

12. Nitrogen and sulfur

Starter Quiz · 课前小测

A-Level Chemistry

Name: _____ Score: _____

- Nitrogen gas is unreactive because it has:
 - ☐ a strong triple bond and a non-polar molecule
 - ☐ a weak single bond
 - ☐ a permanent dipole
 - ☐ an unpaired electron
- Oxides of nitrogen (NO_x) are produced by:
 - ☐ lightning, and the high temperature inside car engines
 - ☐ photosynthesis
 - ☐ dissolving salt in water
 - ☐ burning hydrogen only
- Ammonia acts as a base because:
 - ☐ the lone pair on nitrogen can accept a proton (H^+)
 - ☐ it donates a proton
 - ☐ it has no lone pair
 - ☐ it gains electrons
- In a catalytic converter, NO and CO react to form:
 - ☐ nitrogen and carbon dioxide (harmless gases)
 - ☐ more NO
 - ☐ sulfur dioxide
 - ☐ ammonia
- The bond formed when NH_3 accepts H^+ is a coordinate bond because:
 - ☐ both shared electrons came from the nitrogen atom
 - ☐ each atom gave one electron
 - ☐ electrons were transferred
 - ☐ no electrons are shared
- Ammonia (NH_3) acts as a base because it can accept a _____.

- Oxides of nitrogen from car engines contribute to acid rain and photochemical smog.

☐ True ☐ False

- How does NO_2 contribute to acid rain?
 - ☐ it forms nitric acid directly and catalyses the oxidation of SO_2 to SO_3
 - ☐ it neutralises acids
 - ☐ it removes sulfur dioxide
 - ☐ it has no effect
- The test for an ammonium salt is to warm it with NaOH and look for:
 - ☐ ammonia gas (sharp smell; damp red litmus turns blue)
 - ☐ a white precipitate
 - ☐ a colour change to yellow
 - ☐ hydrogen gas
- Photochemical smog forms when NO_x reacts in sunlight with unburned hydrocarbons to make:
 - ☐ PAN (peroxyacetyl nitrate)
 - ☐ ammonia
 - ☐ pure oxygen
 - ☐ water only

1. **a strong triple bond and a non-polar molecule**

The $\text{N}\equiv\text{N}$ triple bond is very strong, and the symmetrical molecule is non-polar — both make it unreactive.

2. **lightning, and the high temperature inside car engines**

Lightning (natural) and the heat of internal combustion engines both make N_2 and O_2 combine into NO.

3. **the lone pair on nitrogen can accept a proton (H^+)**

A Brønsted–Lowry base accepts a proton; ammonia's nitrogen lone pair does exactly that.

4. **nitrogen and carbon dioxide (harmless gases)**

$2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$; the harmful gases become harmless ones.

5. **both shared electrons came from the nitrogen atom**

Nitrogen supplies both electrons of the new N–H bond, making it a coordinate (dative) bond.

6. **proton**

$\text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+$.

7. **True**

NO_x are atmospheric pollutants.

8. **it forms nitric acid directly and catalyses the oxidation of SO_2 to SO_3**

NO_2 dissolves to form nitric acid, and it also speeds up $\text{SO}_2 \rightarrow \text{SO}_3$, which forms sulfuric acid.

9. **ammonia gas (sharp smell; damp red litmus turns blue)**

A base displaces ammonia from the salt; the ammonia smells sharp and turns damp red litmus blue.

10. **PAN (peroxyacetyl nitrate)**

In sunlight NO_x and hydrocarbons form PAN, a harmful part of the brown photochemical smog.