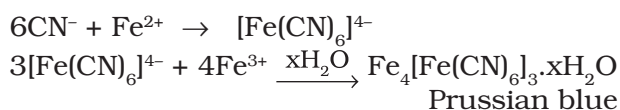
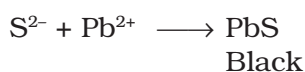


concentrated sulphuric acid. The formation of Prussian blue colour confirms the presence of nitrogen. Sodium cyanide first reacts with iron(II) sulphate and forms sodium hexacyanidoferrate(II). On heating with concentrated sulphuric acid some iron(II) ions are oxidised to iron(III) ions which react with sodium hexacyanidoferrate(II) to produce iron(III) hexacyanidoferrate(II) (ferriferrocyanide) which is Prussian blue in colour.



(B) Test for Sulphur

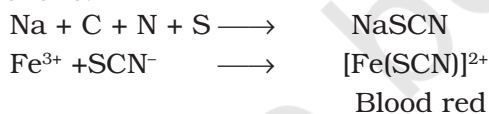
- (a) The sodium fusion extract is acidified with acetic acid and lead acetate is added to it. A black precipitate of lead sulphide indicates the presence of sulphur.



- (b) On treating sodium fusion extract with sodium nitroprusside, appearance of a violet colour further indicates the presence of sulphur.



In case, nitrogen and sulphur both are present in an organic compound, sodium thiocyanate is formed. It gives blood red colour and no Prussian blue since there are no free cyanide ions.



If sodium fusion is carried out with excess of sodium, the thiocyanate decomposes to yield cyanide and sulphide. These ions give their usual tests.



(C) Test for Halogens

The sodium fusion extract is acidified with nitric acid and then treated with silver nitrate. A white precipitate, soluble in ammonium hydroxide shows the presence of chlorine, a yellowish precipitate, sparingly soluble in ammonium hydroxide shows the presence of

bromine and a yellow precipitate, insoluble in ammonium hydroxide shows the presence of iodine.

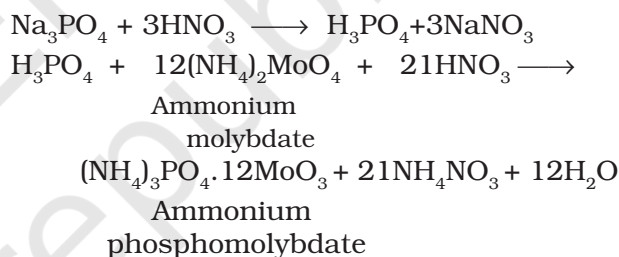


X represents a halogen – Cl, Br or I.

If nitrogen or sulphur is also present in the compound, the sodium fusion extract is first boiled with concentrated nitric acid to decompose cyanide or sulphide of sodium formed during Lassaigne's test. These ions would otherwise interfere with silver nitrate test for halogens.

(D) Test for Phosphorus

The compound is heated with an oxidising agent (sodium peroxide). The phosphorus present in the compound is oxidised to phosphate. The solution is boiled with nitric acid and then treated with ammonium molybdate. A yellow colouration or precipitate indicates the presence of phosphorus.



8.10 QUANTITATIVE ANALYSIS

Quantitative analysis of compounds is very important in organic chemistry. It helps chemists in the determination of mass per cent of elements present in a compound. You have learnt in Unit-1 that mass per cent of elements is required for the determination of empirical and molecular formula.

The percentage composition of elements present in an organic compound is determined by the following methods:

8.10.1 Carbon and Hydrogen

Both carbon and hydrogen are estimated in one experiment. A known mass of an organic compound is burnt in the presence of excess of oxygen and copper(II) oxide. Carbon and hydrogen in the compound are oxidised to carbon dioxide and water respectively.



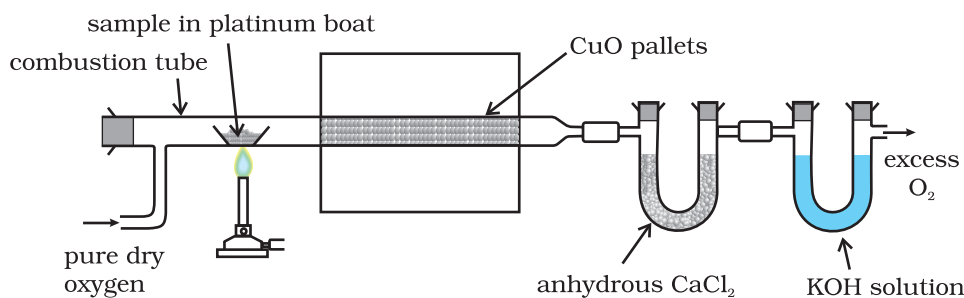


Fig.8.14 Estimation of carbon and hydrogen. Water and carbon dioxide formed on oxidation of substance are absorbed in anhydrous calcium chloride and potassium hydroxide solutions respectively contained in U tubes.

The mass of water produced is determined by passing the mixture through a weighed U-tube containing anhydrous calcium chloride. Carbon dioxide is absorbed in another U-tube containing concentrated solution of potassium hydroxide. These tubes are connected in series (Fig. 8.14). The increase in masses of calcium chloride and potassium hydroxide gives the amounts of water and carbon dioxide from which the percentages of carbon and hydrogen are calculated.

Let the mass of organic compound be m g, mass of water and carbon dioxide produced be m_1 and m_2 g respectively;

$$\text{Percentage of carbon} = \frac{12 \times m_2 \times 100}{44 \times m}$$

$$\text{Percentage of hydrogen} = \frac{2 \times m_1 \times 100}{18 \times m}$$

Problem 8.20

On complete combustion, 0.246 g of an organic compound gave 0.198g of carbon dioxide and 0.1014g of water. Determine the percentage composition of carbon and hydrogen in the compound.

Solution

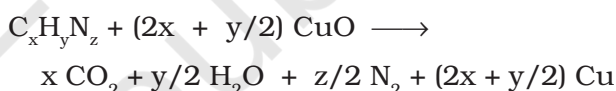
$$\begin{aligned} \text{Percentage of carbon} &= \frac{12 \times 0.198 \times 100}{44 \times 0.246} \\ &= 21.95\% \end{aligned}$$

$$\begin{aligned} \text{Percentage of hydrogen} &= \frac{2 \times 0.1014 \times 100}{18 \times 0.246} \\ &= 4.58\% \end{aligned}$$

8.10.2 Nitrogen

There are two methods for estimation of nitrogen: (i) Dumas method and (ii) Kjeldahl's method.

(i) Dumas method: The nitrogen containing organic compound, when heated with copper oxide in an atmosphere of carbon dioxide, yields free nitrogen in addition to carbon dioxide and water.



Traces of nitrogen oxides formed, if any, are reduced to nitrogen by passing the gaseous mixture over a heated copper gauze. The mixture of gases so produced is collected over an aqueous solution of potassium hydroxide which absorbs carbon dioxide. Nitrogen is collected in the upper part of the graduated tube (Fig.8.15).

Let the mass of organic compound = m g

Volume of nitrogen collected = V_1 mL

Room temperature = T_1 K

$$\text{Volume of nitrogen at STP} = \frac{P_1 V_1 \times 273}{760 \times T_1}$$

(Let it be V mL)

Where p_1 and V_1 are the pressure and volume of nitrogen, p_1 is different from the atmospheric pressure at which nitrogen gas is collected. The value of p_1 is obtained by the relation;

p_1 = Atmospheric pressure – Aqueous tension
22400 mL N_2 at STP weighs 28 g.

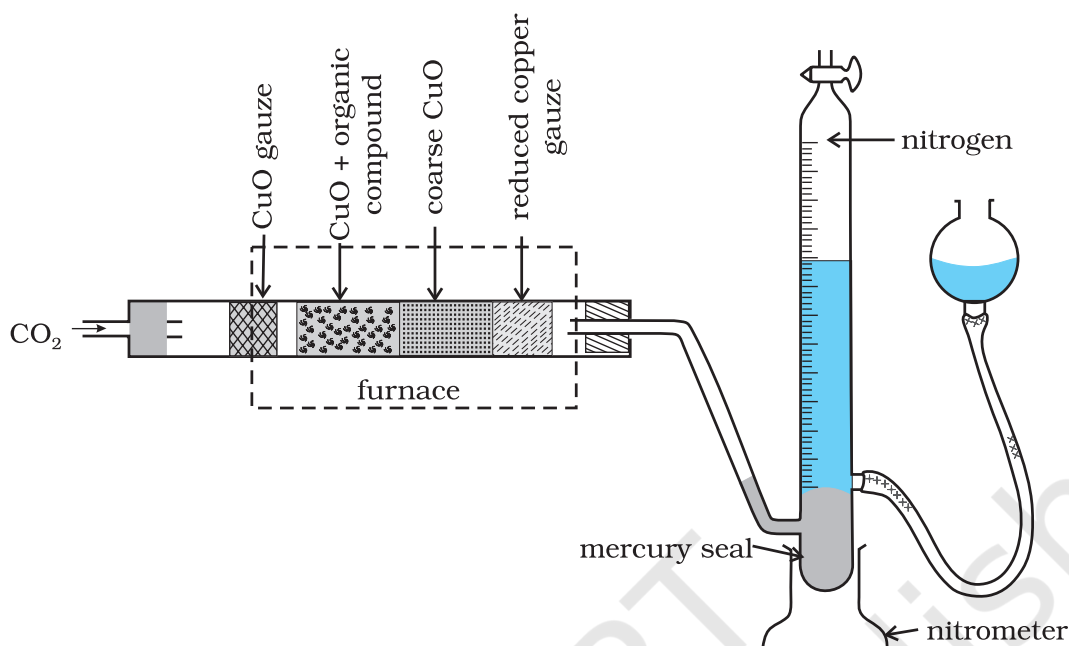


Fig. 8.15 Dumas method. The organic compound yields nitrogen gas on heating it with copper(II) oxide in the presence of CO_2 gas. The mixture of gases is collected over potassium hydroxide solution in which CO_2 is absorbed and volume of nitrogen gas is determined.

$$V \text{ mL N}_2 \text{ at STP weighs} = \frac{28 \times V}{22400} \text{ g}$$

$$\text{Percentage of nitrogen} = \frac{28 \times V \times 100}{22400 \times m}$$

Problem 8.21

In Dumas' method for estimation of nitrogen, 0.3g of an organic compound gave 50mL of nitrogen collected at 300K temperature and 715mm pressure. Calculate the percentage composition of nitrogen in the compound. (Aqueous tension at 300K=15 mm)

Solution

Volume of nitrogen collected at 300K and 715mm pressure is 50 mL

Actual pressure = 715-15 =700 mm

$$\text{Volume of nitrogen at STP} = \frac{273 \times 700 \times 50}{300 \times 760} = 41.9 \text{ mL}$$

22,400 mL of N_2 at STP weighs = 28 g

$$41.9 \text{ mL of nitrogen weighs} = \frac{28 \times 41.9}{22400} \text{ g}$$

$$\begin{aligned} \text{Percentage of nitrogen} &= \frac{28 \times 41.9 \times 100}{22400 \times 0.3} \\ &= 17.46\% \end{aligned}$$

(ii) Kjeldahl's method: The compound containing nitrogen is heated with concentrated sulphuric acid. Nitrogen in the compound gets converted to ammonium sulphate (Fig. 8.16). The resulting acid mixture is then heated with excess of sodium hydroxide. The liberated ammonia gas is absorbed in an excess of standard solution of sulphuric acid. The amount of ammonia produced is determined by estimating the amount of sulphuric acid consumed in the reaction. It is done by estimating unreacted sulphuric acid left after the absorption of ammonia by titrating it with standard alkali solution. The difference between the initial amount of acid

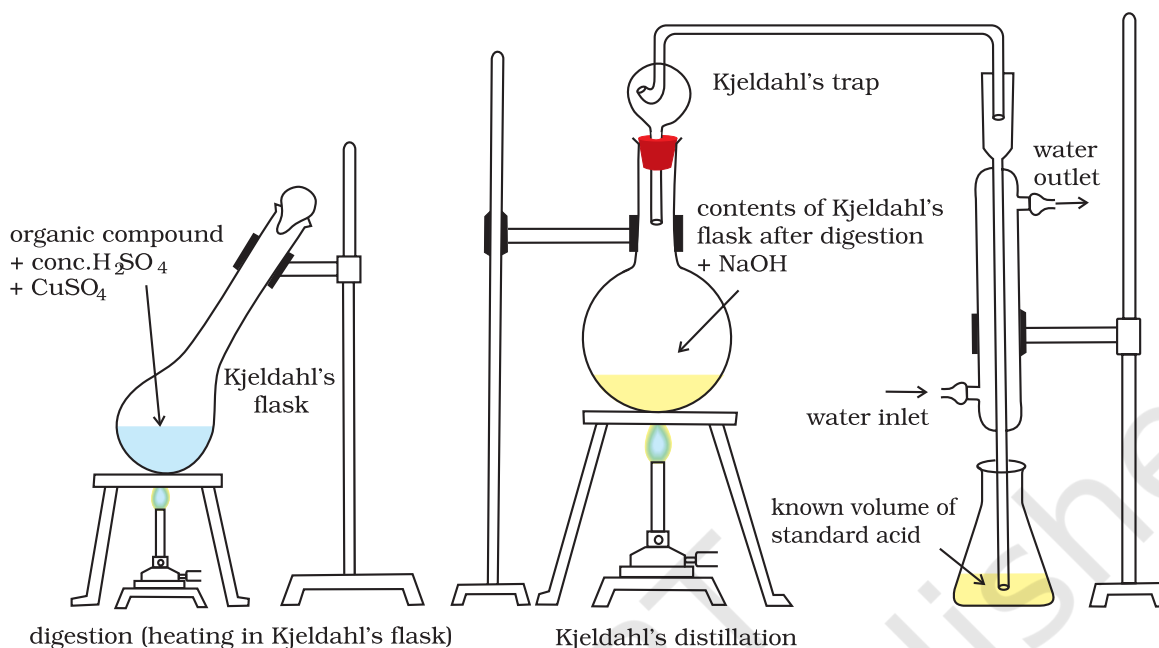
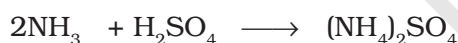
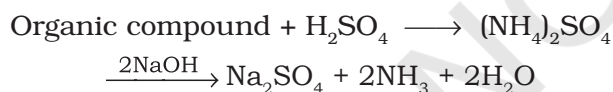


Fig.8.16 Kjeldahl method. Nitrogen-containing compound is treated with concentrated H_2SO_4 to get ammonium sulphate which liberates ammonia on treating with NaOH ; ammonia is absorbed in known volume of standard acid.

taken and that left after the reaction gives the amount of acid reacted with ammonia.



Let the mass of organic compound taken = m g
Volume of H_2SO_4 of molarity, M , taken = V mL

Volume of NaOH of molarity, M , used for titration of excess of H_2SO_4 = V_1 mL

V_1 mL of NaOH of molarity M

= $V_1/2$ mL of H_2SO_4 of molarity M

Volume of H_2SO_4 of molarity M unused = $(V - V_1/2)$ mL

$(V - V_1/2)$ mL of H_2SO_4 of molarity M

= $2(V - V_1/2)$ mL of NH_3 solution of molarity M .

1000 mL of 1 M NH_3 solution contains 17 g NH_3 or 14 g of N

$2(V - V_1/2)$ mL of NH_3 solution of molarity M contains:

$$\frac{14 \times M \times 2(V - V_1/2)}{1000} \text{ g N}$$

$$\begin{aligned} \text{Percentage of N} &= \frac{14 \times M \times 2(V - V_1/2)}{1000} \times \frac{100}{m} \\ &= \frac{1.4 \times M \times 2(V - V_1/2)}{m} \end{aligned}$$

Kjeldahl method is not applicable to compounds containing nitrogen in nitro and azo groups and nitrogen present in the ring (e.g. pyridine) as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

Problem 8.22

During estimation of nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.5 g of the compound in Kjeldahl's estimation of nitrogen, neutralized 10 mL of 1 M H_2SO_4 . Find out the percentage of nitrogen in the compound.

Solution

1 M of 10 mL H_2SO_4 = 1 M of 20 mL NH_3
1000 mL of 1 M ammonia contains 14 g nitrogen
20 mL of 1 M ammonia contains

$$\frac{14 \times 20}{1000} \text{ g nitrogen}$$

$$\text{Percentage of nitrogen} = \frac{14 \times 20 \times 100}{1000 \times 0.5} = 56.0\%$$

8.10.3 Halogens

Carius method: A known mass of an organic compound is heated with fuming nitric acid in the presence of silver nitrate contained in a hard glass tube known as Carius tube, (Fig.8.17)

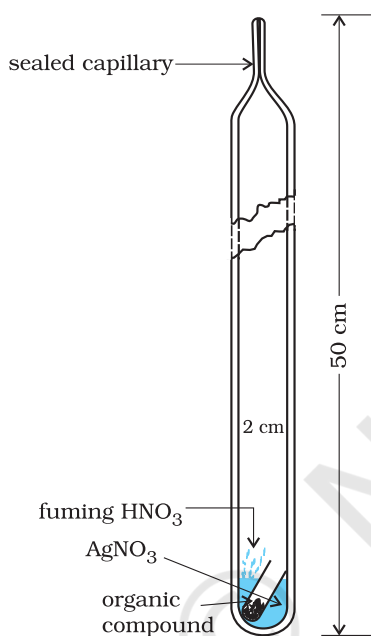


Fig. 8.17 Carius method. Halogen containing organic compound is heated with fuming nitric acid in the presence of silver nitrate.

in a furnace. Carbon and hydrogen present in the compound are oxidised to carbon dioxide and water. The halogen present forms the corresponding silver halide (AgX). It is filtered, washed, dried and weighed.

Let the mass of organic

compound taken = m g

Mass of AgX formed = m_1 g

1 mol of AgX contains 1 mol of X

Mass of halogen in m_1 g of AgX

$$= \frac{\text{atomic mass of X} \times m_1 \text{ g}}{\text{molecular mass of AgX}}$$

Percentage of halogen

$$= \frac{\text{atomic mass of X} \times m_1 \text{ g}}{\text{molecular mass of AgX}}$$

Problem 8.23

In Carius method of estimation of halogen, 0.15 g of an organic compound gave 0.12 g of AgBr. Find out the percentage of bromine in the compound.

Solution

$$\begin{aligned} \text{Molar mass of AgBr} &= 108 + 80 \\ &= 188 \text{ g mol}^{-1} \end{aligned}$$

188 g AgBr contains 80 g bromine

$$0.12 \text{ g AgBr contains } \frac{80 \times 0.12}{188} \text{ g bromine}$$

$$\begin{aligned} \text{Percentage of bromine} &= \frac{80 \times 0.12 \times 100}{188 \times 0.15} \\ &= 34.04\% \end{aligned}$$

8.10.4 Sulphur

A known mass of an organic compound is heated in a Carius tube with sodium peroxide or fuming nitric acid. Sulphur present in the compound is oxidised to sulphuric acid. It is precipitated as barium sulphate by adding excess of barium chloride solution in water. The precipitate is filtered, washed, dried and weighed. The percentage of sulphur can be calculated from the mass of barium sulphate.

Let the mass of organic

compound taken = m g

and the mass of barium

sulphate formed = m_1 g

1 mol of BaSO_4 = 233 g BaSO_4 = 32 g sulphur

$$m_1 \text{ g BaSO}_4 \text{ contains } \frac{32 \times m_1}{233} \text{ g sulphur}$$

$$\text{Percentage of sulphur} = \frac{32 \times m_1 \times 100}{233 \times m}$$

Problem 8.24

In sulphur estimation, 0.157 g of an organic compound gave 0.4813 g of

barium sulphate. What is the percentage of sulphur in the compound?

Solution

$$\text{Molecular mass of BaSO}_4 = 137 + 32 + 64 \\ = 233 \text{ g}$$

233 g BaSO₄ contains 32 g sulphur

$$0.4813 \text{ g BaSO}_4 \text{ contains } \frac{32 \times 0.4813}{233} \text{ g sulphur}$$

$$\text{Percentage of sulphur} = \frac{32 \times 0.4813 \times 100}{233 \times 0.157} \\ = 42.10\%$$

8.10.5 Phosphorus

A known mass of an organic compound is heated with fuming nitric acid whereupon phosphorus present in the compound is oxidised to phosphoric acid. It is precipitated as ammonium phosphomolybdate, (NH₄)₃PO₄·12MoO₃, by adding ammonia and ammonium molybdate. Alternatively, phosphoric acid may be precipitated as MgNH₄PO₄ by adding magnesia mixture which on ignition yields Mg₂P₂O₇.

Let the mass of organic compound taken = *m* g and mass of ammonium phosphomolybdate = *m*₁ g

$$\text{Molar mass of (NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3 = 1877 \text{ g}$$

$$\text{Percentage of phosphorus} = \frac{31 \times m_1 \times 100}{1877 \times m} \%$$

If phosphorus is estimated as Mg₂P₂O₇,

$$\text{Percentage of phosphorus} = \frac{62 \times m_1 \times 100}{222} \%$$

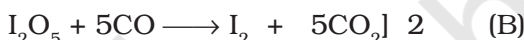
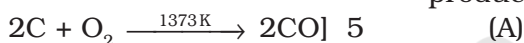
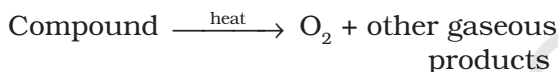
where, 222 u is the molar mass of Mg₂P₂O₇, *m*, the mass of organic compound taken, *m*₁, the mass of Mg₂P₂O₇ formed and 62, the mass of two phosphorus atoms present in the compound Mg₂P₂O₇.

8.10.6 Oxygen

The percentage of oxygen in an organic compound is usually found by difference between the total

percentage composition (100) and the sum of the percentages of all other elements. However, oxygen can also be estimated directly as follows:

A definite mass of an organic compound is decomposed by heating in a stream of nitrogen gas. The mixture of gaseous products containing oxygen is passed over red-hot coke when all the oxygen is converted to carbon monoxide. This mixture is passed through warm iodine pentoxide (I₂O₅) when carbon monoxide is oxidised to carbon dioxide producing iodine.



On making the amount of CO produced in equation (A) equal to the amount of CO used in equation (B) by multiplying the equations (A) and (B) by 5 and 2 respectively; we find that each mole of oxygen liberated from the compound will produce two moles of carbon dioxide.

Thus 88 g carbon dioxide is obtained if 32 g oxygen is liberated.

Let the mass of organic compound taken be *m* g
Mass of carbon dioxide produced be *m*₁ g

$$\therefore m_1 \text{ g carbon dioxide is obtained from } \frac{32 \times m_1}{88} \text{ g O}_2$$

$$\therefore \text{Percentage of oxygen} = \frac{32 \times m_1 \times 100}{88 \times m} \%$$

The percentage of oxygen can be derived from the amount of iodine produced also.

Presently, the estimation of elements in an organic compound is carried out by using microquantities of substances and automatic experimental techniques. The elements, carbon, hydrogen and nitrogen present in a compound are determined by an apparatus known as CHN *elemental analyser*. The analyser requires only a very small amount of the substance (1-3 mg) and displays the values on a screen within a short time. A detailed discussion of such methods is beyond the scope of this book.

SUMMARY

In this unit, we have learnt some basic concepts in structure and reactivity of organic compounds, which are formed due to covalent bonding. The nature of the covalent bonding in organic compounds can be described in terms of **orbitals hybridisation** concept, according to which carbon can have sp^3 , sp^2 and sp hybridised orbitals. The sp^3 , sp^2 and sp hybridised carbons are found in compounds like methane, ethene and ethyne respectively. The tetrahedral shape of methane, planar shape of ethene and linear shape of ethyne can be understood on the basis of this concept. A sp^3 hybrid orbital can overlap with 1s orbital of hydrogen to give a carbon - hydrogen (C-H) single bond (sigma, σ bond). Overlap of a sp^2 orbital of one carbon with sp^2 orbital of another results in the formation of a carbon-carbon σ bond. The unhybridised p orbitals on two adjacent carbons can undergo lateral (side-by-side) overlap to give a pi (π) bond. Organic compounds can be represented by various structural formulas. The three dimensional representation of organic compounds on paper can be drawn by **wedge** and **dash** formula.

Organic compounds can be classified on the basis of their structure or the functional groups they contain. 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. The naming of the organic compounds is carried out by following a set of rules laid down by the International Union of Pure and Applied Chemistry (**IUPAC**). In IUPAC nomenclature, the names are correlated with the structure in such a way that the reader can deduce the structure from the name.

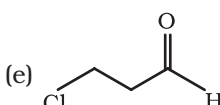
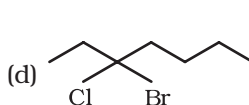
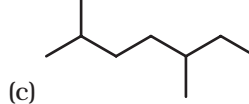
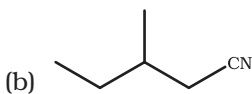
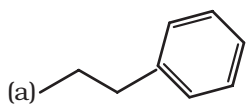
Organic reaction mechanism concepts are based on the structure of the substrate molecule, fission of a covalent bond, the attacking reagents, the electron displacement effects and the conditions of the reaction. These organic reactions involve breaking and making of covalent bonds. A covalent bond may be cleaved in **heterolytic** or **homolytic** fashion. A heterolytic cleavage yields **carbocations** or **carbanions**, while a homolytic cleavage gives **free radicals** as reactive intermediate. Reactions proceeding through heterolytic cleavage involve the complimentary pairs of reactive species. These are electron pair donor known as **nucleophile** and an electron pair acceptor known as **electrophile**. The **inductive**, **resonance**, **electromeric** and **hyperconjugation effects** may help in the polarisation of a bond making certain carbon atom or other atom positions as places of low or high electron densities.

Organic reactions can be broadly classified into following types; **substitution**, **addition**, **elimination** and **rearrangement** reactions.

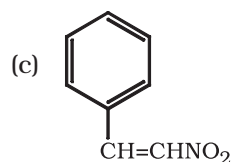
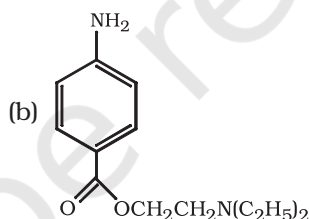
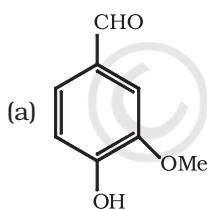
Purification, qualitative and quantitative analysis of organic compounds are carried out for determining their structures. The methods of purification namely : sublimation, distillation and differential extraction are based on the difference in one or more physical properties. **Chromatography** is a useful technique of separation, identification and purification of compounds. It is classified into two categories : adsorption and partition chromatography. Adsorption chromatography is based on differential adsorption of various components of a mixture on an adsorbent. Partition chromatography involves continuous partitioning of the components of a mixture between stationary and mobile phases. After getting the compound in a pure form, its qualitative analysis is carried out for detection of elements present in it. Nitrogen, sulphur, halogens and phosphorus are detected by **Lassaigne's test**. Carbon and hydrogen are estimated by determining the amounts of carbon dioxide and water produced. Nitrogen is estimated by **Dumas** or **Kjeldahl's** method and halogens by **Carius** method. Sulphur and phosphorus are estimated by oxidising them to sulphuric and phosphoric acids respectively. The percentage of oxygen is usually determined by difference between the total percentage (100) and the sum of percentages of all other elements present.

EXERCISES

- 8.1 What are hybridisation states of each carbon atom in the following compounds ?
 $\text{CH}_2=\text{C}=\text{O}$, $\text{CH}_3\text{CH}=\text{CH}_2$, $(\text{CH}_3)_2\text{CO}$, $\text{CH}_2=\text{CHCN}$, C_6H_6
- 8.2 Indicate the σ and π bonds in the following molecules :
 C_6H_6 , C_6H_{12} , CH_2Cl_2 , $\text{CH}_2=\text{C}=\text{CH}_2$, CH_3NO_2 , HCONHCH_3
- 8.3 Write bond line formulas for : Isopropyl alcohol, 2,3-Dimethylbutanal, Heptan-4-one.
- 8.4 Give the IUPAC names of the following compounds :



- 8.5 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.
- 8.6 Draw formulas for the first five members of each homologous series beginning with the following compounds. (a) $\text{H}-\text{COOH}$ (b) CH_3COCH_3 (c) $\text{H}-\text{CH}=\text{CH}_2$
- 8.7 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
- 8.8 Identify the functional groups in the following compounds

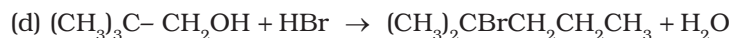
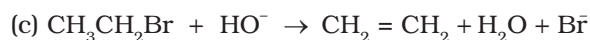
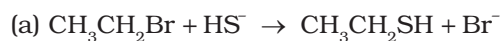


- 8.9 Which of the two: $\text{O}_2\text{NCH}_2\text{CH}_2\text{O}^-$ or $\text{CH}_3\text{CH}_2\text{O}^-$ is expected to be more stable and why?
- 8.10 Explain why alkyl groups act as electron donors when attached to a π system.
- 8.11 Draw the resonance structures for the following compounds. Show the electron shift using curved-arrow notation.
 (a) $\text{C}_6\text{H}_5\text{OH}$ (b) $\text{C}_6\text{H}_5\text{NO}_2$ (c) $\text{CH}_3\text{CH}=\text{CHCHO}$ (d) $\text{C}_6\text{H}_5-\text{CHO}$ (e) $\text{C}_6\text{H}_5-\text{CH}_2^+$
 (f) $\text{CH}_3\text{CH}=\text{CH}\text{CH}_2^+$
- 8.12 What are electrophiles and nucleophiles ? Explain with examples.
- 8.13 Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles:

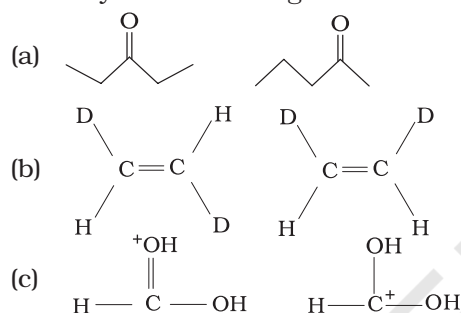




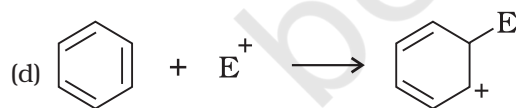
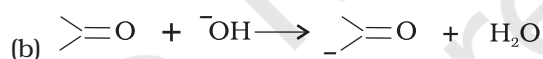
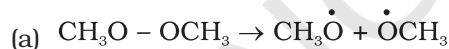
8.14 Classify the following reactions in one of the reaction type studied in this unit.



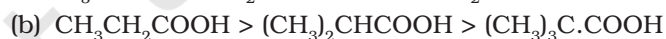
8.15 What is the relationship between the members of following pairs of structures ? Are they structural or geometrical isomers or resonance contributors ?



8.16 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.



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



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

(a) Crystallisation (b) Distillation (c) Chromatography

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

8.20 What is the difference between distillation, distillation under reduced pressure and steam distillation ?

- 8.21 Discuss the chemistry of Lassaigne's test.
- 8.22 Differentiate between the principle of estimation of nitrogen in an organic compound by (i) Dumas method and (ii) Kjeldahl's method.
- 8.23 Discuss the principle of estimation of halogens, sulphur and phosphorus present in an organic compound.
- 8.24 Explain the principle of paper chromatography.
- 8.25 Why is nitric acid added to sodium extract before adding silver nitrate for testing halogens?
- 8.26 Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens.
- 8.27 Name a suitable technique of separation of the components from a mixture of calcium sulphate and camphor.
- 8.28 Explain, why an organic liquid vaporises at a temperature below its boiling point in its steam distillation ?
- 8.29 Will CCl_4 give white precipitate of AgCl on heating it with silver nitrate? Give reason for your answer.
- 8.30 Why is a solution of potassium hydroxide used to absorb carbon dioxide evolved during the estimation of carbon present in an organic compound?
- 8.31 Why is it necessary to use acetic acid and not sulphuric acid for acidification of sodium extract for testing sulphur by lead acetate test?
- 8.32 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.
- 8.33 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.
- 8.34 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.
- 8.35 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.
- 8.36 In the organic compound $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{C} \equiv \text{CH}$, the pair of hybridised orbitals involved in the formation of: $\text{C}_2 - \text{C}_3$ bond is:
(a) $sp - sp^2$ (b) $sp - sp^3$ (c) $sp^2 - sp^3$ (d) $sp^3 - sp^3$
- 8.37 In the Lassaigne's test for nitrogen in an organic compound, the Prussian blue colour is obtained due to the formation of:
(a) $\text{Na}_4[\text{Fe}(\text{CN})_6]$ (b) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (c) $\text{Fe}_2[\text{Fe}(\text{CN})_6]$ (d) $\text{Fe}_3[\text{Fe}(\text{CN})_6]_4$
- 8.38 Which of the following carbocation is most stable ?
(a) $(\text{CH}_3)_3\text{C}^+$ (b) $(\text{CH}_3)_3\text{C}^+$ (c) $\text{CH}_3\text{CH}_2\text{CH}_2^+$ (d) $\text{CH}_3\text{CH}^+\text{CH}_2\text{CH}_3$
- 8.39 The best and latest technique for isolation, purification and separation of organic compounds is:
(a) Crystallisation (b) Distillation (c) Sublimation (d) Chromatography
- 8.40 The reaction:
 $\text{CH}_3\text{CH}_2\text{I} + \text{KOH}(\text{aq}) \rightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{KI}$
is classified as :
(a) electrophilic substitution (b) nucleophilic substitution
(c) elimination (d) addition