Sample Paper 11 Solutions

Class XII 2023-24

Chemistry

Time: 3 Hours **Max. Marks: 70**

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Directions (Q. Nos. 1-16) : The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Which of the following colligative property can provide molar mass of proteins (or polymers or colloids) with greatest precision?

(a) Osmotic pressure

(b) Elevation of boiling point

(c) depression of freezing point

(d) Relative lowering of vapour pressure

Ans : (a) Osmotic pressure

Molecular masses of polymers are best determined by osmotic pressure method. Firstly because other colligative properties gives so low values that they cannot be measured accurately and secondly, osmotic pressure measurements can be made at room temperature and do not require heating which may change the nature of polymer.

2. Correct formula of potassium ferrocyanide is

(a) $K_3[Fe(CN)_6]$ (b) $K4[Fe(CN)_6]$

(c) $K_2[Fe(CN)_6]$ (d) $K[Fe(CN)_6]H_2O$

Ans : (b) $K_4[Fe(CN)_6]$

In potassium ferrocyanide, Fe is in +2 oxidation state. So, its correct formula is $K_4[Fe(CN)_6]$

3. Williamson synthesis is used to prepare

(a) Acetone (b) Diethyl ether

(c) P.V.C. (d) Bakelite

Ans : (b) Diethyl ether

By heating alkyl halide with sod. or pot. alkoxides (Williamson synthesis) diethyl ether is formed. This is the most important industrial and laboratory method and may be used for preparing simple as well as mixed ethers. For example :

$$C_2H_5ONa + C_2H_5I \rightarrow C_2H_5O \cdot C_2H_5 + NaI$$

4. Which of the following statement is incorrect?

(a) Silver glance mainly contains silver sulphide.

(b) Gold is found in native state.

(c) Zinc is blende mainly contains zinc chloride.

(d) Copper pyrites also contain Fe_2S_3

Ans : (c) Zinc is blende mainly contains zinc chloride.

Zinc blende mainly contains ZnS and not $ZnCl_2$.

5. A 5% solution of cane sugar (Mol. Wt = 342) is isotonic with 1% solution of substance X. The molecular weight of X is –

(a) 68.4 (b) 34.2

(c) 171.2 (d) 136.2

Ans : (a) 68.4

Strength (C) of 5% cane sugar solution

$$= 5 \text{ gm}/100 \text{ ml}$$

$= 50$ gms/litre

$= \frac{50}{342}$ moles/litre

(mol. wt. of sugar = 342)

So, osmotic pressure of 5% cane sugar

Solution, $\pi_1 = C \times R \times T$

where, C =Concentration of solution in moles/litre

T = Temp. in degrees kelvin

$R = 0.0821$ litre atoms $K^{-1}mol^{-1}$

$\pi_1 = \frac{50}{342} \times 0.0821 \times T$ ...(1)

Concentration of 1% sol. of substance X

$= 1$ gm/100 ml

$= 10$ gms/litre

$= \frac{10}{M}$ moles/litre

Where,

M = molecular mass of substances X

So, π_2 (osmotic pressure of 1% solution of substance X)

$= \frac{10}{M} \times 0.0821 \times T$ ...(2)

As both solution are isotonic, so $\pi_1 = \pi_2$

$\frac{50}{342} \times 0.0821 \times T = \frac{10}{M} \times 0.0821 \times T$

M (mo. wt. of X) $= \frac{342}{5} = 68.4$

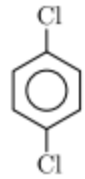
6. Which of the following possesses highest melting point?

(a) Chlorobenzene (b) *m*-dichlorobenzene

(c) *o*-dichlorobenzene (d) *p*-dichlorobenzene

Ans : (d) *p*-dichlorobenzene

Para-di-chlorobenzene has most symmetrical structure than others. It is found as crystalline lattice form, therefore, it has highest melting point (52°C) due to symmetrical structure.



Para Chlorobenzene

7. Which of the following statements about primary amines is 'False'?

(a) Alkyl amines are stronger bases than aryl amines.

(b) Alkyl amines react with nitrous acid to produce alcohols

(c) Aryl amines react with nitrous acid to produce phenols

(d) Alkyl amines are stronger bases than ammonia.

Ans : (c)Aryl amines react with nitrous acid to produce phenols

Aryl amines do not produce phenol on treatment with nitrous acid.

8. In DNA, thymien is held by two hydrogen bonds with the base

(a) Adenine (b) Cytosine

(c) Thymine (d) Guanine

Ans : (a) Adenine

DNA structure, Nitrogen-base thymine is bonded through two hydrogen bonds with adenine.

9. The standard electrode potentials of four elements A,B, C and D are –3.05, –1.66, –0.40 and +0.80. The highest chemical reactivity will be exhibited by:

(a) A (b) B

(c) C (d) D

Ans : (a) A

Standard electrode potential i.e. reduction potential of A is minimum (–3.05 V) i.e. its oxidation potential is maximum which implies 'A' is maximum reactive chemically.

10. The cell used in Apollo mission was

(a) Leclanche cell (b) Daniell cell

(c) Voltaic cell (d) Bacon cell

Ans : (d) Bacon cell

The Bacon-fuel-cell is used in Apollo mission. It is a kind of H_2-O_2 fuel cell. Hence, (d) is the correct option.

11. A catalyst can affect reversible reaction by

(a) changing equilibrium constant

(b) slowing forward reaction

(c) attaining equilibrium in both directions

(d) none of the above

Ans : (c) attaining equilibrium in both directions

A catalyst can affect reversible reaction by attaining equilibria in both directions.

12. Which of the following the strongest acid is

(a) CH_3COOH (b) CH_2ClCH_2COOH

(c) $CH_2ClCOOH$ (d) CH_3CH_2COOH

Ans : (c) $CH_2ClCOOH$

Chlorine is electron withdrawing group. Further Inductive effect is stronger at α position than β-position i.e.,

$\overset{\alpha}{C}H_2ClCOOH > \overset{\beta}{C}H_2Cl\overset{\alpha}{C}H_2COOH$

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Alkyl isocyanides in acidified water give alkyl form-amides.

Reason : In isocyanides, carbon first acts as a nucleophile and then as an electrophile.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

In an isocyanide, first an electrophile and then a nucleophile add at the carbon to form a species which usually undergoes further transformations.

$$R\overset{+}{N} \equiv \bar{C} + E^+ \longrightarrow R\overset{+}{N} \equiv CE \xrightarrow{Nu} RN \equiv C(Nu)E$$

$$R\overset{+}{N} \equiv \bar{C} + H_2O \longrightarrow RN = CHOH \longrightarrow \underset{\text{alkylformamide}}{RNHCHO}$$

14. **Assertion :** DNA has a double helix structure.

Reason : The two strands in a DNA molecule are exactly similar.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (c) Assertion is correct but Reason is incorrect.

The two strands in a DNA molecule are not exactly similar but are complimentary.

15. **Assertion :** Ethylenediaminetetraacetate ion forms an octahedral complex with the metal ion.

Reason : It has six donor atoms which coordinate simulatneously to the metal ion.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

16. **Assertion :** Amines are basic in nature.

Reason : Presence of lone pair of electrons on nitrogen atom.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

Amines are basic in nature due to presence of a lone pair of electrons on nitrogen.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. State and explain Faraday's second law of electrolysis.

Ans :

Faraday's second law of electrolysis states that, when the same quantity of electricity is passed through several electrolytes, the mass of the substances deposited are proportional to their respective chemical equivalent or equivalent weight.

18. Why do the transition elements exhibit higher enthalpies of atomisation ?

Ans :

Because transition elements have large number of unpaired electrons they have stronger interatomic interaction and hence stronger bonding between atoms.

19. Give the similarities between $>C=O$ and $>C=C<$ bond.

Ans :

1. Both double bonds $>C=O$ and $>C=C<$ are made up of one σ bond and one π bond.
2. In both hybridisation of C atom is sp^2.
3. Both are planer in nature.
4. Both give addition reactions.

20. Define molecularity of a reaction. Illustrate with an example.

Ans :

The number of reaction species (atoms, ions or molecules) talking parts in an elementary reaction, which must colloid simultaneously to bring about a chemical reaction is called molecularity of a reaction.

$$NH_4NO_2 \longrightarrow N_2 + 2H_2O \text{ (Unimolecular)}$$
$$2HI \longrightarrow H_2 + I_2 \text{ (Bimolecular)}$$
$$2NO + O_2 \longrightarrow 2NO_2 \text{ (Trimolecular)}$$

or

Give the mechanism for the decomposition reaction of H_2O_2 in alkaline medium catalysed by I^- ions.

Ans :

Chemical equation of decomposition of H_2O_2 in alkaline medium is

$$2H_2O_2 \xrightarrow[\text{Alkaline medium}]{I^-} 2H_2O + O_2$$

Mechanism−

It is a first order reaction w.r.t. both H_2O_2,I^-. This reaction takes place is two steps.

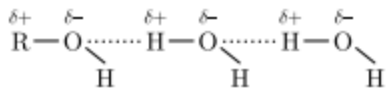
(i) $H_2O_2 + I^- \longrightarrow H_2O + IO^-$

(ii) $H_2O_2 + IO^- \longrightarrow H_2O + I^- + O_2$

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

Ans :

Alcohols can form H-bonds with water, therefore they are soluble in water



but hydrocarbons cannot form H-bond with water hence are insoluble in water.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. What are Faraday's laws of electrolysis? Explain.

Ans :

Faraday's First Law : Faraday's first law state that the amount the chemical reaction occurring at an electrode by passing current is proportional to the quantity of electricity passed through the electrolyte (in solution or in molten state).

Faraday's Second law : States that when the same quantity of electricity is passed through different electrolytes, the amounts of different substances formed are proportional to their chemical equivalent weights (i.e., atomic mass of the metal divided by the number of electrons required to reduce a cation of the metal).

$$\frac{W_1}{E_1} = \frac{W_2}{E_2} = \frac{W_3}{E_3} = \ldots\ldots$$

where, W is the mass of substance and E is its equivalent.

23. Give the name and chemical composition of important ores of Aluminium and Copper.

Ans :

(a) Ore of aluminium

$$= \text{Bauxite}\,(Al_2O_3 + SiO_2 + TiO_2 + Fe_2O_3)$$
$$\text{Cryalite} = Na_3AlF_6$$

(b) $$\text{Copper} = \text{Copper pyrite}\,CuFeS_2$$
$$\text{Malachite} = CuCO_2Cu(OH)_3$$

24. The atomic sizes of Fe, Co, Ni are nearly same. Explain with reason.

Ans :

When we move from left to right in $3d$ series, the nuclear charge increases which decreases the size but the addition of electrons in the d-subshell increases the screening effect which counter balance the effect of increased nuclear charge hence the atomic size from Cr to Cu is almost the same.

25. How are IUPAC and common names given to phenols?

Ans :

1. The simplest hydroxyl derivative of benzene is phenol which is also its accepted IUPAC and common name.
2. The methyl phenols are given the common name of cresols.
3. Dihydroxy derivatives of benzene are known as benzenediol and positions of $-OH$ groups are indicated by numbers.
4. Phenols containing a carbonyl group such as $-CHO$, $>C=O$, $-COOH$ or $-COOR$ are named as hydroxy

derivatives of the parent aromatic compound.

26. How will you convert the following :

(a) Ethyl alcohol from ethyl amine.

(b) Ethyl amine from ethyl alcohol.

Ans :

(a) Ethyl alcohol from ethyl amine :

$$\underset{\text{(ethylamine)}}{C_2H_5NH_2} + HNO_2 \xrightarrow{NaNO_2+H} \underset{\text{(ethyl alcohol)}}{C_2H_5OH} + N_2 + H_2O$$

(b) Ethyl amine from ethyl alcohol:

$$\underset{\text{(ethyl alcohol)}}{C_2H_5OH} + NH_3 \xrightarrow{ZnCl_2} \underset{\text{(ethyl amine)}}{C_2H_5NH_2} + H_2O$$

27. Define the terms :

(i) Biomolecules.

(ii) Reducing Sugars.

Ans :

(i) **Biomolecules :** Biomolecules are complex chemical substances which form the basis of life i.e. they build up living system as well as responsible for their growth.

Examples : Carbohydrates, proteins, vitamins and nucleic acids, etc.

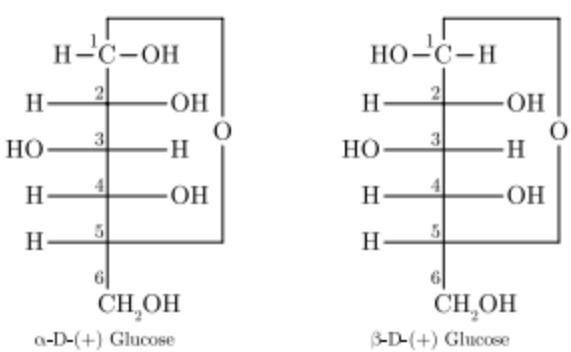
(ii) **Reducing Sugars :** All those carbohydrates in which functional groups (aldehydic or ketonic) are free, reduce Fehling solution and Tollen's reagent are called reducing sugar e.g. glucose, fructose while others which do not reduce these reagents are called non reducing sugar e.g. Sucrose.

or

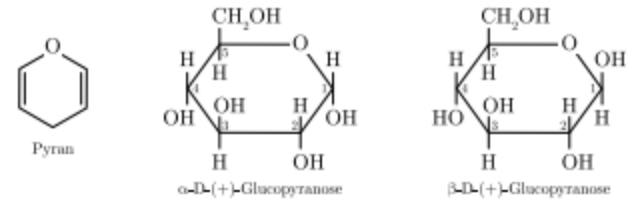
What is essentially the difference between α-glucose? What is meant by pyranose structure of glucose?

Ans :

Glucose is found to exist in two different crystalline forms which are named α and β. In which one of the $-OH$ groups add to the $-CHO$ group and forms a cyclic hemiacetal structure. The two cyclic hemiacetal forms of glucose differ in the configuration of hydroxyl group at C_1 called anomeric carbon. Such isomers i.e. α-form and β-form are called anomers. The six membered cyclic structure of glucose is called pyranose structure, in analog with pyran.



Fischer structure



Haworth structure

28. How will you convert ethanal to the following compounds?

(i) Butane-1, 3-diol

(ii) But-2-enal

(iii) But-2-enoic acid

Ans :

(i) Ethanal to Butane-1, 3-diol

$$CH_3CHO \xrightarrow[\text{(Aldol condensation)}]{(NaOH)} \underset{\text{3-Hydroxybutanal}}{CH_3\overset{4}{C}H\overset{3}{O}H\overset{2}{C}H_2\overset{1}{C}HO} \xrightarrow{LiAlH_4} \underset{\text{Butan-1, 3-diol}}{CH_3CH(OH)CH_2CH_2OH}$$

(ii) Ethanal to But-2-enal

$$\underset{\text{Ethanal}}{CH_3CHO} \xrightarrow[\text{(Aldol condensation)}]{(NaOH)} \underset{\text{3-Hydroxybutanal}}{CH_3CH(OH)CH_2CHO} \xrightarrow[-H_2O]{\text{Heat}} \underset{\text{But-2-enal}}{CH_3CH=CHCHO}$$

(iii) Ethanal to But-2-enoic acid

$$\underset{\text{Ethanal}}{CH_3CHO} \xrightarrow{\text{As in (ii)}} \underset{\text{But-2-enal}}{CH_3CH=CHCHO} \xrightarrow[\text{or } MnO_2]{\text{Tollen's reagent}} \underset{\text{But-2-enoic acid}}{CH_3CH=CHCOOH}$$

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The study of the conductivity of electrolyte solutions is important for the development of electrochemical devices, for the characterisation of the dissociation equilibrium of weak electrolytes and for the fundamental understanding of charge transport by ions. The conductivity of electrolyte is measured for electrolyte solution with concentrations in the range of 10^{-3} to $10^{-1}\,\text{mol}\,\text{L}^{-1}$ as solution in this range of concentrations can be easily prepared. The molar conductivity (A_m) of strong electrolyte solutions can be nicely fit by Kohlrausch equation.

$$A_m = \Delta^\circ_m - K\sqrt{C} \qquad ...(1)$$

Where, $\Delta 3^\circ_m$ is the molar conductivity at infinite dilution and C is the concentration of the solution. K is an empirical proportionality constant to be obtained from the experiment. The molar conductivity of weak electrolytes, on the other hand, is dependent on the degree of dissociation of the electrolyte. At the limit of very dilute solution, the Ostwald dilution law is expected to be followed,

$$\frac{1}{\Delta^\circ_m} = \frac{1}{\Delta^\circ_m} + \frac{\Delta^\circ_m C_A}{(\Delta^\circ_m)^2 K_d} \qquad ...(2)$$

Where, C_A is the analytical concentration of the electrolyte and K_d is dissociation constant. The molar conductivity at infinite dilution can be decomposed into the contributions of each ion.

$$\Delta^\circ_m = V_+\lambda^\circ_+ + V_-\lambda^\circ_- \qquad ...(3)$$

Where, λ_+ and λ_- are the ionic conductivities of positive and negative ions, respectively and V_+ and λ_- are their stoichiometric coefficients in the salt molecular formula.

Answer the following questions :

(a) Give reason why conductivity of CH_3COOH decreases on dilution.

(b) The value of Δ°_m of $Al_2(SO_4)_3$ is $858\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$, while $\lambda^\circ SO_4^{2-}$ is $160\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$ calculate the limiting ionic conductivity of Al^{3+}.

(c) Calculate Δ°_m for acetic acid.

Given that :

$$\Delta^\circ_m(\text{HCl}) = 426\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$
$$\Delta^\circ_m(\text{NaCl}) = 126\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$
$$\Delta^\circ_m(CH_3COONa) = 91\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$

or

(d) Calculate the degree of dissociation of acetic acid at 298 K, given that :

$$\Delta_m(CH_3COOH) = 11.7\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$
$$\Delta_m(CH_3COO^-) = 49.9\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$
$$\Delta^\circ_m(H^+) = 349.1\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$

Ans :

(a) Conductivity of CH_3COOH (weak electrolyte) Decreases with dilution because the number of current carrying particles i.e., ions present per cm^3 of the solution becomes less and less on dilution.

(b) $$\Delta^\circ_m Al_2(SO_4)_3 = 2\lambda^\circ_m Al^{3+} + 3\lambda^\circ_m SO_4^{2-}$$
$$858 = 2\lambda^\circ_m Al^{3+} + 3 \times 160$$
$$\lambda^\circ_m Al^{3+} = \frac{858 - 480}{2}$$
$$= 189\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$

(c) $$\Delta^\circ_m(\text{HCl}) = \lambda^\circ_{H^+} + \lambda^\circ_{Na^+}$$
$$\Delta^\circ_m(\text{NaCl}) = \lambda^\circ_{Na^+} + \lambda^\circ_{Cl^-}$$
$$\Delta^\circ_m(CH_3COONa) = \lambda^\circ_{CH_3COO^-} + \lambda^\circ_{Na^+}$$
$$\Delta^\circ_m(CH_3COOH) = \lambda^\circ_{CH_3COO^-} + \lambda^\circ_{H^+}$$
$$= \lambda^\circ_{H^+} + \lambda^\circ_{Cl^-} + \lambda^\circ_{(CH_3COO^-} + \lambda^\circ_{Na^+} - \lambda^\circ_{Cl^-} - \lambda^\circ_{Na^+}$$
$$= \Delta^\circ_m(\text{HCl}) + \Delta^\circ_m(CH_3COONa)$$
$$= -\Delta^\circ_m \text{NaCl}$$
$$= 426 + 91 - 126 = 391\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$

or

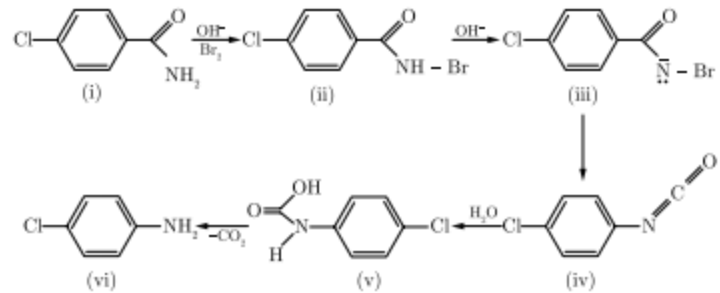
(d) According to Kohlraucht law,

$$\Delta\,CH_3COOH = \lambda^\circ CH_3COO^- + \lambda^\circ H^+$$

Degree of dissociation,

$$\alpha = \frac{\Delta_m}{\Delta^\circ_m}$$
$$= \frac{11.7\,\text{S}\,\text{cm}^2\text{mol}^{-1}}{(49.9 + 349.1)\,\text{S}\,\text{cm}^2\text{mol}^{-1}}$$
$$= \frac{11.7}{390} = 3 \times 10^{-2}$$

30. $RCONH_2$ is converted into RNH_2 by means of Hoffmann bromamide degradation. During the reaction amide is treated with Br_2 and alkali to get amine. This reaction is used to descend the series in which carbon atom is removed as carbonate ion (CO_3^{2-}). Hoffmann bromide degradation reaction can be written as :



Answer the following questions :

(a) Why cannot primary aromatic amines be prepared by Gabriel phthalimide synthesis?

(b) Write the chemical equation involved in the following reaction : Hofmann bromamide degradation reaction

(c) Write the structures of A, B and C in the following :

(i) $C_6H_5-CONH_2 \xrightarrow{Br_2/aq.KOH} A \xrightarrow[0-5^\circ C]{NaNO_2+HCl} B \xrightarrow{KI} C$

or

(d) An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br_2 and KOH forms a compound 'C' of molecular formula C_6H_7N. Write the structures and IUPAC names of compounds A, B and C.

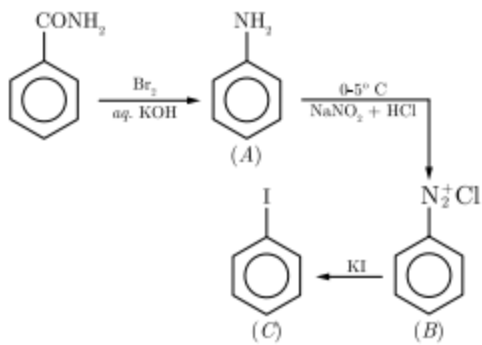
Ans :

(a) Aromatic amines cannot be prepared by Gabriel phthalimide synthesis because aryl halides do not undergo nucleophilic substitution with the anion formed byphthalimide.

(b) $\underset{\text{Acid amide}}{R-CONH_2} + Br_2 + 4NaOH \longrightarrow$

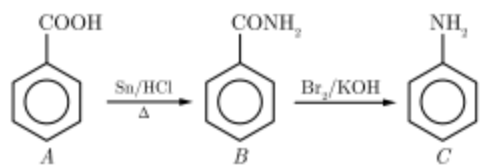
$R-NH_2 + Na_2CO_3 + 2NaBr + \underset{1^\circ\text{amine}}{2H_2O}$

(c) (i)



or

(d) Formula of the compound 'C' indicates it is an amine. Since it is obtained by the reaction of Br_2, and KOH with the compound 'B' so compound 'B' can be an amide. As 'B' is obtained from compound 'A' by reaction with ammonia followed by heating so, compound 'A' could be an aromatic acid. Formula of compound 'C' shows it to be aniline, then 'B' is benzamide and compound 'A' is benzoic acid. The sequence of reactions can be written as follows :



SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write various methods of preparation of alcohol.

Ans :

1. From Haloalkanes (alkyl halides)

$\underset{\text{Bromoethane}}{CH_3CH_2-Br} + KOH\,(aq) \longrightarrow \underset{\text{Ethanol}}{CH_3CH_2-OH} + KBr$

2. From Alkenes

(a) Hydration of Alkenes-(addition of a molecule of water)

$\underset{\text{Propene}}{CH_3-CH=CH_2} \xrightarrow[(ii)\ H_2O/Boil]{(i)\ H_2SO_4} \underset{\text{Propan-2-ol}}{CH_3-\underset{OH}{\underset{|}{CH}}-CH_3}$ (Mark addition)

(b) Hydroboration-oxidation

$\underset{\text{Propan-1-ol}}{CH_3-CH=CH_2} \xrightarrow[(ii)H_2O_2/OH^-]{(i)(BH_3)_2} CH_3-CH_2-CH_2-OH$

(Anti Mark addition)

3. From Carbonyl Compounds

(a) By reduction of aldehydes and ketones

$\underset{\text{Aldehyde}}{R-CHO} \xrightarrow[\text{or } LiAlH_4 \text{ or } NaBH_4]{H_2/Ni \text{ or } Na/C_2H_5OH} \underset{1^\circ\text{ Alcohol}}{RCH_2OH}$

$\underset{\text{Ketone}}{\begin{matrix}R\\R'\end{matrix}\!\!>\!C=O} \xrightarrow[\text{or } LiAlH_4 \text{ or } NaBH_4]{H_2/Ni \text{ or } Na/C_2H_5OH} \underset{2^\circ\text{ Alcohol}}{\begin{matrix}R\\R'\end{matrix}\!\!>\!CHOH}$

(b) By reduction of carboxylic acid and esters

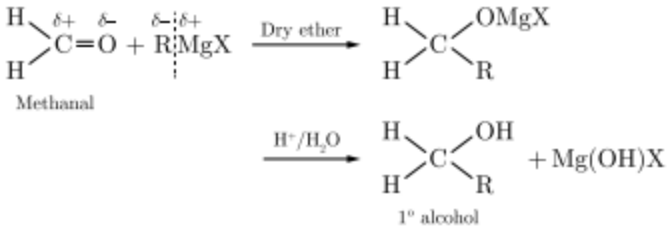
$\underset{\text{Carboxylic acid}}{RCOOH} \xrightarrow[(ii)\ H_2O]{(i)LiAlH_4} \underset{\text{Alcohol}}{RCH_2OH}$

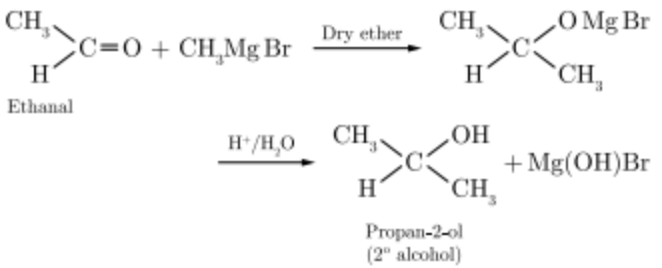
$\underset{\text{Carboxylic acid}}{RCOOH} \xrightarrow[H^+]{R'OH} \underset{\text{Ester}}{RCOOR'}$

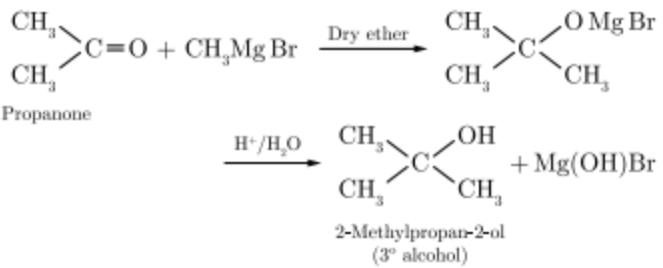
$\xrightarrow[\text{Catalyst}]{H_2} RCH_2OH + R'OH$

(Commercial preparation)

4. **From Grignard Reagents :** The first step of the reaction is the nucleophilic addition of Grignard reagent to the carbonyl group to form adduct. Hydrolysis of the adduct yields an alcohol.







5. From aliphatic primary amines

32. (a) What do you mean by the term 'Depression of freezing point'?

(b) State Raoult's Law of depression of freezing point. How is it useful in determining the molecular weight of non-volatile and non-electrolyte solute?

Ans :

(a) We know that, freezing point of a liquid is the temperature at which, its solid and liquid phases have the same vapour pressure. The freezing point of pure liquid is fixed. But if we add a non-volatile solute, in the pure liquid, the freezing point of the liquid is lowered the vapour pressure of the liquid is descreated due to presense of non-volatile solution particles at the surface of liquid.

$$\Delta T_F = \text{F.P.of solvent} - \text{F.P.of solution}$$

Where, F.P = Freezing point

(b) The depression of freezing point of solvent by dissolving a non-volatile solute is directly proportional to the molal concentration of the dissolved solute.

$$\Delta T_F \propto C_m$$

or $\Delta T_F = K_f \times Cm$ (K_f is the molal depression constant. Thus molal depression constant (K_f) may be defined as the depression in freezing point which would be produced by dissolving one mole of non-volatile solute in 1000g of solvent.

or

(a) What do you mean by relative lowering of vapour pressure?

(b) The relative lowering of vapour pressure of 1% solution of Aniline in Ether was 0.007. Calculate the molecular weight of Aniline.

Ans :

(a) The relative lowering of vapour pressure of a liquid is the pressure of the vapour which is directly proportion to the mole fraction of solute i.e. relative lowering in V.P.

Where, ΔP = difference in vapour pressure

P° = V.P. of pure liquid

x_B = mole fraction of solute

$$\frac{\Delta P}{P^\circ} \propto x_B,$$

$\frac{\Delta P}{P^\circ}$ is known as relative lowering n vapour pressure.

(b) Given,

Relative lowering of V.P. = 0.007

1% solution of aniline,

Weight of solute = 1 g (w)

Weight of solution = 100 g

Hence, weight of solvent = 99 g (w)

Molecular weight of aniline = ?

Mole weight of ether = 74 (m)

We known that,

$$\frac{\Delta P}{P^\circ} = \frac{P_0 - P_s}{P_0} = \frac{W \times M}{m \times w} \; (= x_B)$$

$$0.007 = \frac{W \times M}{m \times w} \left(= \frac{x_B}{x_A}\right), \text{ [For dilute solution]}$$

Hence, $$m = \frac{W \times M}{0.007 \times w}$$

$$m = \frac{1 \times 74}{0.007 \times 99} = 106.78$$

33. What are haloalkanes and haloarenes ? Give their classification.

Ans :

When one or more hydrogen atoms of aliphatic or aromatic hydrocarbon are replaced by halogen atom (s), alkyl halide (haloalkane) and aryl halide (haloarene) are formed respectively.

Classification

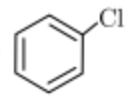
Haloalkanes and haloarenes may be classified as follows :

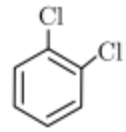
(i) **On the Basis of Number of Halogen Atoms :** Depending upon number of halogen atoms (F, Cl, Br, I) they are classified as mono, di or poly halogen compounds. For example,

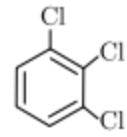
(a) C_2H_5Cl
Chloroethane

(b) CH_2Cl-CH_2Cl
1, 2-Dichloroethane

(c) $CH_2Cl-CHCl-CH_2Cl$
1, 2, 3-Trichloropropane

(d) 
chlorobenzene

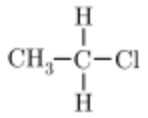
(e) 
1, 2-Dichlorobenzene
(m-Dichlorobenzene)

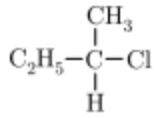
(f) 
1, 2, 3-Trichlorobenzene

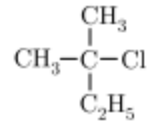
d, e, f are types of arylhalide or haloarene in which-X is attach to an aromatic ring.

(ii) **Compounds Containing sp^3 C − X Bond (X = F, Cl, Br, I) :**

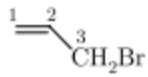
(a) **Alkyl Halides or Haloalkanes (R − X) :** They are classified as primary, secondary and tertiary according to the nature of carbon to which halogen is attached.

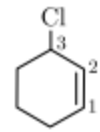

Primary (1°)


Secondary (2°)

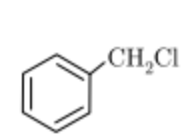

Tertiary (3°)

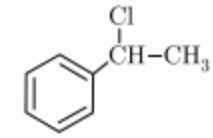
(b) **Allylic Halides :** In these compounds halogen atom is bonded to an sp^3 hybridised carbon atom next to carbon-carbon double bond (C = C) i.e. to an allylic carbon.

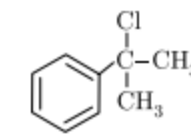

3-Bromoprop-1-ene(1°)
(Allyl bromide)


3-Chloro-cyclohex-1-ene(2°)

(c) **Benzylic Halides :** In these compounds the halogen atom is bonded to an sp^3-hybridised carbon atom next to an aromatic ring.


Benzylchloride (1°)

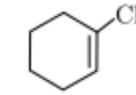

1-chloro-1-phenyl ethane (2°)


2-chloro-2-phenyl propane (3°)

(iii) **Compounds Containing sp^2 C − X Bond :**

Vinylic Halides : In these compounds halogen atom is bonded to an sp^2 hybridised carbon atom of a carbon-carbon double bond (C = C).


Chloro ethene
(vinyl chloride)


1-Chlorocyclohex-1-ene

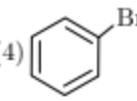
or

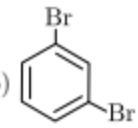
Write common name and IUPAC names of the following:

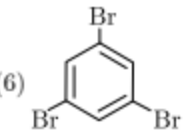
(1) $CH_3CH_2CH_2Br$

(2) $H_3C-CH(Cl)-CH_3$

(3) $H_3C-CH(CH_3)-CH_2Cl$

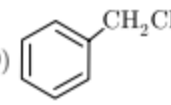
(4) 

(5) 

(6) 

(7) CH_3-CHCl_2

(8) CH_2Cl-CH_2Cl

(9) 

(10) $CHCl_3$

(11) CCl_4

(12) $(CH_3)_3CCH_2Br$

(13) $(CH_3)_3CBr$

(14) $CH_2 = CHCH_2Br$

(15) $CH_2 = CHCl$

Ans :

	Common Name	IUPAC Name
1.	n-Propyl bromide	1-Bromopropane
2.	Isopropyl chloride	2-Chloropropane
3.	Isobutyl Chloride	1-Chloro-2-methylpropane
4.	Bromobenzene	Bromobenzene
5.	m-Dibromobenzene	1, 3-Dibromobenzene
6.	sym-Tribromobenzene	1, 3, 5-Tribromobenzene
7.	Ethylidene chloride (gem-dihalide)	1, 1-Dichloroethane
8.	Ethylene dichloride (vic-dihalide)	1, 2-Dichloroethane
9.	Benzyl chloride	Chlorophenylmethane
10.	Chloroform	Trichloromethane
11.	Carbon tetrachloride	Tetrachloromethane
12.	neo-Pentyl bromide	1-Bromo-2, 2-dimethyl propane
13.	Allyl bromide	3-Bromopropene
14.	Vinyl chloride	Chloroethene

□□□□□□□