

19.1 Primary amines

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS amine 胺 • primary amines 伯胺 • halogenoalkane 卤代烷 • nucleophilic substitution 亲核取代
• nitrile 腈

Objective

Build the skills to answer exam questions on **primary amines** 伯胺 — making them from a **halogenoalkane** 卤代烷 and ammonia.

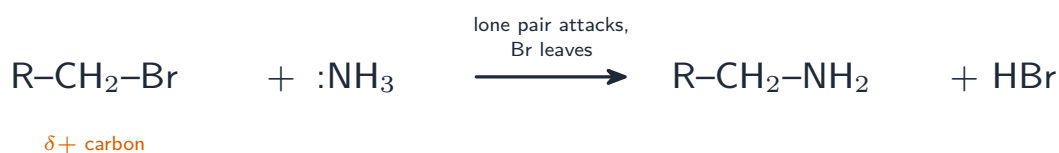
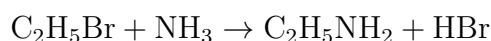
You must be able to:

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

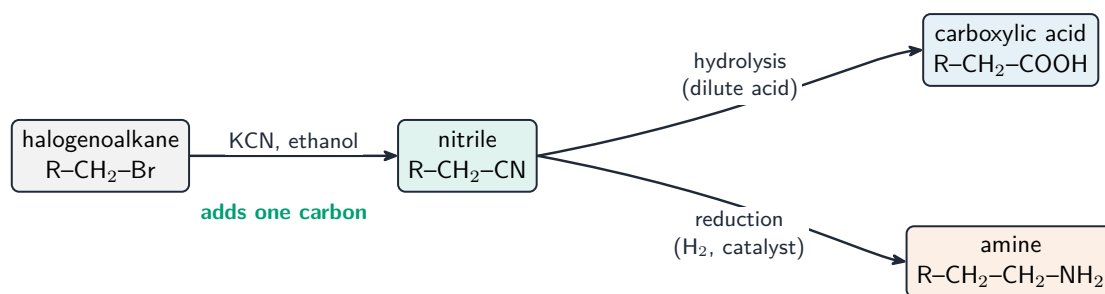
1 Worked examples

■ Making a primary amine

An **amine** has an -NH_2 group. Heat a halogenoalkane with **ammonia** in ethanol, under pressure:



A nucleophilic substitution: ammonia's lone pair attacks the $\delta+$ carbon, displacing the halogen



Amines via the nitrile route

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

2 Practice

2.1 State the reagents and conditions to make ethylamine from bromoethane. [2]

2.2 Name the type of mechanism of this reaction. [1]

3 Exam-style questions

3.1 Why is an excess of ammonia used when making a primary amine? [1]

- **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
-

3.2 The species that attacks the halogenoalkane is: [1]

- **A** the lone pair on nitrogen of ammonia
 - **B** the H^+ ion
 - **C** a free radical
 - **D** the bromide ion
-

3.3 (a) Write the equation for the reaction of bromoethane with ammonia. [1]

(b) Explain why this reaction is classed as nucleophilic substitution. [2]

Solutions

2.1 ammonia (NH_3) in ethanol; heated under pressure.

2.2 nucleophilic substitution.

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) $\text{C}_2\text{H}_5\text{Br} + \text{NH}_3 \rightarrow \text{C}_2\text{H}_5\text{NH}_2 + \text{HBr}$.

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