

Exercise walk-through

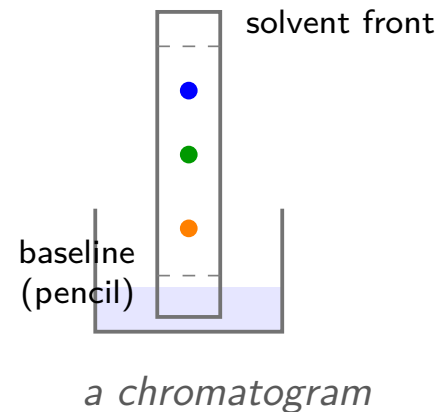
12.5

Identification of ions and gases

IGCSE Chemistry

What we will cover

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



The flame test colours, and the two purple fades

lithium

red

sodium

yellow

potassium

lilac (purple)

calcium

orange-red

copper(II)

blue-green

acidified potassium manganate(VII)its purple colour fades with both **sulfite** ions and sulfur dioxide gas – the same reagent, two different tests

Use a clean nichrome wire dipped in acid between tests. Sodium's yellow is so strong that a trace of it masks every other colour.

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

Exercises 2.1·2.2

2.1 Give the test and result for carbon dioxide gas.

[2]

2.2 State the flame colour given by a potassium ion.

[1]

Exercises 2.1·2.2

2.1 Give the test and result for carbon dioxide gas.

[2]

2.1

- bubble the gas through **limewater**
- limewater turns **milky**

2.2 State the flame colour given by a potassium ion.

[1]

2.2

- potassium ion flame: **lilac** (purple)

Exercise 3.1

3.1 A white precipitate forms when dilute nitric acid and silver nitrate are added. The ion present is: [1]

☐

A sulfate

B carbonate

C chloride

D nitrate

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A sulfate

B carbonate

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D nitrate

3.1 C

- nitric acid + silver nitrate $\rightarrow$ white ppt: **chloride**
- A is barium nitrate; B fizzes with acid; D gives no ppt

Exercise 3.2 (a)

3.2 A solution gives a light blue precipitate with sodium hydroxide that dissolves in excess aqueous ammonia to a deep blue solution.

(a) Name the cation present.

[1]

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(a) Name the cation present.

[1]

(a)

- light blue ppt that dissolves in excess ammonia: **copper(II)**, Cu^{2+}

Exercise 3.2 (b)

3.2 A solution gives a light blue precipitate with sodium hydroxide that dissolves in excess aqueous ammonia to a deep blue solution.

(b) Describe the test for a sulfate ion and its result.

[2]

Exercise 3.2 (b)

3.2 A solution gives a light blue precipitate with sodium hydroxide that dissolves in excess aqueous ammonia to a deep blue solution.

(b) Describe the test for a sulfate ion and its result.

[2]

(b)

- add dilute nitric acid then **barium nitrate**
- a **white precipitate** confirms a sulfate

Exercise 3.3

3.3 Describe the test for hydrogen gas and its positive result.

[2]

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3.3 Describe the test for hydrogen gas and its positive result.

[2]

3.3

- hold a **lighted splint** at the mouth of the tube
- a **squeaky pop** shows hydrogen

Exercise 3.4 (a)

3.4 An unknown white solid **S** dissolves in water. Three tests are carried out.

- Adding dilute nitric acid then silver nitrate gives a **cream** precipitate.
- Adding aqueous sodium hydroxide and warming gives a gas that turns damp red litmus **blue**.
- Adding dilute hydrochloric acid gives **no** effervescence.

(a) Identify the anion and the cation present in **S**, and name the compound.

[3]

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(a) Identify the anion and the cation present in **S**, and name the compound. [3]

(a)

- cream ppt with silver nitrate: **bromide**, Br^-
- gas turning damp red litmus blue: **ammonium**, NH_4^+
- **S** is **ammonium bromide**, NH_4Br

Exercise 3.4 (b)

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(b) Name the gas produced in the second test and give the equation for its formation from the ion present.

[2]

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(b)

- the gas is **ammonia**, NH_3
- $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$

Exercise 3.4 (c)

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(c) Explain what the third test rules out, and why.

[2]

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(c) Explain what the third test rules out, and why.

[2]

(c)

- it rules out **carbonate**
- a carbonate would **fizz** with dilute acid, and no gas was seen

Exercise 3.4 (d)

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(d) Describe the tests for carbon dioxide, hydrogen and oxygen, giving the positive result in each case.

[3]

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(d)

- CO_2 : limewater turns **milky**
- H_2 : lighted splint, **squeaky pop**
- O_2 : glowing splint **relights**

Exercise 3.4 (e)

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(e) Explain why the nitric acid is added before the silver nitrate.

[2]

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[2]

(e)

- the acid **removes carbonate**, which would ppt with silver nitrate
- without it a carbonate would give a **false positive** for a halide