

19. Nitrogen compounds

Starter Quiz · 课前小测

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

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.