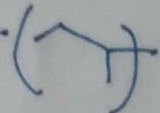


Carbon-carbon sigma bonds (Alkanes)

①

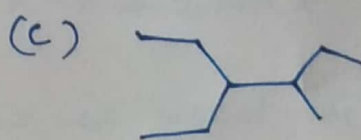
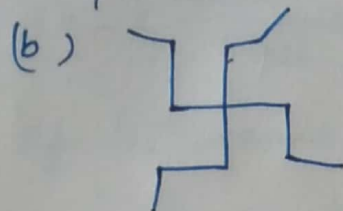
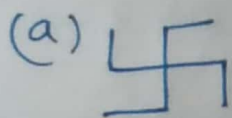
Alkanes or Paraffins have the general formula C_nH_{2n+2}
(little affinity)

Some of the alkyl groups are, Me - Methyl, Et - Ethyl
Pr - Propyl, But - Butyl, i-Pr (Isopropyl) CH_3-CH-
 CH_3

CH_3-CH_2-CH- () Sec-Butyl (s-Bu), $CH_3-\overset{\overset{CH_3}{|}}{CH}-CH_3$ (Isobutyl),

$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}$ (t-Bu, tert-butyl), $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2$ (Neopentyl) etc.

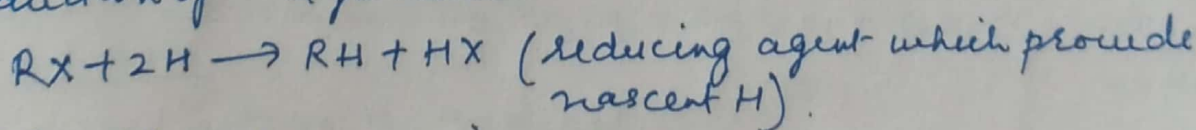
Q write the IUPAC names & condensed formula of the following compounds



→ Alkanes show mainly structural (chain) & conformational isomerism.

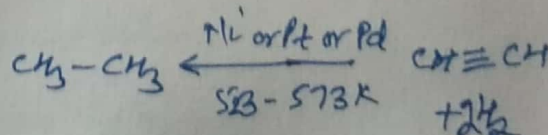
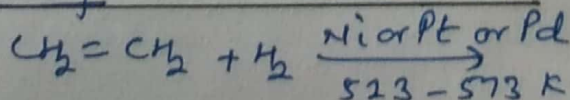
General method of Preparation

(i) Reduction of alkyl halides

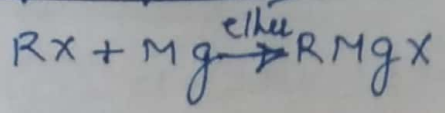


- Zn + CH_3COOH or Zn + dil HCl or Zn + NaOH
- Zn + Cu (couple) + Ethanol
- LiAlH₄ + Ether (reduce 1° & 2° RX to RH & 3° RX to alkene)
- Red P + HI at 150°C
- NaBH₄ + EtOH (only 2° & 3° RX to RH not 1° RX)
- Mg + ether followed by H₂O

(ii) Using unsaturated HC^S

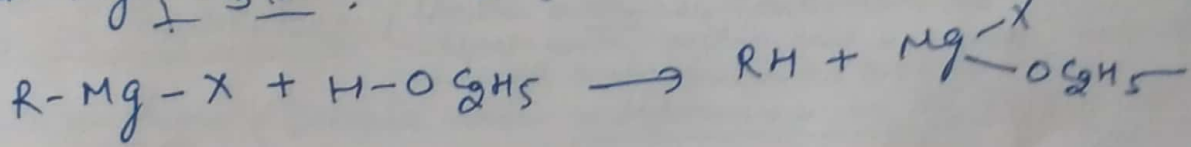
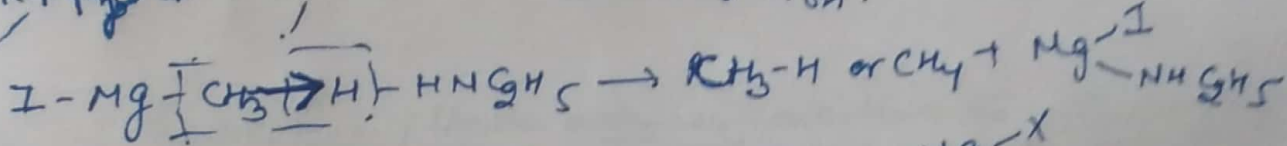
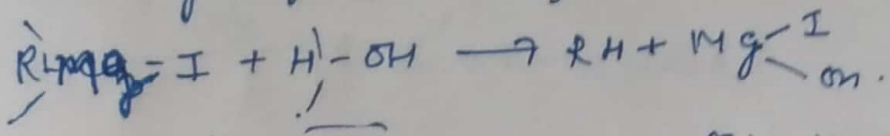


By Grignard reagent (G.R)

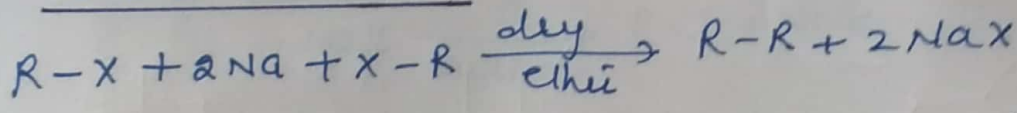


Ease of formation of G.R is
 Iodide > bromide > chloride
 $CH_3I > C_2H_5I > C_3H_7I$

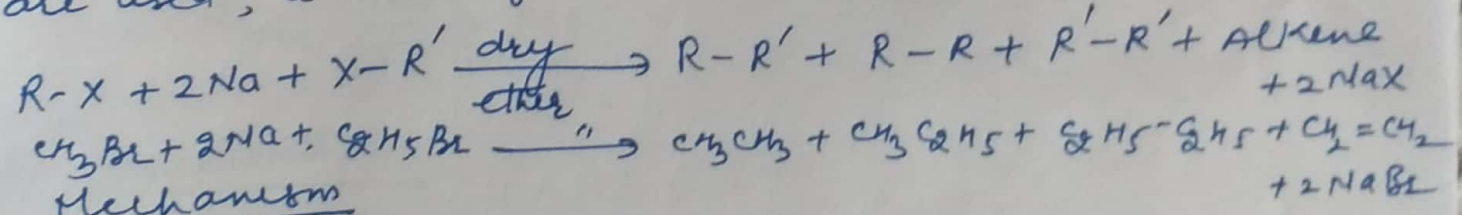
G.R. undergo decomposition with H_2O , $R'OH$, phenol, amine, alkynes undergo formation of alkane (containing active hydrogen) for eg.



Wurtz Reaction



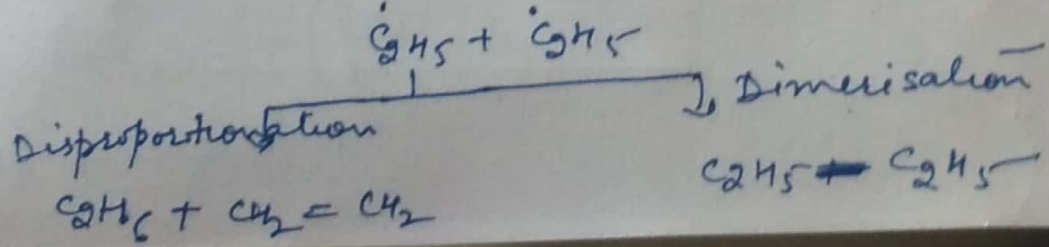
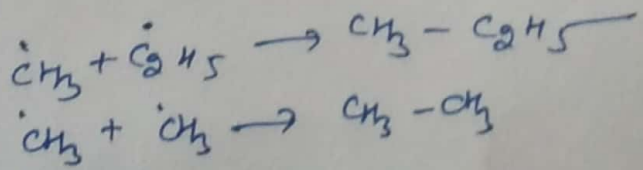
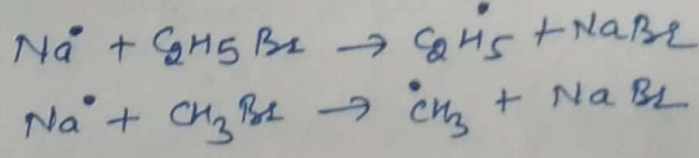
limitations of the same RX is used the alkane containing odd no. of C-atoms or unsymmetrical alkanes can not be prepared. If different-alkyl halides are used, a mix. of alkanes & alkenes is obtained



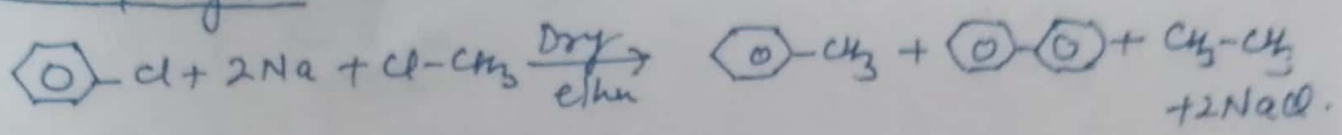
Mechanism

→ Na metal act as a radical

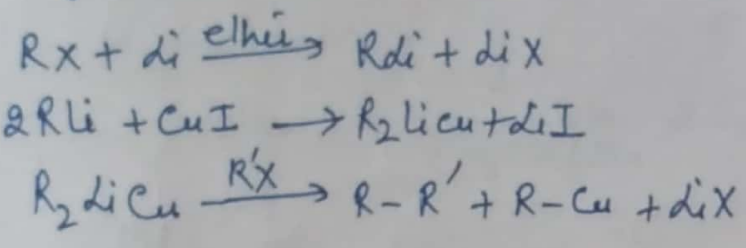
Chain propagation



Wurtz-Fittig RX

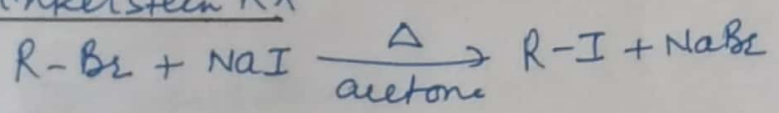


Corey-House Synthesis

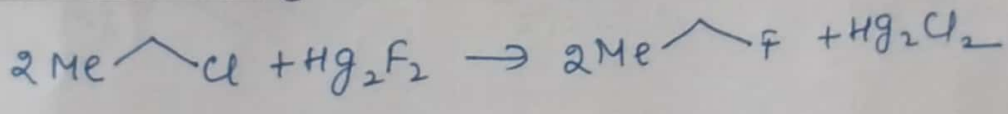


Chemical Properties (Under ordinary conditions the alkanes don't react with ordinary reagents. However they undergo substitution RX by free radical chain mechanism in +ve of UV light, heat or Peroxide.)

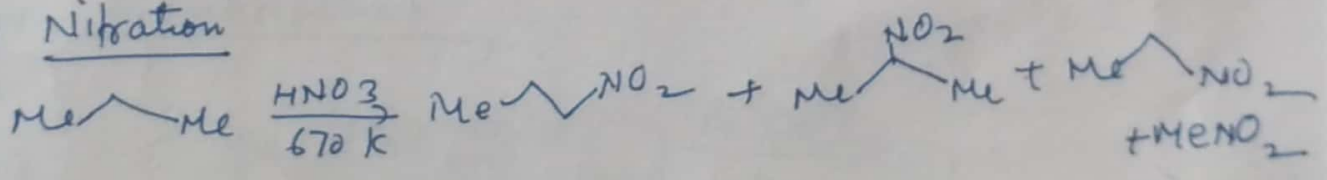
- (i) Halogenation (Details with mechanism in the last)
- (ii) Finkelstein RX



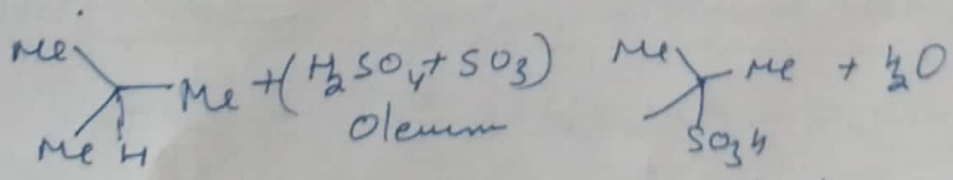
- (iii) Fluorination (Swart's RX)



- (iv) Nitration

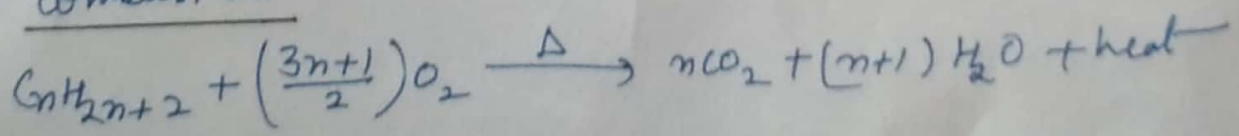


- (v) Sulphonation

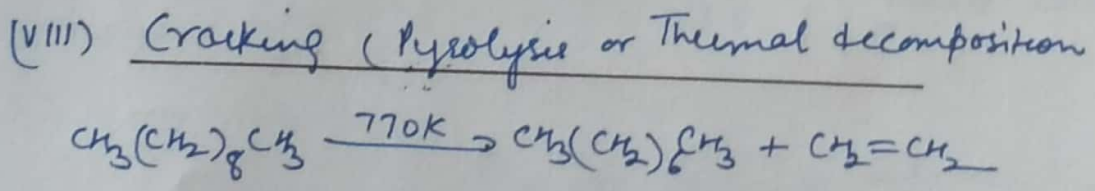
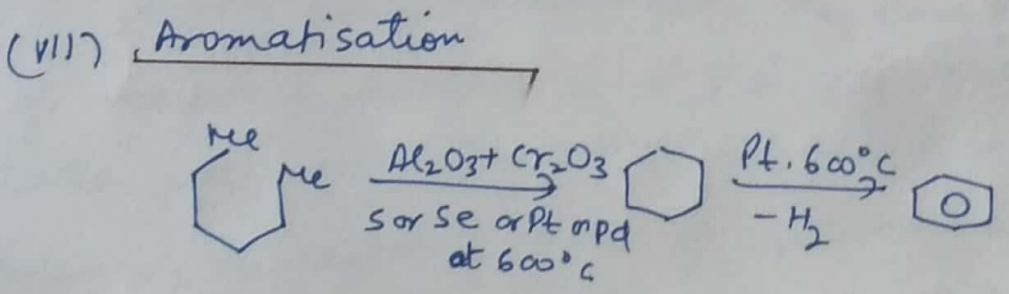
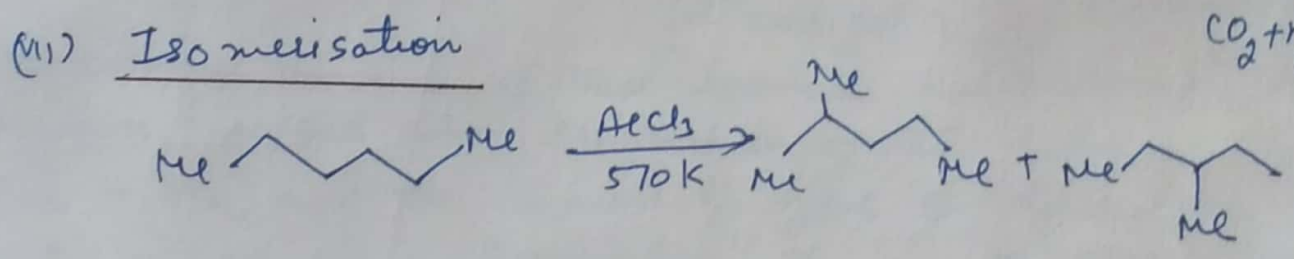
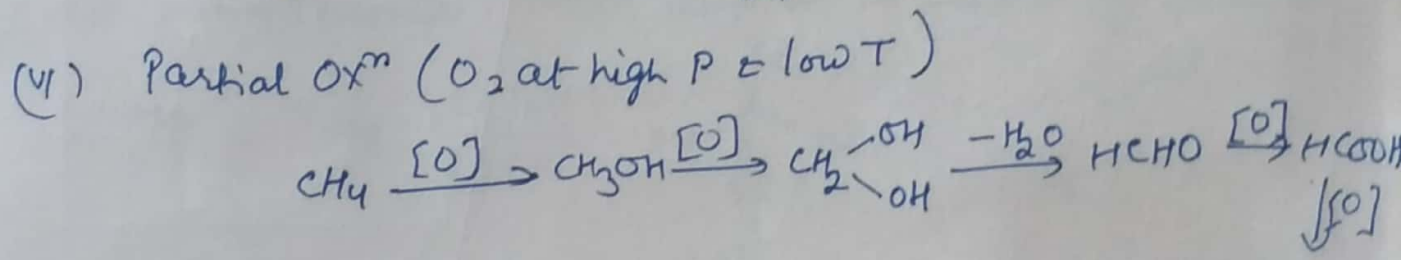
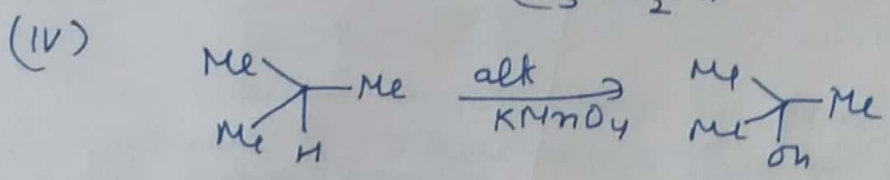
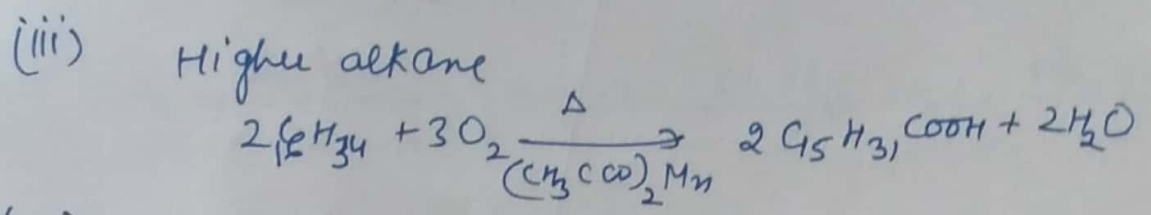
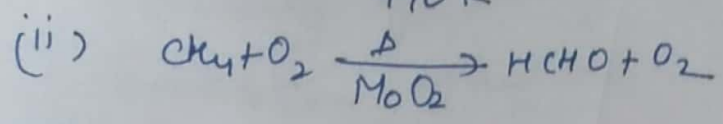
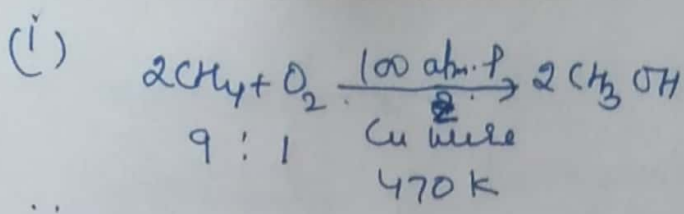


H-atom is replaced by -SO₃H gp in the order 3° > 2° > 1°

- (vi) combustion



- (vii) catalytic oxⁿ

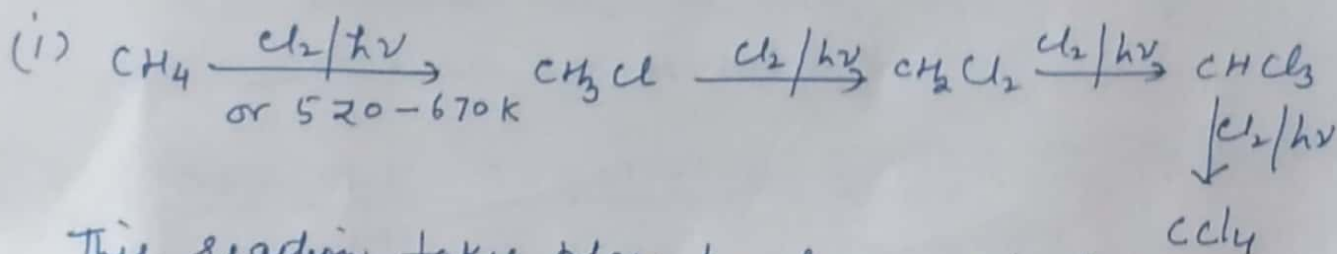


Halogenation in Alkanes

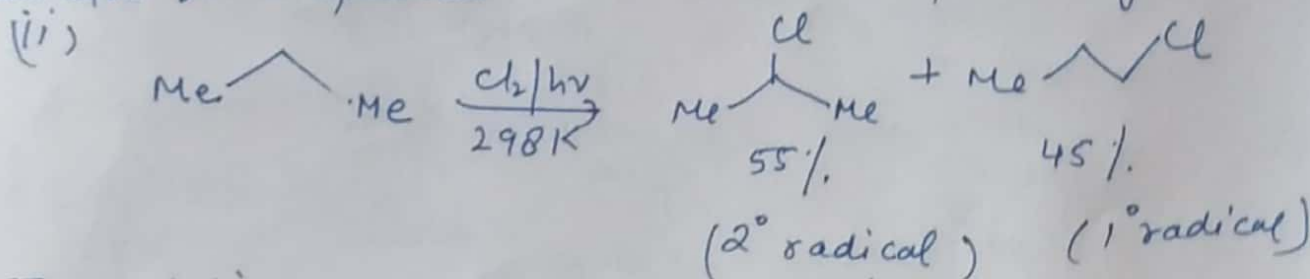
(5)

Reactivity of halogenation : $F_2 > Cl_2 > Br_2 > I_2$

Activation order is : $F_2 < Cl_2 < Br_2 < I_2$



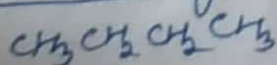
This reaction takes place by free radical subⁿ in the presence of UV light at high temp or in presence of radical initiator such as peroxide.



The relative amounts of these isomeric haloalkanes, however, depend upon the nature of the halogen (Cl_2 or Br_2) and the number of types of hydrogen ($1^\circ, 2^\circ, 3^\circ$) being substituted. The ease of substitution of various hydrogens is $3^\circ > 2^\circ > 1^\circ$, but their relative rates vary with the nature of halogens. For eg., with Cl_2 the relative rate of substitution of $3^\circ > 2^\circ > 1^\circ$ hydrogens at 573K is (5:3.8:1) while with Br_2 is 1600:82:1

Relative yields of products depend upon

(1) Probability factor



6 - $1^\circ H$

4 - $2^\circ H$

probability is 6:4 or 3:2

(2) Reactivity of H

$3^\circ > 2^\circ > 1^\circ$

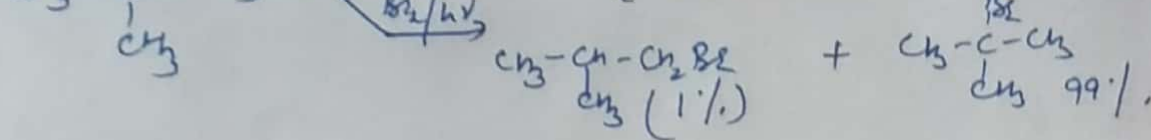
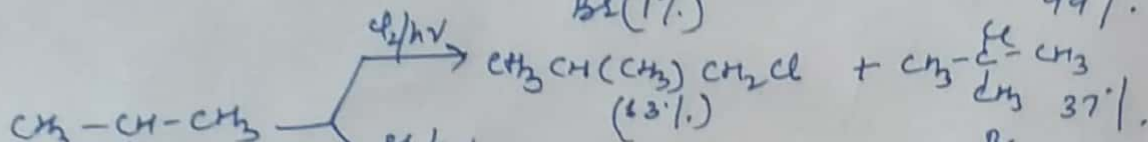
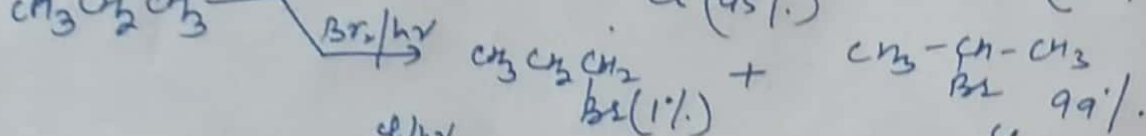
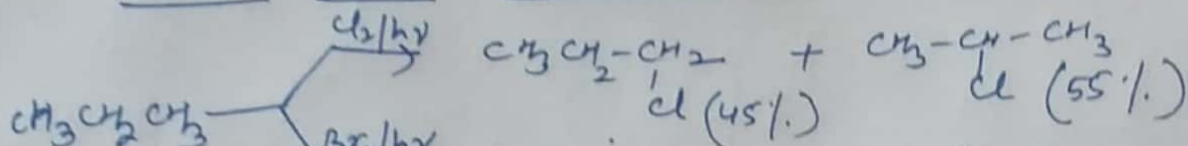
(3) Reactivity of halogen

(16)

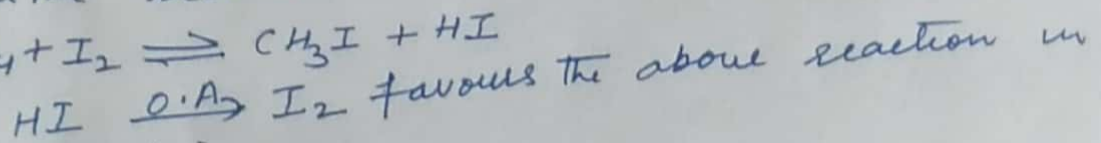
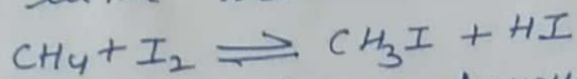
⇒ More reactive Cl_2 is less selective & more influenced by probability factor.

→ Less reactive Br_2 is more selective and less influenced by probability factor.

HIGHER THE REACTIVITY LESSER THE SELECTIVITY



Iodination is generally not carried out to prepare RI as the reaction is highly exothermic and reversible. But it is carried out in the presence of an oxidising agent, such as HIO_3 , HgO and HNO_3 , as it removes the HI formed in the reaction.



forward direction.

Fluorination is highly exothermic reaction and is difficult to control.