

Identification of metal ions

Flame tests

When compounds containing certain metal ions are placed in a flame they may give a characteristic colour to the flame. These colours can be used in the identification of these metal ions.

Table 1 Flame colours

| Metal ion | Flame colour |
|------------------|--------------|
| Ca ²⁺ | brick red |
| Cu ²⁺ | green |
| K ⁺ | lilac |
| Na ⁺ | yellow |

Method: take a nichrome wire and dip it into concentrated hydrochloric acid. Place the wire into a blue Bunsen flame. If the wire is clean no colour should appear, if there is some colour repeat the dipping and heating until the wire is clean. Then touch the wire to a solid sample of the compound and put it back into the flame, note the flame colour.

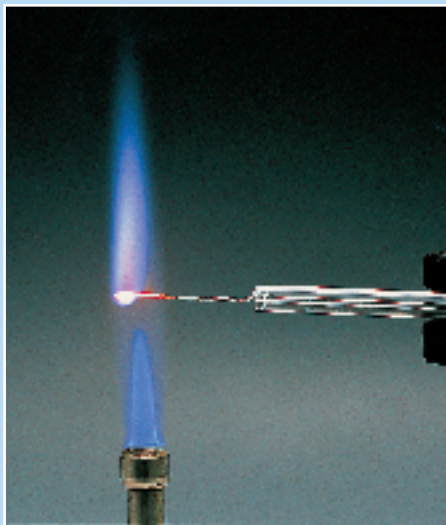
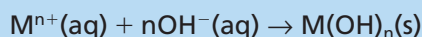


Figure 4 Potassium compounds make the Bunsen flame lilac

Using sodium hydroxide solution or ammonia solution to precipitate the metal hydroxide

Most metal hydroxides are insoluble and can be formed by precipitation.



Several of the hydroxides have a characteristic colour that can be an aid to identification of the metal ion.

Some of the precipitates disappear when excess sodium hydroxide or ammonia solution is added. This is because the metal hydroxide undergoes a further reaction forming a soluble substance.

| Metal ion | with NaOH solution | | | with NH ₃ solution | | |
|------------------|--------------------|--------|-----------|-------------------------------|--------|-----------|
| | precipitate | colour | in excess | precipitate | colour | in excess |
| K ⁺ | no | — | — | no | — | — |
| Na ⁺ | no | — | — | no | — | — |
| Ca ²⁺ | yes | white | insoluble | yes | white | insoluble |
| Mg ²⁺ | yes | white | insoluble | yes | white | insoluble |
| Al ³⁺ | yes | white | soluble | yes | white | insoluble |
| Zn ²⁺ | yes | white | soluble | yes | white | soluble |
| Fe ²⁺ | yes | green | insoluble | yes | green | insoluble |
| Fe ³⁺ | yes | brown | insoluble | yes | brown | insoluble |
| Cu ²⁺ | yes | blue | insoluble | yes | blue | soluble |

Table 2