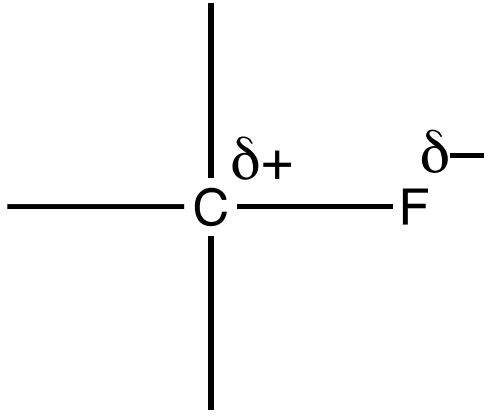
WWW.CHEMSHEETS.CO.UK

HALOGENOALKANES

C–halogen bond is polar



δ+ C attacked by nucleophiles (lone pair donors) which replace the halogen (substitution)

e.g. OH^- CN^- NH_3

rate of reaction

fastest ← **slowest**

iodoalkanes > bromoalkanes > chloroalkanes > fluoroalkanes

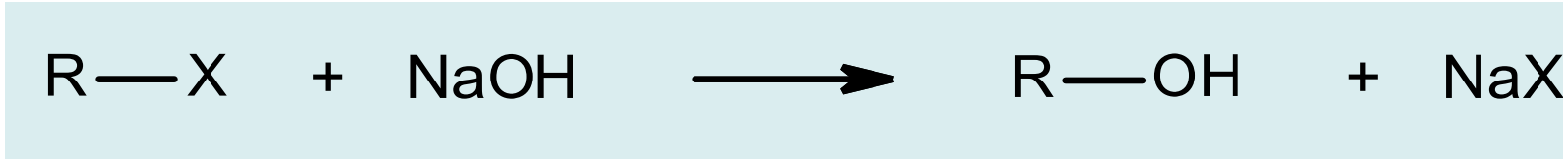
C–halogen bond strength

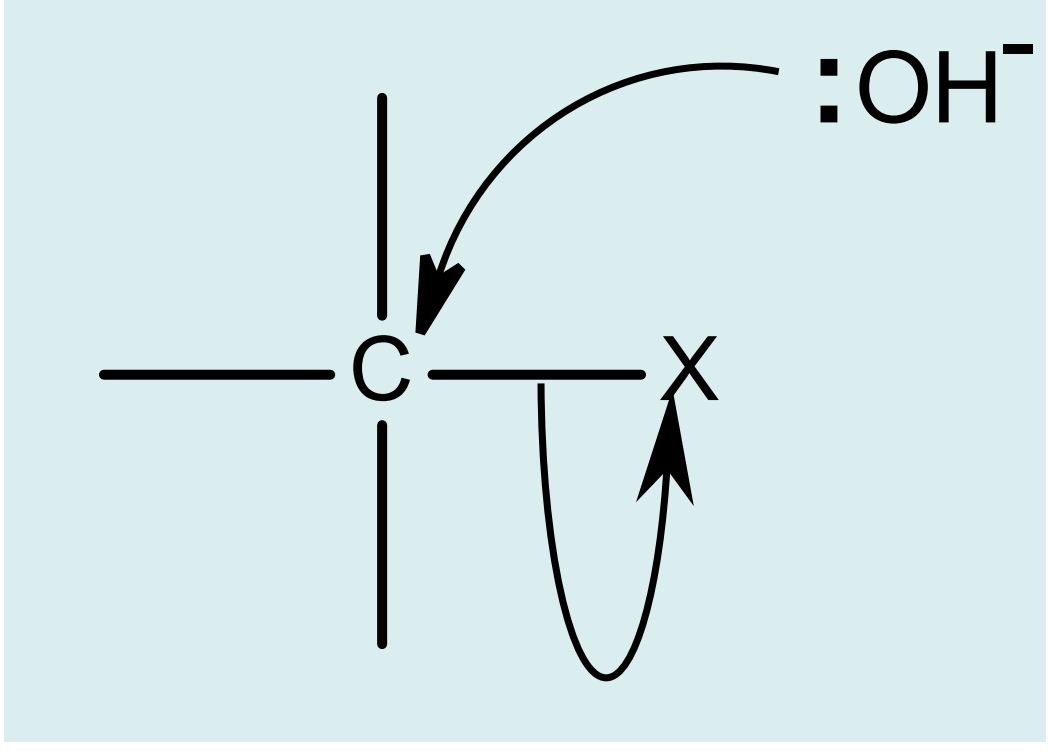
weakest bond → **strongest bond**

C–I > C–Br > C–Cl > C–F

Nucleophilic Substitution

OH^-

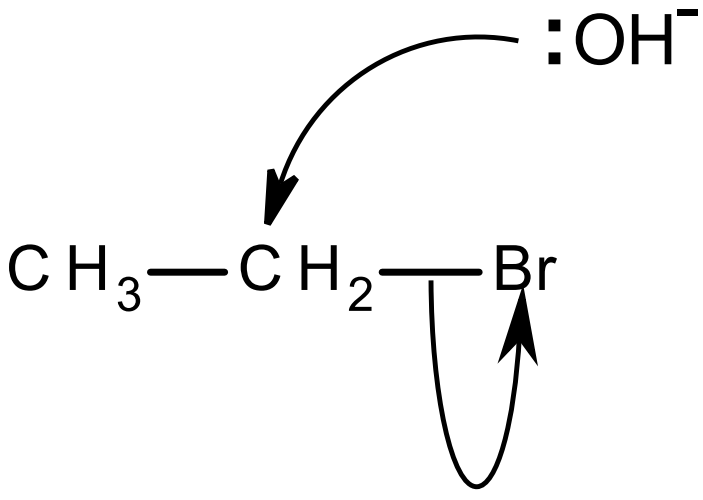




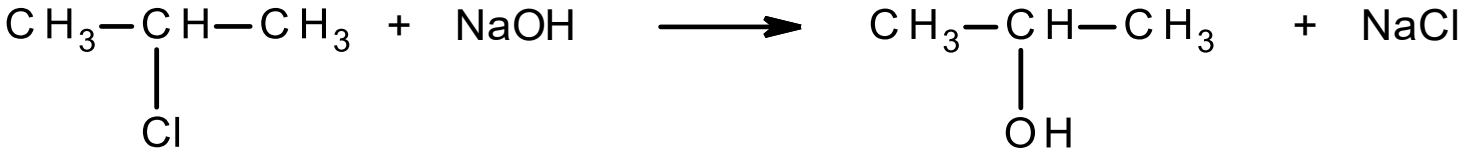
e.g. bromoethane + aqueous NaOH

$$CH_3-CH_2-Br + NaOH \longrightarrow CH_3-CH_2-OH + NaBr$$

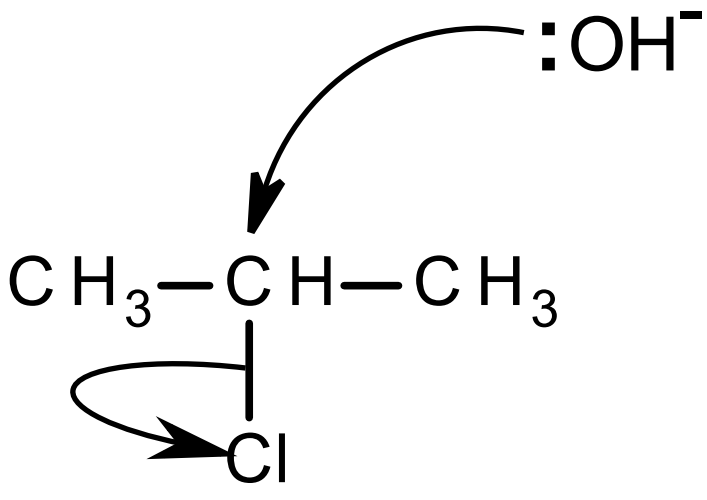
nucleophilic substitution



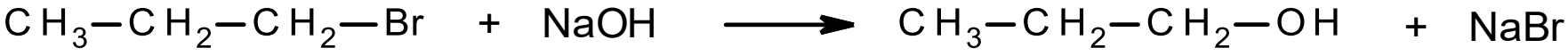
e.g. 2-chloropropane + aqueous NaOH



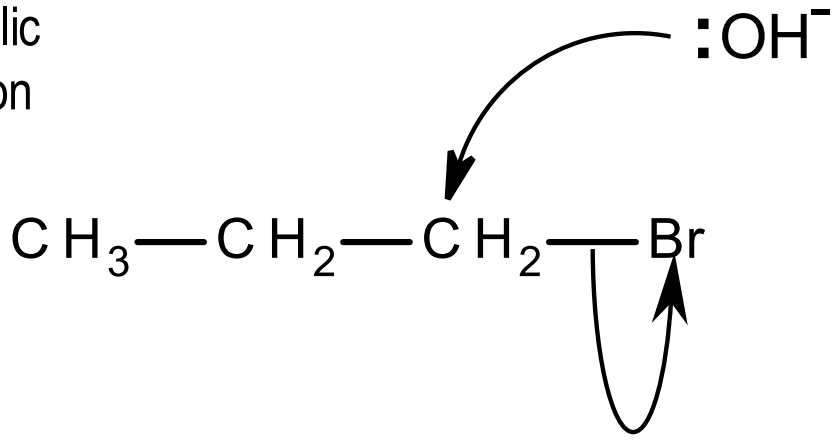
nucleophilic substitution



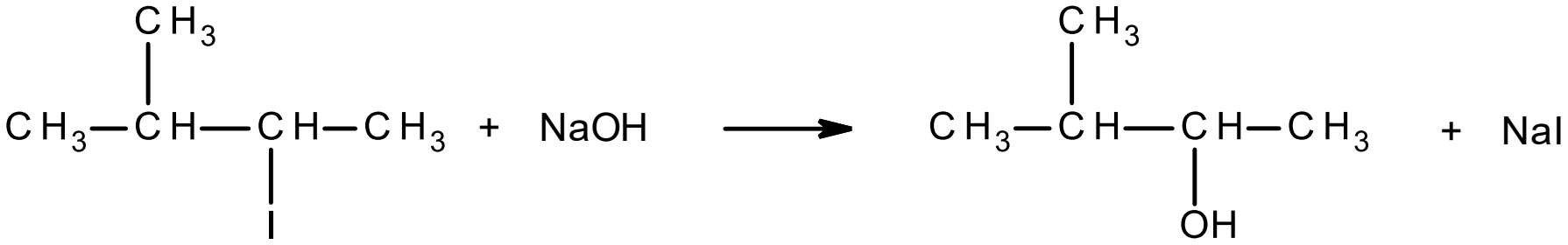
e.g. 1-bromopropane + aqueous NaOH



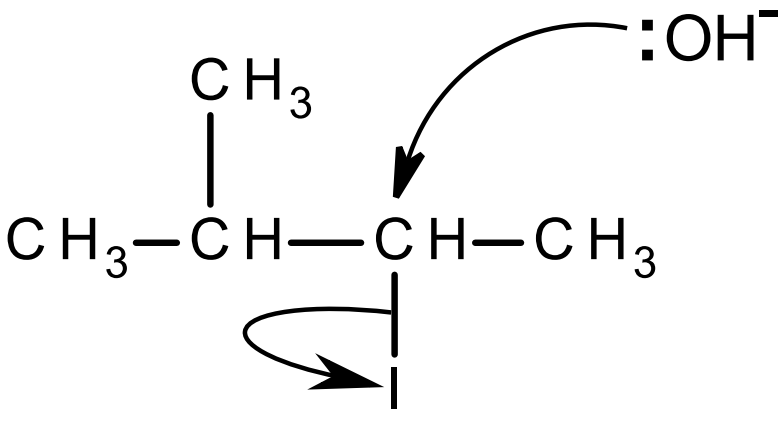
nucleophilic substitution



e.g. 2-iodo-3-methylbutane + aqueous NaOH



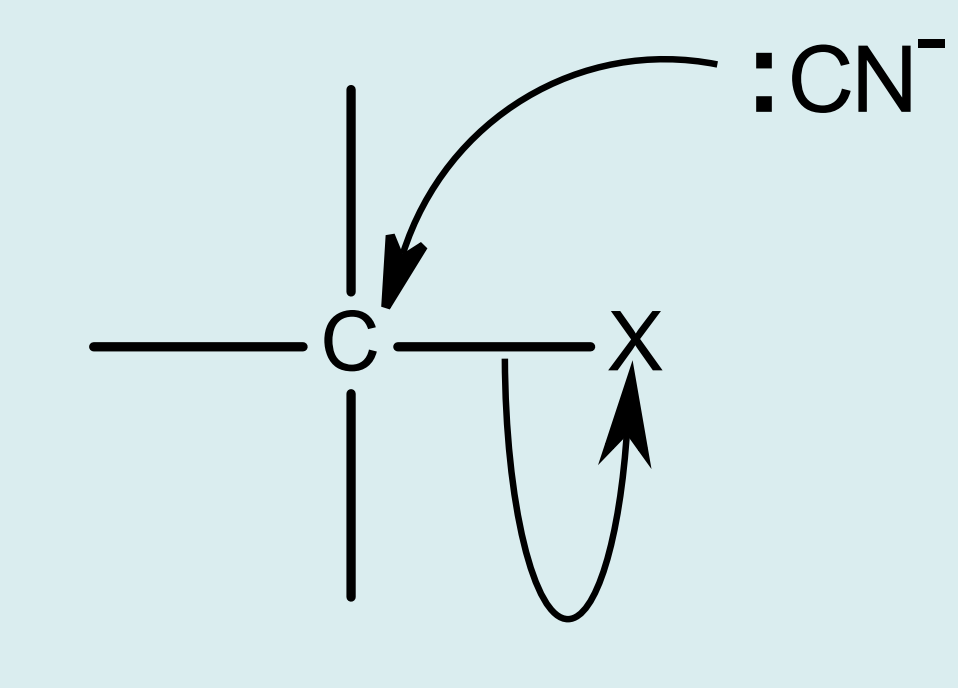
nucleophilic substitution



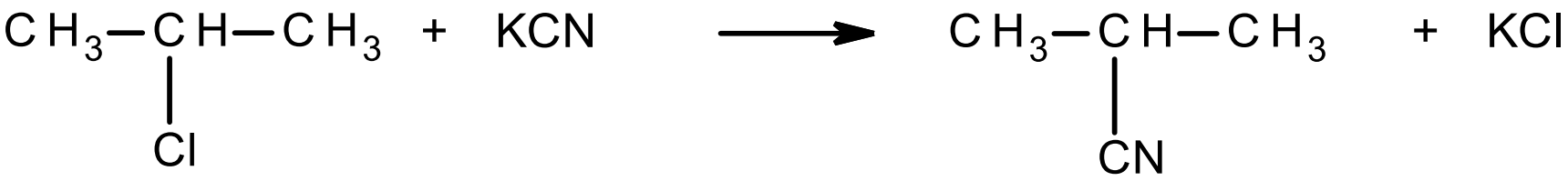
Nucleophilic Substitution

CN^-

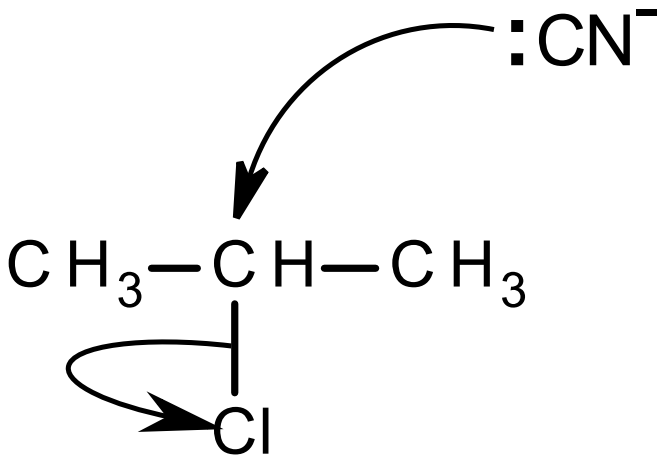
$$R{-}X + KCN \longrightarrow R{-}CN + KX$$



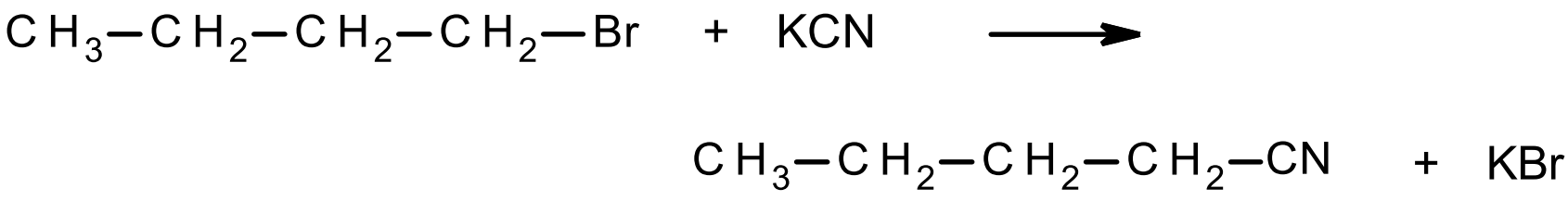
e.g. 2-chloropropane + KCN



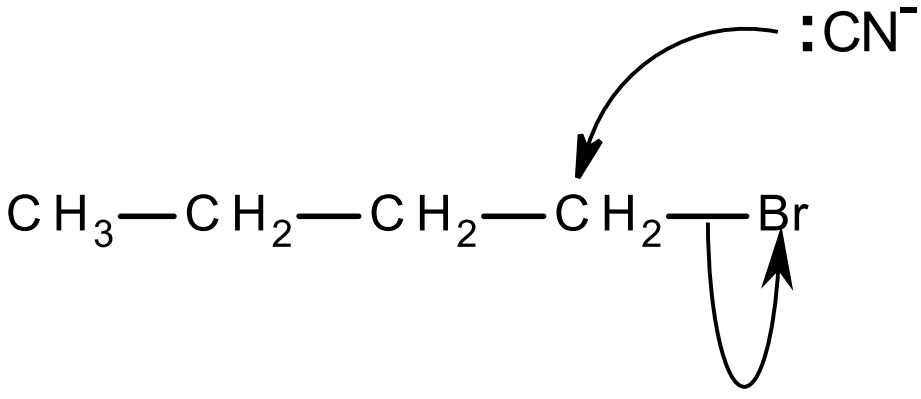
nucleophilic substitution



e.g. 1-bromobutane + KCN



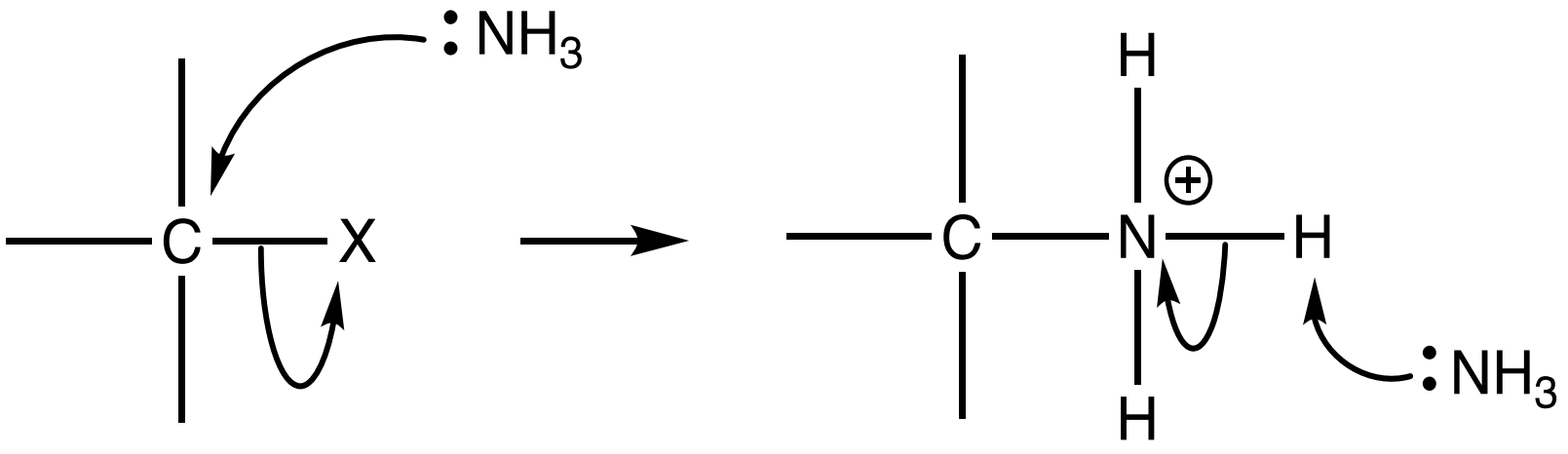
nucleophilic substitution



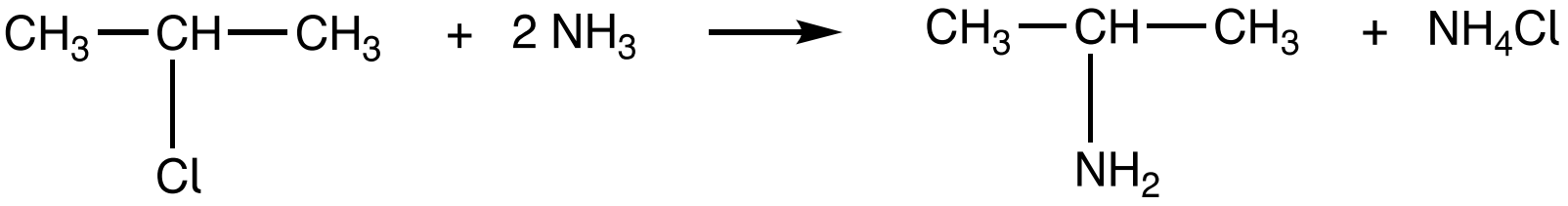
Nucleophilic Substitution

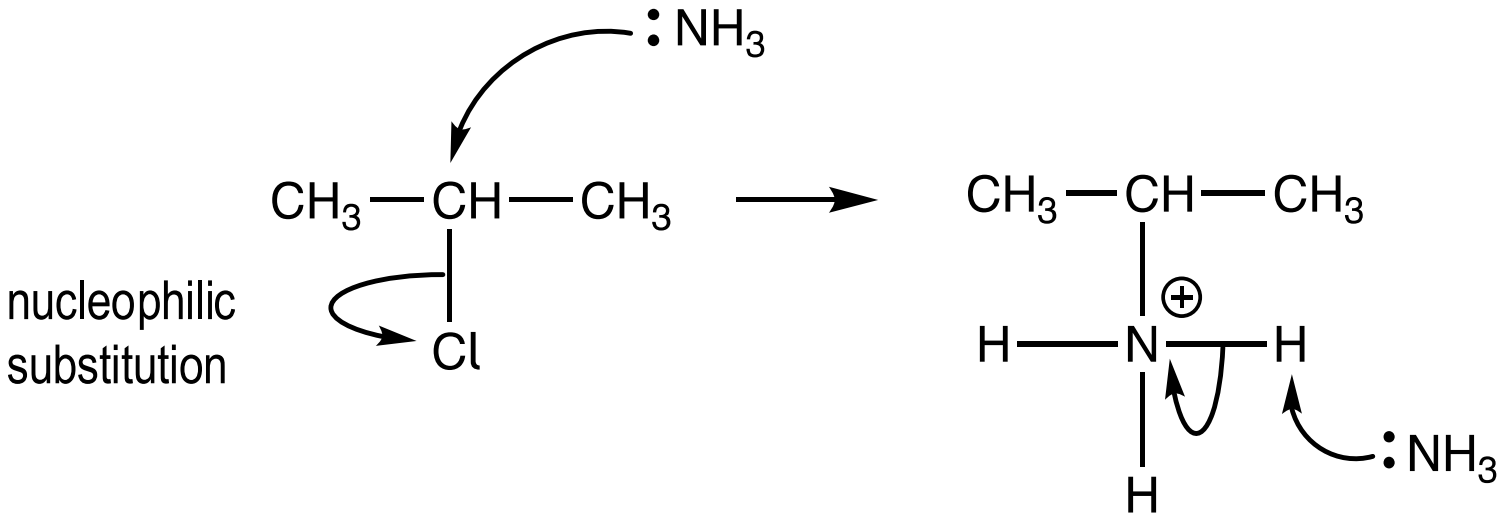
NH_3

$$R{-}X + 2\,NH_3 \longrightarrow R{-}NH_2 + NH_4X$$

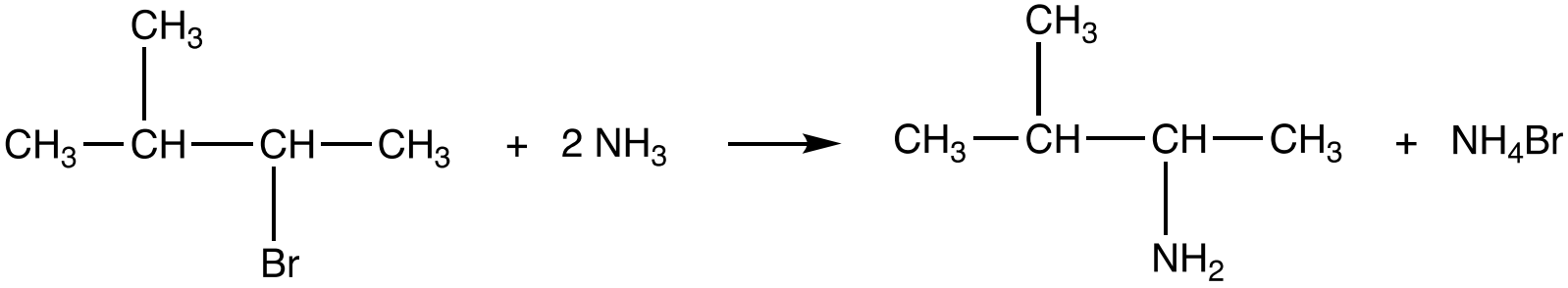


e.g. 2-chloropropane + NH_3

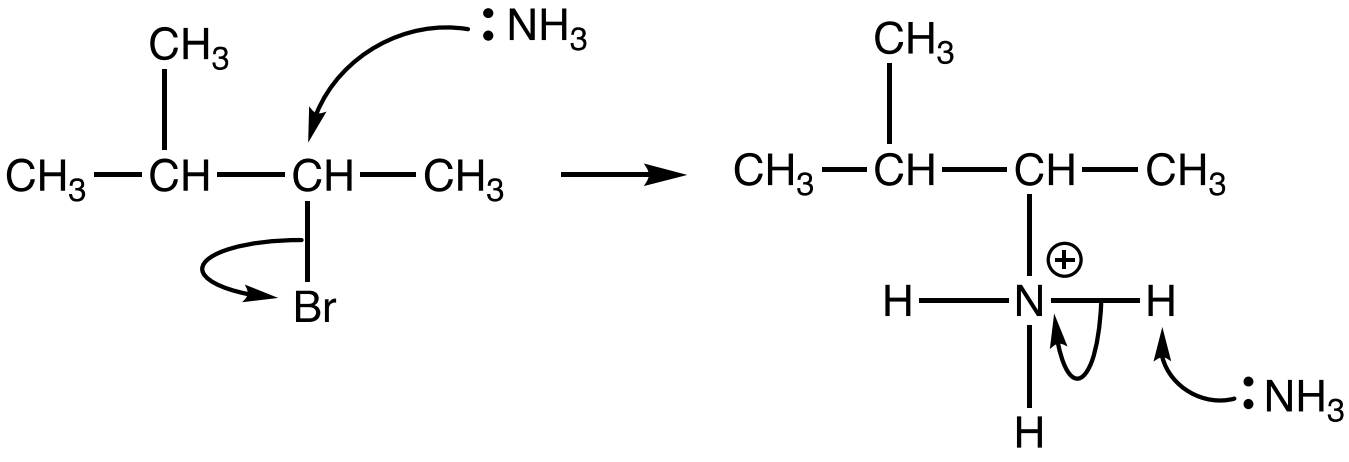




e.g. 2-bromo-3-methylbutane + NH_3



nucleophilic substitution

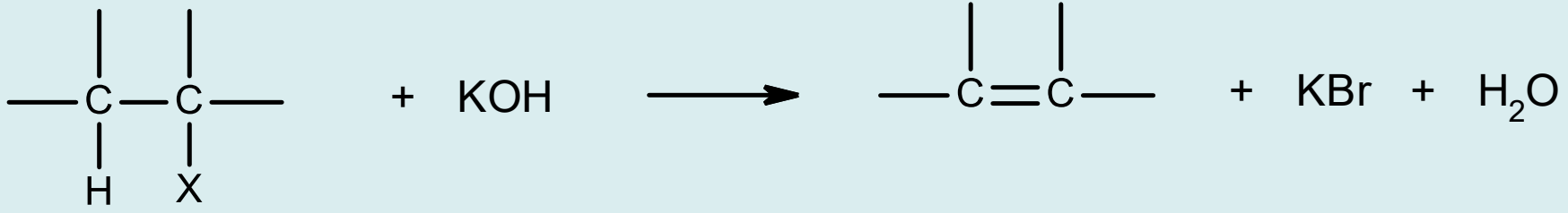


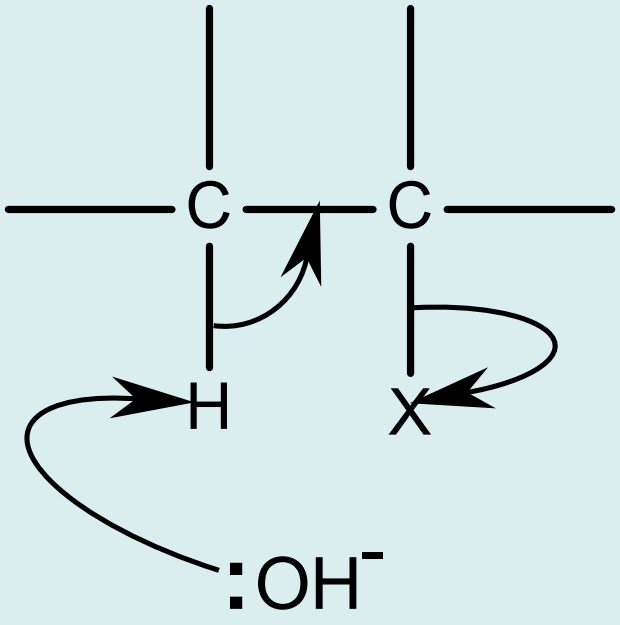
COMPETING REACTIONS WITH OH^-

Mechanism name	Nucleophilic substitution	Elimination
Solvent	Water (NaOH)	Ethanol (KOH)
Temperature	Warm	Hot
Role of OH^-	Nucleophile	Base
Products	Alcohol	Alkene(s)

Elimination

OH^-



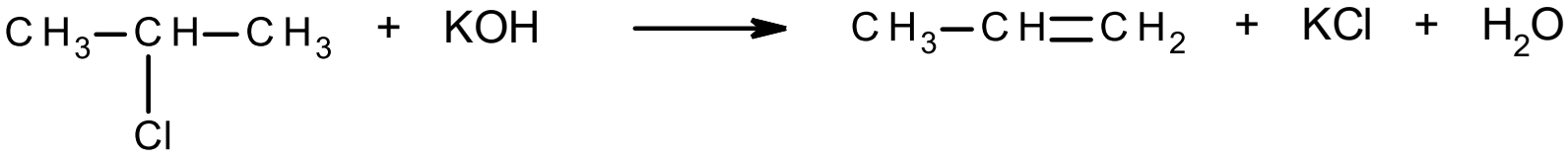


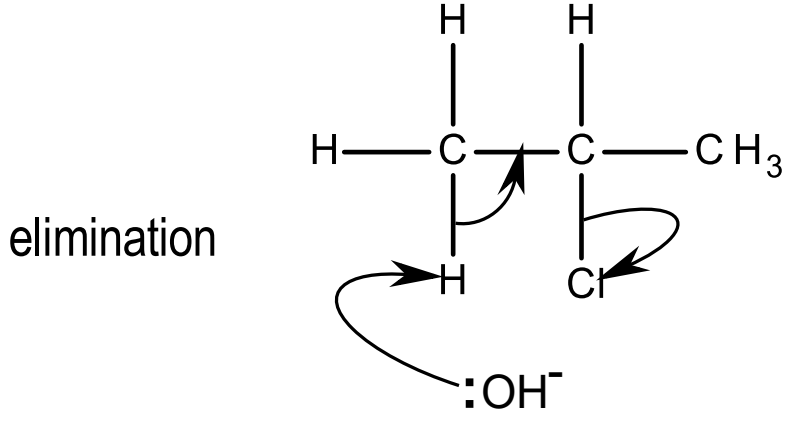
- Hot, ethanolic KOH (not warm, aq NaOH)
- Lose X and H from adjacent C (if there is an H on adjacent C)
- Forms alkene(s)
- Can get different alkenes depending which adjacent C the H comes from
- OH^- acts as base (not nucleophile)

Elimination

OH^-

e.g. 2-chloropropane + hot, ethanolic KOH

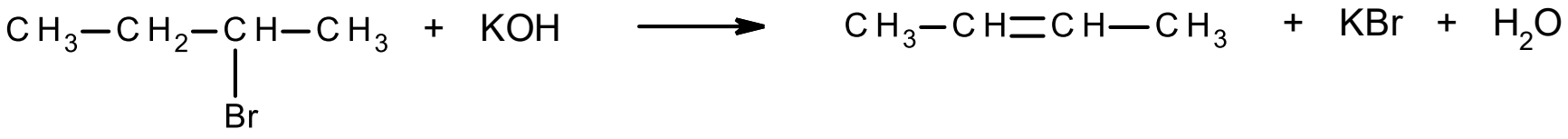


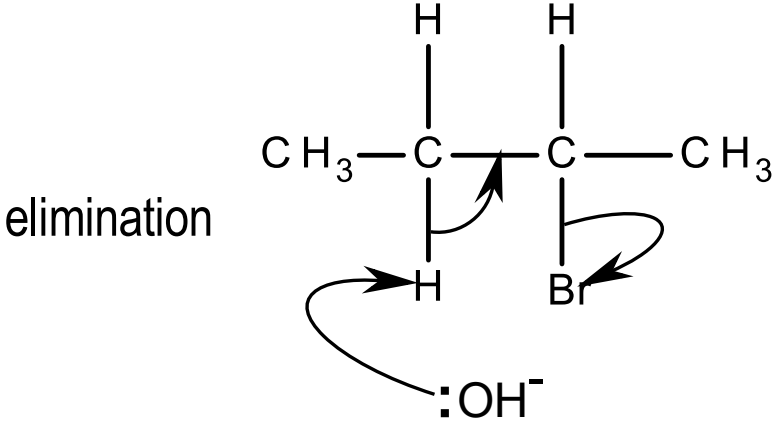


Elimination

OH^-

e.g. 2-bromobutane + hot, ethanolic KOH





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