



Organic Chemistry Revision Sheets

Halogenoalkanes | Nucleophilic Substitution (with :CN⁻)

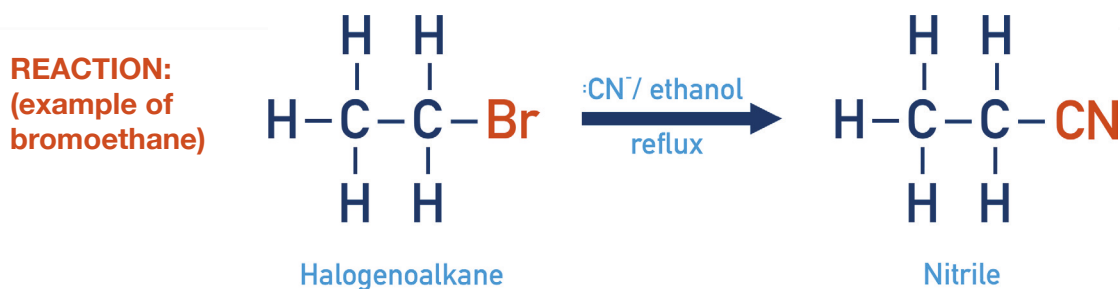
Reaction

REACTANTS: Halogenoalkane and Sodium or Potassium Cyanide (NaCN or KCN)

CONDITIONS: Heat under reflux, Ethanolic (ethanol as the solvent, **no water present**)

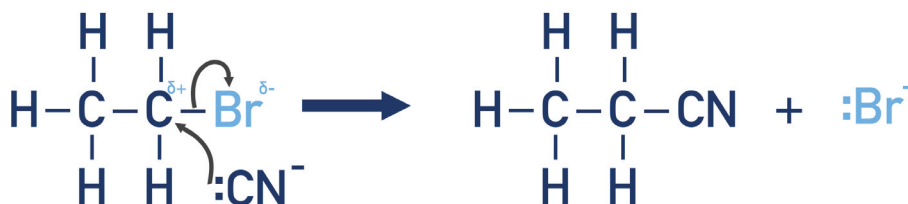
PRODUCT(S): Nitrile and Halide Ion (*forms salt with Na⁺ or K⁺*)

REACTION TYPE: Nucleophilic Substitution



Mechanism

Cyanide ion (CN⁻) acts as a nucleophile and attacks the partially positive carbon atom in the carbon-halogen bond. The carbon-halogen bond breaks, forming a nitrile and a halide ion. CN group is **substituted** for the halogen group.



Notes:

- Reaction must be carried out in **ethanolic conditions (in ethanol, no water present)**, otherwise **an alcohol is likely to form** rather than the nitrile.
- Reaction is heated under reflux to ensure no volatile substances are lost.
- The strength of the carbon-halogen bond (bond enthalpy) determines the speed of the reaction. The stronger the bond, the slower the nucleophilic substitution reaction. *C-F bond is strongest, giving the slowest reaction; the C-I bond is weakest, giving the fastest reaction.*