

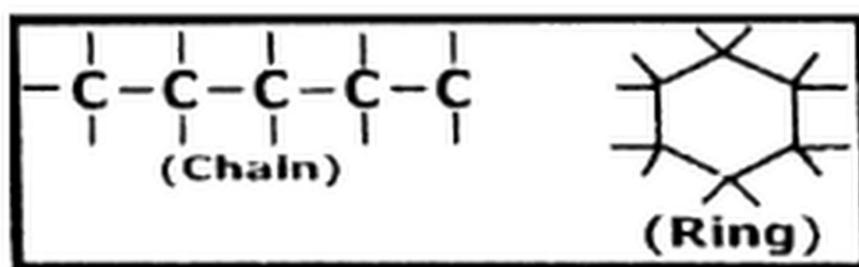
**2. Give short answer.****(i). What is catenation?****Ans: Catenation:**

The self-linking ability of carbon atoms is called catenation.

OR

**Catenation:**

Catenation is the unique ability of carbon to bond itself forming long chains and rings and also to form compounds containing rings and chains together. This property of carbon results in enormous ranges of compounds of carbon.

**(ii) Define isomerism.****Ans: Isomerism:**

Compounds having same molecular formula but different structural formula is called isomers and this phenomenon process is called isomerism.

**Isomers of the alkanes up to pentane:**

Molecular formula	Structural formula	No of isomers
Methane, CH <sub>4</sub>	CH <sub>4</sub>	1
Ethane, C <sub>2</sub> H <sub>6</sub>	CH <sub>3</sub> —CH <sub>3</sub>	1
Propane, C <sub>3</sub> H <sub>8</sub>	CH <sub>3</sub> —CH <sub>2</sub> —CH <sub>3</sub>	1

<b>Butane, C<sub>4</sub>H<sub>10</sub></b>	i) CH <sub>3</sub> —CH <sub>2</sub> —CH <sub>2</sub> —CH <sub>3</sub> ii) CH <sub>3</sub> — $\underset{\text{CH}_3}{\text{CH}}$ —CH <sub>3</sub>	2
<b>Pentane, C<sub>5</sub>H<sub>12</sub></b>	i) CH <sub>3</sub> —CH <sub>2</sub> —CH <sub>2</sub> —CH <sub>2</sub> — CH <sub>3</sub> ii) CH <sub>3</sub> — $\underset{\text{CH}_3}{\text{CH}}$ —CH <sub>2</sub> —CH <sub>3</sub> CH <sub>3</sub> CH <sub>3</sub> iii) CH <sub>3</sub> —C—CH <sub>3</sub>   CH <sub>3</sub>	3

**Note:** Hexane (C<sub>6</sub>H<sub>14</sub>) has five isomers and decane (C<sub>10</sub>H<sub>22</sub>) has 75 isomers.

(iii) Give three examples of alkyl groups.

- Ans: (i) Methyl      CH<sub>3</sub>—  
 (ii) Ethyl         CH<sub>3</sub>CH<sub>2</sub>—  
 (iii) Propyl        CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>—

(iv) Define functional group.



**(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 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 behaviors (Homology):**

There exists a close relationship between different organic compounds. This similarity in behavior 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.

**5. List major commercial sources of alkanes:****Ans: Sources of Organic compounds:**

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

**i. 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 contain methane, hydrogen and carbon monoxide gases. 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.

**ii. Natural gas:**

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

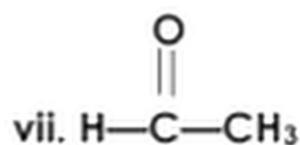
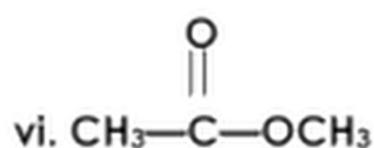
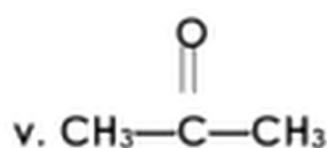
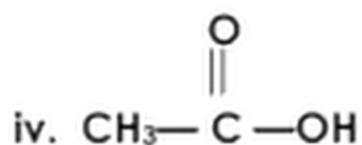
**iii. Petroleum:**

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.

**iv. Living organisms:**

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

**6. Identify the following compounds on the basis of functional groups they contain and encircle the functional group.**



**Ans:**

i. $\text{CH}_3\text{—CH=CH}_3$ Alkene	ii. $\text{CH}_3\text{—C}\equiv\text{CH}$ Alkyne
iii. $\text{CH}_3\text{—CH}_2\text{—COOH}$ Carboxyl Group	iv.

	$\begin{array}{c} \text{O} \\    \\ \text{CH}_3-\text{C}-\text{OH} \end{array}$ <p>Carbonyl Group</p>
<p>v.</p> $\begin{array}{c} \text{O} \\    \\ \text{CH}_3-\text{C}-\text{CH}_3 \end{array}$ <p>Carbonyl Group</p>	<p>vi.</p> $\begin{array}{c} \text{O} \\    \\ \text{CH}_3-\text{C}-\text{OCH}_3 \end{array}$ <p>Ester group</p>
<p>vii.</p> $\begin{array}{c} \text{O} \\    \\ \text{H}-\text{C}-\text{CH}_3 \end{array}$ <p>Carbonyl Group</p>	

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

**Ans:** Heptane ( $\text{C}_7\text{H}_{16}$ )

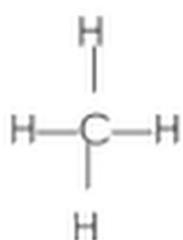
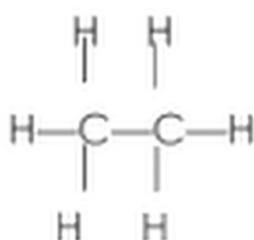
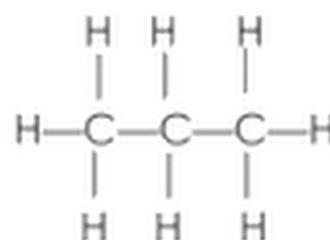
8. What is the name of the alkyl group obtained by removing an end hydrogen atom from (i) propane (ii) ethane?

**Ans: (i)** Propyl

**(ii)** Ethyl

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

**Ans:** Structural formula of two simple alkanes:

**Methane****Ethane****Propane**

**Structural formula of one alkane:**



## 10. What is meant by the functional group?

**Ans: Functional groups:**

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

**Common functional groups:**

Name of class	Functional Group	General formula
Alkane	None	R—H
Alkene	$\begin{array}{c}   \quad   \\ -\text{C}=\text{C}- \end{array}$	$\begin{array}{c} \text{R} \quad \text{R} \\   \quad   \\ \text{R}-\text{C}=\text{C}-\text{R}''' \end{array}$
Alkyne	$-\text{C}\equiv\text{C}-$	R—C≡C—R'

Alcohol	$\begin{array}{c}   \\ -\text{C}-\text{O}-\text{H} \\   \end{array}$	$\text{R}-\text{O}-\text{H}$
Ether	$\begin{array}{c}   \quad   \\ -\text{C}-\text{O}-\text{C}- \\   \quad   \end{array}$	$\text{R}-\text{O}-\text{R}'$
Aldehyde	$\begin{array}{c} \text{O} \\    \\ -\text{C}-\text{H} \end{array}$	$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{H} \end{array}$
Ketone	$\begin{array}{c} \text{O} \\    \\ -\text{C}- \end{array}$	$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{R} \end{array}$
Amine	$\begin{array}{c}   \\ -\text{C}-\text{N}- \\   \quad   \end{array}$	$\begin{array}{c} \text{H} \\   \\ \text{R}-\text{N}-\text{R} \end{array}$
		$\begin{array}{c} \text{H} \\   \\ \text{R}-\text{N}-\text{R}' \end{array}$
		$\begin{array}{c} \text{H} \\   \\ \text{R}-\text{N}-\text{R}'' \end{array}$
Carboxylic Acid	$\begin{array}{c} \text{O} \\    \\ -\text{C}-\text{O}-\text{H} \end{array}$	$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{O}-\text{H} \end{array}$
Ester	$\begin{array}{c} \text{O} \quad   \\    \quad   \\ -\text{C}-\text{O}-\text{C}- \\ \quad \quad   \end{array}$	$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{O}-\text{R}' \end{array}$

11. Identify the type of following compounds as an alcohol, aldehyde or ketone:

(a)  $\text{HCHO}$ , which is used to manufacture polymers such as urotropine which is used to treat urinary tract infection.

(b)  $\text{CH}_3\text{COOH}$ , which is used in nail polish remover.

(c)  $\text{CH}_3\text{CH}_2\text{OH}$ , which is used in the preparation of many organic substances such as plastics, cosmetics, tinctures etc.

**Solution:**

(a)  $\text{HCHO}$ : Aldehyde because  $\text{CHO}$ — group is attached.

(b)  $\text{CH}_3\text{COCH}_3$ : Ketone because  $\text{CO}$ — group is attached.

(c)  $\text{CH}_3\text{CH}_2\text{OH}$ : Alcohol because  $\text{OH}$  group is attached to an alkyl group.

### THINK-THANK

12. Given a molecular formula of a compound containing C, H and O and single bonds. List all the possible functional group this compound can have?

**Solution:** Alcohols are characterized by the presence of the hydroxyl group. ( $-\text{OH}$ ) attached to a hydrocarbon chain.



**Methanol**

**(Methyl alcohol)**



**Ethanol**

**(Ethyl alcohol)**

**General formulas for alcohol:**

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

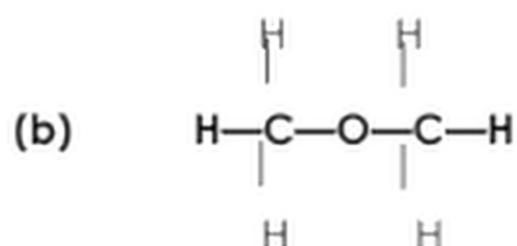
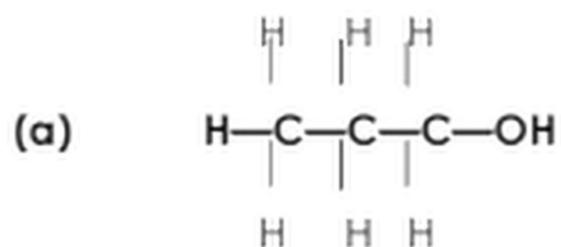


**1-Propanol**



**1-Butanol**

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



Solution:

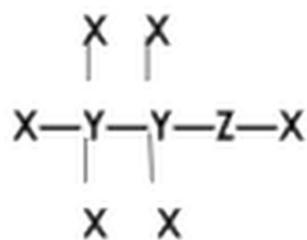
(a) Condensed structural formula:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$       1-Propanol

The functional group is alcohol.

(b) Condensed structural formula:  $\text{CH}_3\text{OCH}_3$       Dimethyl ether

The functional group is ether.

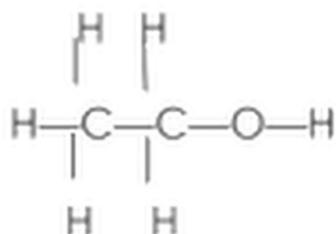
14. The diagram represents an organic compound that contains three different elements.



What could be the compound?

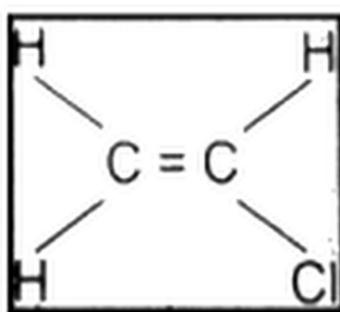
a) Ethanoic acid      b) propene      c) Ethanol      d) propane.

Solution:

**Ethanol**

Therefore, option c) Ethanol is correct.

15. Polyvinyl chloride (PVC) 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.

**Solution:** Vinyl chloride is a unsaturated compound because it contain carbon-carbon double bond.

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

(a) Alcohol (b) aldehyde (c) carboxylic acid (d) alkene

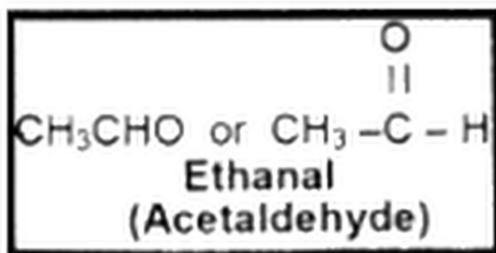
**Solution:**

**(a) Alcohol**

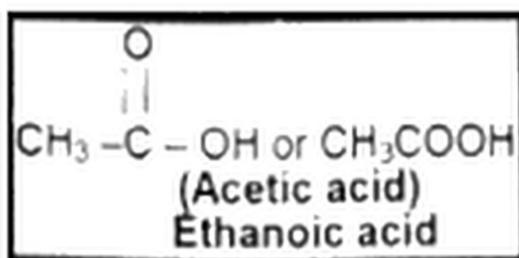


**Ethanol (ethyl alcohol)**

(b) Aldehyde



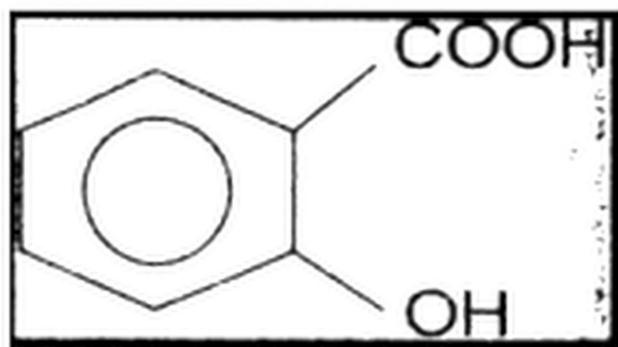
(c) Carboxylic acid:



(d) Alkene



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.

Solution:

Functional groups:

- i. Carboxyl group                      ii. Carbonyl group

18. General formula for alkane is  $\text{C}_n\text{H}_{2n+2}$ . What will be the general formula for alkyl radical?

Solution: General formula for alkyl radical:  $\text{C}_n\text{H}_{2n+1}$

19. Water adds to ethene according to the following reactions:



Identify functional groups in the reactant and product molecules.

**Solution:** Functional group in the reactant: Alkene

Functional group in the product: Alcohol

20. Bonding of carbon atom to heteroatoms increases the number of organic compounds. Justify it.

**Solution:** All heteroatoms have a greater or lesser attraction for electron than does carbon. Thus, each bond between a carbon and heteroatom is polar. The most important atomic grouping that contains such reactive polar bonds are also able to generate functional groups. Therefore, bonding of carbon atom to heteroatom increases the number of organic compounds.

