

## #":HYDROCARBON AND ITS COMPOUND:"#

\*Those compounds which are composed up of only carbon and hydrogen is called hydrocarbon.

E.g.methane ( $\text{CH}_4$ ), ethane ( $\text{C}_2\text{H}_6$ ), ethyne ( $\text{C}_2\text{H}_4$ ) etc

\*Hydrocarbon and their derivatives are known as organic compounds. E.g. methane, alcohol, glucose etc

1. Alcohol =  $\text{C}_2\text{H}_5\text{OH}$
2. Glucose =  $\text{C}_6\text{H}_{12}\text{O}_6$

Hence, all the hydrocarbons are organic compounds but all the organic compounds are not hydrocarbons.

→On the basis of the bonds between carbon atoms, hydrocarbons are of two types, they are: -

1. Saturated hydrocarbons
2. Unsaturated hydrocarbons

**\*Saturated hydrocarbons:** - Those hydrocarbons which contain single bonds between the carbon atoms are called saturated hydrocarbons or ALKANES.

Their general formula is →  $[\text{C}_n\text{H}_{2n+2}]$

While naming the alkanes in IUPAC\*\* system suffix "-ane" is used and prefix is used according to number of carbon atoms.

$\text{C}_1 \rightarrow \text{Meth}$

$\text{C}_6 \rightarrow \text{Hex}$

$\text{C}_2 \rightarrow \text{Eth}$

$\text{C}_7 \rightarrow \text{Hept/Sept etc}$

$\text{C}_3 \rightarrow \text{Prop}$

$\text{C}_4 \rightarrow \text{But}$

$\text{C}_5 \rightarrow \text{Pent}$

→ International Union of Pure and Applied Chemistry.

Alkanes	Molecular formula	Structural formula	Condensed formula
Methane	CH <sub>4</sub>		CH <sub>4</sub>
Ethane	C <sub>2</sub> H <sub>6</sub>		CH <sub>3</sub> CH <sub>3</sub>
Propane	C <sub>3</sub> H <sub>8</sub>		CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>
Butane	C <sub>4</sub> H <sub>10</sub>		CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>

Alkanes are known as paraffins because of their least chemical reactivity.

**\*Unsaturated hydrocarbon:** - Those hydrocarbon which contain multiple Bonds (at least one, double or triple bond) between carbon atoms are known as unsaturated hydrocarbons. They are of two types:

1.\*# Alkenes:→ The unsaturated hydrocarbons which contain at least one double bond between carbon atoms are called alkenes. They are commonly called alkylenes.

Their general formula is → [C<sub>n</sub>H<sub>2n</sub>]

They are called olefins because they are reactive and are derived from petroleum.

IUPAC name	Common name	Molecular Formula	Structural formula
Ethene	Ethylene	C <sub>2</sub> H <sub>4</sub>	
Propene	Propylene	C <sub>3</sub> H <sub>6</sub>	

Butene	Butylene	C <sub>4</sub> H <sub>8</sub>	

2.\*# Alkynes: → The unsaturated hydrocarbons which contain at least one triple bond between carbon atoms are called alkynes.

Their general formula is → [C<sub>n</sub>H<sub>2n-2</sub>]

IUPAC name	Common Name	Molecular formula	Structural formula	Condensed formula
Ethyne	Acetylene	C <sub>2</sub> H <sub>2</sub>		
Propyne	Allylene	C <sub>3</sub> H <sub>4</sub>		
Butyne	Crotonylene	C <sub>4</sub> H <sub>6</sub>		

Homologous series: - A series of organic compounds having similar structure and same functional group arranged in increasing order of their molecular weight is known as a homologous series.

Each member of a homologous series is known as a homologue of its adjacent member. E.g.

Alkane homologous series:      Alcohol homologous series:

Methane [ $\text{CH}_4$ ]

Methyl alcohol [ $\text{CH}_3\text{OH}$ ]

Ethane [ $\text{C}_2\text{H}_6$ ]

Ethyl alcohol [ $\text{C}_2\text{H}_5\text{OH}$ ]

Propane [ $\text{C}_3\text{H}_8$ ]

Propyl alcohol [ $\text{C}_3\text{H}_7\text{OH}$ ]

Butane [ $\text{C}_4\text{H}_{10}$ ] etc

Butyl alcohol [ $\text{C}_4\text{H}_9\text{OH}$ ] etc

### Characteristics of homologous series: -

1. All the members of a homologous series are represented by same general formula.
2. Each member differs from its adjacent membrane by  $-\text{CH}_2$  group.
3. They show similar chemical properties.
4. They have same general method of preparation.

\*Alkyl group: -A Group obtained by removing one hydrogen atom from alkane is known as alkyl radical.

Methane [ $\text{CH}_4$ ]  $\xrightarrow{-\text{H}}$   $\text{CH}_3$ - [methyl]

Ethane [ $\text{C}_2\text{H}_6$ ]  $\xrightarrow{-\text{H}}$   $\text{C}_2\text{H}_5$ - [ethyl]

Propane [ $\text{C}_3\text{H}_8$ ]  $\xrightarrow{-\text{H}}$   $\text{C}_3\text{H}_7$  [Propyl] etc

\*Functional groups: - An atom or a group of atoms directly attached to the carbon chain that determines overall chemical behavior of an organic compound is known as functional group.

Hydroxyl  $\rightarrow$   $-\text{OH}$

Ether  $\rightarrow$   $-\text{O}-$

Carboxyl  $\rightarrow$   $-\text{COOH}$  etc

Notes: -

Alkyl group + Functional group = Organic compound. Methyl + $-\text{OH}$ = $\text{CH}_3\text{OH} \rightarrow$ Methyl alcohol.
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### Hydrocarbons and their related compounds: -

1. Methane: - Methane is the first member of alkane homologous series. Its molecular formula is  $\text{CH}_4$  and molecular structure (structural formula) is:

Methane is also known as Marsh Gas because it is produced in the marshy land by the bacterial decomposition of plants and animal matter.

It is also known as Fire damp because it forms an explosive mixture with air in coal mines.

\*Uses of methane gas: →

- It is used as fuel.
- It is used to manufacture water gas, methyl chloride ( $\text{CH}_3\text{Cl}$ ), chloroform ( $\text{CHCl}_3$ ), carbon tetrachloride ( $\text{CCl}_4$ ) etc
- It is used in making printing ink.

Ethane: - Ethane is the second member of alkane homologous series. Its molecular formula is  $\text{C}_2\text{H}_6$  and molecular structure (structural formula) is:

\*Uses of ethane gas: →

- It is used as fuel.
- It is used in preparing other organic compounds.

Propane: - Propane is the third member of alkane homologous series. Its molecular formula is  $\text{C}_3\text{H}_8$  and molecular structure (structural formula) is:

\*Uses of propane gas: →

- Propane is used as fuel in many cases.
- Propane is used as refrigerant.
- Propane is used to prepare other organic compounds.

2. Butane: - Butane is the fourth member of alkane homologous series. Its molecular formula is  $C_4H_{10}$  and its molecular structure (structural formula) is:

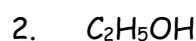
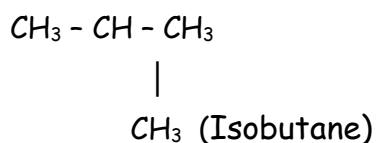
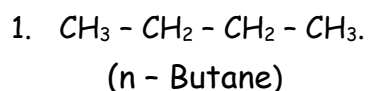
\*Uses of butane gas: →

- It is used as fuel
- It is used to manufacture synthetic rubber.
- It is used to prepare other organic compounds.

### Isomers and Isomerism: -

The phenomenon in which organic compounds having same molecular formula have different structure is known as isomerism.

Different structures of the organic compounds having same molecular formula are called isomers.



(Ethyl alcohol)

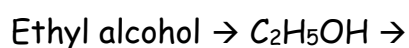


(Dimethyl ether)

Alcohol: - the organic compound containing functional group -OH is known as alcohol. E.g. methyl alcohol ( $CH_3OH$ ), ethyl alcohol ( $C_2H_5OH$ ) etc

There are three types of alcohol:

- Monohydric alcohol: → The alcohol which contains one -OH group is known as monohydric alcohol. E.g.  
Methyl alcohol →  $CH_3OH$  →



2) Dihydric alcohol:→ The alcohol which contains two -OH groups is known as dihydric alcohol e.g. ethylene glycol.

2. Trihydric alcohol:→ The alcohol which contains three -OH groups is known as trihydric alcohol. E.g. Glycerol.

**\*\*Generally the word alcohol refers to ethyl alcohol. Its IUPAC name is Ethanol.**

**#Methyl alcohol**: - It is the first member of monohydric alcohol. Its molecular formula is  $\text{CH}_3\text{OH}$  and structural formula is:

**\*Physical properties of methyl alcohol**: -

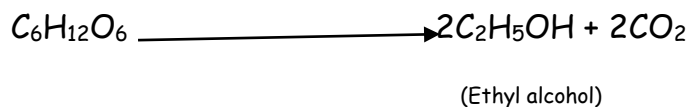
- It is a colorless liquid.
- It is water miscible.
- It is inflammable.

**\*Uses of methyl alcohol**: -

- It is used as solvent to dissolve fat, oil, paint etc
- It is used for dry cleaning.
- It is used to prepare different organic compounds like methyl chloride, formaldehyde etc

**#Ethyl alcohol**: - It is the second member of monohydric alcohol. Its molecular formula is  $\text{C}_2\text{H}_5\text{OH}$  and its structural formula is:

It is prepared by the fermentation of glucose by the enzyme zymase present in yeast.



\*Physical properties of ethyl alcohol: -

- a. It is colorless liquid.
- b. It is water soluble.
- c. Its boiling point is  $78^\circ\text{C}$  and freezing point is  $-117^\circ\text{C}$ .

\*Uses of ethyl alcohol: -

- a. It is used in alcoholic beverages.
- b. It is used as thermometric liquid.
- c. It is used as preservation for biological specimen.
- d. It is used as fuel in spirit lamp.

Glycerol / Glycerin: -

It is the simplest trihydric alcohol. Its name derived from Greek word 'glyceros' meaning sweet. Its molecular formula is  $\text{C}_3\text{H}_5(\text{OH})_3$  and structural formula is:

**\*\*** It is prepared from propane by replacing three hydrogen atoms by hydroxyl groups.

\*Physical properties of Glycerin: -

- a. It is a colorless liquid with sweet taste.
- b. It is viscous and water soluble.
- c. It is hygroscopic.



\*Uses of glycerin: -

- It is used as sweetening agents in confectionary, medicine etc
- It is used in making printing ink and stamp pads.
- It is used in making soap and cosmetics.
- It is used to preserve fruits and tobacco from drying.
- It is used as lubricants in watches.

Ether: - The organic compound containing functional group -O- is known as ether.

Some examples are: -

- Dimethyl ether:  $\rightarrow \text{CH}_3 - \text{O} - \text{CH}_3 \rightarrow$
- Methyl ethyl ether:  $\rightarrow \text{CH}_3 - \text{O} - \text{C}_2\text{H}_5 \rightarrow$
- Diethyl ether:  $\rightarrow \text{C}_2\text{H}_5 - \text{O} - \text{C}_2\text{H}_5 \rightarrow$

(Diethyl ether is simply called ether.)

\*Physical properties of ether: -

- It is a colorless volatile liquid with sweet smell.
- It is slightly soluble in water.

\*Uses of ether: -

- It is used as local anesthesia during surgery.
- It is used as refrigerant.
- It is used as solvent.

