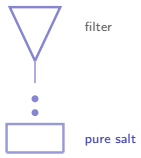
Acids, Bases & Salts

IGCSE Chemistry ▪ Topic 7

IGCSE Chemistry

What we will cover



preparing salts

1 Acids and bases

Acids and their reactions

An **acid** 酸 forms H^+ in water.

- metal → **salt** 盐 + hydrogen (effervescence)
- **base** 碱 → salt + water (**neutralisation** 中和)
- **carbonate** 碳酸盐 → salt + water + CO_2

> You cannot *see* hydrogen – write effervescence, not "hydrogen is given off".

Indicators

An **indicator** 指示剂 is a dye that changes colour.

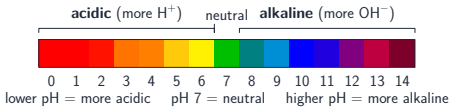
- **litmus** 石蕊 – red in acid, blue in alkali
- methyl orange – red in acid, yellow in alkali
- thymolphthalein – colourless in acid, blue in alkali

Strong vs weak acids

A **strong acid** 强酸 (HCl, H_2SO_4, HNO_3) is fully ionised. A **weak acid** 弱酸 (ethanoic) is only partly ionised, so at the same concentration it has a higher pH and reacts more slowly.

The pH scale

pH < 7 acid, $= 7$ **neutral** 中性, > 7 alkali. Each step of 1 is a tenfold change in $[H^+]$.



- with **metals** 金属: acid + metal → a **salt** 盐 + **hydrogen** 氢气
- with bases: acid + **base** 碱 → a salt + water (this is **neutralisation** 中和)
- with **carbonates** 碳酸盐: acid + carbonate → a salt + water + **carbon dioxide** 二氧化碳

2 Oxides and salts

Oxides

acidic	**basic**	**amphoteric** 两性
non-metal oxides (SO_2, CO_2)	metal oxides (CuO, CaO)	react with both (Al_2O_3, ZnO)

Metal oxides tend to be basic; non-metal oxides tend to be acidic.

Making a soluble salt

add an **excess** of an insoluble base, metal or carbonate to the acid

↓

filter to remove the leftover solid (the salt stays dissolved)

↓

evaporate some of the water to make a saturated solution

↓

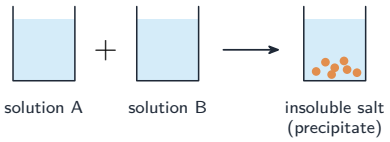
leave to **crystallise**, then dry the pure salt crystals

React acid with excess solid (metal, base or carbonate):

1. add excess, then **filter** 过滤
2. **evaporate** 蒸发 some water
3. **crystallise** 结晶

An alkali needs **titration** 滴定 instead.

Making an insoluble salt



By **precipitation** 沉淀: mix two solutions that each carry one needed ion.

> The insoluble salt appears as a solid – then filter, wash & dry it.

3 Recap

Worked example – choosing a salt preparation

How would you prepare (a) copper(II) sulfate and (b) lead(II) sulfate?

- (a) Copper(II) sulfate is soluble: add excess insoluble copper(II) oxide to warm sulfuric acid.
- Filter off the excess, then crystallise the filtrate.
- (b) Lead(II) sulfate is insoluble: mix two solutions (lead nitrate + sodium sulfate).
- Precipitation: filter, wash and dry the solid.

Ask "is the salt soluble?" first. Soluble ⇒ acid + excess solid, filter, crystallise. Insoluble ⇒ mix two solutions and filter the precipitate.

Topic 7 – key takeaways

1. **Acids** — make H^+; react with metals, bases, carbonates
2. **Strong/weak** — full vs partial dissociation (not conc.)
3. **pH** — < 7 acid, 7 neutral, > 7 alkali
4. **Salts** — soluble: filter/evaporate; insoluble: precipitate

Check yourself

1. What gas forms when an acid reacts with a metal?
2. What does "strong acid" mean?
3. What is the pH of a neutral solution?
4. How do you make an insoluble salt?

Answers **1.** hydrogen **2.** fully dissociated into ions **3.** 7 **4.** precipitation – mix two solutions