PRACTICALS REVISION (C7)

PRACTICAL KEYWORDS

- Accurate – close to the true value (repeat measurements and calculate the mean, repeat using different equipment)
- Fair test – all control variables are kept the same
- Outlier – a result that is different from the rest. These should be ignored when calculating mean values
- Precise – similar results (spread of data is small)
- Resolution – smallest change in a quantity that gives a change in reading
- Repeatable – similar results obtained by the same person and the same equipment
- Reproducible – similar results are obtained by different people and different equipment
- Uncertainty – the doubt in a reading caused by the equipment used

SOURCES OF ERROR

- Random errors – caused by changing conditions or equipment. To reduce these repeat the experiment and calculate a mean

- Systematic errors – could be caused by a faulty piece of equipment or a problem with your method e.g. heat loss in a calorimetry method

RECORDING RESULTS CORRECTLY

In a table:

- Independent variable (what you change) in the left hand column
- Dependent variable (what you measure) in the right hand column
- Units need to be in the column headings

PLOTTING A GRAPH CORRECTLY

- Independent variable (what you change) on the x axis
- Dependent variable (what you measure) on the y axis
- Axes need to be labelled and include units
- Choose a scale which is linear and takes up over half the space available

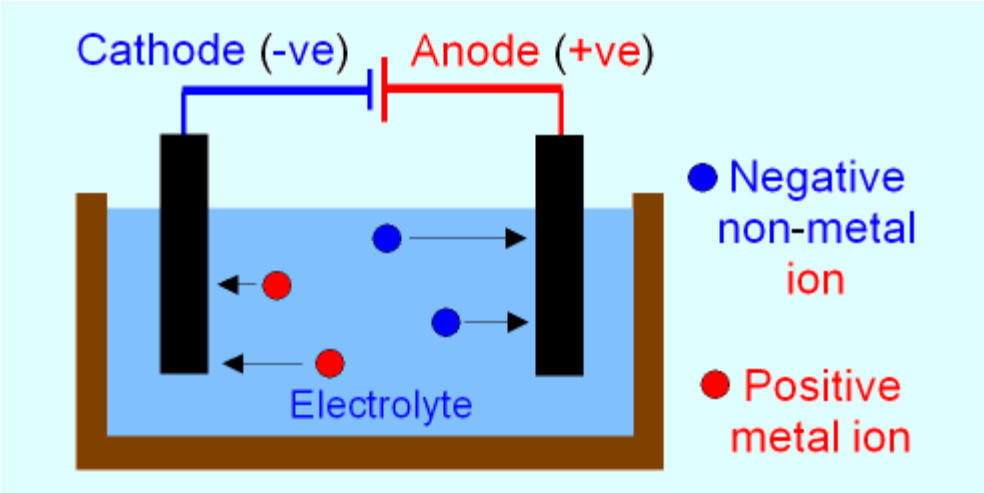
- Continuous variables (can be any value) should be plotted using a line graph
- Discrete (has whole number values e.g. shoe size) and categoric (described by labels e.g. colour) variables should be plotted using a bar graph

PRACTICAL SKILLS – REQUIRED PRACTICALS (UNITS C1,2 AND 3)

- **C2 Electrolysis** – practical set-up of a electrolysis cell
- **C3 Separation techniques** – paper chromatography and measuring R_f values
- **C4 Distillation** – simple distillation e.g. purifying water
- **C7 Production of salts** – making a soluble salt, making an insoluble salt

PRACTICAL SKILLS – REQUIRED PRACTICALS

- **C2 Electrolysis** – practical set-up of a electrolysis cell

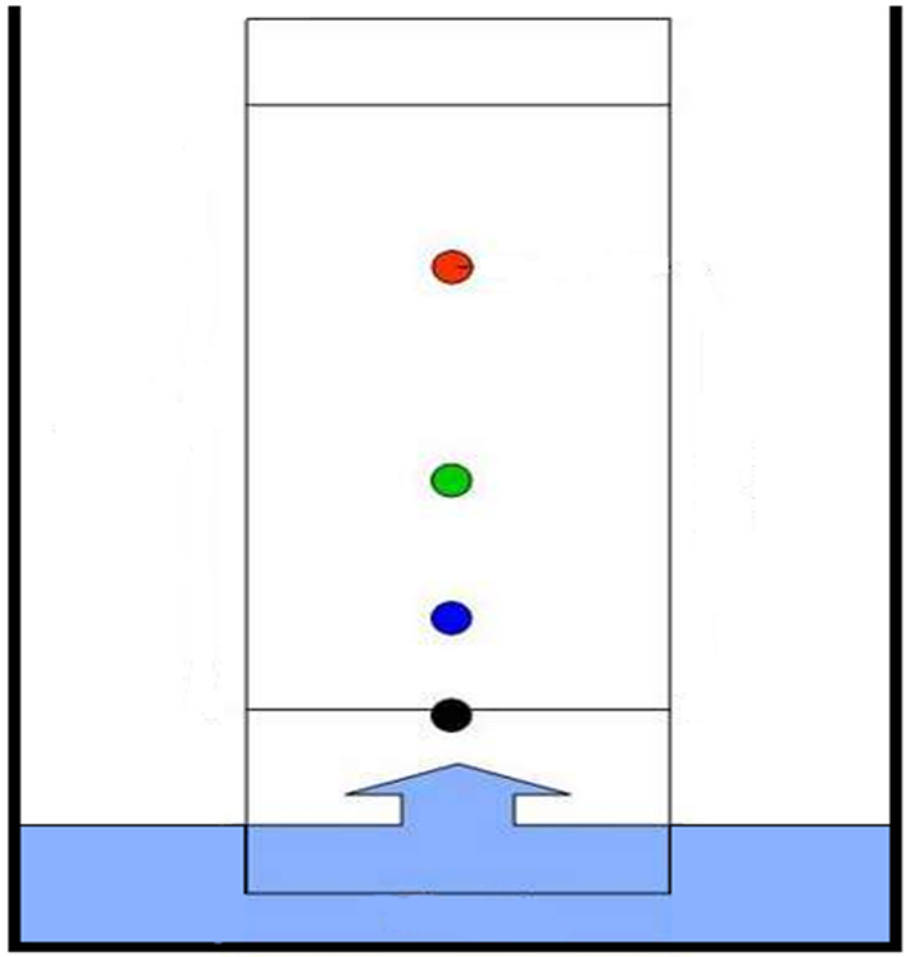


- PANIC (positive anode negative is cathode)
- Positive ions (metal or hydrogen) go to the cathode where they gain electrons (reduction)
- Negative ions (non-metals) go to the anode where they lose electrons (oxidation)
- OILRIG (oxidation is loss, reduction is gain (of electrons))

PRACTICAL SKILLS – REQUIRED PRACTICALS

- **C3 Separation techniques** – paper chromatography and measuring R_f values

CHROMATOGRAPHY

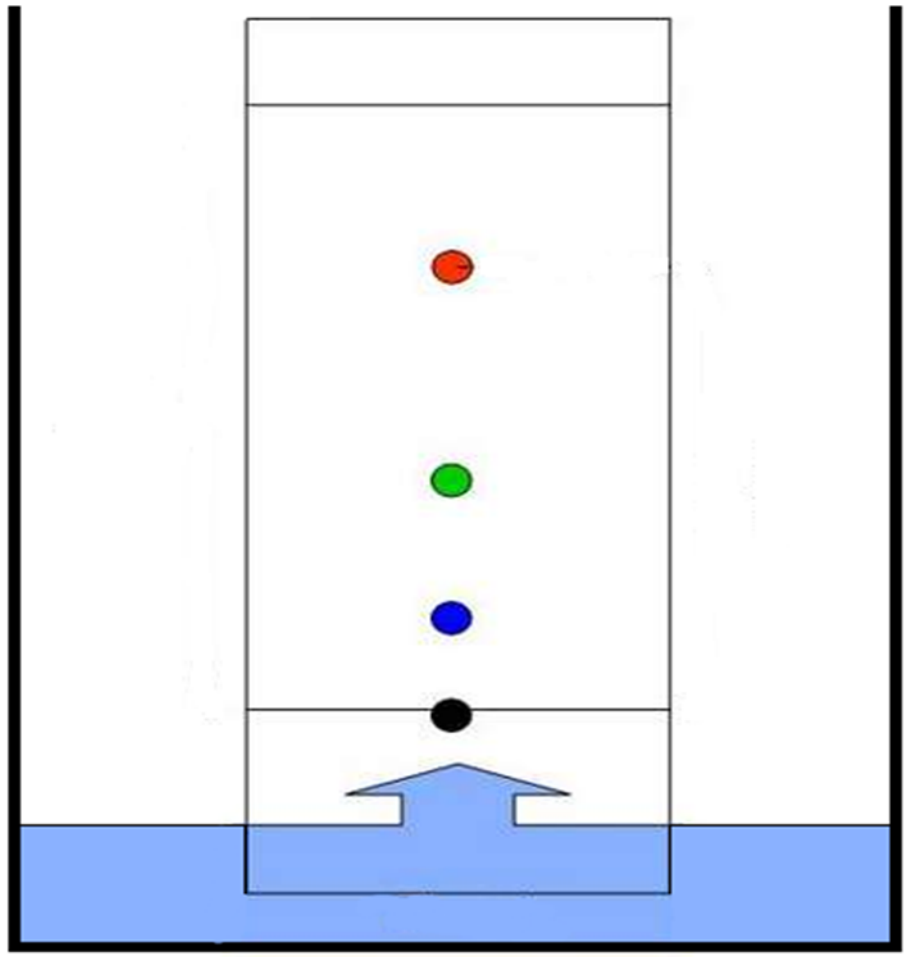


Chromatography lets us **separate** inks and dyes or other substances dissolved in water

As the **solvent** (water) rises through the paper it **dissolves** the sample mixture, which will then **travel** up the paper.

Some particles travel **further** than other particles, due to the differences in **solubility** and their **attractions** with the paper. The number of spots indicates the number of chemicals in the sample (do not include the one on the baseline)

CHROMATOGRAPHY



Possible problems:

Baseline drawn in ink – ink will dissolve in the solvent

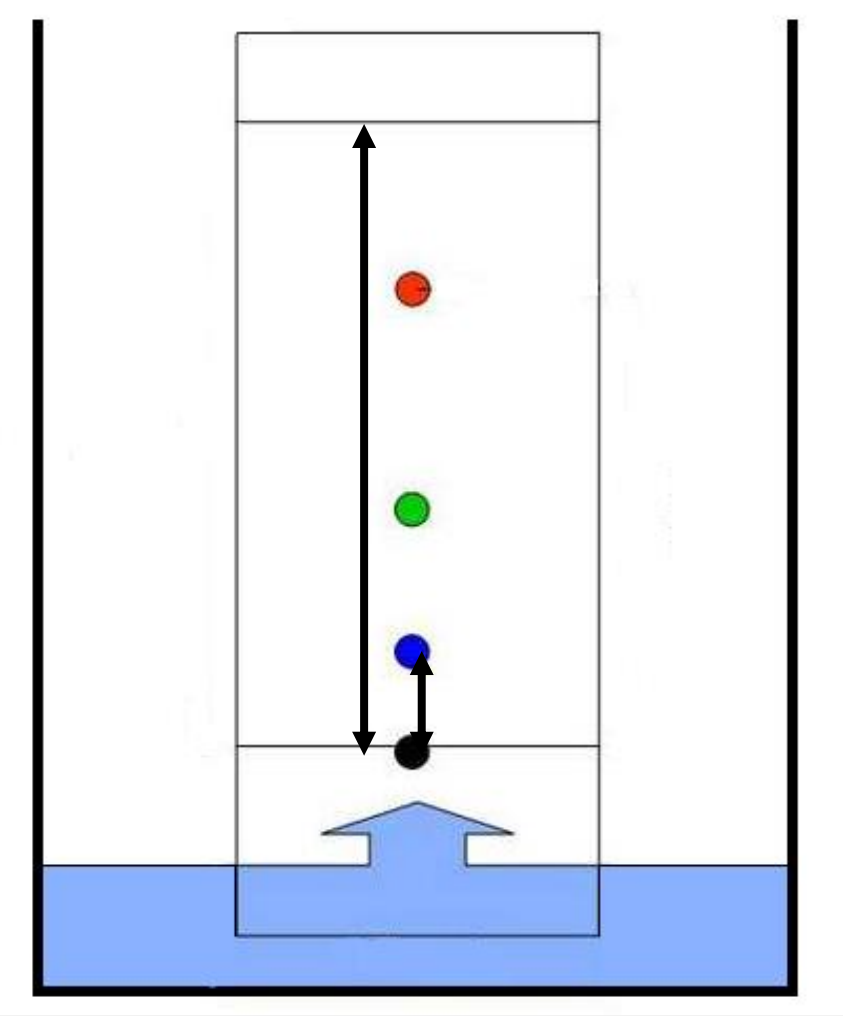
Solvent level above the baseline – sample will dissolve in the solvent and not separate

Sample not soluble in the chosen solvent – spot will stay on the baseline

Left too long and solvent reaches the top of the paper – spots may squash together again

Colourless components – will not be seen

CALCULATING R_F VALUES



Rf = distance from the base line to the spot / distance from the base line to the solvent front

For the blue dot:

Step 1:

Measure the distance from the base line to the dot.

Step 2:

Measure the distance from the base line to the top line.

Step 3:

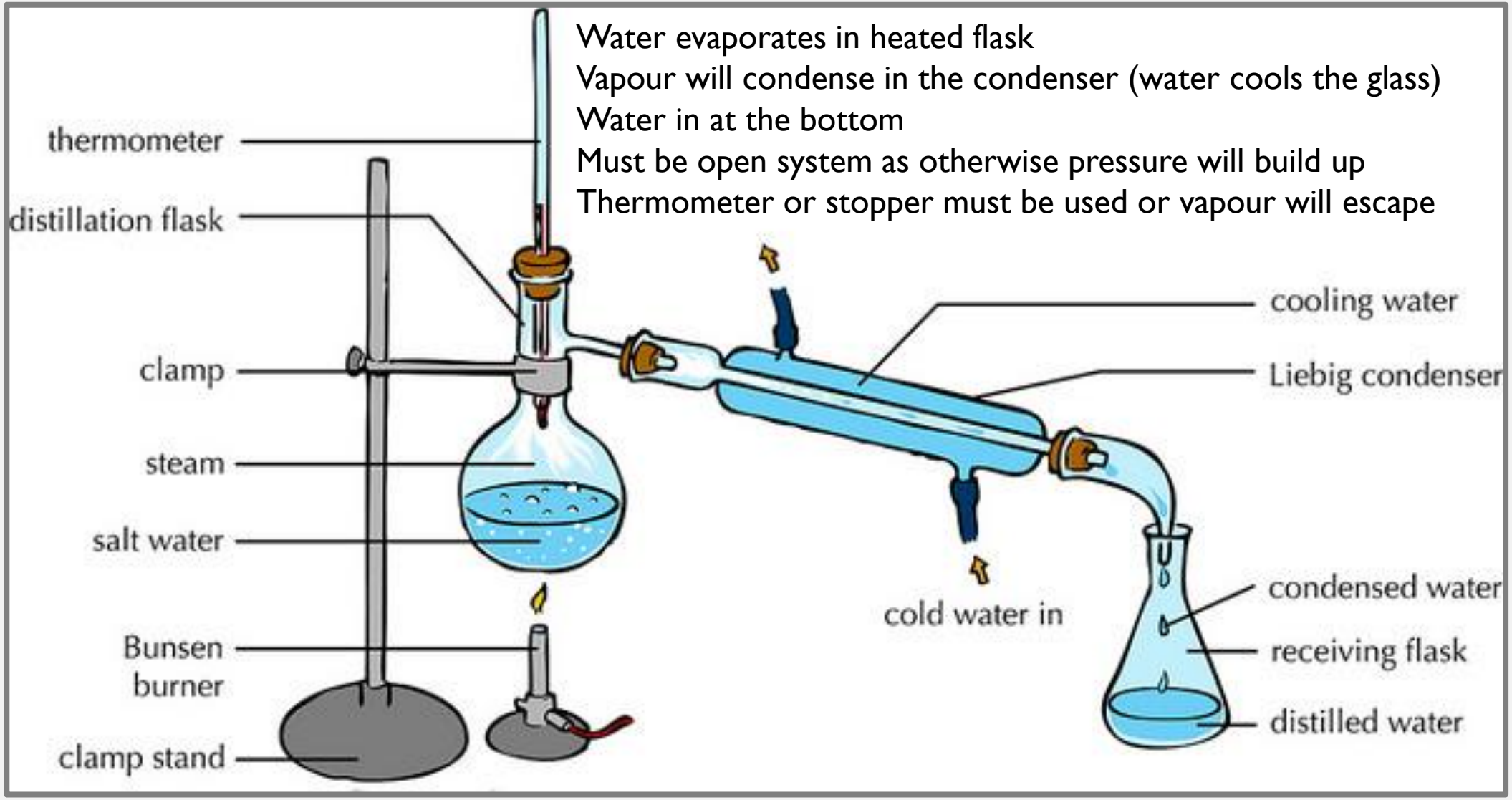
Use the equation above and calculate the R_f value

PRACTICAL SKILLS – REQUIRED PRACTICALS

- **C4 Distillation** – simple distillation e.g. purifying water

DISTILLATION

Water evaporates in heated flask
Vapour will condense in the condenser (water cools the glass)
Water in at the bottom
Must be open system as otherwise pressure will build up
Thermometer or stopper must be used or vapour will escape



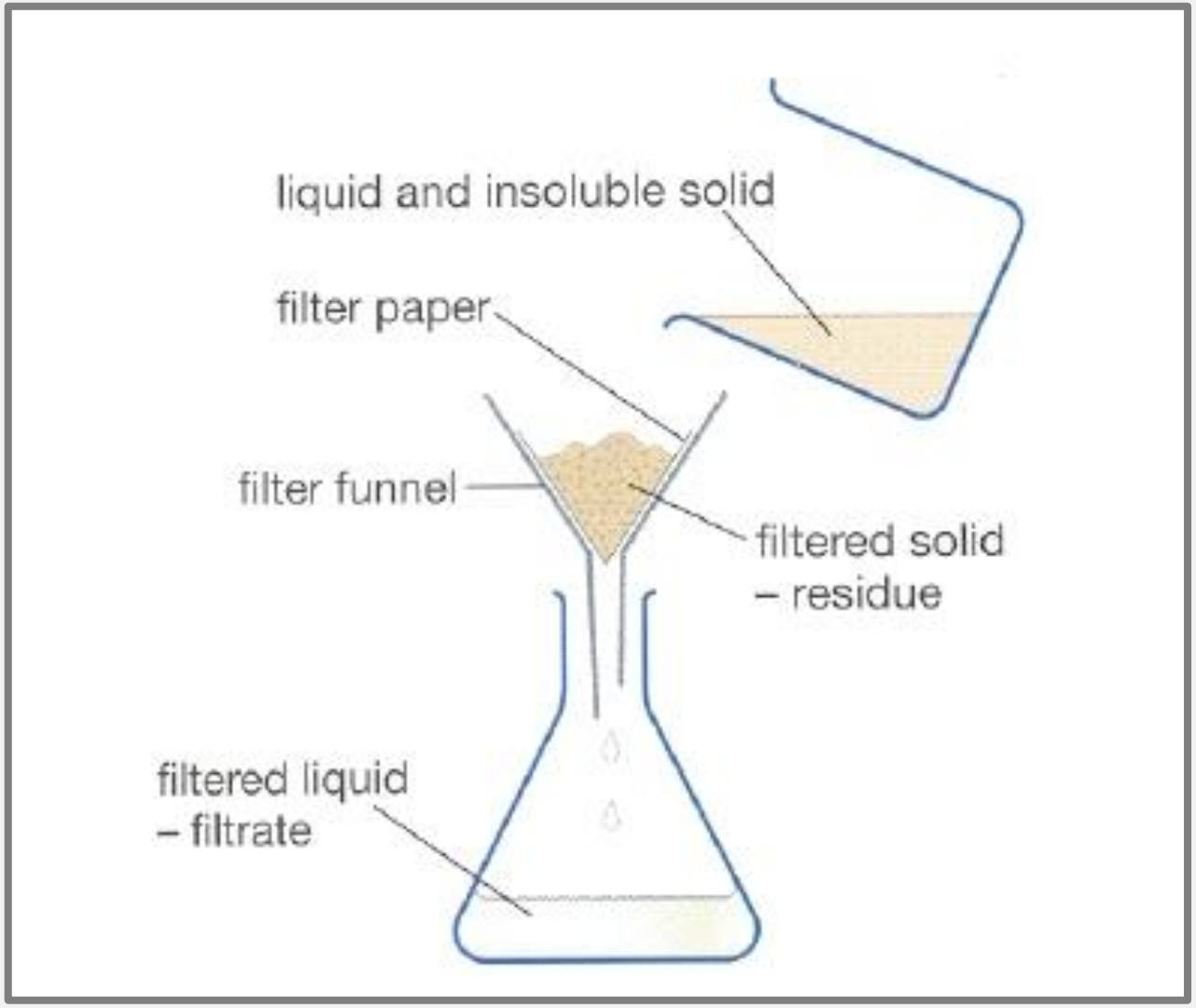
PRACTICAL SKILLS – REQUIRED PRACTICALS

- **C7 Production of salts** – making a soluble salt, making an insoluble salt

Soluble salts

- Mix the reactants, filter out any insoluble solids
- Collect the filtrate (solution)
- Evaporate the solvent to give a saturated solution
- Leave the solution to crystallise
- Filter and collect the crystals
- Wash the crystals with cold solvent
- Dry the crystals overnight

FILTRATION


liquid and insoluble solid
filter paper
filter funnel
filtered solid
– residue
filtered liquid
– filtrate

PRACTICAL SKILLS – REQUIRED PRACTICALS

- **C7 Production of salts** – making a soluble salt, making an insoluble salt

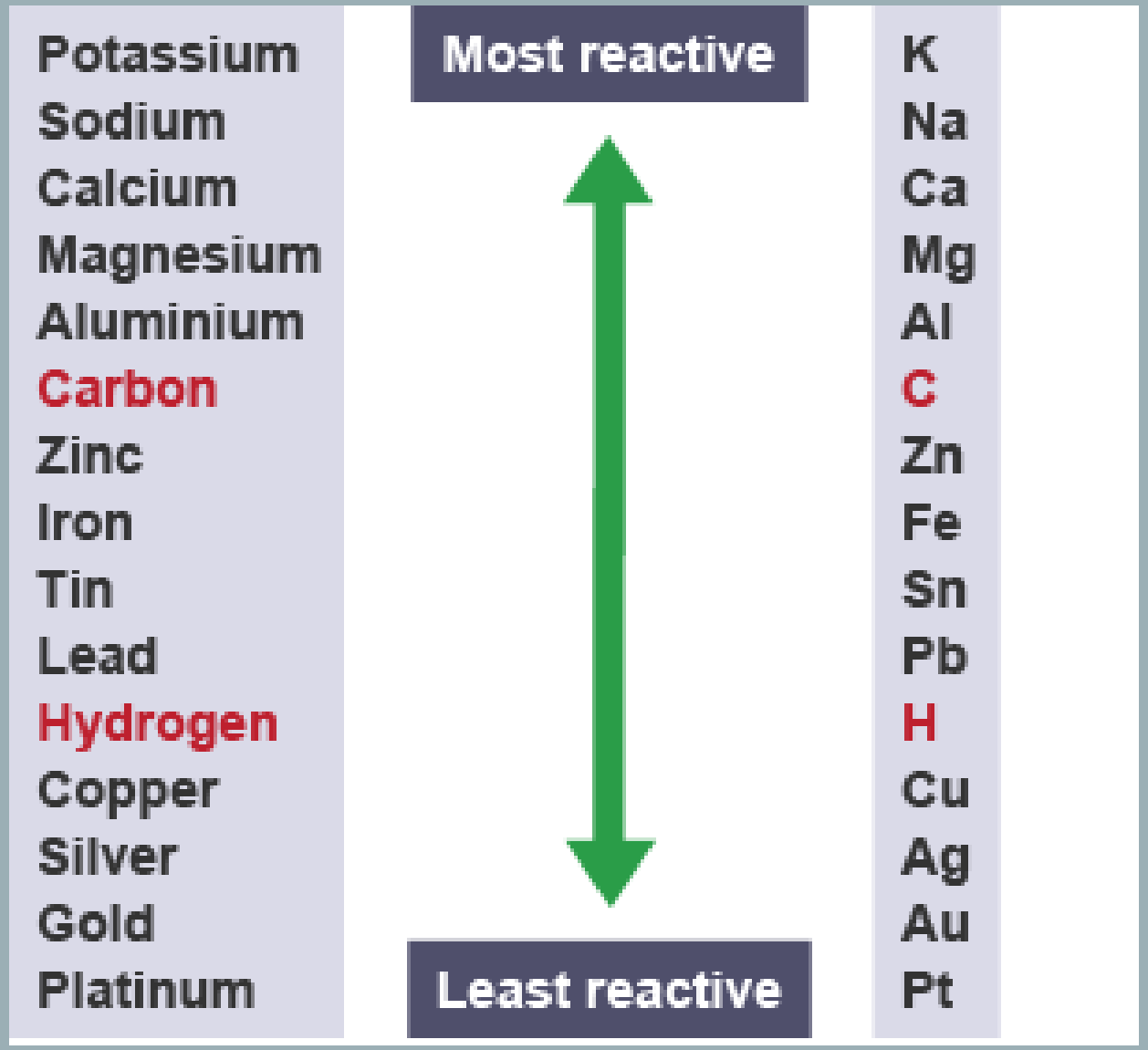
Insoluble salts

- Mix the reactants
- Filter and collect the solid (residue)
- Wash the solid with cold solvent
- Dry the solid overnight

PRACTICAL SKILLS – REQUIRED PRACTICALS (C4,5,6)

- **C1 Reactivity Trends** – determining the reactivity of a metal by reaction with water, with acid and displacement reactions
- **C5 Identification of species** – tests for gases, anions and cations
- **C6 Titration** – determination of the concentration of an unknown concentration of an acid or alkali
- **C8 Measuring Rates of Reactions** – making a soluble salt, making an insoluble salt

C1 – Reactivity TrendsMetals and Water / Metals and Acid



Metal + water --> metal hydroxide + hydrogen

Metal + acid --> metal salt + hydrogen

Observations:
Gas given off (hydrogen)
Increase in temperature (exothermic)

A more reactive metal will be more vigorous (more bubbles per second given off and higher temperature reached)

Reactive metals such as potassium are unsafe with acids as the reaction would be uncontrolled

Method

1. Using a dropping pipette, put a few drops of copper(II) sulfate solution into four of the wells in the spotting tile.
2. Place a strip of magnesium into the first well of liquid, zinc into the second, iron into the third and copper into the fourth. Leave for about a minute.
3. Note down any changes in the table below. If there is no change, write 'No change'.
4. Repeat these steps replacing the copper sulfate solution with each of the other three solutions in turn. Use a fresh dropper for each solution.

Results

	Magnesium sulfate $MgSO_4(aq)$	**Zinc sulfate $ZnSO_4(aq)$**	**Iron(II) sulfate $FeSO_4(aq)$**	**Copper(II) sulfate $CuSO_4(aq)$**
magnesium				
zinc				
iron				
copper				

C5 – IDENTIFICATION OF SPECIES

Gases

- Oxygen – relights a glowing splint
- Hydrogen – gives a squeaky pop with a lit splint
- Chlorine – turns damp blue litmus paper red then white
- Carbon dioxide – turns limewater from clear to cloudy

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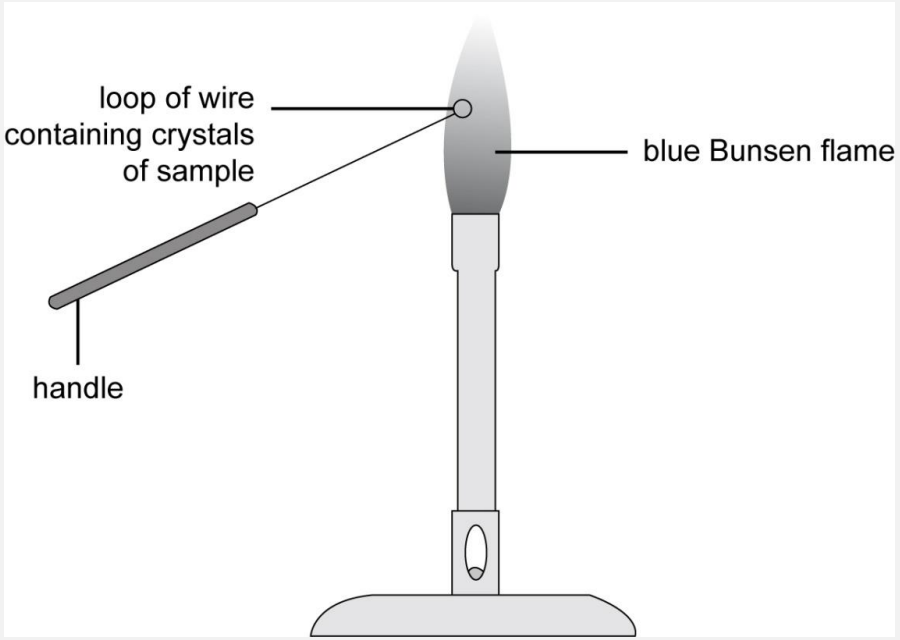
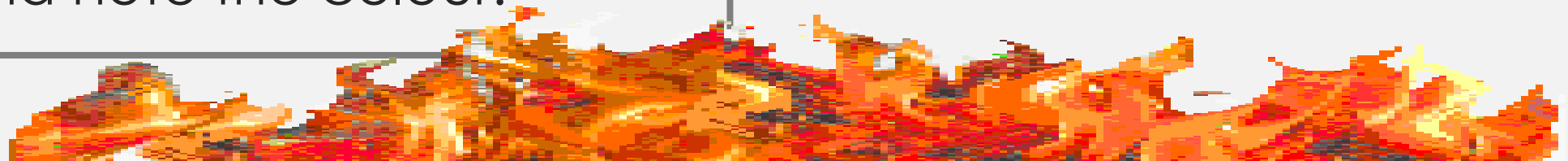
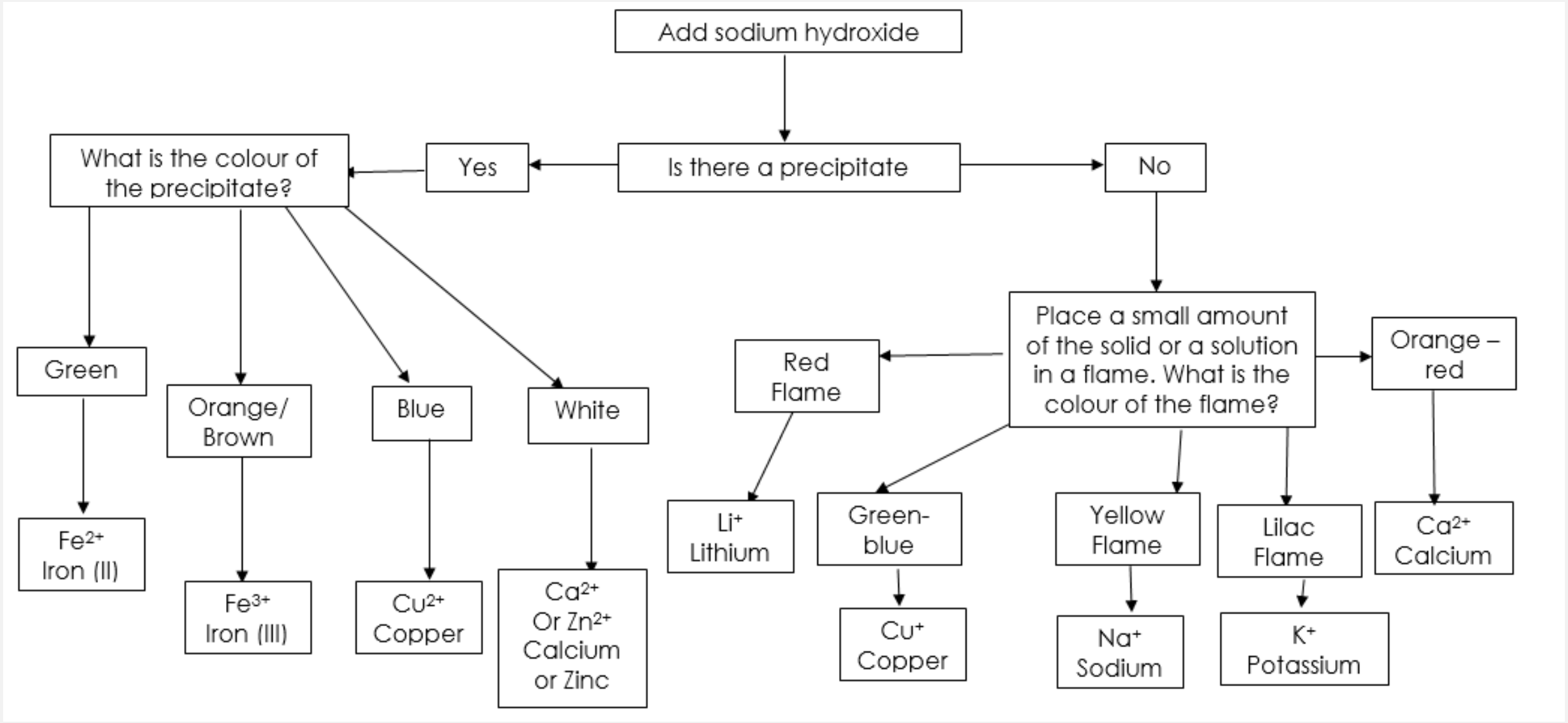
Flame tests

- Put goggles on
- Clean the loop by dipping into acid
- Burn the acid off in the flame until the colour does not change.
- Dip the loop into acid to moisten it
- Dip the loop in the metal salt solution.
- Put the loop in the flame and note the colour.





Metal	Ion	Colour of flame
Lithium	Li^+	Red
Sodium	Na^+	Yellow
Potassium	K^+	Lilac
Calcium	Ca^{2+}	Orange-red
Copper	Cu^{2+}	Green-blue

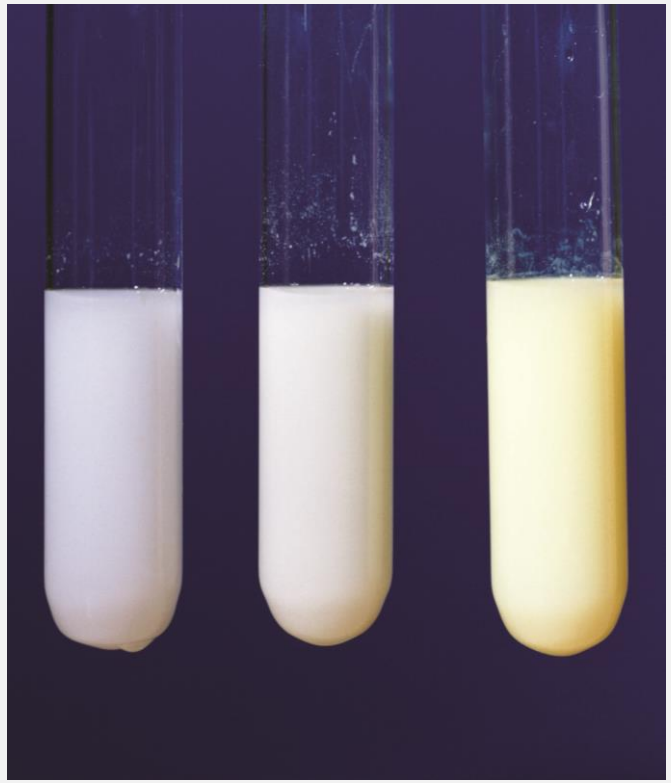

Add sodium hydroxide
Is there a precipitate
Yes
No
What is the colour of the precipitate?
Green
Orange/ Brown
Blue
White
Fe2+ Iron (II)
Fe3+ Iron (III)
Cu2+ Copper
Ca2+ Or Zn2+ Calcium or Zinc
Place a small amount of the solid or a solution in a flame. What is the colour of the flame?
Red Flame
Orange – red
Li+ Lithium
Green-blue
Yellow Flame
Lilac Flame
Ca2+ Calcium
Cu+ Copper
Na+ Sodium
K+ Potassium

TEST FOR **SULFATE IONS**

The test:
Add **barium chloride** in the presence of HCl.

Positive result:
A **white precipitate of barium sulfate** forms

TEST FOR **HALIDE IONS**

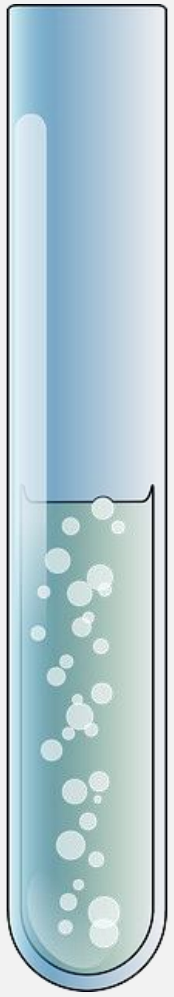


The test:
Add **silver nitrate** in the presence of nitric acid.

Positive result:
A **coloured precipitate of the silver halide** forms

(you can tell if it's Cl^-, Br^- or I^- depending on the colour)

TEST FOR **CARBONATE IONS**



The test:
Add add hydrochloric acid, HCl, and test the gas with **limewater**

Positive result:
The **limewater turns cloudy**, due to CO_2 being released

Sulfate test

1. Place 1cm^3 of sodium sulfate in a test tube.
2. Add two drops of HCl solution and two drops of barium chloride solution.
3. Record your observations in the results table.

Halide test

1. Place 2cm^3 of sodium chloride solution in a test tube.
2. Add two drops of dilute nitric acid, followed by two drops of silver nitrate solution, $AgNO_3$.
3. Record your observations in the table. **Keep this tube.**
4. Repeat with 2cm^3 of sodium bromide, then sodium iodide, then compare the colours of the 3 precipitates.

Carbonate test

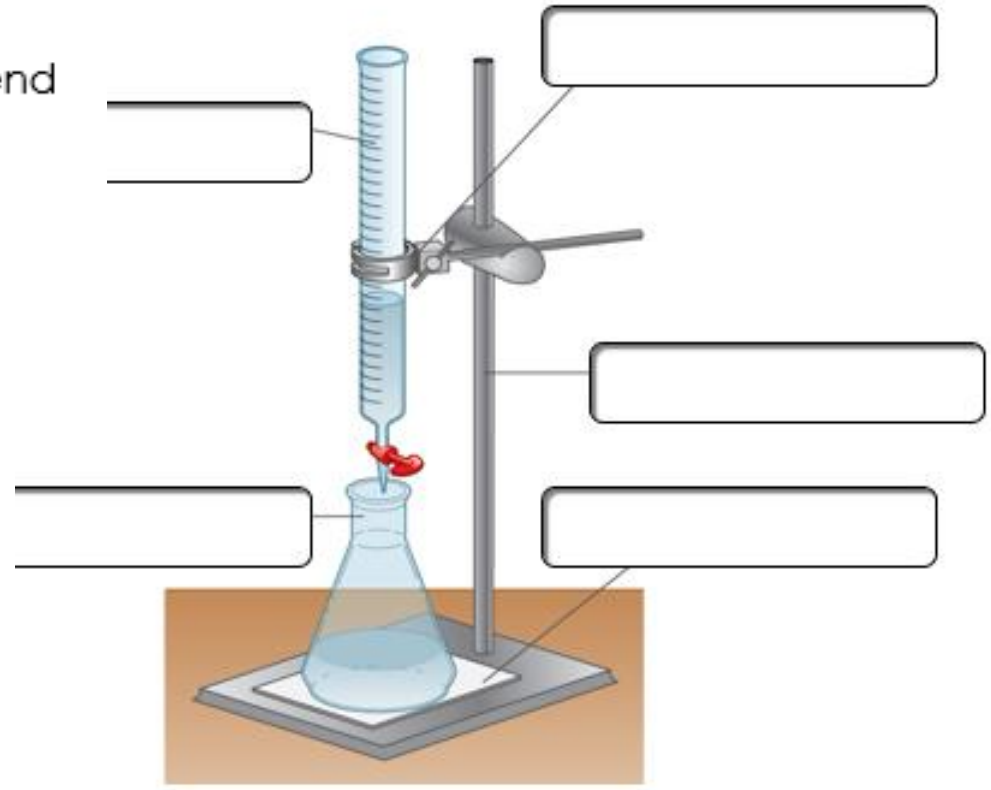
1. Half-fill a test tube with limewater and put it in a test tube rack.
2. Half-fill a boiling tube with sodium carbonate solution and put it in the rack.
3. Add ~2 cm^3 of HCl and quickly pipette up the gas formed (it will sink in the tube so will be just above the liquid).
4. Bubble the gas collected through the limewater and observe what happens.

C6 TITRATION

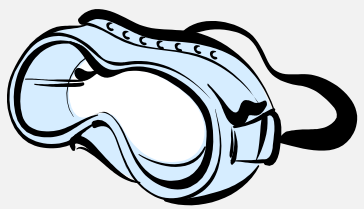
Method

1. Use the 25.0 cm^3 pipette and the pipette filler to transfer 25.0 cm^3 of the sodium hydroxide into a **clean dry** conical flask.
2. Add **three to four drops** of phenolphthalein indicator into the flask.
3. Fill a burette with the hydrochloric acid beyond the mark and then let the solution run out until **the bottom of the meniscus** is exactly on the zero mark. All bubbles should be removed from the jet.
4. Carry out a rough titration by adding the acid to the alkali in small amounts at a time. **Swirl** the flask after every addition and continue until the indicator changes from **pink to colourless**.
5. Repeat the titration accurately by adding the acid **drop-wise** near the end point.
6. Repeat the accurate titrations until you have two **concordant results** (within 0.10 cm^3 of each other).
7. **Record all your readings** to the nearest 0.1 cm^3 in the table below.

	Rough	Accurate		
		1	2	3
Final burette reading (cm^3)				
Initial burette reading (cm^3)				
Volume of HCl added (cm^3)				



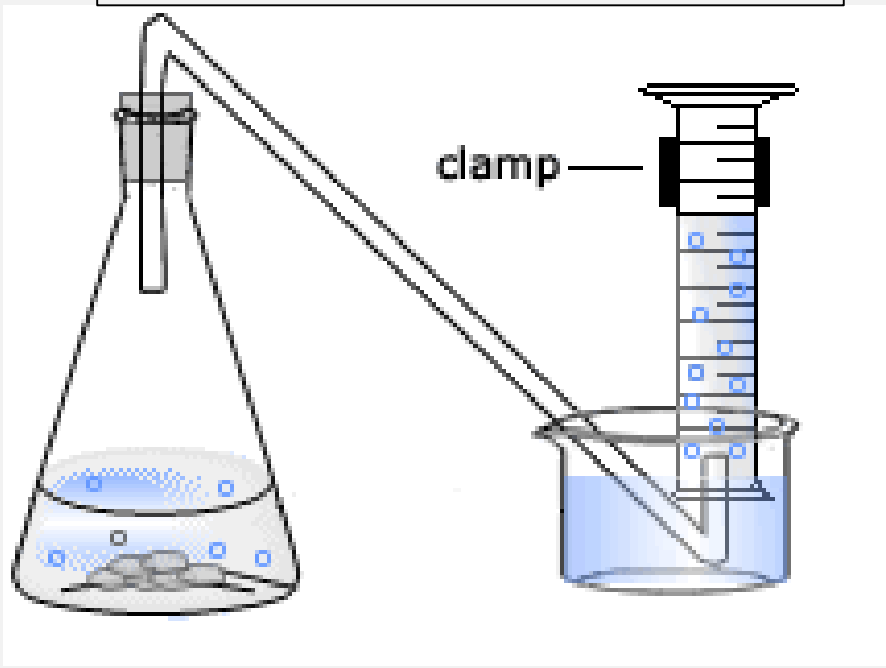
C8 – Measuring Rates of Reaction



1. Set up the upward delivery equipment
2. Using a 25 cm^3 measuring cylinder, measure out 12 cm^3 of 0.5 mol/dm^3 hydrochloric acid, **remove the bung from the flask,** and pour the acid into the flask.
3. Drop in a piece of magnesium ribbon, quickly replace the bung, and start the clock.
4. Record the volume of gas produced at 10-second intervals until no more gas is produced.

Remember:

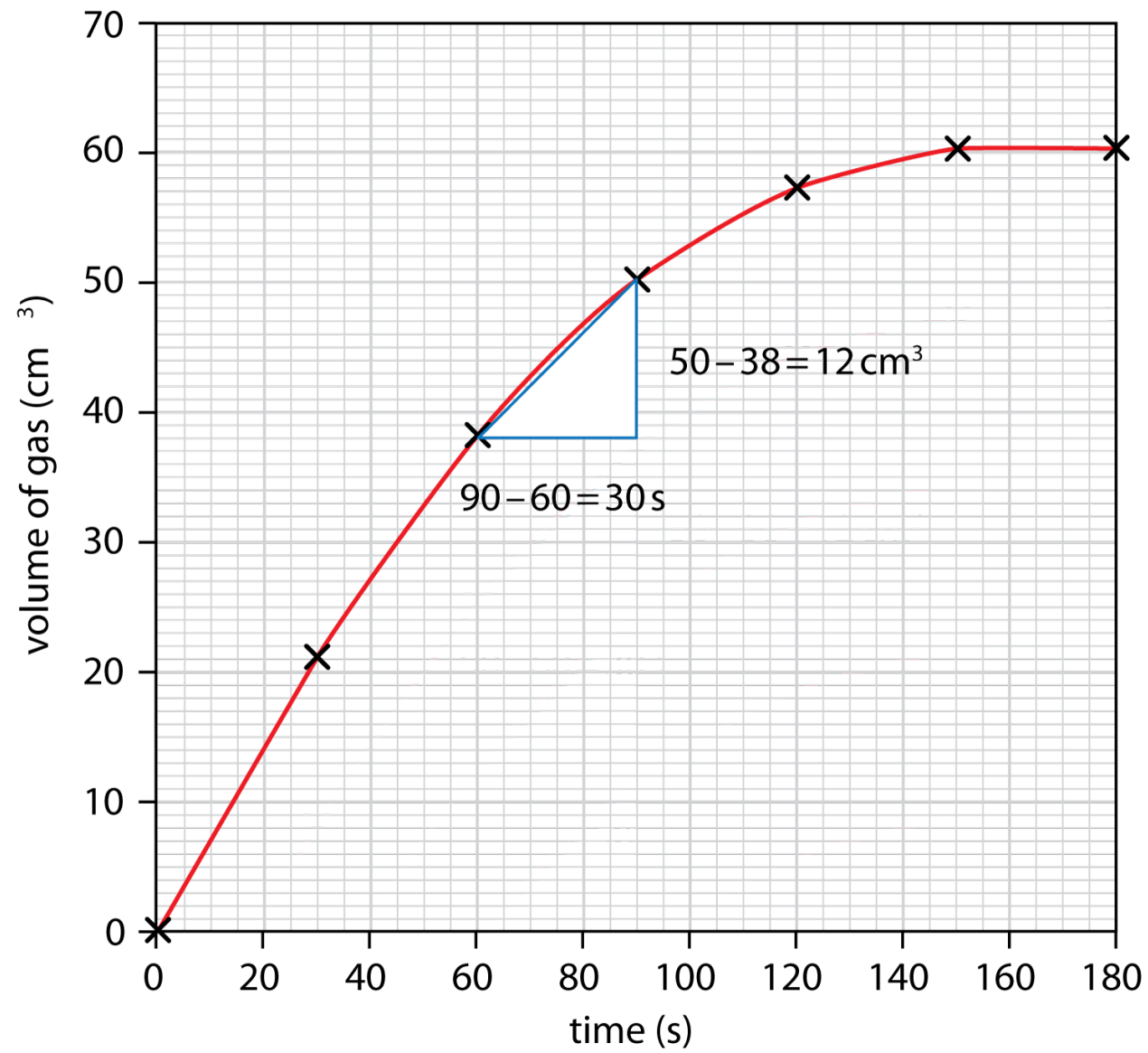
Goggles – must be worn at ALL times as acids are corrosive.



Disadvantage:

- **Cannot be used for soluble gases e.g. carbon dioxide**

Calculating rates- graphs



Calculating the gradient:

$$\text{Gradient} = \frac{12\ \text{cm}^3}{30\ \text{s}}$$

Gradient = 0.4 cm^3/s

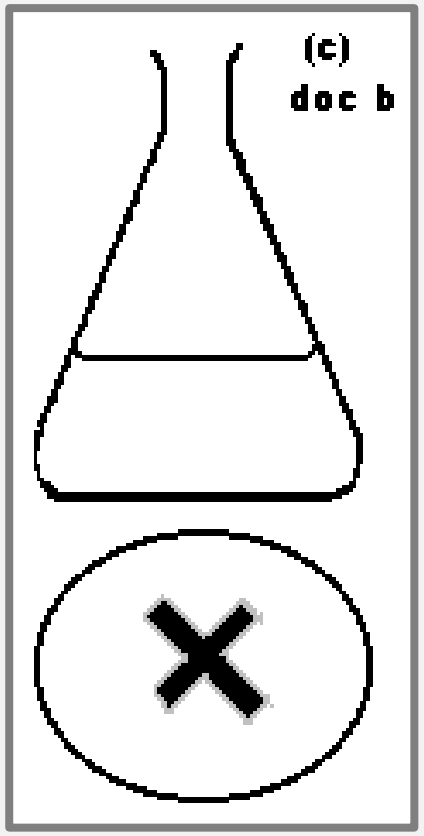
The reaction

sodium thiosulfate + hydrochloric acid → sodium chloride + water + **sulfur dioxide** + sulfur

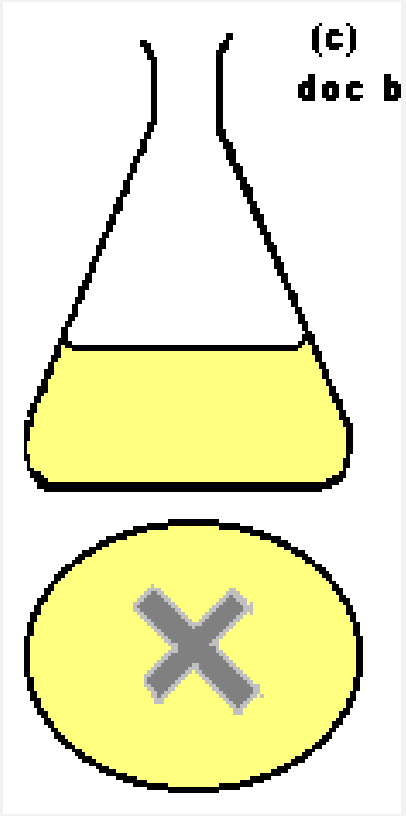
$$Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 + S$$

It is the **sulfur** in the reaction which is the precipitate- this makes it cloudy.

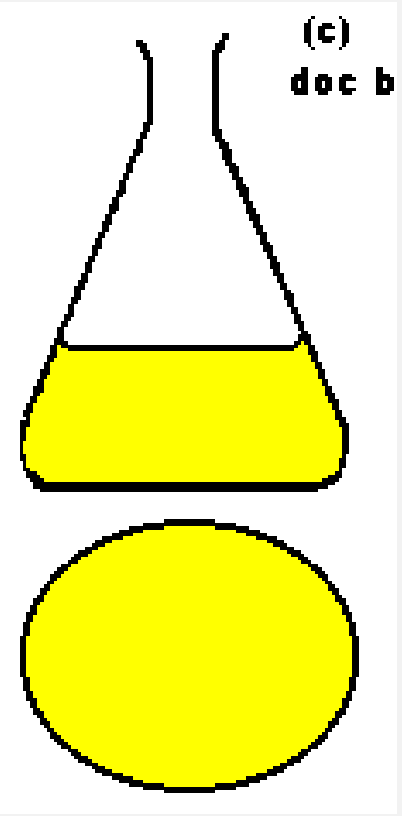
REACTION PROGRESS



mix



ongoing reaction



stop timer

Method

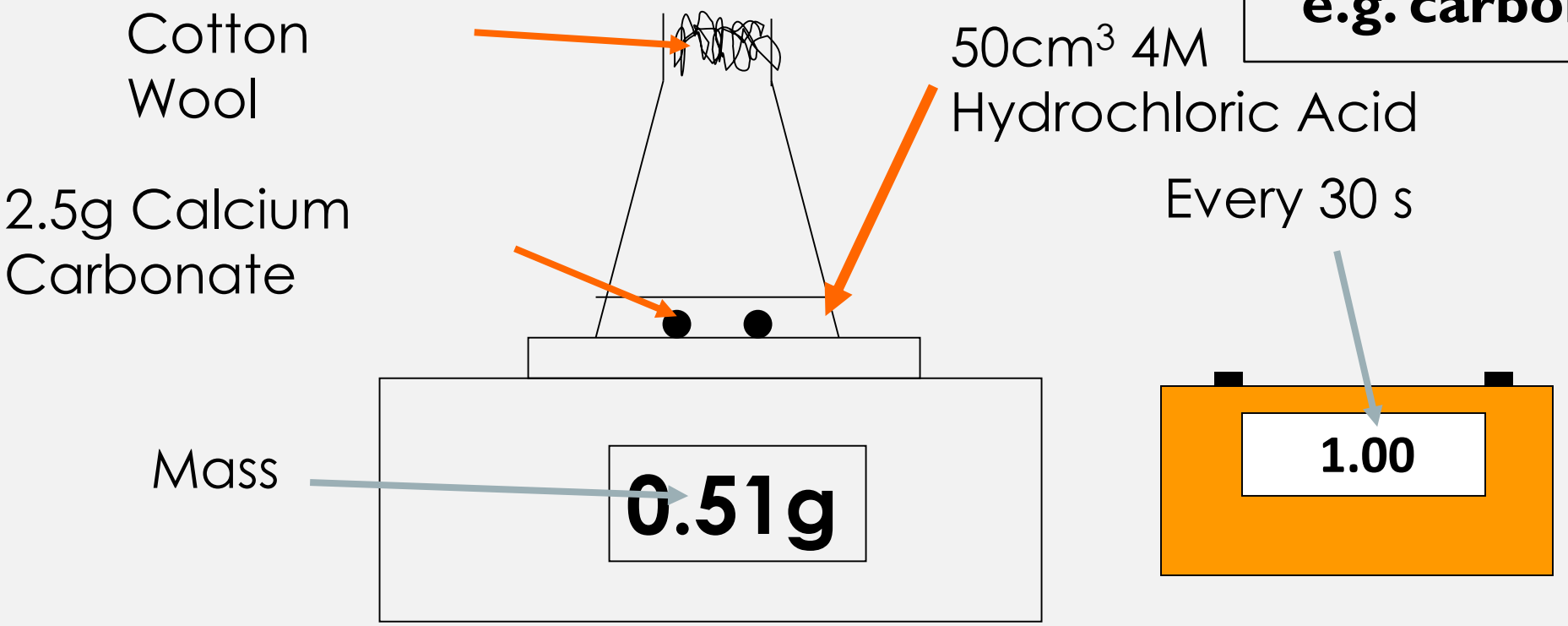
1. Measure 50 cm^3 of sodium thiosulfate solution in a measuring cylinder and pour it into the beaker.
2. Heat the sodium thiosulfate to the correct temperature.
3. Place the beaker over the piece of paper so that you can see the cross on the paper through the solution.
4. Measure out 5 cm^3 of hydrochloric acid using the syringe or small measuring cylinder.
5. Add the hydrochloric acid to the beaker and start the stopwatch. Stir the solution with a glass rod to make sure it is well mixed.
6. Record the time taken for the solution to become so cloudy that you cannot see the cross on the paper under the beaker any more.

Calcium Carbonate + Hydrochloric Acid → Calcium Chloride + Carbon Dioxide + Water

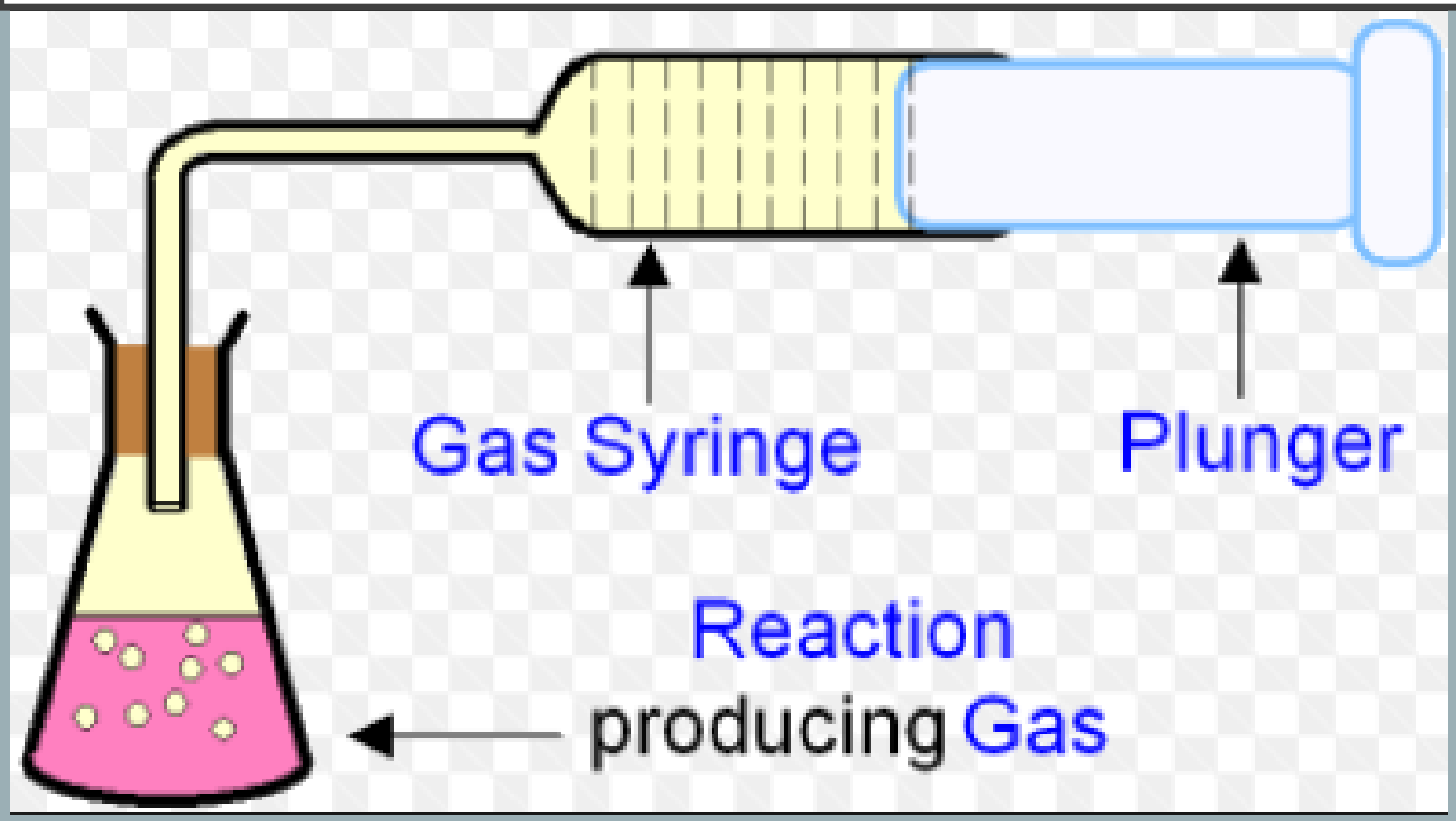
$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

Disadvantage:

- **Can only be used for high density gases e.g. carbon dioxide**



UPWARD DELIVERY



Advantage:

Can be used for any gas