12 Organic Chemistry : Some Basic Principles and Techniques

LESSON AT A GLANCE

- All organic compounds contain carbon and hydrogen as essential constituents.
- In a homologous series two successive members differ in their molecular formula by -CH_2 unit.
- **Aliphatic Compounds** are open chain compounds contain straight or branched chain of carbon atoms.
- **Alicyclic Compounds:** Compounds containing closed ring of carbon compounds.
- **Aromatic Compounds:** Benzene and its derivatives are called aromatic compounds.
- **Functional group:** A functional group is an atom or group of atoms bonded together in a unique fashion and which determines the physical and chemical properties of the compounds.
- **Homolytic Bond Fission:** It leads to the formation of free radicals.
- **Crystallisation** is used to purify organic solids by dissolving them in suitable solvents.
- **Simple distillation** is used to purify liquids with non-volatile impurities.
- **Steam distillation** is used to purify organic compounds which give sufficient vapours at the boiling of water and are insoluble in water.
- **Chromatography** is useful to purify and separate the constituent from a sample.
- **Lassaigne's test** is used to detect carbon, nitrogen, sulphur and halogen inorganic compound.
- **Dumas or Kjeldahl's method:** Nitrogen is estimated by this method.

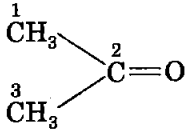
- **Halogens:** Halogens are estimated by Carius method.
- **Sulphur and phosphrous:** Sulphur and phosphorous are estimated by oxidising them to sulphuric and phosphoric acid respectively.
- **Oxygen:** The percentage of oxygen is usually determined by difference between the total percentage (100) and the sum of the percentages of all other elements present.

TEXTBOOK QUESTIONS SOLVED

Q1. *What are hybridisation states of each carbon atom in the following compounds?*

$CH_2{=}C{=}O$, $CH_3CH{=}CH_2$, $(CH_3)_2CO$, $CH_2{=}CHCN$, C_6H_6

Ans. States of hybridisation of various carbon atoms are given against the carbon number which are obtained by numbering them in the chain.

Compound	Carbon number	Hybridisation
(*i*) $\overset{2}{C}H_2{=}\overset{1}{C}{=}O$	C_1	sp
	C_2	sp^2
(*ii*) $\overset{3}{C}H_3{-}\overset{2}{C}H{=}\overset{1}{C}H_2$	C_1	sp^2
	C_2	sp^2
	C_3	sp^3
(*iii*) 	C_1	sp^3
	C_2	sp^2
	C_3	sp^3
(*iv*) $\overset{3}{C}H_2{=}\overset{2}{C}H{-}\overset{1}{C}N$	C_1	sp
	C_2	sp^2
	C_3	sp^2
(*v*) C_6H_6	All carbon atoms	sp^2

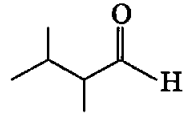
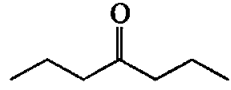
Q2. *Indicate the σ and π bonds in the following molecules:*

C_6H_6, C_6H_{12}, CH_2Cl_2, $CH_2{=}C{=}CH_2$, CH_3NO_2, $HCONHCH_3$

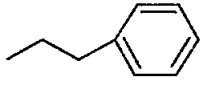
Ans.	Compound	No. of σ-bonds	No. of π-bonds
(*i*)	C_6H_6	12	3
(*ii*)	C_6H_{12} (if cyclic)	18	0
	C_6H_{12} (if open chain)	17	1
(*iii*)	CH_2Cl_2	5	1
(*iv*)	$CH_2{=}C{=}CH_2$	6	2
(*v*)	$CH_3{-}NO_2$	6	1
(*vi*)	$H{-}\overset{\overset{O}{\|}}{C}{-}NH{-}CH_3$	8	1

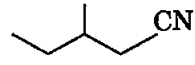
Q3. *Write bond line formulas for: Isopropyl alcohol, 2,3-Dimethyll utanal, Heptan-4-one.*

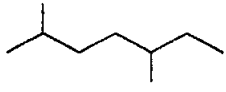
Ans.

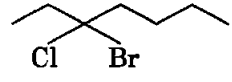
Name of the compound	Bond line formula
(*i*) Isopropyl alcohol	
(*ii*) 2, 3-Dimethylbutanal	
(*iii*) Heptan-4-one	

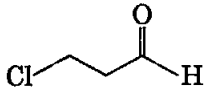
Q4. *Give the IUPAC names of the following compounds:*

(*a*) 

(*b*) 

(*c*) 

(*d*) 

(*e*) 

(*f*) Cl_2CHCH_2OH

Ans. (*a*) 1-Propylbenzene
(*b*) 3-Methylpentanenitrile
(*c*) 2, 5-Dimethylheptane
(*d*) 3-Bromo-3-chloroheptane
(*e*) 3-Chloropropanal
(*f*) 2, 2-Dichloroethanol

Q5. *Which of the following represents the correct IUPAC name for the compounds concerned?*

(*a*) *2, 2-Dimethylpentane or 2-Dimethylpentane*

(*b*) *2, 4, 7-Trimethyloctane or 2, 5, 7-Trimethyloctane*

(*c*) *2-Chloro-4-methylpentane or 4-Chloro-2-methylpentane*

(*d*) *But-3-yn-1-ol or But-4-ol-1-yne.*

Ans. The correct IUPAC names are:

(*a*) 2, 2-Dimethylpentane

(*b*) 2, 4, 7-Trimethyloctane

(*c*) 2-Chloro-4-methylpentane

(*d*) But-3-yn-1-ol

Q6. *Draw formulas for the first five members of each homologous series beginning with the following compounds:*

(*a*) *H— COOH* (*b*) CH_3COCH_3

(*c*) *H—CH = CH*$_2$.

Ans. (*a*) CH_3—COOH

CH_3CH_2—COOH

$CH_3CH_2CH_2$—COOH

$CH_3CH_2CH_2CH_2$—COOH

(*b*) CH_3COCH_3

$CH_3COCH_2CH_3$

$CH_3COCH_2CH_2CH_3$

$CH_3COCH_2CH_2CH_2CH_3$

$CH_3CO(CH_3)_4CH_3$

(*c*) H—CH=CH_2

CH_3CH=CH_2

CH_3CH_2CH=CH_2

$CH_3CH_2CH_2CH$=CH_2

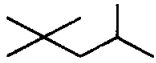
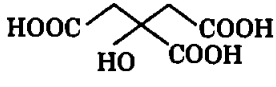
$CH_3CH_2CH_2CH_2CH$=CH_2

Q7. *Give condensed and bond line structural formulas and identify the functional group(s) present, if any, for:*

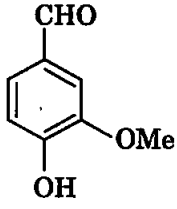
(*a*) *2, 2, 4-Trimethylpentane*

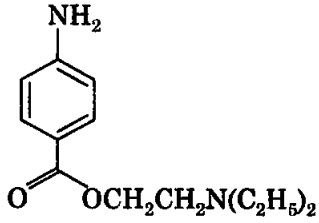
(*b*) *2-Hydroxy-1, 2, 3-propanetricarboxylic acid*

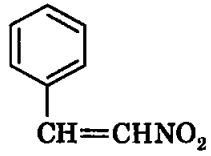
(*c*) *Hexanedial*

Ans.	**Condensed structural formula**	**Bond-line structural formula**	**Functional group(s) present**
(*a*)	$(CH_3)_3CCH_2\ CH(CH_3)_2$		No functional group
(*b*)	HOOC—CH_2C(OH)(COOH)CH_2—COOH		—COOH —OH
(*c*)	OHC—$(CH_2)_4$—CHO		—CHO

Q8. *Identify the functional groups in the following compounds:*

(*a*) 

(*b*) 

(*c*) 

Ans. (*a*) Three functional groups are present

(*i*) Aldehyde (—CHO)

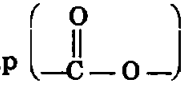
(*ii*) Ether (—OMe)

(*iii*) Phenol (—OH attached to benzene ring)

(*b*) Three functional groups are present

(*i*) Primary amine ($—NH_2$)

(*ii*) Tertiary amine $\{—N(C_2H_5)_2\}$

(*iii*) Ester group 

(*c*) Two functional groups are present

(*i*) Alkene (—CH=CH—)

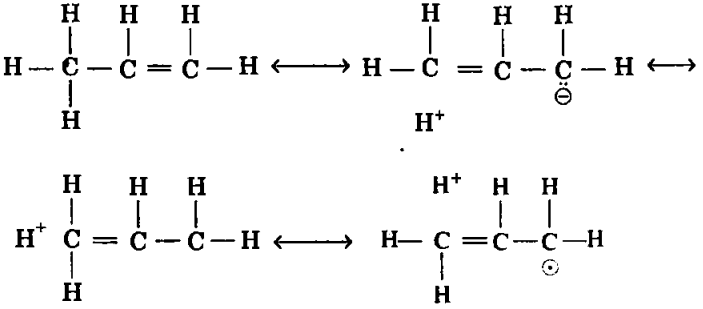
(*ii*) Nitro group ($—NO_2$)

Q9. *Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why?*

Ans. $O_2NCH_2CH_2O^-$ is expected to be more stable. It is due to the fact that $-NO_2$ group is an electron withdrawing group and hence disperses the negative charge on oxygen atom which leads to stability.

Q10. *Explain why alkyl groups act as electron donors when attached to a π-system.*

Ans. When alkyl groups are attached to a π-electron system, they act as electron donors due to hyperconjugation. It can be seen in case of propene, that due to hyperconjugation, the olefinic carbon acquires negative charge.



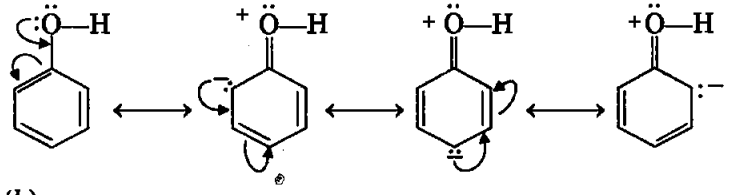
Q11. *Draw the resonance structures for the following compounds. Show the electron shift using curved-arrow notation.*

(*a*) C_6H_5OH (*b*) $C_6H_5NO_2$

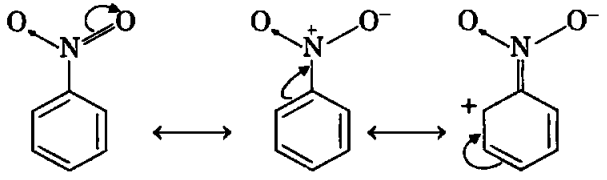
(*c*) $CH_3CH{=}CHCHO$ (*d*) $C_6H_5{-}CHO$

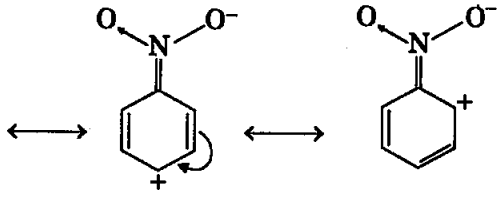
(*e*) $C_6H_5{-}\overset{+}{C}H_2$ (*f*) $CH_3CH{=}CH\overset{+}{C}H_2$

Ans. (*a*)



(*b*)

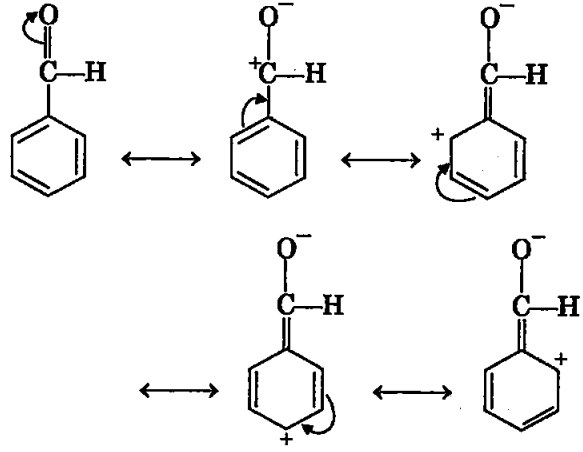




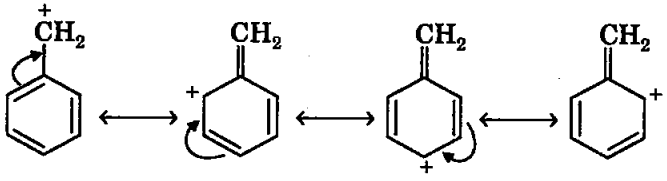
(c) $CH_3-CH=CH-\overset{\overset{O}{\|}}{C}-H \longleftrightarrow CH_3-CH=CH-\overset{\overset{O^-}{|}}{\underset{+}{C}}-H$

$\longleftrightarrow CH_3-\overset{+}{C}H-CH=\overset{\overset{O^-}{|}}{C}-H$

(d)



(e)



(f) $CH_3-CH=CH-\overset{+}{C}H_2 \longleftrightarrow CH_3-\overset{+}{C}H-CH=CH_2$

Q12. *What are electrophiles and nucleophiles? Explain with examples.*

Ans. **Electrophiles:** The name electrophiles means electron loving. Electrophiles are electron defficient. They may be positive ions or neutral molecules.

Ex: H^+, Cl^+, Br^+, NO_2^+, R_3C^+, RN_2^+, $AlCl_3$, BF_3

Nucleophiles: The name nucleophiles means 'nucleus loving' and indicates that it attacks the region of low electron density (positive centres) in a substracte molecule. They are electron rich they may be negative ions or neutral molecules.

Ex: Cl^-, Br^-, CN^-, OH^-, RCH_2^-, NH_3, RNH_2, H_2O, ROH etc.

Q13. *Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles:*

(*a*) $CH_3COOH + \mathbf{HO^-} \longrightarrow CH_3COO^- + H_2O$

(*b*) $CH_3COCH_3 + \mathbf{\bar{C}N} \longrightarrow (CH_3)_2\,C(CN)(OH)$

(*c*) $C_6H_5 + \mathbf{CH_3\overset{+}{C}O} \longrightarrow C_6H_5COCH_3$

Ans. (*a*) HO^- is a nucleophile.

(*b*) $\bar{C}N$ is a nucleophile.

(*c*) $CH_3\overset{+}{C}O$ is an electrophile.

Q14. *Classify the following reactions in one of the reaction type studied in this unit.*

(*a*) $CH_3CH_2Br + HS^- \longrightarrow CH_3CH_2SH$

(*b*) $(CH_3)_2C{=}CH_2 + HCl \longrightarrow (CH_3)_2\,C(Cl)CH_3$

(*c*) $CH_3CH_2Br + HO^- \longrightarrow CH_2{=}CH_2 + H_2O + Br^-$

(*d*) $(CH_3)_3C{-}CH_2OH + HBr \longrightarrow (CH_3)_2CBrCH_2CH_3$

Ans. (*a*) Nucleophilic substitution reaction

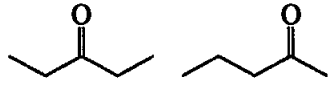
(*b*) Electrophilic addition reaction

(*c*) Elimination reaction

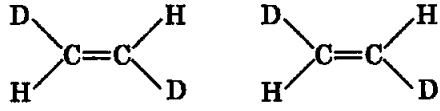
(*d*) Substitution reaction accompanied by rearrangement

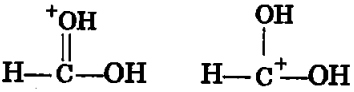
Q15. *What is the relationship between the members of following pairs of structures? Are they structural or geometrical isomers or resonance contributors?*

(*a*)



(*b*)



(c) 

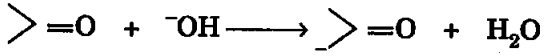
Ans. (a) Structural isomers (Positional isomers)

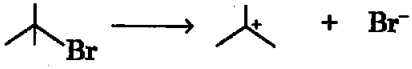
(b) Geometrical isomers

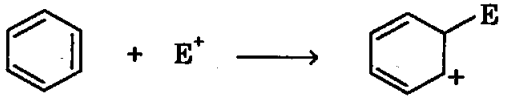
(c) Resonance contributors

Q16. *For the following bond cleavages, use curved-arrows to show the electron flow and classify each as homolysis or heterolysis. Identify reactive intermediate produced as free radical, carbocation and carbanion.*

(a) $CH_3O—OCH_3 \longrightarrow CH_3\dot{O} + OCH_3$

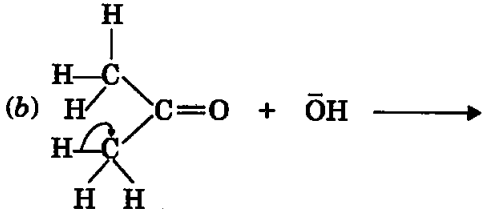
(b) 

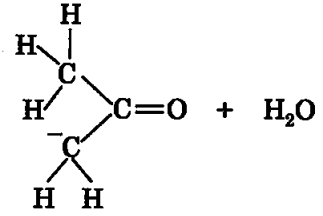
(c) 

(d) 

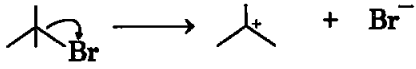
Ans. (a) $CH_3\overset{\curvearrowleft}{O}—\overset{\curvearrowright}{O}CH_3 \longrightarrow CH_3\dot{O} + \dot{O}CH_3$

It is homolysis and the reactive intermediates formed are free radicals.

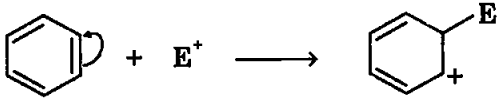
(b) 



It is heterolysis and the reactive intermediate formed is a carbanion.

(c) 

It is heterolysis and the reactive intermediate formed is a carbocation.

(d) 

It is heterolysis and the reactive intermediate formed is a carbocation.

Q17. *Explain the terms Inductive and Electromeric effects. Which electron displacement effect explains the following correct orders of acidity of the carboxylic acids?*

(a) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH$

(b) $CH_3CH_2COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH$

Ans. Inductive Effects: The inductive effect refers to the polarity produced in a molecule as a result of higher electronegativity of one atom compared to another.

Atoms or groups which lose electron towards a carbons atom are said to have a + I Effect.

Those atoms or groups which draw electron away from a carbon atom are said to have-I Effect.

Common examples of–I effect are:

NO_2, F, Cl, Br, I, OH etc.

Examples of

+R effect are (Electron releasing)

$(CH_3)_2C—(CH_3)_2CH—CH_3CH_2—CH_3—$ etc.

Electromeric effect:

The electromeric effect refers to the polarity produced in a multiple bonded compound as it is approached by a reagent.

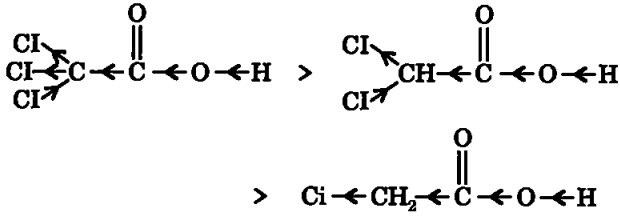
The atom A has lost its share in the electron pair and B has gained this share.

As a result A acquires a positive charge B a negative charge.

It is a temporary effect and takes place only in the presence of a regent.

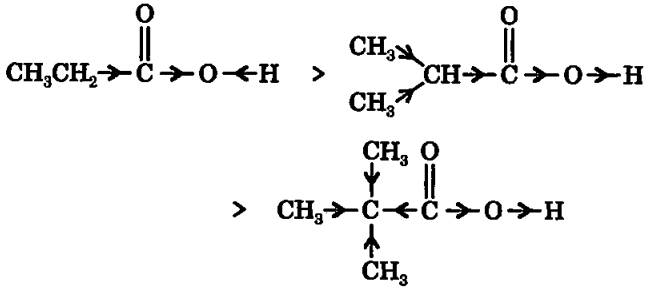
(*a*) **-I-effect** as shown below:

As the number of halogen atoms decreases, the overall -I- effect decreases and the acid strength decreases accordingly.



(*b*) **+I-effect** as shown below:

As the number of alkyl groups increases, the +I-effect increases and the acid strength decreases accordingly.



Q18. *Give a brief description of the principles of the following techniques taking an example in each case.*

(*a*) *Crystallisation* (*b*) *Distillation*

(*c*) *Chromatography*

Ans. (*a*) **Crystallisation:** In this process the impure solid is dissolved in the minimum volume of a suitable solvent. The soluble impurities pass into the solution while the insoluble ones left behind. The hot solution is then filtered and allowed to cool undisturbed till crystallisation is complete. The crystals are then separated from the mother liquor by filtraration and dried.

Example: crystallisation of sugar.

(*b*) **Distillation:** The operation of distillation is employed for the purification of liquids from non-volatile impurities. The impure liquid is boiled in a flask and the vapours so formed are collected and condensed to

give back pure liquid in another vessel. Simple organic liquids such as benzene toluene, xylene etc. can be purified

(*c*) **Chromatography:** Chromatography is based on the principle of selective distribution of the components of a mixture between two phasess, a stationary phase and a moving phase. The stationary phase can be a solid or liquid, while the moving phase is a liquid or a gas. When the stationary phase is solid the basis is adsorption and when it is a liquid the basis is partition.

Chromatography is generally used for the separation of coloured substances such as plant pigments or dyestuffs.

Q19. *Describe the method, which can be used to separate two compounds with different solubilities in a solvent S.*

Ans. Fractional crystallisation is used for this purpose. A hot saturated solution of these two compounds is allowed to cool, the less soluble compound crystallises out while the more soluble remains in the solution. The crystals are separated from the mother liquor and the mother liquor is again concentrated and the hot solution again allowed to cool when the crystals of the second compound are obtained. These are again filtered and dried.

Q20. *What is the difference between distillation, distillation under reduced pressure and steam distillation?*

Ans. **Distillation** is used in case of volatile liquid mixed with non-volatile impurities.

Distillation under reduced pressure: This method is used to purify such liquids which have very high boiling points and which decompose at or below their boiling points.

Steam distillation is used to purify steam volatile liquids associated with water immiscible impuritites.

Q21. *Discuss the chemistry of Lassaigne's test.*

Ans. **Lassaigne's test:** Nitrogen, sulphur, halogens and phosphorous present in an organic compound are detected by Lassaigne's test.

First of all compounds are converted to ionic form by fusing the compound with sodium metal.

$$Na + C + N \xrightarrow{\Delta} NaCN$$

$$2Na + S \xrightarrow{\Delta} Na_2S$$

$$Na + X \xrightarrow{\Delta} NaX$$

[x = cl, Br, I]

Cyanide, sulphide or halide of sodium are extracted from the fused mass by boiling it with distilled water. This extract is known as sodium fusion extract.

Q22. *Differentiate between the principle of estimation of nitrogen in an organic compound by (i) Dumas method and (ii) Kjeldahl's method.*

Ans. (*i*) **Dumas method:** The organic compound is heated strongly with excess of CuO (Cupric Oxide) in an atmosphere of CO_2 when free nitrogen, CO_2 and H_2O are obtained.

(*ii*) **Kjeldahl's method:** A known mass of the organic compound is heated strongly with conc H_2SO_4 and a little potassium sulphate and a little mecury (a catalyst). As a result of reaction the nitrogen present in the organic compound is converted to ammonium sulphate.

Q23. *Discuss the principle of estimation of halogens, sulphur and phosphorus present in an organic compound.*

Ans. **Estimation of halogens:** It involves oxidising the organic substance with fuming nitric acid in the presence of silver nitrate. The halogen of the substance is thus converted to silver halide which is separated and weighed:

Weight of organic compound = W gm

weight of silver halide = x g.

$$\% \text{ of halogen} = \frac{\text{At. wt. of halogen} \times 100x}{\text{Mol.wt of silver halide} \times w}$$

Estimation of sulphur: The organic substance is heated with fuming nitric acid but no silver nitrate is added. The sulphur of the substance is oxidised to sulphuric acid which is then precipitated as barium sulphate by adding excess of barium chloride solution. From the weight of $BaSO_4$ so obtained the percentage of sulphur can be calculated.

$$\% \text{ of sulphur} = \frac{32 \text{ (At. weight of S)}}{233 \text{ (mol weight of } BaSO_4)} \times \frac{\text{weight of} \times 100\ BaSO_4}{\text{weight of organic compound}}$$

Estimation of phosphorous: The organic substance is heated with fuming nitric acid whereupon its phosphorous

is oxidised to phosphoric acid. The phoshoric acid is precipitated as ammonium phosphomolybdate, $(NH_4)_3 PO_4 \cdot 12MoO_3$, by the addition of ammonia and ammonium molybdate solution which is then separated dried and weighted.

$$\% \text{ of P} = \frac{31 \times w_1 \times 100}{1877 \times w}$$

where Molar mass of $(NH_4)_3 PO_4.12M_0O_3 = 1877$ g
If phosphorous is estimated at $Mg_2P_2O_7$

$$\% \text{ of P} = \frac{62 \times w_1 \times 100}{222 \times w}\%$$

Q24. *Explain the principle of paper chromatography.*

Ans. This is the simplest form of chromatography. Here a strip of paper acts as an adsorbent. It is based on the principle which is partly adsorption. The paper is made of cellulose fibres with molecules of water adsorbed on them. This acts as stationary phase. The mobile phase is the mixture of the components to be identified prepared in a suitable solvent.

Q25. *Why is nitric acid added to sodium extract before adding silver nitrate for testing halogens?*

Ans. Sodium extract is alkaline because it contains some sodium hydroxide also. If silver nitrate is added to it, then silver hydroxide will be formed which will interfere with the test for halogens. Due to this reason, sodium extract is acidified with nitric acid before the addition of silver nitrate.

Q26. *Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens.*

Ans. Organic compound is fused with sodium metal so as to convert organic compounds into NaCN, Na_2S, NaX and Na_3PO_4. Since these are ionic compounds and become more reactive and thus can be easily tested by suitable reagents.

Q27. *Name a suitable technique of separation of the components from a mixture of calcium sulphate and camphor.*

Ans. The mixture of calcium sulphate and camphor can be separated by the process of sublimation.

Q28. *Explain, why an organic liquid vaporises at a temperature below its boiling point in its steam distillation?*

Ans. It is because in steam distillation the sum of vapour pressure of organic compound and steam should be equal to atmospheric pressure.

Q29. *Will CCl_4 give white precipitate of AgCl on heating it with silver nitrate? Give reason for your answer.*

Ans. CCl_4 does not give white precipitate of AgCl on heating with silver nitrate because in CCl_4, Cl^- ions are not available. It has all the four chlorine atoms attached by covalent bonds.

Q30. *Why is a solution of potassium hydroxide used to absorb carbon dioxide evolved during the estimation of carbon present in an organic compound?*

Ans. CO_2 is acidic in nature and therefore, it reacts with the strong base KOH to form K_2CO_3.

$$2KOH + CO_2 \longrightarrow K_2CO_3 + H_2O.$$

Q31. *Why is it necessary to use acetic acid and not sulphuric acid for acidification of sodium extract for testing sulphur by lead acetate test?*

Ans. If H_2SO_4 is added for acidification, it will react with lead acetate to form the white precipitate of lead sulphate which will interfere with the test.

Q32. *An organic compound contains 69% carbon and 4.8% hydrogen, the remainder being oxygen. Calculate the masses of carbon dioxide and water produced when 0.20 g of this substance is subjected to complete combustion.*

Ans. Mass of carbon dioxide formed $= \frac{\%C \times m \times 44}{12 \times 100}$

Mass of water formed $= \frac{\%H \times m \times 18}{2 \times 100}$

$\%\ C = 69$

$\%\ H = 4.8$

m = mass of the substance taken = 0.2 g

Substituting these values,

Mass of carbon dioxide formed $= \frac{69 \times 0.2 \times 44}{12 \times 100} = 0.506$ g

Mass of water formed $= \frac{4.8 \times 0.2 \times 18}{2 \times 100}$

$= \mathbf{0.0864\ g.}$

Q33. *A sample of 0.50 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was*

absorbed in 50 mL of 0.5 M H_2SO_4. The residual acid required 60 mL of 0.5 M solution of NaOH for neutralisation. Find the percentage composition of nitrogen in the compound.

Ans. Percentage of $N = \dfrac{14 \times M \times 2\left(V - \dfrac{V_1}{2}\right)}{1000} \times \dfrac{100}{m}$

M = Molarity of H_2SO_4
= Molarity of NaOH solution = 0.5 M
V = Volume of H_2SO_4 taken = 50 mL
V_1 = Volume of NaOH solution used = 60 mL
m = Mass of the substance taken = 0.5 g

Substituting these values,

Percentage of N $= \dfrac{14 \times 0.5 \times 2\left(50 - \dfrac{60}{2}\right)}{1000} \times \dfrac{100}{0.5} =$ **56.**

Q34. *0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound.*

Ans. Percentage of Cl $= \dfrac{\text{Atomic mass of Cl} \times m_1 \times 100}{\text{Molecular mass of AgCl} \times m}$

Atomic mass of Cl = 35.5
m_1 = Mass of AgCl formed = 0.5740 g
Molar mass of AgCl = 143.5 g mol^{-1}
m = Mass of the organic compound
= 0.3780 g

Substituting these values, we obtain

Percentage of Cl $= \dfrac{35.5 \times 0.5740 \times 100}{143.5 \times 0.3780} =$ **37.56.**

Q35. *In the estimation of sulphur by Carius method, 0.468 g of an organic sulphur compound afforded 0.668 g of barium sulphate. Find out the percentage of sulphur in the given compound.*

Ans. Percentage of sulphur $= \dfrac{32 \times m_1 \times 100}{233 \times m}$

m_1 = Mass of barium sulphate formed
= 0.668 g
m = Mass of the organic compound taken
= 0.468 g

Substituting these values, we obtain

$$\text{Percentage of sulphur} = \frac{32\times0.668\times100}{233\times0.468} = 19.66$$

Q36. *In the organic compound* $CH_2{=}CH{-}CH_2{-}CH_2{-}C{\equiv}CH$, *the pair of hybridised orbitals involved in the formation of:* $C_2{-}C_3$ *bond is:*

(a) $sp - sp^2$ (b) $sp - sp^3$

(c) $sp^2 - sp^3$ (d) $sp^3 - sp^3$

Ans. (c)

Q37. *In the Lassaigne's test for nitrogen in an organic compound, the Prussian blue colour is obtained due to the formation of:*

(a) $Na_4[Fe(CN)_6]$ (b) $Fe_4[Fe(CN)_6]_3$

(c) $Fe_2[Fe(CN)_6]$ (d) $Fe_3[Fe(CN)_6]_4$

Ans. (b)

Q38. *Which of the following carbocations is most stable?*

(a) $(CH_3)_3C\overset{+}{C}H_2$ (b) $(CH_3)_3\overset{+}{C}$

(c) $CH_3CH_2\overset{+}{C}H_2$ (d) $CH_3\overset{+}{C}HCH_2CH_3$

Ans. (b)

Q39. *The best and latest technique for isolation, purification and separation of organic compounds is:*

(a) *Crystallisation* (b) *Distillation*

(c) *Sublimation* (d) *Chromatography*

Ans. (d)

Q40. *The reaction*

$$CH_3CH_2I + KOH(aq) \longrightarrow CH_3CH_2OH + KI$$

is classified as:

(a) *electrophilic substitution*

(b) *nucleophilic substitution*

(c) *elimination* (d) *addition*

Ans. (b)

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