Positive ions: colours and precipitates

Teacher / technician

YEAR 10 / LESSON 35 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Live room-temperature microscale precipitations; flame tests and ammonium warming are reference/recorded only.

Coverage and delivery

2.45–2.47: flame-test procedure and five flame colours; sodium hydroxide tests for Cu^{2+}, Fe^{2+}, Fe^{3+} and NH_4^+.

Allow about 50 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, working in 15 pairs

Item	Per pair / setup	Class total
Booklet / writing tools	1 per learner	30 sets
Tile / tray / eye protection	1 tile/tray per pair; 1 protector each	15 sets; 30 protectors
$CuSO_4$ / $FeSO_4$ / $FeCl_3$ / NaOH stocks	1 cm^3 each per pair	20 cm^3 each incl. spare
Dedicated droppers / water	5 per pair	75 droppers; water supply
White background / waste vessel	1 per pair; shared waste	15 backgrounds; 1 vessel

Immediate safety

Wear eye protection. NaOH can damage eyes; avoid contact with all solutions. Report splashes immediately and follow the laboratory eye-rinse procedure. No heating or flames. Collect all liquids and first rinses; wash hands.

Preparation and delivery

Read alongside the student method

YEAR 10 / LESSON 35 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

1. Supply 15 tiles/trays and 30 pupil eye protectors. Per pair dispense 1 cm^3 each of $CuSO_4$, fresh $FeSO_4$, $FeCl_3$ (all 0.1 mol dm^{-3}) and NaOH (0.4 mol dm^{-3}); prepare 20 cm^3 of each stock for class including spare. Use dedicated droppers, labelled by chemical and concentration.

2. Prepare iron(II) stock fresh and trial it; oxidation can obscure the green precipitate. Check current supplier SDS and school assessment for these exact solutions. Avoid skin/eye contact; collect copper-containing waste and all first rinses.

3. The live activity is only the three room-temperature precipitations plus water control. No acid-cleaning loop, naked flame, heated alkali or ammonia generation is requisitioned.

4. Show the flame-test section of the RSC recording if available, otherwise use the clearly labelled reference colours. For ammonium, use the supplied test description rather than treating NaOH itself as evidence of ammonia.

5. Allow 15 minutes live work, 15 minutes flame/ammonium evidence and 20 minutes explanations/cleanup. Do not infer universal selectivity from this small known-ion set.

Close of lesson

- Collect tile contents and first rinses in labelled metal-salt waste. Clean equipment as instructed and wash hands.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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• A precipitate is a newly formed insoluble solid; a coloured but transparent solution is not a precipitate. Students must record their own results.

• $Cu^{2+}(aq) + 2OH^{-}(aq) \rightarrow Cu(OH)_2(s)$; expected blue precipitate.

• Fe^{2+} usually gives a green precipitate, which may brown on standing; Fe^{3+} gives a brown precipitate. Old iron(II) solution can blur the distinction.

• The cleaned loop should not colour the flame before sampling. Strong yellow sodium emission can mask other colours; avoid contamination.

• Li^{+} red; Na^{+} yellow; K^{+} lilac; Ca^{2+} orange-red; Cu^{2+} blue-green. Record observed video colours separately because cameras/displays affect appearance.

• $NH_4^{+} + OH^{-} \rightarrow NH_3 + H_2O$ on warming. Damp red litmus detects alkaline ammonia above the liquid; touching NaOH directly also turns it blue and does not prove ammonia.

References and provenance

Pearson Chemistry specification

RSC identifying ions video

RSC microscale positive-ion reactions

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.