Chapter - 4 Carbon and its compounds

Introduction:

- The element carbon is non-metal. Its symbol is C.
- Carbon is versatile element present in earth crust in form of mineral is 0.02% and atmosphere as carbon dioxide is 0.03%.
- All the living things, plants and animals are made up of carbon-based compounds.

Covalent bonding in carbon compounds

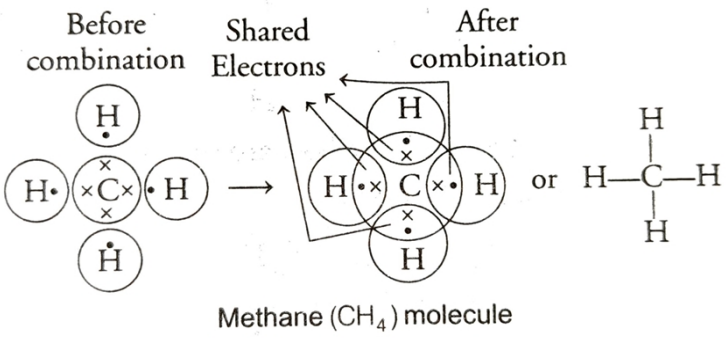
The atomic number of carbons is 6.

Electronic configuration:

	K	L
C (6)	2	4

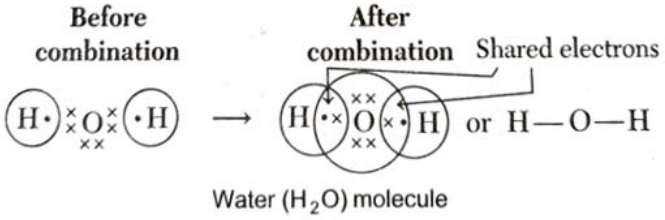
- Carbon is tetravalent, it does not form ionic bond by either losing four electrons (C^{4+}) or by gaining four electrons (C^{4-}). It is difficult to hold four extra electron and would require large amount of energy to remove four electrons. So, carbon can form bond by sharing of its electrons with the electrons of other carbon atom or with other element and attain noble gas configuration.
- The atoms of other elements like hydrogen, oxygen and nitrogen, chlorine also form bonds by sharing of electrons.
- The bond formed by sharing of electrons between same or different atoms is **covalent bond**.

Examples of covalent bonding



Formation of methane

Formation of water molecules



Properties of Covalent Compounds

The compounds containing covalent bonds are called covalent compounds. They have following properties i.e.

- Covalent compounds have low melting and boiling points due to small intermolecular forces of attraction between the atoms.
- Covalent compounds are generally poor conductors of electricity. This is because the electrons are shared between atoms and no charged particles are formed in these compounds.

Versatile Nature of Carbon

i. **Catenation** The property of self-linking of elements mainly C-atoms through covalent bonds to form long, straight or branched chains and rings of different sizes is called catenation.

ii. **Tetravalency of carbon** the valency of carbon is four, i.e., it is capable of bonding or pairing with four other carbon atoms or with the atoms of some other monovalent elements like hydrogen, halogen (chlorine, bromine), etc.

iii. **Tendency to form multiple bonds** Carbon has a strong tendency to form multiple bonds due to its small size. It shares more than one electron pair

with its own atoms or with the atoms of elements like oxygen, nitrogen, Sulphur, etc.

Organic Compounds

The compounds of carbon except its oxides, carbonates and hydrogen carbonate salts, are known as organic compounds.

Hydrocarbons

Organic compounds made up of carbon and hydrogen are called hydrocarbons. These are of two types, i.e.

Saturated Hydrocarbons

Saturated hydrocarbons arc called alkane or paraffin. All the carbon atoms in these are bonded through single bonds. The general formula of these compounds is C_nH_{2n+2} and suffix – “ane" is used in their nomenclature.
e.g., CH_4 (methane), C_2H_6 (ethane), etc.

Unsaturated Hydrocarbons

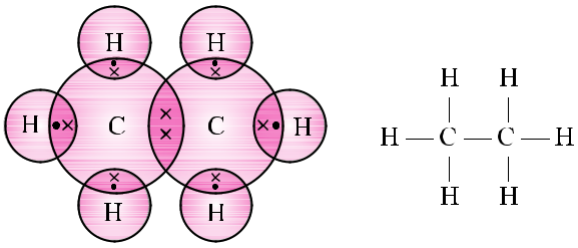
Those compounds in which at least one double or triple bond is present between two carbon atoms are called unsaturated hydrocarbons.

Aliphatic unsaturated hydrocarbons are of two types

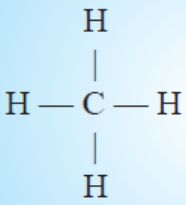
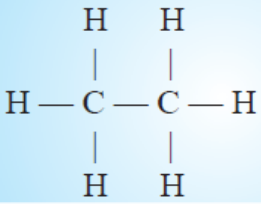
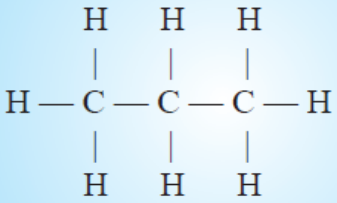
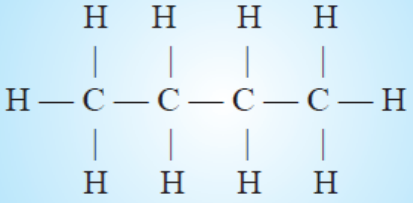
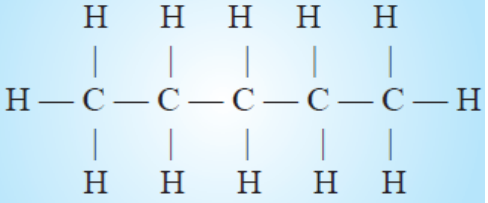
Alkene Those hydrocarbons which have at least one carbon-carbon double bond are called alkenes or olefins. The general formula of these compounds is C_nH_{2n} and suffix “ene”. e.g., C_2H_4 (ethene).
Alkyne those hydrocarbons which must have at least one carbon-carbon triple bond are called alkyne. The general common formula of these compound is C_nH_{2n-n} and suffix “yne”, e.g., C_2H_2 (ethyne).

Electron Dot Structure of Saturated Hydrocarbons

Ethane C_2H_6

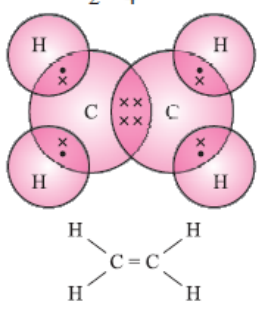


The names, molecular formulae and saturated formulae of saturated hydrocarbons (alkanes) are given below:

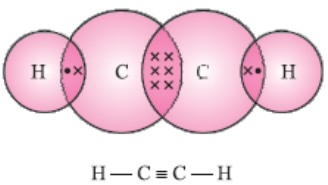
Name of Hydrocarbon	Mileculas formula	Structural Formula
1. Methane	CH_4	
2. Elhane	C_2H_6	
3. Propane	C_3H_8	
4. Butane	C_4H_{10}	
5. Pentane	C_5H_{12}	

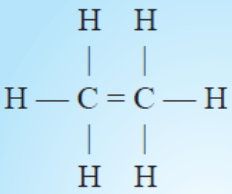
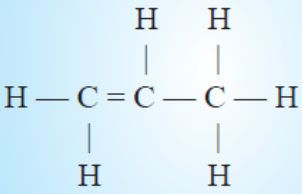
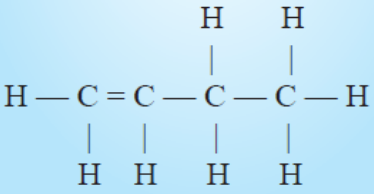
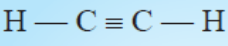
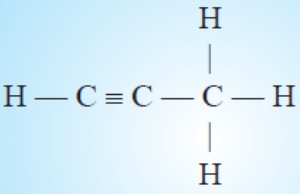
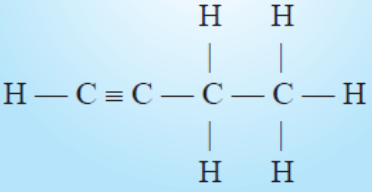
Electron dot structure of unsaturated hydrocarbons

Ethene C_2H_4



Ethyne C_2H_2



Name of Hydrocarbon	Mileculas formula	Structural Formula
Alkenes :		
1. Ethene	C_2H_4	
2. Propene	C_3H_6	
3. Butane	C_4H_8	
Alkynes :		
1. Ethyne	C_2H_2	
2. Propyne	C_3H_4	
3. Butyne	C_4H_6	

Structure of cyclic compound

in some compounds, carbon atoms are arranged in the form of ring. E.g., cyclohexane (C_6H_{12}) and benzene (C_6H_6).