Solutions

Each answer shows the steps, then the **result**.

2.1

- ammonia (NH_3) in ethanol; heated under pressure

2.2

- nucleophilic substitution

2.3

- propylamine (propan-1-amine), $CH_3CH_2CH_2NH_2$

2.4

- the nitrogen atom has a lone pair of electrons that it can donate to a $\delta+$ carbon

3.1 B

- Excess ammonia stops the amine reacting further with the halogenoalkane

3.2 A

- The lone pair on the nitrogen of ammonia is the nucleophile

3.3

(a)

- $C_2H_5Br + NH_3 \rightarrow C_2H_5NH_2 + HBr$

(b)

- ammonia (a nucleophile) uses its lone pair to attack the $\delta+$ carbon and replaces the halogen – a substitution

3.4

(a)

- the ethylamine formed also has a lone pair on nitrogen, so it is also a nucleophile
- it attacks more bromoethane, giving secondary and tertiary amines (and a quaternary ammonium salt)

(b)

- **diethylamine**, $(C_2H_5)_2NH$

3.5

(a)

- KCN in ethanol, heated under reflux
- propanenitrile, CH_3CH_2CN

(b)

- H_2 with a nickel catalyst, or $LiAlH_4$
- the product is propylamine, $CH_3CH_2CH_2NH_2$