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GENERAL ORGANIC CHEMISTRY

Organic compounds

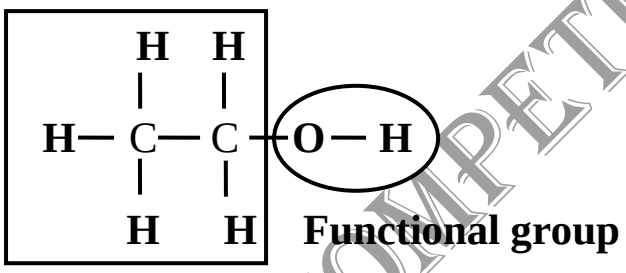
Such compounds which contain carbon as their essential part are called organic compounds.

In general organic compounds consist of following two parts-

(1) Hydrocarbon part (alkyl or aryl group)- It consist of only carbon and hydrogen and decides physical properties such as physical state, melting point, boiling point, density etc. of the compounds.

(2) Functional group- It decides chemical properties of the compounds.

For example, in ethanol molecule, these two parts can be represented as under-



If there is any change in hydrocarbon part, there is change in physical properties of the compound but, if there is a change in functional group, there is change in chemical properties of the compound.

On the basis of functional groups present in the compounds, organic compounds have been classified into a number of families such an alcohol family, aldehyde family, ketone family, carboxylic acid etc.

Homologous Series

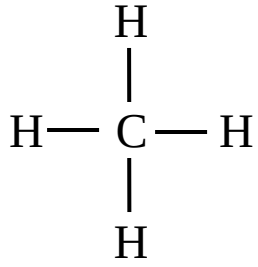
"If different members of an organic family are arranged in increasing order of their molecular masses then a series is obtained which is called homologous series."

Characteristics of Homologous Series

(1) Each homologous series has a simple general formula by which all the members of series can be derived.

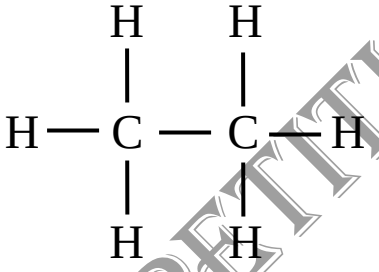
For example, general formula of alkanes is C_nH_{2n+2}.

Here, if n = 1, then formula of alkane = $C_1H_{2\times1+2}$ = CH_4

or 

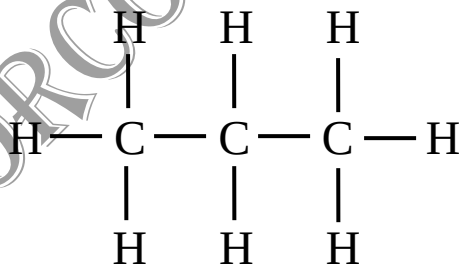
Methane

Here, if n = 2, then formula of alkane = $C_2H_{2\times2+2}$ = C_2H_6

or 

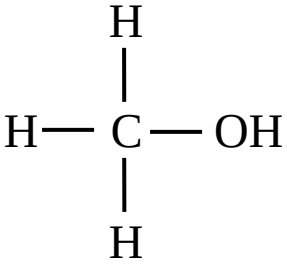
Ethane

Here, if n = 3, then formula of alkane = $C_3H_{2\times3+2}$ = C_3H_8

or 

Propane

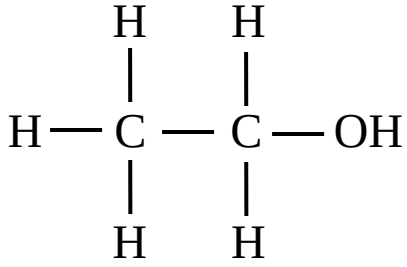
Similarly, general formula of alcohols is $C_nH_{2n+1}OH$.
Here, if n = 1, then formula of alcohol = $C_1H_{2\times1+1}OH$ = CH_3OH

or 

Methanol

Here, if n = 2, then formula of alcohol = $C_2H_{2\times2+1}OH$ = C_2H_5OH

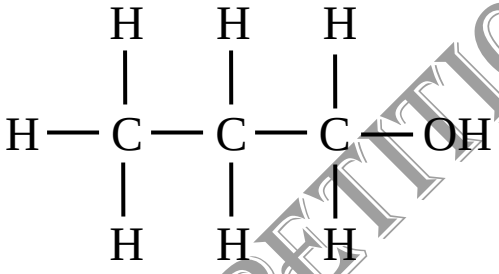
or



Ethanol

Here, if n = 3, then formula of alcohol = $C_3H_{2\times3+1}OH$ = C_3H_7OH

or



Propanol

(2)Two consecutive members of a homologous series differ by -CH_2- group (methylene) group. Thus, there is a difference of 14 units in molecular masses of two consecutive members of a homologous series.

(3)All the members of a homologous series have same functional group and therefore, they resemble in their chemical properties.

(4)Different members of a homologous series differ in their hydrocarbon part and therefore, they differ in their physical properties.

(5) All the members of a homologous series can be prepared by similar methods of preparation.

IUPAC Nomenclature of Organic Compounds

IUPAC name of an organic compound, in general consist of following three parts-

(1) Word root-It represents the number of carbon atoms in longest continuous carbon chain of the compound. For example,

Number of carbon atoms	Word root
1	Meth-
2	Eth-
3	Prop-
4	But-
5	Pent-
6	Hex-
7	Hept-
8	Oct-
9	Non-
10	Dec-

Here, first four word roots are special word roots which are not based on any numeral system. The other word roots are based upon Greek numeral system.

(2) Suffix- Suffixes are of following two types-

(i) Primary suffix-It represents nature of bonding between carbon atoms in longest continuous carbon chain of the compound. For example,

Nature of bonding	**Primary suffix**
C - C	-ane
C = C	-ene
C ≡ C	-yne

Primary suffix is always added with word root for IUPAC naming of the compound. For example,

$$\mathbf{CH_3—CH_3}$$

Eth + ane = Ethane

$$\mathbf{CH_3—CH_2—CH_3}$$

Prop + ane = Propane

$$CH_2 = CH_2$$

Eth + ene = Ethene

$$CH_3 - CH = CH_2$$

Prop + ene = Propene

$$CH \equiv CH$$

Eth + yne = Ethyne

$$CH_3 - C \equiv CH$$

Prop + yne = Propyne

Word root and primary suffix are the essential part of the IUPAC name of an organic compound i.e. these two parts are always present in IUPAC name of an organic compound. Other parts may or not may be present in IUPAC name of the organic compounds.

(ii) Secondary suffix- It represents functional group present in the compound. For example,

Functional group	**Secondary suffix**
-OH (alcohol group)	-ol
-CHO (aldehyde group)	-al
> CO (ketone group)	-one
-COOH (carboxylic acid group)	-oic acid

Secondary suffix, if present is always added after primary suffix. For example,

$$CH_3 - OH$$

Meth + ane + ol = Methanol

$$CH_3 - CH_2 - OH$$

Eth + ane + ol = Ethanol

HCOOH

Meth + ane + oic acid = Methanoic acid

CH_3 ─ COOH

Eth + ane + oic acid = Ethanoic acid

CH_3─ CH_2 ─ COOH

Prop + ane + oic acid = Propanoic acid

(3)Prefix- There are certain atoms or groups which are not considered to be functional groups in IUPAC naming of the organic compounds. These atoms or groups are considered to be substituents in longest continuous carbon chain of the compound and are named as prefix. For example,

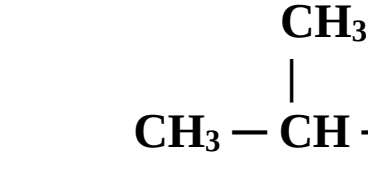
Atom/Group	**Prefix**
-Cl	chloro-
- Br	bromo-
- I	iodo-
- CH_3	methyl-
- CH_2-CH_3	ethyl-
- NH_2	amino-
- NO_2	nitro-

Prefixes if present, are always placed before the word root during IUPAC naming of the organic compounds.

Thus, the sequence of different parts in IUPAC name of an organic compound is as under-

Prefix + Word root + Primary suffix + Secondary suffix

For example, for following compound-



3-Methyl + But + ane + oic acid

= 3-Methylbutanoic acid

4-Bromo + Pent + 2-ene + al

= 4-Bromopent-2-enal

= 4-Bromo-2-pentenal

Here, position of multiple bonds, substituents and functional group is given by numbering the carbon atoms of longest continuous carbon chain of the compounds. In general, numbering of the carbon atoms is done from that end of longest continuous carbon chain of the compound where from the functional group is nearest.