Chemical tests & qualitative analysis

Tests for gases

- **Hydrogen (H_2):** burning splint → **squeaky pop**
- **Oxygen (O_2):** glowing splint → **relights**
- **Carbon dioxide (CO_2):** bubble through **limewater ($Ca(OH)_2$)** → **turns milky/cloudy**
- **Ammonia (NH_3):** damp red litmus → **turns blue**
  forms **white smoke (NH_4Cl)** with HCl gas
- **Chlorine (Cl_2):** damp litmus paper → **bleached white**

Flame tests

Method: clean wire loop → dip in sample → place in blue flame → observe colour

Cation → flame colour:

- Li^+ → **red**
- Na^+ → **yellow**
- K^+ → **lilac**
- Ca^{2+} → **orange-red**
- Cu^{2+} → **blue-green**

Test for water

Add anhydrous copper(II) sulfate:

- white → **blue** if water present

Testing the purity of water

- **Boiling point:** pure water = **100 °C**
- **Evaporation:** pure water leaves **no residue**

Tests for ions (wet chemistry)

Cations with NaOH(aq)

- **NH_4^+:** + NaOH → NH_3 gas → damp red litmus **blue**
- **Cu^{2+}: blue precipitate**
- **Fe^{2+}: green precipitate**
- **Fe^{3+}: brown precipitate**

Anions: Halides (Cl^-, Br^-, I^-)

Method: add dilute **nitric acid**, then **silver nitrate**

- Cl^- → **white ppt (AgCl)**
- Br^- → **cream ppt (AgBr)**
- I^- → **yellow ppt (AgI)**

Sulfate (SO_4^{2-})

Method: add dilute **HCl**, then **barium chloride**

- **white precipitate ($BaSO_4$)** forms

Carbonate (CO_3^{2-})

Method: add dilute acid

- CO_2 released → bubble through limewater → **cloud**