

9. CARBON COMPOUNDS

Prepared By : Dr. P. W. MATTE

www.mathsciencedears.com

CLASS 10TH

SCIENCE & TECHNOLOGY
Part : I

Types of compounds

Compounds are said to be of two types, namely:

1. Organic compounds
2. Inorganic compounds



Organic compounds are characterized by the presence of carbon atoms in them

Organic compounds are mainly found in most of the living things



Most inorganic compounds do not have carbon atoms in them

These compounds are found in non-living things

1) Atomic number

The **number of protons**, which is always equal to the **number of electrons** in the neutral atom, is called the **ATOMIC NUMBER**.

2) Atomic mass

ATOMIC MASS of an atom can be calculated by **adding the mass of protons and neutrons**.

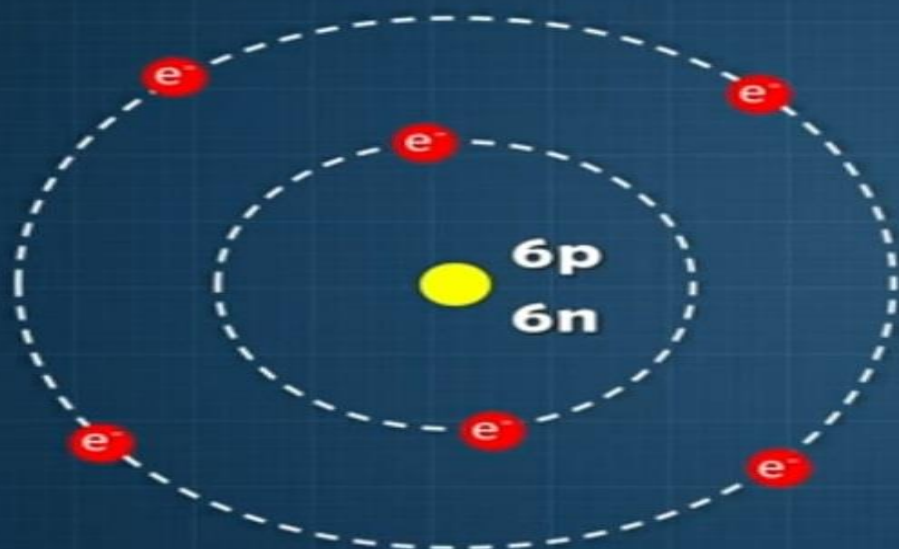
3) Electronic configuration

ELECTRON CONFIGURATION of an atom describes how **electrons** are **distributed** in its **shells**.

4) Valency

VALENCY is the ability of an atom to **gain, lose or share electron** in order to achieve the **noble gas configuration**.

C A R B O N → C



Atomic Number (Z) = **6**

Atomic Mass (A) = **12**

Electronic Configuration = **(2,4)**

Valency = **4**

Group = **14**

Period = **2**

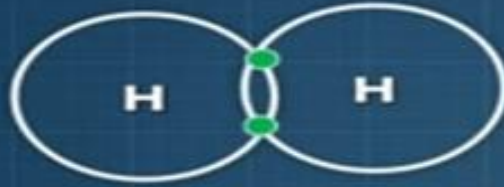
**MATH-
SCIENCE
DEARS**

**MATH-
SCIENCE
DEARS**

COVALENT Bond

Electron dot structure

The **chemical bond** formed by **sharing of two valence electron** between the **two atoms** is called **COVALENT BOND**.



The **electron - dot** structure is also drawn **without showing the circle**.

One pair of shared electrons constitutes **One Covalent Bond**.

MATH-
SCIENCE
DEARS

Do chize ki jaa sakti hai....

Helium ke jaisa



Lose 4
electrons



CARBON



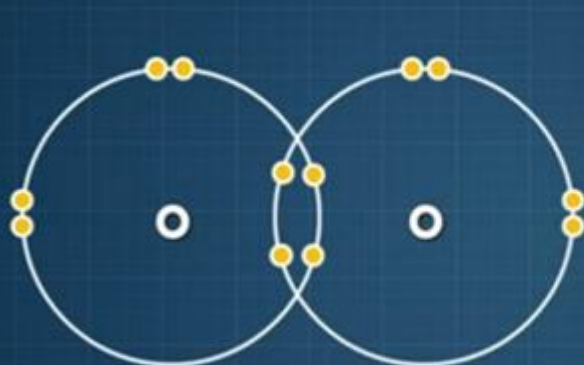
Neon ke jaisa



Gain 4
electrons

OXYGEN

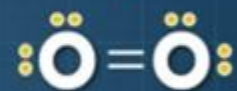
$Z = 8$ Electronic config = (2,6)



Two pairs of
electron shared



Double
Covalent bond



DOUBLE BOND

MATH-
SCIENCE
DEARS

Nitrogen

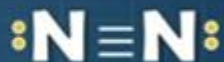
$Z = 7$ Electronic config = (2,5)



Three pairs of
electron shared



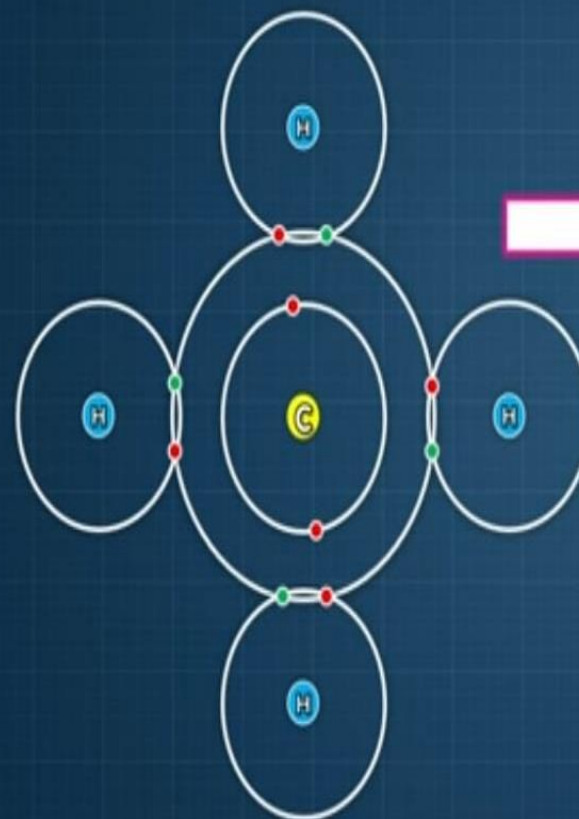
Triple
Covalent bond



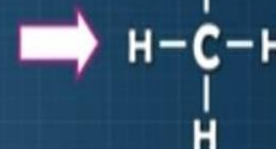
TRIPLE BOND

MATH
SCIENCE
DEARS

METHANE



Electron- dot
structure



Line structure

C

MATH-SCIENCE
DEARS

[www.mathscience
dears.com](http://www.mathsciencedears.com)

Versatile Nature of Carbon:

The existence of such a large number of organic compounds is due to the following nature of carbon,

- **Catenation**
- **Tetravalent nature.**

(i) Catenation:

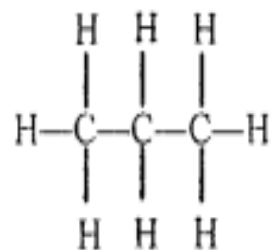
The self linking property of an element mainly carbon atom through covalent bonds to form long straight, branched and rings of different sizes are called Catenation.

This property is due to

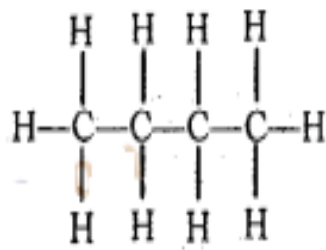
- The small size of the carbon atom.
- The great strength of the carbon-carbon bond.

Carbon can also form stable multiple bonds (double or triple) with itself and with the atoms of other elements.

Straight Chain

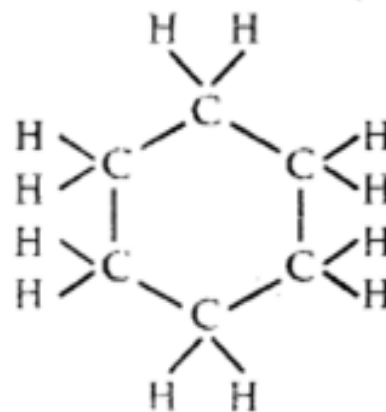


Propane

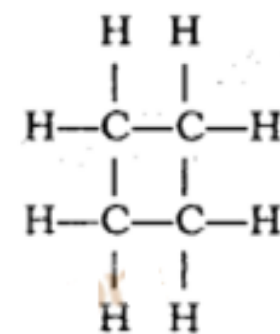


Butane

Rings

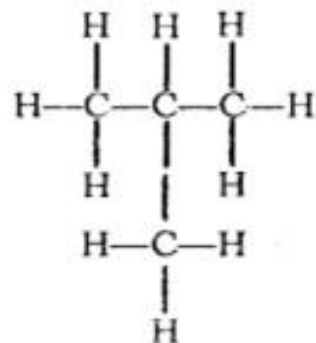


Cyclohexane

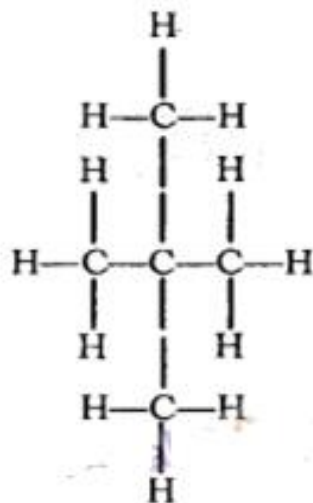


Cyclobutane

Branched Chain



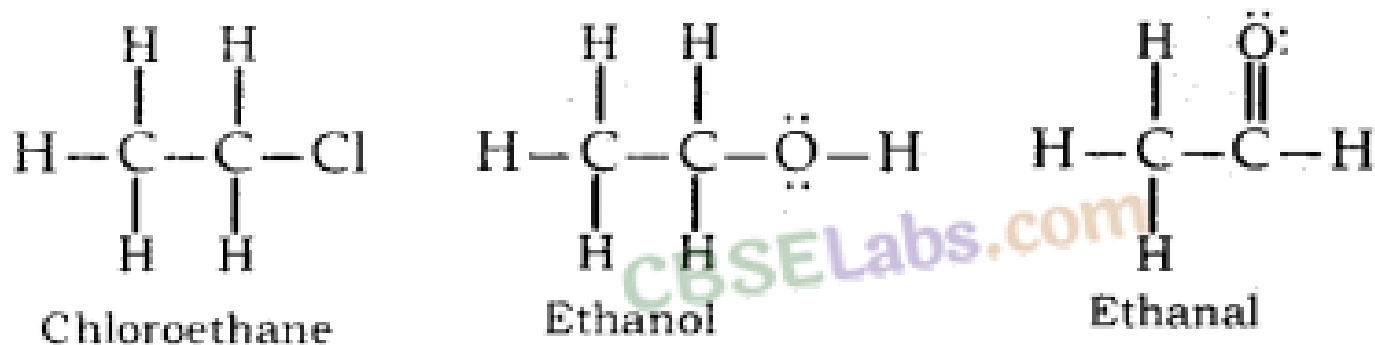
2-Methylpropane



2, 2- Dimethylpropane

(ii) Tetravalent Nature:

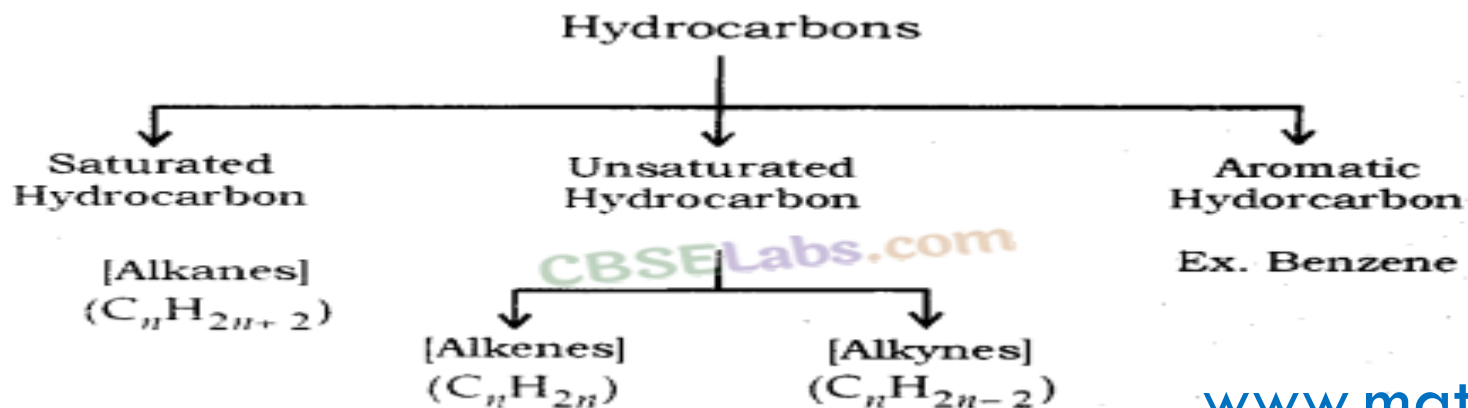
Carbon has valency of four. It is capable of bonding with four other atoms of carbon or some other heteroatoms with single covalent bond as well as double or triple bond.



Hydrocarbons:

Compounds of carbon and hydrogen are known as hydrocarbons.

For example; Methane (CH_4), Ethane (C_2H_6), Ethene (C_2H_4), Ethyne (C_2H_2) etc.



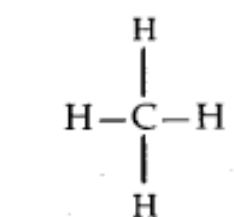
Saturated Hydrocarbon (Alkanes):

General formula is C_nH_{2n+2} .

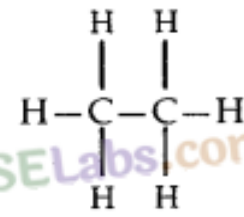
n = number of carbon atoms.

The carbon atoms are connected by only a single bond.

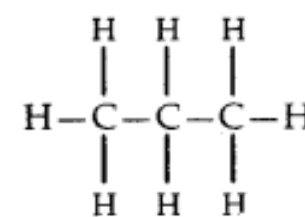
For example; Methane (CH_4), Ethane (C_2H_6) etc.



Methane ($n = 1$)



Ethane ($n = 1$)

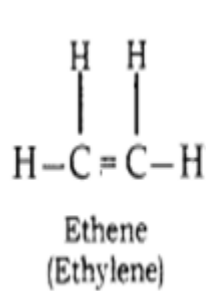


Propane ($n = 3$)

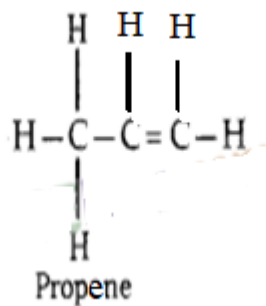
Unsaturated Hydrocarbons

Alkenes: General formula is C_nH_{2n}

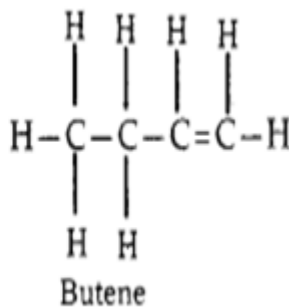
In this, the two carbon atoms are connected by double bond.



Ethene
(Ethylene)



Propene

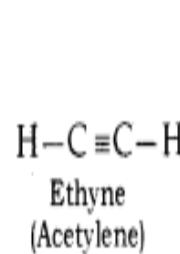


Butene

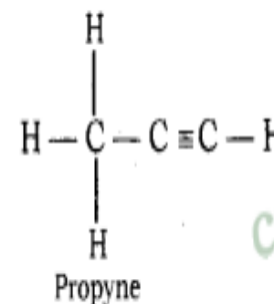
Alkynes:

General formula is C_nH_{2n-2} ,

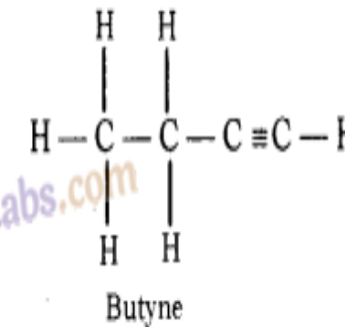
The two carbon atoms are connected by triple bond.



Ethyne
(Acetylene)



Propyne



Butyne

Nomenclature of Organic Compounds:

It is difficult to remember millions of compounds by their individual common name. Thus, to systematize the nomenclature of organic compounds IUPAC (International Union of Pure and Applied Chemistry) has given certain rule which is as follows:

1. Identify the Number of Carbon Atoms in the Compound

S. No	Number of Carbon Atoms	Word Root
1.	One carbon atoms (1-C)	Meth
2.	Two carbon atoms (2-C)	Eth
3.	Three carbon atoms (3-C)	Prop
4.	Four carbon atoms (4-C)	But
5.	Five carbon atoms (5-C)	Pent
6.	Six carbon atoms (6-C)	Hex
7.	Seven carbon atoms (7-C)	Hept
8.	Eight carbon atoms (8-C)	Oct
9.	Nine carbon atoms (9-C)	Non
10.	Ten carbon atoms (10-C)	Dec

Table . General formula and suffix used for alkanes, alkenes and alkynes.

Type of compound	General Formula	Suffix (to be added with word Root)
Alkanes	C_nH_{2n+2}	-ane
Alkenes	C_nH_{2n}	-ene
Alkynes	C_nH_{2n-2}	-yne

Important: No alkene or alkyne is possible with single carbon atom because double or triple bond is not possible between carbon and hydrogen atom. It is only between two carbon atoms.

- **IUPAC name :**
- International Union of Pure and Applied Chemistry gave following rules for naming various compounds :
 - Identify the number of carbon atoms and write the word root corresponding to it.
e.g., If a number of carbon atoms is three, then the word root is a **prop**.
 - Presence of a functional group is indicated by prefix or suffix.
 - **If the name of the functional group is to be given as a suffix, the last letter 'e' in the name of the compound is deleted and the suffix is added.** e.g., a **ketone** with three carbon atoms is named as : **Propane – e = Propan + 'one' = Propanone**. Alcohol with three carbons is propanol. Carboxylic acid with three carbons is propanoic acid.

Halogens, in IUPAC, are written as Prefixes, e.g., Compound With two carbons and one chloro group is named as chloroethane (CH_3CH_2Cl)

2. Identify the functional group

Root word for naming any compound

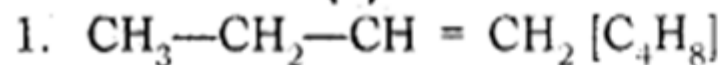
S. No.	Functional Group	Prefix	Suffix
1.	Double bond (=)	—	ene
2.	Triple bond ($\equiv$)	—	yne
3.	Chlorine (—Cl)	Chloro	—
4.	Bromine (—Br)	Bromo	—
5.	Alcohol (-OH)	—	ol
6.	Aldehyde (-CHO)	—	al
7.	Ketone (-CO-)	—	one
8.	Carboxylic acid (-COOH)	—	oic acid

3. Name the Compounds By Following Order

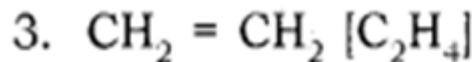
Prefix + Word Root + Suffix

Examples :

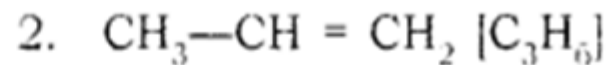
A. Double bond (=)



But + ene = Butene

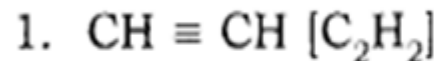


Eth + ene = Ethene

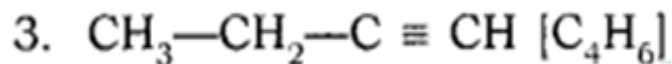


Prop + ene = Propene

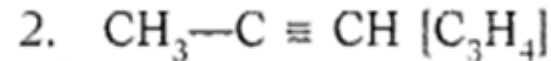
B. Triple bond ($\equiv$) :



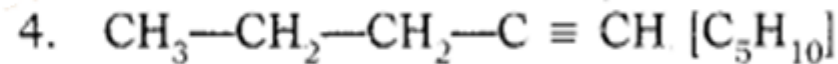
Eth + yne = Ethyne



But + yne = Butyne

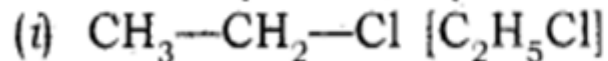


Prop + yne = Propyne

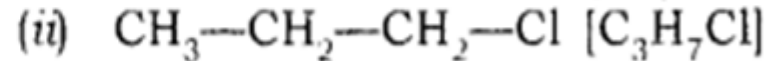


Pent + yne = Pentyne

C. Chlorine (—Chloro) :

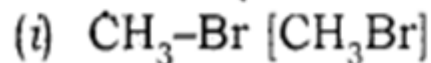


Chloro + ethane = Chloroethane

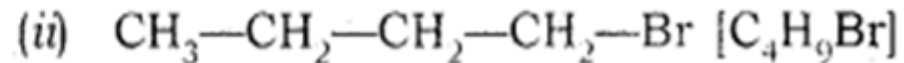


Chloro + propane = Chloropropane

D. Bromine (—Bromo) :

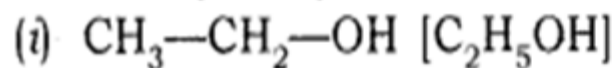


Bromo + methane = Bromomethane

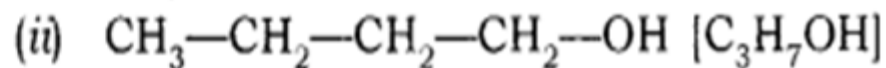


Bromo + butane = Bromobutane

E. Alcohol (—OH) :

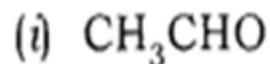


Ethan - e + ol = Ethanol

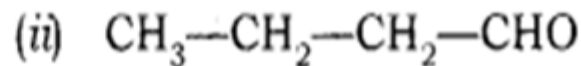


Propan - e + ol = Propanol

F. Aldehyde (—CHO) :

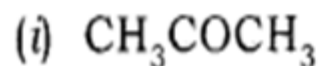


Ethan - e + al = Ethanal

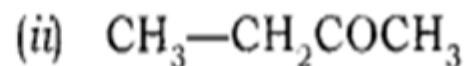


Butan - e + al = Butanal

G. Ketone $\left(\begin{array}{c} \text{O} \\ \parallel \\ \text{—C—} \end{array} \right)$:



Propan - e + one = Propanone

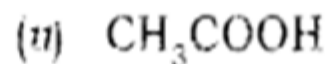


Butan - e + one = Butanone

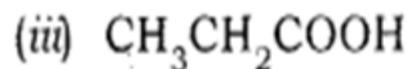
H. Carboxylic Acid (—COOH) :



Methan - e + oic acid = Methanoic acid



Ethan - e + oic acid = Ethanoic acid



Propan - e + oic acid = Propanoic acid

Chemical Properties of Carbon Compounds:

The important chemical properties are as follows:

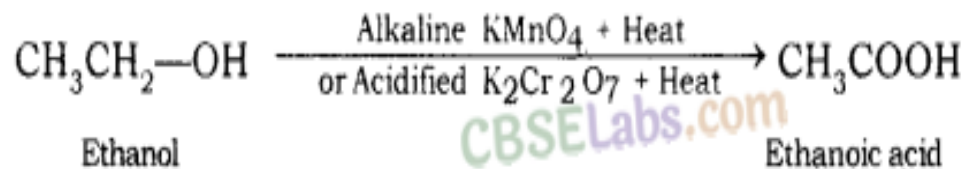
1. Combustion : The complete combustion of carbon compounds in the air gives carbon dioxide water, heat and light.



Carbon burns in air or oxygen to give carbon dioxide and heat and light.



2. Oxidation: Oxidation of ethanol in presence of oxidizing agents gives ethanoic acid.



Oxidizing Agent: Some substances are capable of adding oxygen to others, are known as Oxidising Agent.

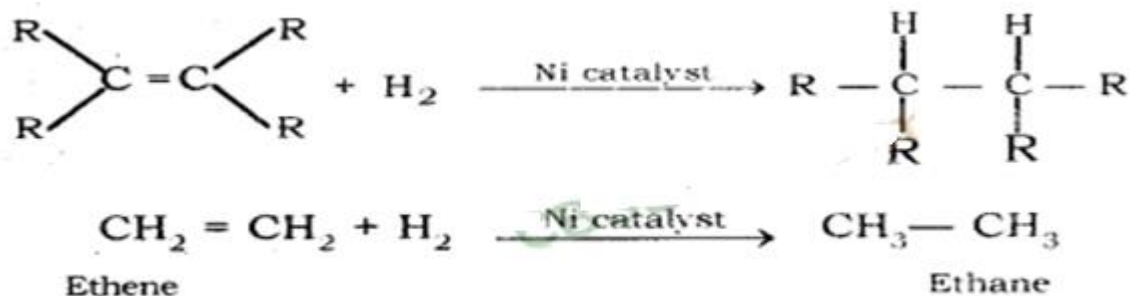
Example: Alkaline KMnO_4 (or $\text{KMnO}_4\text{—KOH}$) Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ (or $\text{K}_2\text{Cr}_2\text{O}_7\text{—H}_2\text{SO}_4$)

KMnO_4 – Potassium permanganate

$\text{K}_2\text{Cr}_2\text{O}_7$ – Potassium dichromate

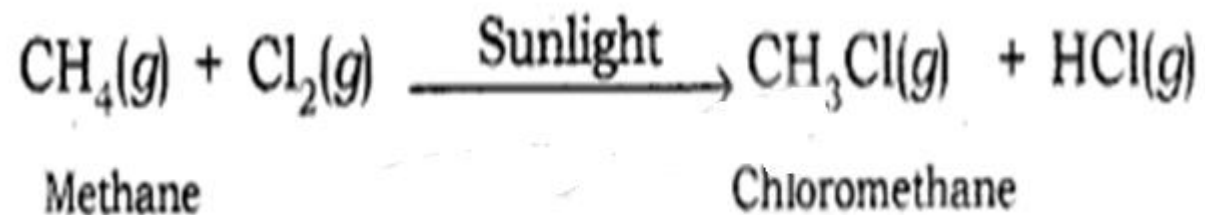
3. Addition Reaction:

Addition of dihydrogen with unsaturated hydrocarbon in the presence of catalysts such as nickel or platinum or palladium are known as Hydrogenation (addition) reaction.



4. Substitution Reaction:

Replacement of one or more hydrogen atom of an organic molecule by another atom or group of the atom is known as Substitution Reaction.



Some Important Carbon Compounds :

Ethanol ($\text{CH}_3\text{CH}_2\text{—OH}$): Commonly known as Ethyl Alcohol.

Physical Properties

- It is colourless, inflammable liquid.
- It is miscible with water in all proportions.
- It has no effect on the litmus paper.

Chemical Properties

Reaction with sodium



Reaction with concentrated H_2SO_4

(Dehydration Reaction)



THANK YOU

Prepared By : Dr. P. W. MATTE



www.mathsciencedears.com