UNIT-II10 Hours

- **Alkanes*, Alkenes* and Conjugated dienes***

  SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

  Stabilities of alkenes, SP^2 hybridization in alkenes [DEPTH OF BIOLOGY]

  E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

  Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement [DEPTH OF BIOLOGY]

Halogenation of Alkanes

$C_1 - C_4$ ⟶ colourless gas

$C_5 - C_7$ ⟶ colourless liquids

$C_8 \leq$ ⟶ higher members are solids.

Alkanes ⟶ allylic saturated hydrocarbons are also known as paraffins

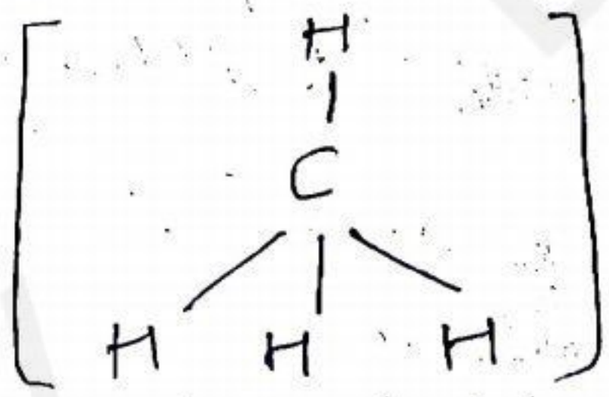
↓ little ↓ affinity or reactivity

These are called so as they are very less reactive towards most of the reagent

→ But these can react when we provide them

↑ temp. and pressure.

* General formula ⟶ C_nH_{2n+2}
* Alkanes generally has Tetrahedral structure.



Tetrahedral structure

Halogenation ⟶ replacement of one or more hydrogen atoms in an organic compound by halogen.

- Type of substitution reaction.

- It is carried out by heating it with a suitable halogen in presence of U.V light or by heating the reaction mixture to 520k − 670k.
- order of reactivity of diff. Halogens are −

$F_2 > Cl_2 > Br_2 > I_2$

due to more electronegativity of these halogens.

Chlorination ⟶ During chlorination of Methane all the four hydrogen atoms are replaced one by one to form mixture of products.

$$CH_4 + Cl_2 \xrightarrow[520-670k]{h\nu} CH_3Cl + HCl$$
chloromethane.

$$CH_3Cl + Cl_2 \xrightarrow[520-670k]{h\nu} CH_2Cl_2 + HCl$$
dichloromethane

$$CH_2Cl_2 + Cl_2 \xrightarrow[520-670k]{h\nu} CHCl_3 + HCl$$
trichloromethane

$$CHCl_3 + Cl_2 \xrightarrow[520-670k]{h\nu} CCl_4 + HCl$$
Tetrachloromethane

[DEPTH OF BIOLOGY]

Bromination ⟶ Bromine react with alkane in a similar manner but less readily.

$$H_3C-CH_3 + Br_2 \longrightarrow H-\underset{H}{\overset{H}{\underset{|}{\overset{|}{C}}}}-\underset{H}{\overset{H}{\underset{|}{\overset{|}{C}}}}-Br + HBr$$

Ethane — Bromoethane

Iodination ⟶ The reaction of Iodine with alkane is reversible because the hydrogen iodine forms as a byproduct is a moderate reducing agent and hence the Iodoalkane get converted back to Alkane

[DEPTH OF BIOLOGY]

$$CH_4 + I_2 \rightleftharpoons CH_3-I + HI$$
Iodomethane.

Direct Iodination of Alkane cannot be sought about however, it can be carried in the presence of an oxidising agent such as Iodic Acid (HIO_3) or Nitric acid (HNO_3) which oxidises HI to I_2

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$$[5HI + HIO_3 \longrightarrow 3I_2 + 3H_2O]$$

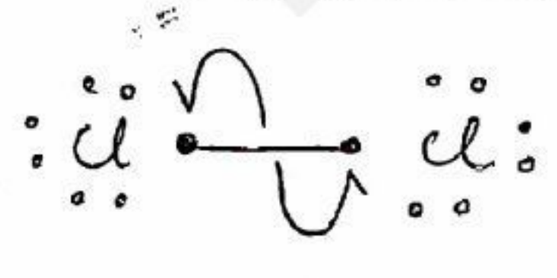
Fluorination ⟶ fluorination of alkanes are too vigorous Thus fluorination of alkane with pure fluorine is in little practical use.

However it can be carried out by diluting fluorine with Inert gas such as N_2 or Argon.

Mechanism of Halogenation → Halogenation of Alkane occur by a free radical Mechanism which occurs in 3 stages.

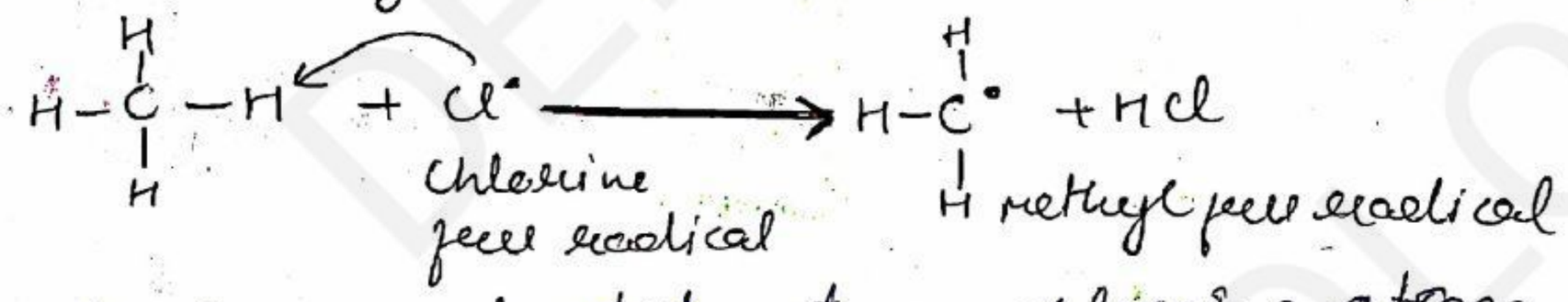
- Chain Initiation
- Chain Propogation
- Chain termination

- **Chain initiation** → Heat or UV light cause the weak halogen bond to undergo homolytic cleavage generates 2 chlorine radical and starting the chain process.

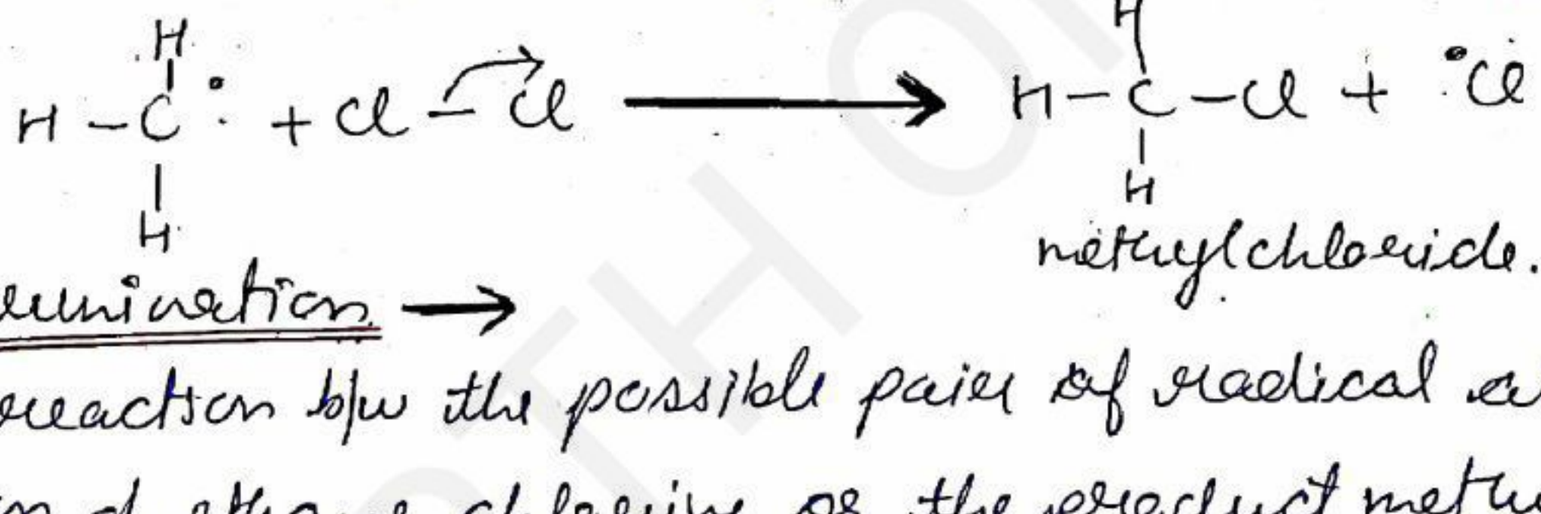


- **Chain Propogation** → held in 2 steps. [DEPTH OF BIOLOGY]

(a) Chlorine radical abstract a hydrogen to form HCl and a methyl radical then.



(b) The methyl radical abstract a chlorine atom form another molecule to Cl_2 to form methyl chloride product and another chlorine radical which can then itself undergo reaction. 2(a) creating a cycle that can repeat. [DEPTH OF BIOLOGY]



Chain termination →

Various reaction b/w the possible pair of radical allow the formation of ethane chlorine or the product methylchloride these reaction remove radical and cyclestop.

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$$Cl\cdot + \cdot Cl \longrightarrow Cl-Cl$$

$$\cdot CH_3 + \cdot CH_3 \longrightarrow CH_3C-CH_3$$

$$\cdot CH_3 + \cdot Cl \longrightarrow H_3C-Cl$$

Uses of Paraffins ⟶

1. Methane is used as fuel in Industry as well as home.
2. Methane is used to make carbon black which is used in the manufacture of printing inks, paints and automobile tyres.
3. Catalytic oxid. of alkanes give OH, Aldehyde and COOH.
4. Higher alkane in form of Gasoline, kerosine oil, diesel lubricating oil and paraffin wax are widely used.
5. Liq. paraffin used in Pediatric laxative.
6. It is used in several cosmetics (Both for hair and skin products)

[DEPTH OF BIOLOGY]