

A-Level Chemistry

Name: _____ Score: _____

1. An amine contains the:
 - ☐ -NH_2 group
 - ☐ -OH group
 - ☐ -COOH group
 - ☐ $\text{C}=\text{C}$ bond
2. Heating a halogenoalkane with KCN in ethanol makes a nitrile, which usefully:
 - ☐ adds one carbon to the chain
 - ☐ removes a carbon
 - ☐ adds an -OH group only
 - ☐ forms an alkene
3. A primary amine is made by heating a halogenoalkane with:
 - ☐ ammonia in ethanol, under pressure
 - ☐ aqueous NaOH
 - ☐ acidified dichromate
 - ☐ bromine water
4. Adding HCN to an aldehyde or ketone gives a hydroxynitrile by:
 - ☐ nucleophilic addition across the $\text{C}=\text{O}$ bond
 - ☐ free-radical substitution
 - ☐ elimination
 - ☐ oxidation
5. The reaction is a nucleophilic substitution because:
 - ☐ the lone pair on ammonia attacks the slightly positive carbon, displacing the halogen
 - ☐ a radical attacks the carbon
 - ☐ a proton is transferred
 - ☐ electrons are transferred to ammonia
6. Amines act as bases because the nitrogen lone pair can accept a _____.

7. Nitriles contain the $\text{-C}\equiv\text{N}$ functional group and can be reduced to amines.

☐ True ☐ False

8. Hydrolysing a nitrile with dilute acid turns -CN into:

☐ -COOH (a carboxylic acid)

☐ -OH (an alcohol)

☐ -NH_2 (an amine)

☐ a $\text{C}=\text{C}$ bond

9. Why is an excess of ammonia used?

☐ so the amine product does not react further

☐ to lower the temperature

☐ to make the reaction reversible

☐ to remove water

10. Reducing a nitrile (with H_2 and a catalyst) gives:

☐ an amine

☐ a carboxylic acid

☐ an alkene

☐ a ketone

A-Level Chemistry

1. **-NH₂ group**

An amine has an -NH₂ group, where nitrogen replaces a hydrogen of ammonia.

2. **adds one carbon to the chain**

The CN group adds a carbon (a nucleophilic substitution); HCN with a carbonyl gives a hydroxynitrile instead.

3. **ammonia in ethanol, under pressure**

Ammonia (in ethanol, under pressure) substitutes the halogen to give the amine.

4. **nucleophilic addition across the C=O bond**

CN⁻ adds across the carbonyl; the O⁻ then takes an H⁺ — nucleophilic addition.

5. **the lone pair on ammonia attacks the slightly positive carbon, displacing the halogen**

Ammonia is the nucleophile; its nitrogen lone pair attacks the C-X carbon and pushes out the halogen.

6. **proton**

$\text{R-NH}_2 + \text{H}^+ \rightarrow \text{R-NH}_3^+$.

7. **True**

They add one carbon to the chain.

8. **-COOH (a carboxylic acid)**

Hydrolysis converts the nitrile group to a carboxylic acid (with an ammonium salt by-product).

9. **so the amine product does not react further**

The amine is itself a nucleophile and could react again; excess ammonia favours the primary amine.

10. **an amine**

Reduction of a nitrile gives an amine — a route to a longer-chain amine.