

Microscale reactions of ammonia – teacher notes

In this experiment, students observe what happens when ammonia reacts with indicator solution, copper(II) sulfate solution and Nessler's reagent.

Topic

Gases

Timing

20 minutes

Equipment

Apparatus

- Eye protection
- Student sheet
- Clear plastic sheet (eg ohp sheet)
- Plastic Petri dish, 9 cm, base and lid
- Plastic pipette
- Scissors

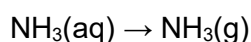
Chemicals

Solutions should be contained in plastic pipettes – see the accompanying guidance on apparatus and techniques for microscale chemistry (<https://rsc.li/3eioSQW>), which includes instructions for preparing solutions.

- Ammonia solution, 3 mol dm⁻³
- Full-range indicator solution, diluted 1:1 with deionised water
- Copper(II) sulfate solution, 0.2 mol dm⁻³
- Nessler's reagent (an alkaline solution of mercury iodide containing the complex ion HgI₄⁻)

Method

Evaporation of ammonia gas from ammonia solution:



Observations

1. Full-range indicator solution turns blue-green.
2. Copper(II) sulfate solution turns hazy and then develops deep blue streaks as the tetraamminocopper(II) ion is formed.

3. Nessler's reagent turns first yellow then brown. This is a very sensitive test for ammonia. The compound formed has the formula $(\text{OHg}_2\text{NH}_2)\text{I}$ and consists of covalent metal–non-metal bonds which might provide an interesting point for subsequent class discussion.

Health, safety and technical notes

- Read our standard health and safety guidance (<https://rsc.li/3uJNkbb>).
- Wear eye protection throughout (splash-resistant goggles to BS EN166 3).
- Wear protective gloves.
- Nessler's reagent, K_2HgI_4 , is EXTREMELY TOXIC by all routes and contains mercury. It is also CORROSIVE and toxic to aquatic life. Avoid contact with the skin and wash off quickly with water if this does occur.
- Ammonia solution, $3 \text{ mol dm}^{-3} \text{ NH}_3(\text{aq})$, is CORROSIVE – see CLEAPSS Hazcard HC006 and CLEAPSS Recipe Book RB006.
- Copper(II) sulfate solution, $0.2 \text{ mol dm}^{-3} \text{ CuSO}_4(\text{aq})$, causes eye damage and is toxic to aquatic life – see CLEAPSS Hazcard HC027c and CLEAPSS Recipe Book RB031.
- Some formulations of universal indicator can still be flammable at a 1:1 dilution. Keep away from sources of ignition.