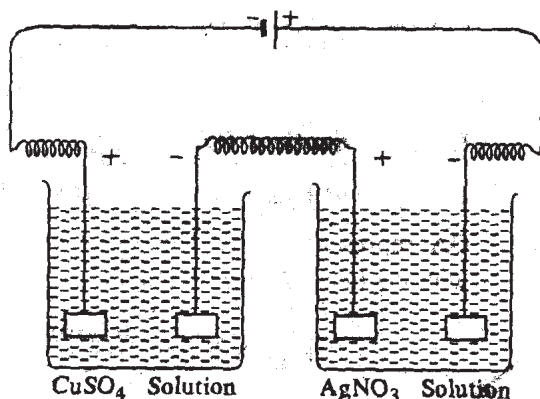
## Chapter - 3

# ELECTROCHEMISTRY

### VSA Type Qyestiouns (1 Mark)

1. Define electrochemistry.
2. List two main advantages of electrochemistry.
3. What is a galvanic cell?
4. Draw a cell diagram for Daniell cell.
5. Mention the purpose of salt-bridge placed between two half cells of a galvanic cell.
6. Condition for Daniell cell in which there is no flow of electrons or current or we can conclude that there is no chemical reaction.  $(E_{ext.} = 1.1V)$
7. What is meant by standard electrode potential?
8. Give the redox reaction involved in Daniell cell.
9. How is electrode potential different from a cell potential?
10. What is the significance of standard hydrogen electrode(SHE)?
11. Can you store zinc sulphate solutions in a copper container?
12. How does an electrochemical series help us in predicting whether a redox reactions is feasible in a given direction or not?
13. Write Nernst equation for the electrode reaction  $M^{n+}(aq) + ne^{-} \rightarrow M(s)$
14. As per electrochemical series and on the basis of  $E^{\circ}$  values :-
  - (a) Gas which have highest tendency to reduce.
  - (b) Weakest oxidising ion.
15. List the two factors that influence the value of cell potential of a galvanic cell.
16. How is equilibrium constant of a reaction related to standard cell potential?
17. Why is equilibrium constant (K) related to only  $E^{\circ}_{cell}$  and not  $E_{cell}$ ?
18. Define cell constant.
19. What is the SI unit of cell constant?
20. Define specific conductance.
21. How does specific conductance vary with temperature?
22. What is the SI unit of (i) Conductance (ii) Conductivity?
23. What is a concentration cell?

10. ★ Account for the fact that when chlorine is passed through a fluoride solution, no reaction takes place. (Given  $E^\circ_{F_2/2F^-} = 2.87V$ ,  $E^\circ_{Cl_2/2Cl^-} = -1.36V$ )
11. ★ Copper does not dissolve in  $HCl$  (aq) but dissolves in  $HNO_3$  (aq) producing  $Cu^{2+}$  ions. Explain the difference in behaviour.  
(Given  $E^\circ_{Cu^{2+}/Cu} = +0.34V$ ,  $E^\circ_{Cl_2/2Cl^-} = +1.36V$  and  $NO_3^- + 4H^+ + 3e^- \rightarrow NO_{(g)} + 2H_2O, E^\circ_{NO_3^-/NO} = +0.97V$ ).
12. Explain the following observations :
- The product of electrolysis of molten  $NaCl$  are sodium metal and chlorine gas.
  - The product of electrolysis of aqueous sodium chloride solutions are  $NaOH$ ,  $Cl_2$  and  $H_2$ .
13. Represents a concentration cell using copper sulphate solutions of two concentrations  $C_1$  and  $C_2$ . How can emf of such a cell be calculated.
14. What are full cells? Describe the principle and overall reaction involved in the working of hydrogen-oxygen fuel cell.
15. Explain the meaning of the terms :-
- Ionic mobility
  - Overvoltage
16. What is electrochemical series? List its two characteristics.
17. ★ The figure shows two electrolytic cells connected in series.

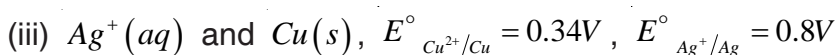
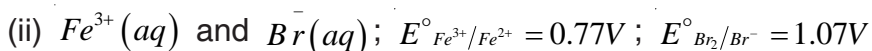
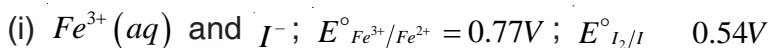


- How much electricity is required for the reduction of 1 mole of  $Ag^+$  ions to  $Ag$ ?
- If three Faradays of electricity is passed through these cells what is the ratio of cations [ $Ag^+$  and  $Cu^{2+}$ ] deposited on cathodes? (**Ans** : (a) 1F, (b) 2:1)

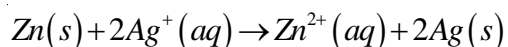
- (a) Arrange oxidising agents in order of increasing strength.
- (b) Which of these oxidising agents will oxidise  $Cu$  to  $Cu^+$  under standard conditions?

### SA (II) Type Questions (3 Marks)

1. ★ Using the standard electrode potential, product the reaction, if any that occurs between the following :-



2. State the relationship amongst cell constant of a cell, resistance of this solution in the cell and conductivity of the solution. How is molar conductivity of a solute related to conductivity of its solution?
3. Describe the composition of anode and cathode in a mercury cell. Write the electrode reactions for this cell. Why it provides constant voltage throughout its life?
4. Give reasons for :
- (i) For a weak electrolyte, its molar conductivity in dilute solution increases sharply as its concentration in solution is decreased.
- (ii) Molar conductivity of a strong electrolyte like  $KCl$  decrease slightly while increasing concentration?
- (iii) It is not easy to determine  $\Lambda_m$  of a weak electrolyte by extrapolation of  $\sqrt{c}$  vs  $\Lambda_m$  curve?
5. List two disadvantages of corrosion. Describe the following methods of prevention of corrosion.
- (a) Electrochemical method
- (b) Covering the surface by other metal.
6. Formulate the galvanic cell in which the following reaction takes place :-



State :-

- (a) Which one of its electrodes is negatively charged?
- (b) The reaction taking place at each of its electrode.
- (c) The direction of current within this cell.

$$\frac{k_1 + k_2}{2} = \frac{1}{R} \times y, \quad \frac{1}{2} \left[ \frac{y}{50} + \frac{y}{100} \right] = \frac{1}{R} \times y \Rightarrow R = 66.66 \text{ ohm ]}$$

4. (a) Explain Faraday's first and second law of electrolysis.
- (b) Silver is deposited on a metallic vessel of surface area  $800 \text{ cm}^2$  by passing current of 0.2 ampere. for 3 hours. Calculate the thickness of silver deposited. [Density of silver  $10.47 \text{ g cm}^{-3}$ , atomic mass of silver =  $107.924 \text{ gmol}^{-1}$ ]

(Ans :  $2.9 \times 10^{-4} \text{ cm}$ )

5. (a) Describe the construction and working of standard hydrogen electrode.
- (b) Calculate the equilibrium constant for the reaction :-

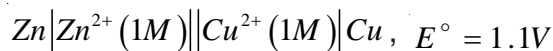
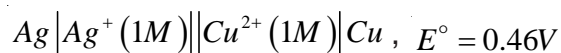


Given  $E^\circ_{Ce^{4+}/Ce^{3+}} = 1.44V$ ,  $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.68V$ .

(Ans :  $7.6 \times 10^{12}$ )

### Numerical Problems :-

1. ★ The emf of the following cells are

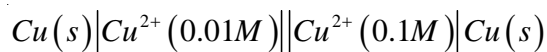


(Ans : 0.64 V)

Calculate emf of the cell



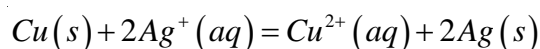
2. For concentration cell



- (a) Calculate the cell potential
- (b) Will the cell generate emf when concentration becomes equal.

(Ans : 0.295 V, No)

3. Calculate the equilibrium constant for the reaction at  $25^\circ C$ .

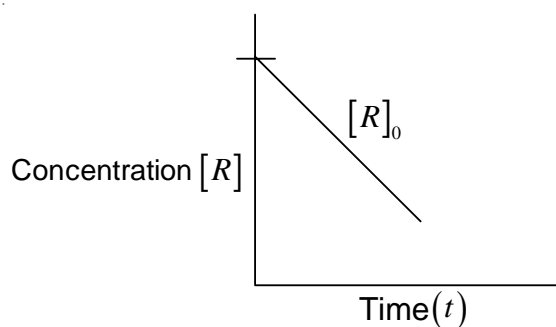


The standard cell potential for the reaction at  $25^\circ C$  is 0.46 V.

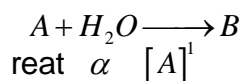
(Ans :  $4.0 \times 10^{15}$ )

11. The molar conductivity of 0.1M  $CH_3COOH$  solution is  $4.6 \text{ S cm}^2 \text{ mol}^{-1}$ . Calculate the conductivity and resistivity of the solution. **(Ans :  $0.00046 \text{ s cm}^{-1}$ ,  $2174 \Omega \text{ cm}$ )**
12. The molar conductivities of  $NH_4^+$  ion and  $73.5 \text{ Scm}^2 \text{ mol}^{-1}$  and  $76.2 \text{ Scm}^2 \text{ mol}^{-1}$  respectively. The specific conductivity of 0.1 M  $NH_4Cl$  is  $1.288 \times 10^{-2} \text{ Scm}^{-1}$ . Calculate the dissociation constant of  $NH_4Cl$ . **(Ans :  $7.396 \times 10^{-2}$  )**
13. Molar conductivity as infinite dilution for  $NH_4Cl$ ,  $NaOH$  and  $NaCl$  solution at 298K are respectively 129.8, 218.4 and  $108.9 \text{ Scm}^2 \text{ mol}^{-1}$  and  $\lambda_m$  for  $10^{-2}$  M solution of  $NH_4OH$  is  $9.33 \text{ Scm}^2 \text{ mol}^{-1}$ . Calculate the degree of dissociation of  $NH_4OH$ . **(Ans : 0.039)**

What does the slope of the graph represent?



11. Mention the order of a reaction if the rate of reaction does not depend on the concentration of any of the reactants.
12. For the elementary step of a chemical reaction

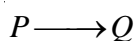


What is the (i) molecularity and (ii) order of the reaction?

13. ★ For a chemical reaction  $A \longrightarrow B$

The rate of the reaction quadruples when the concentration of A is doubled. The rate of the reaction is :  $Rate = K[A]^n$ . What is the value of n? **(Ans : n = 2)**

14. What is the value of the order of reaction of an artificial radioactive decay?
15. Mention one example of zero order reaction.
16. Express the relation between the half-life period of a reactant and initial concentration for a reaction of  $n^{th}$  order.
17. ★ A reaction is 50% completes in 2 hours and 75% complete in 4 hours. What is the order of reaction?
18. What is the source of activation energy in a photochemical reaction?
19. ★ Consider an endothermic reaction



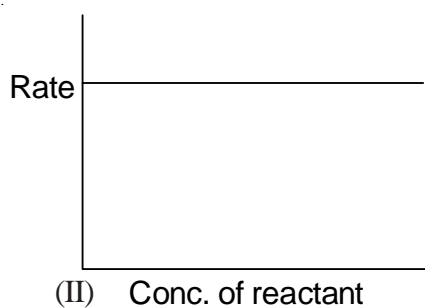
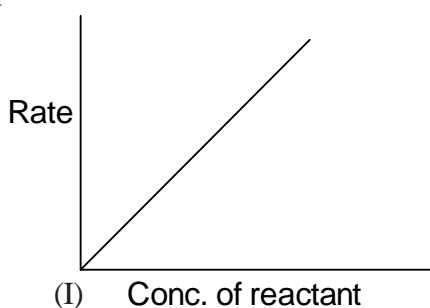
With activation energies  $E_b$  and  $E_f$  respectively for the backward and forward reactions. Express the relationship between  $E_b$  and  $E_f$ .

**[Hint :  $\Delta H = +ive$ ,  $\Delta H = E_f - E_b$  or  $E_b - E_f$ ]**

20. Suggest an appropriate reason for the observation : “on increasing temperature of the reacting system by 10 degrees, the rate of reaction almost doubles.”
21. The rate constant of a reaction is given by the expression :

If the volume of the reaction vessel is doubled, how would it affect the rate of the reaction?  
**(Ans : Diminish to 1/8 value of initial value)**

6. What is meant by 'half life of a reaction'? Show that half life for a first order reaction is independent of initial concentration.
7. Explain with an example, what is a pseudo order of reaction.
8. List four methods used to determine the order of reaction.
9. Show that time required for 99.9% of the first order reaction is 10 times of  $t_{1/2}$  for first order chemical reaction.
10. The graphs (I and II) given below are plot of rate of reaction verses concentration of the reaction. Predict the order from the graphs.



11. ★ (a) For a reaction  $A + B \rightarrow Products$ , the rate law is given by

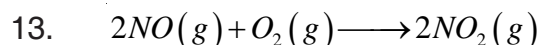
$$r = k[A]^{1/2}[B]^2$$

What is the order of reaction?

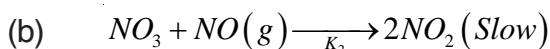
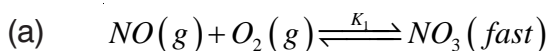
- (b) The conversion of molecules X to Y follows second order kinetics. If concentration of X is increased to three times how will it affect the rate of formation of Y?

**(Ans : (a)  $5/2$  (b) 9 times)**

12. The slope of the line in the graph of  $\log k$  verses  $1/T$  for a reaction is  $-5841 \text{ K}$ . Calculate the energy of activation.  
**(Ans :  $1.12 \times 10^5 \text{ J mol}^{-1}$ )**



What is the predicted of rate law, if mechanism is





reaction. ( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ,  $\log 4 = 0.602$ )

(Ans : 24.206 kJ/mol)

7. The rate of reaction triples when the temperature changes from  $20^\circ\text{C}$  to  $50^\circ\text{C}$ . Calculate the energy of activation. ( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ,  $\log 3 = 0.4771$ )

(Ans : 28.818 kJ  $\text{mol}^{-1}$ )

8. ★ (a) For a reaction, the energy of activation is zero. What is the value of rate constant at 300K if  $k_1 = 1.6 \times 10^{-6} \text{ Sec}^{-1}$  at 280K ( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ )

(Ans :  $k_2 = k_1 = 1.6 \times 10^{-6} \text{ Sec}^{-1}$ )

- (b) Rate constant ( $k$ ) of a reaction varies with temperature according to the equation

$$\log k = \log A - \frac{E_a}{2.303T}$$

Where  $E_a$  is the energy of activation. On plotting a graph between  $\log k$  versus  $\frac{1}{T}$ , a straight line with a slope  $-6670\text{K}$  is obtained. Calculate  $E_a$  for the reaction ( $R = 127.71 \text{ kJ mol}^{-1}$ )

[Hint : Slope of the line =  $E_a/2.303 R$ ]

9. ★ A hydrogenation reaction is carried out at 550 K. If the same reaction is carried out in the presence of a catalyst at the same rate. The temperature required is 400 K calculate the activation energy of the reaction if the catalyst lowers the activation barrier by 20 kJ  $\text{mol}^{-1}$ .

[Hint :  $k = A e^{-E_a/RT}$ . In the absence of catalyst,  $E_a = x \text{ kJ mol}^{-1}$ . In the presence of catalyst,  $E_a = (x - 20) \text{ kJ mol}^{-1}$ ]

(Ans :  $E_a = 100 \text{ kJ mol}^{-1}$ )

10. The rate constant for the first order decomposition of  $\text{H}_2\text{O}_2$  is given by the following equation  $\log k = 14.34 - 1.25 \times 10^4 \text{ K} / T$ .

Calculate  $E_a$  for this reaction and at what temperature will its half-period be 256 minutes.

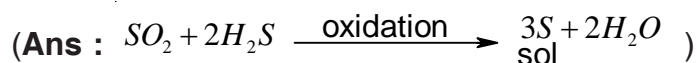
11. Show that for a first order reaction, time required for 99% completion is twice for the

## Chapter - 5

# SURFACE CHEMISTRY

### VSA Type Qyestions (1 Mark)

1. Why does a gas mixed with another gas not form a colloidal system?
2. Under what condition it is possible to obtain ultra clean surface of the metals.
3. Why adsorbate particles are attracted and retained on the surface of adsorbent?
4. What is sorption? Give one example.
5. "Chemisorption is highly specific." Illustrate with one example.
6. "Adsorbents in finely divided form are more effective." Why?
7. Define the term 'Critical temperature' of the gas.
8. Mention one shape-selective catalyst used to convert alcohol into gasoline.
9. 'Generally high temperature is favourable for chemisorption as compared to physisorption.' Why?
10. Name the catalyst used in the following process :
  - (i) Haber process for the manufacture of  $NH_3$  gas.
  - (ii) Ostwald process for the manufacture of nitric acid.
11. Write the relationship given by Freundlich, also mention the terms involved.
13. Which group elements show maximum catalytic activity for hydrogenation reactions?  
(Hint : 7-9 group. elements)
14. How sol of sulphur can be prepared by chemical method?



15. Name the enzyme which converts milk into curd. (Ans : lacto bacilli)
16. What are the optimum temperature and  $pH$  under which enzymes are highly active.  
(Ans : Temperature 298–310K &  $pH$  –5 to 7)
17. What are the physical states of dispersed phase and dispersion medium in foam rubber.
18. Identify the micelle in the following :-
  - (i) Sulphur sol      (ii) Solution of  $KCl$
  - (iii) Starch sol      (iv)  $C_{17}H_{35}COO^-Na^+$

36. What is purple of casium? (Ans : Colloidal sol of gold)
37. Which of the following is more effective in coagulating +vely charged ferric hydroxide sol  
- (i)  $KCl$  (ii)  $CaSO_4$  (iii)  $K_3[Fe(CN_6)]$
38. Mention the cause of peptization.
39. State the purpose of impregnating the filter paper with collodion solution.
40. Mention one use of  $ZSM-5$  catalyst.

### SA (I) Type Questions (2 Marks)

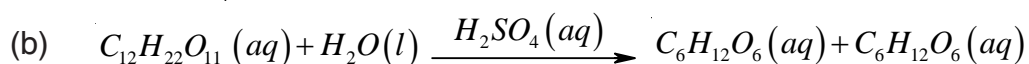
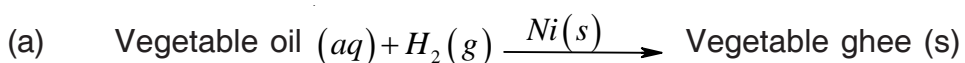
41. Arrange the gases  $CO$ ,  $N_2$  and  $CH_4$  in increasing order of adsorption on the surface of charcoal in a closed vessel. Give reasons also.

(Hint :  $N_2 < CO < CH_4$  as critical temp.  $\propto$  Extent of adsorption)

42. What happens :-  
(a) when animal charcoal is added in a solution of methylene blue dye.  
(b) when aqueous solution of raw sugar is passed over beds of animal charcoal.
43. A small amount of silica gel and a small amount of anhydrous calcium chloride are placed separately in two beakers containing water-vapour. Name the phenomenon that takes place in both the beakers.

(Hint : Silica gel-Adsorption, Anhydrous  $CaCl_2$ -Absorption, as it forms  $CaCl_2 \cdot 2H_2O$  )

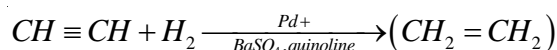
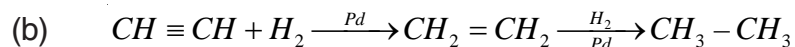
44. Write the differences between adsorption and absorption.
45. How physisorption can be distinguished from Chemisorption?
46. Identify the following reactions as Homogeneous and Heterogeneous catalysis :



47. When and why Gas masks are used?
48. Write the factors upon which the catalytic reaction of shape-selective catalysis depends?  
(Hints : (a) Pore structure of the catalyst (b) Size of the reactant & product molecules. )
49. Mention two examples of emulsifying agents for o/w emulsions and w/o emulsions.
50. Suggest a mechanism of enzyme catalysed reaction along with the diagram.
51. What are the conditions for the occurrence of (a) Electrophoresis and (b) Electroosmosis.

65. Mention the two important features of solid catalysts and explain with the help of suitable examples.
66. How are the following colloids different from each in respect of dispersion medium and dispersed phase? Give one example of each type. (a) An aerosol (b) A hydrosol (c) An emulsion.
67. What happens :-
- By persistent dialysis. (**Hint** : coagulation)
  - When river water meets the sea water.
  - When alum is applied on cuts during bleeding.
68. Distinguish between multimolecular, macromolecular and associated colloids with the help of one example of each.
69. (a) How are emulsions useful in preparing photographic plates or films?  
 (b) Explain with diagram the process of electrical precipitation of smoke.
70. (a) What property of colloids is responsible for the sun to look red at the time of setting?  
 (b)  $C_2H_2$  on addition with  $H_2$  forms ethane in presence of palladium but if reaction is carried in the presence of barium sulphate and quinoline, the product is ethene and not ethane.

(Ans : (a) Sun is at horizon and blue part of the light is scattered away by the dust particles as light has to travel a long distance through the atmosphere.



71. (a) How does the size of the colloidal particles comparable to the size of the particles present in the true solution?  
 (b) Calculate the ratio of the volume of the colloid particles ( $V_c$ ) and volume of the solute particles in a true solution ( $V_s$ ).

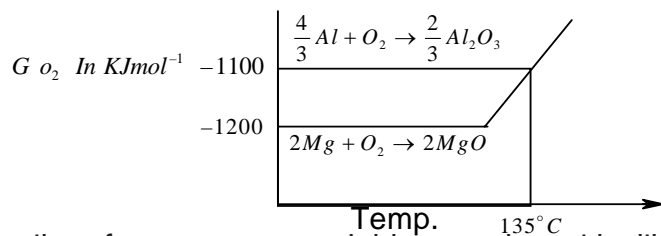
(Ans : (a) For true solution diameter range = 1 to 10 Å for colloidal solution diameter range = 10 to 1000Å)

$$(b) \quad \frac{V_c}{V_s} = \frac{\frac{4}{3} r_c^3}{\frac{4}{3} r_s^3} = \frac{r_c^3}{r_s^3} = \frac{10/2^3}{1/2^3} = 10^3$$

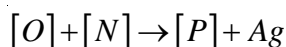
18. Which form of iron is used in making anchors, chains and agricultural components?  
(Ans : Wrought iron)
19. Write the reaction involved in the extraction of copper from low grade ores and scraps.  
(Ans :  $Cu^{2+}(aq) + H_2(g) \rightarrow Cu(s) + 2H^+(aq)$ )
20. Although aluminium is above hydrogen in the electrochemical series, it is stable in air and water. Why?
21. Zinc and not copper is used for the recovery of metallic silver from the complex  $[Ag(CN)_2]^-$ , although electrode potentials of both zinc and copper are less than that of Ag. Explain why?  
(Hint : Zinc reacts at faster rate as compared with copper further zinc is cheaper than copper)

### SA (I) Questions (2 Marks)

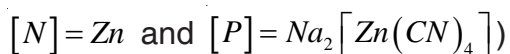
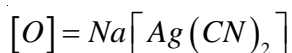
22. Name the process for the beneficiation of (i) An ore having impurities lighter than it. (ii) Sulphide ores.
23. What is cryolite? Mention its use in the extraction of aluminium. (Ans :  $Na_3AlF_6$ )
24. The graphite electrodes in the extraction of 'Al' by Hall-Haroult process need to be changed frequently. Why?
25. Write the chemical formulae of the following :-  
(a) Haematite (b) Magnetite (c) limonite (d) Siderite.  
(Ans : (a)  $Fe_2O_3$  (b)  $Fe_3O_4$  (c)  $Fe_2O_3 \cdot 3H_2O$  (d)  $FeCO_3$  )
26. Give equations for the industrial extraction of zinc from calamine.  
[Ans :  $ZnCO_3 \rightarrow ZnO + CO_2$  (Calcination) &  $ZnO + C \rightarrow Zn + CO$  (Reduction)]
27. Name the elements contained in anode mud during refining of copper. Why does it contain such elements?  
(Ans : Au & Ag . Since they are less electropositive than copper)
28. What is blister copper? Why is it called so?
29. Name one metal that is refined by each of the following processes :-  
(i) Mond process (ii) Van Arkel process  
(iii) Zone refining (iv) Distillation
30. What kind of elements are suitable for purification by chromatography?



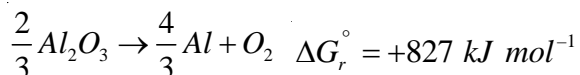
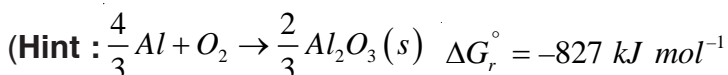
41. ★ The active silver forms a water soluble complex with dilute aqueous solution of  $NaCN$  in the presence of a gas (M). The silver metal is obtained by the addition of a metal (N). Write the structures of (O) and (P) and identify (M) and (N) in the following reaction sequence.



(Hint : Metallurgy of silver;  $[M] = O_2$ )



42. Calculate the minimum e.m.f. required to carry out the electrolysis of  $Al_2O_3$ . Given that  $\Delta G_r^\circ (Al_2O_3) = -827 \text{ kJ mol}^{-1}$ . Faraday's constant (F) =  $96500 \text{ C mol}^{-1}$ .



No. of electrons involved in this redox reaction = 4

$$\Delta G^\circ = -nE_{cell}^0 F$$

$$E_{cell}^0 = -\frac{\Delta G^\circ}{nF} = \frac{+827 \times 10^3 \text{ J mol}^{-1}}{4 \times 96500 \text{ C mol}^{-1}} = -2.14V$$

19. Sulphur has a greater tendency for catenation than oxygen. Explain.
20. Bond dissociation energy of  $F_2$  is less than that of  $Cl_2$ . Why?
21. Write the reaction of  $PCl_5$  with heavy water.
22. How many  $P-O-P$  bonds are there in cyclotrimeta-phosphoric acid?
23. In group 16, the stability of +6 oxidation state decreases and that of +4 oxidation state increases down the group. Why?
24. The electron gain enthalpy with negative sign for oxygen ( $-141kJ/mol$ ) is less than that of sulphur ( $-200kJ/mol$ ). Why?
25. Write the equation for the decomposition of hydrogen peroxide in the presence of finely divided metal and  $MnO_2$  as catalyst.
26. Name an element that occurs in nature as a decay product of thorium and uranium minerals.
- 27.

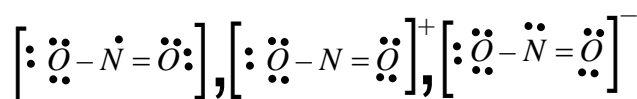
	O	S
M.P/ K	55	393
B.P/ K	90	718

Explain the large difference between the m.p and b.p of oxygen and sulphur.

28. Fluorine exhibit only  $-1$  oxidation state whereas other halogens exhibit +ve oxidation states also. Explain.
29. Arrange the following oxo acids of chlorine in increasing order of acidic strength.  
 $HOCl, HOClO, HClO_3, HOClO_3$
30. The majority of known noble gas compounds are those of Xenon. Why?
31. ★ "Hypophosphorus acid is a good reducing agent." Justify with an example.
32. ★ Draw the structure of  $H_4P_2O_7$  and find out its basicity?
33. ★ Arrange the following triatomic species in the order of increasing bond angle.

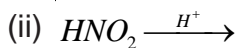


[Hint :



$NO_2$  has one non bonding electron,  $NO_2^-$  has 2 non bonding  $e^-$ ,  $NO_2^+$  has no nonbonding  $e^-$  on N atom. Bond angle of  $NO_2^+$  is maximum but  $NO_2^-$  is minimum. ]

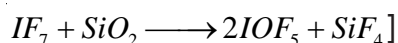
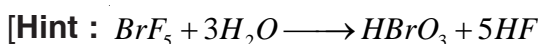
- (i)  $(NH_4)_2Cr_2O_7 \longrightarrow$
- (ii)  $NH_4Cl(aq) + NaNO_2(aq) \longrightarrow$
11. (i)  $NH_2CONH_2 + H_2O \longrightarrow$
- (ii)  $FeCl_3(aq) + NH_4OH \longrightarrow$
12. (i)  $Ca_3P_2 + H_2O(l) \longrightarrow$
- (ii)  $I_2 + HNO_3(conc.) \longrightarrow$
13. (i)  $Ba(N_3)_2 \longrightarrow$
- (ii)  $4H_3PO_3 \xrightarrow{\Delta}$
14. (i)  $PH_4I + KOH \longrightarrow$
- (ii)  $HgCl_2 + PH_3 \longrightarrow$
15. (i)  $PCl_3 + 3H_2O \longrightarrow$
- (ii)  $S + H_2SO_4(conc) \longrightarrow$
16. (i)  $Al_2O_3(s) + NaOH(aq) + H_2O(l) \longrightarrow$
- (ii)  $HCl + O_2 \xrightarrow{CuCl_2}$
17. (i)  $Ca(OH)_2 + Cl_2 \longrightarrow$
- (ii)  $XeF_4 + H_2O \longrightarrow$
18. (i)  $Na_2SO_3 + Cl_2 + H_2O \longrightarrow$
- (ii)  $NaHCO_3 + HCl \longrightarrow$
19. (i)  $XeF_6 + H_2O \xrightarrow[\text{Hydrolysis}]{\text{Complete}}$
- (ii)  $XeF_6 + H_2O \xrightarrow[\text{Hydrolysis}]{\text{Partial}}$
20. (i) Why does chlorine water loses its yellow colour on standing?
- (ii) What happens when chlorine reacts with dilute solution of  $NaOH$ ? Write the



33. ★ Suggest reason why only binary compounds of noble gases are fluorides and oxides of Krypton, Xenon and Radon.

(Hint : F and O are most electronegative elements)

34. ★ Which fluorinating agents are often used instead of  $F_2$ ? Write two chemical equations showing their use as fluorinating agents.



35. ★ (i) Hydrolysis of  $XeF_6$  is not regarded as a redox reaction. Why?

(ii) Write a chemical equation to represent the oxidising nature of  $XeF_4$ .



### SA (II) Type Questions (3 Marks Questions)

- How is  $HNO_3$  prepared on a large scale. Name the process. Write chemical equations of the reactions involved. What concentration by mass of  $HNO_3$  is obtained by this process and how can it be further concentrated to 98%?
- Write the chemical equation for the laboratory preparation of  $O_2$  gas. How can it be converted to  $O_3$ ?
  - How does  $O_3$  react with lead sulphide. Give its chemical equation.
- Assign reason for the following :
  - Noble gases have large positive value of electron gain enthalpy.
  - Helium has the lowest boiling point than any known substance.
  - $IF_7$  is known but  $ClF_7$  is not known.
- How is  $SO_2$  gas prepared in the laboratory? What happens when it is passed through acidified  $KMnO_4$  solution?
  - "The behaviour of  $SO_2$  is very similar to that of  $CO_2$ ." Give a chemical equation to justify the statement.
- Assign reason for the following statements :-

### Long Answer type Questions (5 Marks)

1. How is  $PH_3$  prepared in the laboratory? How is it purified? How does the solution of  $PH_3$  in water react on irradiation with light and on absorption in  $CuSO_4$ ? How can you prove that  $PH_3$  is basic in nature?

Write the chemical equations for all the reactions involved.

2. Assign a possible reason for the following :
- (i) Stability of +5 oxidation state decreases and that of +3 oxidation state increases down the group 15 elements.
  - (ii)  $H_2O$  is less acidic than  $H_2S$ .
  - (iii)  $SF_6$  is inert while  $SF_4$  is highly reactive.
  - (iv)  $H_3PO_2$  and  $H_3PO_3$  act as good reducing agents while  $H_3PO_4$  does not.
  - (v) Noble gases have comparatively large size in their respective period.
3. (i) How is  $XeF_6$  prepared from the  $XeF_4$ ? Write the chemical equation for the reaction.
- (ii) Deduce the structure of  $XeF_6$  from VSEPR theory.
- (iii) How does  $XeF_2$  reacts with  $PF_5$ ?
- (iv) Give one use each of helium and Neon.
- (v) Write the chemical equation for the hydrolysis (Complete) of  $XeF_4$ .
4. (i) Why does nitrogen show anomalous behaviours? Discuss the trend of chemical reactivity of group 15 elements with.
- (a) Oxygen (b) Halogens (c) Metals
- (ii)  $H_3PO_2$  is a dibasic acid. Why?
5. (i) Draw the structure of Ozone.
- (ii) Give one chemical reaction to show that ozone is an oxidising agent.
- (iii) Give two probable reasons for the depletion of ozone layer.
- (iv) How is  $N_2O$  gas prepared. Write the chemical equation for the reaction.
6. (i) Why oxygen show anomalous behaviour?
- (ii) Discuss the trend in chemical reactivity of group 16 elements with :-
- (a) Hydrogen (b) Oxygen (c) Halogens
- (ii) Arrange the following in the order of increasing acid strength :

## Chapter - 8

### THE d- and f- BLOCK ELEMENTS

#### VSA Type Question (1 Mark Questions)

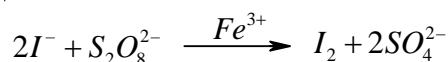
- Out of the following which one is a transition metal?  
 $A = [Ar]3d^{10}4s^2$                        $B = [Kr]4d^{10}5s^1$
- Write the electronic configuration of  $Cr^{3+}$  ion. (Atomic number of  $Cr = 24$ )
- Which element among transition elements exhibit the highest oxidation state?
- Write the general electronic configuration of transition elements.
- Gold has completely filled d orbitals ( $5d^{10}$ ) in its ground state. How can you say that it is a transition element? (Atomic number of gold = 79)
- Out of the following d-block elements, identify the element which does not exhibit variable oxidation state :  $Cr, Co, Zn$
- Except  $Zn, Cd$  and  $Hg$ , the other transition metals have high melting points. Why?
- In the  $3d$  series ( $Sc \rightarrow Zn$ ) why the enthalpy of atomization of zinc is the lowest?
- $Cu^+$  ion is unstable in aqueous solution. Why?
- Although  $Co^{2+}$  ion appears to be stable, it is easily oxidised to  $Co^{3+}$  ion in the presence of a strong ligand. Explain.
- First ionization enthalpies of  $5d$ -series elements is higher than those of  $3d$ - and  $4d$ -series elements. Why?
- Which of the following ions give coloured solution on dissolution in water?
- Why  $Mn^{2+}$  compounds are more stable than  $Fe^{2+}$  compounds towards oxidation to their +3 state?  
(At. No. of  $Mn = 25, Fe = 26$ )
- Ions of the same charge in a given series of transition elements show progressive decrease in their radii. Why?
- Nickel show an oxidation state zero in its complex compound  $[Ni(Co)_4]$ . Assign a reason.
- Calculate the magnetic moment of  $Cu^{2+}$  ( $Z = 29$ ) on the basis of 'Spin-only' formula.

- (ii) Zirconium (II transition series) and Hafnium (III transition series) exhibit similar radii. Why?
4. Write complete chemical equations for :
- (i) Oxidation of  $Fe^{2+}$  by  $Cr_2O_7^{2-}$  in acidic medium
- (ii) Oxidation of  $Mn^{2+}$  by  $MnO_4^-$  in neutral medium.
5. (i) Why do transition metals show high melting points?  
(ii) Out of Fe and Cu, which one would exhibit higher melting point?
6.  $Ni(II)$  compounds are found to be thermodynamically more stable than  $Pt(IV)$  compounds while  $Pt(IV)$  compounds are relatively more stable than  $Ni(IV)$  compounds. Give a possible reason.  
[At. Nos. – Ni = 28, Pt = 78]
7. (i) Out of  $Co^{2+}$  and  $Ti^{4+}$  ions which one will give coloured aqueous solution.  
(ii) How will each of them respond to magnetic field and why?
8. Mention two compounds that form the basis of Ziegler catalysts. Give its one use.
9. Give two examples of oxo metal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.
10. For the first row transition metals the enthalpy of atomisation values are :

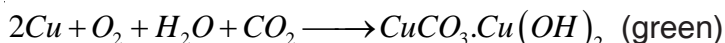
	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
$\Delta_a H^\theta / kJ mol^{-1}$	326	473	515	397	281	416	425	430	339	126

Assign reason for the following :

- (i) Transition elements have higher values of enthalpies of atomisation.  
(ii) The enthalpy of atomisation of zinc is the lowest.
11. Account for the following :-  
(i) Copper shows its inability to liberate hydrogen gas from the acids.  
(ii) Scandium ( $Z = 21$ ) does not exhibit variable oxidation states.
12. Copper ( $I$ ) compounds undergo disproportionation. Write the chemical equation for the reaction involved and give reason.
13. Iron( $III$ ) catalyses the reaction :

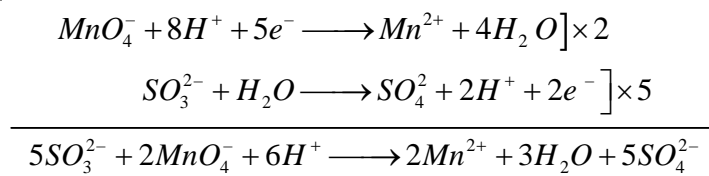


24. ★ Copper corrodes in moist air to produce a green layer on its surface. Explain why?  
 (Hint : In moist air, a layer of basic copper carbonate is formed on the surface.



25. ★ Calculate the number of moles of  $\text{KMnO}_4$  that will be needed to react completely with one mole of sulphite ion in an acidic medium.

[Hint : 2/5 mole



∴ 5 moles of sulphite ions oxidised by 2 moles of  $\text{KMnO}_4$ ]

### SA (II) Type Questions (3 Marks)

- What are transition metals?
  - Write any two characteristic properties of transition metals.
  - “Transition metals show paramagnetic behaviour.” Comment.
- Write the electronic configuration of  $\text{Pm}^{2+}$  ion ( $Z = 61$ ). Using Hund's rule.
  - Calculate the magnetic moment of the divalent ion  $\text{Pm}^{2+}$  in aqueous solution.
  - Arrange the following oxides in the increasing order of their acidic character :



- Account for the following :-
  - With  $3d^4$  configuration,  $\text{Cr}^{2+}$  acts as a reducing agent but  $\text{Mn}^{3+}$  acts as an oxidising agent. (At. number of Cr = 24, Mn = 25)
  - The atomic radii of transition elements decrease with atomic number in a given series.
  - The  $E^\circ$  value for  $\text{Mn}^{3+}/\text{Mn}^{2+}$  couple is much more than  $\text{Fe}^{3+}/\text{Fe}^{2+}$  couple.

$$[E^\circ_{\text{Mn}^{3+}/\text{Mn}^{2+}} = +1.57\text{V} \quad E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = +0.77\text{V}]$$

- What is the general electronic configuration of 2nd transition series?
  - Deduce the number of 3d electrons in the following ions :

[Hint : Among these halids, the transition metal ion having maximum numbers of unpaired electrons will be drawn strongly into the magnetic field

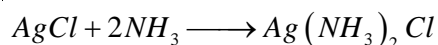
$$Ti^{4+} = 3d^0 \quad \text{no. of unpaired } e^- = 0 \quad \mu = 0$$

$$V^{3+} = 3d^2 \quad \text{no. of unpaired } e^- = 2 \quad \mu = 2.76 \text{ BM}$$

$$Fe^{2+} = 3d^6 \quad \text{no. of unpaired } e^- = 4 \quad \mu = 4.9 \text{ BM ]}$$

15. ★ Account for the following :-

- (i) How are  $H_2O$  molecules bonded in  $CuSO_4 \cdot 5H_2O$  ?
- (ii) Silver chloride dissolves in excess of ammonia.
- (iii) Cuprous chloride is diamagnetic while cupric chloride is paramagnetic.



[Hint : (ii)  $AgCl + 2NH_3 \longrightarrow Ag(NH_3)_2Cl$   
Complex – Diamminesilver(I) Chloride

### Long Questions (5 Marks)

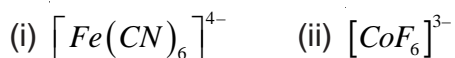
1. Explain giving reasons the following properties of transition metals :
  - (i) Transition metals and their compounds are known for their catalytic activity.
  - (ii) Transition metals form Interstitial compounds.
  - (iii) Transition metals show paramagnetic behaviour.
  - (iv) Transition metals form coloured complexes
  - (v) The enthalpies of atomisation of transition elements are quite high.
2.
  - (i) Name the ore from which  $KMnO_4$  is prepared.
  - (ii) Write the steps involved in the preparation of  $KMnO_4$  along with the chemical equations.
  - (iii) How does  $KMnO_4$  react with :
    - (a) Hydrogen sulphide gas in acidic medium.
    - (b) Potassium iodide in acidic as well as alkaline medium.
3.
  - (i) What is Lanthanide contraction?
  - (ii) What are its probable causes?
  - (iii) Write two consequences of lanthanide contraction.
  - (iv) Mention the best single use of lanthanides.

## Chapter - 9

### CO-ORDINATION COMPOUNDS

#### VSA Type Questions (1 Mark)

1. Define coordination compounds?
2. Write the name of counter ion in  $Hg[Co(SCN)_4]$ .
3. Calculate the oxidation state of nickel in  $[Ni(CO)_4]$  (Ans : 4)
4. Calculate the coordination number of central atom in  $[Co(C_2O_4)_3]^{3-}$  (Ans : 6)
5. What is the coordination number of iron in  $[Fe(EDTA)]^-$  ? (Ans : 6)
6. Which complex compound is used in Chemotherapy? Write its formula also.  
(Ans : Cis-Platin,  $Pt Cl_2 NH_3_2$  )
7. Write the coordination entity used to estimate the hardness of water volumetrically.
8. Give the IUPAC name of  $[Pt Cl_2(NH_2CH_3)(NH_3)_2]Cl$ .
9. How many geometrical isomers are possible for the complex  $[Ni(CO)_4]$ , which is tetrahedral in nature?  
(Ans : No isomers, as the relative positions of the unidentate ligands attached to the central metal atom are same with respect to each other)
10. Arrange the following in the increasing order of conductivity in solution.  
 $[Ni(NH_3)_6]Cl_2$ ;  $[Co(NH_3)_6]Cl_3$  and  $[CoCl_2(en)_2]Cl$
11. Arrange the following ligands in increasing order of  $\Delta_0$  (Crystal field splitting energy) for octahedral complexes :  
 $Cl^-$ ,  $NH_3$ ,  $I^-$ ,  $CO$ ,  $en$
12. Write I.U.P.A.C. name of Tollen's reagent.
13. Define the term stability of a complex in solution.
14. Calculate the overall complex dissociation equilibrium constant for the  $[Cu(NH_3)_4]^{2+}$  ion given that overall stability constant ( $\beta_4$ ) for this complex is  $2.1 \times 10^{13}$ .



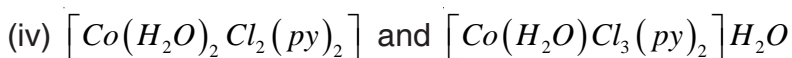
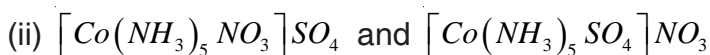
(Ans : (i) 0 BM (ii) 4.47 B.M.)

30. Explain the following :-

(i) All octahedral complexes of  $Ni^{2+}$  must be outer orbital complexes.

(ii)  $NH_4^+$  ion does not form any complex.

31. What type of structural isomerism is represented by the following pairs :



32. How complex compounds are applicable in (i) electroplating of silver, gold or other noble metals (b) in photography.

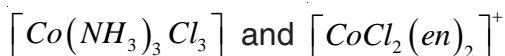
33. Mention two limitations of crystal Field Theory.

34. Explain the nature of bonding in  $Ni(CO)_4$  with the help of diagram.

35. Derive a relationship between stepwise stability constants and overall stability constant of a complex in the solution. How overall stability constant varies with dissociation equilibrium constant?

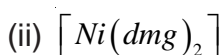
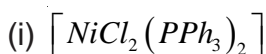
36. Explain as to how the two complexes of nickel  $[Ni(CN)_4]^{2-}$  and  $Ni(CO)_4$  have different structures but do not differ in their magnetic behaviours. (At. no. of Ni = 28)

37. Draw the structures of geometrical isomers of the coordination complexes –



(At no. of Co = 27)

38. ★ Write the IUPAC name of the complexes :



(Hint : (i) Dichloridobis (triphenylphosphine) nickel (II) (b) Dimethylglyoximatonicel (II))

39. ★ How does EDTA help as a cure for bad poisoning?

[Calcium in calcium & EDTA complex is replaced by bad in the body. The more

45. Name the central metal atom/ion present in (a) Chlorophyll (b) Haemoglobin (c) Vitamin  $B_{12}$ .  
(Ans : (a) Mg (b) Fe (c) Co)
46. A metal complex having composition  $Cr(NH_3)_4Cl_2Br$  has been isolated in two forms A & B. The form 'A' reacts with  $AgNO_3$  solution to give a white precipitate which is readily soluble in dilute aq. ammonia whereas 'B' gives a pale yellow precipitate, soluble in concentrated ammonia solution. Write the formulae of 'A' & 'B.' Also mention the isomerism arising among 'A' & 'B'.

[Hint :  $A \rightarrow [Cr(NH_3)_4BrCl]Cl$ ,  $B \rightarrow [Cr(NH_3)_4Cl_2]Br$ , (Ionisation isomerism)]

47. Write the limitations of Valence Bond Theory.
48. Draw a sketch to show the splitting of d-orbitals in an octahedral crystal field state for a  $d^6$  ion how the actual configuration of the split d-orbitals in an octahedral crystal field is decided by the relative values of  $\Delta_0$  and pairing energy (P)?

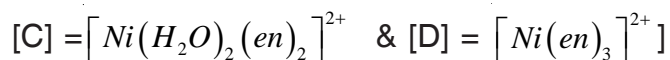
49. ★ For the complex  $[Fe(en)_2Cl_2]Cl$  identify :

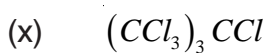
- (i) The oxidation no. of iron.
- (ii) The hybrid orbitals and the shape of the complex.
- (iii) The magnetic behaviour of the complex.
- (iv) The number of geometrical isomers.
- (v) Whether there is an optical isomer also and
- (vi) Name of the complex. [At. no. of Fe = 26]

50. ★ A chloride of fourth group element of quantitative analysis gives a green coloured complex [A]. The aqueous solution of which treated with ethane-1, 2-diamine (en) gives pale - yellow solution [B] which on subsequent addition of ethane-1, 2-diamine turns to blue/ purple [C] and finally violet [D].

Identify the element and [A], [B], [C] and [D].

[Hint : Nickel, [A] =  $[Ni(H_2O)_6]^{2+}$ ; [B] =  $[Ni(H_2O)_4(en)]^{2+}$ ;





2. Write the structure of following halogen compounds :-

(i) 1, 4 - Dibromobut - 2 - ene

(ii) 4 - tert - Butyl - 3 - iodoheptane

(iii) 1- Bromo- 4 - sec. butyl - 2- methylbenzene

(iv) 1 -Chloro - 4 - ethylcyclohexane

(v) 1 - Bromo - 4 - chlorobut - 2- yne

(vi) 2 - Bromo -3, 3 - bis - (4 - Chlorophenyl) butane

(vii) p - Bromotoluene

(viii) 1 - Chloro - 4 - ethylcyclohexane

(ix) Perfluorobenzene

(x) 1 - Bromo - 4 - sec. butyl - 2 - methylbenzene

3. Arrange the following in the increasing order of property indicated :-

(i) Bromomethane, bromoform, chloromethane, dichloromethane. (Increasing order of boiling points)

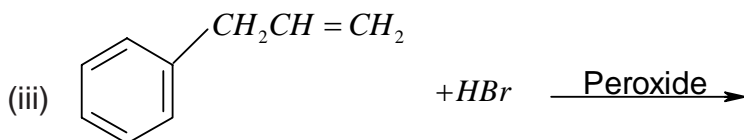
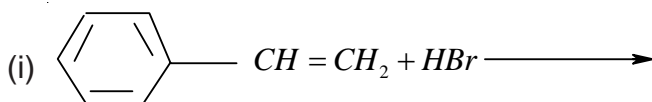
(ii) 1 - Chloropropane, isopropyl chloride, 1 - chlorobutane (increasing order of b.pt.)

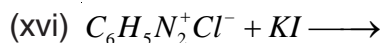
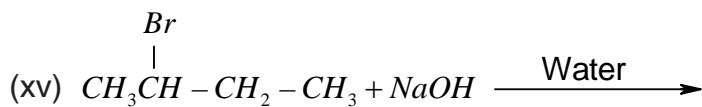
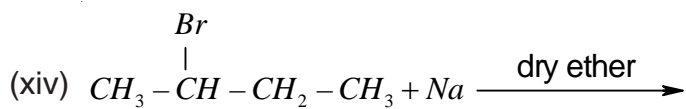
(iii) Dichloromethane, chloroform, carbon tetrachloride. (increasing order of dipole moment)

(iv)  $CH_3F$ ,  $CH_3Cl$ ,  $CH_3Br$ ,  $CH_3I$  (increasing reactivity towards nucleophilic substitution)

(v) O, m, p - dichlorobenzenes (increasing order of melting points)

4. Complete the following reactions :-





5. How will you bring about the following conversions :-

(i) Propene to propan-1-ol

(ii) Ethanol to But-1-yne

(iii) 1-Bromopropane to 2 - Bromopropane

(iv) Benzene to 4 - Bromonitrobenzene

(v) Aniline to chlorobenzene

(vi) 2 - Methyl - 1 - propene to 2 - chloro -2- methylpropane

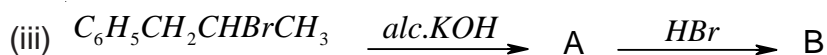
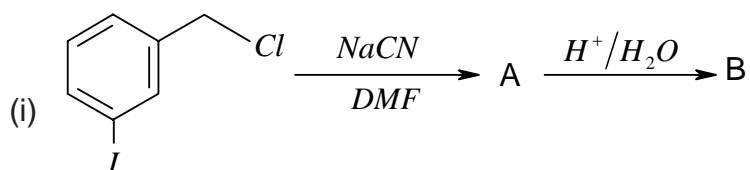
(vii) Ethyl chloride to propanoic acid

(viii) But - 1 - ene to n - butyl iodide

(ix) Ethanol to butane

(x) Tert - butylbromide to isobutylbromide

6. Identify the products formed in the following sequence :-



(iii) Electrophilic and nucleophilic substitution reactions.

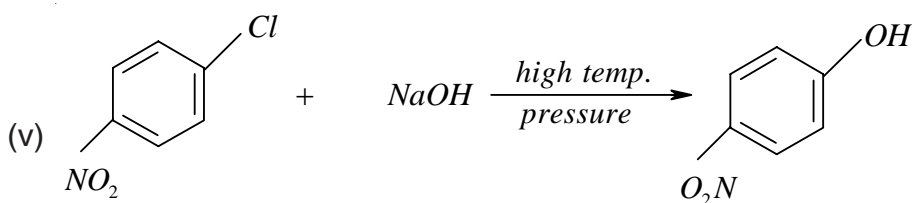
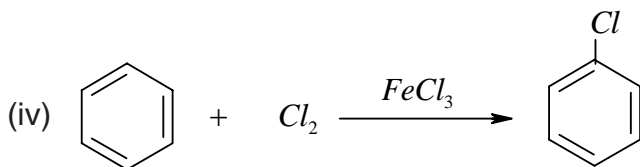
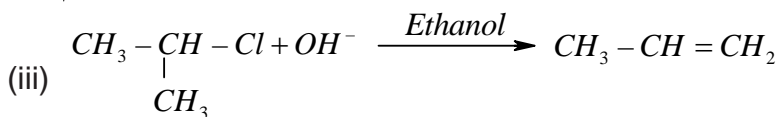
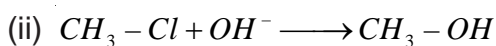
10. Give a chemical test to distinguish between the following pairs of compounds :-

(i) Chlorobenzene and cyclohexylchloride

(ii) Chlorobenzene and benzyl chloride

(iii) n-Propylbromide and isopropylbromide

11. Give mechanism of the following reactions :-



13. Which compound in each of the following pairs will react faster in S<sub>N</sub>2 reaction with OH<sup>-</sup> and why?

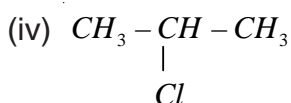
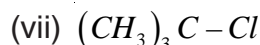
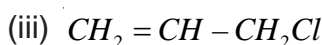
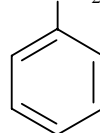
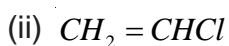
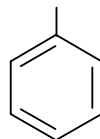
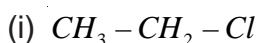
(i) CH<sub>3</sub>Br or CH<sub>3</sub>I

(ii) (CH<sub>3</sub>)<sub>3</sub>CCl or CH<sub>3</sub>Cl

14. In the following pairs which halogen compound undergoes faster S<sub>N</sub>1 reaction :-

- (ix) Chlorobenzene on reaction with fuming sulphuric acid gives ortho and para chlorosulphonic acids.
- (x) 2, 4-Dinitro chlorobenzene is much more reactive than chlorobenzene towards hydrolysis reaction with  $NaOH$ .
- (xi) Grignard reagent should be prepared under anhydrous conditions.
- (xii) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.
- (xiii) Neopentyl bromide undergoes nucleophilic substitution reactions very slowly.
- (xiv) Vinyl chloride is unreactive in nucleophilic substitution reactions.
- (xv) Benzyl chloride and alkyl chloride are easily hydrolysed with  $NaOH$ .
- (xvi) Haloalkanes undergo nucleophilic substitution reactions but haloarenes undergo electrophilic substitutions.
- (xvii) Chloroform is stored in tightly sealed coloured bottles.
- (xviii) The use of DDT is banned in many countries of the world.
- (xix) Optically active 2-iodobutane on treatment of with  $NaI$  in acetone gives a product which does not show optical activity.
- (xx) Methyl iodide is hydrolysed at faster rate than methyl chloride.

17. Write the hybrid state of different carbons in the following compounds :-

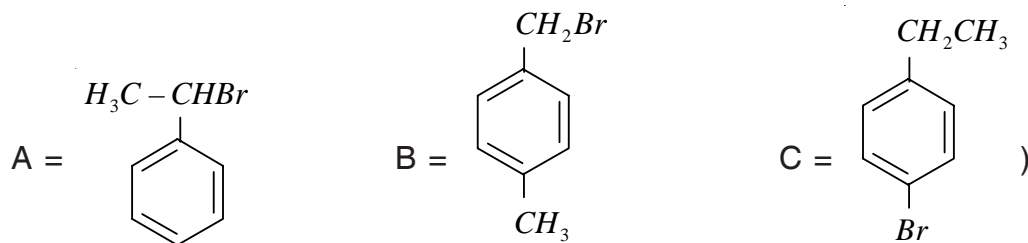


18. Write the different products formed by the monochlorination of following compounds :-



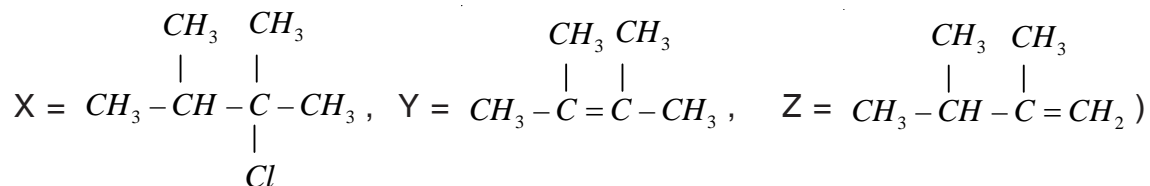
B and C respectively. Identify A, B and C.

(Ans :



23. ★ An alkyl halide X having molecular formula  $C_6H_{13}Cl$  on treatment with potassium tert. butoxide gives two isomeric alkenes Y and Z. Both alkenes on hydrogenation give 2, 3-Dimethylbutane. Identify X, Y and Z.

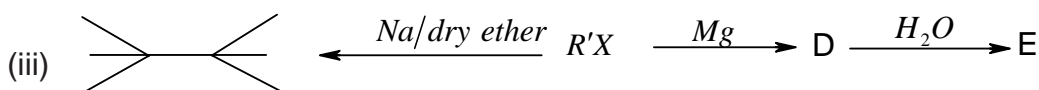
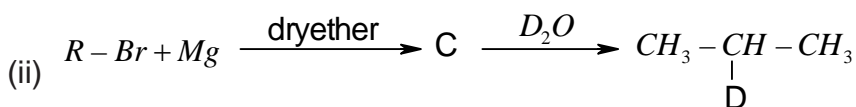
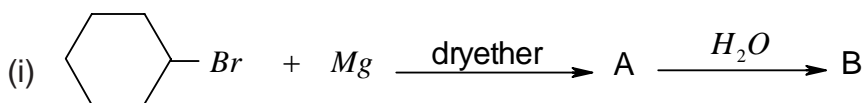
(Ans :

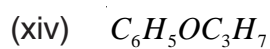
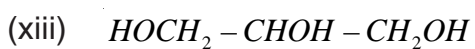


24. ★ An organic compound (A) having molecular formula  $C_3H_7Cl$  on reaction with alcoholic solution of  $KCN$  gives compound B. The compound B on hydrolysis with dilute  $HCl$  gives compound C and on reduction with  $H_2/Ni$  gives l-aminobutane. Identify A, B and C.

(Ans : A =  $CH_3CH_2CH_2Cl$ , B =  $CH_3CH_2CH_2CN$ , C =  $CH_3CH_2CH_2CONH_2$ )

25. ★ Identify A, B, C, D, E, R and R' in the following sequence of reactions :-





2. Write the structures of the compounds whose IUPAC names are given below :-

(i) 2- Methylpropan - 2- ol

(ii) 1 - Phenylpropan - 2- ol

(iii) 3 - Cyclohexylpentan - 3- ol

(iv) 2, 3 - Dimethylphenol

(v) 3, 5 - Dimethoxyhexane - 1, 3, 5 - triol

(vi) Cyclohexylmethanol

(vii) 2 - Ethoxy - 3 - methylpentane

(viii) 3 - Chloromethylpentan - 2 - ol

(ix) 1 - Ethoxy - 2 - methylpropane

(x) 1 - Methoxy - 2 - chloroethane

(xi) p - Nitroanisole

(xii) 1 - Ethoxy - 4, 4 - dimethylcyclohexane.

3. Describe the following reactions with example :-

(i) Hydroboration oxidation of alkenes

(ii) Acid catalysed dehydration of alcohols

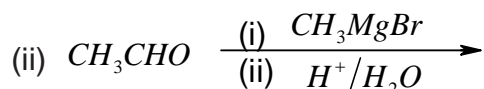
(iii) Williamson synthesis

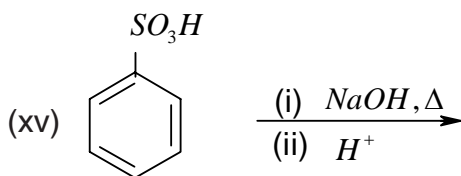
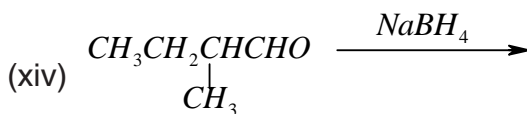
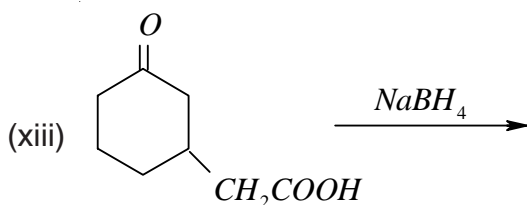
(iv) Reimer Tiemann reaction

(v) Kolbe's Reaction

(vi) Friedel - crafts acylation of anisole

4. Complete the following reactions :-





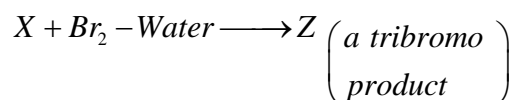
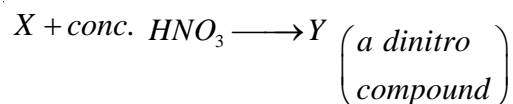
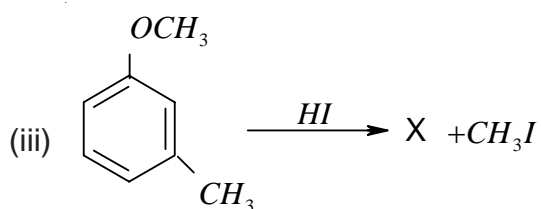
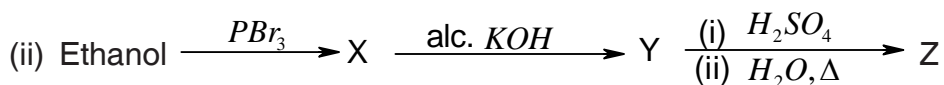
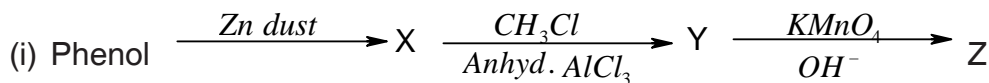
5. What happens when :-

- (i) Aluminium reacts with t-butylalcohol
- (ii) Phenol is oxidised with chromic acid
- (iii) Cumene is oxidised in the presence of air and the product formed is treated with dilute acid.
- (iv) Phenol is treated with conc.  $HNO_3$ .
- (v) Phenol is treated with chloroform in presence of dilute  $NaOH$ .

6. How will you convert :-

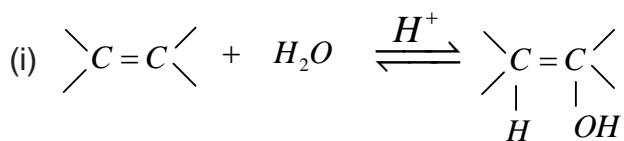
- (i) Propene to propan - 1 - ol
- (ii) Anisole to phenol
- (iii) Phenol to 2, 4, 6 - tribromoethanol
- (iv) Butane - 2- one to butan - 2- ol
- (v) Ethanal to ethanol
- (vi) Phenol to ethoxybenzene
- (vii) Phenol to salicylic acid
- (viii) 1 - Phenylethene to 1 - Phenylethanol
- (ix) Formaldehyde to cyclohexylmethanol

8. Identify X, Y and Z in the following sequence of reactions :-

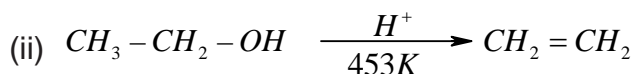


9. Describe the mechanism of alcohols reacting both as nucleophiles and electrophiles in their reactions.

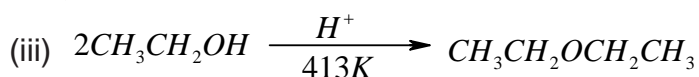
10. Write the mechanism for following reactions :-



(acid catalysed hydration of alkenes)

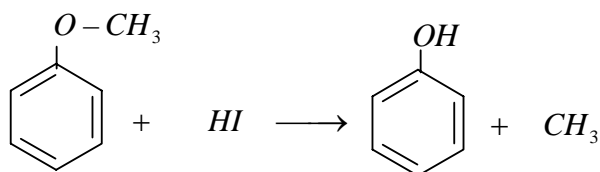


(acid catalysed dehydration of alcohols)



(xiii) Diethylether is soluble in water.

(xiv) The phenylmethylether reacts with  $HI$  to form phenol and iodomethane and not iodobenzene and methanol.



(xv) Methanol is less acidic than water.

(xvi) Alcohols can act as weak base as well as weak acids.

(xvii) Phenols do not give protonation reaction readily.

(xviii) Alcohols undergo nucleophilic substitution reactions but phenols do not undergo nucleophilic substitution at  $C-1$  carbon.

(xix) Absolute ethanol can not be obtained by fractional distillation of ethanol water mixture.

(xx) Commercial ethanol is mixed with a small amount of methanol to form denatured alcohol.

(xxi) O-Nitrophenol is more acidic than phenol.

12. Arrange the following in the increasing order of property shown :-

(i) Methanol, Ethanol, Diethylether, Ethylene glycol. (Boiling points)

(ii) Phenol, O-nitrophenol, m-nitrophenol, p-nitrophenol. (Acidic strength)

(iii) Dimethylether, ethanol, phenol. (Solubility in water)

(iv) Phenol, p-methylphenol, p-nitrophenol. (Acidic strength)

(v) n-butanol, 2-methylpropan-1-ol, 2-methylpropan-2-ol. (Acidic strength)

13. Give the commercial method of preparation and two important uses of following (i) methanol (ii) ethanol.

14. Give a chemical test to distinguish between the following pair of compounds. Also write the chemical reaction involved in the test.

(i) n-Propylalcohol and isopropylalcohol

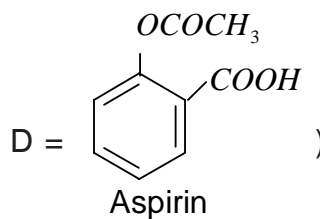
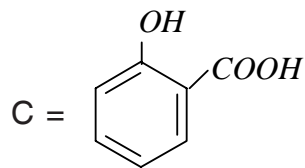
(ii) Methanol and ethanol

(iii) Cyclohexanol and phenol

(iv) Propan-2-ol and 2-methylpropan-2-ol

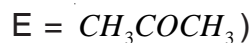
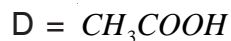
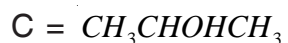
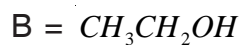
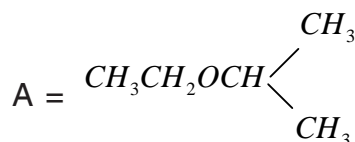
(v) Phenol and chlorobenzene

(vi) Phenol and anisole



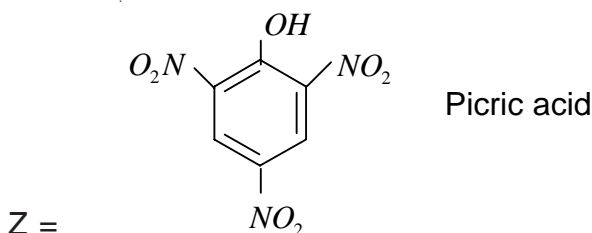
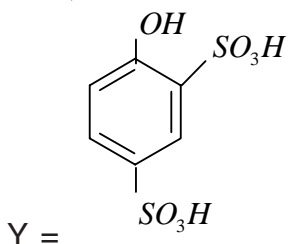
19. An ether A ( $C_5H_{12}O$ ) when heated with hot concentrated  $HI$  produced two alkyl halides which on hydrolysis form compounds B and C. Oxidation of B gives an acid D whereas oxidation of C gave a ketone E. Deduce the structures of A, B, C, D and E.

(Ans :

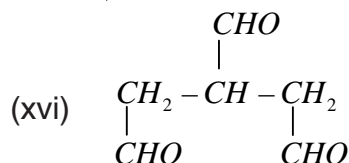
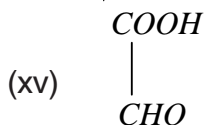
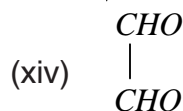
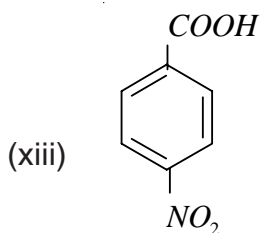
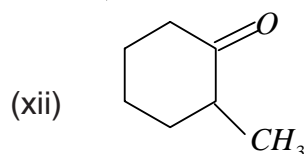
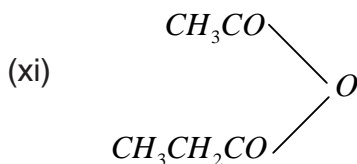
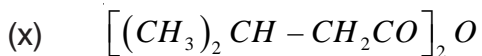
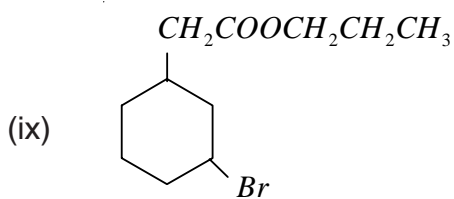


20. ★ Phenol, when it first reacts with concentrated sulphuric acid forms Y. Y is reacted with concentrated nitric acid to form Z. Identify Y and Z and explain why phenol is not converted to Z by reacting it with conc.  $HNO_3$ .

(Ans :

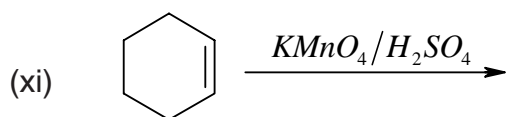
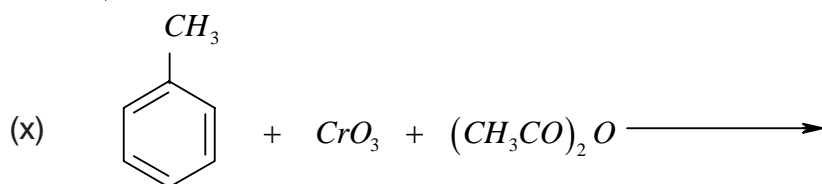
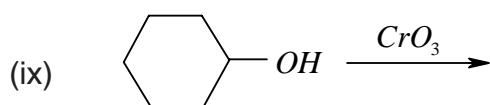
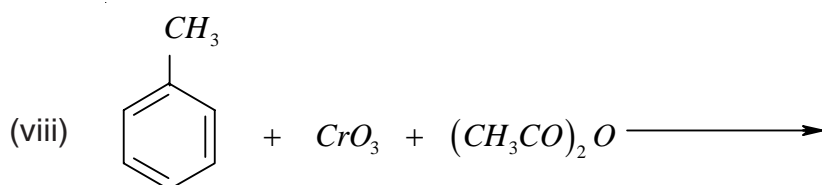
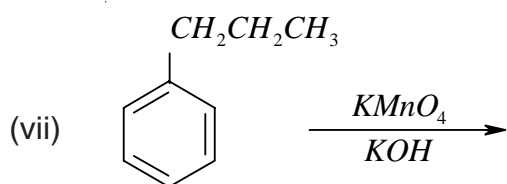
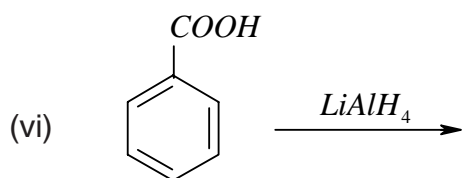
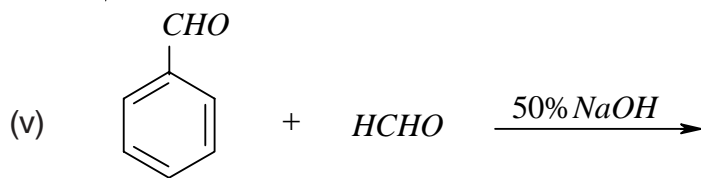
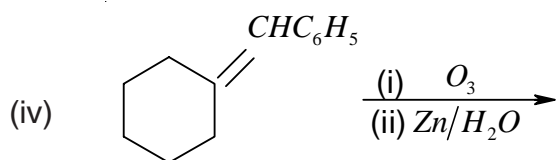


Phenol is not reacted directly with conc.  $HNO_3$  because the yield of picric acid is very poor in this method.)

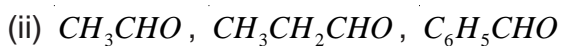


3. Explain the following reactions giving one example in each :-

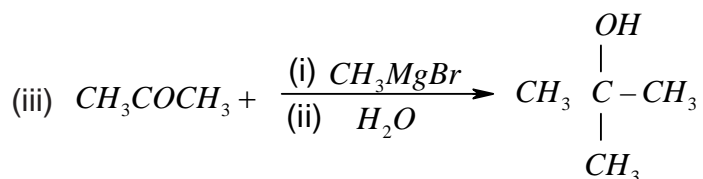
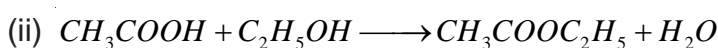
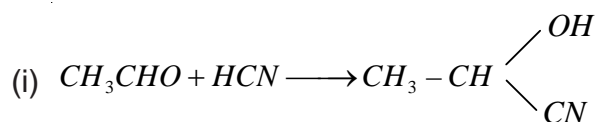
- (i) Rosenmund reduction reaction
- (ii) Stephen reaction
- (iii) Etard reaction
- (iv) Gatterman - Koch reaction
- (v) Aldol condensation
- (vi) Cross Aldol condensation
- (vii) Cannizzaro reaction
- (viii) Decarboxylation reaction
- (ix) Kolbe's reaction
- (x) Hell-Volhard-Zelinsky reaction
- (xi) Friedel Craft's acetylation



9. Arrange the following in the order of increasing reactivity towards HCN or 2, 4-DNP reagent.



10. Give the reaction mechanism for following reactions :-



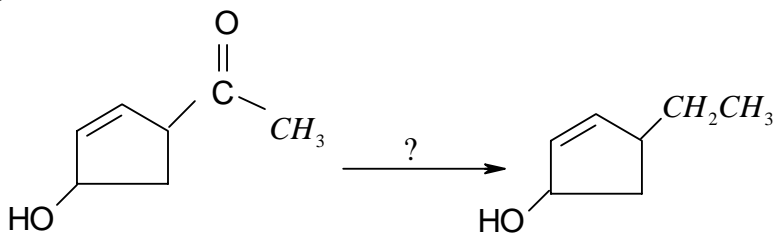
11. Give the chemical tests to distinguish between following pair of compounds :-

- (i) Propanal and propanone
- (ii) Ethyl acetate and methyl acetate
- (iii) Benzaldehyde and Benzoic acid
- (iv) Benzaldehyde and acetaldehyde
- (v) Formic acid and acetic acid
- (vi) Propanal and propanol
- (vii) Ethanoic acid and ethylethanoate.

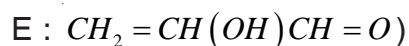
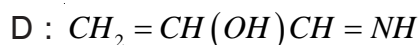
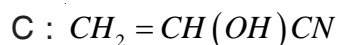
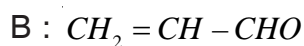
12. Give reason for the following :-

- (i) The reactivity of aromatic aldehydes and ketones is less than that of aliphatic carbonyl compounds towards nucleophilic addition reactions.
- (ii) Benzaldehyde does not give Fehling test.
- (iii) The  $\alpha-H$  atoms in ethanal are acidic in nature.
- (iv) p-Nitrobenzaldehyde is more reactive than benzaldehyde towards nucleophilic

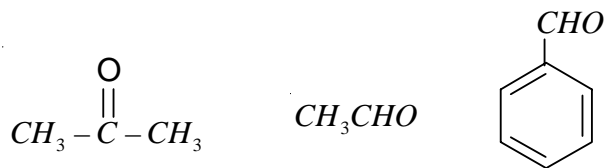
15. ★ You are given four different reagents  $Zn-Hg/HCl$ ,  $NH_2-NH_2/OH^-$ ,  $H_2/Ni$  and  $NaBH_4$ . Select one reagent for the following transformation :



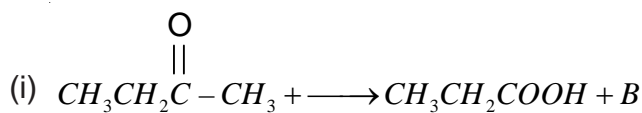
16. ★ An organic compound  $C_5H_{10}O$  gives a positive DNP test. It does not reduce Tollen's reagent but forms an addition compound with sodium hydrogensulphate. On reaction with iodine in presence of sodium precipitate B and another compound C. On oxidation it forms two acids D and E. Identify A, B, C, D and E.
17. ★ Formaldehyde and acetaldehyde on treatment with dil.  $NaOH$  form A which on heating changes to B. When B is treated with HCN form C. Reduction of C with DIBAL-H yields D which on hydrolysis yields E.

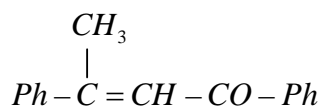


18. ★ Arrange the following in the increasing order of reactivity with  $C_6H_5MgBr$ .



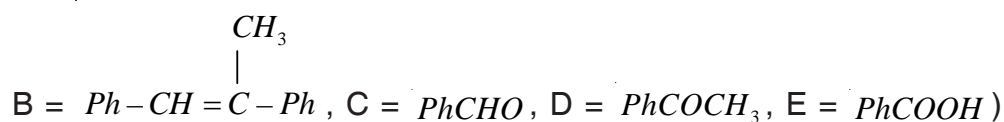
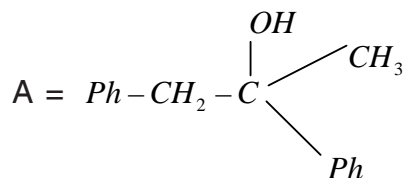
19. ★ Identify the missing reagent/products in the following reactions :-



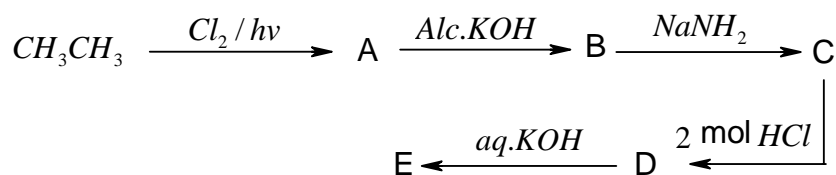


Identify A, B, C, D and E

(Ans :



22. ★ Identify A, B, C, D and E in the following :-



(Ans : A =  $\text{CH}_3\text{CH}_2\text{Cl}$

B =  $\text{CH}_2=\text{CH}_2$

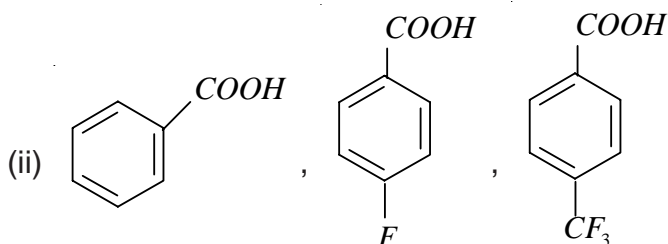
C =  $\text{CH}\equiv\text{CH}$

D =  $\text{CH}_3\text{CHCl}_2$

E =  $\text{CH}_3\text{CHO}$ )

23. ★ Arrange the following acids in the increasing order of acidic strength

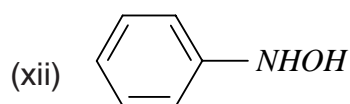
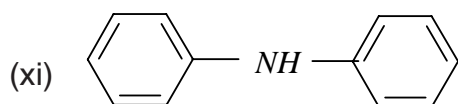
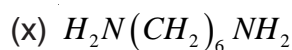
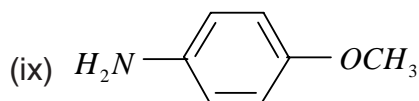
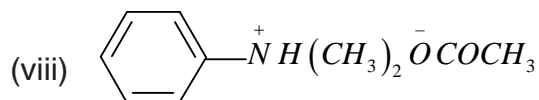
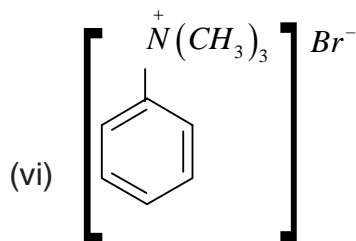
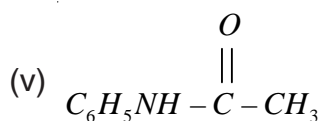
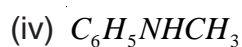
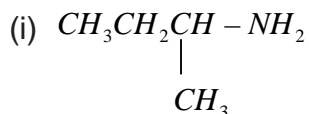
(i) Formic acid, benzoic acid, Acetic acid



(iii)  $\text{CH}_3\text{CH}_2\text{COOH}$ ,  $\text{C}_6\text{H}_5\text{COOH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$

## Chapter - 13 AMINES

1. Write the IUPAC names of following amines :-



2. Giving an example of each describe the following reactions :-

(i) Hoffman Bromamide reaction

(ii) Gabriel Phthalimide synthesis

(iii) Gatterman reaction

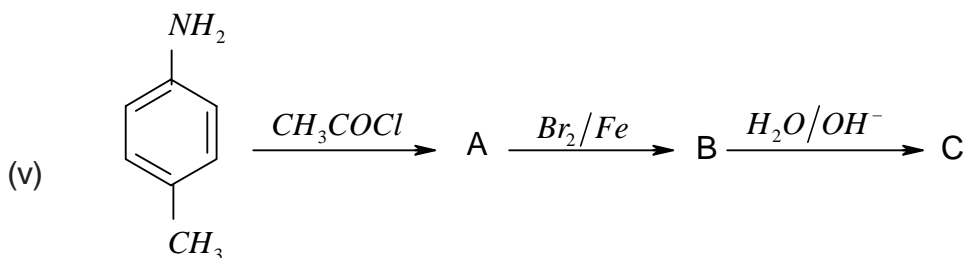
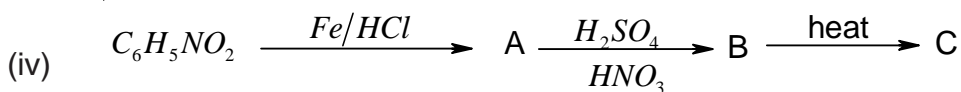
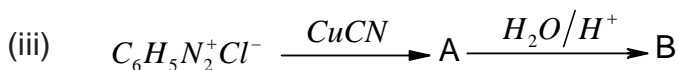
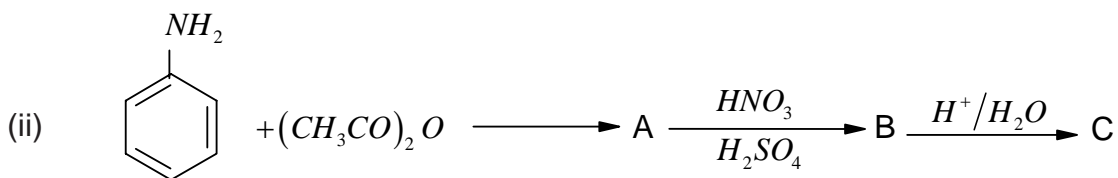
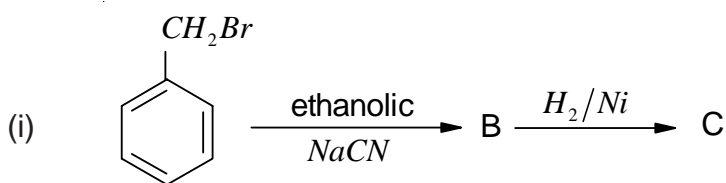
(iv) Coupling reaction

(v) Hoffman's ammonolysis

(vi) Carbylamine reaction

(vii) Acetylation of aniline

3. Describe the method for identification of primary, secondary and tertiary amines. Also write the chemical equations of the reactions involved.



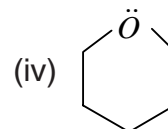
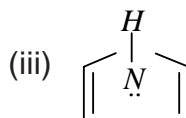
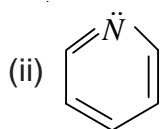
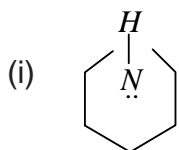
9. Give one chemical test to distinguish between the following pairs of compounds :-

- (i) Methylamine and dimethylamine
- (ii) Secondary and tertiary amines
- (iii) Ethylamine and aniline
- (iv) Aniline and benzylamine
- (v) Methylamine and methanol
- (vi) Methylamine and N, N-Dimethylamine
- (vii) Ethanol and ethanamine

10. Explain why :-

- (i) The  $C-N-C$  bond angle in trimethyl amine is  $108^\circ$ .
- (ii) The quaternary ammonium salts having four different alkyl groups are optically active.

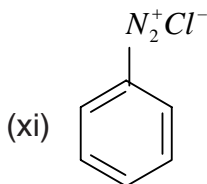
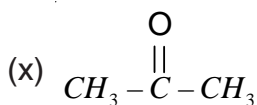
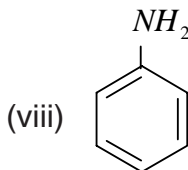
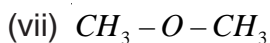
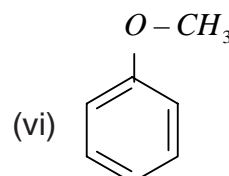
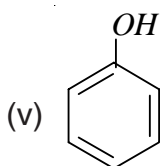
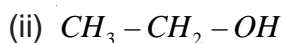
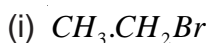
13. Arrange the following compounds in the increasing order of basicity :-



14. Why do amines act as nucleophiles? Give example of a reaction in which methylamine acts as a nucleophile.

15. Why does diazonium ion act as an electrophile? Give example of a reaction where diazonium ion acts as an electrophile.

16. Identify both the electrophilic and nucleophilic centres in the following classes of compounds :-



17. ★ Three isomeric amines A, B and C have the molecular formula  $C_3H_9N$ . Compound A on reaction with benzene sulphonyl chloride forms a product which is soluble in  $NaOH$ . Compound B on reaction with benzene sulphonyl chloride forms a product which is insoluble in  $NaOH$  and compound C does not react with benzene sulphonyl chloride.

## Chapter - 14

# BIOMOLECULES

### POINTS TO REMEMBER

1. Carbohydrates are optically active polyhydroxy aldehydes or ketone or molecules which provide such units on hydrolysis.
2. They are broadly classified into three groups-monosaccharides, oligosaccharides and polysaccharides.
3. Glucose the most important source of energy for mammals is obtained by the digestion of starch.
4. Monosaccharides are held together by glycosidic linkages to form disaccharides or polysaccharides.
5. Proteins are the polymers of about twenty different  $\alpha$ -amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids because they can not be synthesised in our body, Hence must be provided through diet.
6. Proteins perform various structural and dynamic functions in the organisms. Proteins which contain only  $\alpha$ -amino acids are called simple proteins.
7. The secondary or tertiary structure of proteins get disturbed on change of  $pH$  or temperature and they are not able to perform their functions. This is called denaturation of proteins.
8. Enzymes are biocatalysts which speed up the reactions in biosystems. They are very specific and selective in their action and chemically all enzymes are proteins.
9. Vitamins are accessory food factors required in the diet. They are classified as fat soluble (A, D and K) and water soluble (B and C).
10. Nucleic acid are responsible for the transfer of characters from parents to offsprings.
12. There are two types of nucleic acids : DNA and RNA. DNA contains a five carbon sugar molecule called 2-deoxy base and RNA contains ribose.
13. Both DNA and RNA contain adenine, guanine and cytosine. The fourth base is thymine in DNA and uracil in RNA. The structure of DNA is double strand while that of RNA is a single strand molecule.
14. DNA is the chemical basis of heredity and have the coded message for proteins to be synthesised.
15. There are three types of RNA i.e., m-RNA, r-RNA and t-RNA which actually carry out the protein synthesis in the molecule.
16. Human stomach do not have any enzyme capable of breaking cellulose molecules and thus we cannot digest cellulose.
17. Vitamins A and C are known to increase resistance to disease.

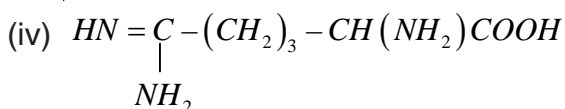
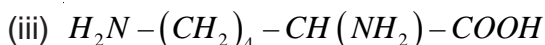
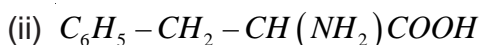
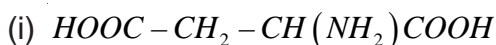
27. ★ Name the vitamin responsible for coagulation of blood.
28. ★ Except vitamin  $B_{12}$  all other vitamin of group B, should be supplied regularly in diet. Why?

**SA (I) Type Questions (2 Marks)**

- Classify carbohydrates on the basis of functional group present. Give one example of each class.
- What are the hydrolysis products of
  - Maltose
  - Cellulose
- What are the two components of starch? Out of them which is water soluble?
- Acetylation of glucose with acetic anhydride gives glucose pentacetate. Write the structure of the pentacetate.
  - Explain – Why glucose pentacetate does not react with hydroxylamine?

[Hint : The molecule glucose pentacetate has a cyclic structure in which –CHO does not react with hydroxylamine.]

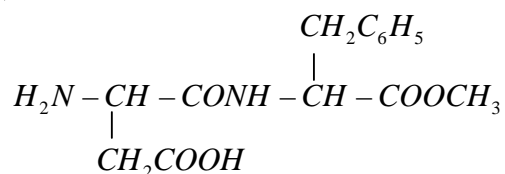
- Give the names and structure of two enomers of fructose.
- Explain the term glycosidic linkage. Give the type of glycosidic linkage present in sucrose.
- Classify the following as monosaccharides or oligosaccharides.
  - Ribose
  - Maltose
  - Galactose
  - Lactose
- Classify monosaccharides on the basis of functional group. Give example of each class.
- State two main differences between globular and fibrous proteins.
- Classify the following  $\alpha$  – amino acids as neutral acidic or basic.



- If you have two amino acids glycine and alanine, what are the structures of two possible dipeptide that they can form?

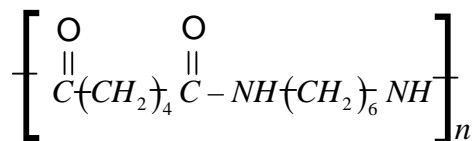
## SA (II) Type Questions (3 Marks)

- Enumerate the structural difference between DNA and RNA. Write down the structure of a nucleoside which is present only in RNA.
- ★ An optically active amino acid (A) can exist in three forms depending on the  $pH$  of the medium if the molecular formula of (A) is  $C_3H_7NO_2$ , write :-
  - The ionic structure of (A) in aqueous medium.
  - What two functional groups does this ion behave?
  - What is the specific name for such ion?
- ★ Aspartame, an artificial sweetener, has the following structure :-

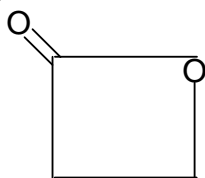


- Write the zwitter ion structure of the above mentioned peptide.
  - Write the structure of two amino acids which will be formed after its hydrolysis.
- Define the following as related to proteins :-
    - Peptide linkage
    - Primary structure
    - Denaturation and renaturation.
  - Differentiate between the following :-
    - Secondary and tertiary structure of protein.
    - $\alpha$ -Helix and  $\beta$ -pleated sheet structure of proteins.
    - Fibrous and globular proteins.
  - What are enzymes?
    - Why are enzymes specific in nature?
    - Predict whether the enzyme-substrate complex will have activation energy higher or lower than the activated complex formed without enzyme?

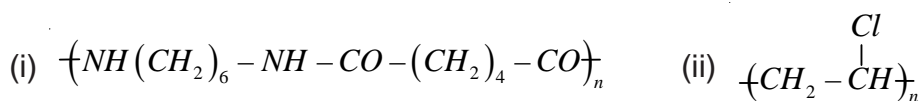
6. Name the element used for vulcanisation.
7. Give the monomers of bakelite.
8. Identify the monomer in the following polymeric structure.



9. Nylon-2- Nylon-6 is a biodegradable polymer obtained from glycine  $\text{H}_2\text{N} - \text{CH}_2 - \text{COOH}$  and amino caproic acid  $\text{H}_2\text{N}(\text{CH}_2)_5\text{COOH}$  . Write the structure of this polymer.
10. Give two uses of teflon.
11. Name the polymer used for making insulation material for coating copper wire.  
[Hint : PVC]
12. Write the name and structure of monomers of the polymer which is used as synthetic wool.
13. What is the difference in Buna-N and Buna-S?
14. Name the polymer used for making radio television cabinets and feeding bottles of children.
15. What do the 6 and 66 represent in the names nylon-6 and nylon-66?
16. Give the full form of PHBV.
17. Which of the following sets has all members capable of repeatedly softening on heating and hardening on cooling.
  - (i) Glyptal, Melamine, PAN.
  - (ii) PVC, PMMA, Polystyrene.
  - (iii) Polypropylene, urea formaldehyde resin, teflon.
18. ★ Why benzoyl peroxide is used as an initiator for chain growth polymerisation?
19. ★ Write the structure of polymer produced by the treatment of the following monomer with a catalytic amount of hydroxide ion.



20. ★ During the free radical polymerisation reactions purest sample of monomers are taken



11. Arrange the following polymers in the order of increasing intermolecular forces :
- (i) Nylon - 6,6, Buna-S, Polythene.  
(ii) Nylon - 6, Neoprene, PVC.
12. Write the expanded form and give the structures of monomers for the following polymers. (i) PAN (ii) PTFE
13. Novolac is the linear polymer which on heating with formaldehyde forms cross-linked bakelite. Write the structures of monomers and the polymer novolac.
14. Write the structure of following polymers and also give their one use :
- (i) Polystyrene (ii) Melamine formaldehyde resin.
15. Identify the polymer used in the manufacture of paints and lacquers. Write the structure of the polymer and its monomers.
16. How does alkalization change the character of natural rubber?
17. A regular copolymer of ethylene and Vinyl chloride contains alternate monomer of each type :-
- (i) Give the structure of the copolymer formed.  
(ii) What is the weight percentage of ethylene in this polymer?
18. Write the structure of the monomer used in the synthesis of :-
- (i) Nylon - 6 (ii) Nylon - 6,6
19. Linking in benzene ring through  $-CH_2-$  group in bakelite is always at -ortho- and para-position. Explain.
20. Give reason for the following :-
- (i) Tyre made up of natural rubber tend to crack and wither rapidly in areas around major cities where high levels of ozone and other industrial pollution are found.  
(ii) Nylon is more easily damaged by acids or alkali as compared to chain growth polymer such as orlon and polythene.
- [Hint : (i) Ozone attack double bond of polymeric rubber  
(ii) Acid hydrolysis the amide linkage of nylon.]**
21. ★ The monomer of natural rubber gives two moles of  $CH_2O$  and one mole of  $CH_3COCHO$  on ozonolysis.
- (i) Write the structure of monomer.  
(ii) Write all cis configuration of polymeric chain.

## Chapter - 16

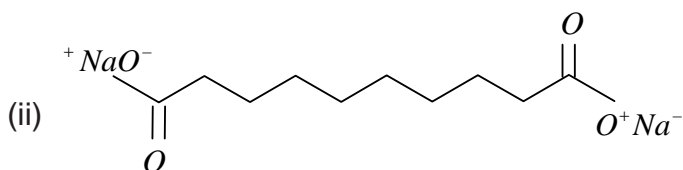
# CHEMISTRY IN EVERYDAY LIFE

### POINTS TO REMEMBER

1. A drug is a chemical agent which effects human metabolism and provides cure from ailment. If taken in doses higher than recommended, these any have poisonous effect.
2. Use of chemicals for therapeutic effect is called chemotherapy.
3. Drugs usually interact with biological macromolecules such as carbohydrates, proteins, lipids and nucleic acids. These are called target molecules.
4. Drugs are designed to interact with specific targets so that these have the least chance of affecting other targets. This minimises the side effects and localises the action of the drug.
5. Drugs like analgesics, antibiotics, antiseptics, disinfectants, antacids and tranquilizers have specific pharmacological functions.
6. Antifertility drugs are used to control population. These contain a mixture of synthetic estrogen and progesterone derivatives.
7. Chemicals are added to food for there preservation, enhancing their appeal and adding nature value by them.
8. Artificial sweetening agents like aspartame, saccharin etc. are of great value of diabetic persons and people who need to control their calories.
9. These days detergents are much in vogue and get preference over soaps because they work even in hard water.
10. Synthetic detergents are classified into three main categories namely anionic, cationic and non-ionic.
11. Detergents with straight chain of hydrocarbons are preferred over branched chain as the latter are non-biodegradable and consequently causes environmental pollution.
12. The unbranched hydrocarbon side chains of the detergent molecule are more prone to attack by bacteria, so the detergents are more easily bio-degradable and pollution is prevented.

### VSA Type Questions (1 Marks)

1. Write formula and IUPAC name of Aspirin.
2. Give two types of the drugs classified on the basis of pharmacological effect.
3. What is the role of Bithionol in toilet soaps?



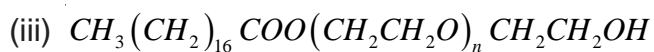
### SA (I) Type Questions (2 Marks)

- Mention two types of drugs having different pharmacological effect and the mode of action.
- Can soap be used at  $pH$  7 or below? Explain.
- Explain the following terms as used in medicinal chemistry :  
(i) Target molecules      (ii) Enzyme inhibitors.
- Give one important use of each of following :-  
(i) Equanil      (ii) Morphine
- Explain the term lead molecules. Write two different sources of lead molecules.

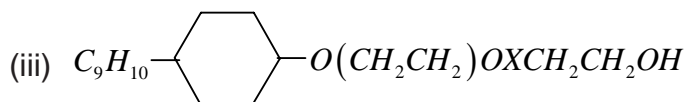
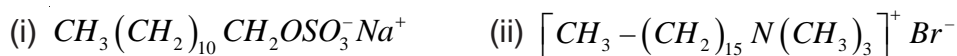
**[Hint :** A knowledge of the physiological function of the drug target in the body helps us to choose a compound which can interact with the target and hence is expected to be therapeutically active. These compounds are called lead molecules and drugs are designed from these compounds.

Lead compounds can be obtained from natural sources such as plants, tree, bushes, venoms and metabolites of microorganisms lead molecule have also been isolated from fish, coral, sponger and marine organism.]

- (i) What are antibiotics?  
(ii) Where in India penicillin is manufactured?
- Which of the following drug is used for :-  
(i) treating allergic conditions.  
(ii) to get relief from pain.  
Cromphenisamine, Ciprofloracin, Hesoin, Chloramphenicol.
- Give two reasons why the drug should not be taken without consulting a doctor?
- State the main difference between bacteriostatic and bacteriocidal antibiotics. Give one example of each.
- What are antifertility drugs? Give the names of constituents of an oral contraceptive.
- What do you mean by monobiodegradable detergents? How can we make biodegradable detergents?
- ★ If water contains dissolved calcium hydrogencarbonate, which out of soap and detergent

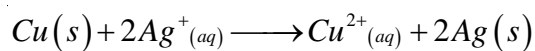


11. ★ Classify the following structures as cationic detergents, anionic detergents or nonionic detergents :



Where ( $X = 5-10$ )

12. Explain the term hyperacidity discuss two types of medicines use to check hyperacidity and their mode of action.
13. ★ How do enzyme inhibitors work? Distinguish between competitive and noncompetitive enzyme inhibitors.

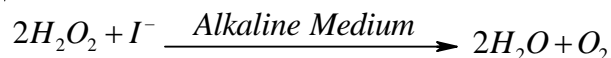


Given  $E^\circ_{Cu^{2+}/Cu} = +0.34V$ ,  $E^\circ_{Ag^+/Ag} = 0.80V$

Q. 10 How does molar conductivity vary on dilution for

- weak electrolyte and
- strong electrolyte. Explain graphically.

Q. 11 Write the mechanism of the reaction :-



Rate equation for this reaction is

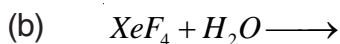
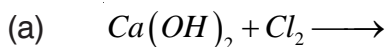
$$\text{Rate} = K[H_2O_2][I^-]$$

Q. 12 The  $\Delta_f G^\circ$  values for the formation of  $Cr_2O_3$  and  $Al_2O_3$  are  $-540$  and  $-827 \text{ kJ mol}^{-1}$  of  $O_2$  respectively. Is the reduction of  $Cr_2O_3$  possible with  $Al$ . Justify your answer.

Q. 13 Draw the structure of  $SF_6$  and  $XeF_6$ .

**OR**

Complete the following reactions.



Q. 14 Explain the following with suitable reason

- Why O-nitro phenol is more acidic than O-methoxy phenol?
- Why reactivity of carbonyl compounds to enhance towards weak nucleophile in acidic medium.

Q. 15 Explain using crystal field theory – The  $[Mn(H_2O)_5]^{2+}$  ion contains five unpaired electrons while  $[Mn(CN)_6]^{4-}$  ion contains only one unpaired electrons?

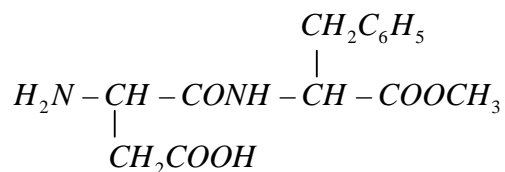
Q. 16 Describe with an example :-

- Cannizaro reaction
- Hoffman's bromamide reaction

Q. 17 A biodegradable polymer is used in speciality packaging, orthopaedic devices and in controlled release of drugs. Identify the polymer and give its structure.

- (ii) Benzene to m-bromophenol
- (iii) Methanol to ethanoic acid.

Q. 27 Aspartame, an artificial Sweetner, has the following structure :



- (i) Write the Zwitter ion structure of the above mentioned peptide.
- (ii) Write the structure of two amino acids which will be formed after its hydrolysis.

**OR**

Enumerate the difference between DNA and RNA. Write the structure of a nucleoside which is present only in RNA.

Q. 28 (i) State and derive Raoult's law for a solution containing.

- (a) Volatile solute    (b) non volatile solute

- (ii) Benzene and toluene form nearly ideal solution. At a certain temperature the vapour pressure of pure benzene and pure toluene are 150 mm of Hg and 50 mm of Hg. Calculate the vapour pressure of the solution containing equal weights of benzene and toluene.

**OR**

- (i) What is meant by abnormal molecular mass? Illustrate it with suitable example.
- (ii) 19.5g of  $\text{CH}_2\text{FCOOH}$  is dissolved in 500 g of water. The depression in the freezing point of water observed is  $1.0^\circ\text{C}$ . Calculate the van't Hoff factor and dissociation constant of fluoroacetic acid.

Q. 29 (i) Explain

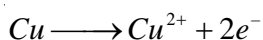
- (a) Out of  $\text{Cr}^{2+}$  and  $\text{Mn}^{2+}$  which one is stronger reducing agent? (Atomic No. of Cr = 24, Mn = 25.)
- (b)  $\text{Cu}^{2+}$  is more stable than  $\text{Cu}^+$  in aqueous solution.
- (ii) Compare the chemistry of the lanthanoids with that of actinoids with reference to
  - (a) Electronic configuration
  - (b) Oxidation state
  - (c) Chemical reactivity

**OR**

## MARKING SCHEME

1. Free electrons occupy spaces created by loss of  $O_2$  from  $ZnO$  when heated. (1)
2. Acidic  $NH_4Cl$  corrode with zinc container. (1)
3. The process of conversion of a freshly prepared precipitate into colloidal solution by adding suitable electrolyte. (1)
4. No, because of its poor conductivity. (1)
5.  $[Cr(H_2O)_4Cl_2]Cl < [Ni(NH_3)_6]Cl_2 < [Co(NH_3)_6]Cl_3$  (1)
6. Benzene-1, 2-dicarbaldehyde. (1)
7. Vitamin K. (1)
8. Making oil seal, gasket and non-stick surface coated utensil. [Any two] ( $\frac{1}{2} \times 2 = 1$ )

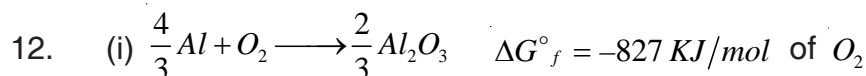
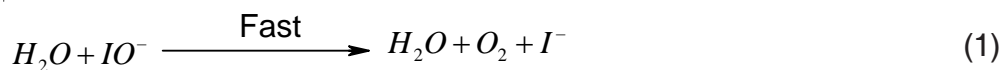
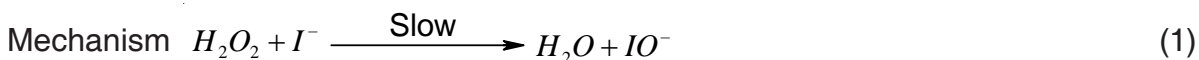
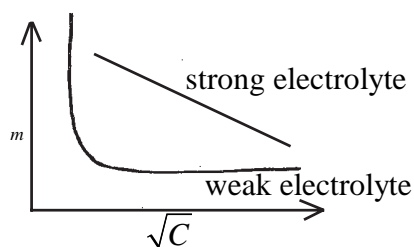
9.  $E^\circ_{cell} = E^\circ_{Ag^+/Ag} - E^\circ_{Cu^{2+}/Cu} = 0.80 - 0.34V = 0.46V$  (1/2)



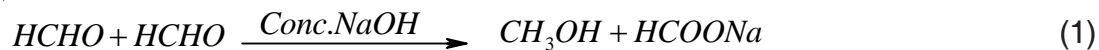
$$0.0591 \log K = nE^\circ \Rightarrow \log K = \frac{nE^\circ}{0.0591} = \frac{2 \times 0.46}{0.0591}$$

$$\log K = 15.5668 \quad K = \text{Anti } 15.5668 = 3.686 \times 10^{15} \quad (1)$$

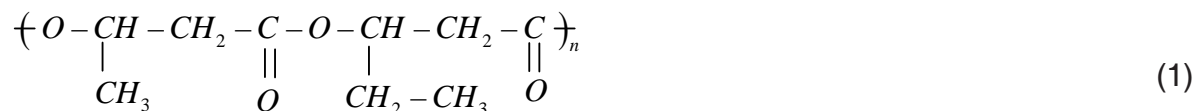
10. (1 × 2 = 2)



alkali are rely oxidized and reduced.



17. Poly- $\beta$  - hydroxybutyrate - Co- p - hydroxy valerate (PHBV) (1)



18. It states the classification according to pharmacological effect of the drug because any drug which will be used to contract the effect of excess acid in the stomach will be called antacid. (1+1)

19. For B.C.C.

$$r = \frac{\sqrt{3}}{4} a = 0.433a = 0.433 \times 287 \text{ pm} = 124.27 \text{ pm} \quad (1)$$

$$d = \frac{Z M}{N_A a^3 10^{-30}} = \frac{2 \times 51.99}{(287)^3 \times 6.02 \times 10^{23} \times 10^{-30}} = 7.32 \text{ g/cm}^3 \quad (1+1)$$

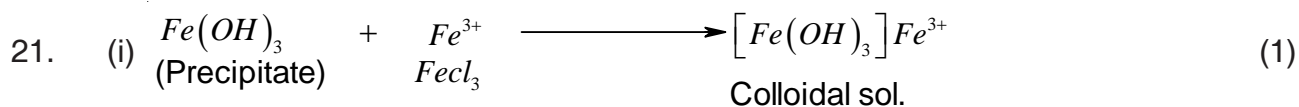
$$20. \quad k = \frac{0.693}{t_{\frac{1}{2}}} \Rightarrow k_1 = \frac{0.693}{20 \text{ min}} = 0.03465 \text{ min}^{-1} \quad (1)$$

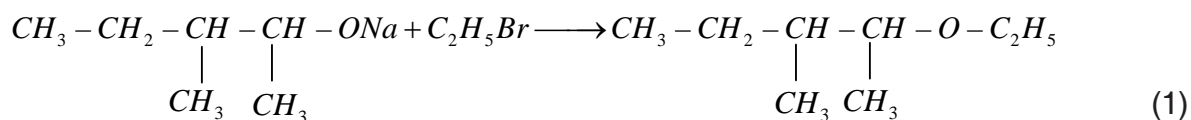
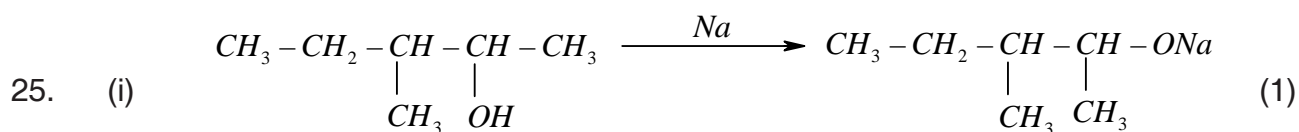
$$k_2 = \frac{0.693}{5 \text{ min}} = 0.1386 \text{ min}^{-1}$$

$$\log \frac{k_1}{k_2} = \frac{E_a}{2.303R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right) = \quad (1/2)$$

$$\log \left[ \frac{0.1386}{0.03465} \right] = \frac{E_a}{2.308 \times 8.314 \text{ Jkmol}^{-1}} \times \left[ \frac{1}{300K} - \frac{1}{350K} \right] \quad (1)$$

$$E_a \quad 24205.8 \text{ Jmol}^{-1} \quad 24.2 \text{ kJmol}^{-1} \quad (1/2)$$

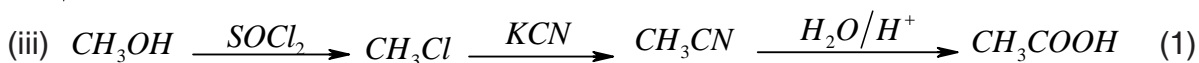
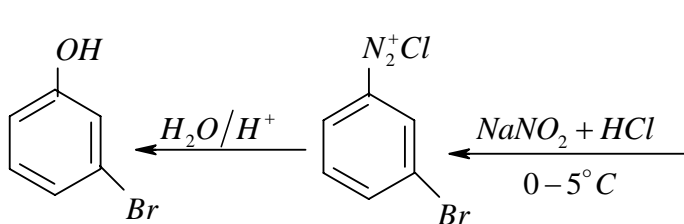
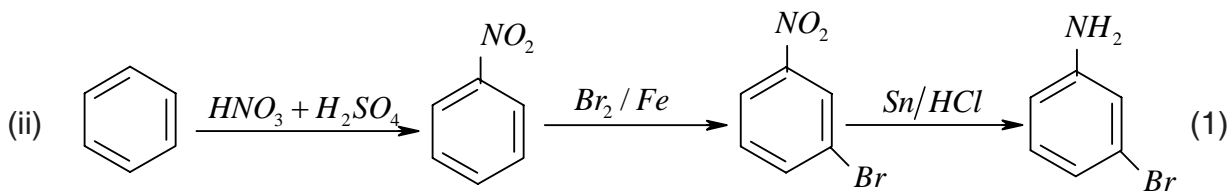
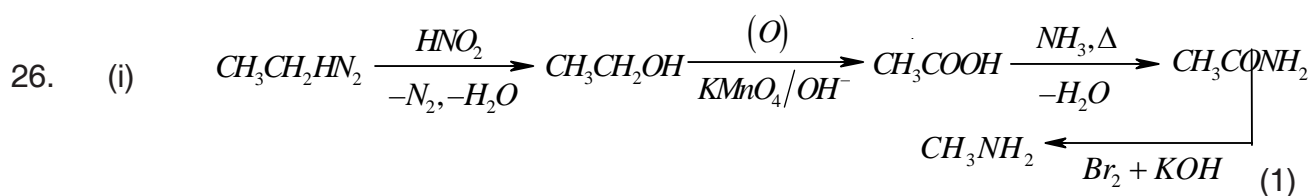




Williamson Synthesis

(ii) Increasing order of b.pt (1)

n-butane < ethoxy ethane < pentanal < Pentan-1-ol



$$(ii) \quad P^{\circ}_{Benzene} = 150mm. \quad P^{\circ}_{Toluene} = 50mm.$$

$$W^{\circ}_{Benzene} = xg \quad W^{\circ}_{Toluene} = xg$$

$$M^{\circ}_{Benzene} = 78mol^{-1} \quad M^{\circ}_{Toluene} = 92mol^{-1}$$

$$x_B = \frac{\frac{x}{78}}{\frac{x}{92} + \frac{x}{78}} \quad \text{and} \quad x_T = 1 - x_B$$

$$P_{solution} = P_B + P_T$$

$$P_B = P^{\circ}_B x_B$$

OR

- (i) Abnormal molar mass – Molar mass of substance calculated from Colligative if comes different then the formula molar mass. i.e. molar mass of  $CH_3COOH$  is  $60gmol^{-1}$  but due to association it comes  $120gmol^{-1}$ . (1+1)

$$(ii) \quad \Delta T_f = i \times k_f \times m \quad i = \frac{\Delta T_f}{k_f \times m}$$

$$\text{Molality} = \frac{19.5}{78 \times 0.5} = 0.15mol \text{ kg}^{-1} \quad (1)$$

$$i = \frac{1.0k}{1.86 \times 0.5} = 1.07530$$

$$\alpha = \frac{i-1}{n-1} = \frac{1.0753-1}{2-1} = 0.0753$$



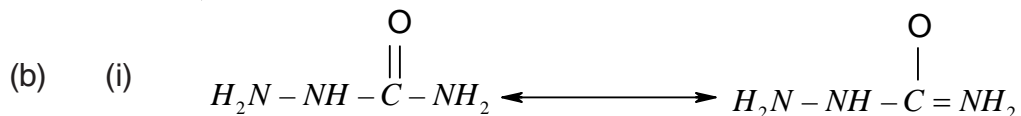
$$\begin{array}{ccc} 0.5 & 0 & 0 \end{array}$$

$$\begin{array}{ccc} 0.5(1-\alpha) & 0.5\alpha & 0.5\alpha \end{array} \quad (1)$$

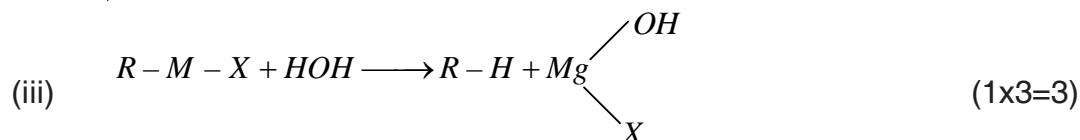
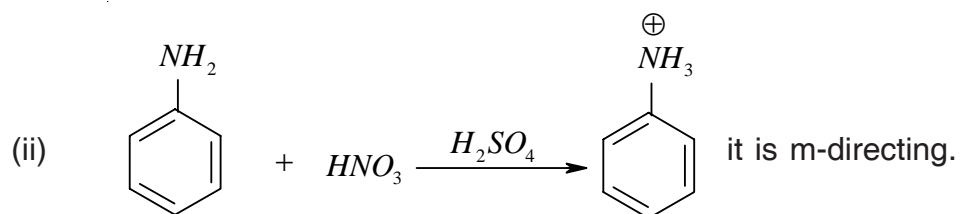
$$K_a = \frac{C^2}{1-C} = \frac{0.5 \cdot 0.0753^2}{1-0.0753} = \underline{\underline{3.07 \cdot 10^{-3}}}$$

Test	Ethanol	Ethanoic Acid
Add $Na_2HCO_3$ test	no reaction	effervescence of $CO_2$

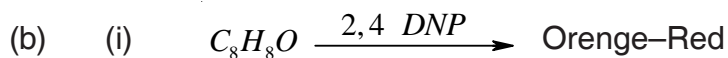
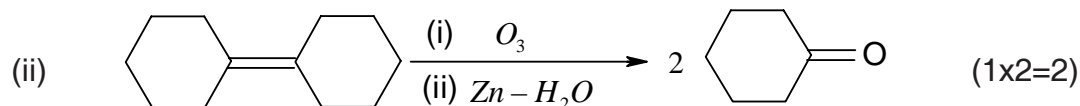
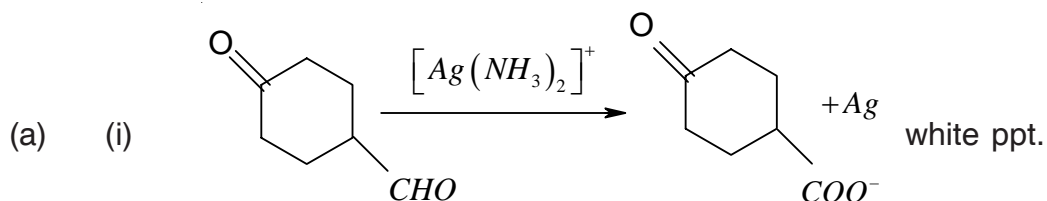
(1x2=2)



Due to resonance.



OR



Means there is  $-C \overset{[A]}{=} O$  carboxyl group.

**MODEL TEST PAPER – II (UNSOLVED)**  
**(FOR Sr. SEC. SCHOOL EXAMINATION - 2010)**  
**CHEMISTRY (Theory)**

**Time Allowed : 3 hours**

**Maximum Marks : 70**

**General Instructions :-**

1. All questions are compulsory.
2. Question No. 1 to 8 are very short-answer questions, carrying 1 mark each. Answer these in one word or about one sentence each.
3. Question No. 9 to 18 are short-answer questions, carrying 2 marks each. Answer these in about 30 words each.
4. Question No. 19 to 27 are short-answer questions, carrying 3 marks each. Answer these in about 40 words each.
5. Question No. 28 to 30 are long-answer questions, carrying 5 marks each. Answer these in about 70 words each.
6. Use log table, if necessary use of calculator is not permitted.

1. A group 14 element is to be converted into n-type semiconductor by doping it with a suitable impurity. To which group should this impurity belong? Give one example.
2. Name a zeolite catalyst which directly converts alcohol into gasoline.
3. Write an equation for the preparation of  $\text{XeOF}_4$  from  $\text{XeF}_6$ .
4. Write one structural difference between DNA and RNA.
5. Write the name of the monomer of Nylon - 6.
6. Mention one example of cationic detergent.
7. Which compound in the following pair will react faster in  $\text{S}_{\text{N}}2$  reaction with  $\text{OH}^-$ ?  
(i)  $(\text{CH}_3)_3\text{C Cl}$  or (ii)  $\text{CH}_3\text{Cl}$
8. How is formalin related to formaldehyde?
9. Draw a labelled diagram which represent the working of hydrogen- oxygen fuel cell. Write the anode and cathode reactions taking place in the above cell.

**OR**

Rusting to iron is an electrochemical phenomenon. Justify by giving anode, cathode and overall reactions.

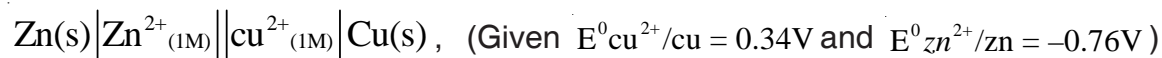
10. The rate constant of a first order reaction for the decomposition of ethyl iodide by the reaction:  
$$\text{C}_2\text{H}_5\text{I}(\text{g}) \longrightarrow \text{C}_2\text{H}_4(\text{g}) + \text{HI}(\text{g})$$

(ii) Zinc oxide is white but it turns yellow on heating. Assign a reason.

20. Calculate the:-

(i) Standard cell potential, and

(ii) Standard gibbs energy, for the reaction occurring in the cell.



(iii) How is the equilibrium constant  $K_c$  for the reaction related to Gibbs energy and  $E^{\circ}_{\text{cell}}$  ?

21. (i) Write the rate law for a first order reaction.  $A + B \longrightarrow C$

Justify the statement for a first order reaction half-life  $(t_{1/2})$  is independent of the initial concentration of the reactant  $[R]_0$ .

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

(a) doubled (b) reduced to half?

22. Explain what happens when:-

(i) A beam of light is passed through a colloidal solution.

(ii) An electrolyte like NaCl is added to hydrated ferric hydroxide sol.

(iii) Electric current is passed through a colloidal sol.

23. (i) How is bauxite different from alumina?

(ii) The value of  $\Delta_r G$  for formation of  $\text{Cr}_2\text{O}_3$  is  $-540\text{KJmol}^{-1}$  and that of  $\text{Al}_2\text{O}_3$  is  $-827\text{KJmol}^{-1}$ . Is the reduction of  $\text{Cr}_2\text{O}_3$  possible with aluminium?

(iii) What is the role of graphite rod in the electrometallurgy of aluminum?

**OR**

Describe the reactions taking place in different zones in the blast furnace during the extraction of iron from haematite.

24. (i) Describe the steps involved in the preparation of potassium dichromate from its

chlorine, fluorine is a stronger oxidising agent than chlorine.

(ii) Write balanced chemical equations for the following reaction:-

Chlorine is passed through a hot and concentrated solution of sodium hydroxide.

(iii) Draw the structure of  $\text{H}_3\text{PO}_3$ .

**OR**

(i) Assign a reason for each of the following:-

(a)  $\text{N}_2$  is less reactive at room temperature.

(b) Fluorine exhibits only  $-1$  oxidation state whereas other halogens exhibit  $+1$ ,  $+3$ ,  $+5$  and  $+7$  oxidation states.

(c) Bond angle in  $\text{PH}_4^+$  is higher than that of in  $\text{PH}_3$ .

(ii) Write balanced chemical equations for the following reactions:-

(a)  $\text{P}_4 + \text{NaOH} + \text{H}_2\text{O} \longrightarrow \text{_____} + \text{_____}$  .

(b)  $\text{U(s)} + \text{ClF}_3 \longrightarrow \text{_____} + \text{_____}$  .

(iii) Draw the structure of peroxodisulphuric acid.

30. (i) Write the steps and conditions involved in the following conversions:-

(a) Propanone to Propene.

(b) Benzoic acid to Benzaldehyde.

(c) Ethanol to 2-Hydroxy butanal.

(ii) Give a chemical test in each case to distinguish between the following pairs of compounds:-

(a) Ethanal and Propanal

(b) Phenol and Benzoic acid

**OR**

(i) Write the steps and conditions involved in the following conversions:-

(a) Benzyl alcohol to phenylethanoic acid.

(b) 4-Methyl acetophenone to benzene  $-1, 4$  -dicarboxylic acid.

(c) Propanal to butanal.

(ii) Give a chemical test in each case to distinguish between the following pairs of compounds.

(a) Propanal and Propanone

(b) Phenol and Benzoic acid