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CARBON AND ITS COMPOUNDS

- All living structures are carbon based.
- Carbon is found both in free state as well as combined state in nature.
- Earth's crust has only 0.02% carbon in the form of minerals like carbonates, hydro carbonates, coal and petroleum and the atmosphere has 0.03% of carbon dioxide.
- Both diamond and graphite are formed by carbon atoms; they are allotropes of carbon. however, the difference lies between them in the manner in which the carbon atoms are bonded to one another.
- In diamond, each atom of the carbon, is bonded to four other carbon atoms and form a rigid three-dimensional structure.
- In graphite, each atom of the carbon, is bonded to three other carbon atoms in the same plane, which gives a hexagonal array.
- There is also difference in some physical structure of diamond and graphite.
- Diamond is the hardest substance known whereas graphite is smooth and slippery substance.
- Graphite is good conductor of electricity whereas diamond is not.
- The compounds, which has identical molecular formula, but different structures, are known as **structural isomers**.
- The saturated hydrocarbons are known as **alkanes**.
- The unsaturated hydrocarbons, which comprise of one or more double bonds, are known as **alkenes**.
- The unsaturated hydrocarbons, which comprise of one or more triple bonds, are known as **alkynes**.
- The gas/kerosene stove used at home has inlets for air so that a sufficiently oxygen-rich mixture is burnt to give a clean **blue flame**.
- If bottoms of cooking vessels getting blackened, it means that the air holes are blocked and fuel is getting wasted.
- Cooking Gas mainly consist of **Butane**.
- **Ethanol** is used as a fuel in cars along with petrol.
- **Ethyl alcohol** is used as an antiseptic to sterilize wounds and syringes in hospitals.
- **Methane** popularly known as marsh gas. Natural consists of over 90 percent methane and some amount of propane and butane.
- **Paddy field** is biggest source of methane gas.
- **Bio gas** consists of 55 to 70 percent methane and 30 to 45 percent carbon.
- **Ethylene** is used for:
 - o Preparation of mustard gas
 - o Preservation and artificial ripening of green fruits
 - o Manufacturing of PVC pipes

Covalent Bond

- Carbon always has a covalent bond.
- The bond formed by sharing of electrons between two atoms are known as covalent bond.
- The boiling and melting points of the carbon compounds is low.
- Most carbon compounds are poor conductors of electricity because they form covalent bond so it does not give rise to free electrons. All electrons are used in making the covalent bond.
- **Graphite is a good conductor of heat and electricity** because it has free electrons.

Melting & Boiling Points Compounds of Carbon

Compound	Formula	Melting point (K)	Boiling point (K)
Acetic acid	CH ₃ COOH	290	391
Chloroform	CHCl ₃	209	334
Ethanol	CH ₃ CH ₂ OH	156	351
Methane	CH ₄	90	111

Allotropes of Carbon

- Allotropy is a property by which an element can exist in more than one form that are physically different and chemically similar. The different forms of that element are called its allotropes.
- The element carbon occurs in different forms in nature with widely varying physical properties. Both diamond and graphite are formed by carbon atoms, the difference lies in the manner in which the carbon atoms are bonded to one another.
- Carbon exists in different allotropic forms and based on their physical nature they are classified as below.
- **Crystalline forms of Carbon:**
 - o Diamond
 - o Graphite
 - o Fullerene
- **Amorphous forms of carbon:**
 - o Charcoal
 - o Coke
 - o Lamp black
 - o Gas carbon

Some Functional Groups of Carbon Compounds

Hetero atom	Class of compounds	Formula of functional group
Cl/Br	Halo (Chloro/bromo) Alkane	—Cl, —Br (substitutes for hydrogen atom)
Oxygen	1. Alcohol	—OH
	2. Aldehyde	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{H} \end{array}$
	3. Ketone	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{R}' \end{array}$
	4. Carboxylic acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OH} \end{array}$

Formula of Saturated Compounds of Carbon and Hydrogen

No of C atoms	Name	Formula
1	Methane	CH ₄
2	Ethane	C ₂ H ₆
3	Propane	C ₃ H ₈
4	Butane	C ₄ H ₁₀
5	Pentane	C ₅ H ₁₂
6	Hexane	C ₆ H ₁₄
7	Heptane	C ₇ H ₁₆
8	Octane	C ₈ H ₁₈
9	Nonane	C ₉ H ₂₀
10	Decane	C ₁₀ H ₂₂

Ethanol

- Ethanol is commonly known as alcohol. All alcoholic beverages and some cough syrups contain ethanol. Its molecular formula is C₂H₅OH.
- Ethanol and ethanoic acid are carbon compounds of importance in our daily lives.
- Ethanol is a liquid at room temperature. Ethanol is commonly called alcohol and is the active ingredient of all alcoholic drinks.
- Ethanol is a colourless liquid, having a pleasant smell and a burning taste.

- Ethanol is used as an anti-freeze in automobile radiators.
- Ethanol is used in medical wipes, as an antiseptic.
- Ethanol is a good solvent, it is also used in medicines such as tincture iodine, cough syrups, and many tonics.
- Ethanol is used for effectively killing microorganisms like bacteria, fungi, etc., by including it in many hand sanitizers.

Ethanoic Acid

- Ethanoic acid or acetic acid is one of the most important members of the carboxylic acid family. Its molecular formula is $C_2H_4O_2$.
- Ethanoic acid is commonly called acetic acid and belongs to a group of acids called carboxylic acids.
- 5-8% solution of acetic acid in water is called vinegar and is used widely as a preservative in pickles.
- Ethanoic acid is used in printing on fabrics.
- The melting point of pure **ethanoic acid is 290k** and hence it often **freezes during winter**. They look like glaciers, so it is called **glacial acetic acid**.

Soaps & Detergents

- Soap is a sodium or potassium salt of long chain carboxylic acid.
- Soap is effective only in soft water.
- Detergent is ammonium or sulphonate salt of long chain of carboxylic acid.
- Detergent is effective in both soft and hard water.

Organic Compounds in Daily Life

Organic compounds are inseparable in human life. Various classes of organic compounds and their uses in our daily life as follows:

Hydrocarbons

- Fuels like LPG, Petrol, Kerosene.
- Raw materials for various important synthetic materials.
- Polymeric materials like tyre, plastic containers.

Alcohols

- As a solvent and an antiseptic agent.
- Raw materials for various important synthetic materials.

Aldehydes

- Formaldehyde as a disinfectant.

- Raw material for synthetic materials.

Ketones

- As a solvent.
- Stain Remover.

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