Amines

Basicity of Amines

Amines are bases (proton acceptors), reacting with acids to form salts. The lone pair of electrons on the N atom forms a dative covalent bond with the proton from an acid (like :NH_3).

Ethylamine + proton → ethylammonium ion

$C_2H_5NH_2$ + H^+ → $C_2H_5NH_3^+$

Amines react with acids to produce salts.

$C_6H_5NH_2$(l) + HCl(aq) ——> $C_6H_5NH_3^+Cl^-$(aq) phenylammonium chloride

This reaction allows an amine to dissolve in water as its salt.

Preparation of amines

1) Formation of amines by substitution of halogenoalkanes. Heating under pressure with excess ethanolic ammonia.

RX + NH_3 → RNH_2 + HX X= halogen atom

Eg to make ethylamine

$CH_3CH_2Cl + NH_3 \rightarrow CH_3CH_2NH_2 + HCl$

Note: multiple substitution can occur to give various products eg $(CH_3CH_2)_2NH$, $(CH_3CH_2)_3N$, $[(CH_3CH_2)_4N]^+Cl^-$

2) Formation of primary aliphatic amines by reduction of nitriles

Step 1 – Nucleophilic substitution of Br^- by CN^-

$$\mathbf{CH_3Br + CN^- \rightarrow CH_3CN + Br^-}$$

Step 2 – Reduction of the CN group by H_2 and Nickel catalyst.

$$\mathbf{CH_3CN + 2H_2 \rightarrow CH_3CH_2NH_2}$$

This method gives a purer product that using ammonia because only the primary amine is formed.

Formation of phenylamine by reduction of nitrobenzene using tin and concentrated HCl, under reflux.

$C_6H_5NO_2$ + 6[H] → $C_6H_5NH_2$ + $2H_2O$