

Carbon and Its Compounds

Carbon

Carbon is a highly versatile element that forms the basic building block of all living organisms as well as many materials we use in daily life. It has unique properties that allow it to form a large number of compounds.

Tetravalency of Carbon

Tetravalency means that a carbon atom has four valence electrons and can form four covalent bonds with other atoms to complete its outermost shell. This property allows carbon to form stable compounds.

Catenation

Catenation is the property of carbon by which it can form long chains, branched chains, or rings by bonding with other carbon atoms. This leads to the formation of a vast number of organic compounds.

Covalent Bond

A covalent bond is a type of chemical bond formed by the sharing of one or more pairs of electrons between two atoms so that each atom achieves a stable electronic configuration.

Covalent Compounds

Covalent compounds are substances formed by covalent bonding. These compounds usually have strong bonds within molecules but weak forces between molecules, resulting in low melting and boiling points.

Allotropes of Carbon

Allotropes are different forms of the same element having different physical properties. Carbon exists in various allotropes such as:

- Diamond
- Graphite
- Fullerene (C-60)

(1) Diamond

Diamond is an allotrope of carbon in which each carbon atom is bonded to four other carbon atoms, making it extremely hard. It is a poor conductor of heat and electricity.

(2) Graphite

Graphite is another allotrope of carbon where atoms are arranged in layers. It is soft, slippery, and a good conductor of heat and electricity.

(3) Fullerenes (C-60)

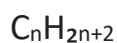
Fullerenes are carbon molecules in which atoms are arranged in the shape of a hollow sphere, resembling a football.

Hydrocarbons

Hydrocarbons are organic compounds made up of only carbon and hydrogen atoms. They form the basis of fuels like petrol, diesel, and natural gas.

Alkanes

Alkanes are saturated hydrocarbons containing only single bonds between carbon atoms. Their general formula is:



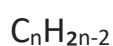
Alkenes

Alkenes are unsaturated hydrocarbons containing at least one double bond between carbon atoms. Their general formula is:



Alkynes

Alkynes are unsaturated hydrocarbons containing at least one triple bond between carbon atoms. Their general formula is:



Saturated Compounds

Saturated carbon compounds contain only single bonds between carbon atoms. They are generally less reactive and burn with a clean flame.

Unsaturated Compounds

Unsaturated compounds contain double or triple bonds between carbon atoms. They are more reactive and burn with a yellow, smoky flame.

Homologous Series

A homologous series is a group of organic compounds having the same functional group and similar chemical properties, where successive members differ by a $-CH_2$ group.

Functional Group

A functional group is an atom or group of atoms that determines the chemical properties of an organic compound. Examples include:

- Alcohol (-OH)
- Aldehyde (-CHO)
- Ketone ($>C=O$)
- Carboxylic acid (-COOH)

Nomenclature of Organic Compounds

It is the system of naming organic compounds using prefixes and suffixes based on the number of carbon atoms and the type of functional group present.

Combustion

Combustion is a chemical reaction in which carbon compounds react with oxygen to produce carbon dioxide (CO_2), water (H_2O), heat, and light.

Oxidising Agent

An oxidising agent is a substance that adds oxygen to another substance or removes hydrogen from it during a chemical reaction.

Addition Reaction

An addition reaction is a reaction in which atoms are added to an unsaturated compound (having double or triple bonds), converting it into a saturated compound.

Substitution Reaction

A substitution reaction is a reaction in which one atom or group of atoms in a compound is replaced by another atom or group.

Ethanol

Ethanol is a liquid alcohol at room temperature with the formula C_2H_5OH . It is commonly used as a fuel and solvent.

Ethanoic Acid (Acetic Acid)

Ethanoic acid is an organic acid with the formula CH_3COOH . Pure ethanoic acid is called **glacial acetic acid** because it freezes at low temperatures.

Esterification

Esterification is a chemical reaction in which a carboxylic acid reacts with an alcohol in the presence of an acid catalyst to form an ester and water.

Saponification

Saponification is the process in which an ester reacts with a base to form a salt (soap) and alcohol. It is used in soap making.

Soaps

Soaps are sodium or potassium salts of long-chain carboxylic acids. They are used as cleansing agents.

Detergents

Detergents are synthetic cleansing agents, usually sodium or ammonium salts of sulphonic acids. They work even in hard water.

Emulsion

An emulsion is a mixture in which oily dirt is suspended in water with the help of soap or detergent molecules.

Hard Water

Hard water is water that contains dissolved salts of calcium and magnesium, which reduce the effectiveness of soap.

Hydrophilic and Hydrophobic Groups

Hydrophilic part: Water-attracting part of a molecule

Hydrophobic part: Water-repelling part of a molecule

These properties help soaps and detergents clean oily dirt.