

# 12 Identifying ions and gases – Part 2

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Vocabulary 词汇

*Write each word three times.* 把每个单词抄写三遍。

| English        | 中文   | Write it 3 times (English) |       |       |
|----------------|------|----------------------------|-------|-------|
| ion            | 离子   | _____                      | _____ | _____ |
| cation         | 阳离子  | _____                      | _____ | _____ |
| anion          | 阴离子  | _____                      | _____ | _____ |
| precipitate    | 沉淀   | _____                      | _____ | _____ |
| hydrogen       | 氢气   | _____                      | _____ | _____ |
| pop            | 爆鸣声  | _____                      | _____ | _____ |
| oxygen         | 氧气   | _____                      | _____ | _____ |
| carbon dioxide | 二氧化碳 | _____                      | _____ | _____ |
| limewater      | 石灰水  | _____                      | _____ | _____ |
| ammonia        | 氨气   | _____                      | _____ | _____ |
| litmus         | 石蕊   | _____                      | _____ | _____ |
| chlorine       | 氯气   | _____                      | _____ | _____ |
| flame test     | 焰色试验 | _____                      | _____ | _____ |
| lithium        | 锂    | _____                      | _____ | _____ |
| sodium         | 钠    | _____                      | _____ | _____ |

| English          | 中文   | Write it 3 times (English) |  |  |
|------------------|------|----------------------------|--|--|
| potassium        | 钾    |                            |  |  |
| copper(II)       | 铜    |                            |  |  |
| sodium hydroxide | 氢氧化钠 |                            |  |  |
| iron(II)         | 铁    |                            |  |  |
| calcium          | 钙    |                            |  |  |
| carbonate        | 碳酸盐  |                            |  |  |
| chloride         | 氯化物  |                            |  |  |
| silver nitrate   | 硝酸银  |                            |  |  |

## Recall

An **ion** 离子 is a charged particle:

- a **cation** 阳离子 is positive (e.g.  $\text{Na}^+$ );
- an **anion** 阴离子 is negative (e.g.  $\text{Cl}^-$ ).

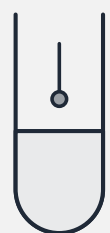
Many tests work by forming a coloured **precipitate** 沉淀 (an insoluble solid).

## New ideas

Read these first, then do the Practice.

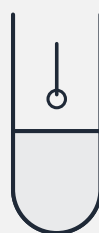
### ■ 1 Tests for gases

| Gas                        | Test                                | Result                 |
|----------------------------|-------------------------------------|------------------------|
| <b>hydrogen</b> 氢气         | a lit splint                        | squeaky <b>pop</b> 爆鸣声 |
| <b>oxygen</b> 氧气           | a glowing splint                    | it relights            |
| <b>carbon dioxide</b> 二氧化碳 | bubble through <b>limewater</b> 石灰水 | turns milky            |
| <b>ammonia</b> 氨气          | damp red <b>litmus</b> 石蕊 paper     | turns blue             |
| <b>chlorine</b> 氯气         | damp litmus paper                   | bleached white         |



hydrogen

lit splint:  
squeaky pop



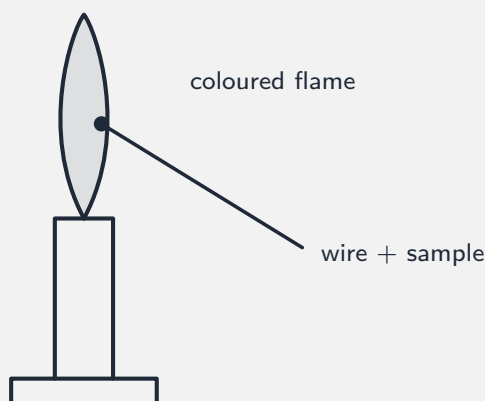
oxygen

glowing splint:  
relights

## ■ 2 Flame tests

A **flame test** 焰色试验 identifies some metal cations by the colour they give a flame:

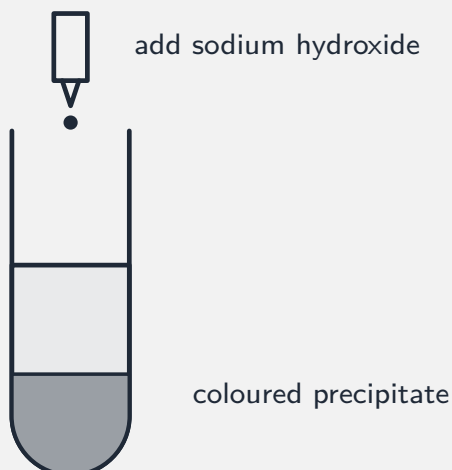
| Cation                                   | Flame colour   |
|------------------------------------------|----------------|
| <b>lithium</b> 锂 ( $\text{Li}^+$ )       | red            |
| <b>sodium</b> 钠 ( $\text{Na}^+$ )        | yellow         |
| <b>potassium</b> 钾 ( $\text{K}^+$ )      | lilac (purple) |
| <b>copper(II)</b> 铜 ( $\text{Cu}^{2+}$ ) | blue-green     |



## ■ 3 Tests for cations

Add aqueous **sodium hydroxide** 氢氧化钠 and look at the precipitate that forms:

| Cation                                 | Precipitate with sodium hydroxide |
|----------------------------------------|-----------------------------------|
| copper(II) ( $\text{Cu}^{2+}$ )        | light blue                        |
| <b>iron(II)</b> 铁 ( $\text{Fe}^{2+}$ ) | green                             |
| iron(III) ( $\text{Fe}^{3+}$ )         | red-brown                         |
| <b>calcium</b> 钙 ( $\text{Ca}^{2+}$ )  | white                             |



#### ■ 4 Two anion tests

- **carbonate** 碳酸盐: add dilute acid → it fizzes and gives carbon dioxide.
- **chloride** 氯化物: add dilute nitric acid, then **silver nitrate** 硝酸银 → a white precipitate.

**Watch out:** keep the gas tests apart —hydrogen → a **lit** splint pops; oxygen → a **glowing** splint relights; carbon dioxide → limewater turns **milky**. In a flame test, sodium is **yellow** and potassium is **lilac** —don't confuse them.

## Practice

Try these in order.

**12.6** Describe the test for hydrogen gas, and its result.

[2]

**12.7** A compound gives a yellow flame in a flame test. Which metal ion does it contain?[1]

**12.8** Sodium hydroxide solution is added to an unknown solution and a red-brown precipitate forms. Name the ion present. [1]

**12.9** Describe the test for the chloride ion ( $\text{Cl}^-$ ), and the result.

[2]

**12.10** How would you show that a gas is carbon dioxide?

[1]

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**12.11 Challenge.** An unknown solution gives a **green** precipitate with sodium hydroxide, and a **white** precipitate when dilute nitric acid then silver nitrate are added. Name the cation and the anion present.

[2]