

2.8 Chemical Tests

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1. KEY VOCABULARY

TERM	MEANING
Test	A procedure giving an observable result that identifies a substance.
Precipitate	An insoluble solid formed in a test, often coloured.
Flame test	Identifying a metal ion by the colour it gives a flame.
Limewater	Calcium hydroxide solution — turns milky with CO_2 .
Damp litmus	Litmus paper used to test gases.

2. TESTS FOR GASES

GAS	TEST & RESULT
Hydrogen	Lit splint → squeaky pop
Oxygen	Glowing splint → relights
Carbon dioxide	Limewater → turns milky
Ammonia	Damp red litmus → turns blue
Chlorine	Damp litmus → bleached white

3. FLAME TESTS (metal ions)

ION	FLAME COLOUR
Lithium, Li^+	Red
Sodium, Na^+	Yellow
Potassium, K^+	Lilac
Calcium, Ca^{2+}	Orange-red
Copper, Cu^{2+}	Blue-green

4. TESTS WITH SODIUM HYDROXIDE

Add sodium hydroxide solution — a coloured precipitate identifies the metal ion:

Cu^{2+} → blue. Fe^{2+} → green. Fe^{3+} → brown.

Ca^{2+} → white. Al^{3+} → white, but dissolves in excess NaOH.

NH_4^+ → ammonia gas on warming (damp red litmus turns blue).

5. TESTS FOR NEGATIVE IONS

Carbonate (CO_3^{2-}): add dilute acid → fizzes, CO_2 turns limewater milky.

Sulfate (SO_4^{2-}): add dilute HCl then barium chloride → white precipitate.

Halides: add dilute nitric acid then silver nitrate → chloride white, bromide cream, iodide yellow.

6. THE WHY

Why we add acid before the sulfate/halide test: it removes carbonate ions that would otherwise give a false positive precipitate.

Why flame tests work: heat excites the metal ion's electrons; as they fall back they release light of a characteristic colour.

7. COMMON EXAM MISTAKES

- ✗ "Oxygen gives a squeaky pop."
- ✓ Hydrogen pops; oxygen relights a glowing splint.
- ✗ "Sodium gives a lilac flame."
- ✓ Sodium is yellow; potassium is lilac.
- ✗ Forgetting to add acid before the sulfate test.
- ✓ Add dilute acid first to rule out carbonate.

8. SELF-CHECK · cover & quiz

Can you...

1. Give the test and result for the five common gases?
2. Recall the flame colours for Li, Na, K, Ca and Cu?
3. Give the precipitate colour for Cu^{2+} , Fe^{2+} and Fe^{3+} with NaOH?
4. Describe the test for a carbonate, a sulfate and a chloride?
5. Explain why dilute acid is added before the sulfate test?
6. Explain how a flame test produces colour?