Chemistry Study Materials for Class 11
(NCERT Based Notes of Chapter- 12)
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SOME BASIC PRINCIPLES AND TECHNIQUES

Organic chemistry is the branch of chemistry that deals with carbon compounds. But all carbon compounds are not considered as organic compounds.

(E.g. CO_2, CO, metal carbonates, bicarbonates etc.). So organic chemistry can be defined as *the branch of chemistry that deals with hydrocarbons and their derivatives*. Hydrocarbons are the major class of organic compounds and they *contain only carbon and hydrogen atoms*. All other organic compounds are formed by replacing one or more hydrogen atoms of hydrocarbons by other atoms or groups (They are called hydrocarbon derivatives).

All carbon compounds present in plants and animals are organic compounds. E.g. Carbohydrates, proteins, vitamins, nucleic acids, amino acids, fats and oils, natural polymers etc. petroleum and coal are the major source of organic compounds (hydrocarbons).

In ancient times, it was believed that a vital force (living body) is necessary for the production of an organic compound. But in 1828, Frederic Wohler proved that this belief was wrong. He prepared urea in the laboratory, by heating ammonium cyanate (NH_4CNO). It was the first organic compound prepared in the laboratory.

$NH_4CNO \xrightarrow{Heat} NH_2CONH_2$ Ammonium cyanate Urea

Then another scientist Kolbe synthesized acetic acid and Berthelot synthesized methane in the laboratory. Nowadays about 95% of the organic compounds are synthesized in the laboratory.

Chemistry behind the existence of large number Carbon compounds

Carbon is a unique element and it can form a large number of compounds due to the following reasons:

i) Tetravalency of carbon: In all of its compounds, the valency of carbon is four. Carbon has 4 electrons in its valency shell and requires 4 more electrons to complete the octet. So it attains the octet configuration by forming 4 covalent bonds.

ii) Ability to form single bond and multiple bonds: C can form single bond and multiple bond (double or triple bond) with itself and also with other elements like oxygen, nitrogen etc. This is possible by sp^3, sp^2 or sp hybridisation.

iii) Catenation: Carbon shows catenation. It is the self linking property of an element to form long chains and rings.

iv) Isomerism: Carbon compounds can show isomerism. It is the phenomenon in which compounds having same molecular formula but different structural formula or spatial arrangement of atoms.

Structural representation of organic compounds

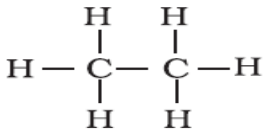
An organic compound can be represented by the following ways:

1. **Complete structural formula**:

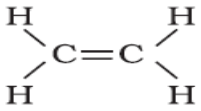
Here all the bonds between atoms are denoted by dashes (−).

A single dash represents a single bond, a double dash represents a double bond and a triple dash represents a triple bond.

E.g.



Ethane



Ethene

2. **Condensed structural formula**:

Here the carbon-hydrogen bonds or all the bonds are omitted except the multiple bonds. It is a simplified representation of an organic compound.

E.g. ethane - CH_3CH_3, propane - $CH_3CH_2CH_3$, butane - $CH_3CH_2CH_2CH_3$, ethene - $CH_2=CH_2$ etc.

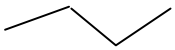
The condensed formula can again simplify as follows:

Butane – $CH_3(CH_2)_2CH_3$, Hexane- $CH_3(CH_2)_4CH_3$, Decane – $CH_3(CH_2)_8CH_3$ etc.

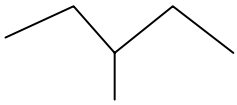
3. Bond line representation:

It is the simplest form of representation of an organic compound. Here carbon and hydrogen atoms are not shown and the lines representing carbon-carbon bonds are drawn in a zig- zag fashion. The only atoms specifically written are oxygen, chlorine, nitrogen etc. The free terminals denote methyl ($–CH_3$) groups.

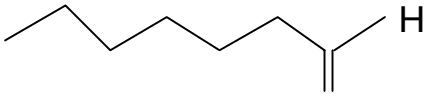
E.g. Butane:



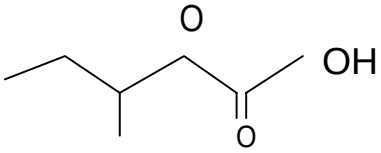
3-Methyl pentane:



Heptanal:

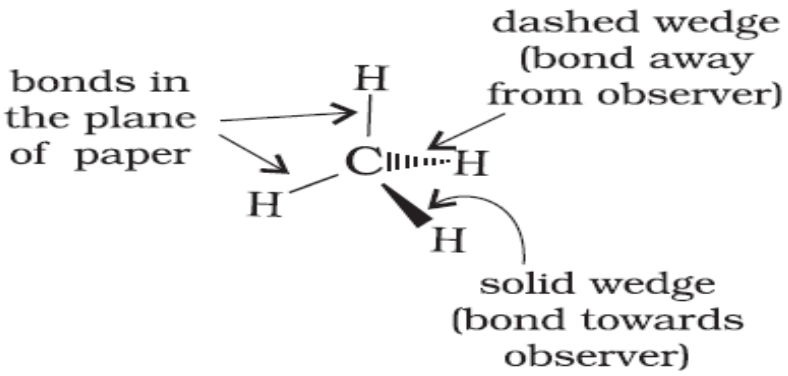


3-Methyl pentanoic acid:



4. **Three-Dimensional Representation (Wedge Representation)**: Here the structure of an organic molecule can be represented by using solid (▬◥) and dashed (┈┈┈) wedges. The solid-wedge is used to indicate a bond projecting out of the plane of paper, towards the observer. The dashed-wedge indicates the bond projecting out of the plane of the paper and away from the observer. The broad end of the wedge is always towards the observer. The bonds lying in plane of the paper are depicted by using a normal line (—).

E.g. methane



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