

# 1. SOLUTIONS

1. State Henry's law. Give its mathematical form.

Ans: Henry's law states that at constant temperature, the solubility of a gas in a liquid is directly proportional to the pressure of the gas. Mathematically,  $p = K_H \cdot \chi$  (where  $p$  is the partial pressure,  $\chi$  is the mole fraction and  $K_H$  is the Henry's law constant).

2. Write any two applications of Henry's law.

Ans: (i) In the preparation of soda water and soft drinks.  
(ii) A medical condition known as Bends in Scuba divers.

3. State Raoult's law.

Ans: The law states that for a solution of volatile liquids, the partial vapour pressure of each component in the solution is directly proportional to its mole fraction present in solution.

Mathematically,  $p_1 = p_1^0 \chi_1$ ,  $p_2 = p_2^0 \chi_2$

4. What are ideal solutions? Write any two properties of ideal solutions. Give one example for such solution.

Ans: These are solutions which obey Raoult's law at all concentrations. For an ideal solution,  $p_1 = p_1^0 \chi_1$ ,  $p_2 = p_2^0 \chi_2$ ,  $\Delta_{\text{mix}}H = 0$  and  $\Delta_{\text{mix}}V = 0$ . E.g. is a mixture of benzene and toluene.

5. What are non-ideal solutions?

Ans: These are solutions which do not obey Raoult's law at all concentrations. For such solutions,  $p_1 \neq p_1^0 \chi_1$ ,  $p_2 \neq p_2^0 \chi_2$ ,  $\Delta_{\text{mix}}H \neq 0$  and  $\Delta_{\text{mix}}V \neq 0$ .

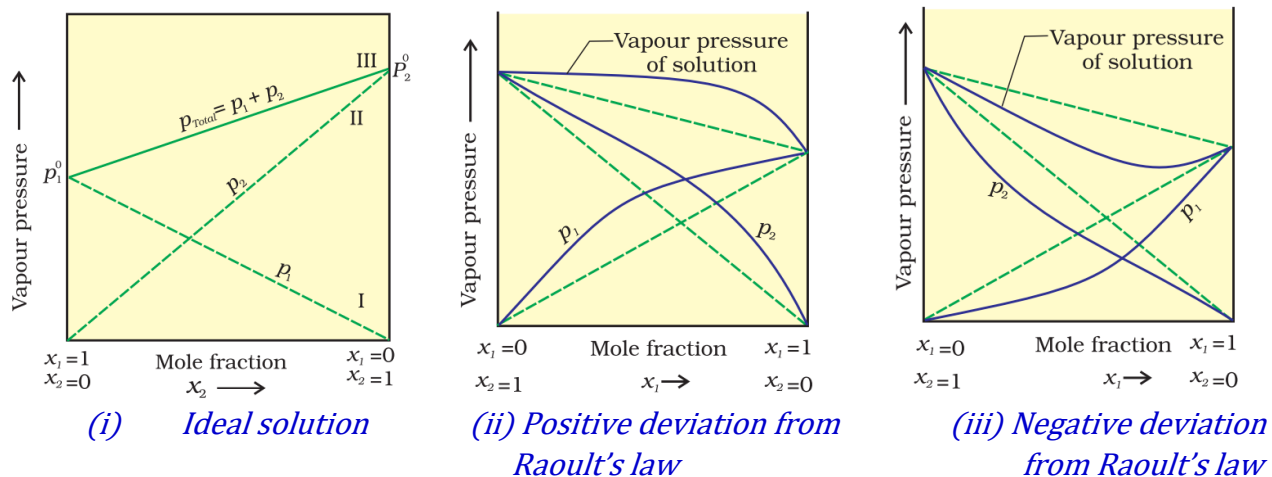
6. What type of deviation is shown by a mixture of chloroform and acetone? Give reason.

Ans: Negative deviation. Chloroform can form hydrogen bond with acetone. So, the solute – solvent interaction increases and hence the vapour pressure decreases.

7. Draw a vapour pressure curve, by plotting vapour pressure against mole fraction for:

(i) an ideal solution (ii) a solution that show positive deviation from Raoult's law (iii) A solution that show negative deviation from Raoult's law.

Ans:



8. What are azeotropes?

Ans: They are constant boiling mixtures and have the same composition in liquid and vapour phases.

9. Explain the different types of azeotropes?

There are 2 types of azeotropes:

Minimum boiling azeotropes: Formed by solutions which show large positive deviation from Raoult's law. E.g. 95% aqueous solution of ethanol by volume.

Maximum boiling azeotrope: Formed by solutions which show large negative deviation from Raoult's law. E.g. 68% aqueous solution of  $\text{HNO}_3$  by mass.

10. What are colligative properties? Name the four types of colligative properties.

Ans: These are properties of dilute solutions, which depend only on the number of solute particles and not on their nature.

The important colligative properties:

(i) Relative lowering of Vapour pressure (ii) Elevation of boiling point  
(iii) Depression of freezing point (iv) Osmotic pressure.

11. What is osmotic pressure?

Ans: It is the excess pressure that must be applied on solution side to prevent osmosis.

12. What is reverse osmosis? Write any one of its applications.

Ans: If a pressure larger than the osmotic pressure is applied to the solution side, the direction of osmosis gets reversed. Now, the solvent molecules will flow out of solution through SPM. This is known as reverse osmosis. It is used in desalination of sea water.

13. For determining the molecular mass of polymers, osmotic pressure is preferred to other properties. Why?

Ans: This is because the magnitude of osmotic pressure is large even for very dilute solutions.

14. Write any 2 advantages of osmotic pressure measurement over other colligative property measurements?

Ans: (i) Osmotic pressure can be measured at room temperature.

(ii) Here molarity of the solution is used instead of molality, which can be determined easily.

15. What are isotonic solutions? Give an example.

Ans: Two solutions having same osmotic pressure are called isotonic solutions. E.g. 0.9% (mass/volume) NaCl solution and our blood cells.

16. For intravenous injections only solutions with osmotic pressure equal to that of 0.9% NaCl solution is used. Why?

Ans: This is because the fluid inside our blood cell is isotonic with 0.9% (mass/volume) NaCl solution. So, osmosis does not occur

17. Define van't Hoff factor. What is its value for KCl solution, if there is 100% dissociation.

Ans: van't Hoff factor (i) =  $\frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$

For KCl,  $i = 2$

18. What happens to the colligative properties when ethanoic acid is treated with benzene? Give reason.

Ans: Colligative properties decreases. This is because ethanoic acid (acetic acid) dimerise in benzene, due to hydrogen bonding.

19. 200 cm<sup>3</sup> of aqueous solution of a protein contains 1.26 g of protein.

The osmotic pressure of the solution at 300 K is found to be  $8.3 \times 10^{-2}$  bar. Calculate the molar mass of protein. ( $R = 0.083 \text{ L bar K}^{-1}\text{mol}^{-1}$ )

Ans: Here  $w_2 = 1.26 \text{ g}$ ,  $R = 0.083 \text{ L bar/K/mol}$ ,  $\pi = 8.3 \times 10^{-2} \text{ bar}$ ,  $T = 300\text{K}$  &  $V = 200 \text{ cm}^3 = 0.2 \text{ L}$

We know that, molar mass of solute,  $M_2 = \frac{w_2 RT}{\pi V}$   
$$= \frac{1.26 \times 0.083 \times 300}{8.3 \times 10^{-2} \times 0.2} = 1890 \text{ g/mol}$$

20. 18g of glucose, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, is dissolved in 1 kg of water in a sauce pan.

At what temperature will water boil at 1.013 bar? ( $K_b$  for water is  $0.52 \text{ K kg mol}^{-1}$ , boiling point of water =  $373.15 \text{ K}$ )

Ans: We know that,  $\Delta T_b = \frac{1000 K_b w_2}{w_1 M_2}$

Here  $w_2 = 18 \text{ g}$ ,  $w_1 = 1 \text{ kg} = 1000\text{g}$ ,  $K_b = 0.52 \text{ K kg/mol}$ ,  $M_2 = 180$ ,  $T_b^0 = 373.15 \text{ K}$ ,  $\Delta T_b = ?$ ,  $T_b = ?$

On substituting in the above equation, we get

$$\Delta T_b = \frac{1000 \times 0.52 \times 18}{1000 \times 180} = 0.052 \text{ K}$$

$$\text{Also } \Delta T_b = T_b - T_b^0$$

$$\text{i.e. } 0.052 = T_b - 373.15$$

$$\text{So, } T_b = 0.052 + 373.15 = 373.202 \text{ K}$$

## 2. ELECTROCHEMISTRY

21. What is a Galvanic cell?

Ans: It is a device that converts chemical energy of some redox reactions to electrical energy.

E.g. Daniel cell, Dry cell etc.

22. Write the representation of a Daniel cell. Also write its anode reaction, cathode reaction and net reaction?

Ans: Representation of Daniel cell:  $\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$

Anode reaction:  $\text{Zn} \rightarrow \text{Zn}^{2+} + 2 \text{e}^-$

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

Net reaction:  $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$

23. Write the Nernst equation for a Daniel cell.

$$\text{Ans: } E_{\text{cell}} = E_{\text{cell}}^0 + \frac{0.0591}{2} \log \frac{[\text{Cu}^{2+}]}{[\text{Zn}^{2+}]}$$

24. Define molar conductivity. What is its unit?

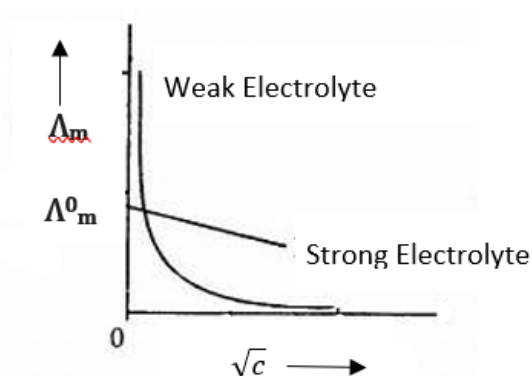
Ans: It is the conductivity of 1 mol of an electrolytic solution placed in a conductivity cell having unit distance between the electrodes and unit area of cross-section.

OR, Molar conductivity ( $\Lambda_m$ ) =  $\frac{1000 \kappa}{M}$  where  $\kappa$  is the conductivity and M is the molarity of the solution.

25. How does molar conductivity of a solution vary with concentration or dilution? Explain.

Ans: The molar conductivity increases with dilution for both strong and weak electrolytes. This is due to the increase in ionic mobility, for strong electrolytes and increase in degree of dissociation, for weak electrolytes.

OR, the graph:



26. State Kohlrausch's law of independent migration of ions. State any one of its applications.

Ans: It states that the limiting molar conductivity of an electrolyte is the sum of the individual contributions of the anion and the cation of the electrolyte.

Application: It is used to calculate the limiting molar conductivity of any electrolytes.

27. What is meant by limiting molar conductivity ( $\Lambda_m^0$ )?

Ans: It is the molar conductivity of an electrolytic solution at zero concentration.

28.  $\Lambda_m^0$  for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm<sup>2</sup> mol<sup>-1</sup> respectively. Calculate  $\Lambda_m^0$  for HAc.

Ans: Given  $\Lambda_m^0$  (NaCl) = 126.4 S cm<sup>2</sup> mol<sup>-1</sup>,  $\Lambda_m^0$  (HCl) = 425.9 S cm<sup>2</sup> mol<sup>-1</sup> and  $\Lambda_m^0$  (NaAc) = 91.0 S cm<sup>2</sup> mol<sup>-1</sup>

On applying Kohlrausch's law,

$$\begin{aligned}\Lambda_m^0 (\text{HAc}) &= \Lambda_m^0 (\text{NaAc}) + \Lambda_m^0 (\text{HCl}) - \Lambda_m^0 (\text{NaCl}) \\ &= 91.0 + 425.9 - 126.4 = \mathbf{390.5 \text{ S cm}^2 \text{ mol}^{-1}}\end{aligned}$$

29. Write any two differences between primary cell and secondary cell.

Ans:

Primary cell	Secondary cell
Cannot be recharged or reused.	Can be recharged and reused.
The cell reaction cannot be reversed.	The cell reaction can be reversed.
E.g. Dry cell, Mercury cell	E.g.: Lead storage cell, Ni-Cd cell

30. What is the electrode potential of the Standard Hydrogen Electrode (SHE), which is used as a reference electrode, to determine the electrode potential of an unknown electrode.

Ans: Zero volt (0 V)

31. Write the anode and cathode reactions occur in the operation of a lead storage battery. Mention the electrolyte used in the battery.

Ans: Anode reaction:  $\text{Pb} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4 + 2\text{e}^-$

Cathode reaction:  $\text{PbO}_2 + \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{PbSO}_4 + 2\text{H}_2\text{O}$

Net reaction:  $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$

Electrolyte used is 38%  $\text{H}_2\text{SO}_4$ .

32. The cell potential of a mercury cell is 1.35 V, and remains constant during its life. Give reason.

Ans: Because the cell reaction does not involve any ion in solution.

33. What are fuel cells?

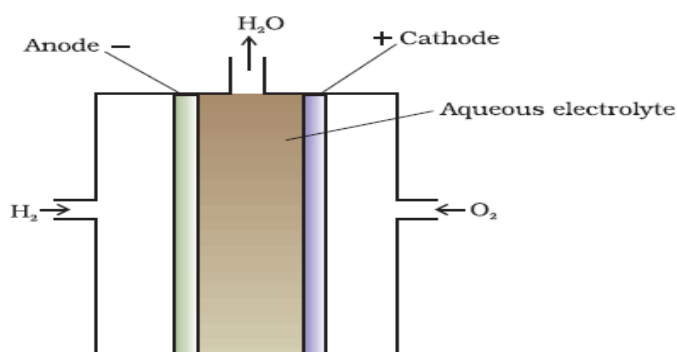
Ans: Fuel cells are galvanic cells which convert the energy of combustion of fuels (like hydrogen, methane, methanol etc.) directly into electrical energy.

34. Write any two advantages of fuel cells.

Ans: (i) It is highly efficient (ii) It is eco-friendly.

35. Diagrammatically represent  $\text{H}_2 - \text{O}_2$  fuel cell. Write the anode reaction, cathode reaction and overall cell reaction taking place in it?

Ans:  $\text{H}_2 - \text{O}_2$  fuel cell



Anode reaction:  $2\text{H}_{2(\text{g})} + 4\text{OH}^-_{(\text{aq})} \rightarrow 4\text{H}_2\text{O}_{(\text{l})} + 4\text{e}^-$

Cathode reaction:  $\text{O}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})} + 4\text{e}^- \rightarrow 4\text{OH}^-_{(\text{aq})}$

Net Reaction:  $2\text{H}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2\text{H}_2\text{O}_{(\text{l})}$

36. What is corrosion? Write any two methods to prevent the corrosion (rusting) of iron.

Ans: It is the process of formation of oxide or other compounds of a metal on its surface by the action of air, water-vapour,  $\text{CO}_2$  etc.

Rusting can be prevented by:

(i) coating the metal surface with paint, varnish etc.

(ii) coating with anti-rust solution.

### 3. CHEMICAL KINETICS

37. What do you mean by rate of a reaction ?

Ans: It is the change in concentration of any one of the reactants or products in unit time.

38. Write any two factors influencing rate of a reaction.

Ans: (i) Concentration of the reactants (ii) Temperature.

39. Write the unit of rate of a reaction.

Ans:  $\text{mol L}^{-1} \text{s}^{-1}$

40. Express the rate of the following reaction in terms of reactants and products:  $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$ .

Ans:  $r = -\frac{1}{2} \frac{\Delta[\text{HI}]}{\Delta t} = \frac{\Delta[\text{H}_2]}{\Delta t} = \frac{\Delta[\text{I}_2]}{\Delta t}$  OR,  $r = -\frac{1}{2} \frac{d[\text{HI}]}{dt} = \frac{d[\text{H}_2]}{dt} = \frac{d[\text{I}_2]}{dt}$

41. Write the units of rate constant k for a zero, first and second order reactions.

Ans:

Order of Reaction	Unit of rate constant
Zero order	$\text{mol L}^{-1} \text{s}^{-1}$
First order	$\text{s}^{-1}$
Second order	$\text{mol}^{-1} \text{L s}^{-1}$

42. Write any three differences between order and molecularity.

Ans:

Order	Molecularity
It is the sum of the powers of the concentration terms in the rate law expression.	It is the total number of reactant species collide simultaneously in a chemical reaction.
It is an experimental quantity	It is a theoretical quantity
It can be zero or fractional	It cannot be zero or fractional

43. What is mean by zero order reaction? Give one example.

Ans: Zero order reaction means that the rate of a reaction is independent of the concentration of the reactants. E.g. Decomposition of ammonia at the surface of platinum at high pressure.

44. The conversion of molecules A to B follows second order kinetics. If concentration of A is increased to three times, how will it affect the rate of formation of B?

Ans: Here  $r = k[\text{A}]^2$

So, if the concentration is increased to 3 times, the rate of the reaction

is increased by 9 times.

45. Write the expression for integrated rate equation for a first order reaction.

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

46. What is mean by half-life period of a reaction?

Ans: It is the time taken to reduce the concentration of a reactant to half of its initial concentration.

47. Write an expression for half-life period of first order reaction.

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

48. By deriving the equation for half-life period of a first order reaction, prove that  $t_{1/2}$  is independent initial concentration of reactants.

$$\text{Ans: For a first order reaction, } k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\text{When } t = t_{1/2}, [R] = \frac{[R]_0}{2}$$

$$\text{So, the above equation becomes: } k = \frac{2.303}{t_{1/2}} \log \frac{[R]_0}{\frac{[R]_0}{2}}$$

$$\text{Or, } t_{1/2} = \frac{2.303}{k} \log 2$$

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

Thus, for a first order reaction, half-life period is independent of initial concentration of the reactants.

49. What are pseudo first order reactions? Give one example.

Ans: These are reactions which appears to follow higher order but actually follows first order kinetics. E.g.: Hydrolysis of ester.

50. Write the Arrhenius equation and identify the terms in it. OR, Write a relation which connects rate constant with temperature.

$$\text{Ans: Arrhenius equation is } k = A \cdot e^{-E_a/RT}$$

Where k – rate constant of the reaction, A – Arrhenius factor,  $E_a$  – activation energy, R – universal gas constant and T – absolute temperature.

51. Calculate the half-life period of a first order reaction whose rate constant is  $200 \text{ s}^{-1}$ .

$$\text{Ans: } t_{1/2} = \frac{0.693}{k} = \frac{0.693}{200} = 3.5 \times 10^{-3} \text{ s}$$

52. Rate constant  $k_2$  of a reaction at 310K is two times of its rate constant  $k_1$  at 300 K. Calculate activation energy of the reaction. ( $\log 2 = 0.3010$ )

and  $\log 1 = 0$ )

Ans: Here  $T_1 = 300\text{K}$ ,  $k_1 = x$ ,  $T_2 = 310\text{K}$ ,  $k_2 = 2x$  and  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303 R} \frac{T_2 - T_1}{T_1 T_2}$$

$$\log \frac{2x}{x} = \frac{E_a}{2.303 \times 8.314} \frac{310 - 300}{300 \times 310}$$

$$\text{So, } E_a = \frac{2.303 \times 8.314 \times 300 \times 310 \times \log 2}{10} = 53598 \text{ J mol}^{-1} = 53.598 \text{ kJ mol}^{-1}$$

## 4. d AND f BLOCK ELEMENTS

53. Write any four characteristic properties of transition elements.

Ans: They are metals, they show variable oxidation states, they form coloured ions, they act as catalysts, most of them are paramagnetic etc.

54. Zinc (atomic number = 30) is not a transition element, though it is a d block element. Why?

Ans: This is due to the absence of partially filled d orbitals in its ground state or in any of its common oxidation states.

55. What is the reason for the catalytic property of transition elements?

Ans: Large surface area and ability to show variable oxidation states are the reason for catalytic property.

56. Transition elements form large number of complex compounds. Why?

Ans: This is due to comparatively smaller size, high ionic charge, presence of partially filled d orbitals and ability to show variable oxidation state.

57. What is the common oxidation state of first row transition elements?

Ans: +2

58. What is the common oxidation state of Lanthanoids?

Ans: +3

59. Transition metal ions are generally coloured. Why?

Ans: This is due to the presence of partially filled d-orbitals or due to d-d transition.

60. Name the two types of magnetic behaviour shown by transition elements.

Ans: Diamagnetism and Paramagnetism

61. Calculate the 'spin only' magnetic moment of  $\text{M}^{2+}(\text{aq})$  ion ( $Z = 27$ ).

Ans: For  $M^{2+}$  ion with atomic number 27, the electronic configuration is  $3d^7$ . So, there are 3 unpaired electrons and hence  $\mu_s = \sqrt{3(3+2)} = 3.87 \text{ BM}$

62. From the following ions, identify the ions which are paramagnetic and show colour in aqueous solution:  $Ti^{2+}$ ,  $Fe^{2+}$ ,  $Sc^{3+}$ ,  $V^{3+}$ ,  $Ti^{4+}$ ,  $Cu^{2+}$ ,  $Cu^+$

Ans:  $Ti^{2+}$ ,  $Fe^{2+}$ ,  $V^{3+}$ ,  $Cu^{2+}$  are paramagnetic and coloured, since they contain partially filled d-orbitals. [Ions with  $d^0$  (e.g.  $Sc^{3+}$ ,  $Ti^{4+}$  etc) and  $d^{10}$  (e.g.  $Cu^+$ ) configurations are diamagnetic and colourless in aqueous solution]

63. Write any three applications of d- and f- block elements.

Ans: Iron is an important construction material.  $TiO_2$  is used in pigment industry. Zn, Ni, Cd,  $MnO_2$  etc are used in making batteries.

64. The catalyst used in the Wacker process for the oxidation of ethyne to ethanal is .....

Ans: Palladium chloride ( $PdCl_2$ )

65. Describe the method of preparation of potassium chromate from chromite ore.

Ans: (i) Conversion of chromite ore to sodium chromate by fusing with sodium carbonate in presence of air.

(ii) Acidification of sodium chromate with sulphuric acid to produce sodium dichromate.

(iii) Sodium dichromate is treated with potassium chloride to get potassium dichromate.

66. How will you prepare  $KMnO_4$  from  $MnO_2$ ?

Ans: The preparation of Potassium permanganate from Pyrolusite ( $MnO_2$ ) involves two steps.

In the first step  $MnO_2$  is fused with  $KOH$  to form potassium manganate. In the second step, potassium manganate is electrolytically oxidised to potassium permanganate.

67. Give one example for the oxidising actions of  $KMnO_4$  and  $K_2Cr_2O_7$ .

Ans: Both of them oxidises ferrous ion to ferric ion in acidic medium.

68. What is Lanthanoid contraction? Give reason for it?

Ans: The regular decrease in the atomic and ionic radii along lanthanide series is known as lanthanide contraction. It is due to the poor shielding effect of f – electrons and increase in nuclear charge.

69. Write any two consequences of Lanthanoid contraction.

Ans: (i) 2<sup>nd</sup> and 3<sup>rd</sup> row transition series elements have similar radii.  
(ii) Lanthanides have similar physical properties and they occur together in nature.

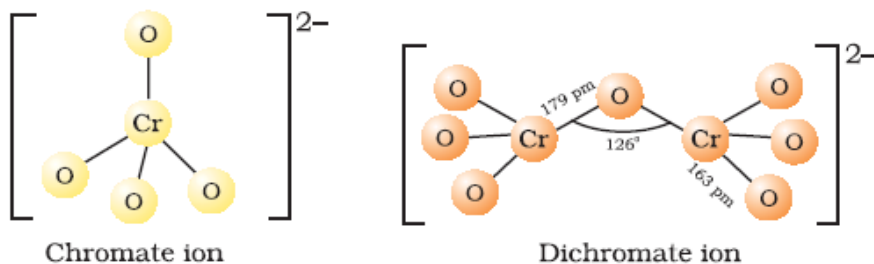
70. Zirconium (Zr) and Hafnium (Hf) have almost similar atomic size.

Why? OR, It is difficult to separate Zr from Hf. Why?

Ans: Due to lanthanoid contraction.

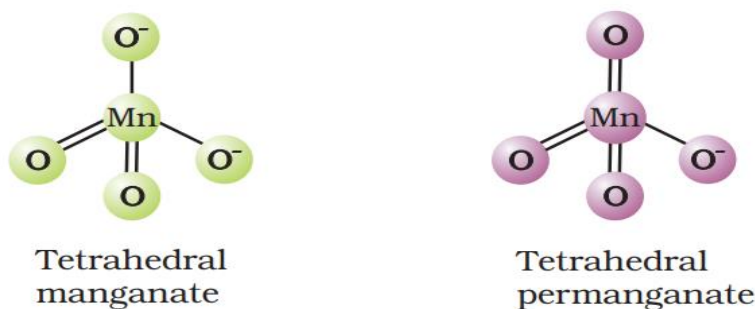
71. Draw the structures of chromate and dichromate ions.

Ans:



72. Draw the structures of manganate and permanganate ions?

Ans:



## 5. CO-ORDINATION COMPOUNDS

73.  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Br}$  is a co-ordination compound. a) Identify the central metal ion b) Name the ligands present in it. c) What is its co-ordination number?

Ans: (a) Central metal ion is  $\text{Cr}^{3+}$  (b) Ligands are  $\text{NH}_3$  and  $\text{Cl}^-$  (c) Co-ordination number = 6

74. Write the IUPAC Names of the following co-ordination compounds:

a)  $[\text{Ni}(\text{CO})_4]$  b)  $\text{K}_3[\text{Fe}(\text{CN})_6]$  c)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  d)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$   
e)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  f)  $[\text{CoCl}_2(\text{en})_2]^+$

Ans: a)  $[\text{Ni}(\text{CO})_4]$  – Tetracarbonylnickel (0)  
b)  $\text{K}_3[\text{Fe}(\text{CN})_6]$  – Potassiumhexacyanidoferrate (III)  
c)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  – Pentaamminechloridocobalt(III)sulphate  
d)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  – Diamminedichloridoplatinum (II)

- e)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  – Hexaaquachromium(III)chloride  
 f)  $[\text{CoCl}_2(\text{en})_2]^+$  – Dichloridobis(ethane-1,2-diamine)cobalt (III)

75. What are ligands? Give examples.

Ans: Ligands are negative ions or neutral molecules which are bonded to the central atom. E.g.:  $\text{Cl}^-$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{CN}^-$  etc.

76. What are chelating ligands? Give an example.

Ans: These are ligands which can form ring complexes with central atom. E.g.: Ethane-1,2-diamine (en) OR, Oxalate ion ( $\text{C}_2\text{O}_4^{2-}$ )

77. What are ambidentate ligands? Write 2 examples.

Ans: These are monodentate ligands containing more than one donor atoms. E.g.:  $\text{NO}_2^-$ ,  $\text{CNO}^-$

78. Describe the four types of structural isomerism exhibited by co-ordination compounds.

Ans: (i) **Ionisation Isomerism**: arises due to the exchange of ions between the inside and outside of co-ordination sphere.

E.g.:  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$  and  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ .

ii) **Linkage Isomerism**: arises in a co-ordination compound containing ambidentate ligand.

E.g.:  $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$

iii) **Co-ordination Isomerism**: arises due to the interchange of ligands between cationic and anionic co-ordination entities.

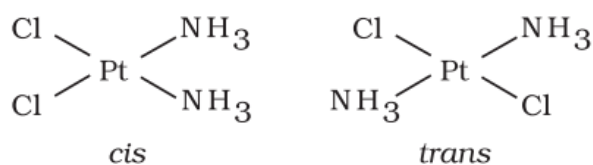
E.g.:  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ , and  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$

iv) **Solvate Isomerism**: arises due to the difference in the no. of solvent molecule bonded to the metal ion as ligand.

E.g.:  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ .

79. Give the structure of cis and trans isomers of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ .

Ans:



80. Write any 4 postulates of Werner's Co-ordination theory?

Ans: (i) Every metal has two types of valencies – primary valencies and secondary valencies.

(ii) Primary valencies are ionisable, while secondary valencies are non-ionisable.

(iii) Primary valencies are always satisfied by negative ions, while

secondary valencies may be satisfied by negative ions or neutral molecules.

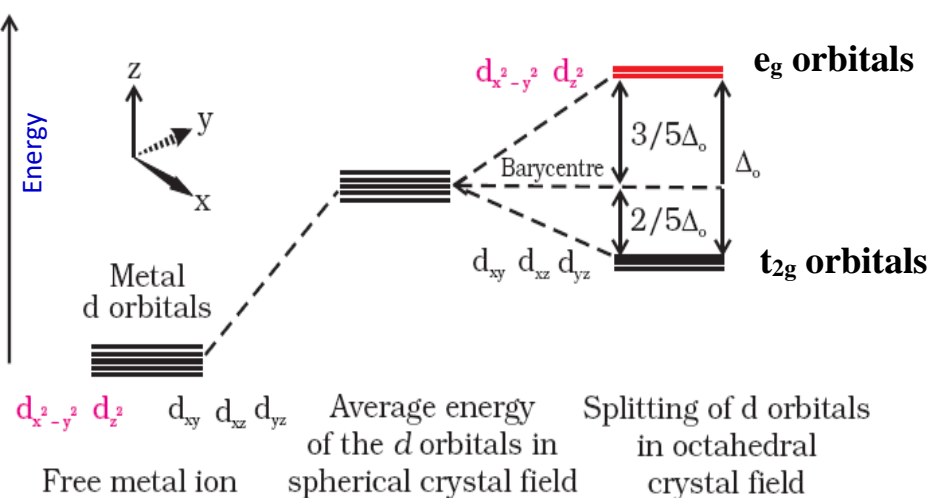
(iv) Primary valencies give the oxidation state of the metal, while secondary valencies give the co-ordination number of the metal.

81.  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is a diamagnetic complex and  $[\text{CoF}_6]^{3-}$  is a paramagnetic complex. Substantiate the above statement using V.B theory.

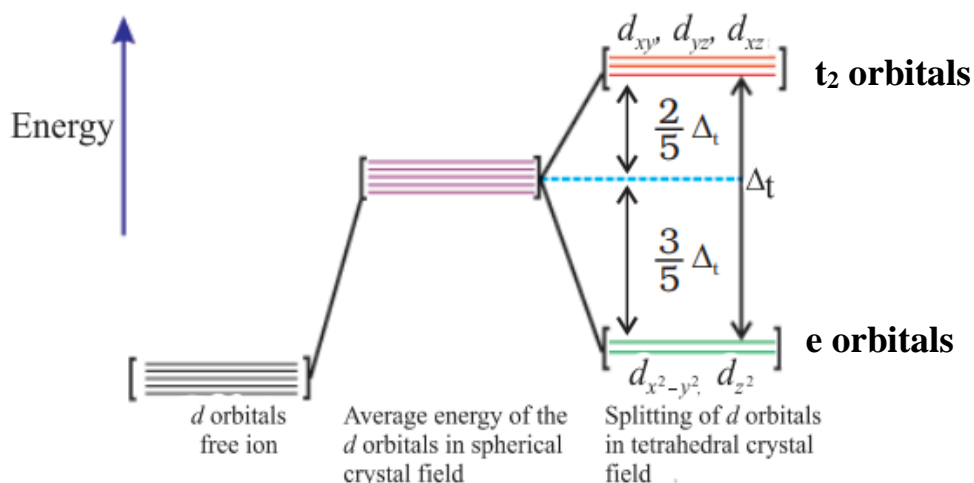
Ans:  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is an inner orbital complex and here all the orbitals are paired. So it is diamagnetic. But  $[\text{CoF}_6]^{3-}$  is an outer orbital complex and here there is unpaired electrons. So it is paramagnetic.

82. Draw the diagram which indicates the splitting of d-orbitals in (a) Octahedral field (b) Tetrahedral field

Ans:



### Octahedral Splitting



### Tetrahedral splitting

83. Name the metal ion present in the following naturally occurring complexes: (a) Haemoglobin (b) Chlorophyll.

Ans: (a) Haemoglobin: Iron ( $\text{Fe}^{2+}$ ) (b) Chlorophyll: Magnesium ( $\text{Mg}^{2+}$ )

84. Write any two limitations of valence bond theory of co-ordination compounds.

Ans: (i) It involves a large number of assumptions.

(ii) It does not explain the colour exhibited by co-ordination compounds.

85. Identify the geometrical isomerism in  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ .

Ans: Fac-mer isomerism

86. What is the primary valency and secondary valency of the central metal ion in the complex  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ .

Ans: Primary valency (oxidation number) = 3 and secondary valency (co-ordination number) = 6

## 6. HALOALKANES AND HALOARENES

87. For the preparation of alkyl chlorides from alcohols, thionyl chloride ( $\text{SOCl}_2$ ) is preferred. Give reason.

Ans: When thionyl chloride is used, we get pure alkyl chlorides, since the bi-products ( $\text{SO}_2$  and  $\text{HCl}$ ) are gases.

88. Write two examples for ambident nucleophiles.

Ans:  $\text{CN}^-$  and  $\text{NO}_2^-$

89. What are Grignard reagents?

Ans: Grignard reagents are alkyl magnesium halides ( $\text{R-MgX}$ ).

90. It is necessary to avoid even traces of moisture from a Grignard reagent. Why?

Ans: This is because Grignard reagent react with moisture and form hydrocarbon.

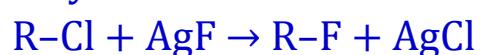
91. Write a suitable method to convert  $\text{CH}_3\text{-CH}_2\text{-Br}$  to  $\text{CH}_3\text{-CH}_2\text{-I}$

Ans: By treating with  $\text{NaI}$  in dry acetone medium. [Finkelstein Reaction]

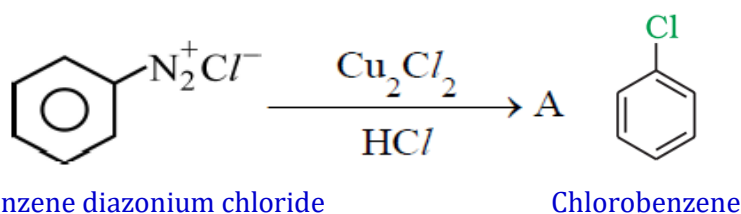


92. Explain the following reactions: a) Swarts reaction b) Sandmeyer's reaction c) Wurtz-Fittig reaction d) Fittig reaction e) Wurtz reaction.

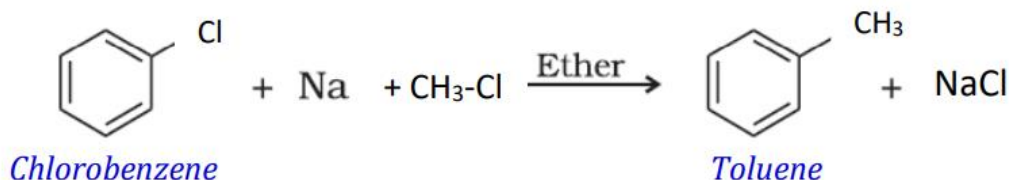
Ans: a) Swarts reaction: Alkyl chlorides or iodides react with  $\text{AgF}$  to form alkyl fluorides.



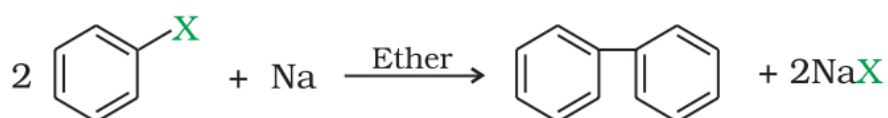
b) Sandmeyer's reaction: Benzene diazonium chloride when treated with cuprous chloride and dil.  $\text{HCl}$ , we get chlorobenzene.



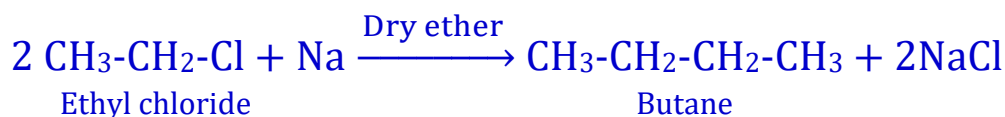
c) Wurtz–Fittig reaction: A mixture of alkyl and aryl halides react with metallic sodium to give alkylarene.



d) Fittig reaction: Aryl halides react with metallic sodium in dry ether to give diaryl.



e) Wurtz reaction: Alkyl halides react with metallic sodium in dry ether to form alkane.



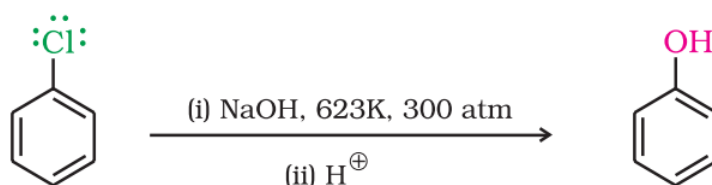
93. Write any 2 reasons for the less reactivity of aryl halides towards nucleophilic substitution reactions.

Ans: (i) Partial double bond character of the C – X bond due to resonance.

(ii) Due to the repulsion between nucleophile and electron rich benzene ring.

94. Give one example for the nucleophilic substitution reactions of chlorobenzene (aryl halides). OR, How will you convert chlorobenzene to phenol?

Ans: Chlorobenzene when heated with aqueous sodium hydroxide solution at 623K temperature and 300 atm pressure followed by acidification, we get phenol.



95. Which is the major product obtained by the β-elimination of 2-bromopentane. Name the rule, which leads to the major product in this elimination reaction and state it.

Ans: Pent-2-ene ( $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_3$ ). The rule is Zaitsev's rule. It states that in dehydrohalogenation reactions, the major product is that alkene which contains maximum number of alkyl groups around  $\text{C} = \text{C}$  bond.

96. Write any 4 differences between  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  reactions.

Ans:

$\text{S}_{\text{N}}1$ Reaction	$\text{S}_{\text{N}}2$ Reaction
Occurs in two steps	Occurs in one step
Order = 1	Order = 2
Intermediate carbocation is formed	No intermediate
Results in racemisation.	Results in inversion of configuration

97. Convert ethyl chloride to ethyl cyanide (propanenitrile)?

Ans: By treating with KCN.



98. Chloroform is stored in closed, dark coloured bottles completely filled up to the neck. Give reason.

Ans: To avoid the oxidation of chloroform to the poisonous compound phosgene.

99. Name a polyhalogen compound used as an insecticide.

Ans: DDT

100. Explain the following terms: (a) Enantiomers (b) Racemic mixture (c) Racemisation.

Ans: (a) Enantiomers are stereoisomers related to each other as non – superimposable mirror images.

(b) Racemic mixture or racemic modification: Equimolar mixture of d and l form of a compound. It is optically inactive.

(c) Racemisation: The process of conversion of enantiomers to racemic mixture.

101. What are freons? How can you prepare a Freon from  $\text{CCl}_4$ ?

Ans: The chlorofluorocarbon compounds of methane and ethane are collectively known as freons. Freon can be prepared from  $\text{CCl}_4$  by Swarts reaction.

102. Moisture should be avoided during the preparation of a Grignard reagent.

Ans: Grignard reagents react with moisture and form alkanes. So moisture should be avoided from Grignard reagent.

## 7. ALCOHOLS, PHENOLS AND ETHERS

103. What is Lucas reagent? Explain how this reagent helps to distinguish primary, secondary and tertiary alcohols.

Ans: Lucas reagent is a mixture of conc. HCl and anhydrous  $\text{ZnCl}_2$ .

Lucas Test: Tertiary alcohols react with Lucas reagent and form immediate turbidity; secondary alcohols form a turbidity within 5 minutes while primary alcohols do not form turbidity at room temperature. They give turbidity only on heating.

104. Alcohols and phenols have higher boiling points. Why?

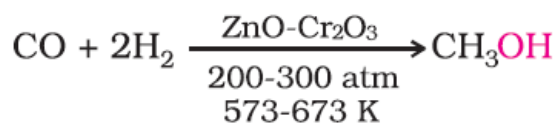
Ans: Because of the presence of inter molecular hydrogen bonding in alcohol and phenol.

105. What is "Wood spirit"? Give its commercial preparation.

Ans: Wood spirit is Methanol Or, Methyl alcohol.

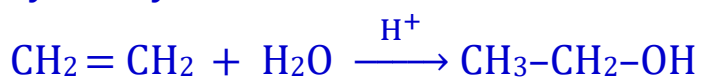
It is commercially prepared by the catalytic hydrogenation of carbon monoxide at about 573-673 K temperature, 200-300 atm pressure and in the presence of  $\text{ZnO} - \text{Cr}_2\text{O}_3$  catalyst.

OR, the equation:



106. Explain a method for the manufacture of ethanol.

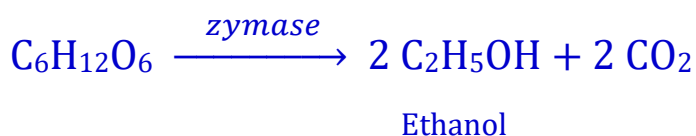
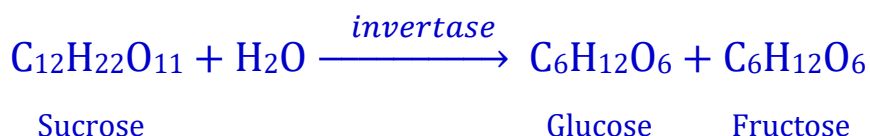
Ans: By the hydration of ethene in acidic medium.



107. Explain the manufacture of ethanol from molasses or cane sugar.

Ans: Ethanol is manufactured by the fermentation of molasses or cane sugar. The sugar in molasses (cane sugar) is converted to glucose and fructose, in the presence of an enzyme, invertase. Glucose and fructose undergo fermentation in the presence of another enzyme, zymase to give ethanol and carbon dioxide.

OR, the equations:



108. Name any two enzymes that are produced by yeast?

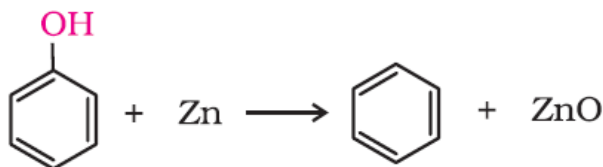
Ans: Invertase and zymase

109. Alcohols are soluble in water. Give reason?

Ans: Due to the formation of inter molecular hydrogen bond with water.

110. How will you convert phenol to benzene?

Ans: By heating with zinc dust.



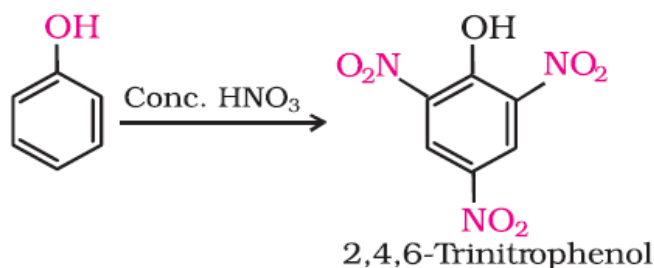
*Phenol*

*Benzene*

111. What is picric acid? Give its preparation.

Ans: Picric acid is 2,4,6-Trinitrophenol

It is prepared by nitrating phenol with conc. HNO<sub>3</sub>.

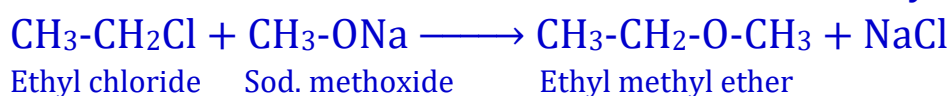


2,4,6-Trinitrophenol

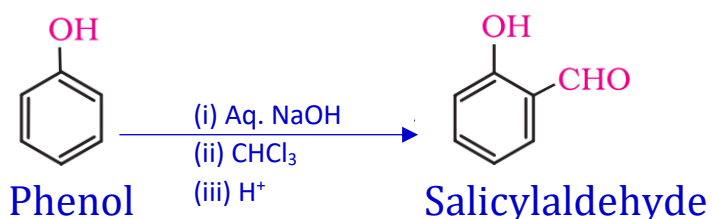
112. Explain the following:

- a) Williamson's synthesis
- b) Reimer-Tiemann Reaction
- c) Kolbe's Reaction
- d) Esterification

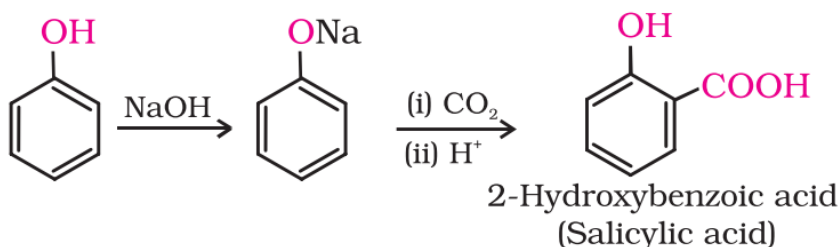
Ans: a) **Williamson's synthesis:** Alkyl halide reacts with sodium alkoxide to form ether. This reaction is called Williamson's ether synthesis.



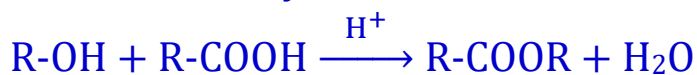
b) **Reimer-Tiemann Reaction:** Phenol when treated with chloroform in the presence of sodium hydroxide, followed by acidification, we get salicylaldehyde.



c) **Kolbe's Reaction:** Phenol when treated with aqueous sodium hydroxide and CO<sub>2</sub> followed by acidification, we get salicylic acid.

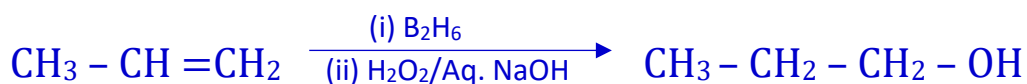


**d) Esterification:** Alcohols and phenols react with carboxylic acids, acid chlorides and acid anhydrides to form esters.

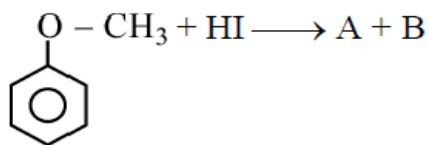


113. What is meant by hydroboration – oxidation reaction? Illustrate it with an example.

Ans: Alkenes add diborane followed by oxidation with hydrogen peroxide in the presence of aqueous sodium hydroxide to form alcohols.



114. Identify A and B in the following reaction

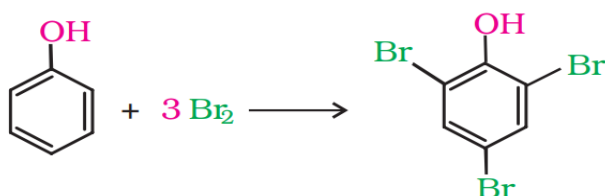


Ans: A is Phenol ( $\text{C}_6\text{H}_5\text{-OH}$ ) and B is Methyl iodide ( $\text{CH}_3\text{-I}$ )

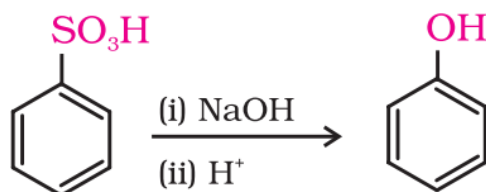
115. How will you convert:

- (i) Phenol to 2,4,6-tribromophenol
- (ii) Benzene sulphonic acid to phenol
- (iii) Aniline to phenol
- (iv) Ethanol to ethanal

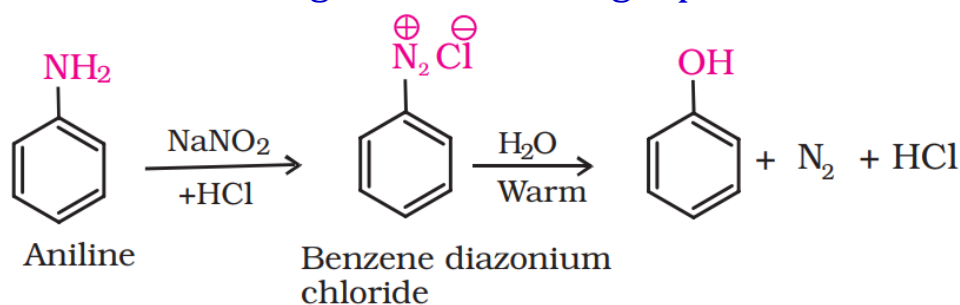
Ans: (i) By treating with bromine water



(ii) Benzene sulphonic acid is treated with molten sodium hydroxide followed by acidification gives phenol.



(iii) Aniline on diazotisation to form benzene diazonium chloride which on warming with water we get phenol.



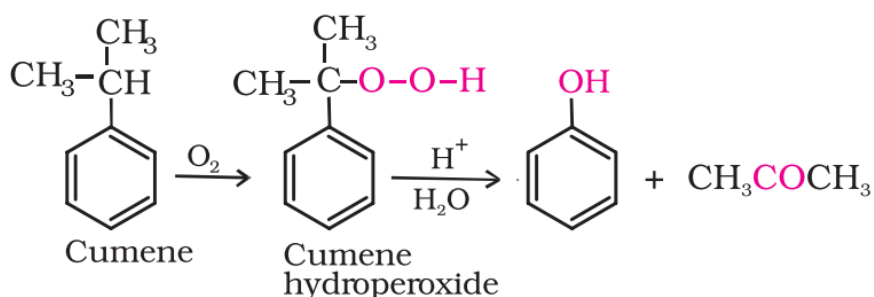
(iv) Ethanol on oxidation using  $\text{CrO}_3$  (chromic anhydride), we get ethanal.



116. What is cumene? How will you prepare phenol from cumene? [Give the manufacture of phenol.]

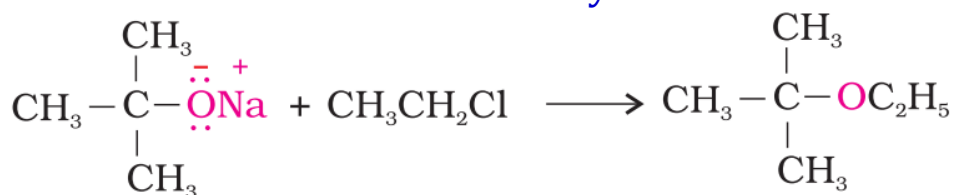
Ans: Cumene is isopropyl benzene (2-Phenylpropene)

When cumene is oxidised in presence of air followed by hydrolysis in presence of acid, we get phenol.



117. Write the correct pair of reactants for the preparation of t-butyl ethyl ether by Williamson synthesis.

Ans: Sodium tert-butoxide and ethyl chloride.



118. How will you prepare the three types of alcohols using Grignard reagent?

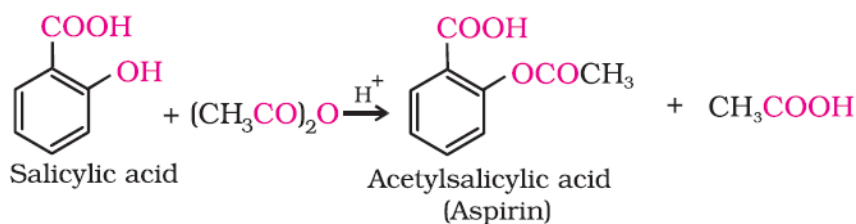
Ans: Primary alcohols are formed when formaldehyde (methanal) reacts with Grignard reagent followed by hydrolysis.

Secondary alcohols are formed when aldehydes other than formaldehyde, react with Grignard reagent followed by hydrolysis.

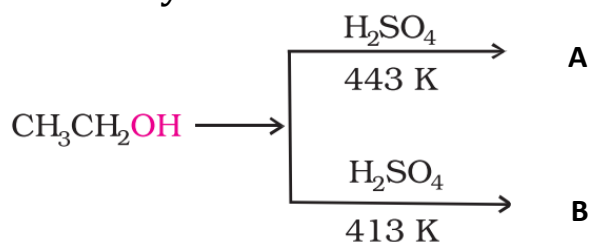
Tertiary alcohols are formed when ketones, react with Grignard reagent followed by hydrolysis.

119. What is aspirin? How is it prepared from salicylic acid?

Ans: Aspirin is acetyl salicylic acid. It is prepared by the acetylation of salicylic acid.



120. Identify A and B in the following reactions:



Ans: A is Ethene (CH<sub>2</sub> = CH<sub>2</sub>) and B is Diethylether (CH<sub>3</sub>-CH<sub>2</sub>-O-CH<sub>2</sub>-CH<sub>3</sub>)

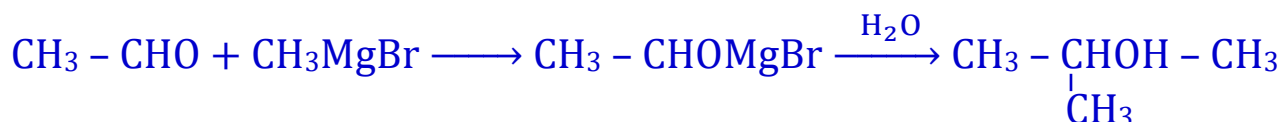
121. Phenols are acidic. Why?

Ans: (i) Due to the greater stability of the phenoxide ion formed.

(ii) Due to the greater electronegativity of sp<sup>2</sup> hybridised carbon to which -OH group is bonded.

122. Write the preparation of propan-2-ol from a Grignard reagent.

Ans: By treating acetaldehyde (CH<sub>3</sub>-CHO) with methyl magnesium bromide (CH<sub>3</sub>MgBr), followed by hydrolysis.



## 8. ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

123. Write two tests to distinguish between aldehydes and ketones.

Ans: Tollens Test and Fehling's test.

124. What is Tollen's reagent and Fehling's reagent. Explain how these reagents are used to distinguish aldehydes and ketones.

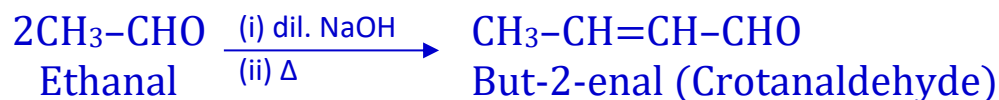
Ans: Tollen's reagent is ammoniacal silver nitrate and Fehling's reagent is a mixture of aqueous CuSO<sub>4</sub> (Fehling's reagent A) and alkaline sodium potassium tartarate (Fehling's reagent B).

Tollen's test: When an aldehyde is heated with Tollen's reagent, we get a bright silver mirror.

Fehling's Test: When an aldehyde is heated with Fehling's reagent A and B, we get a red precipitate of cuprous oxide (Cu<sub>2</sub>O).

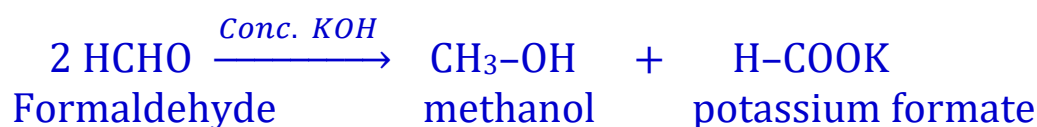
125. What is aldol condensation reaction?

Ans: Aldehydes having at least one  $\alpha$ -hydrogen atom when heated with dilute alkali, we get  $\alpha,\beta$ -unsaturated aldehyde. This reaction is called Aldol condensation reaction.



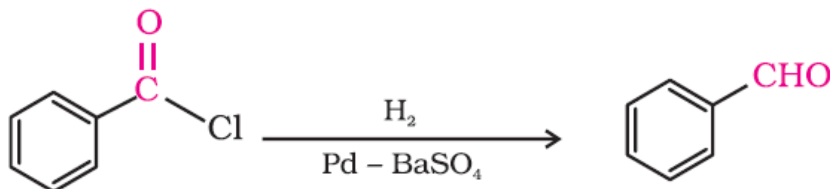
126. What is Cannizzaro reaction?

Ans: Aldehydes having no  $\alpha$ -hydrogen atom, when treated with conc. Alkali, undergo self-oxidation and reduction (disproportionation) to form alcohol and carboxylic acid salt. This reaction is called Cannizzaro reaction.



127. How will you convert  $\text{C}_6\text{H}_5\text{-CO-Cl}$  to  $\text{C}_6\text{H}_5\text{-CHO}$ ? Give the name of this reaction.

Ans: By reduction using  $\text{H}_2$  in presence of palladium and Barium sulphate. [ROSENMUND REDUCTION]

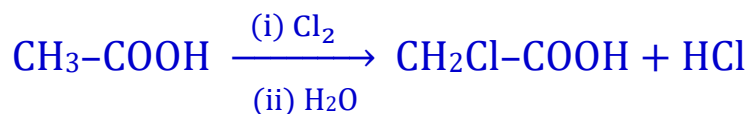


128. Which is more acidic –  $\text{CH}_3\text{COOH}$  or  $\text{CH}_2\text{Cl-COOH}$ . Why?

Ans:  $\text{CH}_2\text{Cl-COOH}$ . This is due to the electron withdrawing inductive effect ( $-I$  effect) of chlorine atom.

129. How will you convert  $\text{CH}_3\text{-COOH}$  to  $\text{CH}_2\text{Cl-COOH}$ ?

Ans: By treating with  $\text{Cl}_2$  in presence of red phosphorus (Hell-Volhard-Zelinsky Reaction OR, HVZ reaction).



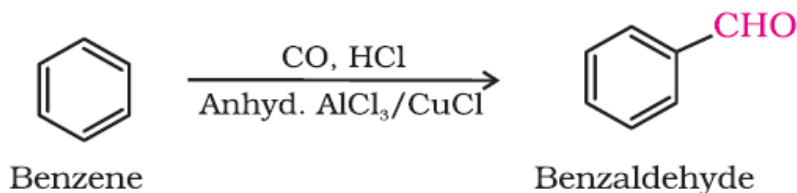
130. Carboxylic acids do not undergo Friedel-Craft's reaction. Why?

Ans: This is because the carboxyl group is deactivating and the catalyst aluminium chloride forms salt with the carboxyl group.

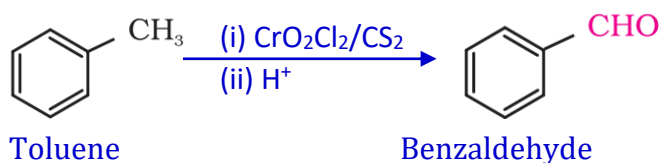
131. Explain the following:

A) Gatterman-Koch reaction    B) Etard Reaction    C) Stephen Reaction

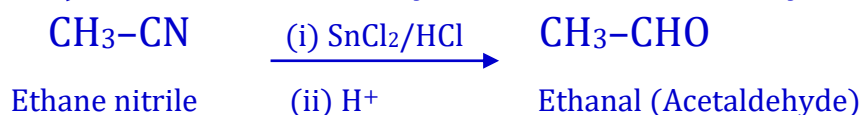
Ans: **A) Gatterman–Koch Reaction:** Benzene when treated with CO and HCl in the presence of anhydrous aluminium chloride or cuprous chloride, we get benzaldehyde.



**B) Etard Reaction:** When toluene is oxidised using chromyl chloride ( $\text{CrO}_2\text{Cl}_2$ ) in  $\text{CS}_2$  followed by acidification, we get benzaldehyde.



**C) Stephen Reaction:** Nitriles when reduced using stannous chloride ( $\text{SnCl}_2$ ) and HCl followed by acidification, aldehydes are formed.



132. Aldehydes are more reactive than ketones towards nucleophilic addition reaction. Why?

Ans: Due to +I effect (electron releasing inductive effect) and steric hindrance of two alkyl groups in ketones.

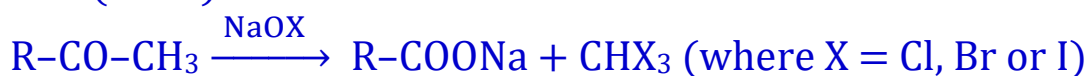
133. Give the preparation of a carboxylic acid by using Grignard reagent?

Ans: Solid  $\text{CO}_2$  react with Grignard reagent followed by acidification, we get carboxylic acid.



134. Explain Haloform reaction.

Ans: Compounds having  $\text{CH}_3\text{-CO-}$  group or  $\text{CH}_3\text{-CHOH-}$  group, when treated with sodium hypohalite (or, halogen and  $\text{NaOH}$ ), we get a haloform ( $\text{CHX}_3$ ). This reaction is called haloform reaction.



135. Suggest a test to distinguish between 2-pentanone and 3-pentanone.

Ans: Iodoform Test. When treated with sodium hypoiodite (NaOI), pentan-2-one gives an yellow precipitate of iodoform, while pentan-3-one does not.

136. Give a chemical test to distinguish between propanal and propanone.

Ans: Tollen's Test

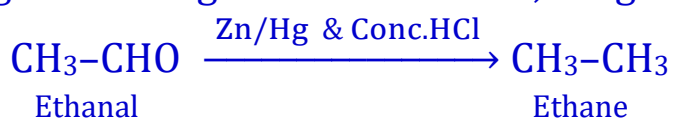
137. Identify the product obtained when Acetic acid is heated with P<sub>2</sub>O<sub>5</sub>.

Ans: Acetic anhydride

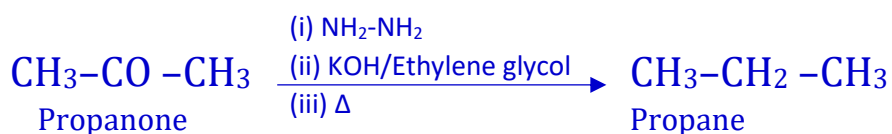
138. Explain the following:

a) Clemmensen reduction b) Wolff-Kishner Reduction

Ans: a) **Clemmensen Reduction:** Aldehydes and ketones when reduced using Zinc amalgam and Conc. HCl, we get alkane.



b) **Wolff-Kishner Reduction:** Aldehydes and ketones when reduced using hydrazine followed by heating with NaOH or KOH in high boiling solvent like ethylene glycol, we get alkane.

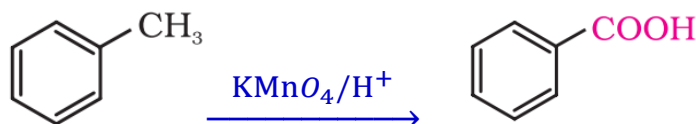


139. Suggest a test to distinguish carboxylic acids from alcohols and phenols.

Ans: Carboxylic acids give brisk effervescence with NaHCO<sub>3</sub> (Sodium bicarbonate). Alcohols and phenols do not give this reaction.

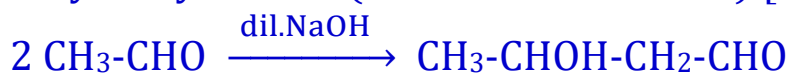
140. Convert toluene to benzoic acid.

Ans: Toluene when oxidised using acidified KMnO<sub>4</sub>, we get Benzoic acid.

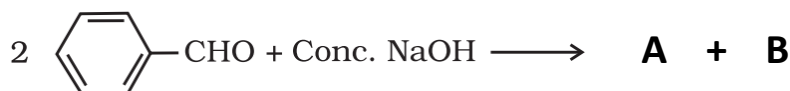


141. Name the product formed when ethanal is treated with dil. NaOH.

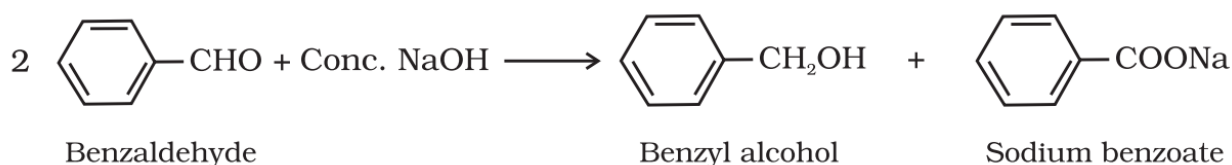
Ans: 3-Hydroxybutanal (CH<sub>3</sub>-CHOH-CH<sub>2</sub>-CHO) [Aldol reaction]



142. Identify A and B in the following reaction:



Ans: A is Benzyl alcohol and B is sodium benzoate [Cannizzaro reaction]



## 9. AMINES

143. What is Hinsberg's reagent? How will you distinguish primary, secondary and tertiary amines using this reagent?

Ans: Hinsberg reagent is Benzenesulphonyl chloride ( $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ )

Primary amines react with Hinsberg reagent to form a precipitate (of N-alkylbenzenesulphonamide), which is soluble in alkali.

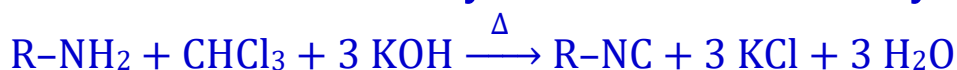
Secondary amines react with Hinsberg reagent to give a precipitate (of N,N-dialkylbenzenesulphonamide), which is insoluble in alkali.

Tertiary amines do not react with Hinsberg reagent.

144. Write the carbyl amine reaction, which is used as test for primary amines.

Ans: Primary amines on heating with chloroform and alcoholic potassium hydroxide form foul smelling isocyanides or carbylamines.

This reaction is known as **carbyl amine reaction or isocyanide test**.



145. Arrange the following compounds in the increasing order of their basic strength in aqueous solution:  $\text{NH}_3$ ,  $\text{C}_6\text{H}_5\text{NH}_2$ ,  $\text{CH}_3\text{NH}_2$ ,  $(\text{CH}_3)_2\text{NH}$ ,  $(\text{CH}_3)_3\text{N}$ .

Ans:  $\text{C}_6\text{H}_5\text{NH}_2 < \text{NH}_3 < (\text{CH}_3)_3\text{N} < \text{CH}_3\text{NH}_2 < (\text{CH}_3)_2\text{NH}$ .

146. Arrange the following amines in increasing order of their basic strength in aqueous solution:  $\text{C}_6\text{H}_5\text{NH}_2$ ,  $\text{C}_2\text{H}_5\text{NH}_2$ ,  $(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $\text{NH}_3$ ,  $(\text{C}_2\text{H}_5)_3\text{N}$ . Justify your answer.

Ans:  $\text{C}_6\text{H}_5\text{NH}_2 < \text{NH}_3 < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_3\text{N} < (\text{C}_2\text{H}_5)_2\text{NH}$ .

This order is due to the inductive effect, solvation effect and steric hindrance of alkyl group.

147. Which is a stronger base:  $\text{CH}_3\text{NH}_2$  or  $\text{C}_6\text{H}_5\text{NH}_2$ ? Why?

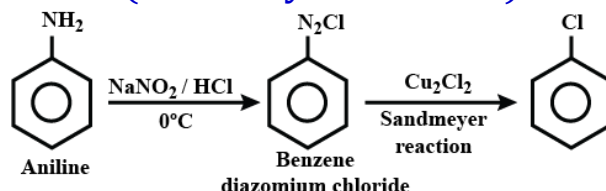
Ans:  $\text{CH}_3\text{NH}_2$ . Due to the electron releasing inductive effect of  $-\text{CH}_3$  group, it will readily accept  $\text{H}^+$  and hence it is more basic. [Or, In  $\text{C}_6\text{H}_5\text{NH}_2$ , the lone pair of electrons is in conjugation with the benzene ring and it is less available for protonation. So, it is less basic.]

148. What is diazotization?

Ans: Aniline on treating with  $\text{NaNO}_2$  and  $\text{HCl}$  (or, with nitrous acid  $[\text{HNO}_2]$ ), we get benzene diazonium chloride. This reaction is known as diazotisation.

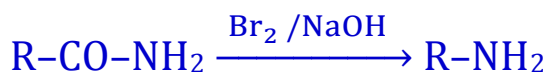
149. How will you convert aniline ( $\text{C}_6\text{H}_5\text{NH}_2$ ) to chlorobenzene?

Ans: Aniline on diazotisation to form benzene diazonium salt, which on treating with  $\text{HCl}$  in presence of cuprous chloride, we get chlorobenzene (Sandmeyer reaction).



150. What is Hoffmann bromamide reaction? What is the significance of this reaction?

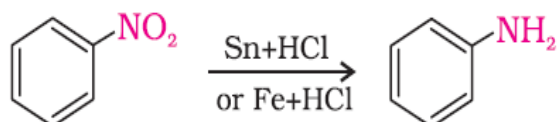
Ans: Amides on treating with bromine and alcoholic  $\text{NaOH}$  to give amines. This reaction is known as Hoffmann Bromamide degradation Reaction.



This reaction is used to prepare amine containing one carbon less than that present in the amide.

151. How will you convert nitrobenzene to aniline

Ans: By reduction using iron and  $\text{HCl}$  or tin and  $\text{HCl}$



152. Eventhough  $-\text{NH}_2$  group is ortho-para directing, nitration of aniline using nitrating mixture gives a large amount of meta nitroaniline. How will you explain this?

Ans: In strongly acidic medium, aniline gets protonated to form anilinium ion, which is meta-directing. So, a large amount of meta isomer is formed.

153. How is a primary amine distinguished from a secondary amine using a chemical test?

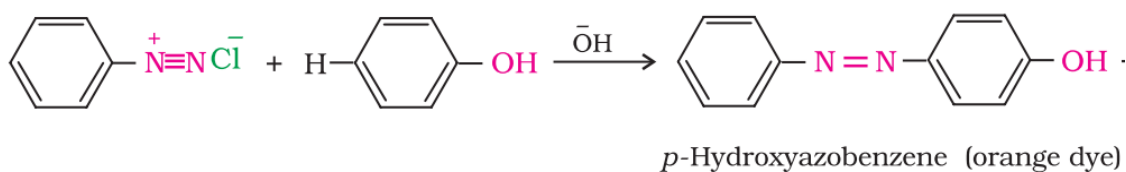
Ans: Carbyl amine reaction or Isocyanide reaction.

154. A white precipitate is obtained when aniline reacts with bromine water at room temperature. The precipitate formed is .....

Ans: 2,4,6-Tribromoaniline

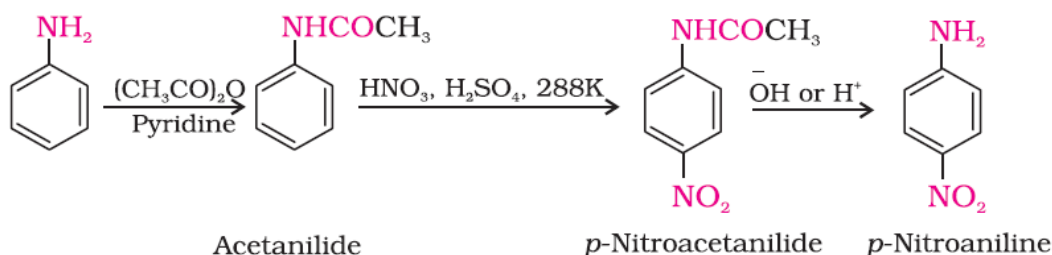
155. What is coupling reaction?

Ans: Benzene diazonium chloride when treated with phenol in basic medium, we get p-hydroxyazobenzene.



156. How will you prepare p-nitroaniline from aniline?

Ans: Aniline is first acetylated to get acetanilide, this on nitrating with nitration mixture followed by acidification, we get p-nitroaniline.



157. Give one chemical test to distinguish between the following pairs of compounds.

- (i) Methylamine and dimethylamine
- (ii) Ethylamine and aniline
- (iii) Aniline and benzylamine
- (iv) Aniline and N-methylaniline.

Ans: (i) Hinsberg test [Methyl amine,  $\text{CH}_3\text{-NH}_2$  is a primary amine and dimethyl amine,  $(\text{CH}_3)_2\text{NH}$  is a secondary amine]

(ii) Reaction with nitrous acid (Ethyl amine reacts with nitrous acid and evolve  $\text{N}_2$  gas) Or, Dye test

(iii) Reaction with nitrous acid Or, Dye test

(iv) Hinsberg test [Aniline,  $\text{C}_6\text{H}_5\text{-NH}_2$  is a primary amine and N-methylaniline,  $(\text{C}_6\text{H}_5\text{-NH-CH}_3)$  is a secondary amine]

158. Aniline does not undergo Friedel-Crafts reaction. Why?

Ans: Aniline forms salt with aluminium chloride, which is used as a catalyst in Friedel – Craft's reaction.

159. Compare the solubility of alcohols and amines in water. Justify.

Ans: Alcohols are more polar than amines and form stronger intermolecular hydrogen bonds with water than amines.

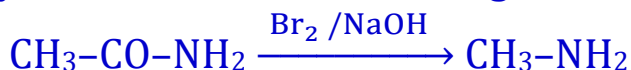
160. Gabriel phthalimide synthesis cannot be used for synthesising aromatic primary amines. Why?

Ans: This is because aryl halides do not undergo nucleophilic substitution reaction with the anion formed by phthalimide.

161. Convert:

- (i) ethanamide (acetamide) to methanamine (methyl amine)
- (ii) Methyl chloride to ethanamine

Ans: (i) By Hoffmann Bromamide degradation reaction.



(ii) By treating with KCN followed by catalytic hydrogenation.



162. Name the test used to identify primary amines using  $\text{CHCl}_3$  and ethanolic KOH.

Ans: Carbyl amine reaction or isocyanide test

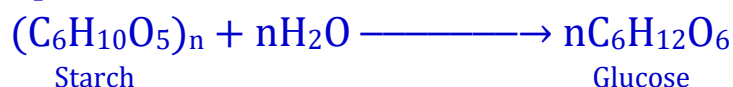
## 10. BIOMOLECULES

163. What is the glycosidic linkage in carbohydrates?

Ans: The C–O–C linkage in carbohydrates is called glycosidic linkage.

164. Write a method to prepare Glucose from Starch.

Ans: Glucose is obtained by boiling starch with dilute  $\text{H}_2\text{SO}_4$  at 393 K under pressure.



165. Hydrolysis of sucrose is known as inversion of cane sugar. Why?

Ans: Sucrose is dextro rotatory but the mixture of product obtained after hydrolysis is laevo rotatory. So, the process is called inversion of cane sugar.

166. What is invert sugar?

Ans: The product obtained after the hydrolysis of cane sugar is called invert sugar. It is a mixture of D-(+)-glucose and D-(–)-fructose.

167. What are oligosaccharides? Give two examples.

Ans: Carbohydrates which on hydrolysis give 2 to 10 monosaccharide units are called oligosaccharides. E.g. Sucrose, lactose, maltose etc.

168. What are polysaccharides? Give two examples.

Ans: They are carbohydrates which give a large number of monosaccharide units on hydrolysis. E.g.: Starch and Cellulose.

169. Explain the amphoteric behaviour of amino acid.

Ans: Amino acids contain both acidic and basic groups. In aqueous solution, they form internal salts known as zwitter ions and hence show amphoteric behaviour.

170. What are essential and non-essential amino acids. Write examples.

Ans: Amino acids which are not synthesised in our body and should be obtained through diet are called essential amino acids. E.g. Lysine and Valine.

Amino acids which are synthesised in our body are called non-essential amino acids. E.g. Glycine and Alanine.

171. What is a peptide linkage?

Ans: The  $-\text{CO}-\text{NH}-$  linkage in proteins and polypeptides is called peptide linkage.

172. Describe primary and secondary structures of proteins.

Ans: **Primary structure:** It gives the sequence of amino acid molecules in a polypeptide chain of protein.

**Secondary structure:** It gives the different shapes in which polypeptide chain can exist. There are two different types of secondary structures:  $\alpha$ -helix and  $\beta$ -pleated sheet structure.

173. Write two differences between fibrous protein and globular protein.

Ans:

Fibrous protein	Globular protein
It has fibre-like shape	It has spherical shape
It is water insoluble	It is water soluble
E.g.: Keratin and myosin	E.g. Insulin and albumins.

174. What is denaturation of proteins? Write an example.

Ans: When a protein is heated or a chemical substance is added to it, it loses its biological activities. This process is called denaturation of protein. E.g.: Hard boiling of egg.

175. Name a fat-soluble vitamin. Write a deficiency disease of it.

Ans: Vitamin A. Deficiency disease is Night Blindness

176. Vitamin 'C' cannot be stored in our body. Why?

Ans: Vitamin C is water soluble and hence it gets excreted through urine. So it cannot be stored in our body.

177. Write the classification of vitamins based on its solubility.

Ans: Water-soluble Vitamins: B and C

Fat-soluble vitamins: A, D, E and K

178. Match the following:

Column I	Column II
Vitamin A	Scurvy
Vitamin B <sub>1</sub>	Xerophthalmia
Vitamin C	Rickets
Vitamin D	Beri-beri

Ans:

Column I	Column II
Vitamin A	Xerophthalmia
Vitamin B <sub>1</sub>	Beri-beri
Vitamin C	Scurvy
Vitamin D	Rickets

179. Differentiate between nucleoside and nucleotide.

Ans: Nucleoside is formed by the combination of pentose sugar with nitrogen base. Nucleotide is formed by the combination of nucleoside with phosphoric acid unit.

180. Match the following:

Column I	Column II
Sucrose	Phosphodiester linkage
Proteins	Adipose tissues
Nucleic Acids	Peptide linkage
Vitamin D	Glycosidic linkage

Ans:

Column I	Column II
Sucrose	Glycosidic linkage
Proteins	Peptide linkage
Nucleic Acids	Phosphodiester linkage
Vitamin D	Adipose tissues

181. Write any two differences between DNA and RNA.

Ans:

DNA	RNA
The pentose sugar in DNA is 2-deoxy ribose.	The pentose sugar in RNA is ribose.
DNA is double stranded.	RNA is single stranded.
The nitrogen bases present in DNA are Adenine, Guanine, Cytosine and Thymine.	In RNA, instead of Thymine, Uracil is present.