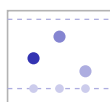


Experimental Techniques & Analysis

IGCSE Chemistry • Topic 12

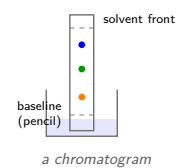
IGCSE Chemistry



Experimental Techniques & Analysis

What we will cover

- 1 Apparatus & key words
- 2 Titration
- 3 Chromatography
- 4 Separation & purification
- 5 Tests for ions
- 6 Tests for gases & flames



1 Techniques

Experimental Techniques & Analysis

Techniques

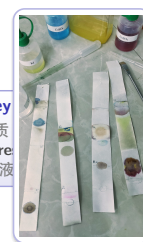
Apparatus and key words

apparatus

burette 滴定管/pipette 移液管
for exact volume; measuring cylinder for rough

key

solute 溶质
solvent 溶剂; re-
filtrate 滤液

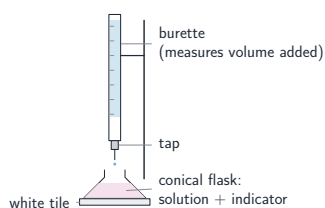


Chromatography separates mixtures of dyes

Experimental Techniques & Analysis

Techniques

Titration

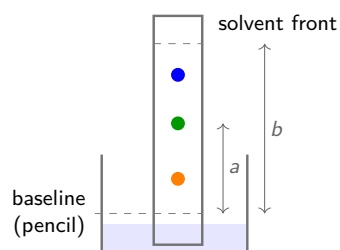


- Use a **volumetric pipette** to measure a fixed volume of one solution into a flask.
- Add a few drops of a suitable **indicator** 指示剂.
- Add the other solution from a **burette**, slowly, until the colour just changes.

Experimental Techniques & Analysis

Techniques

Chromatography



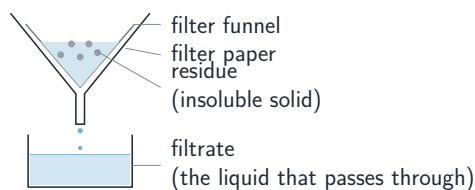
Paper chromatography 纸色谱法
separates a soluble mixture as the solvent rises.

$$R_f = \frac{\text{spot distance}}{\text{solvent distance}}$$

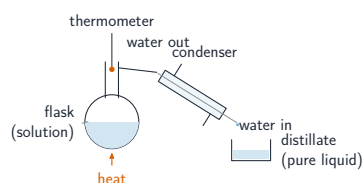
A pure substance gives **one** spot.

Separation and purification

- **filtration** 过滤 – insoluble solid from liquid
- **crystallisation** 结晶 – soluble solid from solution
- **distillation** 蒸馏 – solvent from a solution
- **fractional distillation** 分馏 – liquids by boiling point



Distillation



The solvent boils off, the **condenser** 冷凝管 cools it back, and the pure **distillate** 馏出物 is collected.

Check purity by melting/boiling point: a pure substance has sharp, fixed values.

2 Analysis

Tests for anions

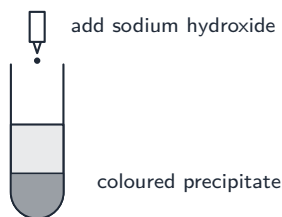
carbonate: add acid → fizzes; gas turns **limewater** 石灰水 milky

chloride/bromide/iodide: HNO_3 then **silver nitrate** 硝酸银 → white/cream/yellow

sulfate: HNO_3 then barium nitrate → white precipitate

nitrate: aluminium + NaOH, warm → ammonia gas

Tests for cations

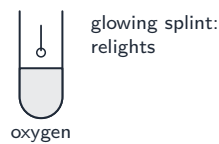
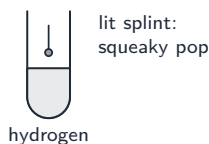


Add **sodium hydroxide** 氢氧化钠 & watch the **precipitate** 沉淀:

- copper(II): light blue iron(II): green
- iron(III): red-brown
- Al, Zn: white, dissolve in **excess**

Tests for gases

- **hydrogen** 氢气: a lighted splint **pops**
- **oxygen** 氧气: relights a glowing splint
- CO_2 : turns limewater milky
- **chlorine** 氯气: bleaches damp litmus
- ammonia: turns red litmus blue



Flame tests

Li red	Na yellow	K lilac
Ca orange-red	Ba green	Cu blue-green

A **flame test** 焰色试验 identifies a metal cation by the colour it gives the flame.

3

Recap

Worked example – a titration calculation

25.0 cm³ of NaOH needs 20.0 cm³ of 0.100 mol dm⁻³ HCl. Find the NaOH concentration.

- Moles HCl = $\frac{20.0}{1000} \times 0.100 = 2.00 \times 10^{-3}$
- NaOH + HCl → NaCl + H₂O: the ratio is 1 : 1.
- So moles NaOH = 2.00×10^{-3} .
- Concentration = $\frac{2.00 \times 10^{-3}}{25.0/1000} = 0.0800 \text{ mol dm}^{-3}$

Three steps every time:
moles of the known →
ratio from the equation
→ concentration. Divide
volumes by 1000 to get
dm³.

Topic 12 – key takeaways

1 Titration

exact volume; stop at the end-point

2 Chromatography

$R_f = \text{spot} / \text{solvent}$; pure = one spot

3 Anions

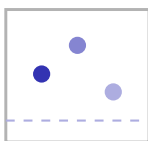
silver nitrate & barium nitrate precipitates

4 Gases

H₂ pops, O₂ relights, CO₂ milky

Check yourself

- 1 What is the end-point of a titration?
- 2 How many spots does a pure substance give?
- 3 What reagent tests for a chloride ion?
- 4 What flame colour does sodium give?



Answers 1. where the indicator just changes colour 2. one 3. silver nitrate (after nitric acid) 4. yellow