Chapter 12: Carbon & its compounds

C12

(A) Carbon

1. **Mention the properties of carbon.**

   Carbon is a non-metal

   It is the first member of group 14 of periodic table.

   Its valency is four.

2. **What happens when?**

   a) A little sugar is heated in a spatula

   It turns black indicating that it contains carbon.

   b) Chapati or roti is over heated.

   It turns black indicating the presence of carbon.

   c) A small quantity of milk is continuously boiled.

   It gets charred indicating the presence of carbon in it.

   d) A small quantity of sand is heated.

   It gets hot but not black indicating the absence of carbon.

3. **Why are carbon-based compounds lumped together as a separate subject within the study of chemistry?**

   Carbon is a unique element. It is the king of versatility. Its ability to connect with other carbon atoms through strong and stable covalent bonds sets it apart from other elements. Carbon forms an exceptionally large number of compounds because of its unique characteristics like catenation, tetravalency and isomerism. Therefore carbon-based compounds lumped together as a separate subject within the study of chemistry.

4. **Will carbon as an atom interact with other atoms to form ionic or covalent bonds?**

   Carbon as an atom interacts with other atoms to from covalent bonds.

5. **What is allotropy?**

   Allotropy is the property of elements which have same chemical properties but different physical properties.

6. **Name the allotropic forms of carbon**

   Crystalline carbon – Diamond & graphite

   Amorphous carbon

7. **Why is diamond hard whereas graphite soft even through both are crystalline forms of carbon?**

   The reason for difference is because of arrangement of carbon atoms.

8. **Mention the uses of graphite.**

   a) Graphite is used as lead in pencils.
   b) It is used as a pigment.
   c) It is used as a moulding material in glass manufacture.
   d) It is used as electrode in batteries, electroplating and electroforming.
   e) It is used in brushes of electric motors
   f) It is used as a neutron moderator in nuclear reactors.

9. Why is carbon a unique element?

Carbon is the king of versatility.

It has the ability to connect with other carbon atoms through strong and stable covalent bonds.

10. How is carbon able to form large number of compounds?

Carbon is able to form thousands of compounds because of its unique characteristics like catenation, tetravalency and isomerism.

11. What are the two properties of carbon which lead to the formation of a large number of carbon compounds?

Catenation and isomerism

12. What is meant by catenation?

The unique ability of carbon to form bonds with other atoms of carbon is called catenation.

13. Mention the type of chain formed by carbon.

a) Straight chain b) Branched chain c) Closed chain

14. Why cannot thousands of compounds of Boron or silicon or germanium not possible?

Even though B-B, Si-Si, Ge-Ge bonds exits, these compounds are unstable and very reactive and do not last long.

15. Write the electronic configuration of carbon atom when it is in ground state.

The electronic configuration of carbon atom in ground state is $1s^2$, $2s^2$, $2p^2$

16. Write the excited state electronic configuration of carbon atom.

$1s^2$, $2s^1$ $2px^1$ $2py^1$ $2pz^1$

17. Why is carbon tetravalent?

Carbon has four electrons in its outermost orbit, so its valency is four.

The electronic configuration of carbon is $1s^2$, $2s^2$, $2p^2$

It has 2 paired and 2 unpaired electrons. On excitation, one electron from 2s level is promoted to 2p level thus there will be four unpaired electrons. Hence carbon is tetravalent.

18. What is isomerism?

The phenomenon in which organic compounds have same molecular formula with different structural arrangement of atoms in them is known as isomerism.

19. What are the properties of isomers?

a) Isomers have same molecular formula.

b) They have different structural arrangement.

c) They have different physical and chemical properties.

20. What do you call the compounds having the same molecular formula but different structural arrangements of atoms?

Isomers

21. Name some elements which exhibit isomerism.

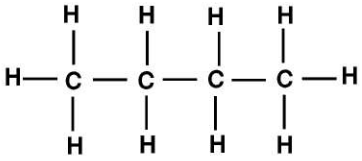
Butane, Pentane

22. Why do first three alkanes methane, ethane and propane have no isomers?

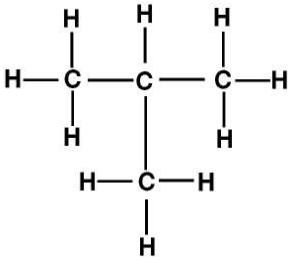
Methane (CH_4), ethane (C_2H_6) and propane (C_3H_8) have no scope for branching of C – C chain hence they do not exhibit isomerism.

23. Write the isomers of butane.

Molecular formula of Butane is C_4H_{10}. It has two isomers n-Butane and Iso-butane.

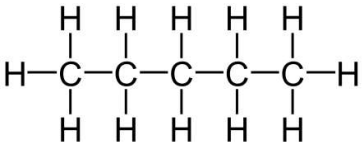


n-butane

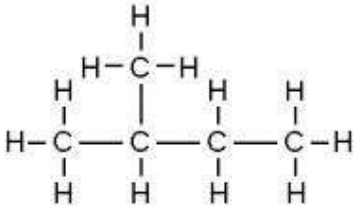


Iso-butane

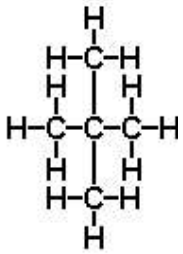
24. Write the isomers of pentane (C_5H_{12}).



n-pentane



Iso-pentane



Neo-pentane

25. What is the vital force theory?

In 1827 Berzelius put forward the vital force theory to account for the formation of organic compounds. According to this theory – Organic compounds were synthesized in living systems under the influence of a vital force.

26. Which was the first organic compound to be prepared?

In 1828 Friedrich Wohler prepared urea, a typical product of animal metabolism by heating an aqueous solution of an inorganic compound ammonium cyanate which is obtained from non-living material.

27. Organic compounds are formed under some vital force. True or false. Explain.

Organic compounds are not formed under vital force is false because earlier they thought that organic compounds could not be prepared in the laboratory. In 1828 Friedrich Wohler prepared urea, a typical product of animal metabolism by heating an aqueous solution of

an inorganic compound ammonium cyanate which is obtained from non-living material. This disproved that organic compounds are formed under some vital force.

28. Which events disproved the vital force theory of Berzelius? OR Why was vital force theory rejected?

The synthesis of urea by Friedrich Wohler, acetic acid by Kolbe and methane by Berthellot disproved the vital force theory.

29. Why are Calcium Carbide (CaC_2), Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen cyanide (HCN) and calcium carbonate ($CaCO_3$) classified as inorganic compounds through they contain carbon?

These compounds contain only one or two carbon atoms per formula unit and contain no carbon-carbon (C-C) bonds or carbon-hydrogen bonds. Hence they are classified as inorganic compounds.

30. Who suggested the classification of chemical compounds as inorganic and organic?

J.J.Berzelius

31. Mention the differences between organic and inorganic compounds.

Sl. No	Property	Organic compounds	Inorganic compounds
1	Melting & Boiling points	Low, generally volatile	High, generally non-volatile
2	Nature of bonding	covalent	ionic
3	Solubility	insoluble in water, soluble in organic solvents	soluble in water, insoluble in organic solvents
4	Combustibility	almost all burn	very few burn
5	Nature of reaction	slower & molecular	very fast reactions
6	Homology & Isomerism	is common	is not common

32. What is organic chemistry?

Organic chemistry is the study of compounds and reactions involving carbon. OR It is the study of chemistry of carbon compounds of both natural and synthetic origin.

33. Name three typical organic compounds commonly present in our food.

Starch, sugar, citric acid, cooking oil etc.

34. Write a note on the significance of organic chemistry.

Organic chemistry is used in biochemistry especially in the pharmaceutical industry and petro-chemistry.

It is used as dyes, flavours, detergents, perfumes, cosmetics.

(B) Hydrocarbons

35. What are hydrocarbons?

Hydrocarbons are the simplest binary organic compounds containing carbon and hydrogen.

36. Why are hydrocarbons currently the main source of world's electrical energy and heat source?

The energy produced when burnt often this energy is used directly as heat as in home heaters which use either oil or natural gas.

37. On the basis of structure, how are hydrocarbons classified?

Based on the structure, hydrocarbons are classified into:

a) Open chain or acyclic compounds.

b) Closed chain or cyclic or ring compounds.

38. What are aliphatic or acyclic or open chain hydrocarbons?

The hydrocarbons which consist of straight or branched chains of carbon atoms are called aliphatic or acyclic hydrocarbons.

39. How are aliphatic hydrocarbons classified?

Aliphatic hydrocarbons are classified into saturated and unsaturated hydrocarbons.

40. What are saturated hydrocarbons?

Aliphatic hydrocarbons are the simplest hydrocarbons which have single bond between carbon atoms.

41. What are alkanes?

Alkanes are saturated hydrocarbons in which the carbon atoms are connected by only single bond.

Ex: Methane, Ethane, Propane

42. Give reason: Ethane is a saturated hydrocarbon.

Ethane is said to be saturated hydrocarbon since each molecule has no carbon-to-carbon double bond and has the maximum possible number of hydrogen atoms.

43. Mention the characteristics of alkanes.

a) In alkanes the carbon atoms are bonded with maximum number of hydrogen atoms.

b) They have single bond between carbon atoms.

c) Their general formula is C_nH_{2n+2}

d) The primary suffix of these hydrocarbons is 'ane'.

44. Why are alkanes referred to as paraffins?

Paraffin is derived from the Latin word meaning 'less activity'. Alkanes are compounds which undergo few reactions. Hence they are referred to as paraffins.

45. Why is methane referred to as 'marsh gas'?

Methane is formed in marshy places by bacterial decomposition of the vegetable matter. Hence it is called marsh gas.

46. Give reason: Alkanes are chemically stable.

In alkanes all carbon atoms are bonded to the maximum number of hydrogen atoms. They are made up single bond between carbon atoms and are saturated with hydrogen in every bond is used. Hence they are chemically stable.

47. Write the molecular formulae of the third and fifth member of homologous series of carbon compounds represented by the general formula C_nH_{2n+2}

Third member n = 3, $C_3H_{2x3+2} = C_3H_8$

Fifth member n = 5, $C_5H_{2x5+2} = C_5H_{12}$

48. What does IUPAC represent?

IUPAC stands for **I**nternational **U**nion of **P**ure and **A**pplied **C**hemistry.

49. Briefly explain the structure of methane.

The molecular formula of methane is CH4. It is the first member of alkanes or the saturated hydrocarbons.

In methane, each carbon is bonded to four other atoms through single covalent bond. The following is the structure of methane.

50. Explain the laboratory method of preparation of Methane.

A mixture of sodium acetate and soda lime (NaOH + CaO) is heated in a hard glass test tube and methane gas is evolved. It is collected by the downward displacement of water.

$CH_3COONA + NaOH \xrightarrow{CaO} Na_2CO_3 + CH_4$

51. Draw a neat diagram of the laboratory manufacture of methane.

52. Why is methane gas collected by the downward displacement of water?

Methane gas is collected by the downward displacement of water because it is insoluble in water.

53. Mention the physical properties of methane.

a) Methane is colourless, odourless gas.

b) It is lighter than air.

c) It is slightly soluble in water and favourable soluble in organic solvents like alcohol and ether.

54. Mention the chemical properties.

a) Methane being saturated is chemically inert.

b) It is not attacked acids, alkalies and oxidising agents like concentrated sulphuric acid, nitric acid and potassium permanganate.

55. What happens when:

a) When a mixture of sodium acetate and soda lime is heated in a hard glass test tube.

Methane gas is evolved.

$CH_3COONA + NaOH \xrightarrow{CaO} Na_2CO_3 + CH_4$

b) Methane is burnt in air or oxygen or methane undergoes complete combustion.

It forms carbon dioxide and water.

$CH_4 + 2O_2 \longrightarrow CO_2 + H_2O$

c) Methane gas burns with yellow flame or methane undergoes incomplete combustion.

It forms carbon monoxide and water.

$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$

d) A mixture of methane and chlorine is exposed to ultraviolet light (sunlight).

Organic product chloromethane is formed

$CH_4 + Cl_2 \xrightarrow{UV} CH_3Cl + HCl$

56. Write about the combustibility of methane.

a) Complete combustion:

During complete combustion methane burns in air or oxygen with a non-luminous flame, forming carbon dioxide and water.

$CH_4 + 2O_2 \longrightarrow CO_2 + H_2O$

b) Incomplete combustion:

During incomplete combustion, methane gas burns with yellow flame, carbon particles are seen.

Methane + Oxygen $\longrightarrow$ Carbon monoxide + Water

$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$

57. Complete and balance the following equation:

a) $CH_4 + O_2 \longrightarrow$

b) $CH_4 + Cl_2 \xrightarrow{UV}$

58. State two disadvantages of incomplete combustion.

Incomplete combustion leads to unburnt carbon in the form of soot which pollutes the atmosphere, blackens cooking utensils.

It leads to the formation of extremely poisonous gas called carbon monodioxide.

59. What is meant by substitution reaction?

The reaction in which one or more hydrogen atoms of a hydrocarbon are replaced by some other atoms is called substitution reaction.

60. Name the product obtained when methane and chlorine is exposed to ultraviolet light (sunlight).

When a mixture of methane and chlorine is exposed to ultraviolet light, chloromethane is formed.

$$CH_4 + Cl_2 \xrightarrow{UV} CH_3Cl + HCl$$

61. How is dichloromethane formed?

When two hydrogen atoms of a methane molecule is replaced by chlorine, dichloromethane is formed.

$$CH_3Cl + Cl_2 \xrightarrow{UV} CH_2Cl_2 + HCl$$

62. How is trichloromethane formed?

When three hydrogen atoms of a methane molecule is replaced by chlorine, trichloromethane is formed.

$$CH_2Cl_2 + Cl_2 \xrightarrow{UV} CHCl_3 + HCl$$

63. How is tetrachloromethane or carbon tetrachloride formed?

When four hydrogen atoms of a methane molecule is replaced by chlorine, tetrachloromethane is formed.

$$CHCl_3 + Cl_2 \xrightarrow{UV} CCl_4 + HCl$$

64. What is homologous series?

A homologous series is a family of organic compounds with the same general formula, similar chemical properties and successive members differing by – CH_2.

65. Name the homologous series of aliphatic hydrocarbons.

Aliphatic hydrocarbons have three homologous series – Alkanes, Alkenes and Alkynes

66. State the characteristics of members of a homologous series.

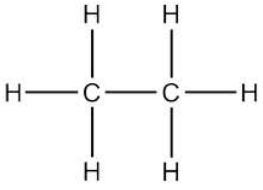
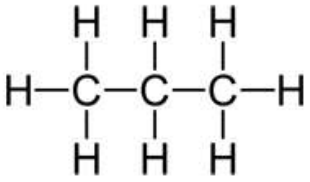
a) They have properties that vary in a regular and predictable manner.
b) They have similar chemical properties.
c) They have gradually varying physical properties.
d) Their formula fit the general molecular formula
e) The adjacent members CH_4 and C_2H_6 or C_5H_{12} and C_6H_{14} differ by one carbon and two hydrogen.

67. Write the next homologue of Methane and Pentane

Methane is CH_4 next homologue is $CH_4 + CH_2 = C_2H_6$ (Ethane)

Pentane is C_5H_{12}, next homologue is $C_5H_{12} + CH_2 = C_6H_{14}$ (Hexane)

68. Give the names and structural formulae of next two higher homologues of methane.

Ethane C_2H_6  and Propane C_3H_8 

69. What is unsaturated hydrocarbon?

A hydrocarbon in which the two carbon atoms are connected by a double bond or a triple bond is called unsaturated hydrocarbon.

Ex: Alkenes and Alkynes

70. Mention the differences between saturated and unsaturated hydrocarbons.

Saturated hydrocarbons	Unsaturated hydrocarbons
1. Hydrocarbons in which carbon atoms are linked by single covalent bonds.	1. Hydrocarbons in which carbon atoms are linked by double and triple covalent bonds.
2. Names of these hydrocarbons end with 'ane'.	2. Names of these hydrocarbons end with 'ene' or 'yne'

71. What are alkenes?

Alkenes are unsaturated hydrocarbons in which the two carbon atoms are connected by double bond.

The name of these hydrocarbons end with 'ene'.

Their general formula is C_nH_{2n}.

They are referred to as olefins.

Ex: Ethene, Propene, Butene etc

72. How is double bond formed in alkenes?

In alkenes, two hydrogen atoms are less when compared to the saturated hydrocarbons. The two of the carbon atoms in the molecule is joined together by two covalent bonds. Thus a double bond is formed.

73. Give reason: Ethene is said to be unsaturated.

Ethene is said to be unsaturated because each molecule does have carbon-to-carbon double bond and has less maximum possible number of hydrogen atoms.

74. The general formula of a homologous series of carbon compounds is C_nH_{2n}. Write the molecular formula of the second and fourth member of the series.

Second member is n=3, $C_3H_{2x3} = C_3H_6$

Fourth member is n=5, $C_5H_{2x5} = C_5H_{10}$

75. What are alkynes?

Alkynes are unsaturated hydrocarbons that contain one triple bond between carbon atoms.

The name of these hydrocarbons end with 'yne'.

Their general formula is C_nH_{2n-2}.

Ex: Ethyne, Propyne etc.

76. Give the general name of the class of compounds having the general formula C_nH_{2n-2}. Write the first member of this homologous series.

Alkynes. The first member is Ethyne.

77. Compare the characteristics of alkanes, alkenes and alkynes.

Alkanes	Alkenes	Alkynes
They are saturated	They are unsaturated	They are unsaturated
They have single bond between carbon atoms	They have double bond between one of the carbon atoms	They have triple bond between one of the carbon atoms.
Their general formula is C_nH_{2n+2}	Their general formula is C_nH_{2n}	Their general formula is C_nH_{2n-2}
Their names end with 'ane'	Their names end with 'ene'	Their names end with 'yne'

78. Select the hydrocarbons which are members of the same homologous series.

C_5H_{10}, C_3H_8, C_6H_{10}, C_4H_{10}, C_7H_{12}, C_8H_{16}

Alkanes: C_3H_8 and C_4H_{10}, Alkenes: C_5H_{10} and C_8H_{16}, Alkynes: C_6H_{10} and C_7H_{12}

79. Classify the following into saturated and unsaturated hydrocarbons – Benzene, cyclopropane, alkene and alkane, methane, ethene, Propyne, butene

Saturated: Alkane, cyclopropane, methane

Unsaturated: Benzene, alkene, ethene, Propyne, butene

80. Classify the following compounds containing double bond and triple bond – Ethyne, benzene, Butyne, pentene

Double bond: Benzene, pentene

Triple bond: Ethyne, Butyne

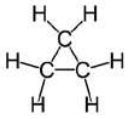
81. Give reason: Alkanes undergo only substitution reactions but alkenes and alkynes undergo both substitution and addition reactions.

Alkenes and alkynes have double and triple bonds, which on breaking can add hydrogen atoms to satisfy the valency.

82. What are Cycloalkanes?

Cycloalkanes are closed chain saturated hydrocarbons having one ring and the general formula C_nH_{2n}.

83. Write the structural formula of the first member of Cycloalkanes.

The first member of the Cycloalkanes is cyclopropane (C3H6). Its structure is 

84. Give reason: Alkenes and Cycloalkanes have same general formula.

Alkenes and Cycloalkanes have same general formula because they have double bond between carbon atoms.

85. Mention the differences between alkenes and Cycloalkanes.

Alkenes	Cycloalkanes
1. They are unsaturated	1. They are saturated
2. They have double bond between carbon atoms	2. They have single bond between carbon atoms.
3. Their name end with 'ene'.	3. Their names end with 'ane'
4. They are acyclic.	4. They are cyclic

86. Even though alkenes and Cycloalkanes have the same general formula, they are different. How?

Alkenes are unsaturated where as Cycloalkanes are saturated.

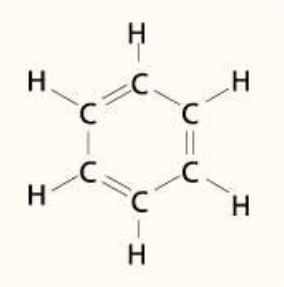
87. What are aromatic hydrocarbons or arenes?

Aromatic hydrocarbons are hydrocarbons that have atleast one aromatic ring (benzene ring).

88. Write the structure of the first member of the aromatic hydrocarbons. OR Explain the structure of benzene.

Benzene is the first member of the aromatic hydrocarbon series.

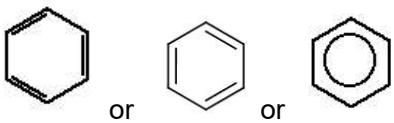
Its molecular formula is C_6H_6. A benzene molecule is made up of 6 carbon atoms and 6 hydrogen atoms. Its structural formula is as shown in the figure. A benzene ring has six carbon atoms with alternate single and double bonds.



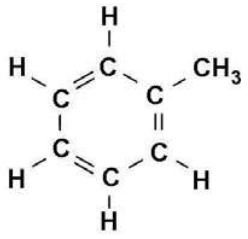
89. Cyclohexane does not belong to aromatic class even though it has a ring structure. How do you justify this?

Cyclohexane is a saturated hydrocarbon in which the carbon atoms are joined by single covalent bonds to form a ring where as in aromatic hydrocarbons have alternate single and double bonds. Hence Cyclohexane is does not belong to aromatic class.

90. Write the different type of representation of structure of benzene.



91. Write the structure of Toluene.



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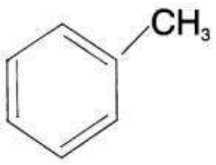
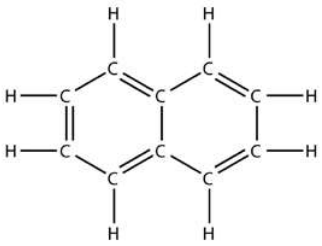


92. Write the structure of Naphthalene.



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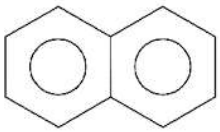


93. Mention the uses of Benzene

a) Benzene is used as solvent for oils, fats, resins, rubber, sulphur, iodine etc.
b) It is used in the manufacture of dyes, drugs, perfumes, explosives etc.
c) It in used in preparation of gammexane, an insecticide.
d) It is used for dry cleaning.

94. Mention the uses of Toluene

a) Toluene is used as a solvent for oils, fats, paints, lacquers, resins etc.
b) It is used in the manufacture of TriNitroToluene (TNT) an explosive.

95. Mention the used of Naphthalene

a) Naphthalene is used as an insecticide in the form of moth balls.
b) It is used in the synthesis of dyes.

(C) Functional Groups

96. What are functional groups?

Derivative hydrocarbons in which one or more hydrogen atoms have been replaced by atom or group of atoms of other elements are called functional groups.

Functional groups are specific groups of atoms or bonds within molecules that are responsible for characteristics chemical reactions.

Functional groups are the sites where reactions occur in organic molecules.

97. On the basics of functional groups present, how are organic compounds classified?

Alkyl / Aryl radical (Less reactive part) and Functional group (Active part)

98. What are alcohols? Write their general formula.

Compounds containing –OH as the functional group are called alcohols. Their general formula is R – OH or $C_nH_{2n+1}OH$

99. Even though NaOH & KOH contains –OH group. It is not included in the group of organic substances. Why?

NaOH and KOH are strong bases which are ionic compound that contain OH ions. Alcohols are covalent compounds, even though they have on or more hydroxyl (-OH) functional group, they do not behave like bases. The – OH group attached to a carbon atom is a covalent bond.

100. Write the molecular formula of first five members of alcohol.

Name of Alcohol	Molecular Formula
1. Methanol	CH_3OH
2. Ethanol	C_2H_5OH
3. Propanol	$CH_3CH_2CH_2OH$ or C_3H_7OH
4. Butanol	C_4H_9OH
5. Pentanol	$C_5H_{11}OH$

101. Write the IUPAC name of the following compounds.

a) C_2H_5OH – Ethanol

b) C_3H_7OH – Propanol

c) C_4H_9OH – Butanol

d) $C_5H_{11}OH$ – Pentanol

102. What are aldehydes? Write their general formula.

Compounds containing –CHO as the functional group are called aldehydes. Their general formula is R – CHO.

103. Write the molecular formula of first five members of aldehydes.

Name of Aldehyde	Molecular Formula
1. Methanal	HCHO
2. Ethanal	CH_3CHO
3. Propanal	CH_3CH_2CHO
4. Butanal	$CH_3CH_2CH_2CHO$
5. Pentanal	$CH_3CH_2CH_2CH_2CHO$

104. What are carboxylic acids? Write their general formula.

Compounds containing –COOH as the functional group are called Carboxylic acids. Their general formula is R – COOH.

105. Write the molecular formula of first five members of carboxylic acid.

Name of carboxylic acid	Molecular Formula
1. Methanoic acid	HCOOH
2. Ethanoic acid	CH_3COOH
3. Propanoic acid	C_2H_5COOH
4. Butananoic acidu	C_3H_7COOH

5. Pentananoic acid	C_4H_9COOH

106. Give the IUPAC name of the following compounds:

a) HCOOH – Methanoic acid

b) CH_3COOH – Ethanoic acid

107. What are amines? Write their general formula.

Compounds containing $–NH_2$ as the functional group are called amines. Their general formula is R $–NH_2$

108. Write the molecular formula of some members of amines.

Name of amine	Molecular Formula
1. Methyl amine	CH_3NH_2
2. Ethyl amine	$C_2H_5NH_2$

109. Name the members of the alkyl groups.

Methyl, ethyl, propyl etc.

110. Name the members of aryl group.

Compounds containing benzene ring are aryl group.

111. Name the functional groups present in the following compounds.

a) CH_3CHO – Aldehyde

b) CH_3CH_2COOH – Carboxylic acid

c) $CH_3CH_2CH_2OH$ – Alcohol

d) Methanal – Aldehyde

e) Methanol – Alcohol

f) Methanoic acid – Carboxylic acid

g) Amino acids – Amines

112. Write the names of the following functional groups:

a) $– C \equiv C –$ Alkyne

b) $C = C$ Alkene

c) – CHO Aldehyde

d) – OH Alcohol

e) – COOH Carboxylic acid

113. Give one example each of the compounds having the following functional groups:

a) Aldehyde group – Methanal

b) Alcohol group – Methanol

c) Carboxylic acid group - Methanoic acid

114. What are amino acids?

Amino acids is a molecule that contains both amino (– NH_2) and carboxylic acid (– COOH) functional groups.

115. Name the simplest and the smallest amino acid found in protein.

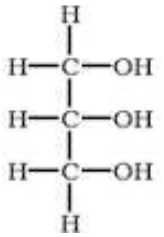
Glycine, Its formula is $H_2N – CH_2 – COOH$

116. What are poly-functional compounds?

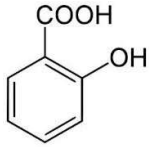
Organic compounds having more than one functional groups are called polyfunctionsl compounds.

Ex: Glycerol, Salicylic acid

117. Write the structure of glycerol or Write the structural formula of the compound having 3 – OH group.



118. Write the structural formula of the compound having one – COOH group.



119. Give reason: Ethanol cannot be called poly-functional compound.

Ethanol has only one functional group – OH.

120. What is glycerol?

Glycerol is a poly functional compound which is obtained as a byproduct of soap. It contains three hydroxyl groups. It is a trihydric alcohol.

121. What is salicylic acid?

Salicylic acid is a poly functional compound which contains one – OH and one – COOH group. It is used in the production of aspirin.

122. Even though Methyl alcohol (CH_3OH) and Ethyl alcohol (C_2H_5OH) contains –OH group. They are not called hydroxides but alcohols. Why?

OR

NaOH is not called as sodium alcohol. Why?

OR

CH_3OH is not called Methyl hydroxide but Methyl alcohol. Why?

In Methyl alcohol and Ethyl alcohol, hydroxyl group is just a group of atoms –OH which is covalently bonded to a carbon atom. In hydroxides –OH is a hydroxyl ion which is formed by ionic bond. Hence methyl alcohol and ethyl alcohol are not called as hydroxides.

(D) Hydrogenation of Oils

123. What are fatty acids?

Long chain alkanes or alkenes if contain a terminal carboxylic acid group(– COOH) are called fatty acids.

124. What are glycerides? How are they formed?

Glycerides are fats or oils. When fatty acids react with trihydric alcohol like glycerol to form ester called glycerides.

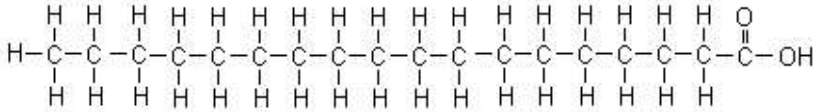
125. How are fats and oils formed?

When fatty acids react with glycerol, fats and oils are formed.

Fatty acid + Glycerol $\xrightarrow{\text{Esterification}}$ Fat/oil + Water

126. Write the molecular formula and structure of Stearic acid.

Stearic acid is a saturated fatty acid. Its molecular formula is $C_{17}H_{35}COOH$. Its structure is



127. Why is Stearic acid a saturated fatty acid?

Stearic acid does not contain double bonds in its carbon atom hence it is a saturated fatty acid.

128. Mention the differences between fats and oils.

Fats	Oils
Fats are mostly saturated	Oils are mostly unsaturated
They are solids at room temperature	They are liquids at room temperature
They are chemically inactive	They are chemically reactive
They are digested slowly	They are digested fast
They have longer shelf life	They have short shelf life
It is easy to transport	It is difficult to transport

129. Give reason:

a) Oils are easy to digest.

Unsaturated oils are easy to digest because they are chemically reactive.

b) Fats are digested slowly.

Fats are saturated, they are chemically inactive hence they are digested slowly.

c) Oils have short shelf life.

Unsaturated oils have short shelf life because they undergo oxidation in air and produce a foul smell.

d) Fats are easy to transport.

Fats are solids at room temperature and have more shelf life as they are chemically inactive. Hence it is easy to transport,

130. What is meant by rancidity of oils?

Rancidity is the process which causes a substance to become rancid, that is, having unpleasant smell or taste.

131. What is meant by hydrogenation of oils?

The process of converting liquid oils into solids saturated fats by passing hydrogen gas through them is called hydrogenation of oils. Finely divided nickel is used as catalyst during the process.

Ex: Vanaspathi

132. What is meant by hydrogenation reaction?

The reactions in which hydrogen atoms are added are called hydrogenation reactions.

Ex: Addition of hydrogen to make Alkyne into Alkene, Addition to hydrogen to make benzene into Cyclohexane.

133. Why is hydrogenation done? OR What is the importance of hydrogenation?

a) Hydrogenated oil has longer shelf life and will not go rancid quickly.

b) It also has a higher melting point and hence used in frying and pastries.

134. Give reason: Hydrogenated Oils are often used in frying and pastries.

Hydrogenated oils have a higher melting point. Hence it is used for frying and pastries.

135. What is meant by saponification?

The process of neutralizing the fatty acids present in oils or fats by adding sodium or potassium hydroxide is called saponification.

136. Explain the steps involved in saponification.

Saponification is the reaction that takes place between oil and sodium hydroxide during the manufacture of soap.

The steps involved are:

1) Hydrolysis of fats or oil into carboxylic acid and glycerol.

2) Neutralization of the fatty acid by sodium hydroxide.

137. What is meant by saponification value?

Saponification value can be defined as the amount of potassium hydroxide in ‘mg’ (milligrams) required to neutralize the fatty acid present in one gram of oil or fat.

138. Why is the knowledge of saponification value of oil important?

Saponification value helps the manufacturer of soap to prepare soap which does not contain excess of potassium hydroxide.

139. Mention the importance of fats and oils?

a) Fats and oils are sources of food in which vitamin A, D, E & K are soluble.
b) It is also a source of light for tribal people.
c) Eskimos use animal fat as a source of light in their igloos.
d) It is also used as a source of heat.

140. How are paraffin wax and beeswax different?

Paraffin wax is a hydrocarbon. Beeswax, a natural wax is mainly made of esters of fatty acids and various long chain alcohols.

141. Mention the uses of beeswax.

Beeswax is used in cosmetics, preparation of drip less candles and skin ointments.

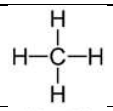
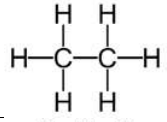
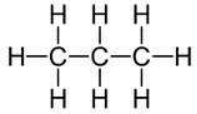
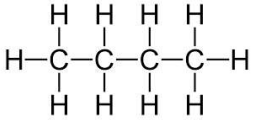
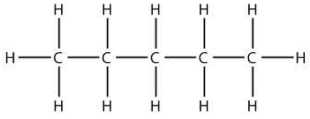
142. Give reason: Hydrocarbon oils are not oils.

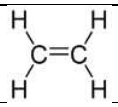
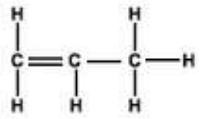
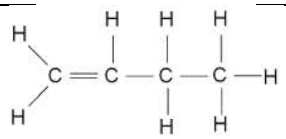
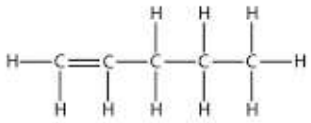
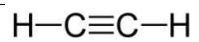
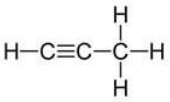
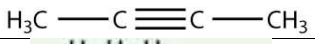
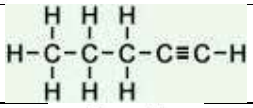
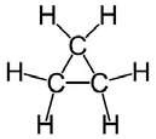
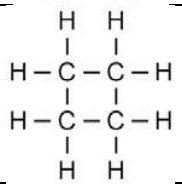
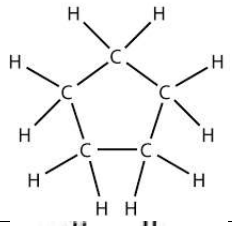
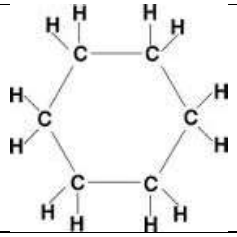
As they do not contain fatty acids.

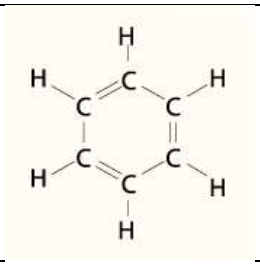
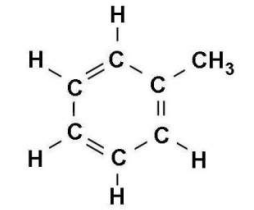
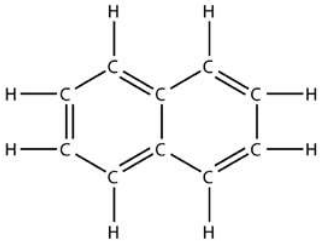
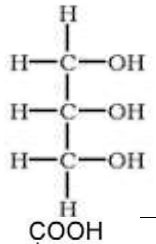
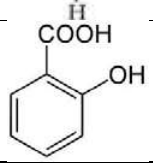
143. What is PUFA?

PUFA stands for Poly Unsaturated Fatty Acid. It is an unsaturated hydrocarbon chain. Because of the presence of double bonds, it is reactive. This makes them more reactive than saturated fatty acids. They are susceptible to attack by free radicals which cause aging, hormone imbalance and immune disorders.

Molecular & Structural formula:

Sl.No	Compound	Molecular formula	Structure
1.	Methane	CH_4	
2.	Ethane	C_2H_6	
3.	Propane	C_3H_8	
4.	Butane	C_4H_{10}	
5.	Pentane	C_5H_{12}	

6.	Ethene	C_2H_4	
7.	Propene	C_3H_6	
8.	Butene	C_4H_8	
9.	Pentene	C_5H_{10}	
10.	Ethyne	C_2H_2	
11.	Propyne	C_3H_4	
12.	Butyne	C_4H_6	
13.	Pentyne	C_5H_8	
14.	Cyclopropane	C_3H_6	
15.	Cyclobutane	C_4H_8	
16.	Cyclopentane	C_5H_{10}	
17.	Cyclohexane	C_6H_{12}	

18.	Benzene	C_6H_6	
19.	Toluene	$C_6H_5CH_3$	
20.	Naphthalene	$C_{10}H_8$	
21	Glycerol	$C_3H_8O_3$	
22	Salicylic acid	$C_7H_6O_3$	

Fill in the blanks:

1. The most common alloy of carbon and iron is **steel**.
2. The valency of carbon is **four**.
3. The second strongest bond between like atoms is **C-C bond**.
4. The crystalline forms of carbon are **diamond and graphite**.
5. The nature of chemical bond present in organic compounds is **covalent bond**.
6. The bond angle between H-C-H in methane molecule is **109^o28^l**.
7. The electronic configuration of carbon is **$1s^2, 2s^2\ 2p^2$**
8. The electronic configuration of carbon in excited state is **$1s^2, 2s^1\ 2px^1\ 2py^1\ 2pz^1$**
9. The ability of carbon atoms to link together to from short or long chain by covalent bond is called **catenation**.
10. The property of carbon atoms to form long chains in compounds is called **catenation**.
11. Organic compounds having same molecular formula with different structural arrangement of atoms in them is known as **isomerism**.
12. The number of organic compounds increases due to the phenomenon of **isomerism**.

13. The person who suggested that organic compounds are derived from organisms is **Berzelius**.
14. The first organic compound which was synthesized from inorganic compound was **urea**.
15. The person who synthesized urea from ammonium cyanate was **Friedrich Wohler**.
16. Friedrich Wohler prepared the organic compound **urea**.
17. The unique properties of carbon atom are **catenation, tetravalency and isomerism**.
18. The study of compounds and reactions involving carbon is called **Organic chemistry**.
19. An example of an organic compound present in our food is **starch**.
20. Simplest binary organic compounds containing carbon and hydrogen only are called hydrocarbons.
21. Compounds of carbon with hydrogen alone are called **hydrocarbons**.
22. IUPAC stands for International Union of Pure and Applied Chemistry.
23. An example of a hydrocarbon in gaseous form is **methane/ propane**.
24. An example of a hydrocarbon in liquid form is **hexane/benzene**.
25. An example of a hydrocarbon in solid form is **wax/naphthalene/asphalt**.
26. An example of a hydrocarbon which is a polymer is **polyethylene**.
27. Hydrocarbons have a characteristic odour only in **vapour** state.
28. The main source of the world's electric energy and heat source is **hydrocarbons**.
29. The two principal sources of hydrocarbons are **petroleum and coal**.
30. Aliphatic hydrocarbons are mainly obtained from **petroleum**.
31. Aromatic hydrocarbons are mainly obtained from **coal**.
32. Saturated hydrocarbons are referred to as **paraffins**.
33. The general formula of alkanes is **C_nH_{2n+2}**
34. Hydrocarbons having the general formula C_nH_{2n+2} are called **alkanes**.
35. Alkenes are referred to as **olefins**.
36. The first member of the alkanes or saturated hydrocarbon is **methane**.
37. Carbon compounds have usually **low** melting points and boiling points.
38. Two adjacent homologues differ by **1 carbon atom and 2 hydrogen atoms**.
39. The unsaturated hydrocarbons having double bond between carbon atom are **alkene**.
40. The general formula of alkene is **C_nH_{2n}**.
41. The hydrocarbon having the general formula C_nH_{2n} is **alkene**.
42. The first member of the alkene hydrocarbon group is **Ethene**.
43. The unsaturated hydrocarbons having one triple bond between carbon atoms are **alkynes**.
44. The general formula of alkynes is **C_nH_{2n-2}**
45. The first member of the alkyne series is **Ethyne**.
46. In homologous series one member differs from the preceding member by a **CH_2** group.
47. The derivatives of a series of hydrocarbons whose simplest member is benzene is **Aromatic hydrocarbons**.
48. Benzene ring was proposed by **Kekule**.
49. The active part of an organic compound is the **functional group**.
50. The less reactive part of an organic compound is the **alkyl/aryl part**.
51. Compounds containing – OH group as functional group are called **alcohols**.

52. The functional group present in CH_3OH is **alcohol**.
53. Compounds containing – COOH group as functional group are called **Carboxylic acids**.
54. Compounds containing – CHO group as functional group are called **Aldehydes**.
55. Compounds containing – NH_2 group as functional group are called **amines**.
56. The compound containing three carbon alcohol is **Propanol**.
57. Organic compounds having more than one functional groups are called **poly-functional compounds**.
58. An example of a poly-functional compound is **amino acid**.
59. A compound having 3 – OH functional group is **Glycerol**.
60. The by-product of preparation of soap is **Glycerol**.
61. A poly-functional compound containing one – OH group and one – COOH group is **Salicylic acid**.
62. Long chain alkanes or alkenes containing terminal carboxylic acid (– COOH) are called **fatty acid**.
63. Fatty acids react with trihydric alcohols to form **glycerides**.
64. The formula of Stearic acid is **$C_{17}H_{35}COOH$**
65. Oils are **unsaturated** and **liquids** at room temperature.
66. Fats are **saturated** and **solids** at room temperature.
67. The process in which oils undergo oxidation and produce a foul smell is called **rancidity**.
68. The process of converting liquid oil into solids saturated fats by passing hydrogen gas is called **hydrogenation**.
69. A reaction in which hydrogen atoms are added is called **hydrogenation reaction**.
70. The process of neutralizing the fatty acids present in the oils or fats by adding sodium hydroxide is called **saponification**.
71. PUFA stands for Poly unsaturated Fatty Acid.