

Chemistry Study Materials for Class 11

(NCERT Based Revision Notes of Chapter- 13)

Ganesh Kumar

Date:-10/03/2021

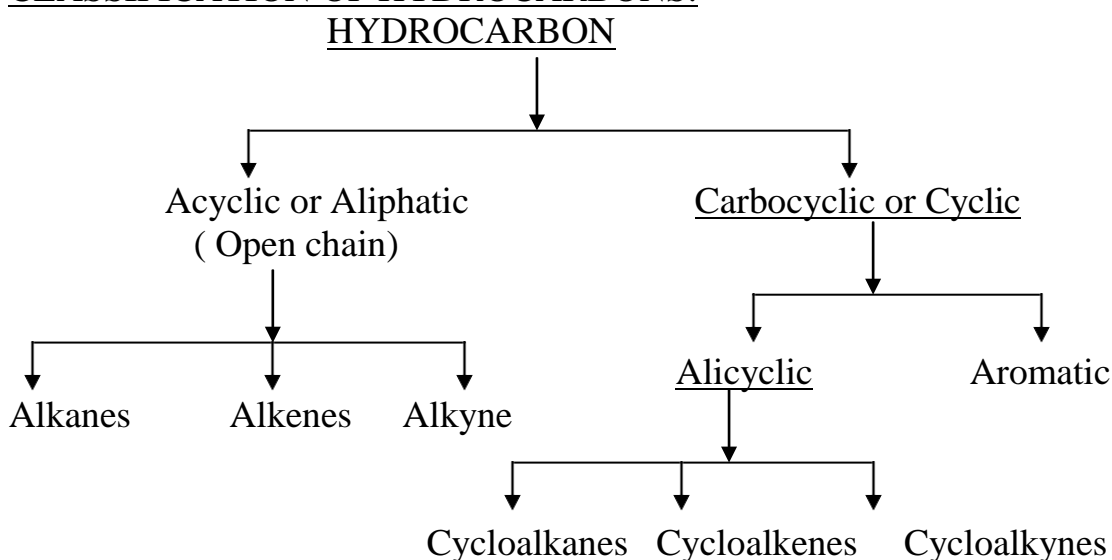
HYDROCARBON

- Hydrocarbons are composed of Carbon and hydrogen.
- The important fuels like Petrol, kerosene, coal gas, CNG, LPG etc. are all hydrocarbons or their mixture.

Sources:

Petroleum and natural gas are the major sources of aliphatic hydrocarbon while coal is an important source of aromatic hydrocarbons. The oil trapped inside the rocks is known as petroleum. PETRA – ROCK, OLEUM – OIL. The oil in the petroleum field is covered with a gaseous mixture known as natural gas. The main constituents of the natural gas are methane, ethane, propane and butane.

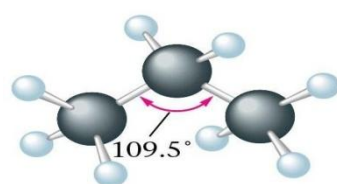
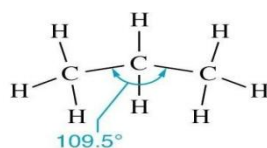
CLASSIFICATION OF HYDROCARBONS:



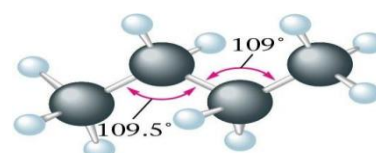
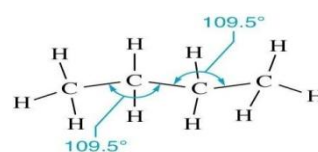
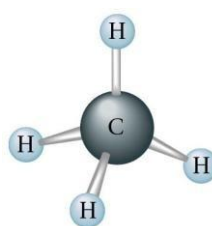
Alkanes:-

- Paraffins
- General formula C_nH_{2n+2}
- sp^3 hybridisation
- C–C bond length 1.54 \AA
- Chemically unreactive
- Show chain, position and optical isomerism.
- Heptane has 9 isomer, Octane 18 and Decane 75.

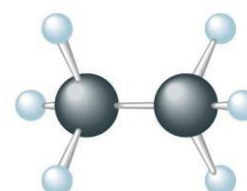
Nomenclature:



(a) Propane



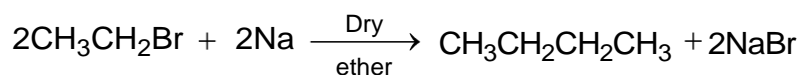
(b) Butane



(c)

Preparation:-

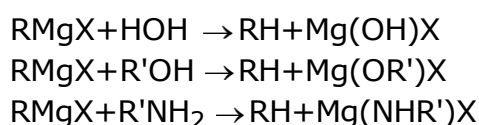
❶ Wurtz reaction:-



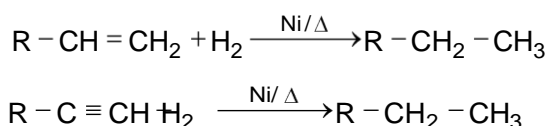
- Follow mainly free radical mechanism
 - Useful in preparing an alkane containing even number of carbon atoms
 - Stepping up reaction
- Frankland reaction



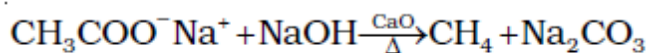
❷ From Grignard reagent (RMgX)



❸ From unsaturated hydrocarbons:- Sabatier-Senderens reduction

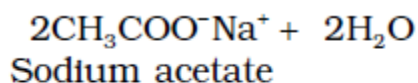


4. From carboxylic acids- Decarboxylation.-

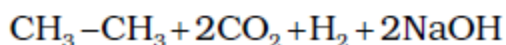


Sodium ethanoate

Kolbe's electrolytic method-



↓ Electrolysis



❖ Physical Properties:-

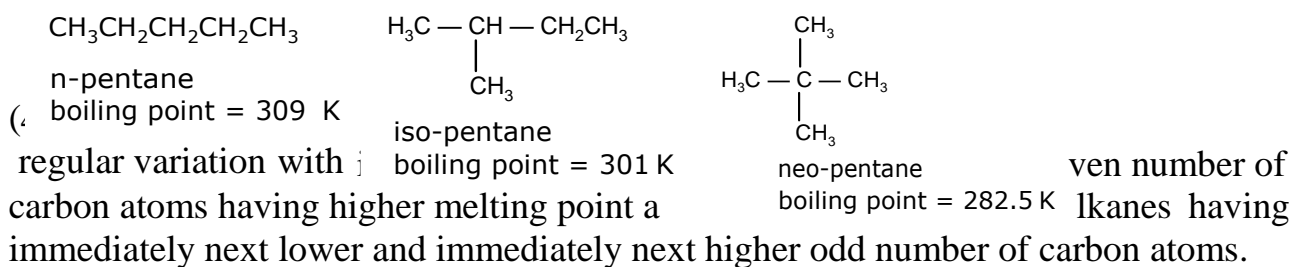
- (1) Nature:- Non-Polar due to covalent nature of C—C bond and C—H bond. C—C bond energy = 83 kJ/mole and C—H bond energy = 99 kJ/mole.
C₁—C₄ = gases, C₅—C₁₇ = colourless odourless liquid and > C₁₇ = Solid.
- (2) Solubility:- Like dissolve like
Viz, Polar compounds dissolve in polar solvent and Non-Polar compound dissolve in non polar solvent.
- (3) Boiling point:- Low boiling point due to non polar in nature.

The molecules are held together only by weak Van der Waals' forces.

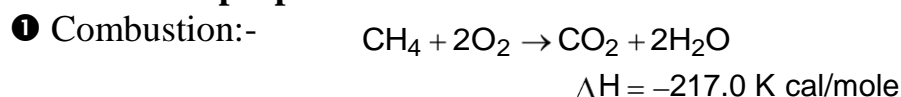
Since we know that the magnitude of Van der Waals' forces is directly proportional to the molecular size. Therefore, the boiling point increases with increase the molecular size i.e. with increase in number of carbon atoms.

Noted:- the boiling points of the branched chain Alkanes are less than the straight chain isomers.

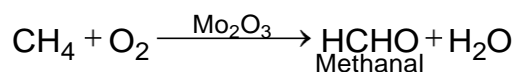
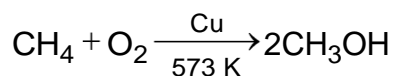
This is due to the fact that branching of the chain makes the molecule more compact and thereby decreases the surface area and consequently, the magnitudes of Van der Waals' forces also decrease.



❖ Chemical properties

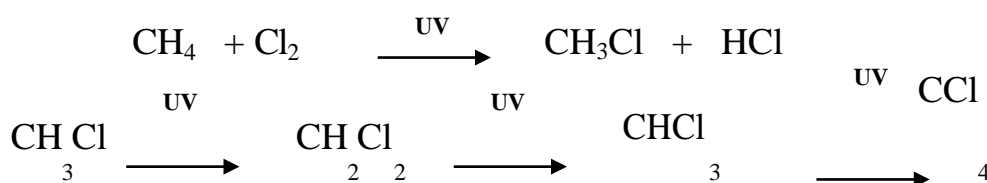


② Oxidation:-

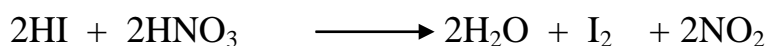
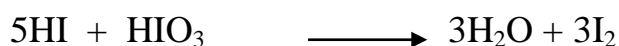
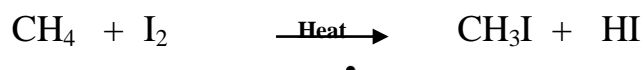


③ Substitution:-

① Halogenation:-



Noted:- Iodination is a reversible reaction. So it is carried out by heating alkane in the presence of some oxidizing agent like iodic acid (HIO_3) or nitric acid (HNO_3) or mercuric oxide (HgO) which oxidizes HI formed during the reaction.

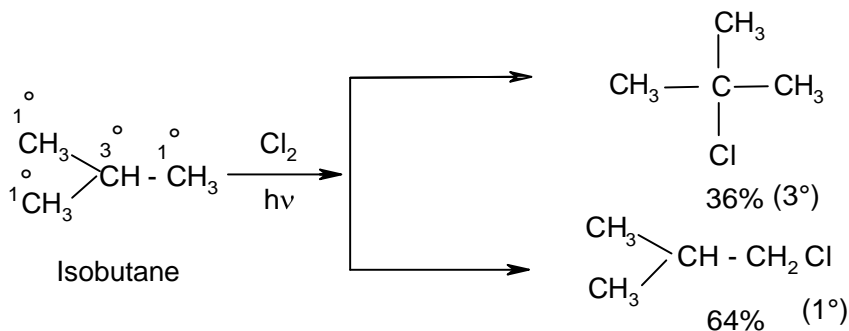
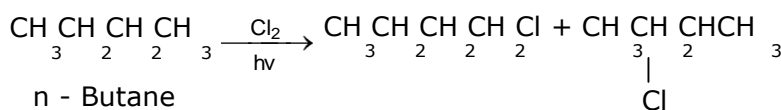
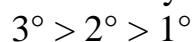


Noted:- Fluorination of alkane takes place explosively resulting even in the rupture of C—C bond in higher alkanes.

• Features of Halogenations:-

(i) The reactivity of Halogens:- $F_2 > Cl_2 > Br_2 > I_2$.

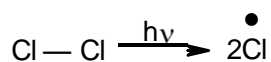
(ii) The rate of replacement of Hydrogens of alkanes is:



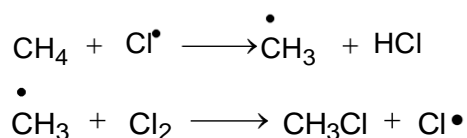
Mechanism:- halogenations reaction take place by free radical mechanism. The reaction proceeds in the following steps:

Initiation

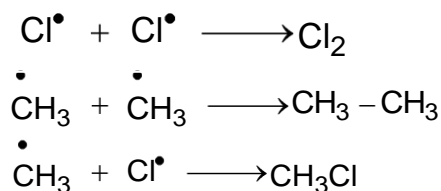
(i) Chain initiation step:-



(ii) Chain Propagation step:-



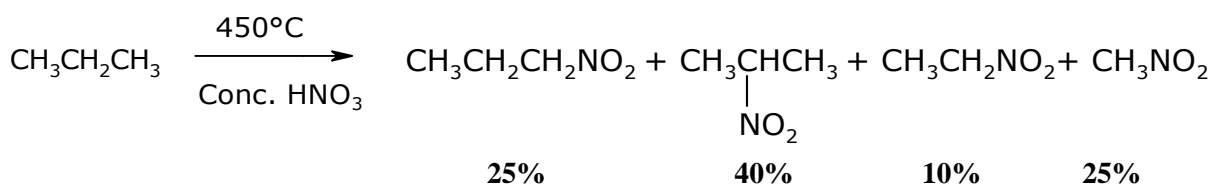
(iii) Chain Termination step:-



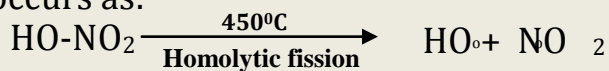
② Nitration:-

☞ The reaction takes places by free radicals mechanism at high temp (450°C).

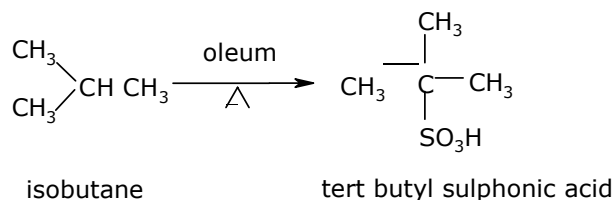
☞ At high temp C—C bond is also broken so that mixture of nitroalkanes is obtained.



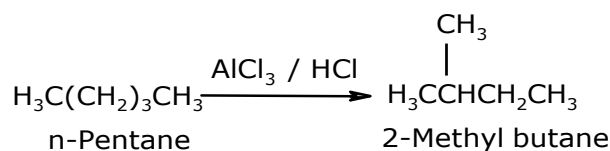
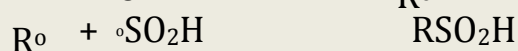
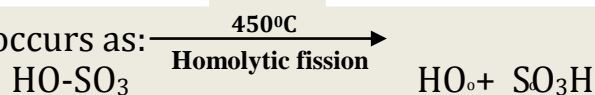
The reaction occurs as:



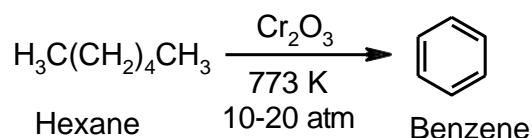
③ Sulphonation:- replacement of hydrogen atom of alkane by $-\text{SO}_3\text{H}$ group.



The reaction occurs as:



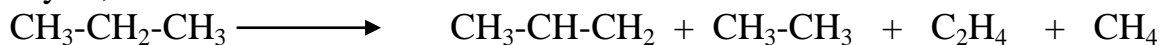
⑤ Aromatization:-



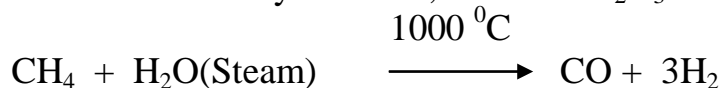
This method is also called dehydrogenation or hydroforming

Similarly, heptane gives toluene, n-Octane give o-xylene and 2, methyl heptane give m-xylene.

⑥ Thermal decomposition or Pyrolysis or cracking or Fragmentation: - when higher alkanes are heated at high temp (about 700-800k) in the presence of alumina or silica catalysts, the alkanes break down to lower alkanes and alkenes.



⑦ Action of steam:- catalyst: nickel, alumina Al_2O_3



This reaction is used for the industrial preparation of hydrogen from natural gas.

8. Isomerisation:-

