

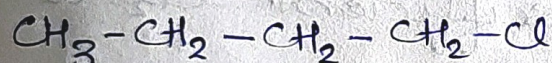
CHEMISTRY OF FUNCTIONAL GROUP-1

Halogen Compounds

→ Replacement of a H atom from alkane by halogen gives alkyl halide

→ classified as 1° , 2° & 3° - based on whether halogen is attached to 1° carbon, 2° carbon etc

1°



n-butyl chloride

1-chlorobutane

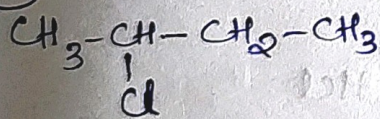
1°



isobutyl chloride

1-chloro-2-methylpropane

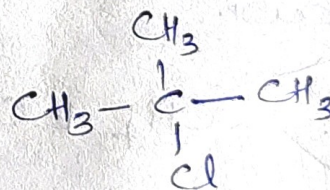
2°



sec-butyl chloride

2-chlorobutane

3°



tert-butyl chloride

2-chloro-2-methylpropane

Preparation:

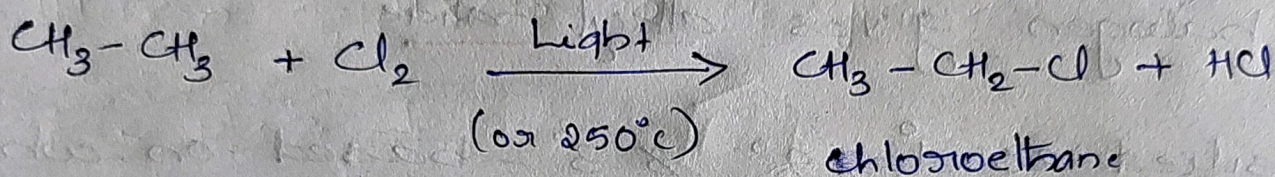
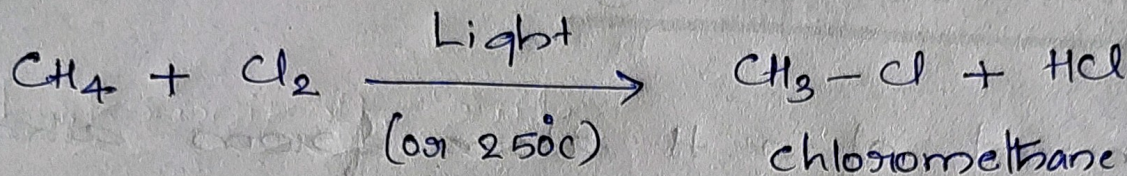
(A) From alkanes by radical halogenation

Order of reactivity of halogens in halogenation is

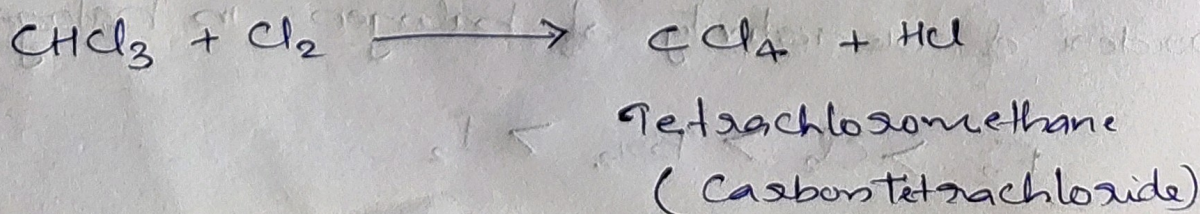
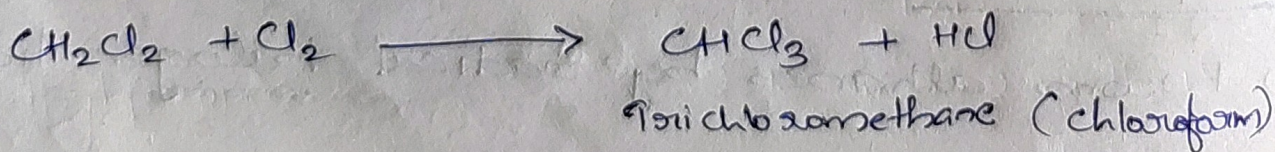
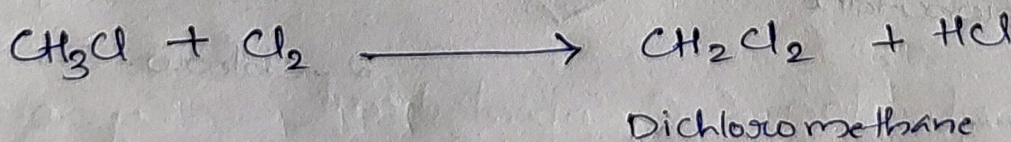
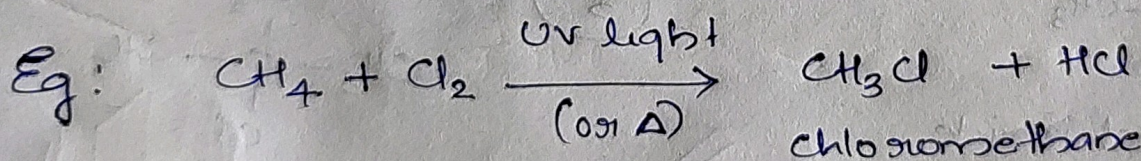


① Chlorination

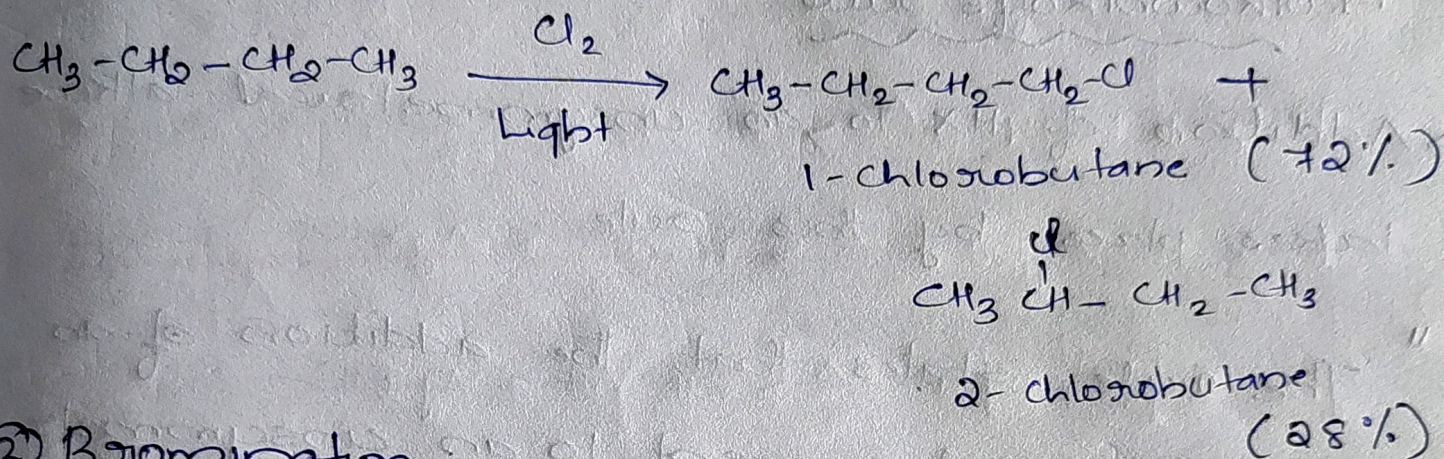
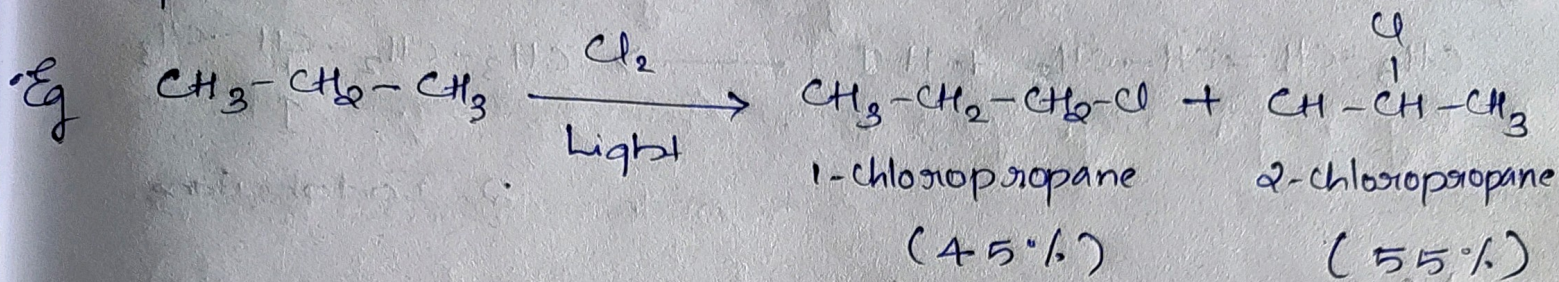
Alkane react with Cl_2 either in presence of UV light / upon heating at $250-400^\circ\text{C}$



→ Extent of chlorination depend upon the amount of Cl_2 used. If sufficient Cl_2 is taken, instead of monochloro derivative successive replacement of H atoms by Cl atoms occur.

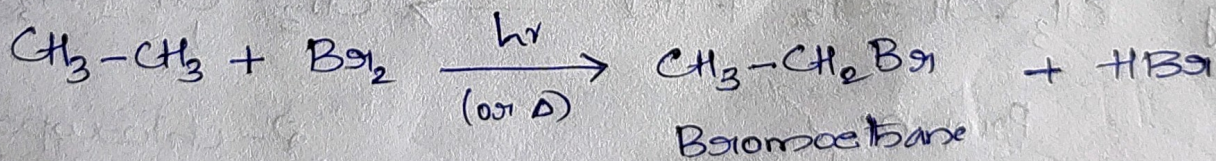
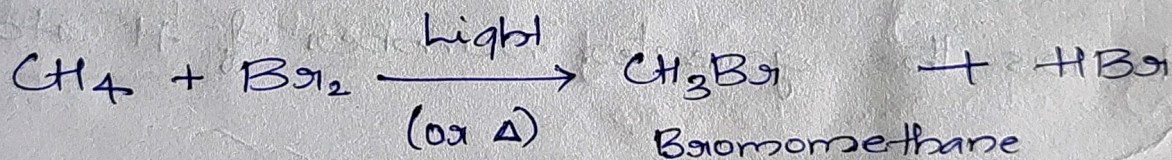


→ chlorination of higher alkanes yield isomeric product



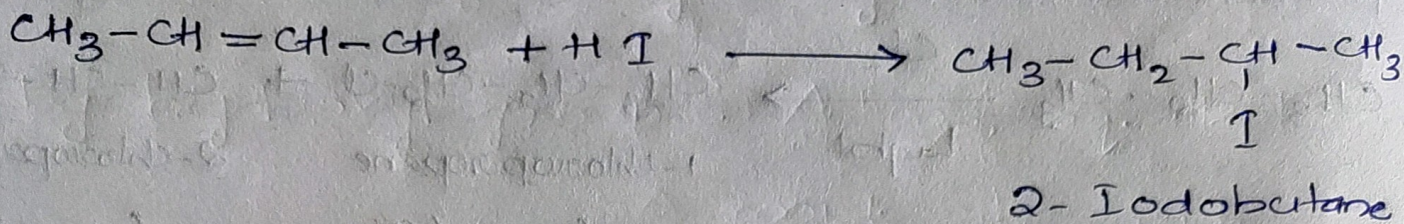
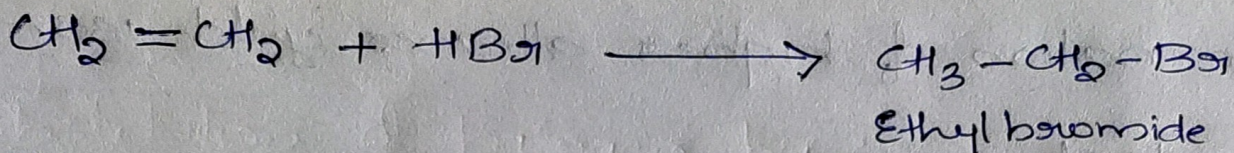
(2) Bromination

Br_2 react with alkanes either in presence of UV light or at $250-400^\circ\text{C}$



(B) From Alkenes

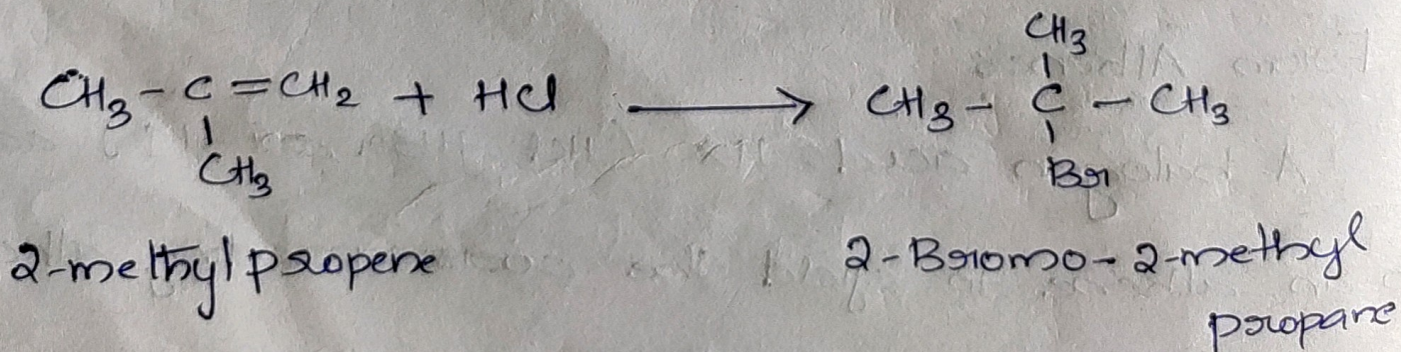
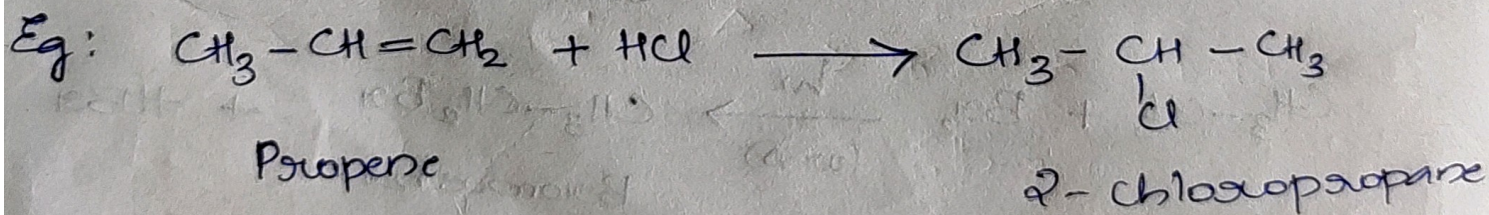
A halogen acid, HX (HCl , HBr or HI) adds to an alkene to yield the corresponding alkyl halide



Markownikoff's rule

→ Addition of HX to an 'unsymmetrical' alkene takes place by this rule

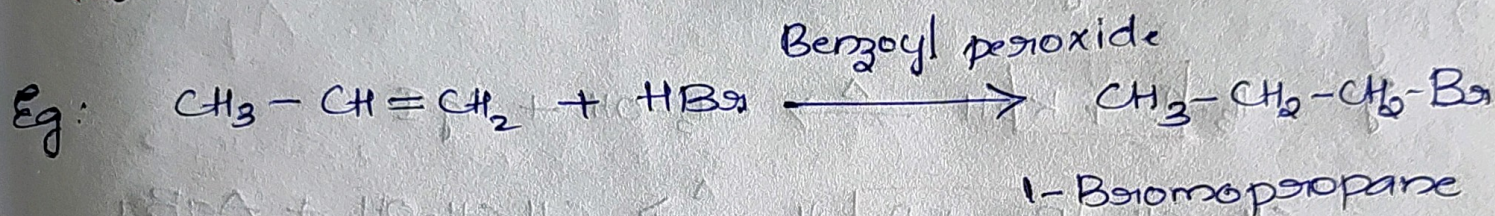
" The rule states that, the addition of an unsymmetrical reagent to an unsymmetrical alkene, the +ve part of the adding molecule goes to that carbon atom which bears the greater number of H atoms "



Order of reactivity of HX for a given alkene



→ The addition of HBr (not HCl or HI) to an unsymmetrical alkene in the presence of a peroxide occurs by "anti-Markovnikov's addition" is known as peroxide effect or Kharasch effect



Reactions of alkyl halides

① Nucleophilic Substitution Reactions

→ Attacking reagent is a nucleophile

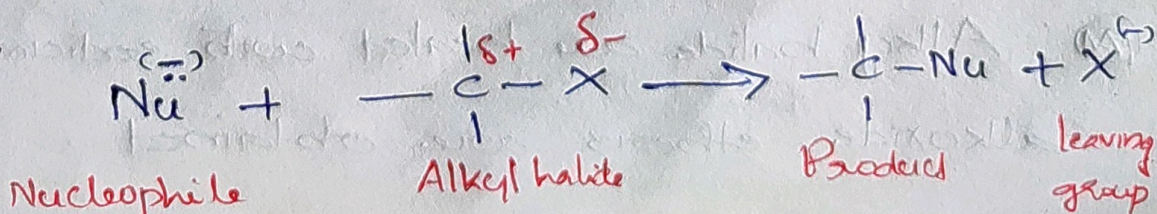
→ Alkyl halides undergo this reaction because

the greater electronegativity of the halogen

makes the C-X bond polar & C atom acquires

partial +ve charge & hence nucleophile is

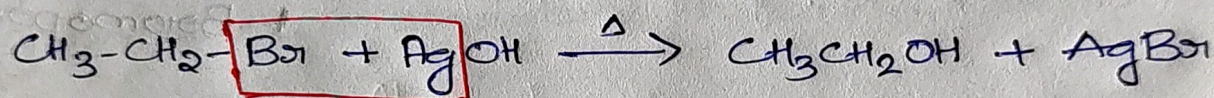
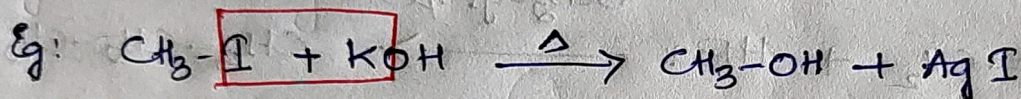
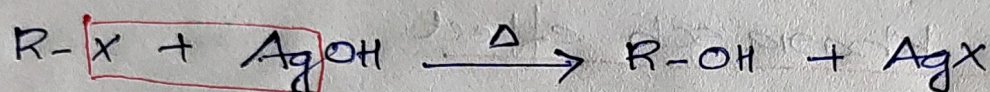
attacked.



Eg:

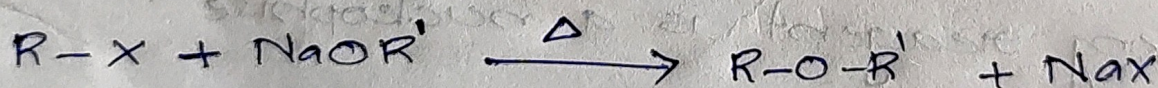
⊛ Substitution of halogen by :

① By hydroxyl group - Action of aq. alkali on moist silver oxide (formation of alcohols)

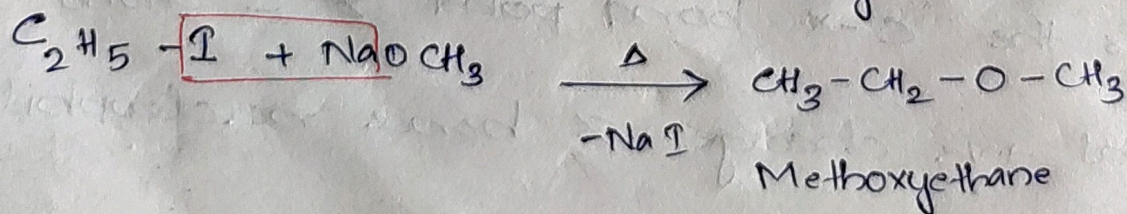
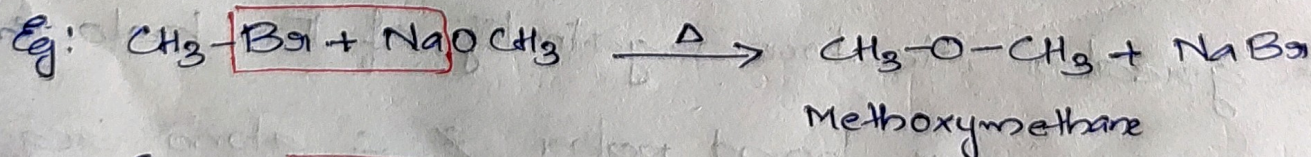


② By alkoxy group - Action of sodium/potassium alkoxide on dry silver oxide (formation of ethers)

(a) Williamson's synthesis

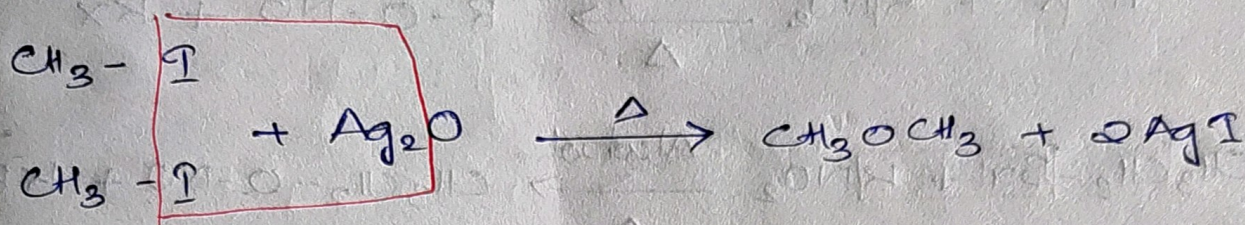
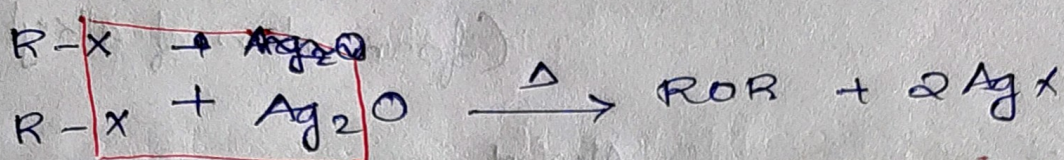


Ether

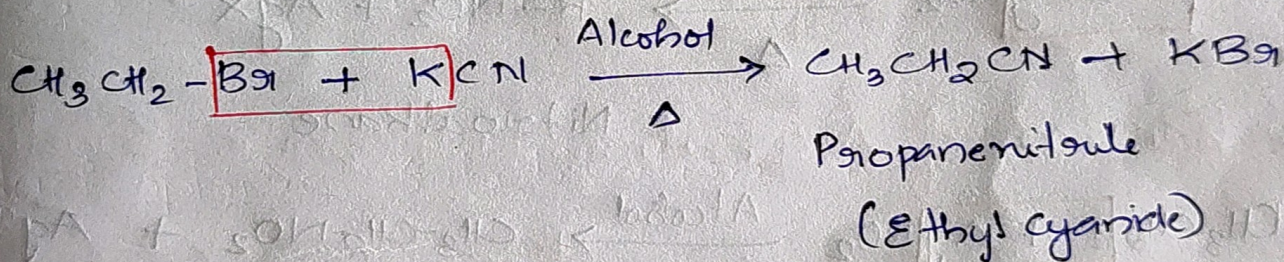
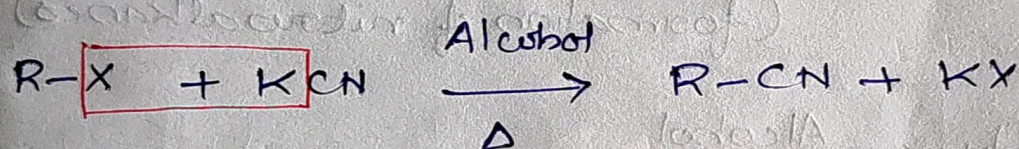


⊛ Alkyl halide are heated with sodium/potassium alkoxide, ethers are obtained

(b) When heated with dry silver oxide

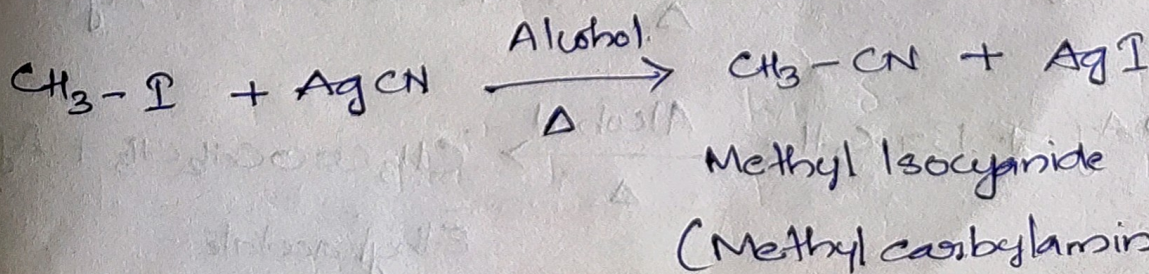
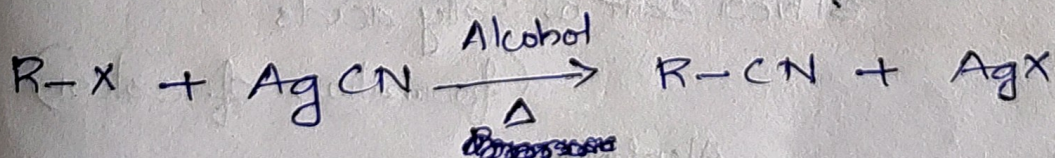


③ By cyano group — Action of alcoholic KCN
(formation of alkyl cyanide or alkanenitriles)

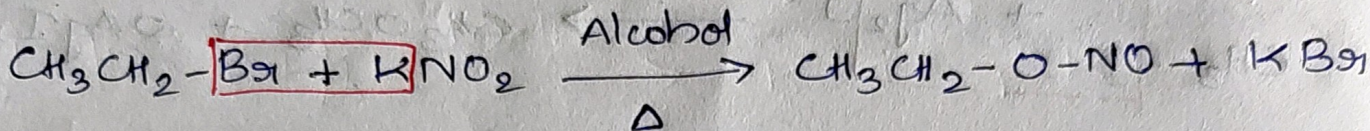
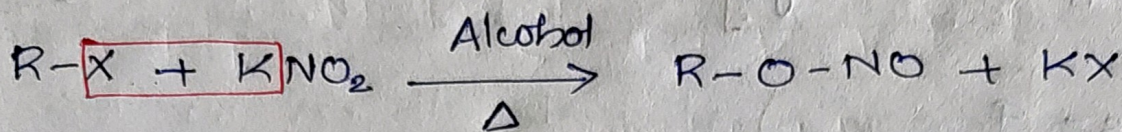


④ By isocyanide group — Action of Alcoholic AgCN

(formation of alkyl isocyanide or alkylcarbylamine)

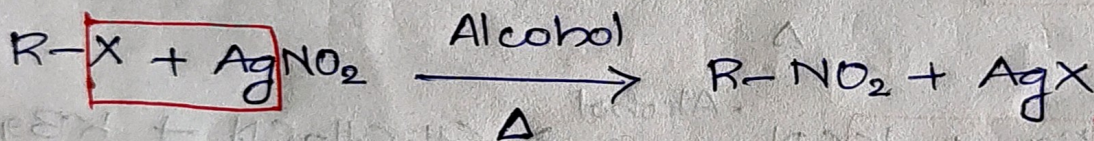


⑤ By nitrate group - Action of alcoholic KNO_2
(formation of alkyl nitrites)

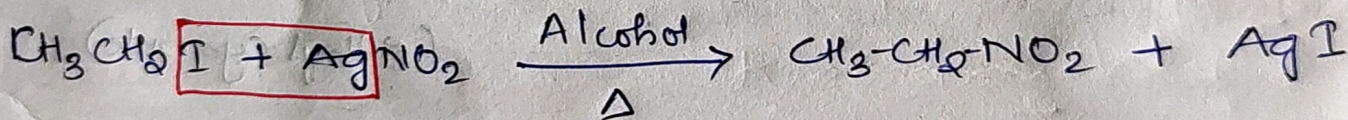


Ethyl nitrite

⑥ By nitro group - Action of alcoholic AgNO_2
(formation of nitroalkanes)



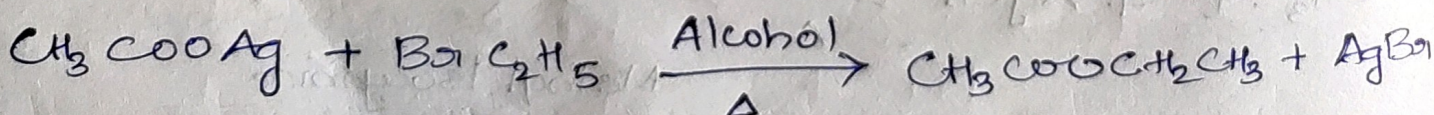
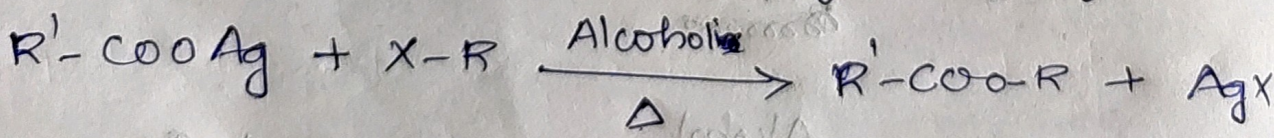
Nitroalkane



Nitroethane

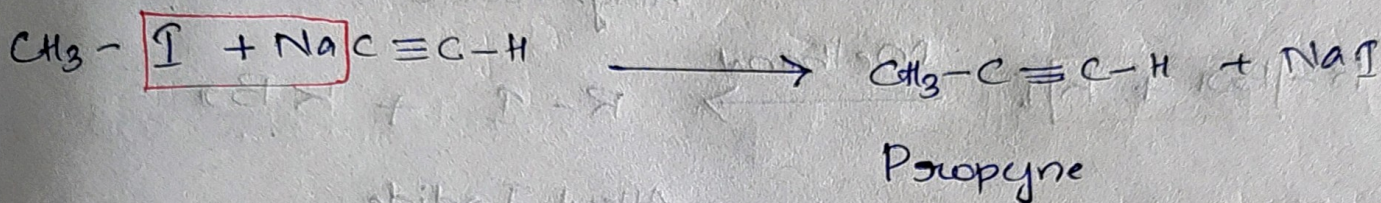
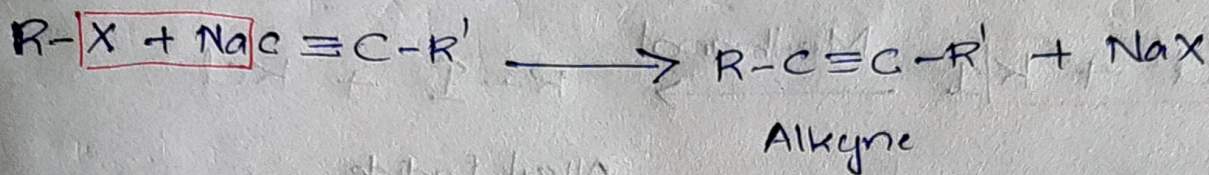
⑦ By carboxylate group - Action of alcoholic solution of silver salt of fatty acids

(formation of ester)



Ethyl acetate

⑧ By alkyl halide group — Action of sodium alkynide
(formation of higher alkynes)



⑨ By amino group — Action of alcoholic NH_3
(formation of amines)

