Chemical Properties of Carbon Compounds

Combustion of Carbon: Carbon, in all allotropic forms, burns in presence of oxygen to form carbon dioxide with evolution of heat and light energy. In case of diamond, graphite and fullerene, they burn completely to form CO_2 because they are purest form of carbon.

$C + O_2 \longrightarrow CO_2 + \text{Heat} + \text{light}$

Most of the carbon compounds are combustible and burn in presence of oxygen to form CO_2 and H_2O. e.g.,

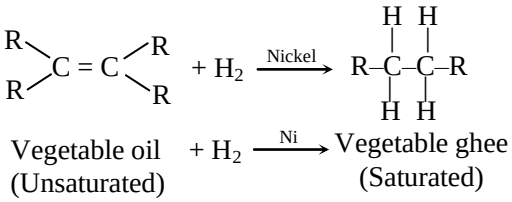
$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l) + \text{heat} + \text{light}$

$2CH_3OH(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 4H_2O(l) + \text{heat light}$

Combustion of Hydrocarbons : If hydrocarbons are burnt in limited supply of oxygen then smoky flame is produced due to incomplete combustion whereas in excess of oxygen, complete combustion takes place and non-luminous bluish flame with high temperature is produced.

Addition Reactions: Those reactions in which unsaturated compounds react with a molecule like H_2, Cl_2, etc., to form another saturated compounds are called addition reactions.

Hydrogenation : It is a process in which unsaturated compound reacts with hydrogen in presence of nickel as a catalyst to form saturated compound



Catalyst: It is a substance which increases the rate of reaction without itself undergoing any permanent chemical change, e.g., Ni, Pt, V_2O_5 are used as catalyst.

Substitution Reactions: Those reaction in which an atom or group of atoms of a compound is replaced by other atom or group of atoms are called substitution reaction.

Saturated hydrocarbons are less reactive and do not react with most reagents.

They react with halogens in presence of sunlight and undergo substitution reaction. The reaction is very fast. It is photochemical reaction because it takes place in presence of sunlight.

$$CH_4(g) + Cl_2(g) \xrightarrow[\text{light}]{\text{Sun}} \underset{\text{Chloromethane}}{CH_3Cl(g)} + HCl(g)$$

$$CH_3Cl(g) + Cl_2(g) \xrightarrow[\text{light}]{\text{Sun}} \underset{\text{Dichloromethane}}{CH_2Cl_2(g)} + HCl(g)$$

Addition of Hydrogen : Ethyne reacts with hydrogen in the presence of a catalyst to give Ethane. Two molecules of hydrogen are added across the carbon-carbon triple bond.

$$\underset{\text{Ethyne}}{HC \equiv CH} + 2H_2 \xrightarrow[573K]{Ni} \underset{\text{Ethane}}{HC_3 - CH_3}$$

Addition of Chlorine : Two molecules of chlorine react with ethyne to form 1, 1, 2, 2-tetrachloroethane.

$$\underset{\text{Ethyne}}{HC \equiv CH} + 2Cl_2 \rightarrow \underset{\text{1,1,2,2-Tetrachloroethane}}{Cl_2CH - CHCl_2}$$

Addition of HCl : Ethyne reacts with HCl in the presence of mercuric chloride ($HgCl_2$) to form vinyl chloride which is monomer of polyvinyl chloride (PVC) (used as plastic)

$$\underset{\text{Ethyne}}{H - C \equiv C - H} + HCl \xrightarrow{HgCl_2} \underset{\substack{\text{Vinyl chloride} \\ \text{(Chloroethene)}}}{CH_2 = CHCl}$$

Combustion of Acetylene : Acetylene burns in presence of oxygen to form CO_2 and H_2O.

$$\underset{\text{Ethyne}}{2C_2H_2(g)} + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l) + \text{heat}$$

Uses of Ethyne :

(i) Oxy-acetylene flame is used for welding purposes.

(ii) It is used for lighting purposes

(iii) It is used to prepare Benzene (C_6H_6)

(iv) It is used for making Vinyl chloride which is used for making PVC (Plastic).