

ORGANIC CHEMISTRY

TOPICAL MULTIPLE CHOICE QUESTIONS

Q.No.1 Encircle the correct option from the given multiple choices.

Organic compounds

(1) Which of the following compound is not study in organic chemistry

- (a) CO_2 (b) $\text{NH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$ (c) CH_3-COOH (d) $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$

(2) The detailed study of organic compound confirm that carbon is essential constituent in combination with _____

- (a) H_2 , N_2 and O_2 (b) S and P (c) Halogens (d) All of these

Chemical Diversity and Magnitude

(3) The Self linkage ability of carbon to form long chains and rings like structure called

- (a) Condensations (b) Isomerism (c) Catenation (d) All of these

(4) The compound have same molecular formula but different structured formula called

- (a) Polymer (b) Resonance (c) Condensed formula (d) Isomers

(5) Pentane have _____ isomers.

- (a) 2 (b) 3 (c) 4 (d) 5

(6) Out of 20 Millions chemical compound the percentage of carbon compound is

- (a) 98% (b) 90% (c) 97% (d) 95%

(7) Organic Compound have melting and boiling point

- (a) High (b) Low (c) Neither High nor low (d) All of the

General characteristics of organic compounds

(8) The Homologous Series is the series of related Compounds in which any adjacent molecules differ by

- (a) $-\text{CH}_2-$ (b) 14 Unit (c) CH_3- (d) Both A and B

Saturated and un-saturated Hydrocarbon

(9) Which of the following Compound is un-saturated?

- (a) C_2H_2 (b) C_3H_6 (c) C_3H_4 (d) C_6H_{14}

Sources of organic compound

(10) The strong heating of coal in absence of air is called

- (a) Fractional Distillation (b) Destructive Distillation
(c) Distillation (d) Bessemerization

Chapter-11

- (11) The percentage of methane in natural gas is
 (a) 80% (b) 85% (c) 95% (d) 75%
- (12) Petroleum Contains the wide variety of alkenes, they are separated by
 (a) Destructive Distillation (b) Fractional Distillation
 (c) Open Heart Process (d) Roasting
- Uses of organic compounds**
- (13) The Gases which are widely available as liquid in fuel Cylinders (LPG) are.
 (a) Propane (b) Butane (c) Ethane (d) Both A and B
- (14) Ethylene is the major starting material for the manufacture of
 (a) Poly ethylene (b) Synthetic rubber
 (c) Nylon (d) All of these
- (15) Which of the following is used as raw material for the preparation of Polyvinyl chloride and nylon.
 (a) Ethylene (b) Acetylene (c) Propane (d) Ethane
- (16) Which of the following is used for artificial ripening of fruits?
 (a) Ethane (b) Propane (c) Ethyne (d) Methane
- (17) Which of the following is used as solvent for fats and oil.
 (a) H_2O (b) Methanol (c) Chloroform (d) All of these
- Alkanes and alkyl radicals**
- (18) The General formula of alkenes is
 (a) C_nH_{2n} (b) C_nH_{2n-2} (c) C_nH_{2n-1} (d) C_nH_{2n+2}
- (19) The General formula of alkyl radical is
 (a) C_nH_{2n} (b) C_nH_{2n-1} (c) C_nH_{2n} (d) C_nH_{2n-2}
- (20) The number of alkyl group formed by butane are
 (a) 1 (b) 5 (c) 3 (d) 4
- Close chain and cyclic compounds**
- (21) Which of the following is Homocyclic organic compound?
 (a) Benzene (b) Cyclo-hexane (c) Naphthalene (d) Both A & B.
- (22) Which of following is not heterocyclic compound.
 (a) Cyclo-Propene (b) Furan (c) Thiophene (d) Pyridine
- Functional groups**
- (23) Esters are recognized by their
 (a) Irritating Smell (b) Fruity Smell
 (c) Pungent Smell (d) Disagreeable smell
- (24) The first antiseptic used in operation theatre is
 (a) Phenol (b) Alcohol
 (c) Chloroform (d) Carbon tetrachloride
- (25) The Functional group which represent the ether family of organic compound is
 (a) $-COOR$ (b) $-O-$ (c) $-COOH$ (d) $-CHO$
- (26) The formic acid have functional group.
 (a) $-COOH$ (b) $-CHO$ (c) $-OH$ (d) $-NH_2$
- (27) Which of the following is ketene
 (a) $CH_3-CO-CH_3$ (b) CH_3-CHO (c) CH_3-OH (d) CH_3-COOH
- (28) The ester family of organic compound is represented by functional group.
 (a) $R-O-R$ (b) $R-OH$ (c) $R-NH_2$ (d) $R-CO-OR$

Chapter-11

- (29) Acetylene is an
 (a) Alkene (b) Alkane (c) Alkyne (d) Alky Radical
- (30) Phenol give _____ colour Precipitate with Bromine water
 (a) Red (b) White (c) Blue (d) Green
- (31) Which of the following gives unpleasant Odour.
 (a) Alcohol (b) Ether (c) Ester (d) amines
- (32) Which of the following is identification test for aldehyde
 (a) Fehling Solution (b) Tollen's test (c) Buyer's test (d) Both A & B
- (33) Ketene gives _____ color with Sodium nitro-prusside Solution
 (a) Red (b) White (c) Black (d) Yellow
- Other Relevant questions**
- (34) The Condensed Structured formula for butane is
 (a) $\text{CH}_3\text{-CH}_2\text{-CH}_3$ (b) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$
 (c) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$ (d) $\text{CH}_3\text{-(CH}_2\text{)-CH}_3$
- (35) Which compound is not Saturated Compound.
 (a) $\text{CH}_3\text{-CH}_3$ (b) CH_4 (c) $\text{CH}_3\text{-CH=CH}_2$ (d) $\text{CH}_3\text{-CH}_2\text{-CH}_3$
- (36) The stamp "Hept" stands for how many carbon atoms.
 (a) 2 (b) 4 (c) 5 (d) 7
- (37) Pitch is produced by
 (a) Coal (b) Coal for (c) Coal gas (d) Petroleum
- (38) The functional group R-O-R is formed in
 (a) Alcohol (b) Ketene (c) Carbolic acid (d) ethers
- (39) In which of the following Compound carbonyl group is attached to -OR and alkyl group.
 (a) Alcohol (b) ether (c) Ester (d) Phenol
- (40) Which of the following is an alcohol
 (a) $\text{C}_2\text{H}_5\text{-OH}$ (b) $\text{C}_6\text{H}_5\text{-OH}$ (c) $\text{CH}_3\text{-O-CH}_3$ (d) $\text{CH}_3\text{-COOH}$

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	b	11	b	21	c	31	c
2	d	12	b	22	a	32	a
3	c	13	d	23	b	33	a
4	d	14	a	24	a	34	b
5	b	15	b	25	b	35	c
6	d	16	c	26	a	36	d
7	b	17	b	27	a	37	c
8	a	18	d	28	d	38	d
9	d	19	b	29	c	39	c
10	b	20	c	30	b	40	a

TOPICAL SHORT QUESTIONS

Q.No.2 Answer these questions. Answer to each part should not exceed three to four lines.

Introduction

Q.1 What is the role of organic compounds in daily life?

Ans: Organic compounds play a vital role in the bodies of living things. Products of industrial organic chemistry such as plastics, rubber, synthetic fibers, paints, glues, varnishes, artificial sweeteners and flavors, drugs, dyes, soaps and detergents etc. are important part of modern life. In addition, the energy on which we rely heavily is based mostly on organic materials found in coal, petroleum and natural gas.

Organic compounds

Q.2 Define organic chemistry.

Ans: It is the branch of chemistry which deals with the study all compounds of carbon except CO_2 , CO , carbonates (CO_3^{2-}), bicarbonates (HCO_3^-), Cyanides (CN^-) and carbides.

In other words we can say that,

"It deals with the study of hydrocarbons and their derivatives."

Q.3 What do you know about organic compounds?

Ans: Organic compounds are defined as the hydrocarbons and their derivatives. A detailed study of organic compounds confirms that carbon is an essential constituent in combination with H, O, N, S, P and halogens. They may also (really) contain metal atoms.

Q.4 What is IUPAC?

Ans: An international body, the international union of pure and applied chemistry is known as IUPAC.

It has derived a system of naming organic compounds that depends on their structure. These names indicate the number of carbon atoms present in the organic compounds. We can easily recognize organic compound by its IUPAC name.

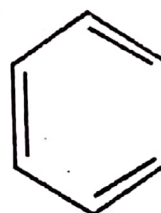
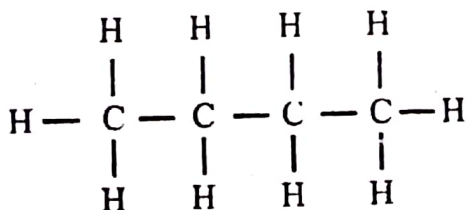
Q.5 Why some of the compounds of Carbon are not studied in organic Chemistry?

Ans: Some compounds of Carbon i.e. Oxide of Carbon (CO and CO_2), Carbonate and Bi-Carbonate, cyanides and carbides are not studied in organic chemistry because their properties are quite different from organic compounds. So these carbon containing compounds are not studied in organic chemistry.

Characteristics of organic compounds

Q.6 What is meant by Catenation? Give example.

Ans: carbon atoms having ability to combine with each other to form long chains and rings. This self linkage ability of carbon to form long chain and ring like structure is called catenation.



Benzene

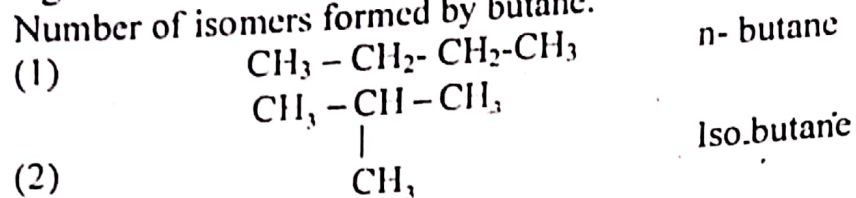
Chapter-11

Q.7 Define Isomerism? Give example.

Ans: Isomerism

The Compound that have same molecular formula but different arrangement of atoms in their molecule are called isomers. This Phenomenon is known as isomerism.
e.g. butane have molecule formula C_4H_{10}

Number of isomers formed by butane.



Q.8 Write three Characteristics of organic Compound?

Ans: The three characteristics of organic compounds are as under.

(i) **Occurrence**

Most of them come from living things or form the things that were once living.

(ii) **Covalent Nature:**

Organic Compound is General Covalent in nature. They may have polar or non polar bond.

(iii) **Melting and boiling points:**

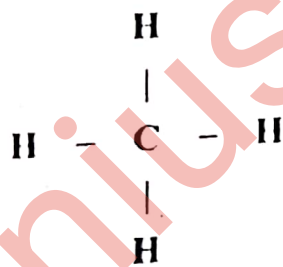
General Organic Compound are volatile, so they have low melting and Boiling points.

Structural formula of organic compounds

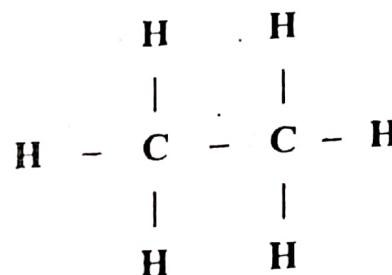
Q.9 Define structural formula and give examples.

Ans: A formula that describes the arrangement of atoms in molecules is called as structural formula.

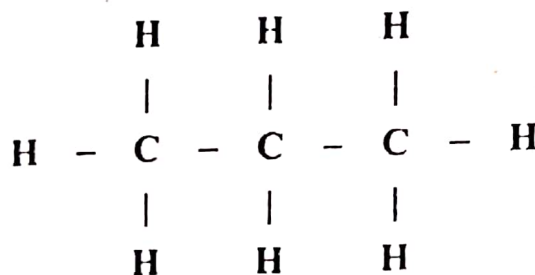
The simple alkanes are straight-chain hydrocarbons. First three members of alkanes have following structural formulas.



Methane



Ethane

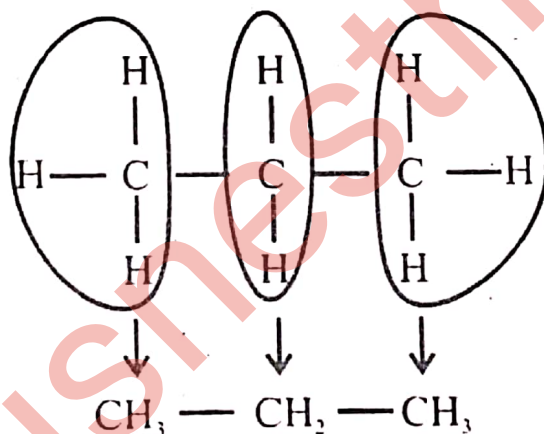
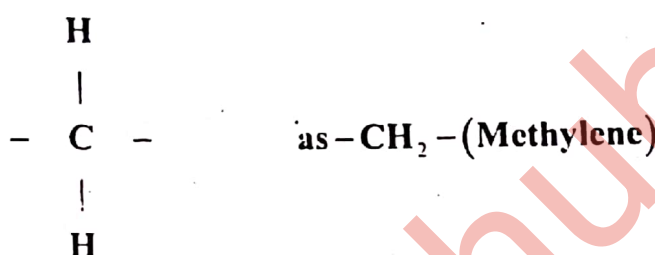
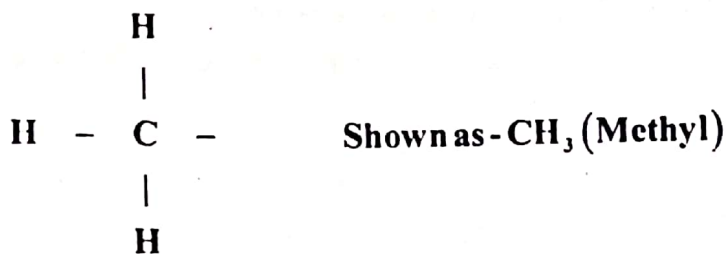


Propane

Q.10 Define condensed structural formula?

Ans: A condensed formula is a structural formula that uses established abbreviation for various groups of chain. In condensed structural formula, we list sequence in which they appear in the naming system.

For instance,



Q.11 What are Saturated hydrocarbon? Give example

Ans: Saturated hydrocarbons

Those hydrocarbons whose carbon-carbon bonds are all single bond one called saturated hydrocarbon.

In other words we can say that,

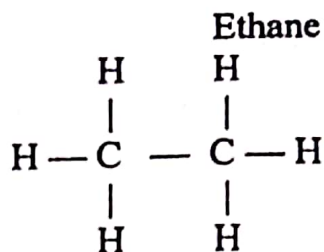
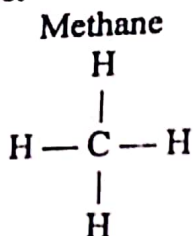
Those hydrocarbons in which valency of carbon is fully satisfied in the single bond are called saturated hydrocarbons

e.g.

Alkane:

Alkanes are saturated hydrocarbons because in alkanes valency of carbon is satisfied by four single bonds.

Example:



Q.12 What are unsaturated hydrocarbons? Give example?

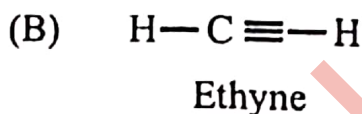
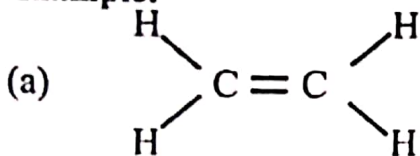
Ans: The hydrocarbon containing carbon — carbon multiple bond i.e. double (=) or triple (\equiv) bonds are called unsaturated hydrocarbon.

e.g.

(a) Alkene \rightarrow Alkene have carbon-carbon double bond

(b) Alkyne \rightarrow Alkyne have carbon-carbon triple bond

Example:



Ethene

Q.13 Mention the reason which are responsible for the formation of millions of organic compounds

Ans: The reason which are responsible for the formation of millions of organic compounds are

- Catenation
- Isomerism
- Small size of carbon
- Multiple bond formation of carbon

Sources of organic compounds

Q.14 Define destructive distillation. Also write the name of fractions which are obtained by destructive distillation of coal?

Ans: The strong heating of coal in the absence of air through which different fraction are separated from each other is called destructive distillation.

The different fractions which are obtained by destructive distillation of coal are

- Coal gas: (gaseous mixture of H_2 , CH_4 and CO)
- Ammonical liquor: solution of NH_3 in water
- Coal tar liquid mixture of 200 different organic compound.
- Coke: pitch (98% Carbon) It is the solid residue which is left behind.

Q.15 What is carbonization and how it takes place?

Ans: The conversion of wood into coal is called carbonization.

It is very slow bio-chemical process. It takes place in the absence of air under high pressure and high temperature over a long period of time (about 500 millions of years)

Q.16 Is coal tar is a compound. What is the importance of coal for?

Ans: Coal tar is not a compound, it is mixture of more than 200 different organic compound which are separated by fractural distillation.

These chemical are very useful in synthetic organic chemistry. These are used to synthesize plastics, dyed. drugs, fibres, paints and varnishes etc.

Uses of organic compounds

Q.17 Write three uses of organic compound.

Ans: The three uses of organic compound are as under.

Use as food:

The food we eat daily such as milk, meat, vegetables etc. contain carbohydrates, proteins, fats, vitamin etc, are all organic stuff.

Uses as Houses:

wood is cellulose. It is used for making houses and furniture of all kind.

Uses as fuel:

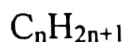
The fuel we use for automobiles and domestic purposes are coal, petroleum and natural gas. These are called fossil fuels. All of these are organic compound.

Alkanes and Alkyl radical

Q.18 Define alkyl radical? Give example:

Ans: Alkyl radical:

An alkyl radical is a group of atom obtained by removing one hydrogen atom from an alkane.

General formula:**Representation:**

Alkyl radical are represented by 'R'

Example:

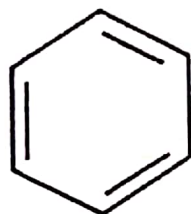
Classification of organic compounds

Q.19 Why organic compounds are classified into different groups and sub-group?

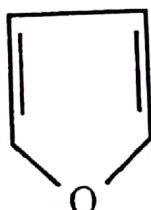
Ans: There are millions of organic compound. It is not possible to study each compound individually. To make their study, they are classified into various group and subgroups.

Q.20 What are heterocyclic compounds?

Ans: Those cyclic compounds which contain one or more other than carbon atoms in the ring are called Heterocyclic compounds. e.g.



Pyridine



Furan



Thiophene

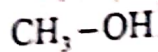
Chapter-11

Functional groups

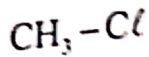
Q.21 Define functional group? Give example?

Ans: An atom or group of atom that give a family of organic compound its characteristics chemical and physical properties is called a functional group.

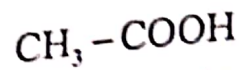
Example:



Alcoholic functional
Group



Halide functional
Group



Carboxylic acid functional
Group

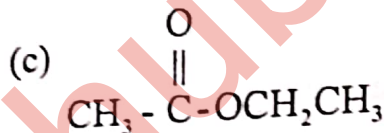
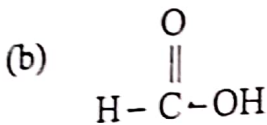
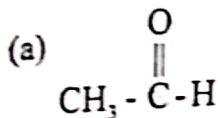
Q.22 Write down the formula of

(a) Acetaldehyde

(b) Formic acid

(c) Ethyl ethanoate

Ans: The chemical formula of all these compounds are



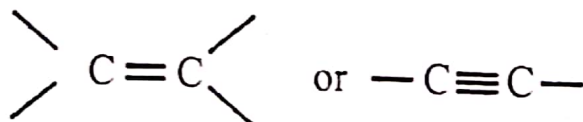
Q.23 How pharmaceutical chemists synthesize the particular substance?

Ans: To develop a synthesis scheme for a particular substance produced by plants and animals or new effective drug, pharmaceutical chemists first analyze the target molecule. They look for a suitable starting material. The synthesis involves two steps.

- Changes in the carbon skeleton
- Inter conversion of functional groups.

So, pharmaceutical chemists determine whether the reaction changes the have same number of carbon atoms, then they can accomplish the synthesis by one or more functional group inter-conversion. If they are of different sizes, then they modify the carbon skeleton. For this they look for a molecule that allows them to make a possible carbon containing skeleton to obtain the product. Then they look for ways to obtain the functional groups of the target molecule.

Q.24 Write identification test for unsaturated compound?



Ans: The identification test for unsaturated compounds are

(i) Bromine water test:

Dissolve a pinch of organic compound in 2cm^3 of carbon tetra chloride. Add 2cm^3 of bromine water in it and shake

Result: Bromine will be decolourized.

(ii) Bayer's test

Dissolve about 0.2 g of organic compound in water. Add 2-3 drops of alkaline KMnO_4 solution in it and shake.

Result: Pink colour will disappear

Q.25 Write Identification test for phenol?

Ans: Identification for phenol:

Dissolve a pinch of carbolic acid (phenol) in 5cm^3 of water in a test tube. Add bromine water in the above solution

Result: Phenol give white precipitate with bromine water.

Q.26 How amines are tested?

Ans: Test for amine

Heat pinch of amine in 2cm^3 of alcoholic solution of KOH and 0.5cm^3 of chloroform.

Result: It gives extremely unpleasant or foul odour

Q.27 Write identification test for aldehyde?

Ans: identification test for aldehyde:

Mix equal volume of Fehling solution A and B in a test tube.

Add a pinch of glucose in it and boil for some time.

Result: ALDEHYDES give red Precipitate with Fehling solution.

Q.28 Write Identification test for Ketone?

Ans: identification test for Ketone:

Take $2-3\text{cm}^3$ of sodium nitropruside solution in a test tube and few drop of NaOH solution.

Add 1cm^3 of acetone in the above test tube.

Result: Ketones gives red colour with alkaline sodium nitropruside solution.

SELF ASSESSMENT EXERCISES

11.1

Give the molecular, structural and condensed structural formulas for,

(a) Butane

(b) Hexane

(c) Octane

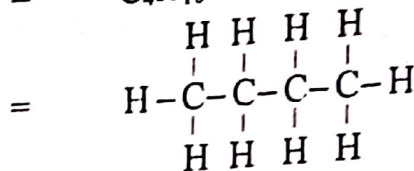
Ans:

(a) Butane:-

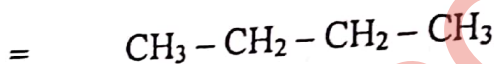
Molecular formula



Structural formula

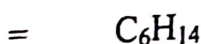


Condensed structural formula

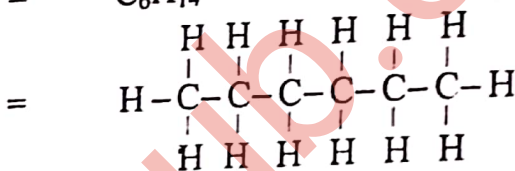


(b) Hexane:-

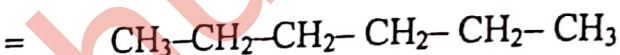
Molecular formula



Structural formula:



Condensed structural formula

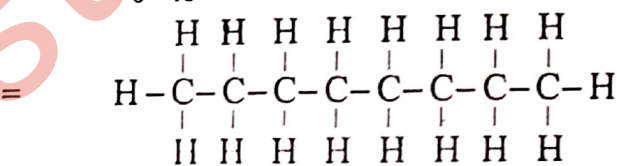


(c) Octane:-

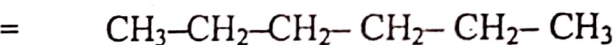
Molecular formula



Structural formula:



Condensed structural formula



11.2

Identify saturated and unsaturated compounds from the following

(a) $CH_3-CH_2-CH_3$ (b) $CH_3-C \equiv CH$ (c) $CH_3-CH=CH_2$ (d) $CH_2=CH-CH=CH_2$

Ans:

(i) $CH_3-CH_2-CH_3$

saturated compound

(ii) $CH_3-C \equiv CH$

unsaturated compound

(iii) $CH_3-C=CH_2$

unsaturated compound

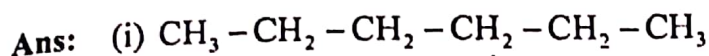
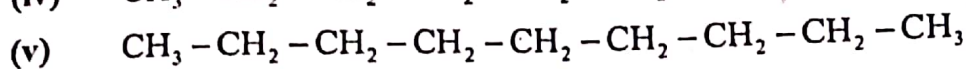
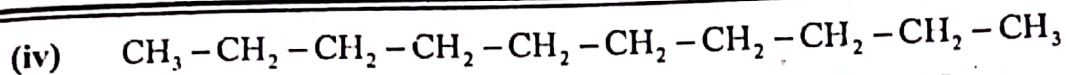
(iv) $CH_2=CH-CH=CH_2$

unsaturated compound

11.3

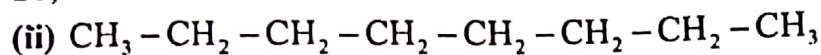
Write IUPAC names of the following alkanes

(i) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$ (ii) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$ (iii) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$



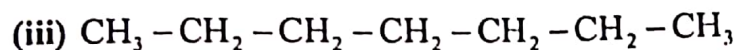
Number of carbon atoms = 6 (stem → Hex)

So, name = Hexane



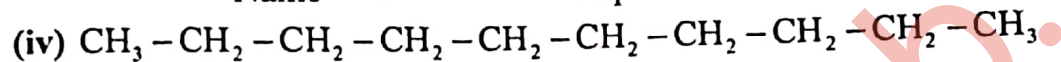
Number of carbon atoms = 8 (stem → Oct)

Name = Octane



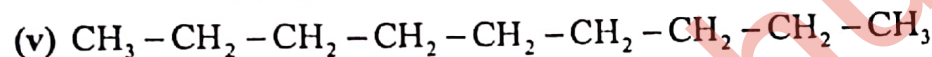
Number of carbon atoms = 7 (stem → Hept)

Name = Heptane



Number of carbon atoms = 10 (stem → Dec)

Name = Decane



Number of carbon atoms = 9 (stem → Non)

Name = Nonane

11.4

(1) List the names of Major sources of alkanes.

Ans: Coal, Natural gas, petroleum, living organism & synthesized in laboratory.

(2) What is natural gas?

Ans: Natural gas is the mixture of low boiling hydro carbons. It is mostly consists of methane i.e. 85%. It also contains smaller amount of ethane, propane & butane.

(3) Write some uses of acetylene

Ans: Ethyne is used

(i) In oxy-acetylene torch for welding and cutting metals.

(ii) For ripening of fruits.

(iii) For the manufacture of polyvinyl acetate (PVA), Polyvinyl chloride (PVC), polyvinyl ethers and rubber.

11.5

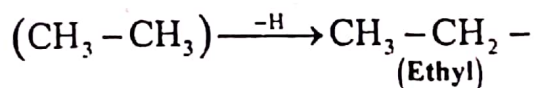
Derive alkyl radicals from the following alkanes.

(a) Ethane

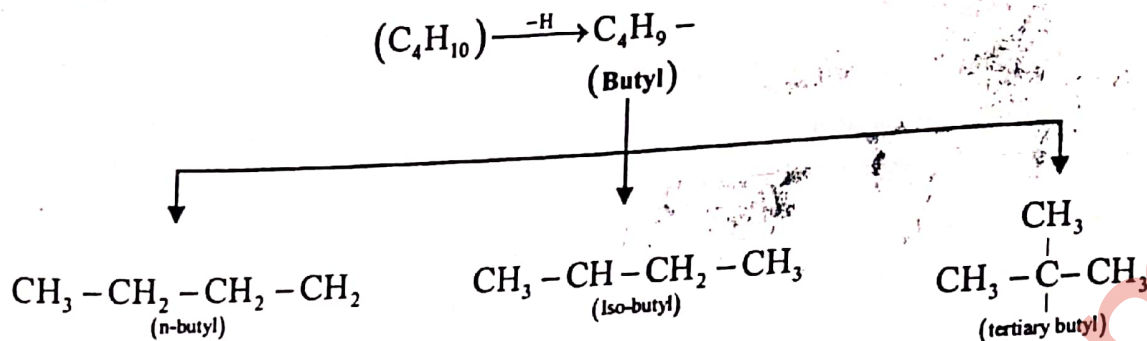
(b) Butane

(c) Propane

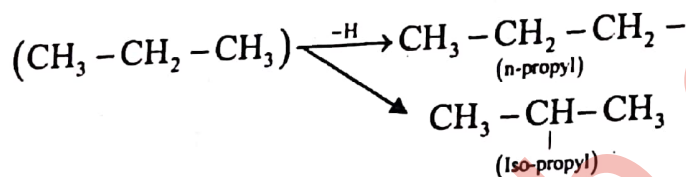
Ans: (a) Ethane



(b) Butane

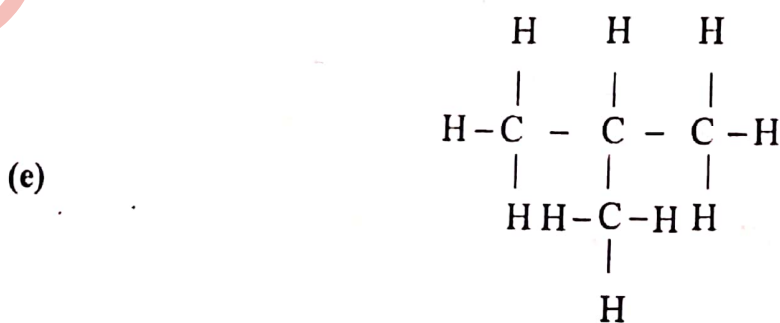
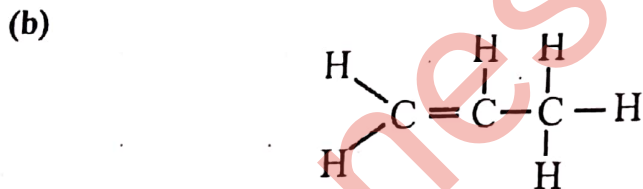
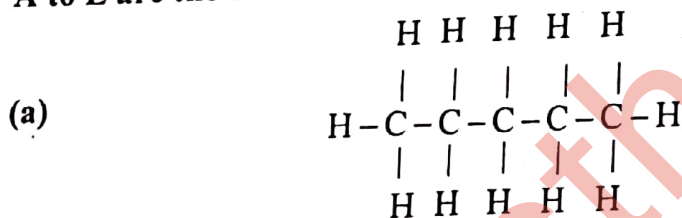


(c) Propane



11.6

A to E are the structural formulas of some organic compounds



Give the letters which represents

- (i) A branched chain compound
 (ii) A cyclic compound
 (iii) Two straight chain compounds.

Ans: (i) A branched chain compound = E
 (ii) A cyclic compound = C
 (iii) Two straight chain compounds = A and B

11.7

Classify the following as alcohol, ether or phenol.

- (a) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
 (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 (c) $\text{C}_6\text{H}_5\text{OH}$
 (d) $\text{C}_2\text{H}_5\text{OH}$

Ans: (a) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ = Ether
 (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ = Alcohol
 (c) $\text{C}_6\text{H}_5\text{OH}$ = Phenol
 (d) $\text{C}_2\text{H}_5\text{OH}$ = Alcohol

11.8

Identify the following compounds as an aldehyde. Or a ketone or a carboxylic acid.

- (a) $\text{CH}_3\text{COCH}_2\text{CH}_3$ (b) $\text{CH}_3\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}\text{CH}$

- (c) $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}\text{COH}$

Ans: (a) $\text{CH}_3\text{COCH}_2\text{CH}_3$ = A Ketone
 (b) $\text{CH}_3\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}\text{CH}$ = An Aldehyde
 (c) $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}\text{COH}$ = A Carboxylic Acid

LONG QUESTION

Q.1 What are the general characteristics of organic compounds?

Ans: General Characteristics of Organic Compounds

- (i) **Occurrence:**
Most of them come from living things or from the things that were once living.
- (ii) **Covalent Nature:**
Organic compounds are generally covalent in nature. They may have polar or non-polar bonds.
- (iii) **Composition:**
Carbon is the main constituent of organic compounds. Hydrogen is also frequently present in organic compounds. Other elements like oxygen, nitrogen, sulphur, phosphorous and halogens are present in many organic compounds.
- (iv) **Melting and Boiling Point:**
Generally organic compounds are volatile. So they have low melting and boiling points.
- (v) **Solubility:**
Organic compounds are non-polar in nature; therefore mostly they are soluble in organic solvents such as ether, benzene, carbon disulphide etc. polar organic compounds are soluble in alcohols such as methyl alcohol and ethyl alcohol.
- (vi) **Similarity in Behaviours (Homology):**
There exists a close relationship between different organic compounds. This similarity in behaviour has made the study of millions of organic compounds easier. They can be classified into few families. A series of related compounds in which any two adjacent molecules differ by $-CH_2-$ group is called homologous series.
- (vii) **Reaction Rates:**
Organic compounds are generally less stable than inorganic compounds. Due to covalent bonding in them, their reaction rates are often slow.

Q.2 Define homologous series. Write the properties of homologous series?

Ans: Homologous Series:

Organic compounds are divided into groups of compounds having similar chemical properties. Each group is known as homologous series. Organic compounds of the same homologous series have the following properties in common.

- (i) All members of a series can be represented by a general formula. For example, general formulae of alkanes, alkenes and alkynes are C_nH_{2n+2} , C_nH_{2n} and C_nH_{2n-2} respectively.
 - (ii) Successive members of the series differ by one unit of $-CH_2$ and 14 units in their relative molecular masses.
 - (iii) They are similar chemical properties because they contain the same functional group.
 - (iv) There is regular change in physical properties, the melting and boiling points increase gradually with the increase of molecular masses.
 - (v) They can be prepared by similar general methods.
- Hydrocarbons are regarded as parent organic compounds. All other compounds are considered to be derived from them by substituting one or more hydrogen atoms of a hydrocarbon by one or more reactive atom or group of atoms.

Q.3 What are the major sources of organic compounds?**Sources of Organic Compounds**

The major commercial sources of alkanes are coal, natural gas, petroleum, and living organisms.

Coal: Coal is a source of many organic compounds. When coal is heated in the absence of air at high temperature, it is converted into coal gas, coal tar and coke. This process is called destructive distillation. Coal is also used as solid fuel.

Coal gas contains methane, hydrogen and carbon monoxide gasses. It is mainly used as a fuel in industry. Coal tar is a source of many organic compounds such as benzene and its derivatives. These compounds can be separated by fractional distillation. These are very useful substances in synthetic organic chemistry. These are used to synthesize plastics, dyes, fibers, drugs, paints, varnishes etc. the residue left behind called pitch is used to metal roads and roofs.

Natural Gas:

Natural gas is a mixture of low boiling hydrocarbons. Natural gas is mostly methane. It also contains smaller amounts of ethane, propane and butane.

Petroleum:

Petroleum contains a wide variety of alkanes including those having very long chains. On fractional distillation petroleum separates into various hydrocarbon components known as fractions. Can you name these fractions? Each fraction is not a pure compound but a mixture of different compounds that boil in a certain range of temperature. (See section 16.4)

Living Organisms:

Many important organic compounds such as proteins, fats, carbohydrates, vitamins, drugs and medicines are obtained from plants and animals.

Synthesis in Laboratory:

More than ten million organic compounds have been prepared in the laboratories. They are being used in medicines, cosmetics, detergents, fertilizers, paints, plastics, flavours etc.

Q.4 Write the uses of organic compounds?**Uses of Organic Compounds.**

- Natural gas and petroleum are used primarily as fuels (see figure 16.9). these are also used as starting materials for the productions of variety of organic compounds.
- Propane and butane which are gases obtained from natural gas are widely available as liquids in fuel cylinders (LPG).
- Ethylene is the major starting material for the manufacture of organic chemicals and products such as polyethylene (Plastic), ethyl alcohol, acetic acid and ethylene glycol called antifreeze.
- Acetylene is widely used in the oxy-acetylene welding and cutting metals, acetylene is also used in the preparation of polymers like PVC (polyvinyl chloride), polyvinyl acetate, synthetic rubber, nylon etc.
- Acetylene is used for artificial ripening of fruits.
- Compounds of phenol help to ensure antiseptic conditions in hospital operating rooms.
- Methanol is used as a solvent for fats, oils, paints and varnishes.
- Many organic compounds are used in the manufacture of drugs, dyes, cosmetics, detergents and soaps, nylon, emulsions and paints etc.

Q.5 How we classify the organic compounds? Explain with examples.

Classification of Organic Compounds

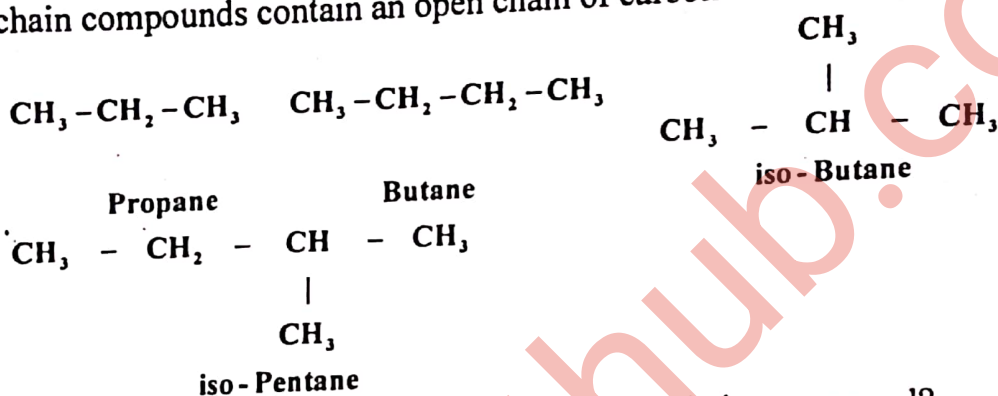
These are million of organic compounds. It is not possible to study each compound individually. To make their study easy, they are classified into various groups and sub-groups. It is helpful to pick out these compounds which have similar structure. So you will learn here, the classification of organic compounds on the basis of carbon skeleton.

They are broadly classified into two main groups.

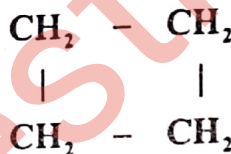
- (i) Open chain compounds or acyclic compounds.
- (ii) Closed chain or cyclic compounds.

(i) Open Chain Compounds

Open chain compounds contain an open chain of carbon atoms. For instance

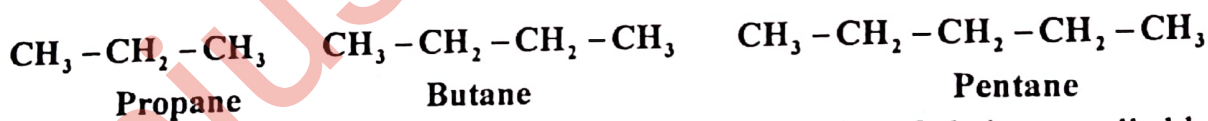


Is the compound having following structure an open chain compound?

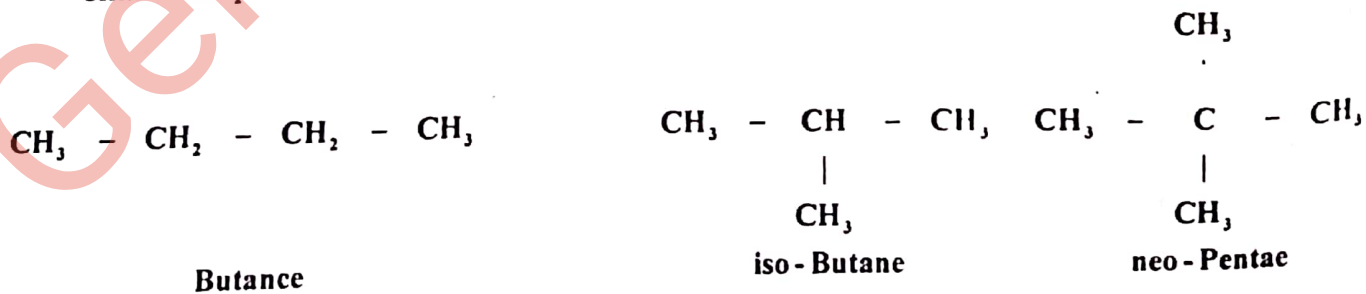


Open chain compounds may be either straight-chain or branched-chain. Those compounds which contain any number of carbon atoms joined one after the other in a chain or row are called **straight-chain compounds**.

For Example



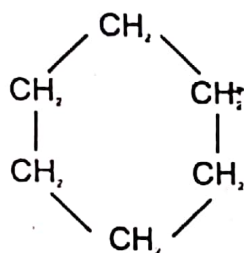
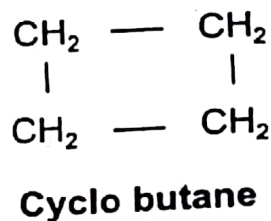
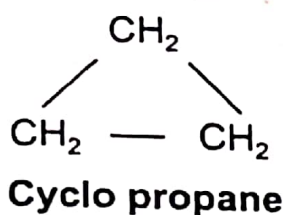
Those compounds which contain carbon atoms on the sides of chain are called branched chain compounds. Which of the following is a branched chain compounds?



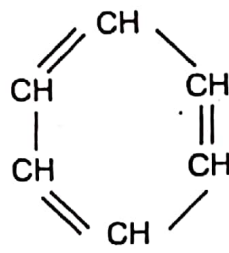
Open chain compound are also called alicyclic compounds

(ii) **Closed Chain or Cyclic Compounds**

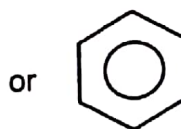
Organic compounds which contain rings of atoms are called closed chain or cyclic compounds. For Example



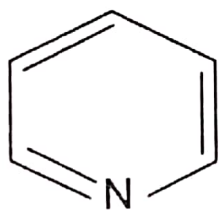
Cyclo hexane



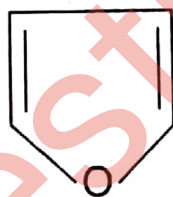
Benzene



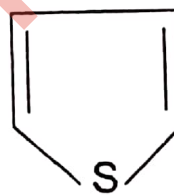
Cyclic compounds which contain ring of carbon atoms are called homocyclic or carbocyclic compounds. Which of the above cyclic compounds are carbocyclic? Cyclic compounds that contain one or more atoms other than carbon atoms in the ring are called heterocyclic compounds e.g.



Pyridine



Furan



Thiophene

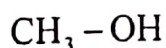
Q.6 Define functional group. Explain some common functional group with example?

Ans: The vast majority of organic compounds contain elements in addition to carbon and hydrogen. Most of these compounds are considered as derivatives of hydrocarbons. This means that they are basically hydrocarbons but they have additional atom or groups of atoms in place of one or more hydrogen atoms called functional groups. In many simple molecules, a functional group is attached to an alkyl group.

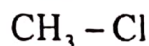
Functional Group:

An atom or groups of atoms or the presence of double (=) or triple bonds (\equiv) that give a family of organic compounds, its characteristic chemical and physical properties is called a functional group:

What is the difference in the following compounds?



Methane alcohol



Methyl Chloride

The study of organic chemistry organized around functional groups. Each functional group defines a family of organic compounds. Although, there are millions of organic compounds, there are only a handful of functional groups. So functional groups make the study of millions of organic compounds easier.

The common functional groups are given below;

Chapter-11

Functional groups containing Carbon, Hydrogen and Halogens Haloalkanes
 Haloalkanes are characterized by the presence of the halogen atom. The haloalkane is a compound in which one hydrogen atom of an alkane is substituted by one halogen atom.
 Which of the following molecules are haloalkanes?

CH_4	$\text{CH}_3 - \text{Cl}$	$\text{CH}_3 - \text{Br}$
Methane	Chloromethane	Bromomethane
CH_3CH_3	$\text{CH}_3\text{CH}_2 - \text{Cl}$	
Ethane	Chloroethane	

Functional groups containing Carbon, Hydrogen and Oxygen Alcohols
 Alcohols are characterized by the presence of the hydroxyl group. (-OH) attached to a hydrocarbon chain.

CH_3OH	$\text{CH}_3 - \text{CH}_2 - \text{OH}$
Methanol	Ethanol
(Methyl alcohol)	(Ethyl alcohol)

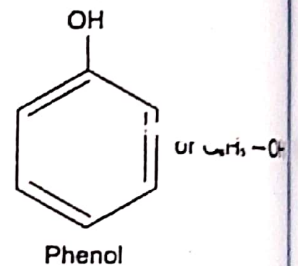
$\text{R} - \text{OH}$ is the general formula for alcohols. Which of the following compounds is an alcohol?

$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
1-Propanol	1-Butanol

Phenols

When an -OH group is attached to a benzene ring, the compound is called a phenol.

Phenol was the first antiseptic used in an operation theatre.

**Ethers**

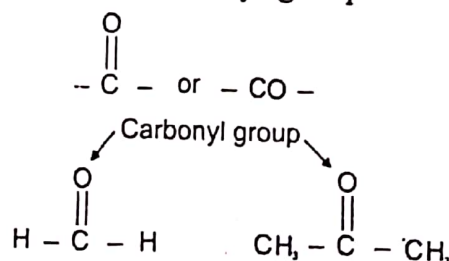
Organic compounds that have two alkyl groups attached to the same oxygen atom are called ethers. These compounds have C - O - C linkage in their molecules.

$\text{CH}_3 - \text{O} - \text{CH}_3$	$\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_3$	$\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$
Dimethylether	Ethyl methyl ether	Diethylether

The general formula for ethers is $\text{R} - \text{O} - \text{R}'$. Where R and R' are alkyl groups which may be same or different.

Aldehydes and ketones

Aldehydes and ketones contain the carbonyl group

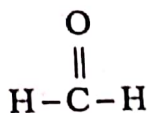


An aldehyde has at least one hydrogen atom or two hydrogen atoms attached to the carbonyl carbon atom. A ketone has two hydrocarbon groups (alkyl) bonded to the carbonyl carbon atom. Which of the above compound is an aldehyde? Which is a ketone?

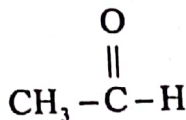
The group in condensed form is written as -CHO. It is characteristic group of aldehydes.

HCHO

or

CH₃CHO

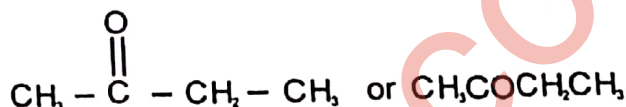
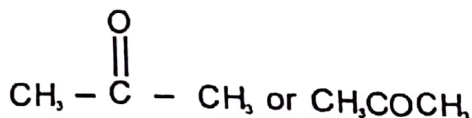
or



The general formula for ketone is $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{R}' \end{array}$ and in condensed form it is written as

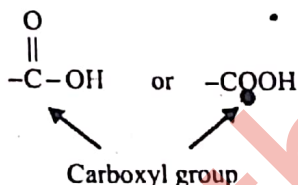
RCOR'. Where R and R' are alkyl groups which may be same or different.

For example



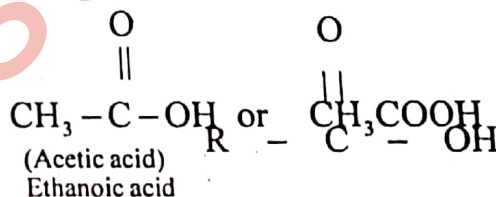
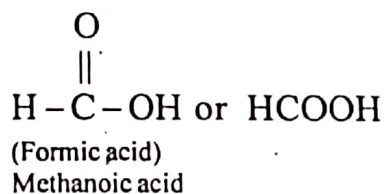
Carboxylic Acids:

The functional group of organic acid is called the carboxyl group.



What is the difference between a carbonyl group and a carboxyl groups?

Examples:

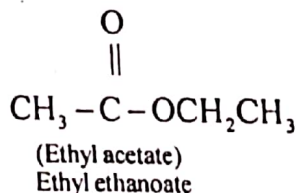
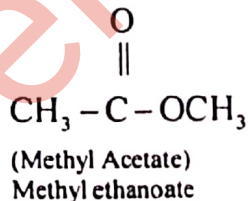


The general formula for carboxylic acids is R - COOH or

Esters:

Compounds having general formula $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{R}' \end{array}$ are called esters. R and R' are alkyl

groups which may be same or different.



$\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{R}' \end{array}$ is the functional group for esters.

Functional groups containing Carbons, Hydrogen and Nitrogen

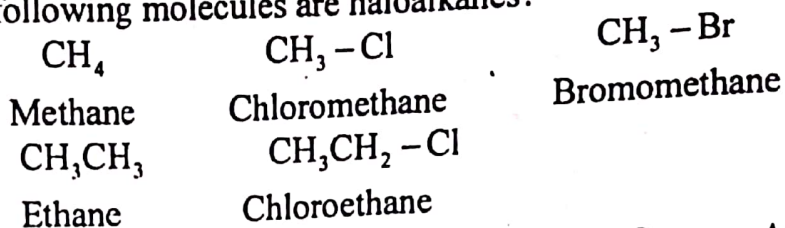
Amines

The functional group of amines is -NH₂.

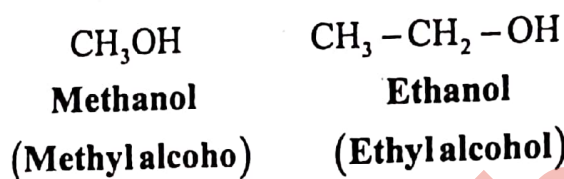
Functional groups containing Carbon, Hydrogen and Halogens Haloalkanes

Haloalkanes are characterized by the presence of the halogen atom. The haloalkane compound in which one hydrogen atom of an alkane is substituted by one halogen atom.

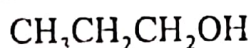
Which of the following molecules are haloalkanes?

**Functional groups containing Carbon, Hydrogen and Oxygen Alcohols**

Alcohols are characterized by the presence of the hydroxyl group. (-OH) attached to hydrocarbon chain.



$\text{R} - \text{OH}$ is the general formula for alcohols. Which of the following compounds is alcohol?



1-Propanol

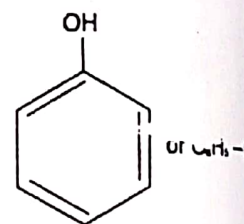


1-Butanol

Phenols

When an -OH group is attached to a benzene ring, the compound is called a phenol.

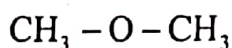
Phenol was the first antiseptic used in an operation theatre.



Phenol

Ethers

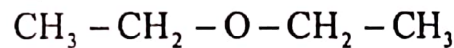
Organic compounds that have two alkyl groups attached to the same oxygen atom are called ethers. These compounds have C - O - C linkage in their molecules.



Dimethyl ether



Ethyl methyl ether

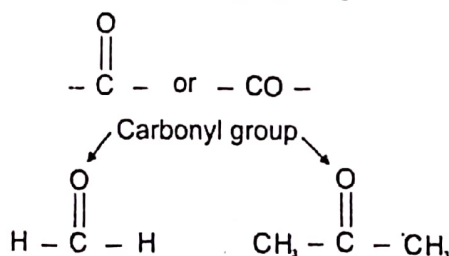


Diethyl ether

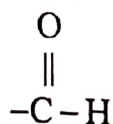
The general formula for ethers is $\text{R} - \text{O} - \text{R}'$. Where R and R' are alkyl groups which may be same or different.

Aldehydes and ketones

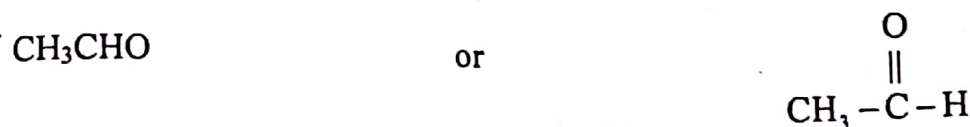
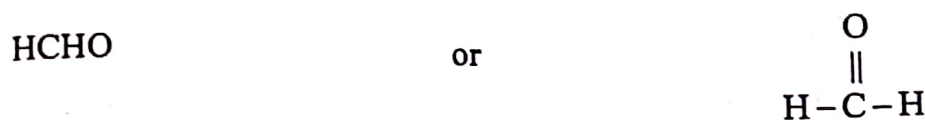
Aldehydes and ketones contain the carbonyl group



An aldehyde has at least one hydrogen atom or two hydrogen atoms attached to the carbonyl carbon atom. A ketone has two hydrocarbon groups (alkyl) bonded to the carbonyl carbon atom. Which of the above compound is an aldehyde? Which is a ketone?

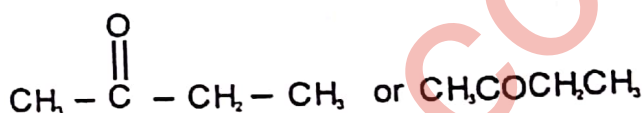
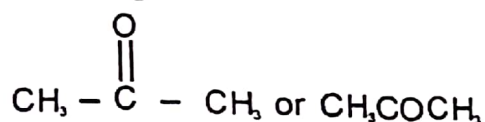


group in condensed form is written as -CHO. It is characteristic group of aldehydes.



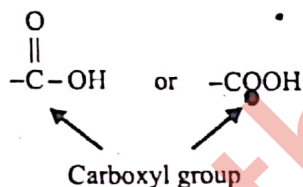
The general formula for ketone is $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{R}' \end{array}$ and in condensed form it is written as RCOR'. Where R and R' are alkyl groups which may be same or different.

For example



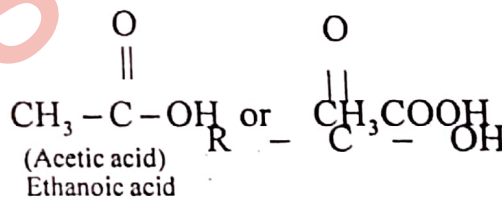
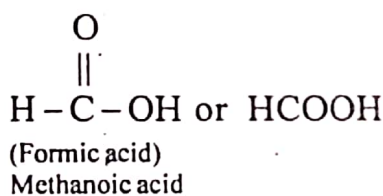
Carboxylic Acids:

The functional group of organic acid is called the carboxyl group.



What is the difference between a carbonyl group and a carboxyl groups?

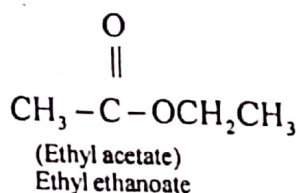
Examples:



The general formula for carboxylic acids is R - COOH or

Esters:

Compounds having general formula $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{R}' \end{array}$ are called esters. R and R' are alkyl groups which may be same or different.

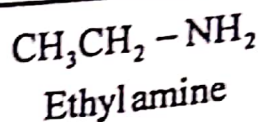
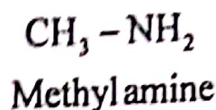


$\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{R}' \end{array}$ is the functional group for esters.

Functional groups containing Carbons, Hydrogen and Nitrogen

Amines

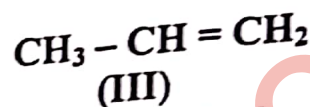
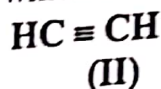
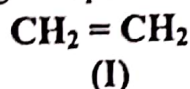
The functional group of amines is -NH₂.



The general formula for amines is $\text{R} - \text{NH}_2$

Functional groups containing Double and Triple Bond

An alkene is a hydrocarbon that contains one or more carbon-carbon double bond. $\text{C} = \text{C}$ is the functional group for alkenes. An alkyne is a hydrocarbon that contains one or more carbon-carbon triple bond. $\text{C} \equiv \text{C}$ is the functional group for alkynes. Which of the following compound is alkene, which is alkyne?



Q.7 How we can identify carboxylic acid, phenols, amines, aldehydes and ketones in terms of functional groups?

Ans: We can identify these functional groups by particular tests which are given below,

(i) **Test for carboxylic acids**

- Take 5 cm³ of vinegar in a test tube and a pinch of NaHCO_3 , test the gas evolved with lime water: what happens?
- Dip blue litmus paper in vinegar. What happens? These two tests indicate the presence of carboxylic group in vinegar.

(ii) **Test for phenol**

- Dissolve a pinch of carbolic acid (phenol) in 5 cm³ of water in a test tube.
- Add bromine water in the above solution.
- What happens? Phenol gives white ppt with bromine water.

(iii) **Test for amine**

- Heat pinch of an amine in 2 cm³ of alcoholic solution of KOH and 0.5 cm³ of chloroform.
- Note the odour of fumes given out.

An amine gives extremely unpleasant or foul odour.

(iv) **Test for Aldehyde**

- Mix equal volumes of Fehling's solution A and B in a test tube.
- Add a pinch of glucose in it and boil for some time.
- What happens?
- Aldehydes give red precipitate with Fehling's solution.

(v) **Test for ketone**

- Take 2-3 cm³ of sodium nitro-prusside solution in a test tube and few drops of NaOH solution.
- Add one cm³ of acetone in the above test tube.
- What happens?

Ketones give red colour with alkaline sodium nitro-prusside solution.

REVIEW QUESTIONS FROM TEXT BOOK

Q.1 Encircle the correct answer

- (i) **Condensed structural formula for butane is**
 (a) $\text{CH}_3 - \text{CH}_2 - \text{CH}_3$ (b) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
 (c) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ (d) $\text{CH}_2 - \text{CH}_3$
- (ii) **$\text{CH}_3 - \text{CH}_2 - \text{CH}_3$ is the chemical formula for**
 (a) Ethane (b) Propane
 (c) Butane (d) Pentane
- (iii) **Which compound is not a saturated hydrocarbon?**
 (a) $\text{CH}_3 - \text{CH}_3$ (b) CH_4
 (c) $\text{CH}_3 - \text{CH} = \text{CH}_2$ (d) $\text{CH}_3 - \text{CH}_2 - \text{CH}_3$
- (iv) **Stem "But" stands for how many Carbon atoms.**
 (a) 2 (b) 3
 (c) 4 (d) 5
- (v) **Pitch is produced by**
 (a) Coal (b) Coal tar
 (c) Coal gas (d) Petroleum
- (vi) **The functional group $-\overset{\text{O}}{\parallel}{\text{C}}-$ is found in**
 (a) Alcohols (b) Ketones
 (c) Carboxylic acids (d) Esters
- (vii) **In which of the following compounds, oxygen is attached to two alkyl carbon atoms?**
 (a) Alcohol (b) Phenol
 (c) Ether (d) Ester
- (viii) **Which of the following is an alcohol?**
 (a) $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$ (b) $\text{CH}_3 - \text{CH}_2 - \text{COOH}$
 (c) $\text{C}_6\text{H}_5 - \text{OH}$ (d) $\text{CH}_3 - \text{CH}_2 - \text{OH}$
- (ix) **The functional group of amines is**
 (a) $-\text{OH}$ (b) $-\text{COOH}$
 (c) $-\text{NH}_2$ (d) $-\text{CHO}$
- (x) **Formic acid contains functional group**
 (a) $-\text{OH}$ (b) $-\text{CO}-$
 (c) $-\text{COOH}$ (d) $-\text{CHO}$

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	b	4	c	7	c	10	c
2	b	5	b	8	d		
3	c	6	b	9	c		

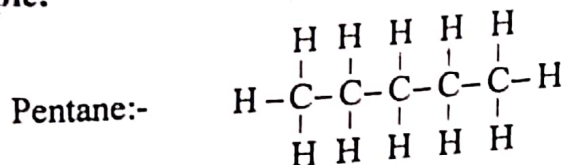
SHORT QUESTIONS

Q. 2 Give short answer

(i) What is catenation?

Ans: "Carbon ability to bond to each other to form long chains and rings. This self-linking ability of carbon is called catenation."

Example:

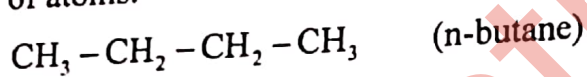


(ii) Define isomerism?

Ans: "The compounds that have same molecular formula but different arrangement of atoms in their molecules are called isomers. This phenomenon is called isomerism."

Example:

- Two compounds have same molecular formula (C_4H_{10}) but different arrangement of atoms.



(iii) Give three examples of alkyl groups.

Ans: "An alkyl group or radical is a group of atoms obtained by removing one hydrogen atom from an alkane."

Example:

Three examples of alkyl group are

- CH_4 (Methane) \longrightarrow CH_3- (methyl)
- CH_3CH_3 (Ethane) \longrightarrow CH_3CH_2- (Ethyl)
- $\text{CH}_3-\text{CH}_2-\text{CH}_3$ (Propane) \longrightarrow $\text{CH}_3-\text{CH}_2-\text{CH}_2-$ (Propyl)

(iv) Define a function group.

Ans: "An atom or group of atoms or presence of double or triple bond that give a family of organic compounds, its characteristics chemical and physical properties is called a functional group."

Example:

- In methyl alcohol ($\text{CH}_3\text{-OH}$) hydroxyl group (OH) is a functional group

(v) What is the difference between an alkane and alkyl radical?

Ans: Difference:

Alkane	Alkyl Radical
<ul style="list-style-type: none"> Hydrocarbons whose carbon-carbon bond are all single bonds are called alkane. The general formula is C_nH_{2n+2} <p>Example:</p> <ul style="list-style-type: none"> ❖ Methane (CH_4) ❖ Ethane (CH_3CH_3) 	<ul style="list-style-type: none"> An alkyl radical is a group of atoms obtained by removing one hydrogen atom from an alkane. The general formula is C_nH_{2n+1} It is represented by R <p>Example:</p> <ul style="list-style-type: none"> ❖ Methyl (CH_3-) ❖ Ethyl (CH_3CH_2-)

Q. 3 What do you mean by the term destructive distillation?

Ans: "When coal is heated in the absence of air at high temperature, it is converted into coal gas, coal tar and cock. This process of separation of different fractions (substances) is called destructive distillation."

Q. 4 List some general properties of organic compounds.

Ans: See long question answer

Q. 5 List some commercial sources of alkanes.

Ans: Sources:

The major commercial sources of alkanes are

- Coal
- Natural gas
- Petroleum
- Living organisms

Q. 6 Identify the following compounds on the basis of functional group their names and encircle the functional group.

Ans:

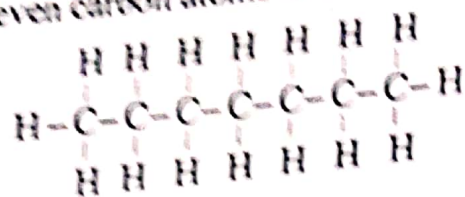
$CH_3 - CH = CH_3$	Propane
$CH_3 - C \equiv CH$	Propyne
$CH_3 - CH_2 - COOH$	Propanic acid
$CH_3 - \overset{O}{\parallel} C - OH$	Carboxylic acid
$CH_3 - \overset{O}{\parallel} C - CH_3$	Acetone
$CH_3 - \overset{O}{\parallel} C - OCH_3$	Acetylene
$H - \overset{O}{\parallel} C - CH_3$	Acetaldehyde

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Q. 7 What is the name of alkane having seven carbon in the chain?

Ans: Alkane:

The alkane that having seven carbon atoms in a chain is called heptane.



Q. 8 What is the name of the alkyl group obtained by removing an end hydrogen atom from (i) Propane (ii) Ethane

Ans: (i) The alkyl group obtained by removing an end hydrogen atom from propane is called propyl $\text{CH}_3-\text{CH}_2-\text{CH}_2-$

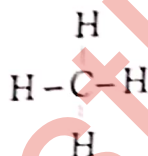
(ii) The alkyl group obtained by removing an end hydrogen atom from ethane is called ethyl. CH_3-CH_2-

Q. 9 Give the structural formula of two simple alkanes and one alkyne.

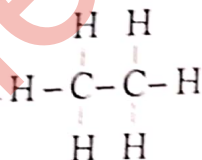
Ans:

Alkanes:

Methane:

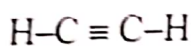


Ethane:



Alkyne:

Ethyne:



Q. 10 What is meant by the term functional group?

Ans: See short questions

Q. 11 Identify the following types of compounds as alcohol, Aldehyde or ketone.

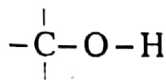
Ans:

- HCHO , which is used to manufacture polymers, such as urotropine which is used to treat urinary tract disinfection Aldehyde.
- CH_3COCH_3 , which is used in nail polish remover Ketone.
- $\text{CH}_3\text{CH}_2\text{OH}$, which is used in the preparation of many organic substance alcohol.

THINK-TANK

Q. 12 Given a molecular formula of a compound containing C, H and O and single bonds. List all functional groups this compounds can have?

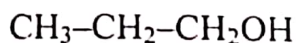
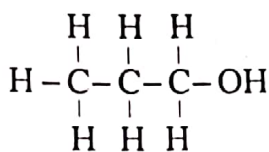
Ans: The functional group that a molecular compound with a formula containing C, H, O and single bonds is Alcohol.



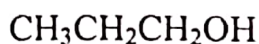
Q. 13 Give the condensed structural formulas of the following compounds and classify each on the basis of functional group.

Ans:

(a)

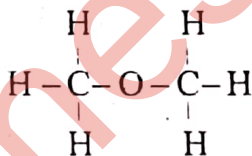


Or

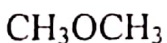


This compound is alcohol.

(b)

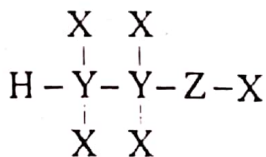


Or



This compound is ether

Q. 14 The diagram represents an organic compounds that contain three different elements.

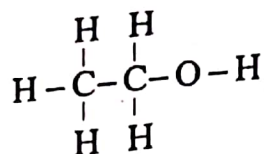


What could be the compound?

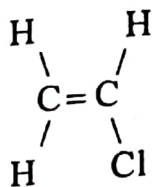
- (a) Ethanoic acid
- (b) Propene
- (c) Ehanol
- (d) Propane

Chapter-11

Ans: This compound is ethanol because of resemblance with following structure.



Q. 15 Polyvinyl chloride is a polymer. It is used for making vinyl sheets, drainage pipes, wire insulation etc. It is obtained from vinyl chloride.



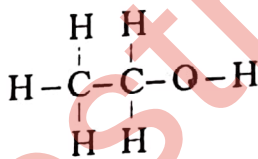
Classify vinyl chloride as saturated or unsaturated compound.

Ans: Vinyl chloride is a unsaturated compound due to the presence of double bond.

Q. 16 For each of the following, draw the structural formulas of a two-carbon containing the indicated functional group.

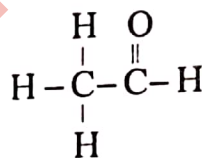
Ans:

(a) Alcohol



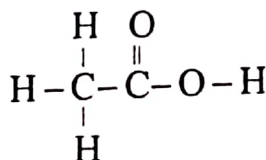
OH is a functional group.

(b) Aldehyde



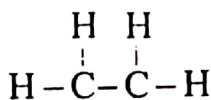
-CHO is a functional group.

(c) Carboxylic acid.



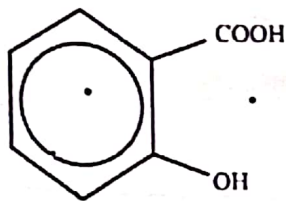
-COOH is a functional group.

(d) Alkene



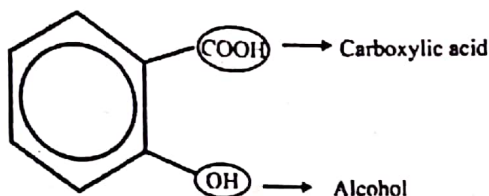
-C=C- is a functional group.

Q. 17 Aspirin is a mild pain killer and fever reducer. It is manufactured from salicylic acid.



Identify functional groups present in it and encircle them.

Ans:

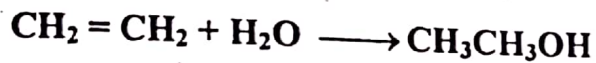


- COOH and - OH both are functional group.

Q. 18 General formula for alkane is C_nH_{2n+2} . What will be the general formula for alkyl radical?

Ans: The general formula for the alkyl radical will be C_nH_{2n+1} .

Q. 19 Water adds to ethane according to the following reaction.



Identify the functional group in reactant and product molecules.

Ans: $\begin{matrix} \diagdown & & \diagup \\ & C = C & \\ \diagup & & \diagdown \end{matrix}$ (alkene) and - OH (alcohol) are the functional groups