Kirkcaldy High School

Chemistry

National 4/5

Laboratory Booklet

Course Overview

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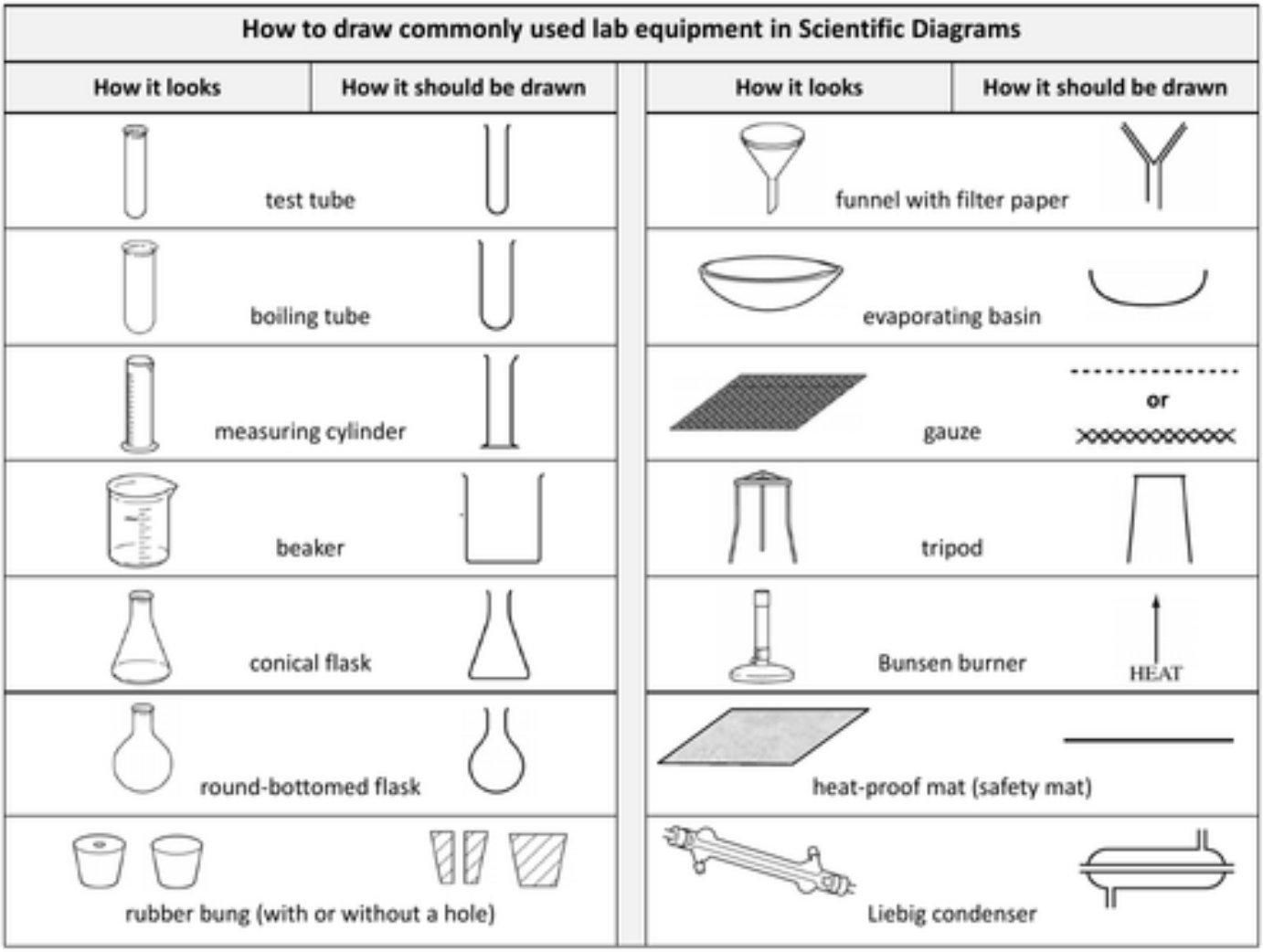
Equipment



Equipment can be found within the cupboards of each room and most experiment kits are found in the back cupboard with exception of kits labelled with the symbol below.

= <u>must be requisitioned from the technician</u>

Hazard Symbols

Acute Toxic

Health Hazard

Flammable

Exclamation Mark

Flame over circle

Gas Cylinder

Exploding Bomb

Environmental Hazard

Corrosion

Safety Precautions

- Never enter a science lab until a teacher is present.
- Coats and outside garments MUST be removed.
- Always wear safety goggles when performing an experiment.
- Only perform the experiments you are told to do.
- Never eat, drink or taste anything in the lab.
- Always inform the teacher of accidents straight away.
- Make sure all chairs and bags are pushed under desks to avoid accidents.
- Never run in the laboratory.
- When in doubt, ASK A TEACHER

= **<u>requires a fume hood</u>**

UNIT 1 - Chemical Changes in Structure

Rates of Reaction

Signs of a Chemical Reaction

Copy the table below into your results section of your report.

Reaction	Observation	Chemical Reaction? (yes/no)
A + B		
C + D		
E + F		
G + H		
I + J		
K + L		
M + N		
O + P		

Method:

1. Using a clean syringe or measuring cylinder add 5 cm^3 of A into a test tube.
2. Using a clean syringe or measuring cylinder add 5 cm^3 of B the same test tube.
3. Record your observation in your results table
4. Repeat the experiment with C + D, E + F, etc…
5. The test tubes of completed reactions can be cleaned in the sink.

Testing for Gases

Carbon Dioxide

Method:

1. Measure 10 cm^3 of 0.5 mol l^{-1} hydrochloric acid into a conical flask and add a spatula of calcium carbonate powder.
2. Quickly place a delivery tube on the conical flask and bubble the gas into a boiling tube half filled with lime water.
3. Record your observations.

Hydrogen

Method:

1. Measure 10 cm^3 of 0.5 mol l^{-1} hydrochloric acid into one test tube and add 2 strips of magnesium into a boiling tube.
2. With a lit splint and slowly put the lit end of the splint into the boiling tube.

Oxygen

Method:

1. Add 10 cm^3 of hydrogen peroxide to a boiling tube and add a spatula of manganese oxide.
2. Slowly put the glowing splint into the boiling tube.
3. Observe what happens to the glowing splint.

Rate and Concentration

Experiment 1

Method:

1. 1. Measure 5 cm^3 of 0.1 mol l^{-1} hydrochloric acid into one test tube and 5 cm^3 of 1 mol l^{-1} hydrochloric acid into another test tube.
2. Add one strip of magnesium ribbon to each of the test tubes.
3. Observe the rate at which the bubbles of hydrogen are released.
4. Test for hydrogen gas using a splint.

Experiment 2

Method:

1. Set up 3 test tubes in a test tube rack.
2. Add 5 cm^3 of acid to each test tube with different concentrations for each (0.1 mol l^{-1}, 0.5 mol l^{-1} or 1.0 mol l^{-1})
3. Add 3 small chips of marble to each of the test tubes.
4. Observe the rate of effervescence.

Rate and Temperature

Method:

1. Add 5 cm^3 of glucose solution (1%) to two different boiling tubes and add a few drops of Benedict's solution to each.
2. Add 150 cm^3 boiling hot water (you will need to heat the water using the kettle) to a beaker.
3. Add 150 cm^3 cold water to another beaker.
4. Place a boiling tube in each of the beakers.
5. Note the results. Pour contents of the boiling tubes down the sink and leave for them for the next group. Keep hot water for next group.

Rate and Surface Area

Experiment 1

Method:

1. Measure 10 cm^3 of 1 mol l^{-1} hydrochloric acid into two small test tubes.
2. Add a spatula of iron filings to one test tube and an iron nail to the other.
3. Observe the rate at which the hydrogen is released.

Experiment 2

Method:

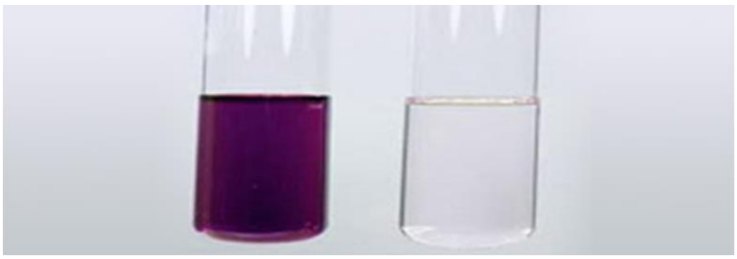
1. Have a beaker half filled with cold water place next to a Bunsen burner.
2. Using tongs, heat the iron nail for 90 seconds and note observations.
3. Add the nail to the beaker of water to rapidly cool the nail.
4. Sprinkle iron filings from high over the Bunsen burner and note observations.

Experiment 3

Method:

1. Set up 3 test tubes in a test tube rack.
2. Add 5 cm^3 of 1 mol l^{-1} acid to each test tube
3. Add a similar quantity of either calcium carbonate powder, small marble chips or large marble chips.
4. Observe the rate of effervescence

Rhubarb



Acidified potassium manganate solution

Method:

1. Cut three 5 cm lengths of rhubarb. Leave one piece as it is, cut one piece in half lengthways, and cut the third piece into 4 evenly-sized pieces.
2. Measure 30 cm^3 of acidified potassium permanganate(VII) solution into a beaker. Pour the same quantity of water into another beaker.
3. Place the beakers on a white tile. Put the whole 5 cm long piece of rhubarb into the potassium permanganate(VII) and start the timer. Stir the solution containing the rhubarb until the purple colour disappears, stop the timer.
4. Rinse out and dry the reaction beaker.
5. Repeat the experiment using the different sized pieces of rhubarb.

Method:

1. Use a measuring cylinder to measure 30 cm^3 of the potassium sodium tartrate into a 250 cm^3 beaker. Add 30 cm^3 of water.
2. Use a measuring cylinder add 20 cm^3 of hydrogen peroxide solution to the solution in the beaker.
3. Note any observations at this stage and write your "method".
4. Place the beaker on a tripod and heat the mixture in the beaker to about 60 °C.
5. Note any observations at this stage.
6. Measure 5 cm^3 of cobalt(II) chloride into a syringe.
7. Turn off the Bunsen burner and add 5 cm^3 of cobalt(II) chloride (syringe) solution to the mixture in the beaker. Take care to avoid skin contact.
8. Note any colour changes and gas produced.

NOTE: Cobalt Chloride is toxic. Wear gloves, don't put the liquid anywhere near your face/nose/mouth, avoid contact with skin and wash hands after use.

Iodine Clock

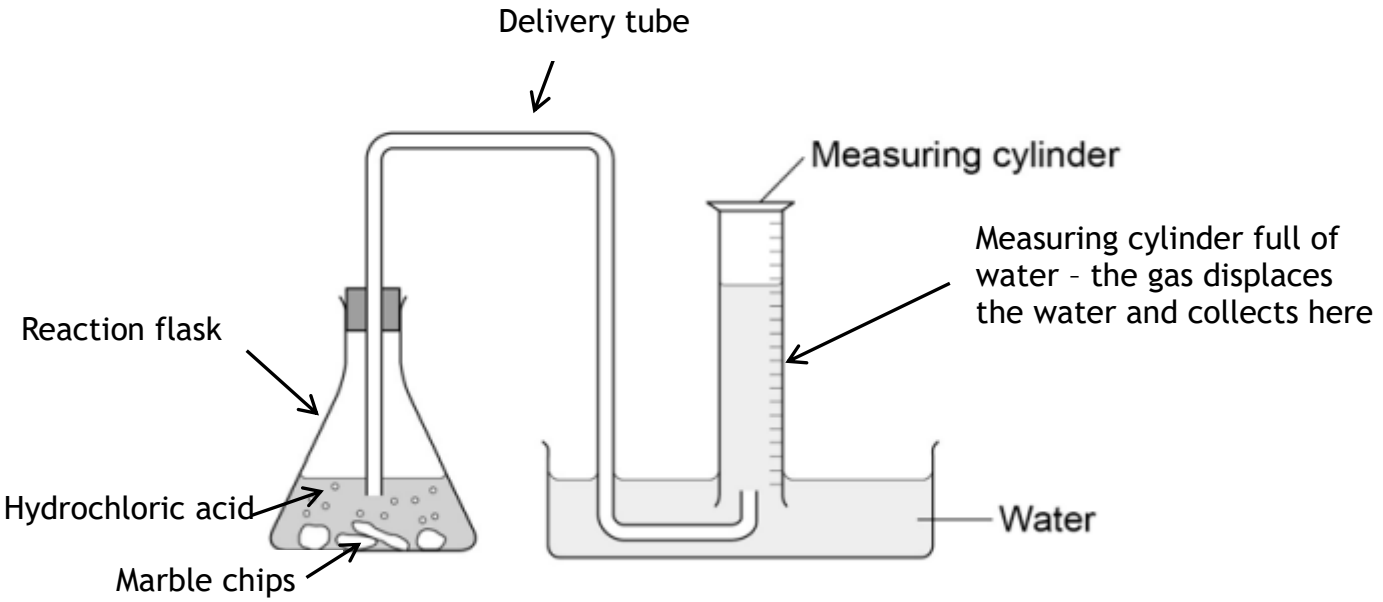
Copy the table below into your results section of your report.

Volume of potassium iodide (cm^3)	Volume of water (cm^3)	Time to change colour (s)	Relative rate (s^{-1})
25			
20			
15			
10			
5			

Method:

1. Using syringes measure these into a conical flask:
    - 10 cm^3 sulphuric acid 1.0 mol l^{-1}
    - 10 cm^3 sodium thiosulphate 0.005 mol l^{-1}
    - 10 drops starch solution
2. Using a measuring cylinder measure this into the conical flask:
    - (see table for volume) cm^3 potassium iodide solution 0.1 mol l^{-1} topped up to 25 cm^3 with water
3. Measure out 5 cm^3 of hydrogen peroxide 0.1 mol l^{-1} into a syringe.
4. Add the hydrogen peroxide to the conical flask as quickly as possible, start the timer and swirl the flask.
5. Stop the clock when the mixture suddenly turns dark blue.
6. Repeat, using other volumes of potassium iodide solution topped to 25 cm^3 with water according to the recipe in the table.

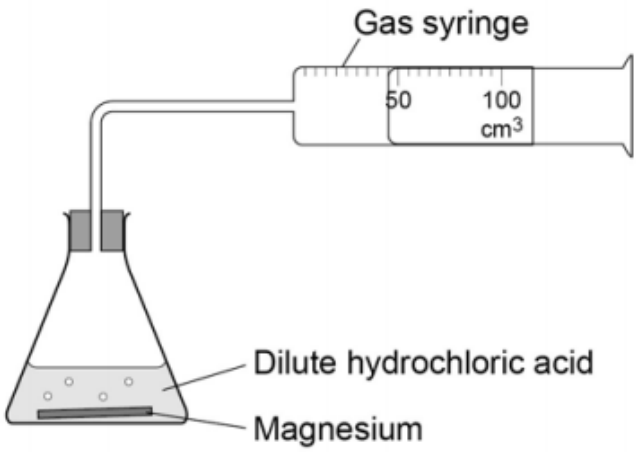
Collecting Gas Under Water



Method:

1. Measure 25 cm^3 of 1 mol l^{-1} HCl into a conical flask fitted with a stopper and a delivery tube
2. Set up an inverted measuring cylinder of water to collect the gas
3. Add 0.5 g marble chips to the acid
4. Measure the volume of gas every 40 seconds
5. Record your results in a table.
6. Plot a graph of volume against time using the same axes for both sets of data

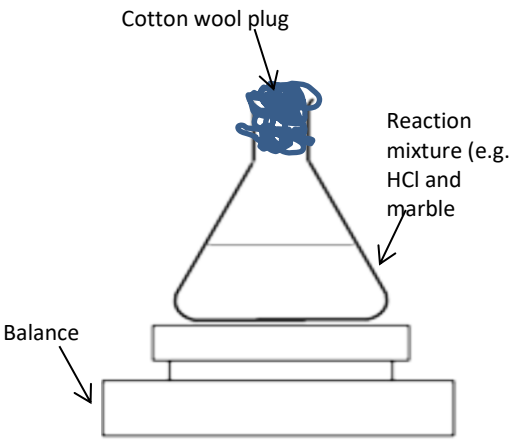
Collecting Gas with a Syringe



Method:

1. Measure 25 cm^3 of 1 mol l^{-1} HCl into a conical flask fitted with a stopper and a delivery tube.
2. Set up a syringe to collect the gas.
3. Add 0.5 g marble chips to the acid.
4. Measure the volume of gas every 40 seconds
5. Record your results in a table.
6. Plot a graph of volume against time using the same axes for both sets of data.

Monitoring Decrease in Mass



Method:

1. Weigh out 0.5 g marble chips.
2. Measure 25 cm^3 1 mol l^{-1} HCl into a conical flask.
3. Place on balance and zero (tare) it.
4. Add 0.5 g marble chips to the boat. Now add it to the acid and take mass readings every 40 seconds.
5. Record your results in a table.
6. Plot a graph of mass versus time

Formulae and Reacting Quantities

Elements and Compounds

Step 1: Separating iron and sulphur

Method:

1. Add 1 spatula of iron powder and 1 spatula of sulphur powder the middle of a filter paper OR piece of A4 paper OR a petri dish.
2. Use a magnet to try and separate the iron from the sulphur below the filter paper/A4 paper.

DO NOT PUT THE MAGNET DIRECTLY ONTO THE IRON.

Step 2: Making iron sulphide (demonstration)

Method:

1. Add 1 spatula of iron powder and 1 spatula of sulphur powder to a dry boiling tube.
2. In a fume hood, making sure the iron and sulphur are well mixed, heat the elements in the boiling tube, observing the colour change.
3. When the compound is formed, use a magnet again to attempt to separate the elements.

Reaction of Aluminium and Iodine (demonstration)

Method:

1. Finely grind 0.4 g of iodine in the mortar.
2. Carefully mix the iodine with 0.1 g of aluminium powder and place the mixture in a small mound on the tin lid.
3. Put one or two drops of warm water onto the top of the mound using the teat pipette. There can be an induction period before the reaction starts but if there appears to be nothing happening add another one or two drops of water. A little detergent in the water assists wetting.
4. When the reaction starts, clouds of purple iodine vapour are released as heat is generated. At this point the fume cupboard should be switched on, as iodine vapour is toxic. The mixture then bursts into flame, producing a white smoke together with the iodine vapour, and leaving a glowing, white residue of aluminium iodide.

Elements: conductors and non-conductors

Copy the table below into your results section of your report.

Material	Conducts (yes/no)
Carbon rod	
Lump sulphur	
Copper foil	
Iron nail	
Silicon	
Zinc	
lead	
aluminium	

Method:

1. Use the conductivity tester on each of the materials and record in your results table if it conducted or not.

Covalent/ionic Compounds: conductors or non-conductors

Copy the table below into your results section of your report and allow for more room to add more materials

Material	Covalent/Ionic	Conducts?
Ethanol		
Sucrose		
Glucose		
Copper (II) sulphate		
Sodium chloride		
Cobalt (II) chloride		

Method:

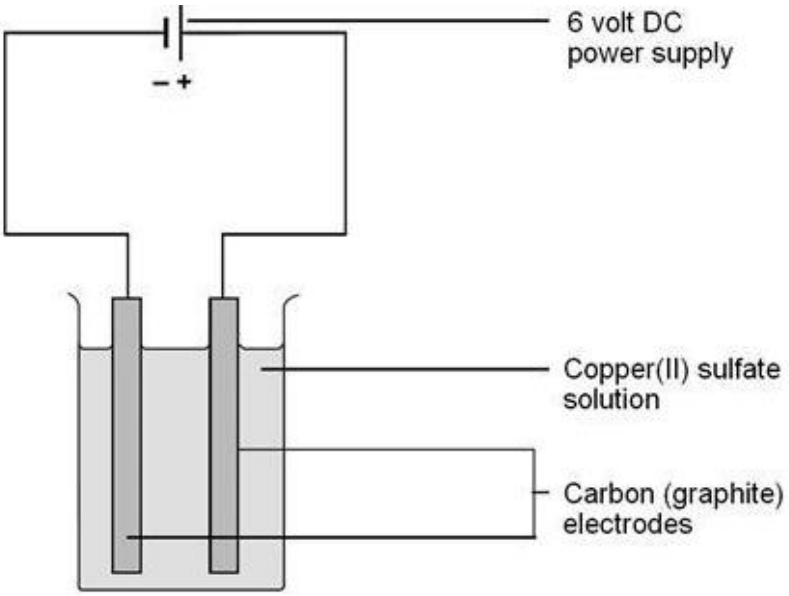
1. Use the conductivity tester on each of the materials and record in your results table if it conducted or not.

Electrolysis of Copper Chloride solution

<u>Open the windows of the classroom before the experiment begins to avoid chlorine build-up.</u>

Method:

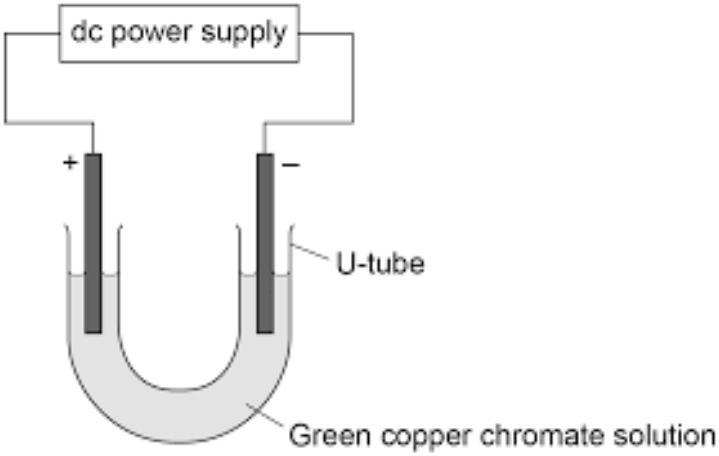
1. Add copper chloride solution to the beaker
2. Add the electrodes to the beaker and attach them to a power pack
3. Turn on the power.
4. Record observations in the results section of your report.



Electrolysis of copper chromate solution (demonstration)

Method:

1. Add copper chromate solution to the u-tube.
2. Attach the electrodes to either side of the u-tube and attach them to a power pack
3. Record observations in the results section of your report.



Flame Tests

Copy the table below into your results section of your report.

Metal in Solution	Flame colour
Copper (Cu)	
Sodium (Na)	
Lithium (Li)	
Potassium (K)	
Calcium (Ca)	
Barium (Ba)	

Method:

1. Safely light a Bunsen burner on a heat proof mat.
2. Using a set of tongs, hold each of the splints that have been soaked in metal solution in a blue flame and record the flame colours in your results table.

Solubility

Copy the table below into your results section of your report.

	Soluble (Yes/No)			
Solute	**Water**	**Acetone**	**Ethanol**	**White Spirits**
Sodium Chloride				
Sugar (glucose)				
Candle Wax				
Copper (II) sulphate				

Method:

1. Add 5 cm^3 of a solvent into a test tube and add a small spatula of a solute.
2. Swirl the test tubes to allow the possibility of dissolving.
3. Record the solubility in the results table.

Acids and Bases

Testing for Acids and Alkalis

Copy the table below into your results section of your report.

	Indicator Colour	Acid	Alkali
Phenolphthalein			
Bromothymol blue			
Litmus			
Methyl orange			
pH paper			

Method:

1. Using test tubes, test each of the indicators with acid and alkali and note the colour change in your results table.

The pH Scale

Copy the table below into your results section of your report.

Chemical	Colour	pH (1 – 14)	Acid or Alkali
Vinegar			
Water			
Washing Soda			
Soap Solution			
Citric Acid			
Sodium Chloride			
Sodium Carbonate			

Method:

1. Using a dimple tile, test each of the chemicals provided with universal indicator and record the colour.
2. Using the pH scale provided, approximate the pH of each of the chemicals.

Dilution

Method:

1. Set up a test tube rack with six test tubes. Label them 1-6.
2. Add 10 cm^3 hydrochloric acid to test tube 1.
3. Read the following instructions very carefully;
5. In test tube 2, add 1 cm^3 of the acid from test tube 1 and 9 cm^3 of water.
6. In test tube 3, add 1 cm^3 of the acid from test tube 2 and 9 cm^3 of water.
7. In test tube 4, add 1 cm^3 of the acid from test tube 3 and 9 cm^3 of water.
8. In test tube 5, add 1 cm^3 of the acid from test tube 4 and 9 cm^3 of water.
9. In test tube 6, add 1 cm^3 of the acid from test tube 5 and 9 cm^3 of water.

Neutralisation

Copy the table below into your results section of your report.

Volume of Alkali Added (cm^3)	Colour of Solution	pH
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Method:

1. Use a measuring cylinder to measure 10 cm^3 acid into a clean small beaker.
2. Add a few drops of universal indicator and note the colour and pH in your table
3. Rinse the measuring cylinder with water.
4. Add 1 cm^3 alkali to the beaker.
5. Note the colour and pH in your table
6. Add another 1 cm^3 alkali and note result
7. Repeat until you have added 9 cm^3.
8. Now use a dropper and add alkali drop by drop until the solution turns green
9. Note the final volume of alkali used.

Oxides, Carbonates and MAZIT metals

Copy the tables below into your results section of your report.

Oxides and Carbonates

Substance	pH in water	pH in acid
CuO		
CaO		
MgO		
AlO		
ZnO		
$CuCO_3$		
$MgCO_3$		

MAZIT metals

Metal	pH
Mg	
Al	
Zn	
Fe	
Sn	

Method:

1. Fill a test tube rack with clean dry test tubes.
2. Half fill each test tube with water or 0.5 mol l^{-1} hydrochloric acid and add universal indicator
3. Add each of the metal oxides, carbonates or MAZIT metals into the acid or water and allow them to mix.
4. Record the pH of the mixture.

Setting up a Burette

Method:

1. *Assemble the burette*: Attach the burette clamp to the ring stand, and secure the burette in the clamp. Ensure the burette is vertical and the tip is not touching any surfaces.
2. *Rinse the burette*: Close the stopcock and fill the burette about halfway with the titrant. Rotate the burette gently to ensure the entire inner surface is wetted. Open the stopcock to drain the water into a waste container. Repeat this process at least two more times.
3. *Fill the burette with titrant*: Close the stopcock and place a funnel at the top of the burette. Carefully pour the titrant solution into the burette until it reaches the desired level (usually just above the zero mark). Remove the funnel and allow any excess titrant to drain into the waste container.
4. *Remove air bubbles*: Inspect the burette for air bubbles, particularly near the stopcock. Gently tap the burette to dislodge any bubbles. If necessary, open the stopcock and let a small amount of titrant flow through the tip to remove any remaining bubbles.
5. *Adjust the starting volume*: Open the stopcock and let the titrant flow until the bottom of the meniscus aligns with the zero mark or another predetermined starting point. Collect the excess titrant in a waste container.
6. *Record the initial volume*: Note the starting volume of the titrant in the burette. Be sure to read the volume at the bottom of the meniscus and record your measurement to the appropriate level of precision.
7. Your burette is now ready for use in your titration or other laboratory experiment

Performing the titration

Method

1. Pipette 25 cm^3 of hydrochloric acid into a conical flask.
2. Add the indicator: If required, add a few drops of an appropriate indicator to the analyte solution. The choice of indicator depends on the type of titration.
3. Place the conical flask onto the white tile.
4. Adjust the burette height: Make sure the tip of the burette is above the opening of the conical flask and not submerged in the analyte solution.
5. Begin the titration: Slowly open the burette stopcock and allow the titrant to flow into the analyte solution. The rate of flow should be slow enough to accurately observe changes in the solution.
6. Monitor the colour change: Observe the solution for any colour changes or other indicators of the endpoint (e.g., a pH meter reading). As you approach the endpoint, the colour change will last longer.
7. Slow the titration rate: As you approach the endpoint, reduce the titrant flow rate to drops or even half-drops to ensure a precise reading. Stop the titration when the endpoint is reached, as indicated by a permanent colour change or a stable pH meter reading.
8. Record the final burette volume: Note the volume of titrant remaining in the burette at the bottom of the meniscus. Record your measurement to the appropriate level of precision.
9. Calculate the results: Subtract the initial burette volume from the final volume to determine the volume of titrant used. Use the stoichiometry of the balanced chemical equation and the known concentration of the titrant to calculate the concentration or amount of the analyte.
10. Repeat the titration: For increased accuracy, perform the titration at least two more times and calculate the average of the results

Precipitation

Copy the table below into your results section of your report.

	Precipitate? (Y/N)				
	Potassium Iodide	**Lead Nitrate**	**Sodium Carbonate**	**Cobalt Chloride**	**Nickel Sulphate**
Potassium Iodide					
Lead Nitrate					
Sodium Carbonate					
Cobalt Chloride					
Nickel Sulphate					

Method:

1. *Set up a test tube rack full of clean, dry test tubes.*
2. *M*ix 1 cm^3 of each of the corresponding solutions from the results table to a test tube and record if a precipitate is formed.
3. Clean the test tubes in the sink once the results have been recorded.

UNIT 2 - Nature's Chemistry

Homologous Series

Fuels (demonstration)

Keep a good distance with both experiments!

Exploding can (methane)

Method:

1. Fill the can with methane gas.
2. After filling place the can on a tripod.
3. Ignite the gas from the hole on the top of the can.
4. Stand back and wait until the can explodes.

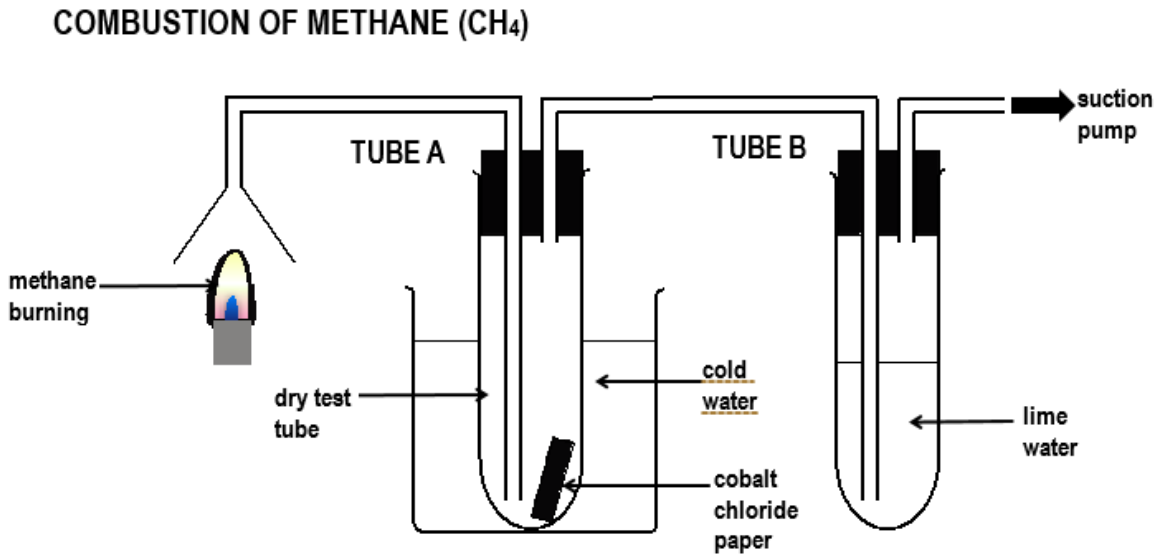
Whoosh Bottle

Method:

1. Pour 5 cm^3 of ethanol into the water cooler bottle and swirl around the interior.
2. Pour out the excess and light a splint taped to the end of a metre stick.
3. Carefully light the top of the bottle.

Products of Combustion Apparatus (demonstration)

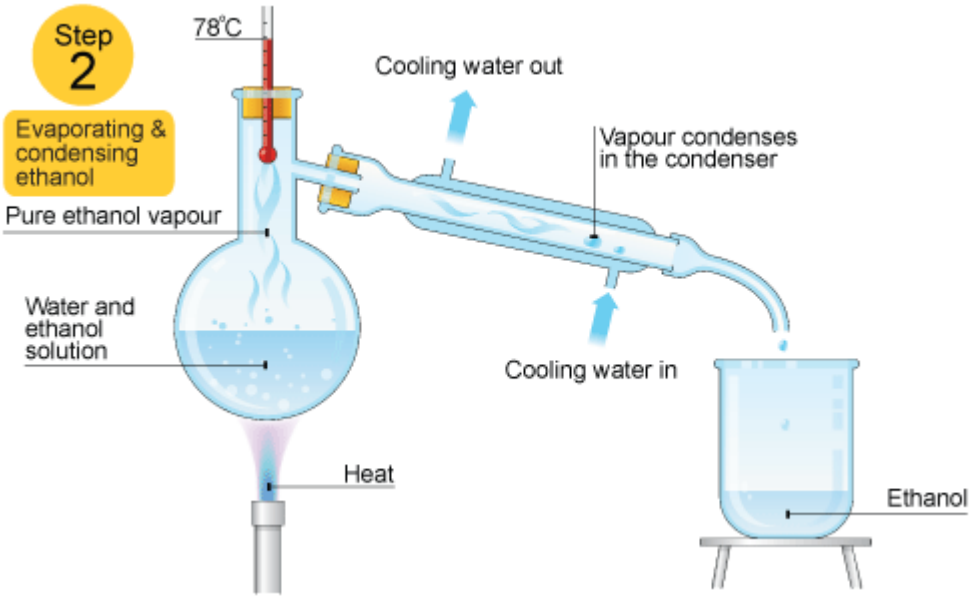
Set up the equipment as shown below.



The products of combustion of methane are sucked into the apparatus.

Distillation of alcohol/water (demonstration)

Set up the equipment as shown below.



Testing of Alkanes, Alkenes, Cycloalkanes (demonstration)

Copy the table below into your results section of your report.

Hydrocarbon	Alkane or alkene	Saturated or Unsaturated	Observation when bromine was added

Method:

1. Add a dropper of a chosen alkane or alkene into a test tube
2. Add 2 drops of bromine solution.
3. Swirl the test tube.
4. Record your observations in the results table.
5. Repeat with all available hydrocarbons.

Disposal: Use organic waste containers

Properties of Carboxylic Acids

Method:

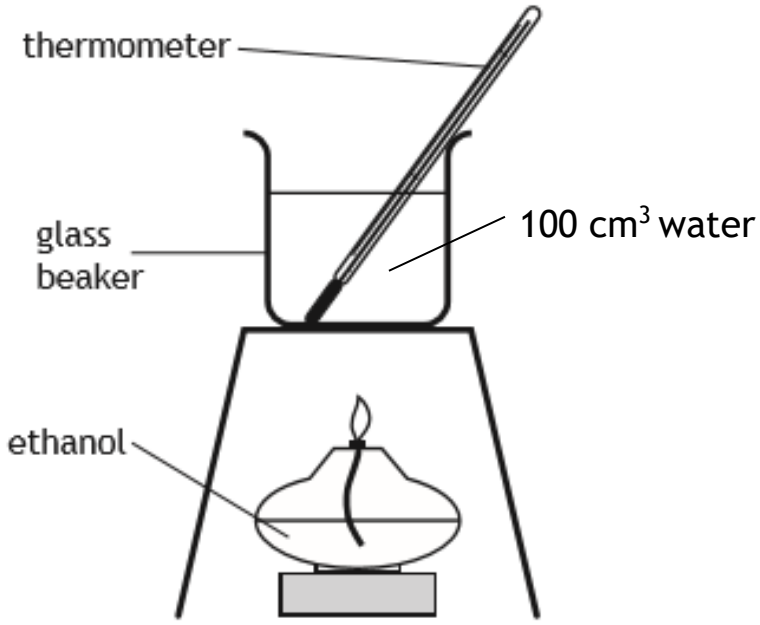
1. Half fill a test tube with ethanoic acid and another with propanoic acid and add universal indicator.
2. Add a spatula of marble chips into each test tube.
3. Record your observations.

Energy from Fuels

Energy from fuels

Method:

Set up the apparatus as shown below.



1. Measure and record the mass of spirit burner before lighting.
2. Record the temperature of the water before lighting the burner.
2. Light the spirit burner and allow the water to heat up by 30 – 50 °C, record the exact temperature of the water.
4. Calculate the change in temperature.
5. Carefully blow out the spirit burner and allow to cool.
6. Lift the metal can with tongs at the top and put it to the side to cool.
7. Measure and record the mass of the spirit burner.
8. Calculate the energy released from the ethanol.
9. **Optional** - calculate the energy released from 1 mole of ethanol.

UNIT 3 – Chemistry in Society

Metals

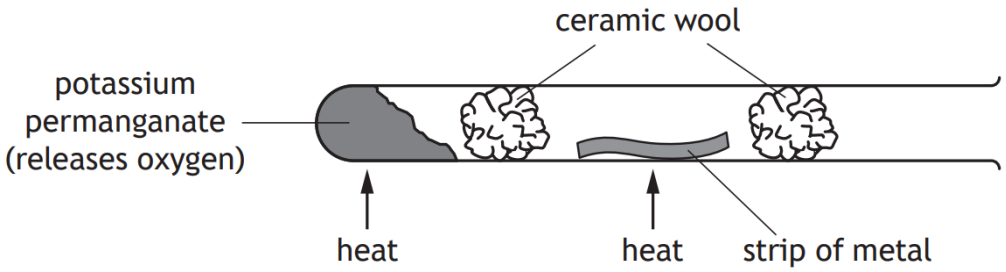
Arculus Tubes (demonstration)

Use two blast screens with this experiment, one in the front and one in the path of the mouth of the test tube

Copy the table below into your results section of your report.

Metal	Observation
Copper	
Zinc	
Aluminium	
Iron	
Magnesium	
Lead	

Method:



Reactions of Metals with Acid and Water

Method:

1. In a test tube rack, half fill 6 test tubes with 1 mol l-1 hydrochloric acid (or water).
2. Add a piece of each metal to the test tubes (copper, zinc, aluminium, iron, magnesium) to the test tubes.
3. Observe the tubes to see if any gas is given off. Feel the test tubes to see if energy is released.

Put a paper towel in the sink to catch the metal when cleaning

Alkali Metals (demonstration)

Method:

1. Wearing gloves, use tweezers to remove a chunk of metal from the oil and place it on a paper towel.
2. Using the scalpel cut a small chunk (approx. 5 mm x 5 mm).
3. Place the chunk of metal into a glass trough half filled with water and some indicator.
4. Repeat with all alkali metals, recording observations.

Reduction of Silver Oxide and Copper Oxide

Heat only

Method:

1. Add a small spatula of silver oxide to a small test tube (in the kit).
2. Hold the top of the test tube using test tube holders.
3. Heat the test tube with a blue flame for 1 – 2 minutes.
4. Drop the test tube into a beaker half filled with cold water.
5. Observe the metal produced.

Put a paper towel in the sink to catch the metal and broken glass when cleaning

Heat and Carbon

Method:

1. Add a small spatula of copper oxide to a small test tube (in the kit).
2. Add a small spatula of carbon powder (optionally scrape charcoal from a wooden block) to the test tube.
3. Place a finger on top of the test tube and shake to mix.
2. Hold the top of the test tube using test tube holders.
3. Heat the test tube with a blue flame for 1 – 2 minutes.
4. Drop the test tube into a beaker half filled with cold water.
5. Observe the metal produced.

Put a paper towel in the sink to catch the metal and broken glass when cleaning

Turning Copper-To-Gold (demonstration)

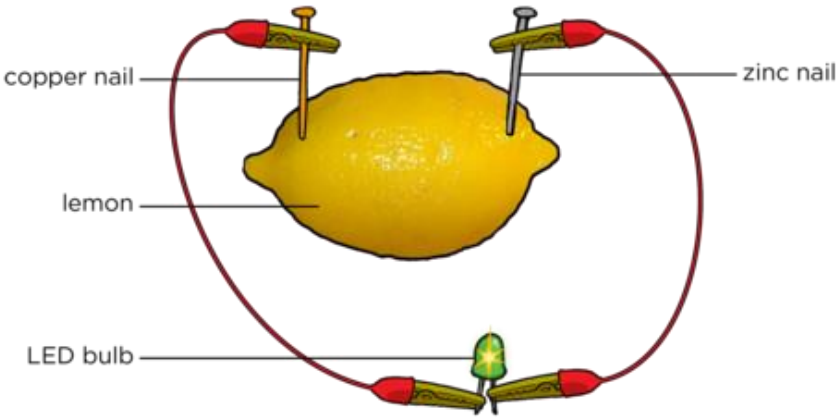
Method:

1. (Teacher) Add 2 spatulas of zinc powder to 100 cm^3 of 2 mol l^{-1} sodium hydroxide in a 400 cm^3 beaker.

2. (Teacher) Heat the reaction mixture with a Bunsen burner until boiling.
3. (Pupil) Using tongs place a copper coin into the bottom of the reaction mixture slowly to avoid smashing the beaker.
4. (Pupil) Wait 30 seconds.
5. (Pupil) Using the tongs remove the coin and immediately clean the coin under cold water.
6. (Pupil) Examine the coin.
7. (Pupil) Using tongs heat the coin until a colour change is observed.
8. (Pupil) Cool the coin under the sink once more before handling.

Lemon Cell

Method:



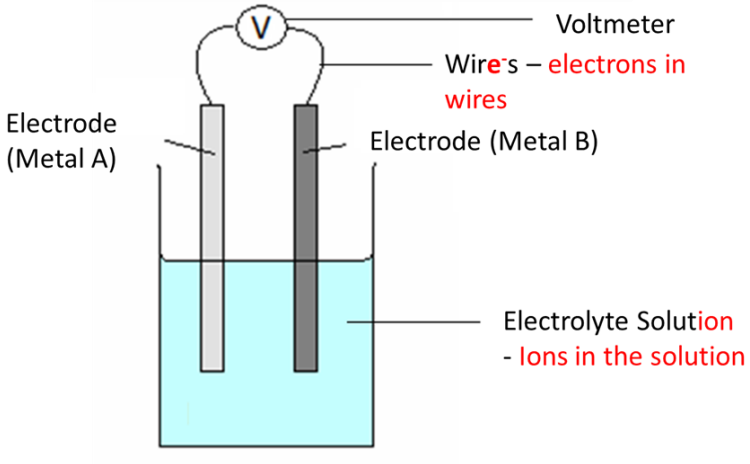
Metal/Copper Cell

Copy the table below into your results section of your report.

Metal A : Metal B	Voltage (V)
Copper : Lead	
Copper : Aluminium	
Copper : Copper	
Copper : Iron	
Copper : Magnesium	
Copper : Zinc	

Method:

1. Set up the electrochemical cell as shown below with Copper as Metal A.
2. Measure the voltage of each pair of metals shown in the table and record the results in the table.



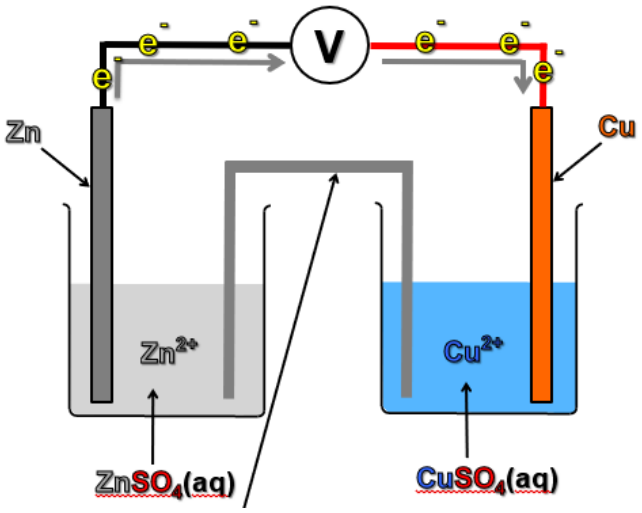
Half Cells

Copy the table below into your results section of your report.

Metal A : Metal B	Voltage (V)
Copper : Lead	
Copper : Aluminium	
Copper : Copper	
Copper : Iron	
Copper : Magnesium	
Copper : Zinc	

Method:

1. Set up the apparatus as shown below.
2. Change the metal electrodes out for different metals as shown in the table.



Northern Lights (demonstration)

<u>Use a blast screen in front of this experiment</u>

Method:

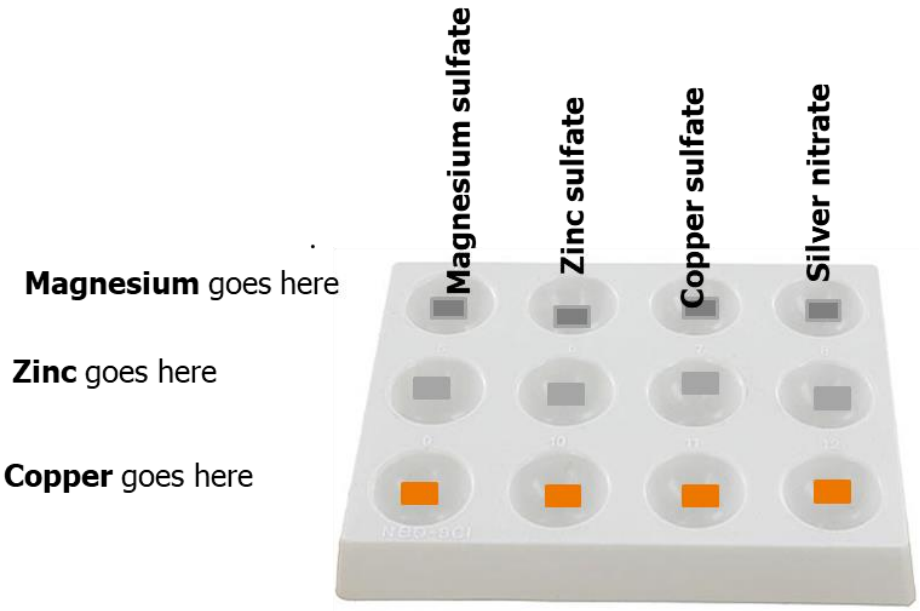
1. Add the acidified copper (II) chloride to a 500 cm^3 conical flask.
2. Scrunch up the aluminium foil and push into the conical flask until submerged in the solution.
3. Light a splint and place it into the flask and observe the reaction.

Displacement Reactions

Copy the table below into your results section of your report.

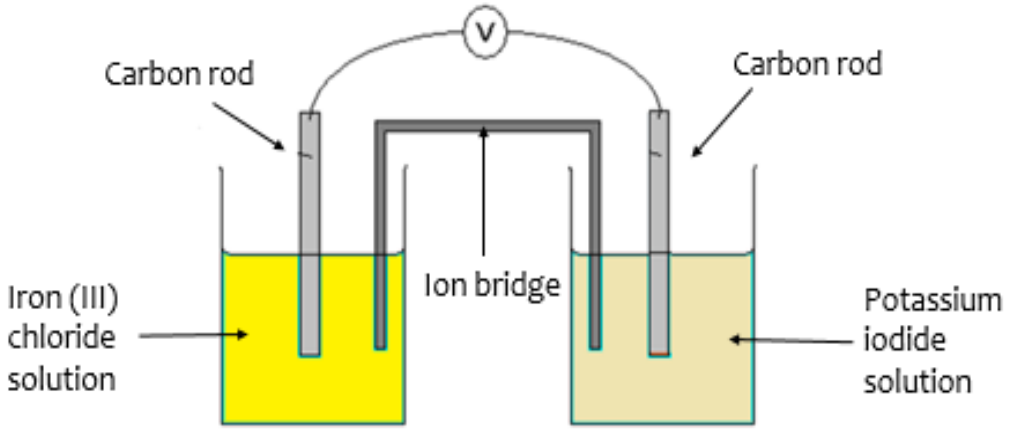
	Reaction Occurs? (Yes/No)			
Solution / Metal	Magnesium Sulfate	Zinc Sulfate	Copper Sulfate	Silver Nitrate
Magnesium				
Zinc				
Copper				

Method:



Non-metals as Electrodes

Method:



Fertilisers

Ammonia Fountain (demonstration)

Method:

1. Use a round-bottom borosilicate flask or a thick-walled Buchner flask for this demonstration (other flasks may implode). Check carefully that the flask has no small cracks. Ensure that the flask is clean and scrupulously dry. The best way to achieve this is to put it in a glassware drying cabinet (or alternative) for an hour or so before it is required. Take it out and stopper it (with a dry stopper!) just before it is filled with ammonia. Even slight dampness will result in failure of the demonstration.

2. Take the two-holed stopper that fits the flask and insert the glass tube, which has been drawn out into a jet, through one of the holes. The glass tube must fit tightly into the rubber stopper – take great care. Insert a cork borer slightly larger than the diameter of the tube through the hole. Insert the tube, and reverse the cork borer. A 1 cm^3 graduated pipette could be used as the glass jet. The tip of the jet should be positioned so that it is in the centre of the flask when the stopper is in place. About 20 cm of tube should protrude out of the flask (see the second diagram below). If this demonstration is to be repeated in future, it is worth making up a set of apparatus to keep for this specific purpose.

3. Select a syringe which will fit tightly into the second hole of the two-holed stopper.

Oxidation of NH_3 using Platinum (Sparking of Air) (demonstration)

Method:

1. Working in a fume cupboard, pour 100 cm^3 of **fresh** concentrated ammonia solution into the flask and put the bung on top of the beaker.
2. Coil the platinum wire around a pencil and then gently slide the coil from the pencil.
3. Attach the coil to the glass rod, which will act as an anchor so that the coil can hang freely from the bung.
4. Heat the platinum in a roaring Bunsen burner to red heat and then rapidly hang the coil through a hole in bung into the flask. The platinum catalyst should glow red hot for several minutes, owing to the exothermic oxidation of ammonia to nitrogen oxide and water vapour:

Chemical Analysis

Flame Tests

Copy the table below into your results section of your report.

Metal in Solution	Flame colour
Copper (Cu)	
Sodium (Na)	
Lithium (Li)	
Potassium (K)	
Calcium (Ca)	
Barium (Ba)	

Method:

1. Safely light a Bunsen burner on a heat proof mat.
2. Using a set of tongs, hold each of the splints that have been soaked in metal solution in a blue flame and record the flame colours in your results table.