4.8.2 and 4.8.3 - Chemical tests

AQA GCSE Chemistry Revision Notes

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How to use these notes

For each question and answer:

- Read it carefully and make sure you **understand** it
- **Memorise** the answer
- **Practice** applying your understanding to past exam questions

You can memorise the answers by using **retrieval practice** - which is when you practise retrieving information from your memory. This can be done using flashcards or a flashcard app, by asking someone to quiz you, or by covering up the answers with a piece of paper and testing yourself. Past paper practice can also be a form of retrieval practice.

4.8.2

What is the test for hydrogen gas (H_2)?

- Procedure: Hold a burning splint at the open end of a test tube of the gas
- Positive result: Burns rapidly with a pop sound

What is the test for oxygen gas (O_2)?

- Procedure: Insert a glowing splint into a test tube of the gas (a glowing splint is a splint that has been lit and then blown out but is still glowing)
- Positive result: The splint relights

What is the test for carbon dioxide gas (CO_2)?

- Procedure: Shake the gas with limewater or bubble the gas through limewater
- Positive result: The limewater turns milky (cloudy)

What is limewater?
A solution of calcium hydroxide

What is the test for chlorine gas (Cl_2)?

- Procedure: Place damp litmus paper in the gas
- Positive result: The litmus paper is bleached and turns white

4.8.3

FLAME TESTS

What is a flame test?
A test in which a sample is held in a flame and any colour change of the flame is observed. It is used to test for the presence of certain metal ions in the sample.

What colour does a flame turn in the presence of lithium compounds?
Crimson

What colour does a flame turn in the presence of sodium compounds?
Yellow

What colour does a flame turn in the presence of potassium compounds?
Lilac

What colour does a flame turn in the presence of calcium compounds?
Orange-red

What colour does a flame turn in the presence of copper compounds?
Green

Why is it sometimes difficult to identify all the metal ions in a sample when doing a flame test?
If a sample contains a mixture of ions, then some of the flame colours may be masked by other colours.

CHEMICAL TESTS FOR METAL IONS

What substance can be used to identify many metal ions?
Sodium hydroxide solution

What is a precipitate?
An insoluble solid formed in a reaction between two solutions

How do you test for aluminium, calcium and magnesium ions (without using a flame test)?

- Add sodium hydroxide solution
- If aluminium, calcium or magnesium ions are present, a white precipitate will form. The precipitate is aluminium hydroxide, calcium hydroxide or magnesium hydroxide.
- Add more sodium hydroxide solution so that it is in excess and observe whether or not the precipitate dissolves.
- If the precipitate dissolves in excess sodium hydroxide solution, then the precipitate is aluminium hydroxide, meaning that aluminium ions are present.
- If the precipitate does not dissolve in excess sodium hydroxide solution, then the precipitate is either calcium hydroxide or magnesium hydroxide, meaning that calcium or magnesium ions are present.

How do you test for copper (II) ions?

- Procedure: Add sodium hydroxide solution
- Positive result: A blue precipitate forms

How do you test for iron (II) ions?

- Procedure: Add sodium hydroxide solution
- Positive result: A green precipitate forms

How do you test for iron (III) ions?

- Procedure: Add sodium hydroxide solution
- Positive result: A brown precipitate forms

What are the balanced symbol equations for the following reactions?

- **Aluminium ions with sodium hydroxide**
- **Calcium ions with sodium hydroxide**
- **Magnesium ions with sodium hydroxide**
- **Copper (II) ions with sodium hydroxide**
- **Iron (II) ions with sodium hydroxide**
- **Iron (III) ions with sodium hydroxide**

- $Al^{3+} + 3OH^- \text{----> } Al(OH)_3$
- $Ca^{2+} + 2OH^- \text{----> } Ca(OH)_2$
- $Mg^{2+} + 2OH^- \text{----> } Mg(OH)_2$
- $Cu^{2+} + 2OH^- \text{----> } Cu(OH)_2$
- $Fe^{2+} + 2OH^- \text{----> } Fe(OH)_2$
- $Fe^{3+} + 3OH^- \text{----> } Fe(OH)_2$

TESTS FOR ANIONS

How do you test for carbonate ions?

- Procedure: Add dilute acid, then if a gas is given off, bubble that gas through limewater.
- Positive result: If the limewater turns milky (cloudy) this shows that the gas given off was carbon dioxide, which shows that the original substance contained carbonate ions.

What are halide ions?
Halide ions are the negative ions of halogens (group 7 elements). Halide ions include chloride ions (Cl^-), bromide ions (Br^-) and iodide ions (I^-).

How do you test for halide ions?

- Add silver nitrate solution and dilute nitric acid.
- If a white precipitate forms, chloride ions are present. The precipitate is silver chloride.
- If a cream precipitate forms, bromide ions are present. The precipitate is silver bromide.
- If a yellow precipitate forms, iodide ions are present. The precipitate is silver iodide.

How do you test for sulfate ions?

- Procedure: Add barium chloride solution and dilute hydrochloric acid
- Positive result: A white precipitate forms

INSTRUMENTAL METHODS

What are instrumental methods?
Instrumental methods are methods in which sophisticated machines are used to identify chemical substances.

What are the advantages of using instrumental methods compared to simple chemical tests?
Instrumental methods are:

- More accurate
- More sensitive
- Faster

What is an example of an instrumental method?
Flame emission spectroscopy

What is flame emission spectroscopy used for?
To identify metal ions in solutions and measure their concentrations

How does flame emission spectroscopy work?

- The sample is put into a flame
- The light given out is passed through a spectroscope
- This produces a line spectrum
- The line spectrum can be analysed to identify the metal ions in the solution and measure their concentrations