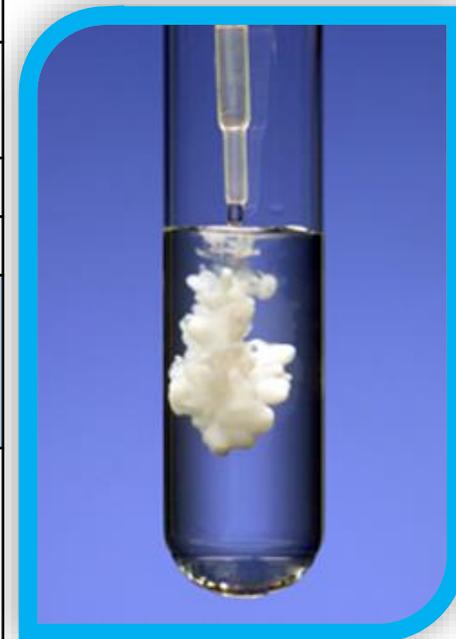


Edexcel GCSE 9-1 Science

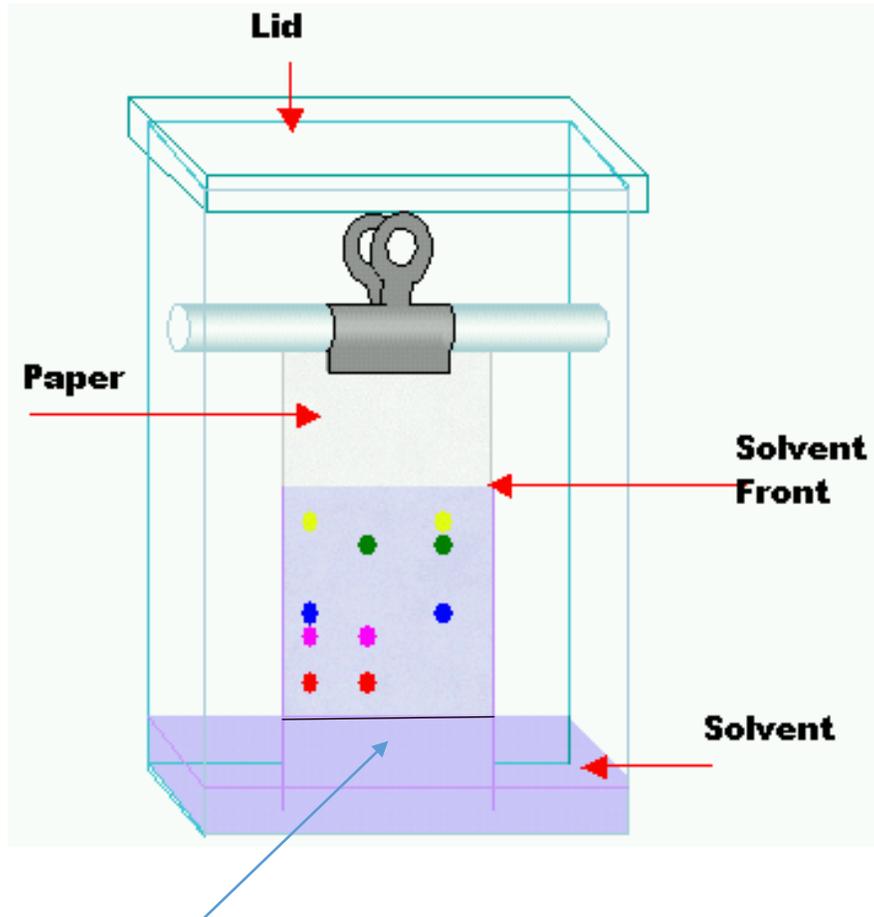
Chemistry Practicals



Chromatography	Separating the different coloured dyes in an ink.
Neutralisation	Investigate what happens to pH of hydrochloric acid when calcium hydroxide (a base) is added.
Preparing a salt	Make copper sulphate crystals using copper oxide and sulfuric acid.
Electrolysis	Electrolyse a solution of copper sulphate to produce copper.
Titration (Separate Only)	To find the volume of hydrochloric acid needed to neutralise 25.0 cm ³ of 0.10 mol dm ⁻³ sodium hydroxide solution.
Rates of reaction	Investigate the effect of surface area on rate of reaction using different sized marble chips.
Ion Tests (Separate Only)	Determine the metal hydroxide precipitate colours for different metals. Use chemical tests to identify halide ions (Cl ⁻ Br ⁻ or I ⁻ or carbonate ions CO ₃ ²⁻ in known solutions
Combustion of Alcohol (Separate Only)	Investigate temperature rise of water by combustion of different alcohols.

Chromatography

“SEPARATE” different coloured liquids



Rf value is “how soluble” a dye is. It can’t be more than 1 because they dye can’t travel further than the solvent front. The further the dye travels the higher the Rf value.

As the solvent soaks up the paper, it carries the mixtures with it. Different components of the mixture will move at different rates. This separates the mixture out.

Rf values

Different chromatograms and the separated components of the mixtures can be identified by calculating the Rf value using the equation:

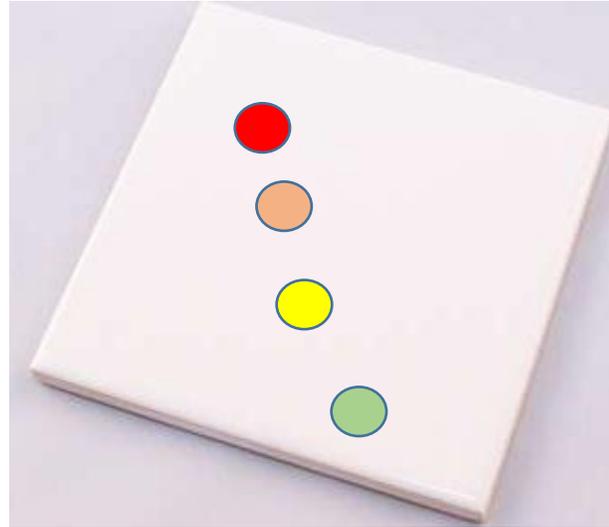
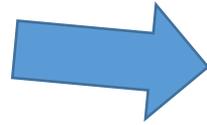
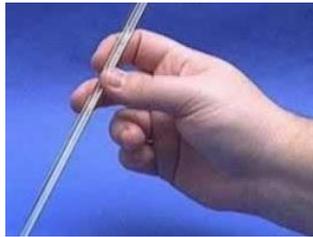
$Rf = \text{distance moved by the compound} \div \text{distance moved by the solvent}$

The Rf value of a particular compound is always the same - if the chromatography has been carried out in the same way. This allows industry to use chromatography to identify compounds in mixtures.

Draw a line in pencil because pencil won’t dissolve!. The line should NOT go into the solvent.

Neutralisation

You will investigate what happens to the pH of a fixed volume of dilute hydrochloric acid when you add calcium hydroxide to it.



Put drops of UI solution on the white tile. You use a glass rod to add drops of the reaction on the tile and find its pH



Add 0.3g of CaOH to the beaker



Mass of Calcium Carbonate (g)	pH of solution
0.3	
0.6	
0.9	
1.2	
1.5	
1.8	
2.1	
2.4	

Preparing a salt



Add copper oxide until no more dissolves!
Why?



Filter to trap the undissolved CuO RESIDUE.

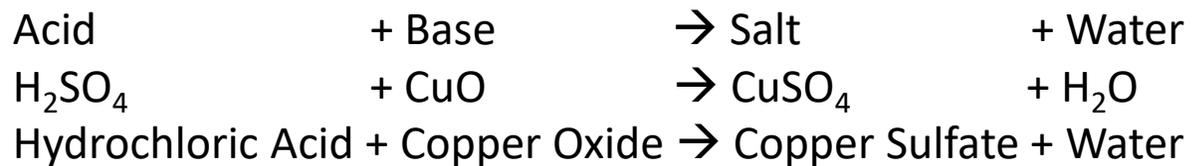


Evaporate. Wear GOGGLES, it spits!

Apparatus

- eye protection
- 100 cm³ conical flask
- 100 cm³ beaker
- Bunsen burner
- gauze and tripod
- heat mat
- Petri dish or watch glass
- 100 cm³ measuring cylinder
- evaporating basin
- spatula
- stirring rod
- filter funnel
- filter paper
- tongs
- water bath (set at 50 °C)
- dilute sulfuric acid
- copper(II) oxide

We made crystals!



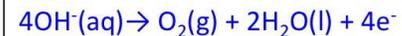
Electrolysis

“lysis” means “splitting”

Remember: This technique is done on a MASSIVE scale to get aluminium from it's ore.

Electrolysis of copper sulfate solution

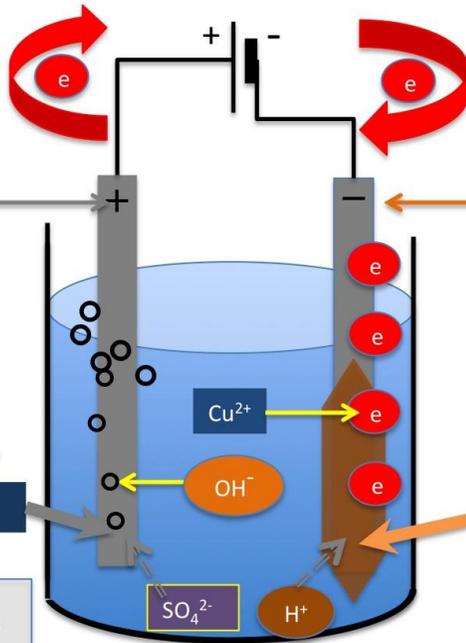
Anode (+) made of carbon



oxidation at anode, loss of e^- and formation of $\text{O}_2(\text{g})$ from $\text{OH}^-(\text{aq})$

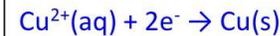
bubbles of O_2 are released at anode

SO_4^{2-} sulfate ions, (aq) $\text{O}_2(\text{g})$ bubbles
 Cu^{2+} $\text{Cu}^{2+}(\text{aq})$ ions H^+ H^+ ions (aq)
 e^- electrons OH^- hydroxide ions $\text{OH}^-(\text{aq})$



Flow of electrons (in opposite direction to electrical current)

Cathode (-) made of carbon



reduction at cathode: gain of e^- and formation of $\text{Cu}(\text{s})$ from Cu^{2+}

pure copper is deposited at cathode

copper plating of cathode

Anions (attracted to Anode)	Cations (attracted to Cathode)
OH^- SO_4^{2-}	H^+ Cu^{2+}

Huge tanks of MOLTEN (liquid) aluminium ore are used. It takes a large amount of electricity so is not great for the environment.

The liquid is called the “electrolyte”

Titration (separate only)

Why use a white tile below the flask?

What colour does methyl orange turn to indicate an acid?

Why fill the burette jet just below the tap to begin?

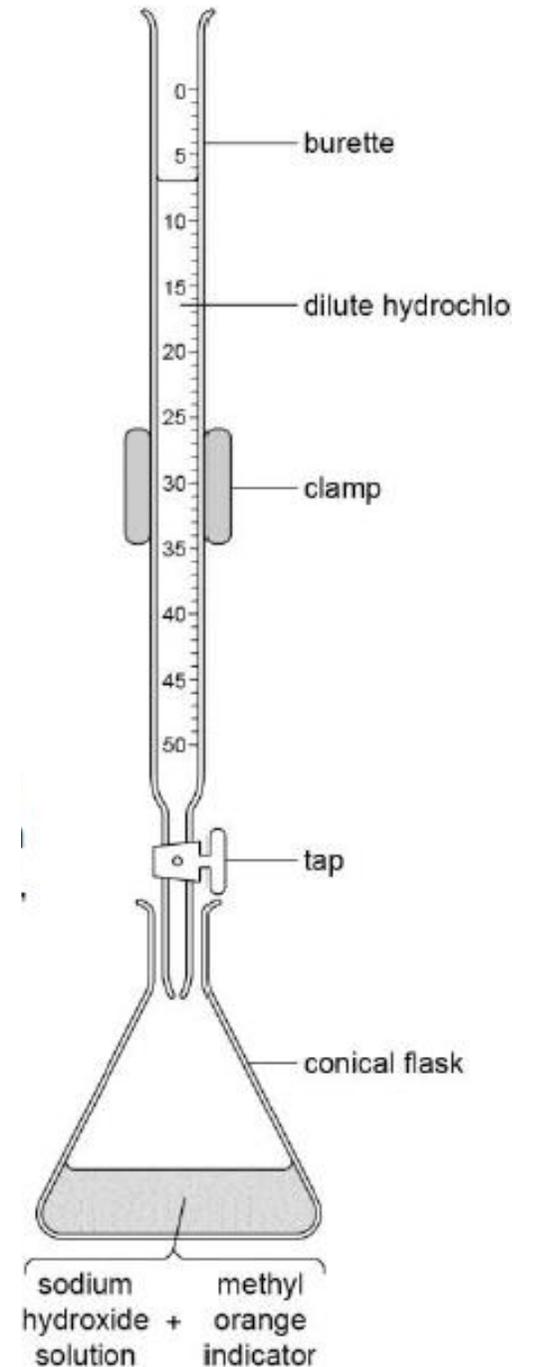
REMEMBER: A titration starts with a trial run. Why?

Step **G**: Stop adding the hydrochloric acid when the indicator turns a peach/orange colour. Record the burette reading. This is the rough titration to give you an approximate volume of hydrochloric acid needed. If the indicator turns pink, you have added too much hydrochloric acid.

Next time round you know where to start releasing acid REALLY slowly.

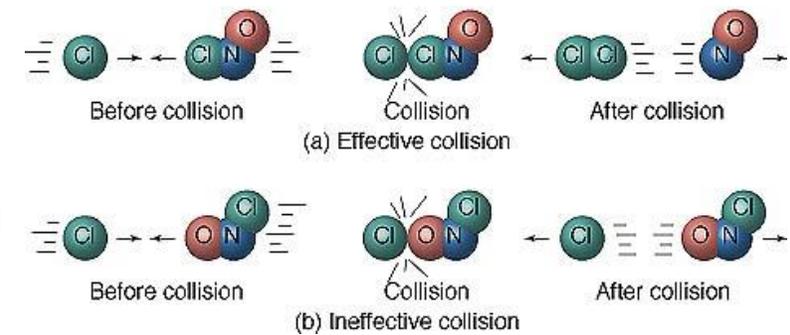
Aim

To find the volume of hydrochloric acid needed to **neutralise** 25.0 cm³ of 0.10 mol dm⁻³ sodium hydroxide solution.



Rates of Reaction

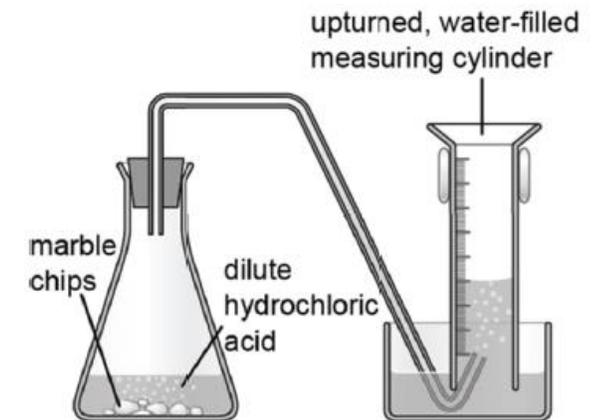
Remember: A reaction is a successful collision between 2 substances. We can make substances collide more or less by changing conditions.



1. **Surface Area: Smaller pieces means more particles exposed to a collision**
2. **Pressure: Particles forced together more collisions**
3. **Concentration: more particles so more collision**
4. **Temperature: particles move faster so more collisions**
5. **Catalyst: helps collisions to happen**

We investigated surface area. We changed the size of marble chip and measured the volume of gas produced per minute.

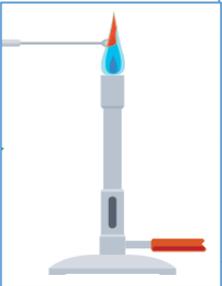
REMEMBER: RATE of a reaction is amount of product produced per minute.



Ion Tests (Separate)

Tests to identify ions in some unknown salts. There are specific tests for cations and anions.

1. Flame tests for metal cations
2. Hydroxide precipitate for metal cations
3. Test for ammonium ions
4. Test for carbonate ions
5. Test for sulfate ions
6. Test for halide ions



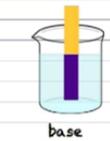
Li ⁺	•	•	orange-red
Na ⁺	•	•	red
K ⁺	•	•	blue-green
Ca ²⁺	•	•	yellow
Cu ²⁺	•	•	lilac

Ion Tests (separate only) Testing for sulfate ions

Sulfate ions in solution, SO_4^{2-} , are detected using barium chloride solution. The test solution is acidified using a few drops of dilute hydrochloric acid, and then a few drops of barium chloride solution are added. A white precipitate of barium sulfate forms if sulfate ions are present.



Ammonium ions



Tests for metal ions - white precipitates

Many metal ions produce white precipitates with sodium hydroxide. These are the two tests you would carry out to identify a metal ion:

1. add dilute sodium hydroxide to a solution of the metal ion
2. add dilute ammonia solution

The second test is necessary because the result of the first test can be the same for some metals. For instance, zinc and aluminium ions have the same reaction with sodium hydroxide as shown in these tables:

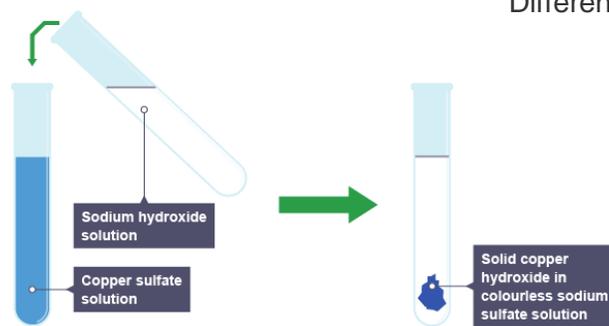
Observation with dilute NaOH

Ion	A few drops	Excess
Zn ²⁺	White precipitate forms	Precipitate redissolves
Ca ²⁺	White precipitate forms	No change
Al ³⁺	White precipitate forms	Precipitate redissolves

Observation with dilute ammonia

Ion	A few drops	Excess
Zn ²⁺	White precipitate forms	Precipitate redissolves
Ca ²⁺	No precipitate formed	No precipitate formed
Al ³⁺	White precipitate forms	No change

Different transition metals form different coloured precipitates :



Solutions containing copper(II) ions form a blue precipitate with sodium hydroxide

Metal ion

Iron(II), Fe²⁺

Iron(III), Fe³⁺

Copper(II), Cu²⁺

Colour

Green - turns orange-brown when left standing

Orange-brown

Blue

Hydroxide precipitates

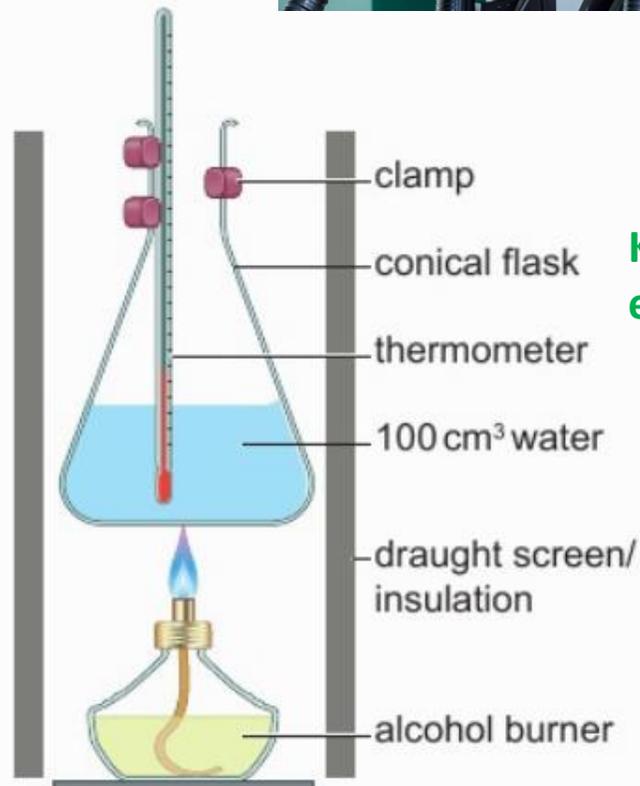
Transition metals form coloured compounds with other elements. Many of these are soluble in water, forming coloured solutions. If sodium hydroxide solution is then added, a transition metal hydroxide is formed. Transition metal hydroxides are insoluble so they form solid precipitates. These precipitates often appear as small particles suspended in a solution

Combustion of Alcohol

- We looked at the temperature increase of a known mass of water, caused by different alcohol fuels.



Remember alcohols are used every day as fuels.



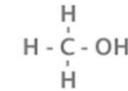
Know your sources of error in this practical.

Calculate the mass of alcohol burned to produce a 1 degree rise in temperature. Need to know mass of burner and fuel **before** and **after** to know how much fuel was used.

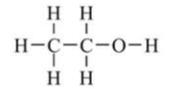
Mass of fuel used / degrees water increased by = Mass of fuel per degree.

Drawings of alcohols

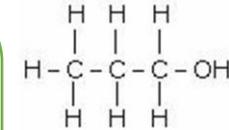
1. Methanol, CH_3OH



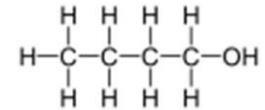
2. Ethanol, $\text{C}_2\text{H}_5\text{OH}$



3. Propanol, $\text{C}_3\text{H}_7\text{OH}$



4. Butanol, $\text{C}_4\text{H}_9\text{OH}$



The more bonds there are, the more energy there is to be released.