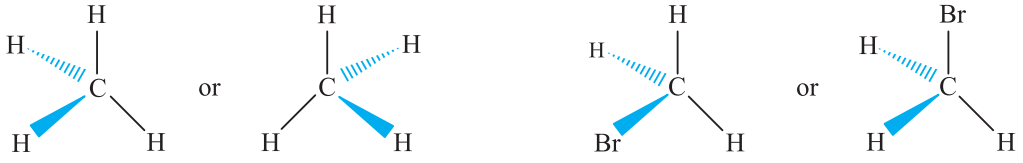
Three - Dimensional Representation

None of the formulae that we have described so far conveys any information about how the atoms of a molecule are arranged in space. There are several ways to represent the three dimensional structure of the organic molecule on paper. For example: by using a solid and dashed wedge formula, the three dimensional image of a molecule from a two dimensional picture can be perceived. In this representation, bonds that project upwards out of the plane of the paper are indicated by a solid wedge ( ), those that lie behind the plane are indicated with a dashed wedge ( ), and those bonds that lie in the plane of the paper are indicated by a line (–). Wedges are shown in such a way that the broad end of the wedge is towards the observer. Generally, we only use three-dimensional formulae when it is necessary to convey information about the shape of the molecule.

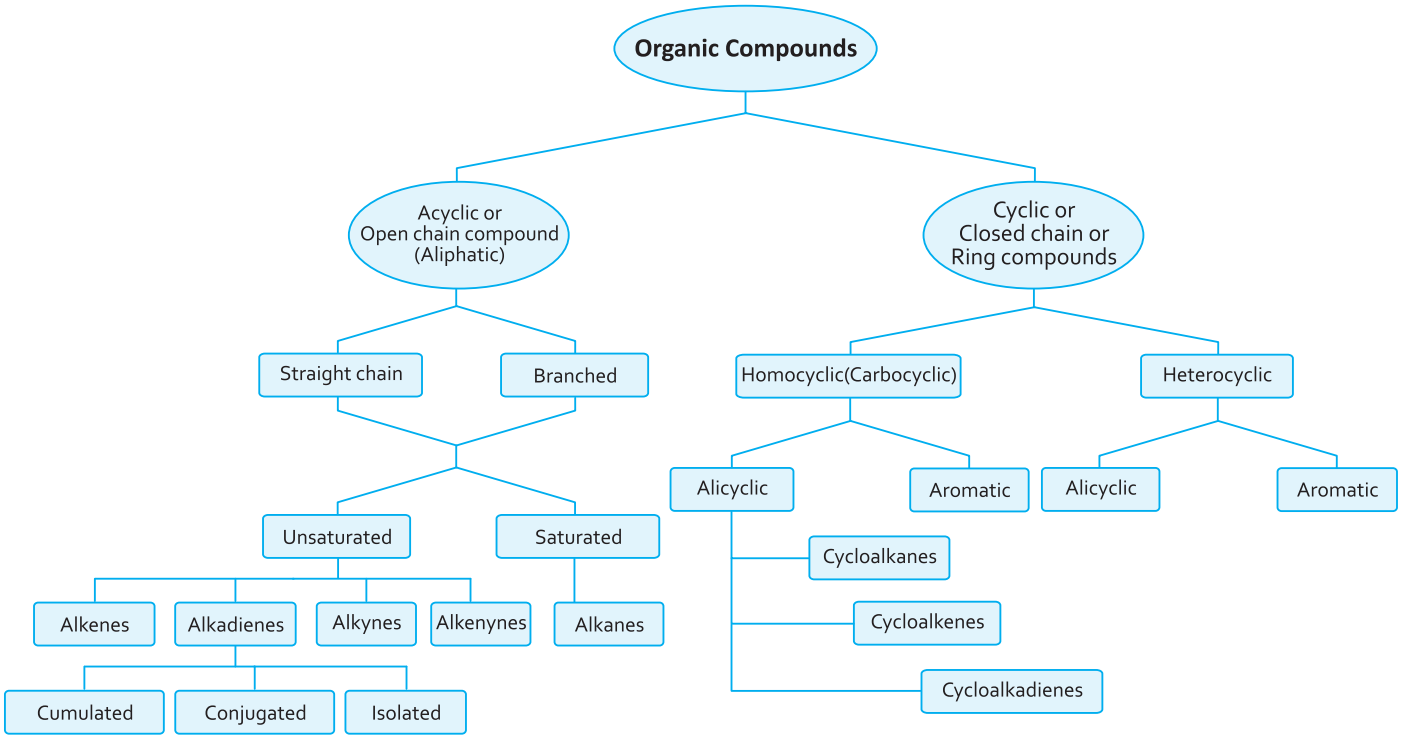


Methane Bromomethane

Wedge and Dash Representation

CLASSIFICATION OF ORGANIC COMPOUNDS Section - 2

Based upon the nature of carbon atom skeleton, the organic compounds have been classified into two categories : Acyclic or Open Chain and Cyclic or Closed chain.



I. Open Chain or Acyclic Compounds : Compounds of carbon having an open chain of carbon atoms, branched or unbranched are called acyclic compounds.

Butane $CH_3-CH_2-CH_2-CH_3$

Isopentane $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_3$

Open chain compounds are also known as **aliphatic compounds** since the earlier compounds of this class were obtained either from animals or vegetable fats. (Greek, aliphatos ≡ fats).

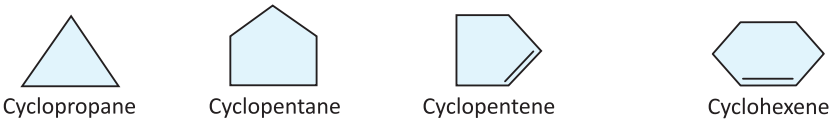
II. Cyclic or Closed Chain or Ring Compounds : Compounds of carbon having closed chain of carbon as well as of other atoms are called cyclic compounds. Depending upon the constitution of the ring, these are further divided into the following categories.

1. Homocyclic or carbocyclic compounds
2. Heterocyclic compounds

1. Carbocyclic or Homocyclic Compounds : Compounds of carbon having closed chain entirely made up of carbon atoms are called carbocyclic or homocyclic compounds. These are further divided into two groups.

(i) Alicyclic Compounds : Closed carbon chains except characteristic benzene ring, resembling in properties with acyclic compounds. These include cycloalkanes, cycloalkenes and cycloalkadienes.

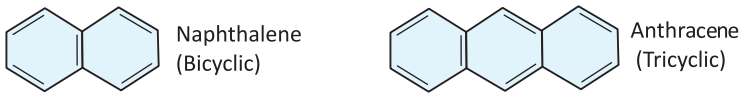
For e.g.,



(ii) Aromatic Compounds : Closed chain of only carbon atoms with alternate single and double bonds. Benzene and its derivatives belong to this category. Some important examples of monocyclic, bicyclic and tricyclic aromatic compounds are as follows.

(a) Monocyclic aromatic compounds :

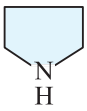
(b) Bicyclic and Tricyclic aromatic compounds :



2. Heterocyclic compounds : Compounds of carbon having closed chain made up of carbon and other atoms. The hetero atoms commonly found in these compounds are oxygen, nitrogen and sulphur and occasionally, phosphorus, boron, silicon and some metal atoms like tin, selenium etc, may also be present. Depending upon the chemical behaviour, these are further classified into the following two categories.

(i) Alicyclic heterocyclic compounds : Alicyclic compounds containing one or more heteroatoms in their rings are called alicyclic heterocyclic compounds. For example:

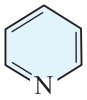
Tetrahydro Furan (THF)



Pyrrolidine

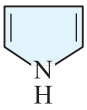
Pyran

(ii) Aromatic heterocyclic compounds : Aromatic cyclic compounds containing one or more heteroatoms in their molecules are called aromatic heterocyclic compounds. For example :



Pyridine

Furan



Pyrrole

Note : An aliphatic compound burns with non-smoky flame (except $CHCl_3$, CCl_4). All aromatic compounds burn with a smoky flame.

NOMENCLATURE OF ORGANIC COMPOUNDS Section - 3

The IUPAC (International Union of Pure and Applied Chemistry) has developed a systematic method of naming organic compounds. This system gives a unique IUPAC name to every organic compound. However before the IUPAC system came into existence, the trivial or common names for organic compounds were used. These were based on their origin or certain properties. Some examples are as follows : (Please note that the contents of following table are NOT to be memorised).

Compound	Trivial Name	Source of Compound
CH_3OH	Wood spirit	Obtained by destructive distillation of wood
CH_3OH	Methyl alcohol	Methu-spirit and hule-wood
NH_2CONH_2	Urea	Obtained from urine
CH_3COOH	Acetic acid	Obtained from Acetum-vinegar
$(COOH)_2$	Oxalic acid	Obtained from oxalis plant
HCOOH	Formic acid	Obtained from ants, (in Latin, Ants ≡ Formicae.)
C_2H_5OH	Grain alcohol (Ethanol)	Obtained by fermentation of grains.

These older names for organic compounds are still widely used by chemists and bio-chemists, and in commerce. For this reason it is necessary to learn the common names (Trivial Names) of some of the organic compounds.

Trivial System Of Nomenclature

Classification of carbon atoms :

In trivial system of naming an organic compound, the carbon atoms of an alkane were classified on the basis of the number of other carbon atoms attached to them, into four categories, viz., Primary carbon atoms, Secondary carbon atoms, Tertiary carbon atoms and Quaternary carbon atoms.