

Chemistry — Carbon and its compounds

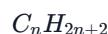
Carbon and Its Compounds

Key Definitions

- **Carbon:** A non-metal element with the atomic number 6, known for its ability to form a vast number of compounds.
- **Allotropes of Carbon:** Different structural forms of carbon, including:
 - **Diamond:** Each carbon atom is tetrahedrally bonded to four other carbon atoms.
 - **Graphite:** Carbon atoms are arranged in layers of hexagonal lattices, with weak forces between layers.
 - **Fullerenes:** Molecules composed entirely of carbon, taking the form of hollow spheres, ellipsoids, or tubes.
 - **Graphene:** A single layer of carbon atoms arranged in a two-dimensional honeycomb lattice.
- **Hydrocarbons:** Compounds consisting solely of carbon and hydrogen. They can be classified as:
 - **Aliphatic Hydrocarbons:** Straight or branched chains (e.g., alkanes, alkenes, alkynes).
 - **Aromatic Hydrocarbons:** Compounds containing benzene rings.
- **Functional Groups:** Specific groups of atoms that impart characteristic properties to organic compounds. Examples include:
 - **Alcohol (-OH)**
 - **Carboxylic Acid (-COOH)**
 - **Aldehyde (-CHO)**
 - **Ketone (C=O)**

Important Formulas

- General formula for alkanes:



- General formula for alkenes:



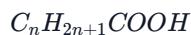
- General formula for alkynes:



- Molecular formula for alcohols:



- Molecular formula for carboxylic acids:



Diagrams

Structure of Diamond

- Each carbon atom forms four strong covalent bonds in a tetrahedral arrangement, resulting in a rigid three-dimensional structure.

Structure of Graphite

- Layers of carbon atoms are bonded in a planar hexagonal arrangement, with weak van der Waals forces between layers allowing them to slide over each other.

Functional Group Examples

- **Alcohol:** R-OH
- **Carboxylic Acid:** R-COOH

Summary Tables

Type of Hydrocarbon General Formula Example

Alkane C_nH_{2n+2} Methane (CH_4)

Alkene C_nH_{2n} Ethene (C_2H_4)

Alkyne C_nH_{2n-2} Ethyne (C_2H_2)

Functional Group Structure Example

Alcohol R-OH Ethanol (C_2H_5OH)

Carboxylic Acid R-COOH Acetic Acid (CH_3COOH)

Aldehyde R-CHO Formaldehyde ($HCHO$)

Ketone R-C(=O)-R' Acetone (C_3H_6O)

Key Takeaways

- Carbon is unique due to its ability to form stable bonds with many elements, leading to a vast array of compounds.
- Understanding the structure and properties of carbon compounds is essential for studying organic chemistry.
- Functional groups determine the chemical behavior of organic molecules.
- Hydrocarbons serve as the foundation for many organic compounds, with distinct properties based on their structure.