

Your teacher may watch to see if you can:

- carry out an experiment appropriately
- use apparatus accurately and safely.

Aim

Dilute sodium hydroxide solution is used to identify metal ions in solution. With certain dissolved metal compounds it forms metal hydroxide **precipitates**. The appearance of the precipitate is different for different metal ions.

You will determine the metal hydroxide precipitate colours for aluminium, calcium, copper, iron(II) and iron(III) ions. You will then use these tests to identify the metal ions present in different unknown solutions.

Method

Apparatus

- eye protection
- dropping pipettes
- test tubes
- test-tube rack
- dilute sodium hydroxide solution
- known solutions (containing Al^{3+} , Ca^{2+} , Cu^{2+} , Fe^{2+} or Fe^{3+} ions)
- unknown solutions

Safety

Wear eye protection.
Sodium hydroxide solution is corrosive.
Avoid skin contact.

Determining metal hydroxide precipitate colours

- Using a dropping pipette, fill a test tube to a depth of about 2 cm with one of the five known solutions.
- Using a different dropping pipette, add a few drops of sodium hydroxide solution to the tube. Hold the test tube near the top and shake the bottom gently from side to side to mix its contents.
- Observe and record the colour of the precipitate produced.
- If a white precipitate is obtained in step **C**, add more sodium hydroxide solution until the test tube is about half full. Observe and record whether the precipitate disappears to leave a colourless solution.
- Repeat steps **A–D** with the other known solutions. Do not contaminate one solution with another.

Identifying metal ions

- Carry out steps **A–D** on the five unknown solutions. Observe and record the colour of each precipitate and whether any white precipitate formed disappears when excess sodium hydroxide solution is added.

Recording your results

Make tables like these to record the metal hydroxide precipitate colours of the known and unknown solutions.

Metal ion	Precipitate colour	Effect of adding excess sodium hydroxide	Unknown	Precipitate colour
aluminium, Al^{3+}			1	
calcium, Ca^{2+}			2	
copper, Cu^{2+}			3	
iron(II), Fe^{2+}			4	
iron(III), Fe^{3+}			5	

Considering your results

- Use your results to identify the metal ions in each unknown solution.

Evaluation

- Explain why step **D** is needed to identify certain metal ions in solution.