Exercise walk-through

Primary amines ▪ 19.1

eXercise

You must be able to

- recall the reaction of a halogenoalkane with ammonia to make a primary amine
- describe it as a nucleophilic substitution

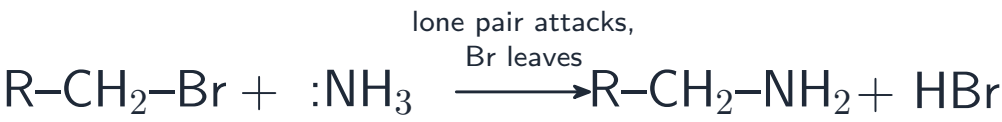
Method — Making a primary amine

An **amine** has an –NH group. Heat a halogenoalkane with **ammonia** in ethanol, under pressure:

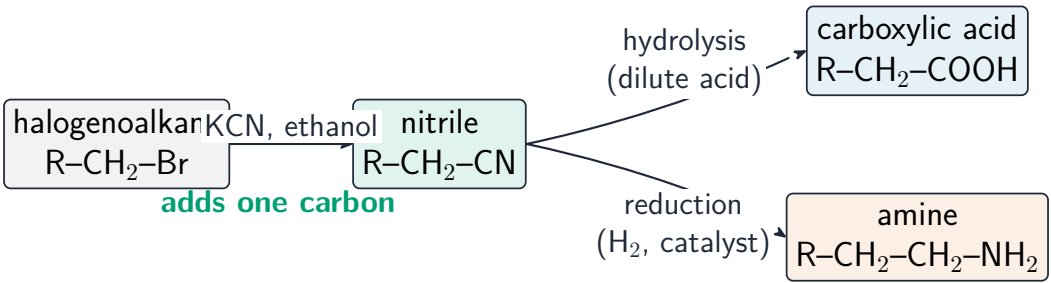
$$C_2H_5Br + NH_3 \rightarrow C_2H_5NH_2 + HBr$$

Use an **excess** of ammonia, or the amine made reacts again with more halogenoalkane.

Method — Making a primary amine



Method — Making a primary amine



Amines via the nitrile route

Practice 2.1 ▪ 2 marks

State the reagents and conditions to make ethylamine from bromoethane.

Solution 2.1

Worked steps

ammonia (NH) in ethanol B1; heated under pressure B1.

Practice 2.2 ▪ 1 mark

Name the type of mechanism of this reaction.

Solution 2.2

Worked steps

nucleophilic substitution B1.

Exam-style 3.1 ▪ 1 mark

Why is an excess of ammonia used when making a primary amine?

A to speed up the reaction

B to stop the amine reacting further with the halogenoalkane

C to lower the temperature

D to act as a catalyst

Solution 3.1

Method: Making a primary amine

A to speed up the reaction

B to stop the amine reacting further with the halogenoalkane ✓

C to lower the temperature

D to act as a catalyst

Worked steps

B. Excess ammonia stops the amine reacting further with the halogenoalkane.

Exam-style 3.2 ▪ 1 mark

The species that attacks the halogenoalkane is:

A the lone pair on nitrogen of ammonia

B the H^+ ion

C a free radical

D the bromide ion

Solution 3.2

Method: Making a primary amine

A the lone pair on nitrogen of ammonia ✓

B the H ion

C a free radical

D the bromide ion

Worked steps

A. The lone pair on the nitrogen of ammonia is the nucleophile.

Exam-style 3.3 ▪ 1 mark

(a) Write the equation for the reaction of bromoethane with ammonia.
(b) Explain why this reaction is classed as nucleophilic substitution.

Solution 3.3

Method: Making a primary amine

Worked steps

(a) $C_2H_5Br + NH_3 \rightarrow C_2H_5NH_2 + HBr$ **B1**.
(b) ammonia (a nucleophile) uses its lone pair to attack the $\delta+$ carbon **M1** and replaces the halogen — a substitution **A1**.