UNIT – XI – FUNDAMENTALS OF ORGANIC CHEMISTRY

| Mr. S.JOHNSON., M.Sc., M.Sc., B.Ed.,

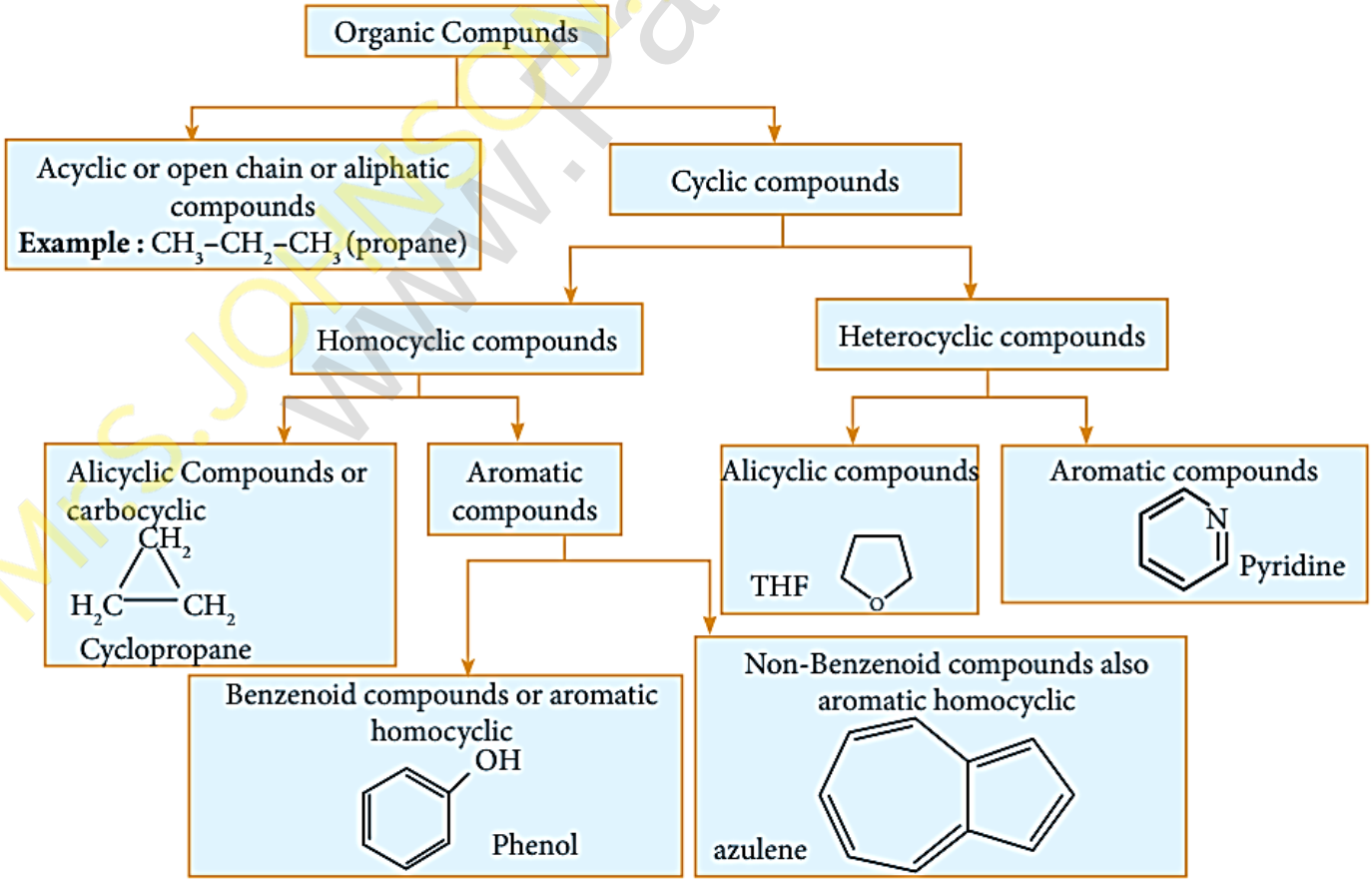
UNIT – 11 – FUNDAMENTALS OF ORGANIC CHEMISTRY

II. WRITE BRIEF ANSWER TO THE FOLLOWING QUESTIONS.

31. Give the general characteristics of organic compounds. [HY-19, FMT,CRT-22]

- They are covalent compounds of carbon and generally insoluble in water and readily soluble in organic solvent such as benzene, toluene, ether, chloroform etc...
- Many of the organic compounds are inflammable (except CCl_4). They possess low boiling and melting points due to their covalent nature
- Organic compounds are characterized by functional groups. A functional group is an atom or a specific combination of bonded atoms that react in a characteristic way, irrespective of the organic molecule in which it is present. In almost all the cases, the reaction of an organic compound takes place at the functional group. They exhibit isomerism which is a unique phenomenon.
- **Homologous series:** A series of organic compounds each containing a characteric functional group and the successive members differ from each other in molecular formula by a CH_2 group is called homologous series. Eg.
  - **Alkanes:** Methane (CH_4), Ethane (C_2H_6), Propane (C_3H_8) etc.
  - **Alcohols:** Methanol (CH_3OH), Ethanol (C_2H_5OH) Propanol (C_3H_7OH) etc.)
  - Compounds of the homologous series are represented by a general formula Alkanes C_nH_{2n+2}, Alkenes C_nH_{2n}, Alkynes C_nH_{2n-2} and can be prepared by general methods. They show regular gradation in physical properties but have almost similar chemical property.

32. Describe the classification of organic compounds based on their structure. [FMT-22, CRT-22]



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33. Write a note on homologous series. [HY-19, SEP-21, MAR-24]

- **Homologous series:** A series of organic compounds each containing a characteric functional group and the successive members differ from each other in molecular formula by a CH_2 group is called homologous series. Eg.
  - **Alkanes:** Methane (CH_4), Ethane (C_2H_6), Propane (C_3H_8) etc.
  - **Alcohols:** Methanol (CH_3OH), Ethanol (C_2H_5OH) Propanol (C_3H_7OH) etc.)
  - Compounds of the homologous series are represented by a general formula Alkanes C_nH_{2n+2}, Alkenes C_nH_{2n}, Alkynes C_nH_{2n-2} and can be prepared by general methods. They show regular gradation in physical properties but have almost similar chemical property

34. What is meant by a functional group? Identity the functional group in the following compounds. (a) acetaldehyde (b) oxalic acid (c) di methyl ether (d) methylamine

A functional group is an atom or a specific combination of bonded atoms that react in a characteristic way, irrespective of the organic molecules in which it is present.

	Common name	Molecular formula	Functional group
(a)	Acetaldehyde	CH_3CHO	-CHO
(b)	Oxalic acid	COOH | COOH	-COOH
(c)	Dimethyl ether	CH_3-O-CH_3	-O-
(d)	Methylamine	CH_3-NH_2	-NH_2

35. Give the general formula for the following classes of organic compounds (a) Aliphatic monohydric alcohol (b) Aliphatic ketones (c) Aliphatic amines

(a) Aliphatic monohydric alcohol : $C_nH_{2n+1}OH$

(b) Aliphatic ketones : $C_6H_{2n}O$

(c) Aliphatic amines : $C_nH_{2n+1}NH_2$

36. Write the molecular formula of the first six members of homologous series of nitro alkanes.

The first six members of nitro alkanes are

(i) CH_3NO_2 – Nitro methane CH_3NO_2

(ii) $CH_3CH_2NO_2$ – Nitro ethane $C_2H_5NO_2$

(iii) $CH_3CH_2CH_2NO_2$ – Nitro propane $C_3H_7NO_2$

(iv) $CH_3CH_2CH_2CH_2NO_2$ – Nitro butane $C_4H_9NO_2$

(v) $CH_3CH_2CH_2CH_2CH_2NO_2$ – Nitro pentane $C_5H_{11}NO_2$

(vi) $CH_3CH_2CH_2CH_2CH_2CH_2NO_2$ – Nitro hexane $C_6H_{13}NO_2$

37. Write the molecular and possible structural formula of the first four members of homologous series of carboxylic acids. [QY-22]

The first four members of homologous series of carboxylic acids are

	Molecular formula	Name	Structural formula
1	HCOOH	Formic acid	H—C(=O)—OH

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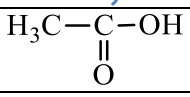
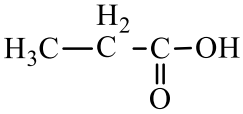
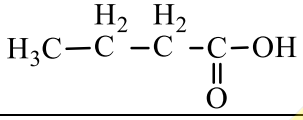
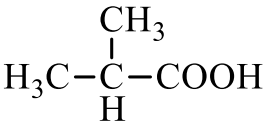
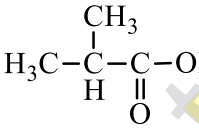
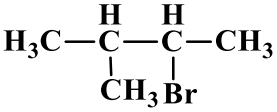
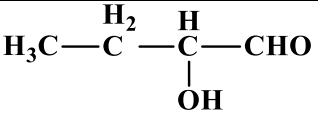
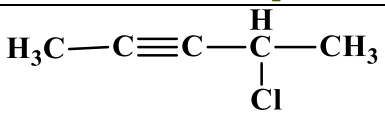
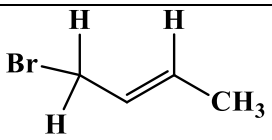
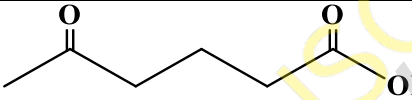
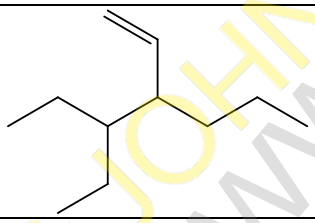
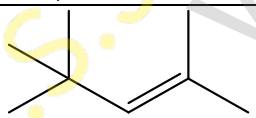
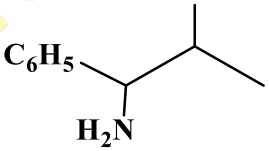
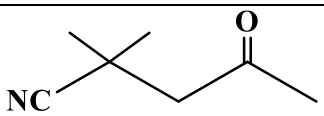
2	CH_3COOH	Acetic acid	
3	CH_3-CH_2-COOH **[MAR24]**	Propanoic acid	
4	CH_3-CH_2-CH_2-COOH	Butanoic acid	
5		Isobutyric acid	

38. Give the IUPAC names of the following compounds.

(i)	**$(CH_3)_2CH$-CH_2-$CH(CH_3)$-$CH(CH_3)_2$**	**2,3,5-trimethylhexane [FMT-22]**
(ii)	 **[MAY-22]**	**2-bromo-3-methylbutane**
(iii)	**CH_3-O-CH_3 [MAY-22]**	**Methoxymethane**
(iv)	 **[MAY-22]**	**2-hydroxybutanal**
(v)	**CH_2=CH-CH=CH_2 [MAY-22]**	**Buta-1,3-diene**
(vi)	 **[JUN-19.MAY-22]**	**4-chloropent-2-yne**
(vii)		**1-bromobut-2-ene**
(viii)	 **[JUN-19]**	**5-oxohexanoic acid**
(ix)		**3-ethyl-4-ethenylheptane**
(x)		**2,4,4-trimethylpent-2-ene**
(xi)		**2-methyl-1-phenylpropan-1-amine**
(xii)		**2,2-dimethyl-4-oxopentanenitrile**
(xiii)	**CH_3-CH_2-O-$CH(CH_3)_2$ [JUN-19]**	**2-ethoxypropane**

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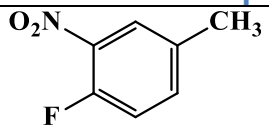
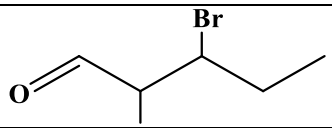
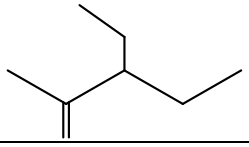
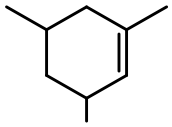
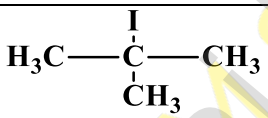
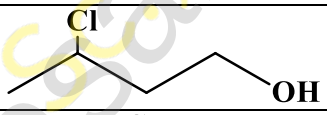
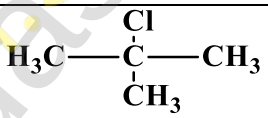
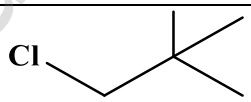
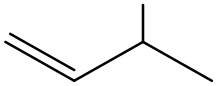
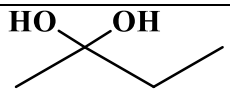
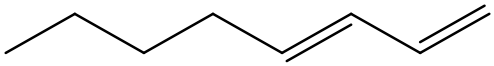
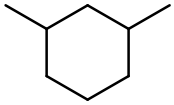
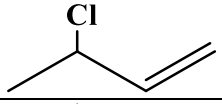
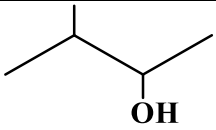
(xiv)		1-fluoro-4-methyl-2-nitrobenzene
(xv)		3-bromo-2-methylpentanal

39. Give the structure for the following compound.

(i)	3-ethyl-2-methyl-1-pentene	
(ii)	1,3,5-trimethylcyclohex-1-ene	
(iii)	Tertiary butyl iodide	
(iv)	3-chlorobutanal	
(v)	3-chlorobutanol	
(vi)	2-chloro-2-methylpropane	
(vii)	2,2-dimethyl-1-chloropropane	
(viii)	3-methylbut-1-ene	
(ix)	Butan-2,2-diol	
(x)	Octan-1,3-diene	
(xi)	1,3-dimethylcyclohexane	
(xii)	3-chlorobut-1-ene	
(xiv)	3-methylbutan-2-ol	
(xv)	acetaldehyde	CH_3-CHO

40. Describe the reactions involved in the detection of nitrogen in an organic compound by Lassaigne method. [MAR-19]

$$Na + \underbrace{C + N} \longrightarrow NaCN$$

From organic compounds

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$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$ (from excess of sodium)

$6NaCN + Fe(OH)_2 \rightarrow Na_4[Fe(CN)_6] + 2NaOH$

Sodium ferrocyanide

$3Na_4[Fe(CN)_6] + FeCl_3 \rightarrow \mathbf{Fe_4[Fe(CN)_6]_3} + 12NaCl$

Ferric ferrocyanide (Prussian blue or green ppt)

41. Give the principle involved in the estimation of halogen in an organic compound by carius method.

A known mass of the organic compound is heated with fuming HNO_3 along with $AgNO_3$. C, H & S gets oxidized to CO_2, H_2O, SO_2 and halogen combines with $AgNO_3$ to form a precipitate of silver halide.

$$X \xrightarrow[AgNO_3]{fum.HNO_3} AgX\downarrow$$

The ppt of AgX is filtered, washed, dried and weighed. From the mass of AgX and the mass of the organic compound taken, percentage of halogens are calculated.

42. Give a brief description of the principles of (i) Fractional distillation [JUN-19] (ii) Column chromatography.

(i) Fractional distillation: This is one method to purify and separate liquids present in the mixture having their boiling point close to each other. In the fractional distillation, a fractionating column is fitted with distillation flask and a condenser. A thermometer is fitted in the fractionating column near the mouth of the condenser. This will enable to record the temperature of vapour passing over the condenser. The process of separation of the components in a liquid mixture at their respective boiling points in the form of vapours and the subsequent condensation of those vapours is called fractional distillation. The process of fractional distillation is repeated, if necessary. This method finds a remarkable application in distillation of petroleum, coal-tar and crude oil.

(ii) Column chromatography: This is the simplest chromatographic method carried out in long glass column having a stop cock near the lower end. This method involves separation of a mixture over a column of adsorbent (Stationery phase) packed in a column. In the column a plug of cotton or glass wool is placed at the lower end of the column to support the adsorbent powder. The tube is uniformly packed with suitable absorbent constitute the stationary phase. (Activated aluminum oxides (alumina), Magnesium oxide, starch are also used as absorbents). The mixture to be separated is placed on the top of the adsorbent column. Eluent which is a liquid or a mixture of liquids is allowed to flow down the column slowly. Different components are eluted depending upon the degree to which the components are adsorbed and complete separation takes place. The most readily adsorbed substances are retained near the top and others come down to various distances in the column.

43. Explain paper chromatography.

Paper chromatography (PC) is an example of partition chromatography. The same procedure is followed as in thin layer chromatography except that a strip of paper acts as an adsorbent. This method involves continues differential portioning of components of a mixture between stationary and mobile phase. In paper chromatography, a special quality paper known as chromatography paper is used. This paper act as a stationary phase.

A strip of chromatographic paper spotted at the base with the solution of the mixture is suspended in a suitable solvent which act as the mobile phase. The solvent rises up and flows

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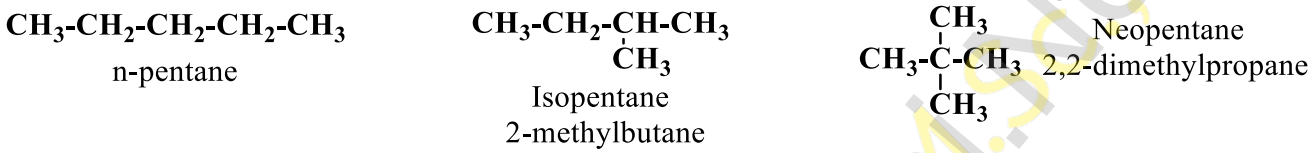
over the spot. The paper selectively retains different components according to their different partition in the two phases where a chromatogram is developed. The spots of the separated colored compounds are visible at different heights from the position of initial spots on the chromatogram. The spots of the separated colorless compounds may be observed either under ultraviolent light or by the use of an appropriate spray reagent.

44. Explain various types of constitutional isomerism (structural isomerism) in organic compounds. [AUG-22]

This type of isomers have same molecular formula but differ in their bonding sequence. Structural or constitutional isomerism is further classified into following types.

Chain or nuclear or skeletal isomerism: These isomers differ in the way in which the carbon atoms are bonded to each other in a carbon chain or in other words isomers have similar molecular formula but differ in the nature of the carbon skeleton (ie. Straight or branched)



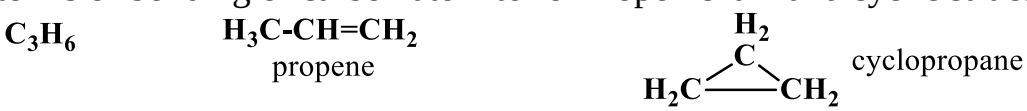
Position isomerism: If different compounds belonging to same homologous series with the same molecular formula and carbon skeleton, but differ in the position of substituent or functional group or an unsaturated linkage are said to exhibit position isomerism.

Functional isomerism: Different compounds having same molecular formula but different functional groups are said to exhibit functional isomerism.

Metamerism: [CRT-22] This type of isomerism is a special kind of structural isomerism arises due to the unequal distribution of carbon atoms on either side of the functional group or different alkyl groups attached to the either side of the same functional group and having same molecular formula. This isomerism is shown by compounds having functional group such as ethers, ketones, esters and secondary amines between two alkyl groups.

Tautomerism: It is a special type of functional isomerism in which a single compound exists in two readily inter convertible structures that differ markedly in the relative position of atleast one atomic nucleus, generally hydrogen.

Ring chain isomerism: In this type of isomerism, compounds having same molecular formula but differ in terms of bonding of carbon atom to form open chain and cyclic structures for eg:



45. Describe optical isomerism with suitable example. [MAY-22]

Compounds having same physical and chemical property but differ only in the rotation of plane of the polarized light are known as optical isomers and the phenomenon is known as optical isomerism.

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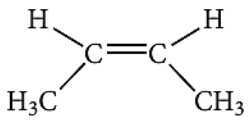
The optical isomer, which rotates the plane of the plane polarised light to the right or in clockwise direction is said to be dextro rotatary (dexter means right) denoted by the sign (+), whereas the compound which rotates to the left or anticlockwise is said to be leavo rotatary (leavues means left) denoted by sign(-). Dextrorotatory compounds are represented as 'd' or by sign (+) and lavorotatory compounds are represented as 'l' or by sign (-).

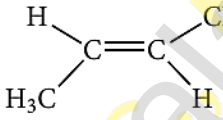
46. Briefly explain geometrical isomerism in alkene by considering 2-butene as an example. [SEP-20]

Geometrical isomers are the stereoisomers which have different arrangement of groups or atoms around a rigid frame work of double bonds. This type of isomerism occurs due to restricted rotation of double bonds, or about single bonds in cyclic compounds.

In alkenes, the carbon-carbon double bond is sp^2 hybridized. The carbon-carbon double bond consists of a σ bond and a π bond. The σ bond is formed by the head on overlap of sp^2 hybrid orbitals. The π bond is formed by the side wise overlap of 'p' orbitals. The presence of the π bond lock the molecule in one position. Hence, rotation around C=C bond is not possible. This restriction of rotation about C-C double bond is responsible for geometrical isomerism in alkenes.



cis - 2-butene



Trans 2-butene

These two compounds are termed as geometrical isomers and are distinguished from each other by the terms cis and trans. The cis isomer is one in which two similar groups are on the same side of the double bond. The trans isomers is that in which the two similar groups are on the opposite side of the double bond, hence this type of isomerism is often called cis-trans isomerism.

47. 0.30g of a substance gives 0.88g of carbon dioxide and 0.54g of water calculate the percentage of carbon and hydrogen in it. [HY-22]

Weight of organic compound = 0.30 g; Weight of CO_2 = 0.88 g; Weight of water = 0.54 g

Percentage of carbon: 44 g of carbondioxide contains, carbon = 12 g

0.88 g of carbon dioxide contains, carbon = $\frac{12 \times 0.88}{44}$ g

0.30 g substance contains, carbon = $\frac{12 \times 0.88}{44 \times 0.30}$ g

100 g substance Contains = $\frac{12 \times 0.88}{44 \times 0.30} \times 100$g = **80 g** of carbon Percentage of carbon = **80 %**

Percentage of hydrogen: 18 g of water contains, hydrogen = 2 g

0.54 g of water contains, hydrogen = $\frac{2 \times 0.54}{18}$ g

0.30 g of substance contains hydrogen = $\frac{2 \times 0.54}{18 \times 0.30}$ g

100 g of substance contains = $\frac{2 \times 0.54}{18 \times 0.30} \times 100$ g = **20 g** of hydrogen % of hydrogen = **20 %**

48. The ammonia evolved from 0.20g of an organic compound by Kjeldahl method neutralised 15ml of N/20 sulphuric acid solution. Calculate the percentage of Nitrogen.

W. of organic compound = 0.20g; Vol. of H_2SO_4 = 15 ml; strength of H_2SO_4 taken =N/20=0.05N

Percentage of nitrogen = $\frac{14 \times N\,V}{1000 \times w} \times 100 = \frac{14 \times 0.05 \times 15}{1000 \times 0.20} \times 100 = \frac{1050}{200} =$ **5.25%**

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49. 0.32g of an organic compound, after heating with fuming nitric acid and barium nitrate crystals is a sealed tube game 0.466g of barium sulphate. Determine the percentage of sulphur in the compound.

Mass of the substance taken = 0.32 g; Mass of $BaSO_4$ formed = 0.466 g;

Molecular mass of $BaSO_4$ = 137 + 32 + 64 = 233g

Then, mass of Sulphur in 0.466 g of $BaSO_4$ = $\frac{0.466\times32}{233}$

Percentage of Sulphur in compound = $\frac{0.466\times32\times100}{233\times0.32}$ = **20 %**

50. 0.24g of an organic compound gave 0.287g of silver chloride in the carius method. Calculate the percentage of chlorine in the compound.

Mass of organic compound = 0.24 g; Mass of silver chloride = 0.287 g;

143. 5 g AgCl contains = 35.5 g chlorine; 0.287 g of AgCl contains = $\frac{35.5}{143.5}\times$ 0.287

Percentage of chlorine = $\frac{35.5\times0.287}{143.5\times0.24}\times 100$ = **29.58 %**

51. In the estimation of nitrogen present in an organic compound by Dumas method 0.35g yielded 20.7ml of nitrogen at 150C and 760mm pressure. Calculate the percentage of nitrogen in the compound.

Volume of N_2 at NTP = $\frac{V\times P}{t+273}\times\frac{273}{760}$ = V_0 ml

Substituting the various values in the above equation, V_0 = $\frac{20.7\times760}{288}\times\frac{273}{760}$ = **19.62 ml**

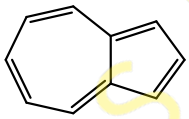
Weight of 19.62 ml of Nitrogen = $\frac{28}{22400}\times$ 19.62 g

∴ Percentage of Nitrogen = $\frac{28}{22400}\times 19.62\times\frac{100}{0.35}$ = **4.9 %**

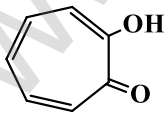
EVALUATE YOURSELF

1. Give two examples for each of the following type of organic compounds. (i) non-benzonoid aromatic, (ii) aromatic heterocyclic, (iii) alicyclic (or) carbocyclic compound and (iv) aliphatic open chain. [AUG-22]

(i) non-benzonoid aromatic compound

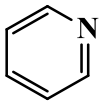


azulene

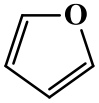


tropolone

(ii) aromatic heterocyclic compound



pyridine



furan

(iii) alicyclic (or) carbocyclic compound

cyclopentane

cyclohexane

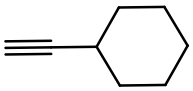
(iv) aliphatic open chain compound

CH_3-CH_2-CH_2-CH_2-CH_3 n-pentane

CH_3-CH_2-CH_2-OH 1-propanol

2. Write structural formula for the following compounds (i) cyclohexa-1,4-diene, (ii) ethynylcyclohexane

cyclohexa-1,4-diene



ethynylcyclohexane

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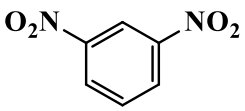
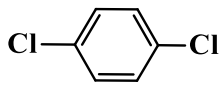
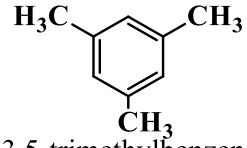
3. Write structural formula for the following compounds (i) m-dinitrobenzene, (ii) p-dichlorobenzene, (iii) 1,3,5-trimethylbenzene [MAR-19, QY-22]



m-dinitrobenzene



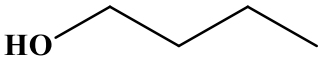
p-dichlorobenzene



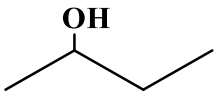
1,3,5-trimethylbenzene

4. Write all the possible isomers of molecular formula $C_4H_{10}O$ and identify the isomerisms found in them.

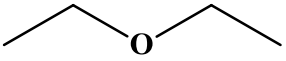
Positional isomerism:



butan-1-ol



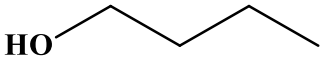
butan-2-ol



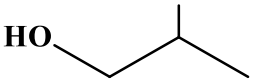
ethoxyethane

methoxypropane

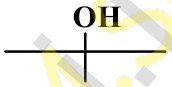
Chain isomerism:



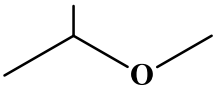
butan-1-ol



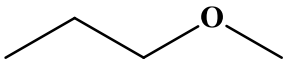
2-methylpropanol



2-methyl-2-propanol

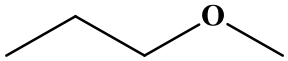


2-methoxypropane



methoxypropane

butan-1-ol



methoxypropane

Functional isomerism:

5. 0.2346g of an organic compound containing C, H & O, on combustion gives 0.2754g of H_2O and 0.4488g CO_2. Calculate the % composition of C, H & O in the organic compound [C=52.17, H = 13.04, O = 34.79]

Weight of organic substance (w) = 0.2346g; Weight of water (x) = 0.2754g;

Weight of CO_2 (y) = 0.4488g

Percentage of carbon = $\frac{12}{24} \times \frac{y}{w} \times 100 = \frac{12}{24} \times \frac{0.4488}{0.2346} \times 100 =$ **52.17%**

Percentage of hydrogen = $\frac{2}{18} \times \frac{y}{w} \times 100 = \frac{2}{18} \times \frac{0.2754}{0.2346} \times 100 =$ **13.04%**

Percentage of oxygen = 100 – (52.17 + 13.04) = 100 – 65.21 = **34.79%**

6. 0.16 g of an organic compound was heated in a carius tube and H_2SO_4 acid formed was precipitated with $BaCl_2$. The mass of $BaSO_4$ was 0.35g. Find the percentage of sulphur

Weight of organic substance (w) = 0.16g; Weight of Barium sulphate (x) = 0.35g;

Percentage of Sulphur = $\frac{32}{233} \times \frac{x}{w} \times 100 = \frac{32}{233} \times \frac{0.35}{0.10} \times 100 =$ **30.04%**

7. 0.185 g of an organic compound when treated with Conc. HNO_3 and $AgNO_3$ gave 0.320 g of silver bromide. Calculate the % of bromine in the compound. (Ag =108, Br = 80)

Weight of organic substance (w) = 0.185g; Weight of Silver bromide (x) = 0.320g;

Percentage of Bromine = $\frac{80}{188} \times \frac{x}{w} \times 100 = \frac{80}{188} \times \frac{0.32}{0.185} \times 100 =$ **73.6%**

8. 0.40 g of an iodo-substituted organic compound gave 0.235 g of AgI by carius method. Calculate the percentage of iodine in the compound. (Ag = 108, I = 127)

Weight of organic substance (w) = 0.40g; Weight of the Silver iodide (x) = 0.235g;

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Percentage of Iodine = $\frac{127}{235}$ x $\frac{x}{w}$ x 100 = $\frac{127}{235}$ x $\frac{0.235}{0.40}$ x 100 = **31.75%**

9. 0.33g of an organic compound containing phosphorous gave 0.397g of $Mg_2P_2O_7$ by the analysis. Calculate the % of P in the compound (MFW of $Mg_2P_2O_7$ is 222, P = 31)

Weight of organic substance (w) = 0.33g; Weight of $Mg_2P_2O_7$ (x) = 0.397g;

Percentage of Phosphorous = $\frac{62}{222}$ x $\frac{x}{w}$ x 100 = $\frac{62}{222}$ x $\frac{0.397}{0.33}$ x 100 = **33.59%**

10. 0.3 g of an organic compound on kjeldahl's analysis gave enough ammonia to just neutralize 30 mL of 0.1N H_2SO_4. Calculate the percentage of nitrogen in the compound. [FRT-23]

Weight of organic compound (w) = 0.3g; Strength of sulphuric acid used (N) = 0.1N;

Volume of sulphuric acid used (v) = 30mL;

Percentage of nitrogen = $\frac{14 \times N\,V}{1000 \times w} \times 100 = \frac{14 \times 0.1 \times 30}{1000 \times 0.3} \times 100 = \frac{4400}{300}$ = **14.3%**

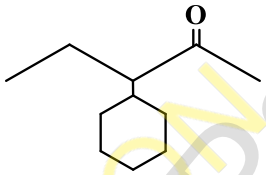
GOVERNMENT QUESTIONS AND ANSWERS

1. How would you detect the percentage of sulphur in an organic compound? [HY-18]

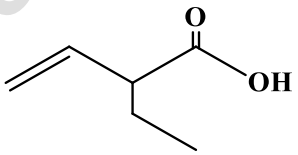
Oxidation test: The organic substances are fused with a mixture of KNO_3 and Na_2CO_3. The sulphur, if present is oxidized to sulphate.

$$Na_2CO_3 + S + 3O \longrightarrow Na_2SO_4 + CO_2$$

2. Give the structural formulae of the following compounds, (i) 3-cyclohexylpentan-2-one, (ii) 2-ethylbut-3-enoic acid [HY-18]



3-cyclohexylpentan-2-one



2-ethylbut-3-enoic acid

3. Which is the suitable method for detection of N_2 present in food and fertilizers? [MAR-19]

Kjeldahls method: This method is carried much more easily than the Dumas method. It is used largely in the analysis of foods and fertilizers. Kjeldahls method is based on the fact that when an organic compound containing nitrogen is heated with Conc. H_2SO_4, the nitrogen in it is quantitatively converted to ammonium sulphate. **[JUN-19]**

4. How do you detect the presence of nitrogen and sulphur together in an organic compound?

If both N & S are present, a blood red colour is obtained due to the following reactions.

$$Na + C + N + S \xrightarrow{Heat} \underset{\text{sodium sulphocyanide}}{NaCNS}$$

$$3NaCNS + FeCl_3 \longrightarrow \underset{\text{ferric sulphocyanide}}{Fe(CNS)_3} + 3NaCl \quad \textbf{(Blood red colour)}$$

5. Give the general formula for the following class of organic compounds. (a) Alkanes (b) Alkenes (c) Alkynes [SEP-21]

(a) Alkanes - $\mathbf{C_nH_{2n+2}}$ (b) Alkenes - $\mathbf{C_nH_{2n}}$ (c) Alkynes - $\mathbf{C_nH_{2n-2}}$

6. Why the Trans isomer is more stable than the Cis isomer. [CRT,HY-22]

Generally the trans isomer is more stable than the corresponding cis isomers. This is because in the cis isomer, the bulky groups are on the same side of the double bond. The streric

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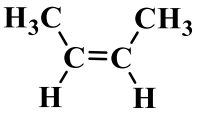
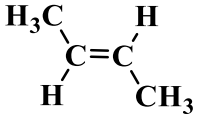
repulsion of the groups makes the cis isomers less stable than the trans isomers in which bulky groups are on the opposite side.

7. Identify the cis and trans isomers for the following compounds. [MAR-19]



Cis-2-butene



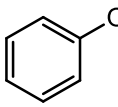
Trans-2-butene

8. Write the IUPAC Name/Molecular formula for the first four members of alcohol. [HY-19]

Name of the Member	Molecular Formula	IUPAC Name	Structural Formula
Methyl alcohol	CH_3OH	Methanol	CH_3-OH
Ethyl alcohol	C_2H_5OH	Ethanol	CH_3-CH_2-OH
Propyl alcohol	C_3H_7OH	Propanol	CH_3-CH_2-CH_2-OH
Butyl alcohol	C_4H_9OH	Butanol	CH_3-CH_2-CH_2-CH_2-OH

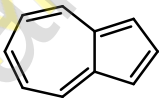
9. Give an example for Benzenoid compound and Non-Benzenoid compound. [HY-19]

Benzenoid/aromatic homocyclic



phenol

Non-Benzenoid/aromatic homocyclic



azulene

10.Explain the stepwise purification of a solid organic compound through crystallization.[SEP20]

It is the most widely used method for the purification of solid organic compound. This process is carried out in by the following step

(i) Selection of solvent: Most of the organic substances being covalent do not dissolve in polar solvents like water, hence selection of solvent (suitable) becomes necessary. Hence the powdered organic substance is taken in a test tube and the solvent is added little by little with constant stirring and heating, till the amount added is just sufficient to dissolve the solute (ie) organic compound. If the solid dissolves upon heating and throws out maximum crystals on cooling, then the solvent is suitable. This process is repeated with other solvents like benzene, ether, acetone and alcohol till the most suitably one is sorted out.

(ii) Preparation of solution: The organic substance is dissolved in a minimum quantity of suitable solvent. Small amount of animal charcoal can be added to decolorize any colored substance. The heating may be done over a wire gauze or water bath depending upon the nature of liquid (ie) whether the solvent is low boiling or high boiling.

(iii) Filtration of hot solution: The hot solution so obtained is filtered through a fluted filter paper placed in a funnel.

(iv) Crystallization: The hot filtrate is then allowed to cool. Most of the impurities are removed on the filter paper, the pure solid substance separate as crystal. When copious amount of crystal has been obtained, then the crystallization is complete. If the rate of crystallization is slow, it is induced either by scratching the walls of the beaker with a glass rod or by adding a few crystals of the pure compounds to the solution.

(v) Isolation and drying of crystals: The crystals are separated from the mother liquor by filtration. Filtration is done under reduced pressure using a Bucher funnel. When the whole of

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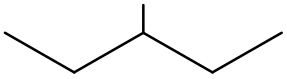
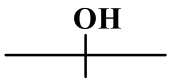
the mother liquor has been drained into the filtration flask, the crystals are washed with small quantities of the pure cold solvent and then dried.

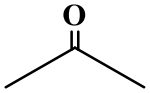
11.Give the structure for the following compounds: (i) 3-methylpentane, (ii) 2-methylpropn-2-ol (iii) Propanone [SEP-21]



3-methylpentane



2-methylpropan-2-ol



Propanone

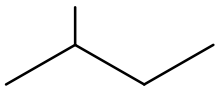
12.0.284 g of an organic substance gave 0.287 g AgCl in a carius method for the estimation of halogen. Find the Percentage of Cl in the compound. [QY-22]

Weight of the organic substance = 0.284 g; Weight of AgCl is = 0.287 g;

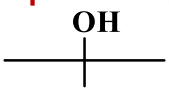
143.5 g of AgCl contains 35.5 g of chlorine

0.287 g of AgCl contains $\frac{35.5}{143.5} \times \frac{0.287}{0.284}$; % of chlorine is $\frac{35.5}{143.5} \times \frac{0.287}{0.284} \times 100 =$ **24.98%**

13.Write the IUPAC name of the following compounds? [HY-22]



2-methylbutane



2-methyl-2-propanol

cyclobutene

14.Identify the functional group in the following compound. (a) propan-2-one, (b) methoxyethane [FMT-22]

a) propan-2-one - Ketone b) methoxyethane - Ether

15.Write IUPAC names for (i) Acetaldehyde, (ii) Ethyl alcohol [FMT-22]

(i) Acetaldehyde - CH_3-CHO - Ethanal

(ii) Ethyl alcohol - CH_3-CH_2-OH - Ethanol

16.Explain sublimation process with example. [FMT-22]

Few substances when heated pass directly from solid to vapour without melting (i.e., liquid). On cooling the vapours will give back solids. Such phenomenon is called sublimation. It is a useful technique to separate volatile and non-volatile solid. It has limited application because only a few substance will sublime.

Example: benzoic acid, naphthalene and camphor

17.Give IUPAC names for the following organic compounds. (i) CH_3-$CH(CH_3)$-CH_2-OH, (ii) $(CH_3)_2$CH-CH=CH_2, (iii) $(CH_3)_2$CH-CH_2-$CH(CH_3)$-$CH(CH_3)_2$ [CRT-23]

(i) CH_3-$CH(CH_3)$-CH_2-OH - 2-methylpropanol

(ii) $(CH_3)_2$CH-CH=CH_2 - 3-methylbut-1-ene

(iii) $(CH_3)_2$CH-CH_2-$CH(CH_3)$-$CH(CH_3)_2$ - 1,2,5-trimethylhexane

18.Give IUPAC names for the following organic compounds. (i) CH_3- CH_2-COOH, (ii) CH_3-CH_2-CO-CH_2-CH_3, (iii) CH_3-CH_2-CH_2-$N(CH_3)_2$ [MAR-24]

(i) CH_3- CH_2-COOH - Propanoic acid

(ii) CH_3-CH_2-CO-CH_2-CH_3 - 2-pentanone

(iii) CH_3-CH_2-CH_2-$N(CH_3)_2$ - N,N-dimethylpropan-1-amine