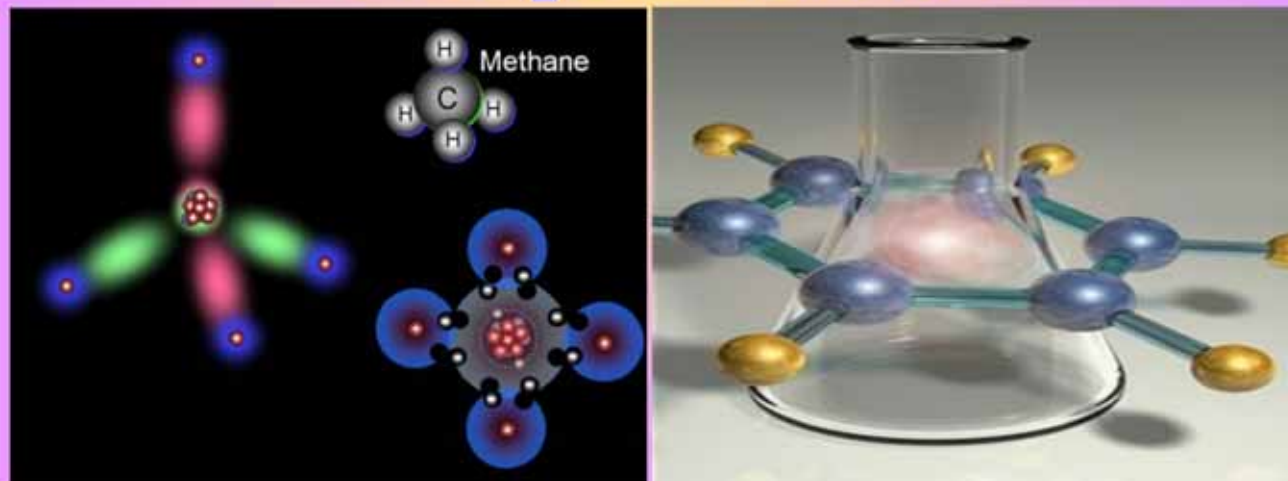


Classification of Organic Compounds



Learning Outcomes:

Students will be able to:

1. classify organic compounds into straight chain, branched chain and cyclic compounds;
2. recognize structural, condensed and molecular formula of some straight chain hydrocarbons.

Introduction:

There are millions of organic compounds known so far, which are much larger than the total number of compounds of all other elements. This is due to:

- ✓ i. the ability of a carbon atom to combine with four atoms or a group of atoms;
- ✓ ii. the fact that carbon atoms can combine with each other indefinitely to form stable chains and rings;
- ✓ iii. the existence of isomerism.

Due to such an enormous number, it is practically not possible to study each individual compound. In order to facilitate their study, organic

compounds are classified into various groups and sub-groups.

Classification of organic compounds

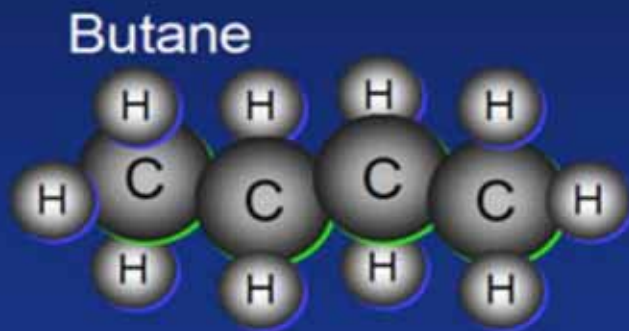
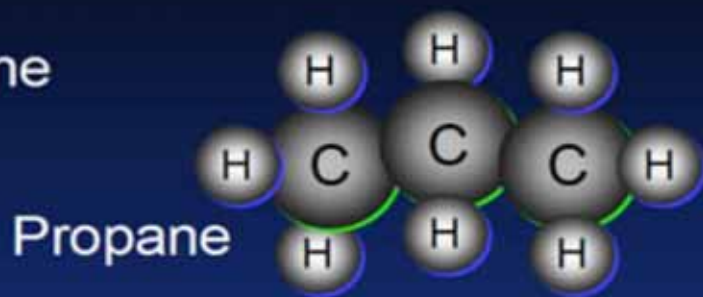
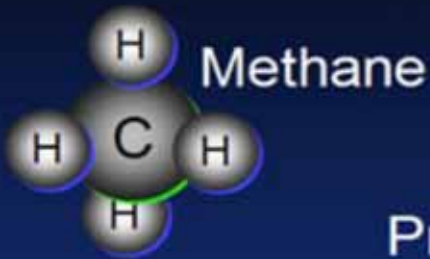
Organic compounds may be broadly classified into the following categories.

- **A. Open Chain or Acyclic Compounds**
- **B. Closed Chain or Cyclic Compounds**




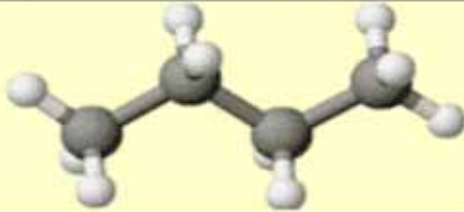
• **A. Open Chain or Acyclic Compounds:**

- These compounds are also called aliphatic compounds and contain open chains of carbon atoms. The chains may be unbranched (straight chain) or branched.

H Hydrocarbons **C**



Hydrocarbons

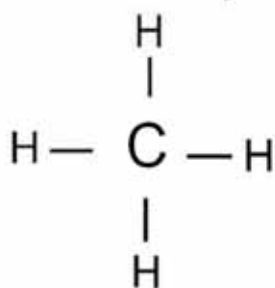
methane CH_4	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	
ethane C_2H_6	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	
propane C_3H_8	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$	
butane C_4H_{10}	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$	

Saturated Organic Compounds:

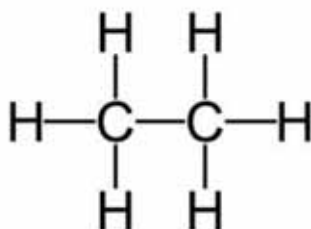
Those organic compounds in which a carbon satisfies its four valencies by single covalent bonds.

For example:

Methane



Ethane

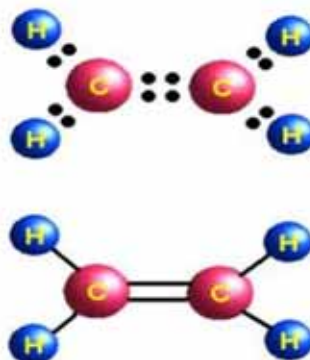
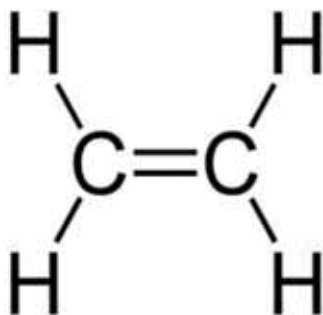


Unsaturated Organic Compounds:

Those compounds in which a carbon satisfies its four valencies by multiple bonds (a double or a triple covalent bond).

For example:

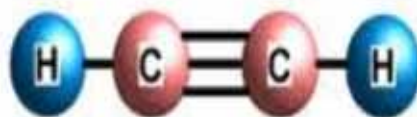
Ethene C_2H_4



Ethyne C_2H_2

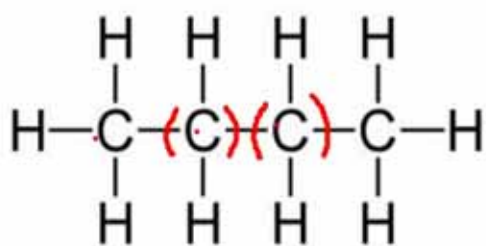


Ethyne C_2H_2

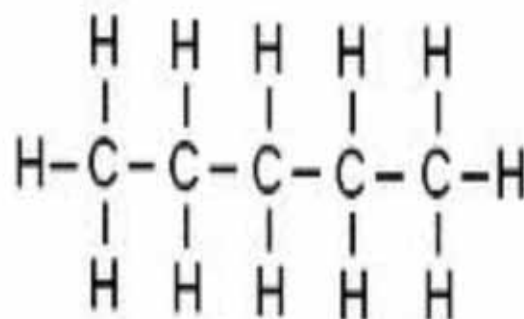


Straight Chain or Unbranched Chain Compounds:

(Those organic compounds in which one carbon atom holds no more than two other carbon atoms) As its name implies, the straight chain is a straight link of carbon atoms.



n-butane

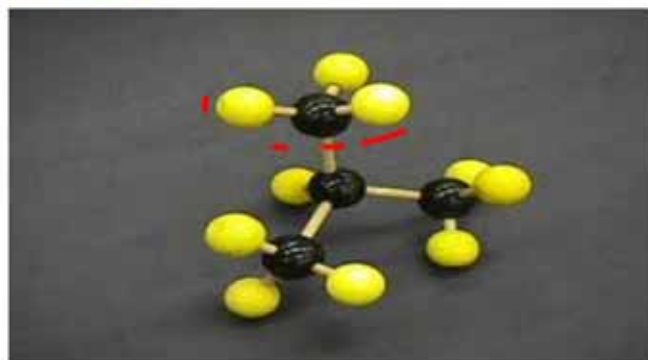
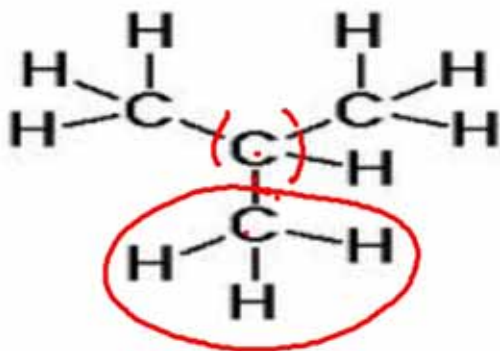


n-pentane

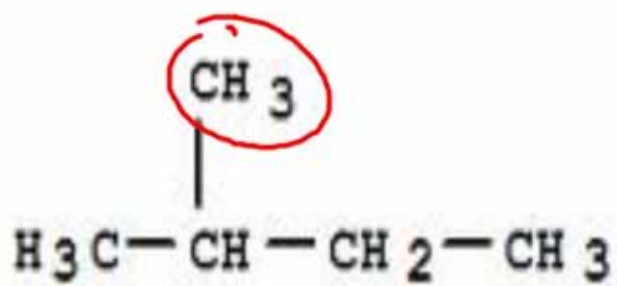
Branched Chain Organic Compounds:

Branched chain organic compounds are those compounds in which (at least one carbon atom holds more than two other carbon atoms). As its name implies, it has branches of other chains coming off another chain. Branching is one of the reasons why there are so many isomers for each compound.

Isobutane



Isopentane:



Isopentane

Closed Chain Compounds:

It is the second category of organic compounds. If the carbon atom attach with each other to form a cyclic chain or ring like structure then it will be a closed chain organic compound.

These closed chain organic compounds can be further classified into two categories.

- i. Homocyclic or carbocyclic compounds
- ii. Heterocyclic compounds

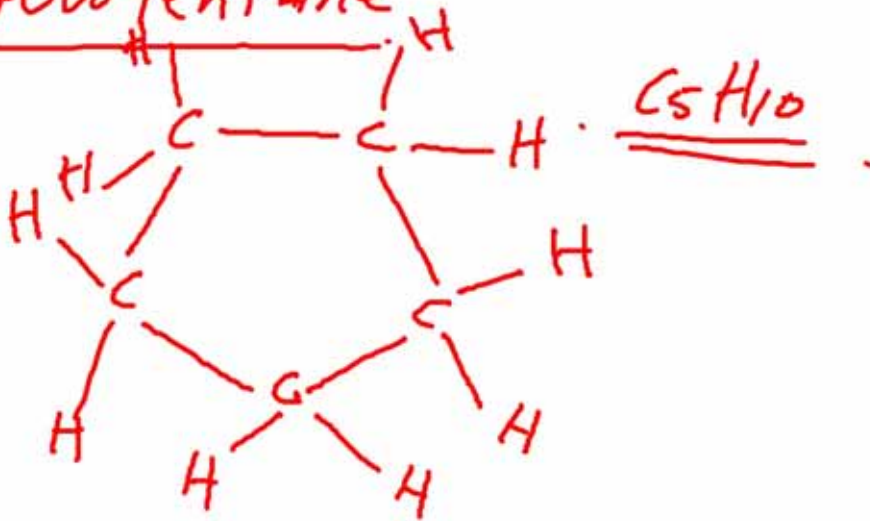
Homocyclic or Carbocyclic Compounds:

Those cyclic compounds which contain only carbon atoms in their cycle are said to be homocyclic compounds.

These compounds can be further divided into two categories.

- i. Alicyclic compounds
- ii. Aromatic compounds

cyclopentane

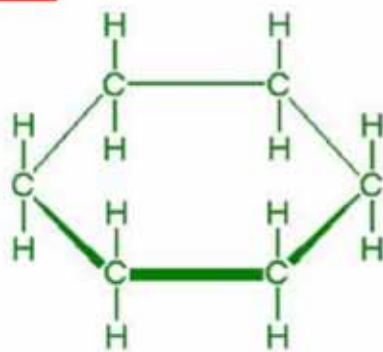


Alicyclic Compounds:

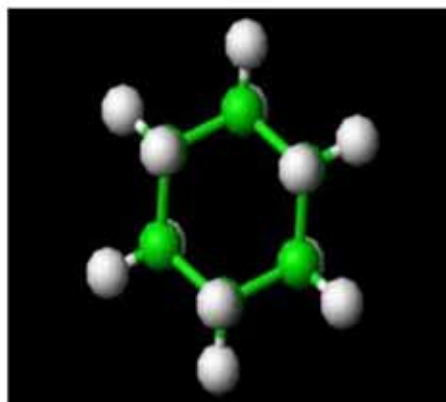
Alicyclic are those closed chain compounds which resemble in their properties with open chain compounds.

For example:

Cyclohexane



cyclohexane, C₆H₁₂

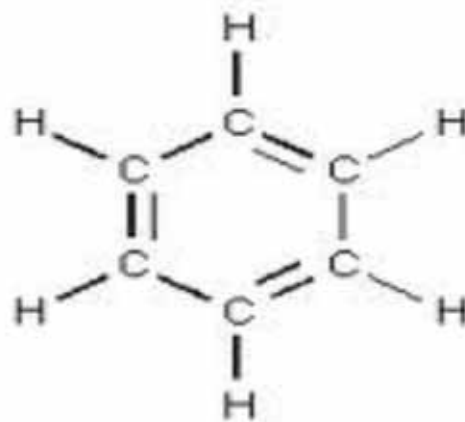
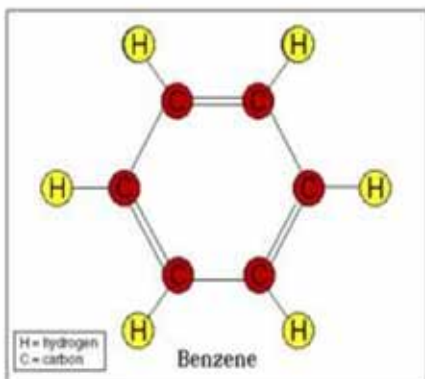


Aromatic Compounds:

Those closed chain compounds which contain benzene nucleus in their molecules and follow huckle rule are called aromatic compounds.

For example:

Benzene

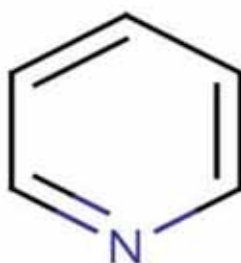


Heterocyclic Compounds:

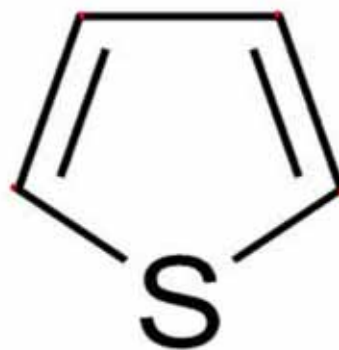
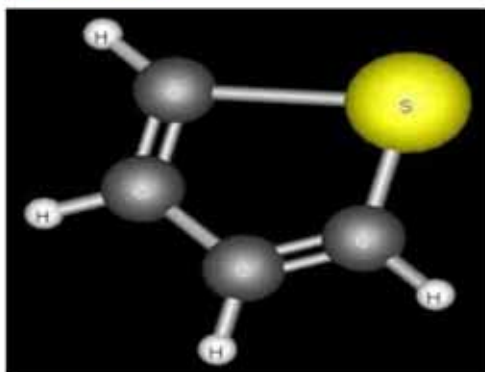
• Heterocyclic compounds are those organic compounds which contain atleast one or more hetero atoms in a closed chain structure. These hetero atoms may be oxygen, nitrogen or sulphur atoms.

For example:

Pyridine



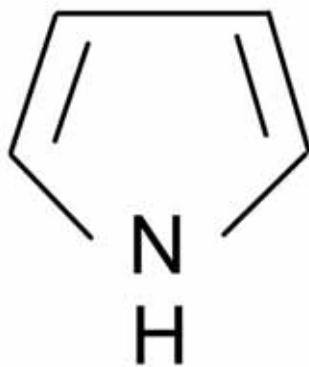
Thiophene



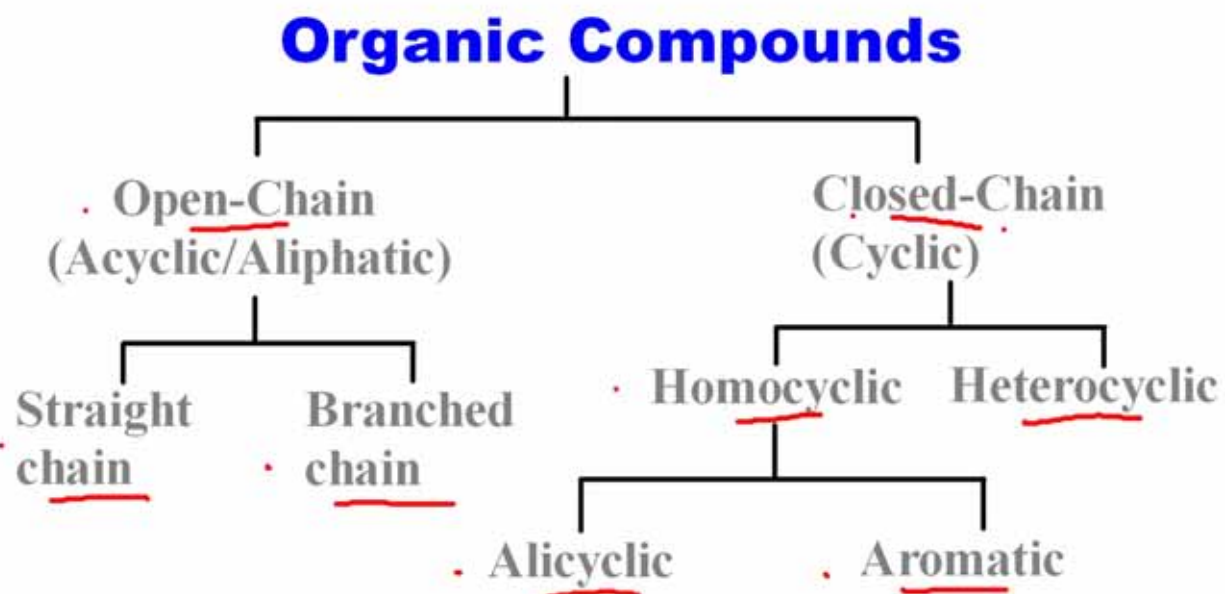
Furan



Pyrrole



The overall classification of organic compounds is given in the following flow chart.



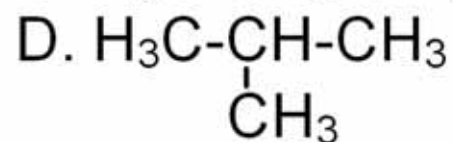
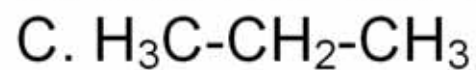
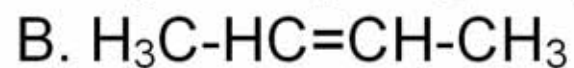
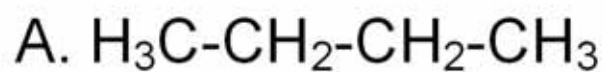
Multiple Choice



Questions



1. Which of the following is the best representation of an unsaturated organic compound?



2. Which of the following is an alicyclic compound?

- A. Benzene
- B. Cyclopentane
- C. Pyridine
- D. n-Hexane

3. Which of the following compound is an alkane?

- A. Propane
- B. Ethene
- C. Ethyne
- D. Propene

