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NEW VERSION

Experiment Manual for Key Stage 3 Physical Science (Sc3 and Sc4)

Martin D Roberts



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Materials and their properties

Year 7

7E Acids and Alkalis

7F Simple Chemical Reactions

7G The Particle Model For Solids, Liquids and Gases

7H Solutions

Year 8

8E Atoms and Elements

8F Compounds and Mixtures

8G Rocks and Weathering

8H The Rock Cycle

Year 9

9E Metals and their Compounds

9F Patterns of Reactivity

9G Environmental Chemistry

9H Using Chemistry

Physical Processes

7I Energy

7J Electrical Circuits

7K Forces And Their Effects

7L The Solar System And Beyond

8I Heating And Cooling

8J Magnets And Electromagnets

8K Light


8L Sound And Hearing

9I Electricity And Energy

9J Gravity And Space

9K Speeding Up

9L Pressure And Moments

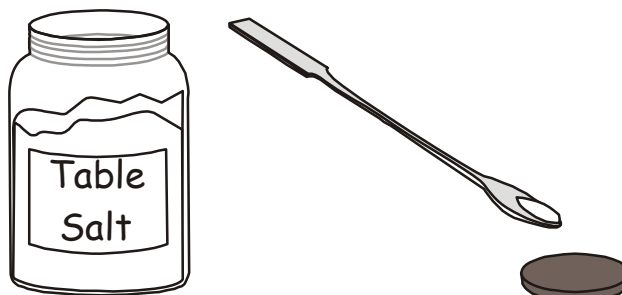
	7E Acids and Alkalis
	What are acids and alkalis like and where do we use them?
7E1	Survey of acids and alkalis
7E2	What are acids and alkalis like?
 7E3	Cleaning old coins
7E4	Acids are corrosive
7E5	Acids: solutions of solids in water
7E6	Acids: solutions of gases in water
	How can acids and alkalis be identified and distinguished from each other?
7E7	Making an indicator from red cabbage
7E8	Using your indicator
7E9	Investigating different litmus papers
7E10	Soil analysis - Part I
7E11	Soil analysis - Part II
	Is there a range of acidity and alkalinity?
7E12	Indicators and acid/alkali strength
7E13	What is pH?
7E14	Safety I: Hazard signs
7E15	Safety II: Concentration
7E16	Safety III: Spillages
7E17	Diluting acids and alkalis
7E18	Acidity/alkalinity of some household products
	What happens when an acid is added to an alkali?
7E19	pH changes during neutralisation
	Where is neutralisation important?
7E20	How to cure indigestion
7E21	Simulating stomach conditions

7E3 Cleaning old coins

Baking powder Spatula Paper towel Collection of old coins Vinegar

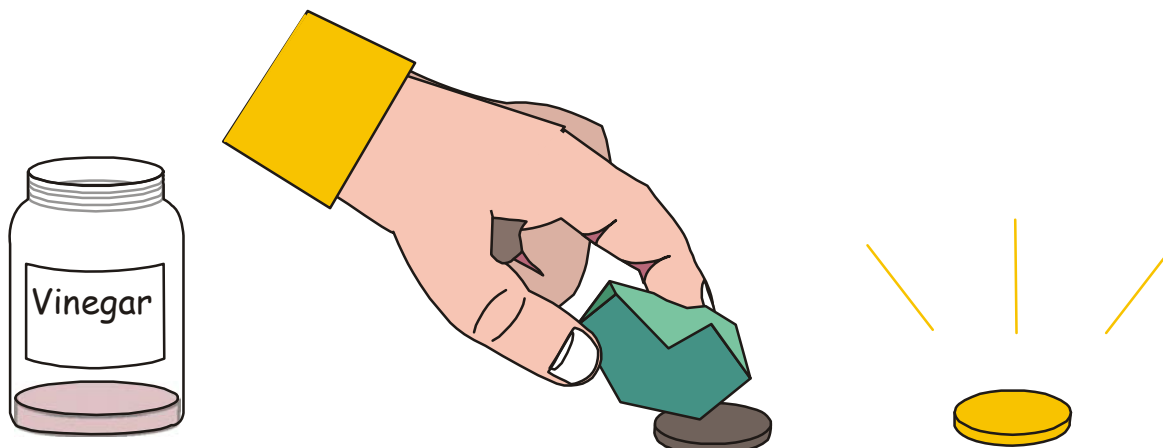
①

Add a small amount of table salt to the surface of a tarnished copper coin.



②

Soak a paper towel in vinegar and use it, with the salt, to rub the surface of the coin.



What happens to the surface of the coin as you rub it?.....

The coin becomes tarnished because Copper reacts with a gas in the air.

Which gas?


What is the substance that forms on the coin?

What is the function of the salt in this experiment?

What class of substance is vinegar, an acid or an alkali?.....

What evidence in this experiment is there that metal oxides dissolve in acids?

.....

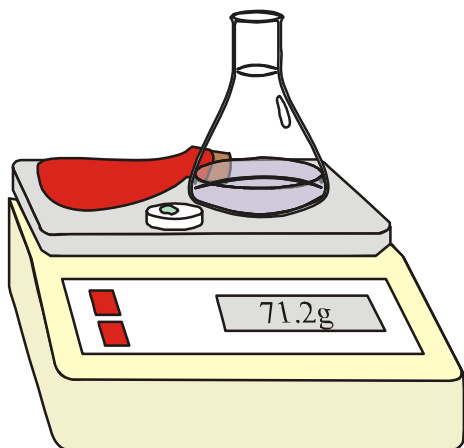
7F Simple Chemical Reactions	
	What is a chemical reaction?
7F1	Chemical reactions: Colour change
7F2	Chemical reactions: Colour change: Kitchen products
7F3	Chemical reactions: Effervescence: Part 1
7F4	Chemical reactions: Effervescence: Part 2
7F5	Recognising chemical reactions: Temperature Change
7F6	Demo: Mass is conserved I
 7F7	Demo: Mass is conserved II
7F8	Plaster of Paris with water
	How does water react with metals?
7F9	Sodium and water
7F10	The "pop" test
7F11	Calcium and water: reaction speed and temperature
	How do acids react with metals?
7F12	Reaction of Zinc with dilute HCL (Grain size)
7F13	Reaction of Zinc with dilute HCL (Temperature)
7F14	Reaction of Magnesium with dilute HCL
	How do acids react with carbonates?
7F15	Making limewater
7F16	Test for Carbon Dioxide: Part 1
7F17	Test for Carbon Dioxide: Part 2
7F18	Reaction of baking powder with vinegar
7F19	Survey of Carbonates
7F20	Dissolving an egg shell
	What new substances are made when materials burn in oxygen?
7F21	Burning Magnesium
7F22	Combustion of Iron wool
7F23	Reaction of Sulphur with Oxygen
7F24	Reaction of Sodium with Oxygen
	What is produced when fuels burn?
7F25	Combustion of Hydrogen
7F26	Combustion of Butane
7F27	Combustion of Sugar: Part 1
7F28	Combustion of Sugar: Part 2
	What is needed for things to burn?
7F29	% of O ₂ in the atmosphere I
7F30	% of O ₂ in the atmosphere II
7F31	Egg in a bottle

7F Equipment list

Chemicals	Specialised Equipment	Household materials
Alkali: Calcium Hydroxide powder	Anti bumping granules	Baking powder
Alkali: Limewater solution	Beaker 250ml	Chalk
Alkali: Sodium Hydroxide 0.5M	Beaker 250ml	Cooking oil
Carbonate: Ammonium Carbonate	Bung + hole for 19mm test tube	Detergent
Carbonate: Calcium Carbonate	Bunsen burner	Granite
Carbonate: Copper Carbonate	Crucible ceramic	Lego bricks large collection
Halide: Cobalt II Chloride	Crucible nickel	Permanent marker
Halide: Iron II Chloride	Digital thermometer	Plastic bottle 500ml
Halide: Sodium Chloride	Disposable pipettes	Plastic bottle push-pull top
Indicator :Litmus paper pH6 to pH8	Electrolysis equipment	Salt
Indicator :Litmus standard	Electronic balance	Straws
Metal: Iron filings	Evaporation dish	String
Metal: Magnesium (ribbon)	Filter paper	
Organic: Alcohol	Fume cupboard	Sugar
Organic: Sudan III	Funnel glass	Transparent plastic cups
Oxide: Calcium Oxide	Funnel plastic	
Oxide: Mercury Oxide	Gas bottle	
Sulphate: Alum	Gas collecting apparatus	
Sulphate: Iron II Sulphate	Gauze	
Sulphate: Magnesium Sulphate Epsom	Glue contact	
Sulphate: Sodium Sulphate	Glue plastic/plastic	
Sulphide: Copper II Sulphide	Glue wood/wood	
Sulphide: Iron II Sulphide	Hot plate	
Metal: Sodium	Lighter	
Indicator: Indicator solution	Measuring cylinder plastic 10ml	
Non metals: Sulphur	Metal cube set	
Acid: Sulphuric 0.1M	Retort stand and clamps	
	Sand tray	
	Spatula	
	Test tube 12mm	
	Test tube 19mm	
	Test tube holder	
	Test tube rack	
	Tongs	
	Tripod stand	
	Tubing plastic 6mm hole	
	Tweezers	
	Watch glass	
	Wooden splints	

7F7 Demo: Mass is conserved II

Flask conical Electronic balance Alka seltzer tablet Balloon Tight fitting rubber bung + hole Stick tack



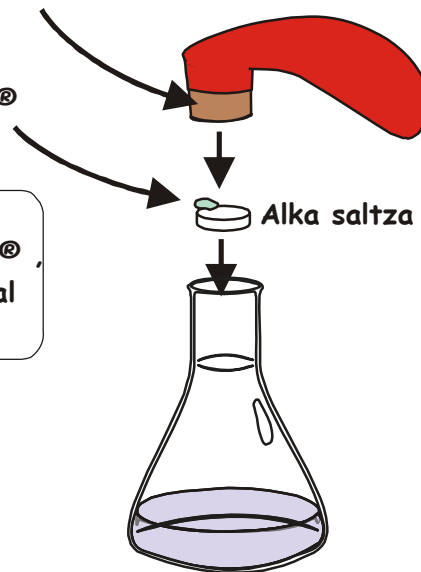
①

Add some water to a conical flask then use an electronic balance to measure the mass of all the components of the experiment.

Rubber bung with hole

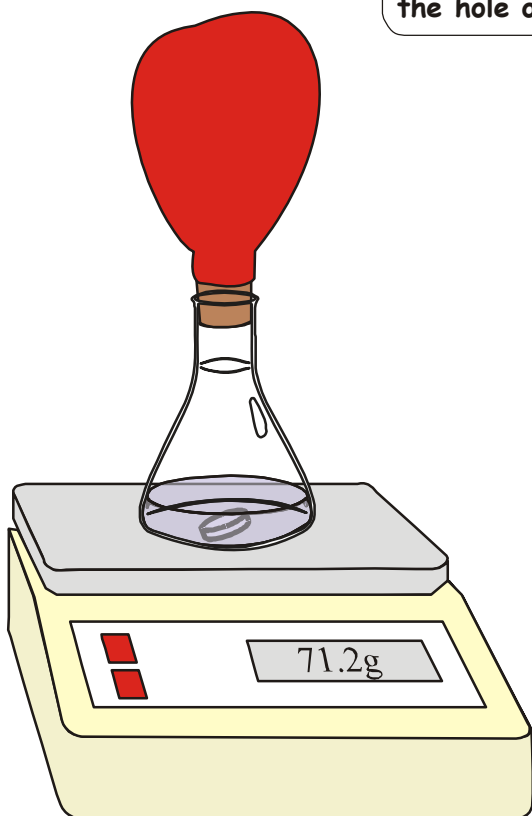
Blue tac ®

Alka saltza tablet



②

Stick the Alka Saltza tablet to the rubber bung using blue tac ®, making sure that you do not seal the hole on the bung.



③

Carefully put the stopper with the tablet attached into a conical flask taking care not to drop the tablet before you are ready.

④

When you are ready, gently tap the conical flask so that the tablet falls into the water and return the apparatus to the electronic balance.

⑤


Monitor the mass of the apparatus as the reaction continues.

What was the initial mass?.....

What was the mass after the reaction had taken place?.....

How does this experiment show that mass is conserved during a chemical reaction?

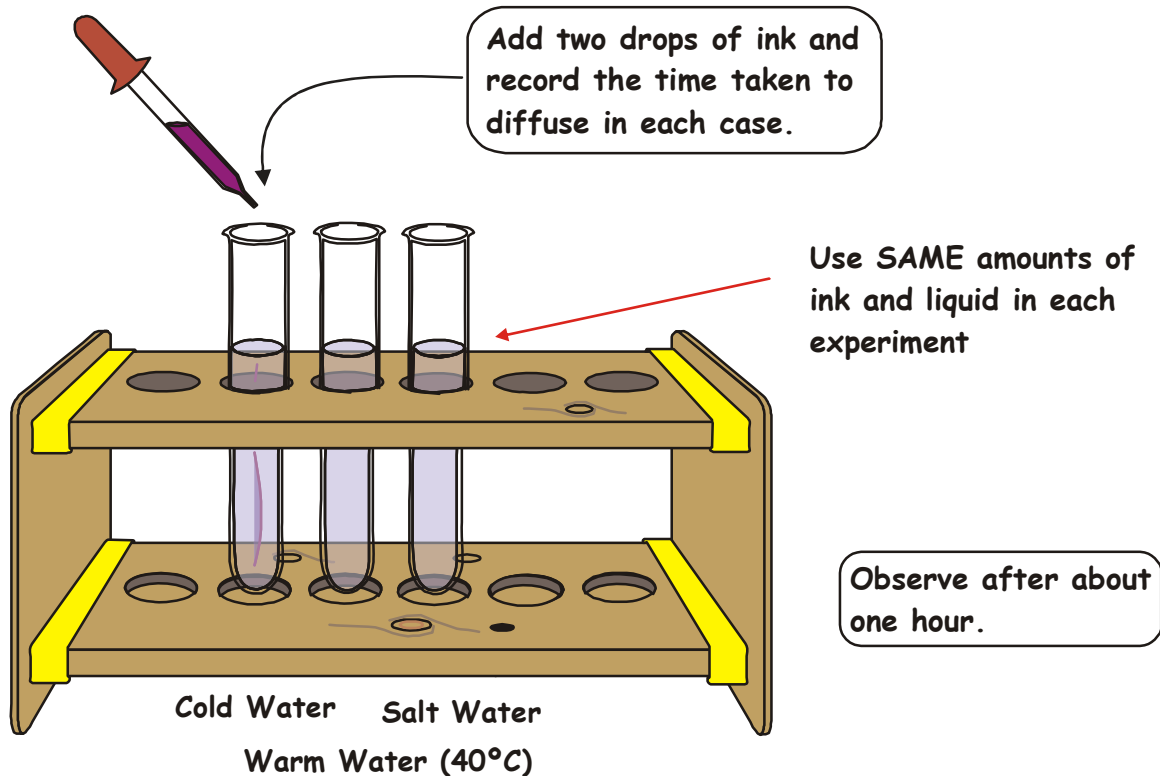
.....

7G Particle Model for S L G	
How can we explain evidence from experiments?	
7G1	Shape of solids, liquids and gases
7G2	Volume of solids, liquids and gases
7G3	Compression of gases and liquids
7G4	Guess the mass
7G5	Volume of geometric shapes
7G6	Measure the average mass
7G7	Measure the average volume
7G8	Measure your lung capacity
7G9	Volume of a drop of water
7G10	Volume of a sheet of A4 paper
7G11	Make a displacement vessel
7G12	Measuring volume with a displacement vessel
What are the differences between S, L and G?	
7G13	Investigating sand: Part 1
7G14	Investigating sand: Part 2
7G15	Comparing the hardness of pencils
7G16	Comparing the fluidity of various liquids
How the particle model explains differences between S, L and G	
7G17	A particle model for the diffusion of ink in water
7G18	A particle model for solids
7G19	A particle model for liquids
How can the particle model explain other phenomena?	
7G20	Brownian motion in milk
7G21	Spaces between molecules
	Diffusion
	7G22 Diffusion of ink in water
7G23	Diffusion of salt particles through agar
7G24	Diffusion of air freshener molecules: teacher demo
7G25	Diffusion of Potassium Permanganate
	Density
7G26	Density of various substances
7G27	Density of various liquids
7G28	Archimedes' Diablo I
7G29	Archimedes' Diablo II
7G30	Expansion of ice

	Atmospheric pressure
7G31	The mass of air in a football
7G32	Demonstration that air has a mass
7G33	How to make a barometer
7G34	Atmospheric pressure I
7G35	Atmospheric pressure II
7G36	How to make a syringe pump
7G37	How to make a suction pump
7G38	Air pressure and flow I
7G39	Air pressure and flow II
7G40	Pressure in a syringe
	Effect of heating matter
7G41	Temperature and fluidity
7G42	Expansion in gases
7G43	Expansion in liquids
7G44	Ball and ring
7G45	Particle model for expansion in solids

7G22 Diffusion of ink in water

Test tube 12mm x3 Test tube rack Ink Salt Pipette



When you initially add the ink to cold water it sinks to the bottom like a "weight".


Why is this?.....

Sketch the distribution of the ink in each case after about 20 minutes:

Cold water	Warm water	Salt water

Explain the differences you see in the three cases above:.....

(See [expt 7G17](#) for particle model.)

	7H Solutions
	How can we tell whether a liquid is a mixture?
7H1	Measure the boiling point of water
7H2	Is tap water pure?
7H3	Measure density
	How much salt can we get from rock salt?
7H4	Concentration of salt in seawater
7H5	Separation of salt from rock salt
7H6	Find the % salt in a rock salt sample
	What happens to the solute when a solution is made?
7H7	Soluble or insoluble?
7H8	Speeding up dissolving: Temperature
7H9	Speeding up dissolving: Powder and stirring
	How can we separate solvents from solutes?
7H10	Separation of water from food colouring
7H11	Separation of salt from sand
7H12	Separation of Alcohol from wine
	Using chromatography separate and substances in mixtures?
 7H13	Separation of pigments by chromatography
7H14	Chromatography of ink
	Is there a limit to the amount of solid that will dissolve in a liquid?
7H15	Growing crystals I
7H16	Growing crystals II
7H17	How to grow big crystals
	What else affects solubility?
7H18	Solubility of sugar: Part I
7H19	Solubility of sugar: Part II

7H13 Separation of pigments by chromatography

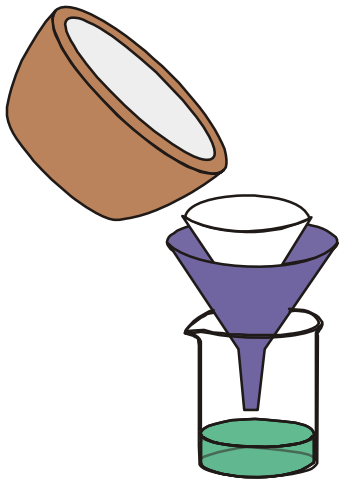
Alcohol Mortar and Pestle Sand Funnel Filter paper Beaker 250ml Kebab stick

①

Take a leaf (e.g. Ivy or geranium) cut it up and add it to a mortar. Add a measure of clean sand and alcohol to the leaves and grind until the pigments are clearly dissolved in the alcohol.



Keep away from ignition sources

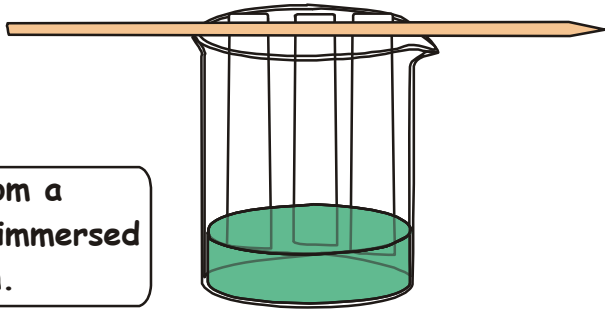


②

Filter the solution into a clean beaker.

③

Suspend strips of filter paper from a tooth pick so that their tips are immersed in the Alcohol/Chlorophyll solution.



Stick your samples in the table below:

①	②	③

Can you identify different pigments in the samples?


.....

Try to find out the name of the pigments

.....

Why do some pigments travel faster than others?.....

.....

8E Atoms and Elements	
	How many different materials are there?
8E1	Survey of materials
8E2	Mixture or pure substance?
8E3	Is water an element?
8E4	What's in a potato?
8E5	Is wood an element?
	What are elements made from?
8E6	Elements: Only one type of atom
	What are elements like?
8E7	The periodic table: First three rows: Colouring atoms
8E8	The periodic table: First three rows: Properties and uses
	8E9 Element bingo
8E10	Element dominoes
8E11	Chemical signs (elements)
8E12	Element card games
8E13	Is this substance an element?
8E14	Characteristics of Sulphur
	How do we get all the other materials?
8E15	Molecules: the gases of the atmosphere
8E16	Making molecules using Lego bricks
8E17	Building compounds using Lego bricks
8E18	Properties of Carbon Dioxide
8E19	Grouping elements compounds and molecules
8E20	Sorting substances using Venn diagrams
	How can we represent the changes when new materials are made?
8E21	Reactions between elements: Iron and Sulphur
8E22	Reactions between elements: Zinc and Sulphur
8E23	Reactions between elements: Hydrogen and Oxygen
8E24	Make an electrolysis bath

8E9 Element bingo

Print, and photocopy the [following page](#) then cut into sets ☐

①

Provide each pupil with a bingo card.

You are going to describe the elements in the first three rows of the P.T. (we suggest the order shown below). When the pupil is sure he or she knows which element you are describing they must cross it off on their bingo card.

H, Be, C, O, Ne, He, Li, B, N, F, Ar, Na, Cl, Mg, S, Al, P, Si

②

Describe the elements in the following way:

a) Say whether it is:

A solid, liquid or a gas

A metal or a non-metal

b) Describe its appearance, if possible.

(e.g. greenish coloured gas, shiny metal)

d) Provide some interesting physical property

(e.g. "soft, you can cut it with a knife",

"floats on water")

e) Provide some interesting chemical property.

(e.g. "reacts vigorously with water")

f) Provide a use of the element.

(e.g. "used to kill bacteria in swimming pools")

8E9 Element bingo

H	Card1						He
	Be	B	C		O	F	
Na	Mg		Si		S	Cl	Ar

	Card2						He
Li	Be	B	C	N		F	Ne
	Mg	Al	Si		S	Cl	

	Card5						He
Li	Be	B		N	O		Ne
Na		Al	Si	P	S	Cl	


H	Card6						
		B	C	N	O	F	Ne
Na	Mg	Al		P	S		Ar

H	Card3						He
Li	Be		C		O		Ne
Na	Mg	Al		P		Cl	Ar

H	Card4						He
	Be		C		O		Ne
Na	Mg	Al		P	S	Cl	Ar

H	Card7						He
	Be	B	C	N		F	Ne
	Mg		Si	P		Cl	Ar

	Card8						
Li	Be	B	C	N	O	F	Ne
Na	Mg				S	Cl	Ar

<h1>8F Compounds and Mixtures</h1>	
How are elements and compounds different?	
8F1	Where are we?
How do compounds differ from the elements from which they are made?	
8F2	Comparing salt with its elements
8F3	Electrolysis of brine solution
8F4	Comparing Iron Sulphide with its elements
8F5	Heating Mercury Oxide
8F6	Heating Mercury Oxide: Lego brick model
8F7	What are compounds made of?
Do compounds react chemically?	
8F8	Reaction of Sodium Carbonate and Iron II Chloride
8F9	Formation of precipitates: Copper II Carbonate
8F10	Reaction of vinegar with Sodium Carbonate
 8F11	Decomposition of Copper II Carbonate
8F12	Formation of precipitates: Iron II Carbonate
8F13	Chemical signs (compounds)
8F14	Reaction of Sodium Hydroxide with Copper II Sulphate
8F15	Reaction of Sodium Hydroxide with Magnesium Sulphate
8F16	Production of Ammonia I
8F17	Production of Ammonia II
8F18	Water of crystallisation: Condensation
8F19	Water of crystallisation: teacher demo
8F20	% of water present in hydrated Copper II Sulphate
Are there other sorts of material besides elements and compounds?	
8F21	Where are we?
8F22	Sorting substances
8F23	Classification of material systems
8F24	Classification of mixtures
8F25	Determine the boiling point of Alcohol
8F26	Boiling point of a mixture of Alcohol and water
8F27	Measure the % of Copper in Brass
8F28	Boiling point of water and salt water
8F29	Melting point of a mixture of ice and salt
8F30	A solution of a gas in a liquid
Separating components of a mixture (links to 7h)	
8F31	A mixture of oil and water
8F32	Separation of oil from water
7H	7H10 to 7H14
Naming compounds and acids	
8F33	Naming compounds: Binary compounds I

8F11 Decomposition of Copper II Carbonate

Ignition tube □ bung + hole □ Tubing/ connector □ T/T holder □ Copper II Carbonate □ beaker □ Limewater □ B/burner □



Use safety goggles

①

Place the dry Copper II Carbonate powder in a test tube. Insert the rubber bung, connector and tube as shown opposite and heat gently.

②

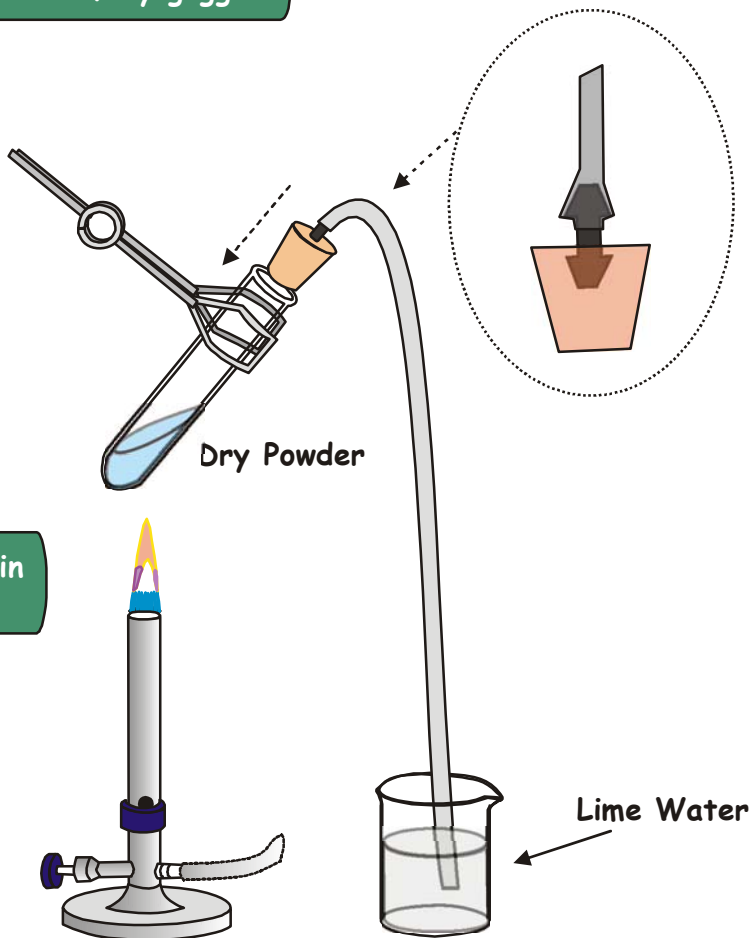
Observe what happens to both the powder and lime water solution.



Heat gently moving in and out of flame.



The dry Copper II Carbonate PPT from previous Expt



What happens to the Copper II Carbonate as you heat it?.....

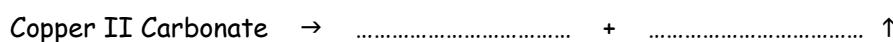
Describe the substance that remains in the test tube:.....

What is its name and formula?.....

What happens to the limewater?.....

What does this tell you?.....


Write down the word equation for its decomposition:



What does the arrow \uparrow mean in the equation above?

.....

Is there any other way you could test for this substance?.....

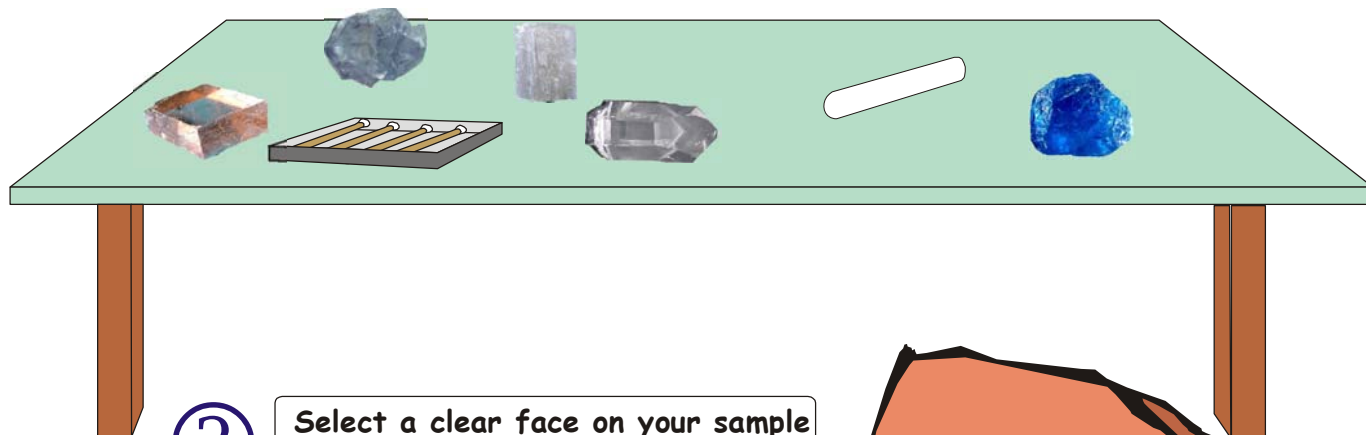
8G Rocks and Weathering	
	What are rocks made of?
8G1	The elements of the Earth's crust
8G2	Classification of rocks according to texture
8G3	Interlocking or non-interlocking grains
8G4	Survey of rocks
8G5	Density of some rocks
8G6	Comparing the hardness of some rocks
8G7	Mohs hardness test (using crystals)
	8G8 Mohs hardness test (finger nail, penny, pen knife)
8G9	Colouring in granite
8G10	Identify the rocks (photo survey)
	How does rain cause rocks to weather?
8G11	Weathering: Concept map
8G12	Rain is acidic
8G13	Rapid erosion
8G14	Permeability of some rocks
8G15	Porosity of different rocks
8G16	Weathering of buildings
	How do changes in temperature cause rocks to weather?
8G17	Freeze-thaw weathering of sandstone
8G18	Erosion of rocks - frost weathering
8G19	Heating and cooling granite in a Bunsen burner flame
	What happens to weathered pieces of rock?
8G20	Transport
8G21	Erosion of rocks - biological erosion
	Why do sediments form layers?
8G22	Formation of sediment beds

8G8 Mohs hardness test (finger nail, penny, pen knife)

Collection of materials of different hardness Knife Penny

①

If you do not have a Mohs testing set available a quick "rule of thumb" method is to use your fingernail, a penny and a steel knife. The hardness of each is listed below.



②

Select a clear face on your sample crystal and hold it firmly.

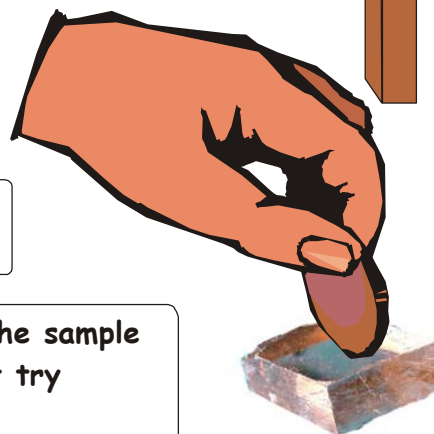
③

Attempt to make a scratch with a penny.

④

If there is a scratch mark it means the sample is softer than the penny and you must try with your finger nail.

If there is no scratch mark you must try with the steel pen knife blade.



Estimate the Mohs hardness of the samples provided by your teacher and write in the table below:



Fingernail: 2.5

Penny: 3

Steel blade: 5.5

Sample name	Mohs hardness

Sample name	Mohs hardness

8H The Rock Cycle	
	<i>How is sedimentary rock formed?</i>
8H1	Three types of rock
8H2	Formation of rocks: Sedimentary: Clastic
 8H3	Formation of coal
8H4	Formation of oil
	<i>Are all limestones different?</i>
8H5	Formation of rocks : Sedimentary: Biogenic
8H6	Formation of rocks : Sedimentary: Precipitation
8H7	The fizz test
8H8	Making slaked lime
	<i>What is different about metamorphic rocks?</i>
8H9	Formation of rocks of the Earth's crust : Metamorphic
8H10	Porosity of clay and baked clay
8H11	Comparing sedimentary and metamorphic rocks
8H12	From sedimentary to metamorphic rock: a model
	<i>Where do igneous rocks come from?</i>
8H13	Formation of rocks of the Earth's crust: Igneous
 8H14	Growing crystals from Salol

8H3 Formation of coal

Print, and photocopy the [following page](#) then cut into sets ☐

①

Explain that coal is classed as a biogenic sedimentary rock. This means that it is produced from sediments resulting from biological activity.

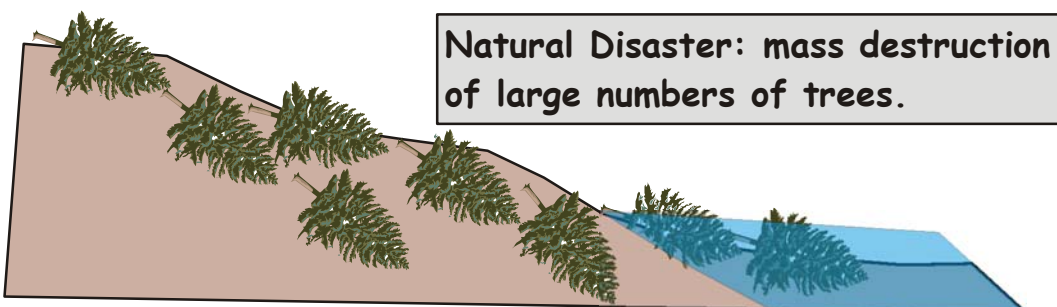
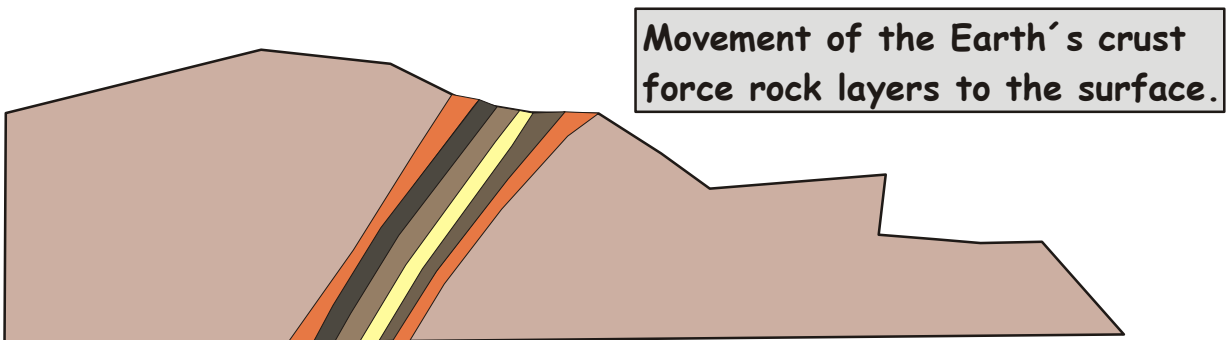
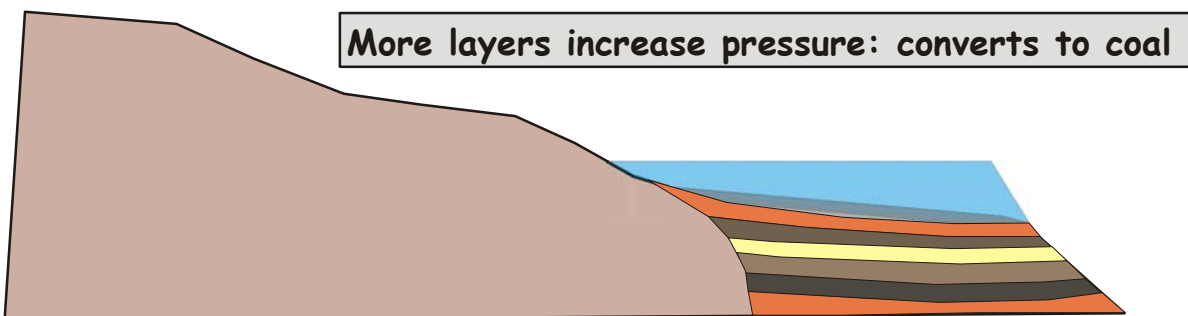
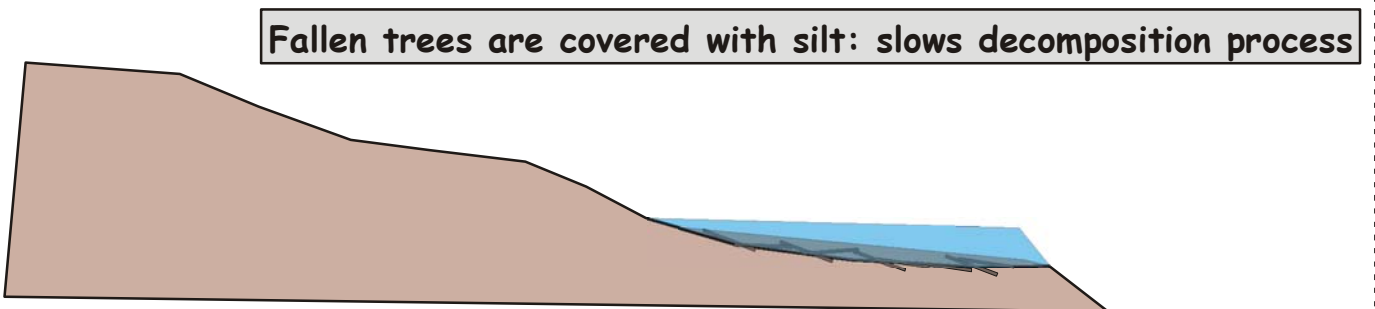
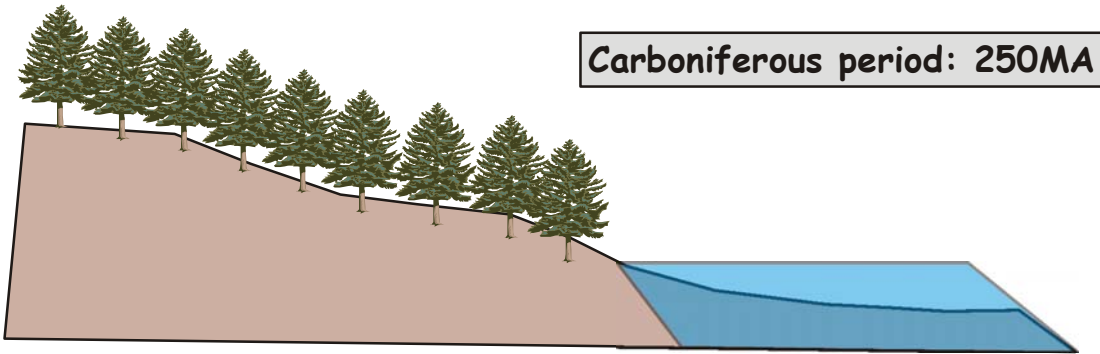
②

Print and photocopy the worksheet on the [following page](#). Explain that this shows the various stages in the production of coal arranged in the wrong order.

③

Get children to cut out the diagrams and stick them into their exercise book in the correct order.

8H3 Formation of coal

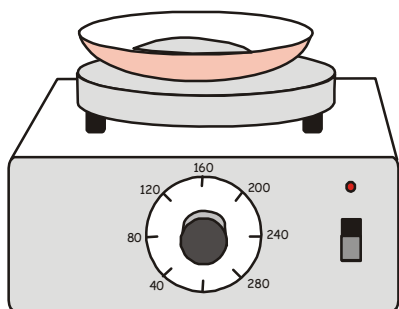


8H14 Growing crystals from Solol

Hotplate Spatula Solol Ceramic dish Ice bath Stopwatch Tongs Freezer Large plastic lid

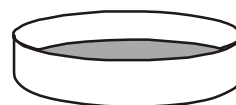
1

Add three measures of Solol to a watch glass and heat on a hotplate set to just above its melting point at 45°C.



2

Freeze some water in a petri dish or large plastic container lid to help cool the liquid Solol.



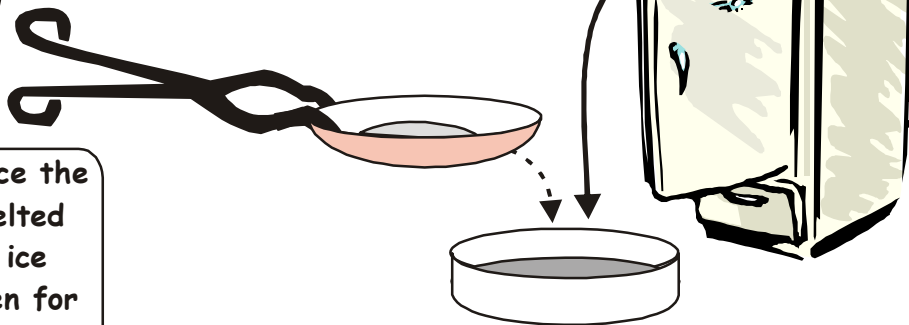
Set hot plate to 48°C

Wear safety goggles.

3

FAST COOLING

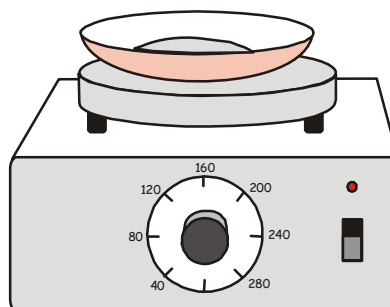
Using a pair of tongs place the watch glass containing melted Solol in contact with the ice and record the time taken for it to completely solidify.



4

SLOW COOLING


Heat the Solol until melting, as before, but this time simply turn the hot plate off and leave the Solol to solidify slowly recording the time taken.



Set hot plate to 48°C

What is the effect of fast cooling on the crystal grain size?

What is the effect of slow cooling on the crystal grain size?.....

9E Metals and Metal Compounds	
	Why are metals useful?
9E1	Internet survey: Uses of metals
9E2	Internet survey: Physical properties
9E3	Malleability of metals
9E4	Hardness of metals
9E5	Density of various metals
	What happens when metals react with acids?
9E6	Metals and acids: Magnesium, Zinc and Tin
9E7	Speeding up the reaction: Zinc and Zinc dust
	How do acids react with metal carbonates?
 9E8	Reaction of metal carbonates with acids
	Evidence of chemical reactions between acids and metal oxides?
9E9	Reaction of Copper Oxide with Sulphuric acid
9E10	Cleaning old coins
9E11	Reaction of Zinc Oxide with Hydrochloric acid
9E12	Reaction of Iron III Oxide and Hydrochloric acid
	What is a salt?
9E13	Construct a lattice of Sodium Chloride
9E14	Salts - part I
9E15	Salts - part II
9E16	The flame test
9E17	Making salts using a burette: part I
9E18	Making salts using a burette: part II
9E19	Making salts: card activity
9E20	Internet survey: Useful salts
9E21	The halide test

9E8 Reaction of metal carbonates with acids

Test tube 16 mm x2 Tubing/connector Bung: one hole Spatula Sodium Carbonate Limewater

①

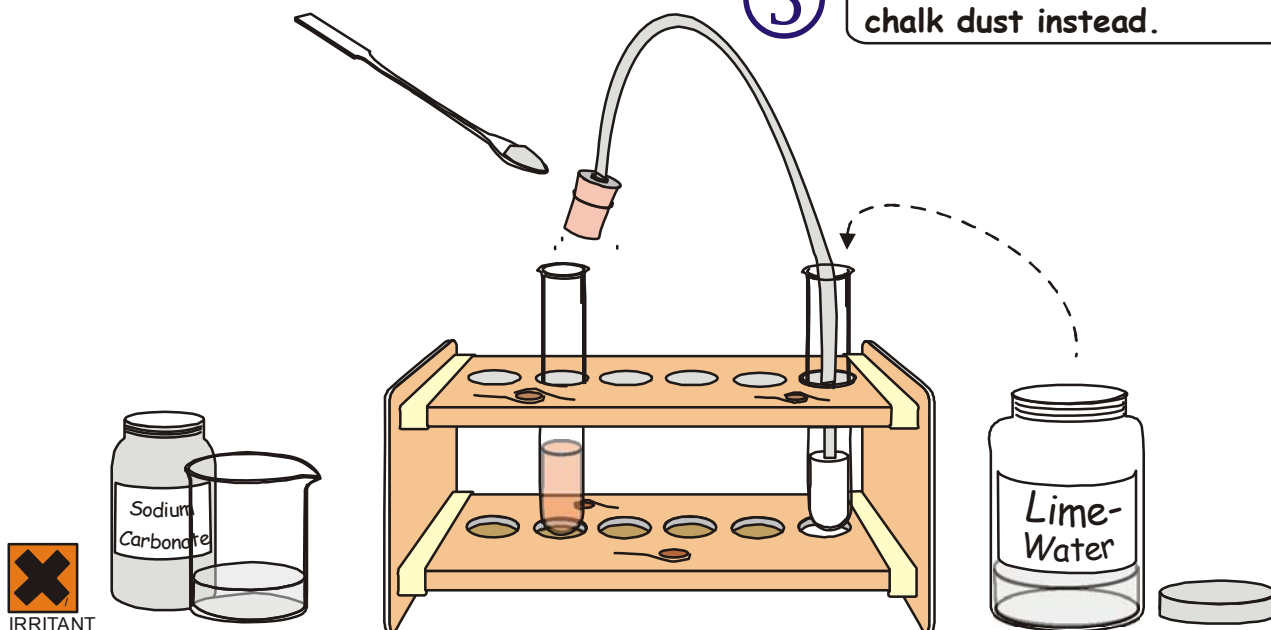
Introduce half a measure of Sodium Carbonate into a test tube with vinegar and observe what happens.

②

Observe what happens to the lime water solution [see [expt 7F10](#)].

③

Repeat the experiment using chalk dust instead.



What happens when the Sodium Carbonate is added to an Acid?.....

What happens to the lime water?.....

What does this tell you?.....

Complete the following: When a Metal Carbonate reacts with an Acid a is produced called, which causes limewater to turn white.

What is the chemical name for chalk?.....


What is its formula?.....

Write down the word equation for the reaction of chalk with HCl:

..... + → +

Find out how chalk was formed.

.....

<h1>9F Patterns Of Reactivity</h1>	
Why do metals tarnish?	
9F1	Tarnishing of alkali metals
9F2	Tarnishing of Copper
How do metals react with water?	
9F3	Reaction of alkali metals with water
9F4	Reaction of metals with water: Teacher demo
9F5	Reaction of Magnesium Oxide with water
Is the order of reactivity of metals with water and acids?	
9F6	The reactivity rhyme
Can we make predictions about the reactions of metals with Oxygen?	
9F7	Reaction of Magnesium with Oxygen: Teacher demo
9F8	Reaction of Copper with Oxygen
9F9	Reaction of Zinc with Oxygen
9F10	Burning alkali metals I
9F11	Burning alkali metals II
Can metals displace each other?	
9F12	Displacement of Iron ions from Iron II Sulphate
 9F13	Displacement by various metals
9F14	Thermite: Iron III Oxide and Aluminium: Preparation
9F15	Thermite: Iron III Oxide and Aluminium: Reaction
9F16	Reaction: Magnesium powder and Silver Nitrate
9F17	Displacement of Silver from Silver Nitrate
How does the activity series relate to uses and sources of metals?	
9F18	Reduction of Copper II Oxide with Carbon
9F19	Reduction of Iron III Oxide with Carbon
9F20	Reduction of Lead II Oxide with Carbon
9F21	Reduction of Lead Oxide with Hydrogen
9F22	Cell electrodes and the reactivity series

9F13 Displacement by various metals

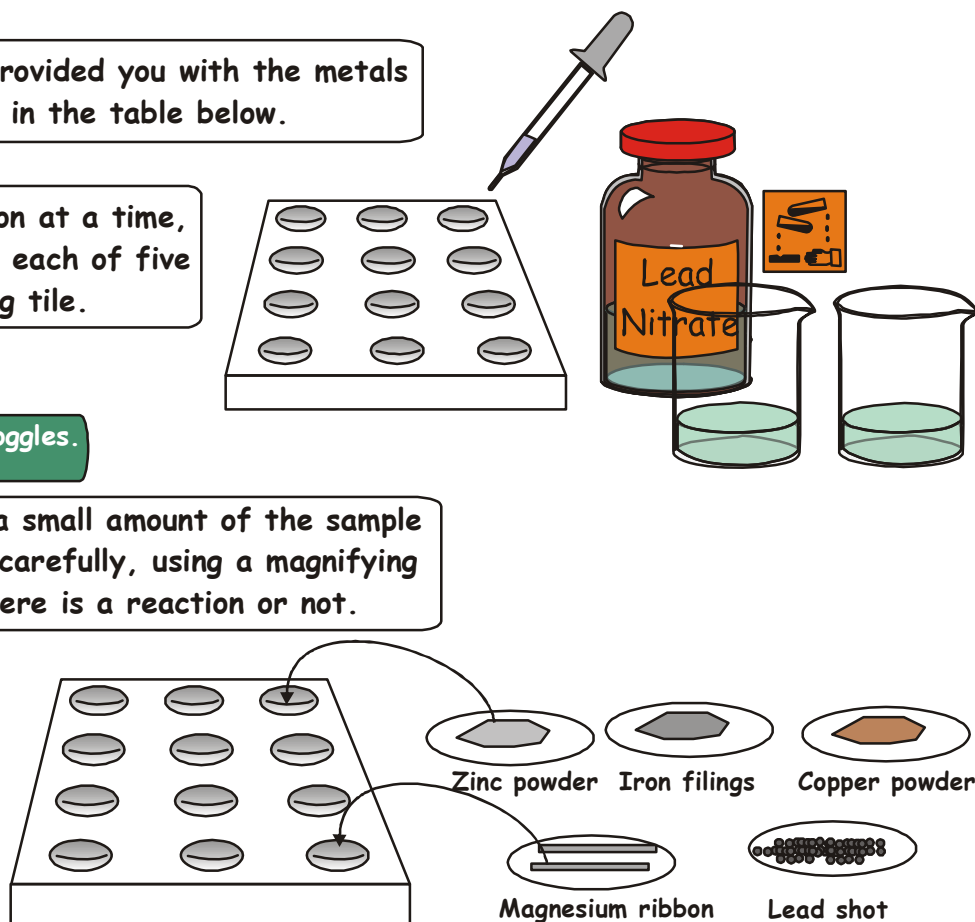
Dropping tile Pipette Beakers 100 ml Metal samples listed below Salt samples listed below

① Your teacher has provided you with the metals and solutions listed in the table below.

② Choosing one solution at a time, add three drops to each of five wells in the spotting tile.

 Wear safety goggles.

③ To each well add a small amount of the sample metals and watch carefully, using a magnifying glass, to see if there is a reaction or not.




Fill in the results table below. Put a "tick" if a displacement reaction takes place. Put a "cross" if no reaction takes place.

	Copper	Iron	Lead	Magnesium	Zinc	
Copper Sulphate	X					
Iron Sulphate		X				
Lead Nitrate			X			
Magnesium Sulphate				X		
Zinc Sulphate					X	

Use the table to place the metals in order of reactivity:

1:..... 2:..... 3:..... 4:..... 5:..... 6:.....

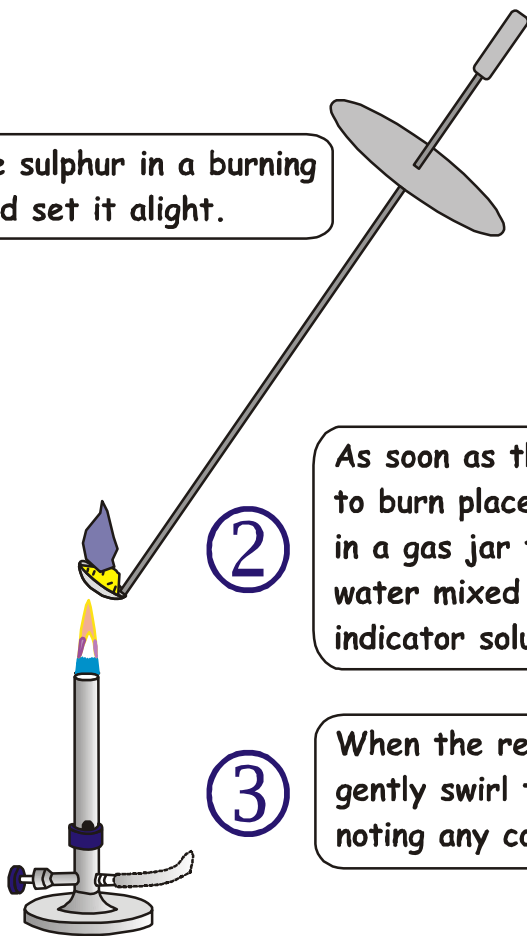
	9G Environmental Chemistry
	How are soils different from each other?
9G1	Make an environmental map of your school grounds
9G2	Investigating the components of soil
9G3	How much air is in soil?
9G4	Humidity of soil
9G5	Measuring the pH of soils
	What happens to rocks and building materials over time?
9G6	Erosion of rocks and buildings
9G7	Acid erosion of rocks
9G8	What is concrete made of?
	What causes acid rain?
9G9	Molecules that contaminate the atmosphere
	9G10 Formation of acid rain from Sulphur Dioxide
9G11	Formation of acid rain from Carbon Dioxide I
9G12	Formation of acid rain from Carbon Dioxide II
	What are the effects of acid rain and how can they be reduced?
9G13	Hard and soft water - part I
9G14	Hard and soft water - part II
9G15	Stop acid rain poster
	Is global warming happening?
9G16	Examining data (excel project)

9G10 Formation of acid rain from Sulphur Dioxide

Gas jar Burning spoon Sulphur Indicator solution Bunsen burner

①

Put some sulphur in a burning spoon and set it alight.

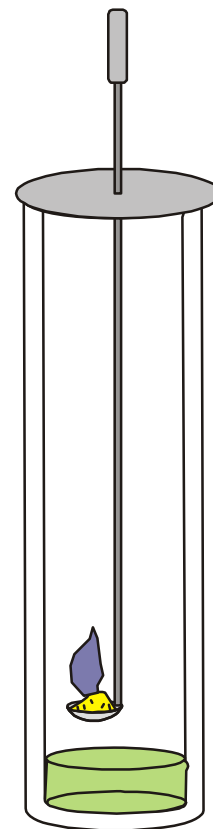



②

As soon as the sulphur starts to burn place the burning spoon in a gas jar that contains some water mixed with universal indicator solution.

③

When the reaction has stopped, gently swirl the solution around noting any colour changes.



 Wear safety goggles.
Fume cupboard.

What is the colour of the flame produced when Sulphur burns?.....

What is the name of the gas formed when Sulphur burns in air?.....

Write down the word equation for this chemical reaction:

..... + → ↑

What happens to the indicator solution?.....

What does this tell you?.....


Write down the word equation for the chemical reaction between the gas and water:

..... + →

Name the product formed.

Find out the names and sources of some of the gasses that produce acid rain:.....

.....

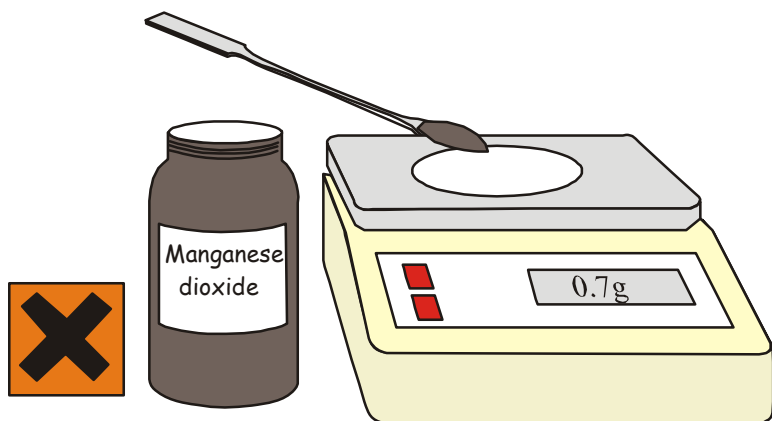
9H Using Chemistry	
	What chemical reactions take place when fuels burn?
9H1	Combustion of Hydrogen
9H2	Combustion of Butane
9H3	Combustion of Sugar
9H4	Production of Oxygen I
9H5	Production of Oxygen II
9H6	Test for Oxygen
9H7	Combustion of Carbon
	How else are chemical reactions used as energy resources?
9H8	Voltaic cells
	9H9 Genie in a bottle
9H10	Glycerol and Potassium Permanganate
9H11	Endothermic reactions: Vinegar and baking powder
9H12	Exothermic reactions: Copper Sulphate and Zinc
	What types of new material are made through chemical Reactions?
9H13	Chemical reactions and your home
	What happens to atoms and molecules when new materials are made?
9H14	Conservation of mass I
9H15	Conservation of mass II
9H16	Balancing simple equations: Teacher presentation
9H17	Conservation of mass : Chalk and Hydrochloric acid

9H9 Genie in a bottle

Large conical flask 500 ml Hydrogen peroxide 30% Manganese dioxide Filter paper Electronic balance Splints

① Pour about 100ml of 30% Hydrogen Peroxide solution into a conical flask.

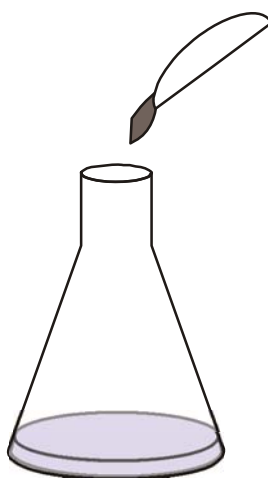
② Add about 1g of Manganese Dioxide to some filter paper.



⚠ Avoid breathing dust.

③ Pour the Manganese Dioxide into the Hydrogen Peroxide solution and **STAND WELL BACK**.

④ Perform the smouldering splint test (**expt 9H6**) on the gas present in the conical flask.



1. Violent reaction
2. Rapid release of Gas
3. Never allow reactants to mix in a sealed container
4. Keep pupils well back.
5. Practice the experiment in absence of pupils
6. Safety goggles

Which gas is released during this experiment?.....

How was the presence of this gas demonstrated?

In its diluted form Hydrogen Peroxide is also known as Oxygenated water. Write down its chemical formula below:

Hydrogen Peroxide:.....

In the presence of Manganese Dioxide, Hydrogen Peroxide will decompose rapidly into Oxygen and water. The Manganese Dioxide acts as a catalyst. What does that mean?

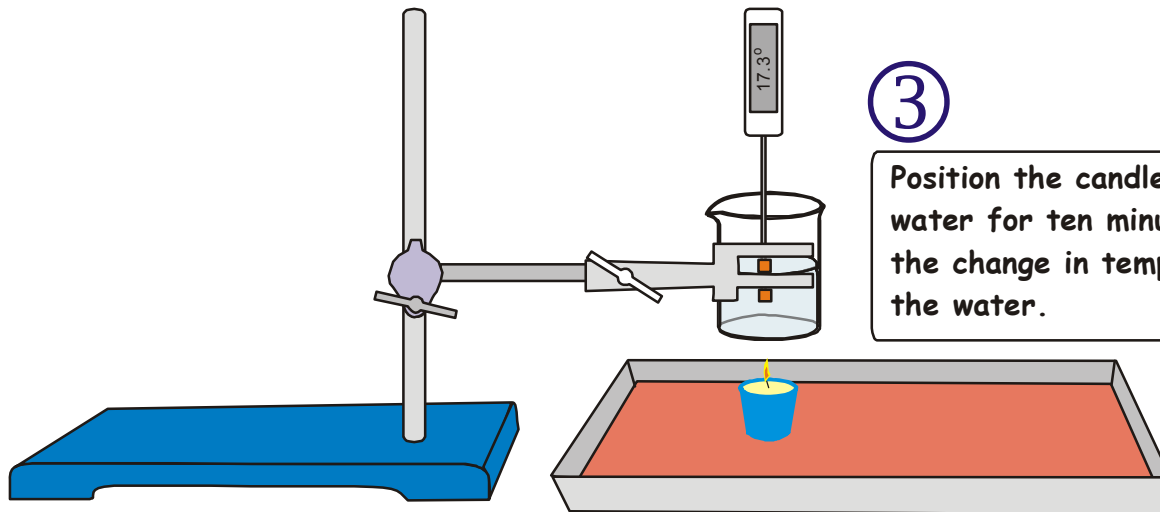
<h1>Unit 7I: Energy Resources</h1>	
	What is energy?
7I1	Energy can be stored - survey
7I2	Energy can be stored - photo survey
7I3	Energy changers - a survey
7I4	Energy can be transformed photo survey
7I5	Energy can be transformed - the light bulb
7I6	Energy can be transformed - the motor
7I7	Energy can be transformed - the heating element
7I8	Energy can be transformed - the solar cell
7I9	Energy can be transformed - the bouncy ball
7I10	Energy can be transformed - the steam engine
7I11	Energy can be transformed - Alka Seltzer ® bomb
7I12	The domino effect
7I13	Energy is lost in transformation - the pendulum
7I14	Energy is lost in transformation - the motor
	Why are fuels useful?
7I15	Energetic content of wax
7I16	Energetic content of Kerosene
7I17	Burning Hydrogen
	What are fossil fuels?
7I18	Formation of coal - cut out and paste
7I19	Formation of oil cut out and paste
7I20	Distillation of coal
	What are renewable energy resources?
7I21	Energy stores - the reservoir
7I22	How to make a solar powered fan
7I23	Construct a hydroelectric generator
7I24	Solar heater I
7I25	Solar heater II
	How do living things use energy?
7I26	Energy stores - food energy
7I27	Energetic content of peanuts and marshmallows
7I28	Electrolysis of water
7I29	Make an electrolysis kit

7I15 Energetic content of wax

Retort stand set 100 ml beaker Digital thermometer Candle Sand tray

①

Add 50ml of water to a 100ml beaker and clamp as indicated opposite.

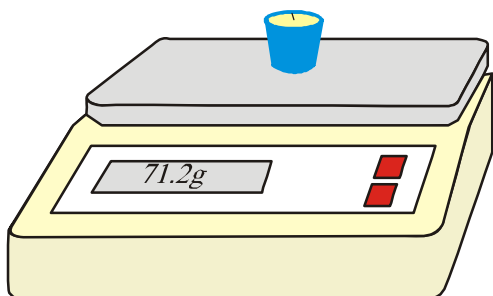


③

Position the candle under the water for ten minutes and note the change in temperature of the water.

 Use a sand tray.

Weigh candle before and after burning



②

Weigh a small candle before and after burning.

What was the mass of the water in the beaker?g

What was the initial temperature of the water?°C

What was the final temperature of the water?°C

If it requires 1 calorie to raise the temperature of 1g of water by 1°C how many calories were released by the candle?

.....

What was: a) the initial mass of the candle?.....g : b) the final mass of the candle?.....g

What was the mass of wax consumed while the candle burned?.....g

Use this information to calculate the calorific content of 100g of candle wax.

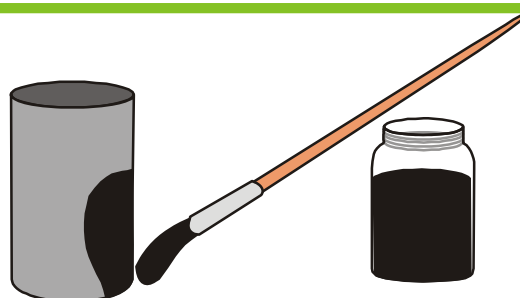
.....

.....

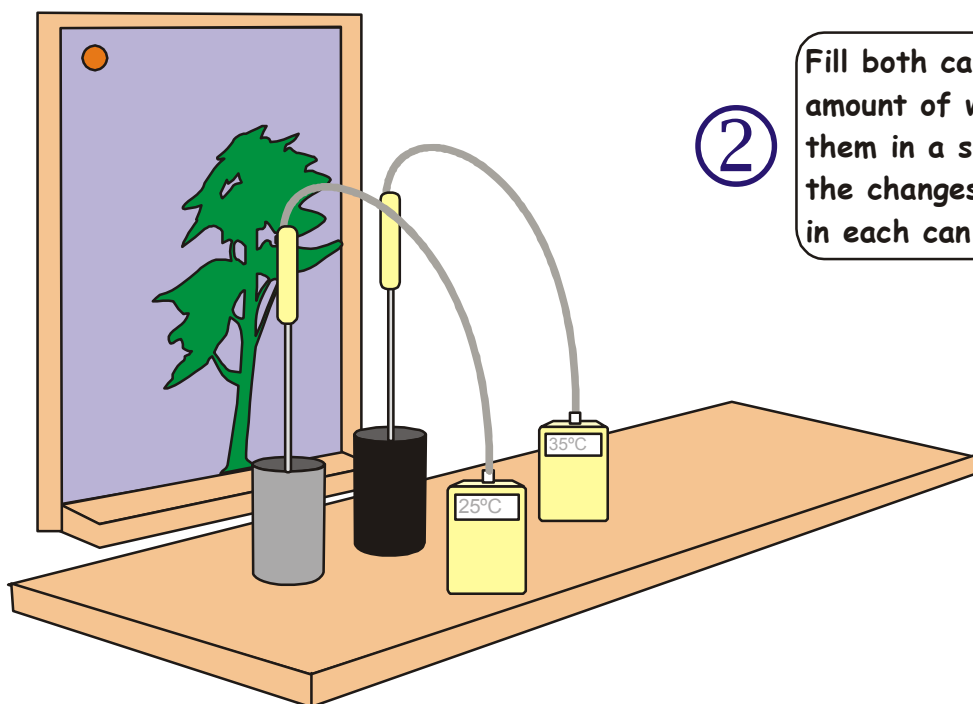
7I24 Solar heater I

Tin x 2 Black paint and paintbrush Digital thermometer

① Use two Aluminium cans. Paint one of them black.



② Fill both cans with the same amount of water and leave them in a sunlit window. Record the changes in temperature in each can.



Record the temperature every minute during ten minutes in the table below:

Time (min)	0	1	2	3	4	5	6	7	8	9	10
Temp (°C) (black can)											
Temp (°C) (control)											

Plot the results on the [graph provided](#).

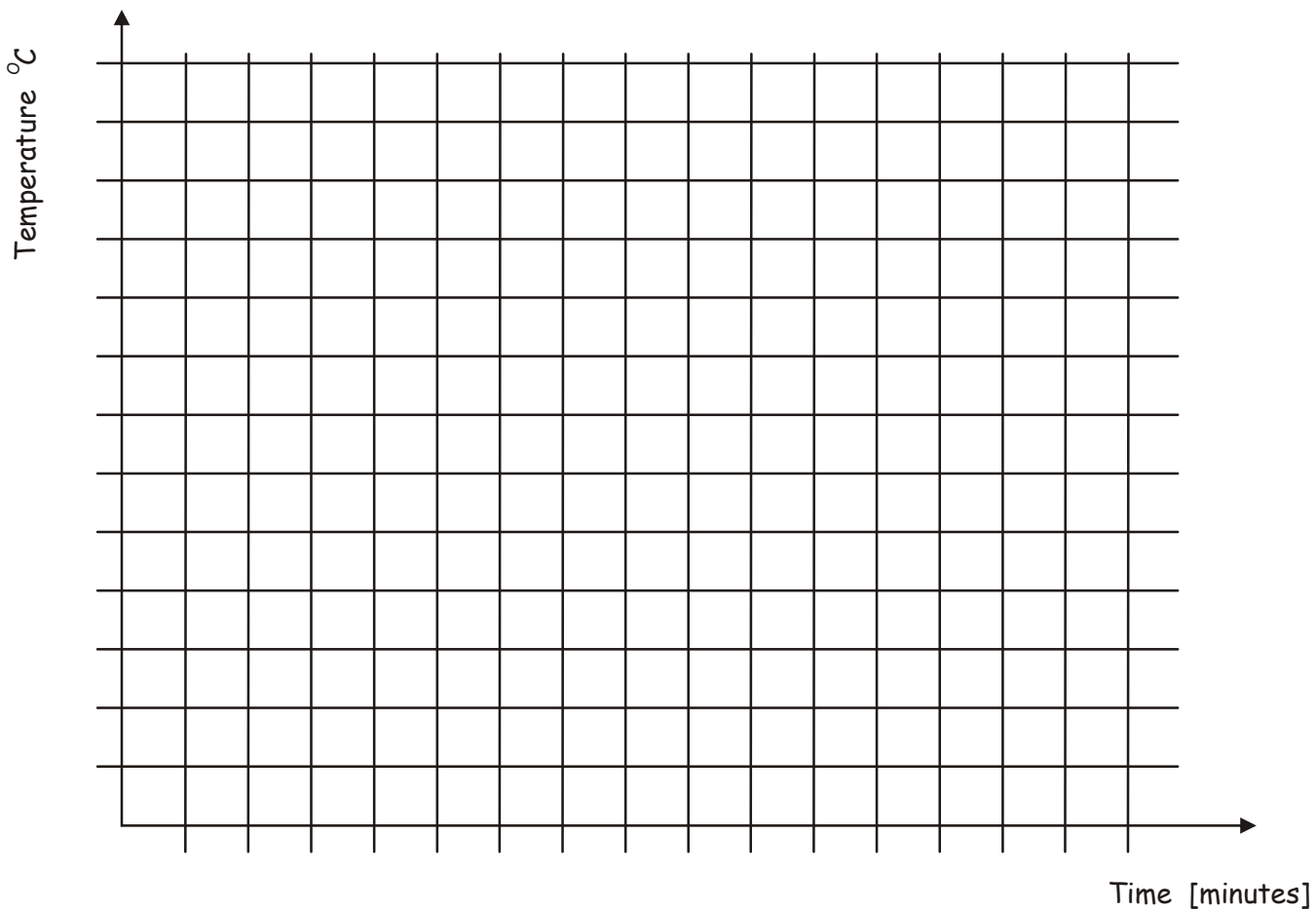
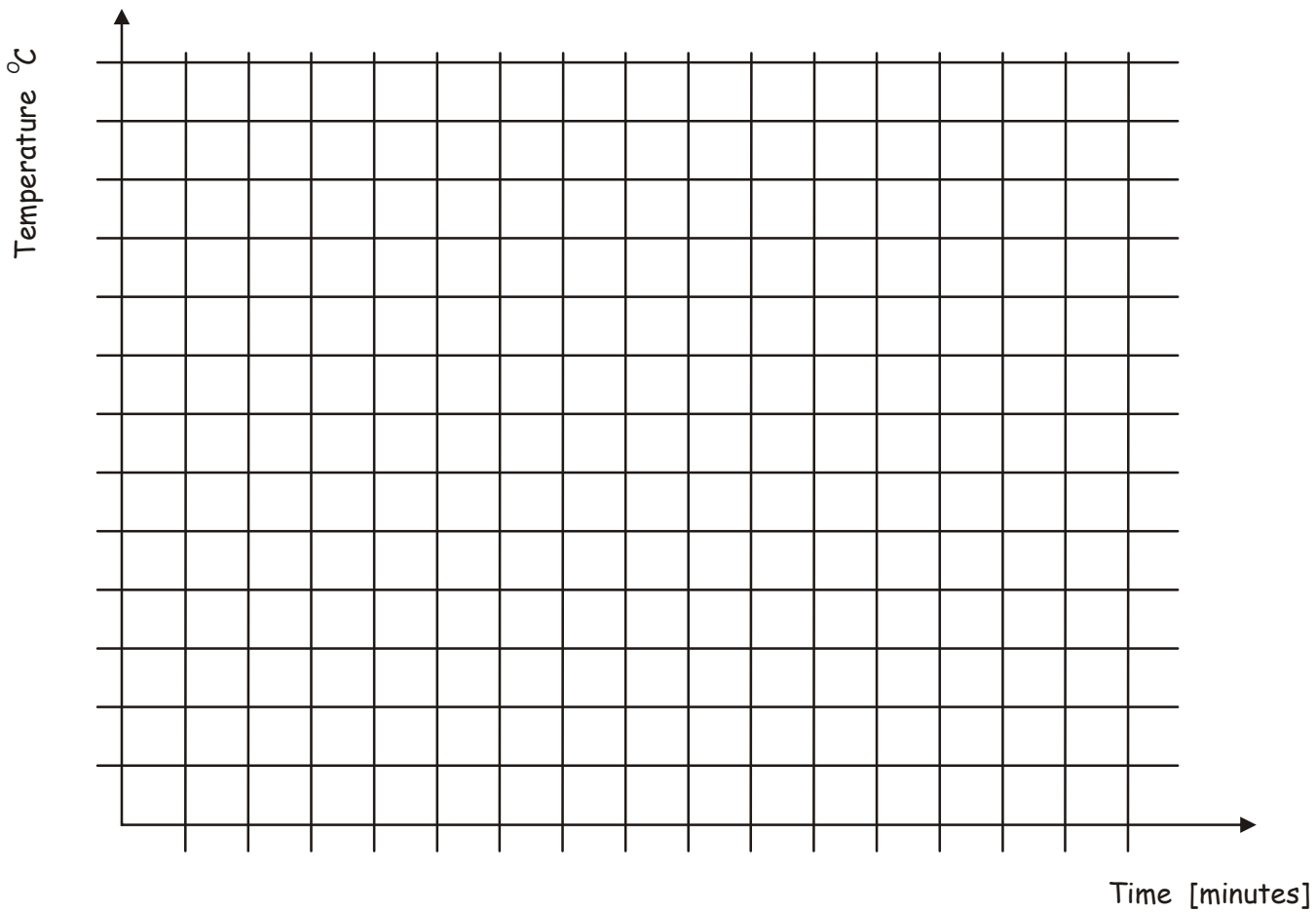
Why was it necessary to have a control in this experiment?

What steps were taken to insure that you carried out a fair test?

Do you notice any difference between the temperatures recorded in each case above?.....

Explain the differences:

7I24 Solar heater I



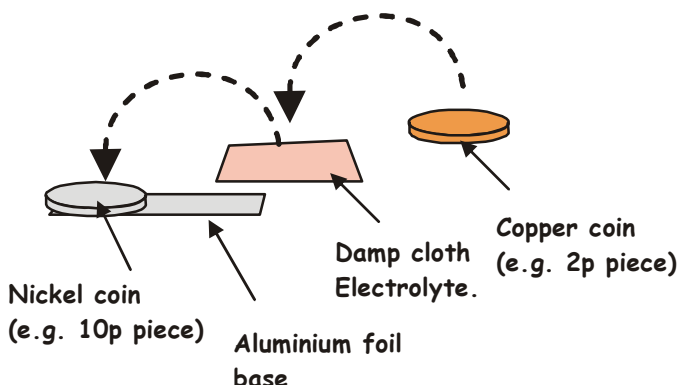
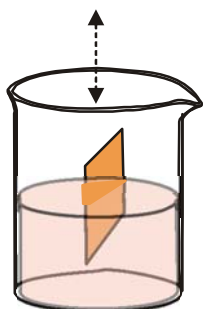
	Unit 7J: Electrical Circuits
	How do electrical circuits work?
7J1	Conductors and insulators
7J2	Electrolytes and non-electrolytes
7J3	Humans conduct
	What happens in a circuit?
7J4	Make a coin battery
7J5	Make a lemon battery
7J6	Different types of batteries
7J7	Find the fault
7J8	Connecting batteries (cells) in series
7J9	How does a light bulb work?
7J10	Connecting light bulbs in series
7J11	Connecting light bulbs in parallel
	How can we explain what happens in electrical circuits?
7J12	An analogy: the water circuit
7J13	Electrical potential - water circuit analogy
7J14	Electrical potential difference I - water circuit analogy
7J15	Electrical potential difference II - water circuit analogy
7J16	Electrical potential difference - thunder clouds I
7J17	Electrical potential difference - thunder clouds II
7J18	Electrical resistance I - water circuit analogy
7J19	Electrical resistance II - water circuit analogy
7J20	Build your own potentiometer
7J21	Using your potentiometer
	What kinds of circuits are useful and what are the hazards?
7J22	Make a quiz board
7J23	Morse code generator - the switch
7J24	Morse code generator - the circuit
7J25	Model ring main lighting circuit
7J26	Hall light switch
7J27	Blow the fuse
7J28	DPDT switch
7J29	The L.E.D
7J30	Current discriminator
7J31	Current discriminator and DPDT switch
7J32	Humidity detector I
7J33	Humidity detector II

7J4 Make a coin battery

Beaker 250 ml Voltmeter Cables + clips Copper and Iron/Nickel based coins Vinegar or lemon juice

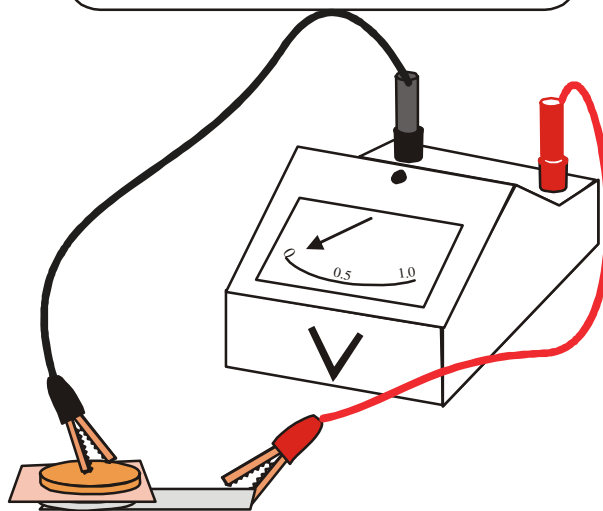
1

Dip some small sections of cloth in vinegar solution and use them to build a dry cell battery as shown below.



2

Measure the electrical potential difference (E.P.D) produced by the combination.



3

Add more cells to the stack and note the E.P.D produced.



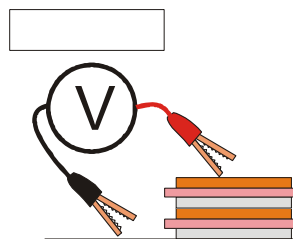
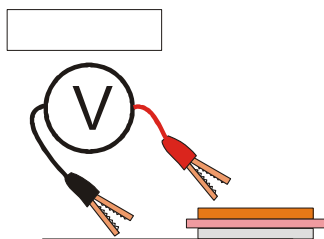
In the battery you have made, which coin represents the positive and which the negative electrodes?

Positive:..... Negative:.....

Why is it necessary to soak the cloth in an acid?

What happens if the coins you use are the same?

Measure the voltmeter reading produced by the combinations below:



What happens to the voltage generated as you increase the number of cells in the pile?

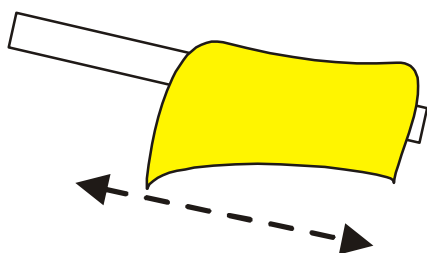
Unit 7K: Forces and their Effects	
	Where do we come across forces?
7K1	Four effects of a force
7K2	Survey of forces
7K3	How to isolate charges
7K4	Forces between charges
7K5	Build your own electroscope
7K6	Polarisation of a conducting sphere
7K7	Deflection of a jet of water
7K8	Attraction of a cereal flake
7K9	How to light a fluorescent tube with a ruler
7K10	Water tension
7K11	Measuring the magnetic force
7K12	Forces in structures
	Why do things float?
7K13	Floating: when forces are balanced
7K14	The up thrust
7K15	Floatability of an object and its density
7K16	The weight of an object in water
7K17	The up thrust produced by different liquids
7K18	Measuring the up thrust using a straw
7K19	Measuring the up thrust using a balance
7K20	Build a densometer
	How do different materials stretch?
7K21	Deformation of a spring
7K22	Comparing springs
7K23	Measure the tension in elastic bands
	What is weight?
7K24	Weight and mass I
7K25	Weight and mass II
7K26	Who can produce the biggest push?
	What does friction do?
7K27	A knot race
7K28	Spinning objects
7K29	Friction I
7K30	Friction II
7K31	Does the weight of an object affect its friction?
7K32	Friction and energy loss in a pendulum
7K33	Friction produces heat

7K8 Attraction of a cereal flake

Cereal flake (e.g. Sugar Puff ®) □ Cotton thread □ Stand set □ Duster □

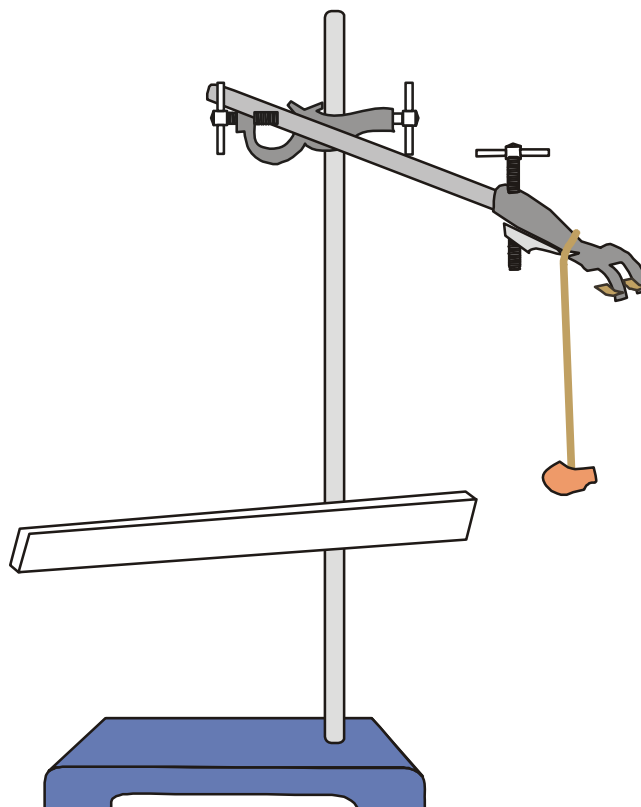
①

Negatively charge a perspex strip and bring it near to the cereal flake and observe what happens.



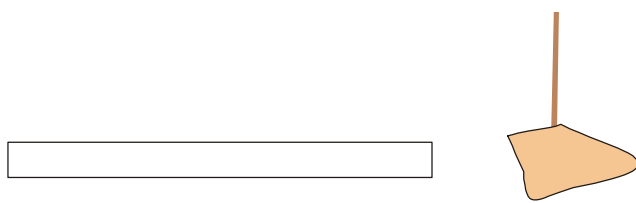
②

Suspend the cereal flake from the retort stand using cotton thread.



Describe what happens as you move the Perspex strip near to the cereal flake:.....

Indicate on the diagram below how the movement of electrons results in an interaction between the cereal flake and the Perspex strip.



Unit 7L: The Solar System and Beyond	
	What is the cause of a year, a month, a day?
7L1	Is the Earth flat? (Eratosthenes' s idea)
7L2	Sun - Earth - Moon model: diameter
7L3	Sun - Earth - Moon model: distance
7L4	Earth - Moon distance
7L5	What is a day?
7L6	What is a month?
7L7	What is a year?
7L8	Variation of hours of daylight with latitude
7L9	Variation of hours of daylight with latitude: data analysis
	How do we see the Sun and Moon?
7L10	Sun's passage viewed at different times of the year (Greenwich)
7L11	Sun's passage viewed from different latitudes (21st June)
7L12	Perspective
7L13	Phases of the Moon
7L14	Demonstrate solar and lunar eclipses using a torch
7L15	Estimate the Moon's diameter using a lunar eclipse
	What causes the seasons on Earth?
7L16	The temperature at the Earth's surface: solar altitude
7L17	The temperature at the Earth's surface: amount of daylight
7L18	UK solar changes throughout the year: data analysis
	What does the solar system consist of?
7L19	Internet survey of the solar system
	What is beyond the solar system?
7L20	Movement of the stars

7L15 Estimate the Moon's diameter using a lunar eclipse

Print and photocopy images on following page Compass and pencil

This photo below shows the initial phase of a Lunar Eclipse. You can see part of the circular shadow produced by the Earth as the Moon starts to enter into the eclipse.

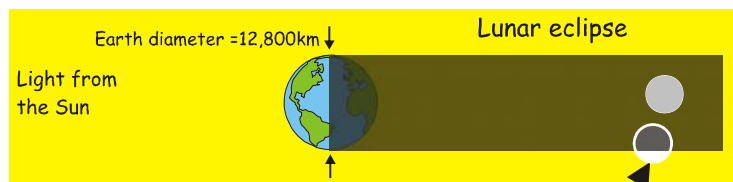


①

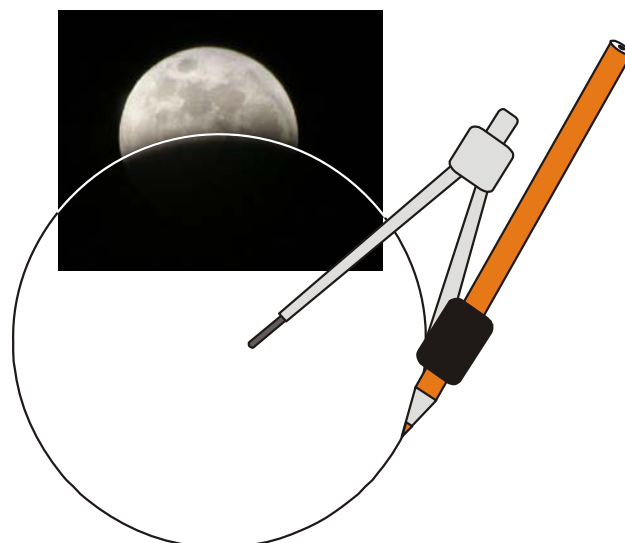
To find the diameter of the Moon you will need to compare the diameter of this shadow with the diameter of the Moon.

②

To do this use the template on the following page and experiment with a set of compasses and a ruler until you find circles that fit.



Use the method opposite to estimate the diameter of the Moon. Templates are provided on the [following page](#).



7L15 Estimate the Moon's diameter using a lunar eclipse



	Unit 8I: Heating and Cooling
	What is temperature?
8I1	Guess the temperature
8I2	Temperature is related to movement
	How do things get hotter or colder?
8I3	Transforming electrical energy into heat
8I4	Transforming light energy into heat
8I5	The Bunsen burner: transforming chemical energy into heat
8I6	Which flame is the hottest?
8I7	Heat flow and differences in temperature
8I8	Big cup - little cup: heat loss problem
8I9	Thermal equilibrium
8I10	A temperature map of your classroom
	How does heat flow from one place to another
8I11	Conductors and insulators
8I12	Conduction in different metals I
8I13	Conduction in different metals II
8I14	Conduction in different metals III
8I15	Convection in liquids
8I16	Convection - make a volcano
8I17	Inverse convection
8I18	Convection in air I
8I19	Convection in air II
8I20	Radiation - simulation of a greenhouse
8I21	The Leslie cube
	How do materials change when they are heated and cooled?
8I22	Expansion in gases
8I23	Expansion in liquids: teacher demo
8I24	Expansion in solids I: teacher demo
8I25	Expansion in solids II: teacher demo
8I26	Crushing can
	How can we reduce energy waste?
8I27	Insulation and cooling
	How can we explain change of state?
8I28	Changes of state
8I29	The effect of salt on the melting point of ice
8I30	Changes of state - evaporation I
8I31	Changes of state - evaporation II
8I32	Changes of state - condensation
8I33	Changes of state - melting: teacher demo
8I34	Changes of state - sublimation: teacher demo

8I11 Conductors and insulators

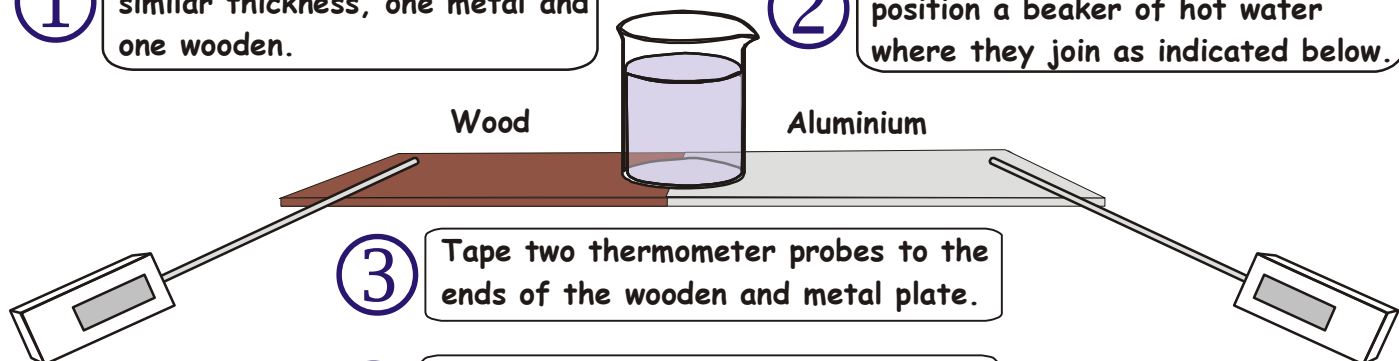
Beaker of hot water Wood strip Aluminium strip Digital thermometer x 2

①

Find two rectangular plates of similar thickness, one metal and one wooden.

②

Place the plates together and position a beaker of hot water where they join as indicated below.



③

Tape two thermometer probes to the ends of the wooden and metal plate.

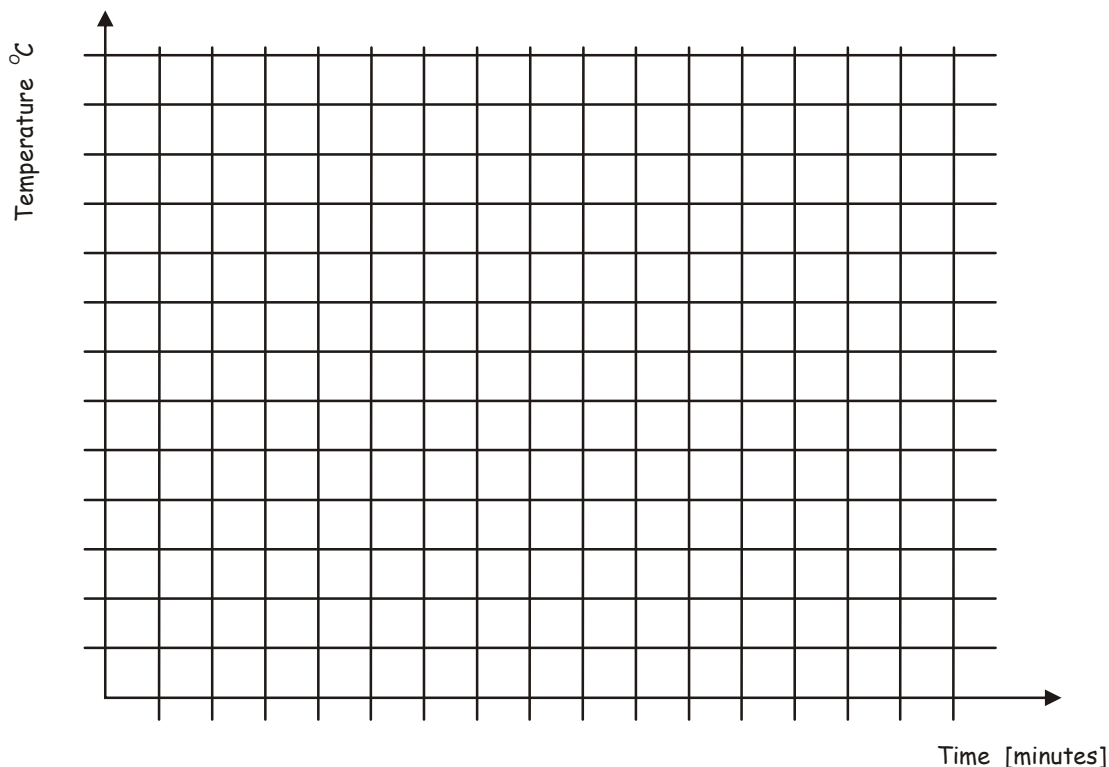
④

Record the temperature in 30 second intervals during a five minute period.

Record the temperature of the wood and Aluminium every 30 seconds for about five minutes:

Time (minutes)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	
Temp °C (Aluminium)												
Temp °C (Wood)												

Plot your measurements on the graph shown below:



Explain the results you obtained:

.....

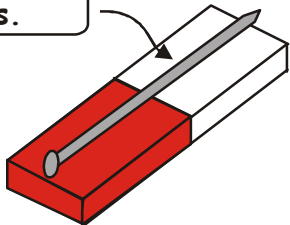
Unit 8J: Magnets and Electromagnets	
	What do magnets do?
8J1	What is a magnet?
8J2	Magnetic material for breakfast
8J3	Test the magnet
	Can magnetism be stopped? Can magnets be made?
8J4	How to create and destroy a magnet
8J5	Make a paper clip float
8J6	Magnetic shielding
	What is a magnetic field?
8J7	How to build a magnetic field viewer
8J8	Magnetic field of a bar magnet
8J9	Magnetic field of two bar magnets
8J10	Magnetic field of a horseshoe magnet
8J11	How to build a compass I
8J12	How to build a compass II
	How can electricity make a magnet?
8J13	The electromagnet
8J14	Oersted effect
8J15	Magnetic field in parallel conductors
8J16	Magnetic field of a solenoid
	How can magnetism make a electricity
8J17	The Faraday effect: a Neodymium magnet in a copper tube
8J18	Make a speaker telephone
8J19	How to make a simple motor

8J4 How to create and destroy a magnet

Bar Magnet Iron Nail Tongs Iron filings Bunsen burner Beaker 250 ml + cold water

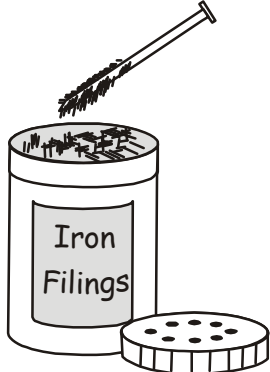
 Use a ceramic bench mat.

1 Leave a large nail on top of a permanent magnet for 5 to 10 minutes.

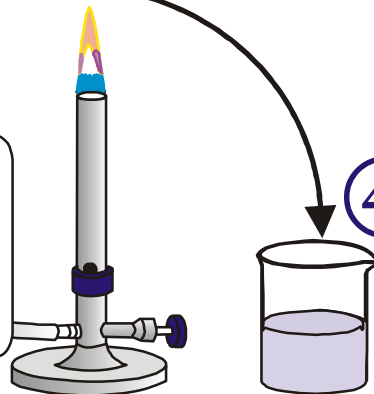


Iron nail

2 Observe how many iron filings the magnetised nail can pick up.

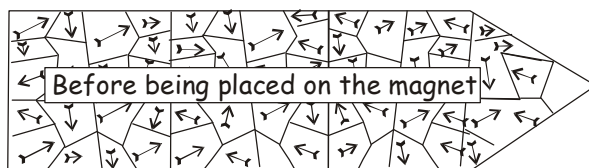


3 Remove the iron filings with a paper towel, heat the nail until red hot then cool rapidly in cold water. Repeat two or three times.

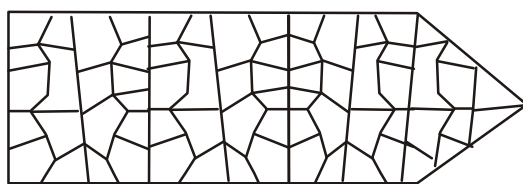


4 Now test the magnetism of the nail by repeating step two above.

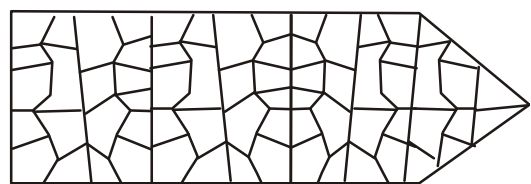
The nail is made of iron which is a magnetic material and consists of billions of small magnetic crystal domains (regions) which are normally disorientated :



Sketch what happens to the orientation of these domains after the nail has been left on a permanent magnet and then after heating and cooling:



After leaving on the permanent magnet



After Heating and Cooling

Explain why heating and cooling a magnet destroys its magnetism?.....

.....

	Unit 8K: Light
	How does light travel?
8K1	Light travels in straight lines
8K2	Light travels in straight lines: shadows
8K3	Light is energy
8K4	Transverse and longitudinal waves
	What happens when light meets an object?
8K5	Transparent, translucent or opaque
8K6	Optical properties of diffusers
	How do we see things? Vision?
8K7	Reflecting light from a yoghurt carton
8K8	Vision - accommodation
8K9	Vision - blind spot
8K10	Vision - integration time
8K11	Binocular vision - field of view
8K12	Integration time: colours on a spinning top
	How do mirrors reflect light?
8K13	The law of reflection
8K14	Multiple reflections
8K15	The retro reflector
8K16	Mirrors
	How are images formed?
8K17	How to make a viewing screen
8K18	How to make a Fresnel lens holder
8K19	How to make a pinhole (shoebox) camera
8K20	Viewing a pinhole camera image
8K21	Project an image of your classroom window
8K22	Form an image of a flame
8K23	Projection of an image onto a screen I
8K24	Projection of an image onto a screen II
8K25	The overhead projector
8K26	Virtual images : a pencil trick
8K27	Make the coin disappear
	Can light be bent?
8K28	Refraction of light
8K29	Convergent and divergent lenses
8K30	Build a beam expander
8K31	Measuring the focal length of various lenses
8K32	Combinations of thin lenses

	What is a spectrum?
8K33	Investigate the colour spectrum
8K34	Prisms and colour
	How can we change colour?
8K35	How to make a light filter
8K36	Filters
8K37	How to make white light
8K38	Mixing colours I - paints
8K39	Mixing colours II - ink jet printer

8K21 Project an image of your classroom window

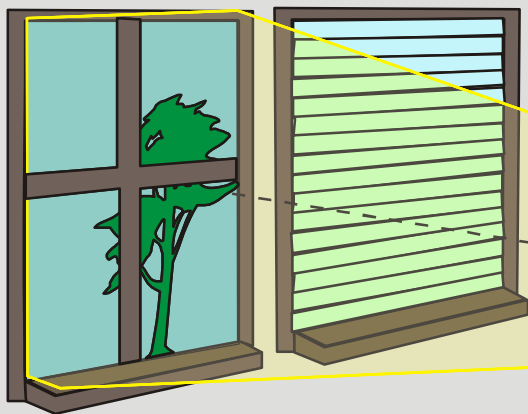
Magnifying glass or lens Viewing screen

1

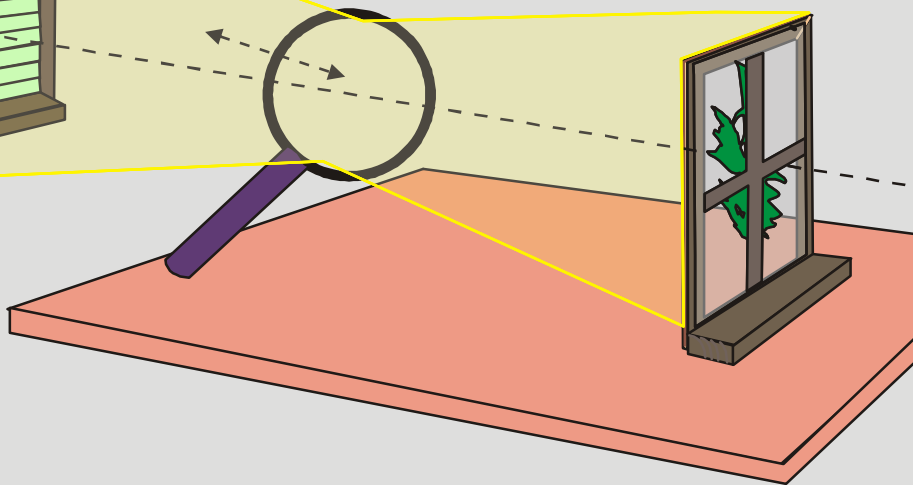
Turn off the light and pull the blinds down except for one window which will act as an illuminated object.

2

Move the lens towards and away from the screen until you see the image of the window.



Window acts as infinity object.



Is the image formed a real or virtual image?.....

How is the image orientated w.r.t the object?.....

The paraxial rays are those that pass from the object through the centre of the lens to the image plane and are not bent by the lens. These have been drawn for you (dotted lines) below.

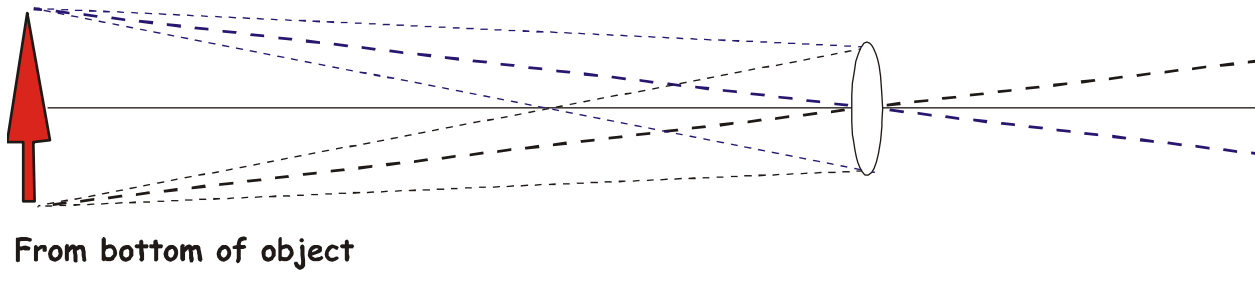
a) Trace the other rays through to the image plane.

b) Draw the image of the arrow in the image plane

Image

From top of object

From bottom of object

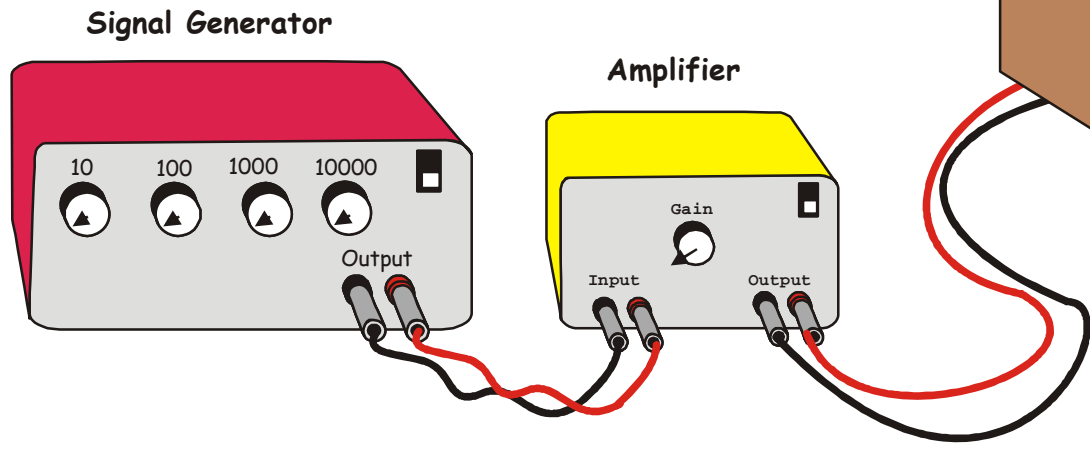
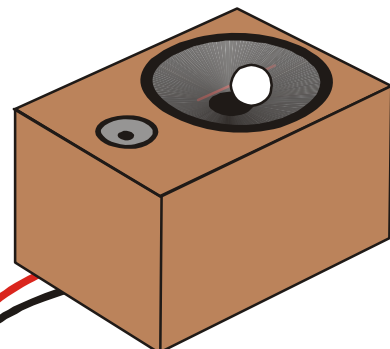


	Unit 8L: Sound and Hearing
	How are different sounds made?
8L1	The orchestra – loudness and pitch
8L2	Good vibrations I
8L3	Good vibrations II
8L4	Vibrations in a speaker
8L5	Pitch and length of a spring
8L6	Pitch and mass of a spring
8L7	Vibrations in a ruler
8L8	Standing waves
	How does sound travel through solids, liquids and gases?
8L9	Sound in a vacuum
8L10	Sound in liquids
8L11	Sound in solids
8L12	Absorption of sound
8L13	Use a slinky to demonstrate a sound wave
8L14	Sound in a string
	How do we hear sounds?
8L15	Model of the ear
8L16	Hearing range - frequency response
8L17	Are two ears better than one?

8L4 Vibrations in a speaker

Speaker Signal generator Amplifier Ping pong ball

- ① Turn a speaker on its side and place a ping pong ball in the cone as indicated below.
- ② Connect the speaker to a signal generator and amplifier.
- ③ Vary the frequency and observe what happens to the ping pong ball.
- ④ Vary the gain of the amplifier and observe what happens to the ping pong ball.



What vibrates in a speaker unit?

How does the frequency effect the behaviour of the ping pong ball?

What happens to the ping pong ball when you increase the gain of the amplifier?

Write the words "frequency" or "gain" along side the following:

The height of the ping pong ball:

How often the ping pong ball bounces:

The loudness of the sound:

The pitch of the sound:

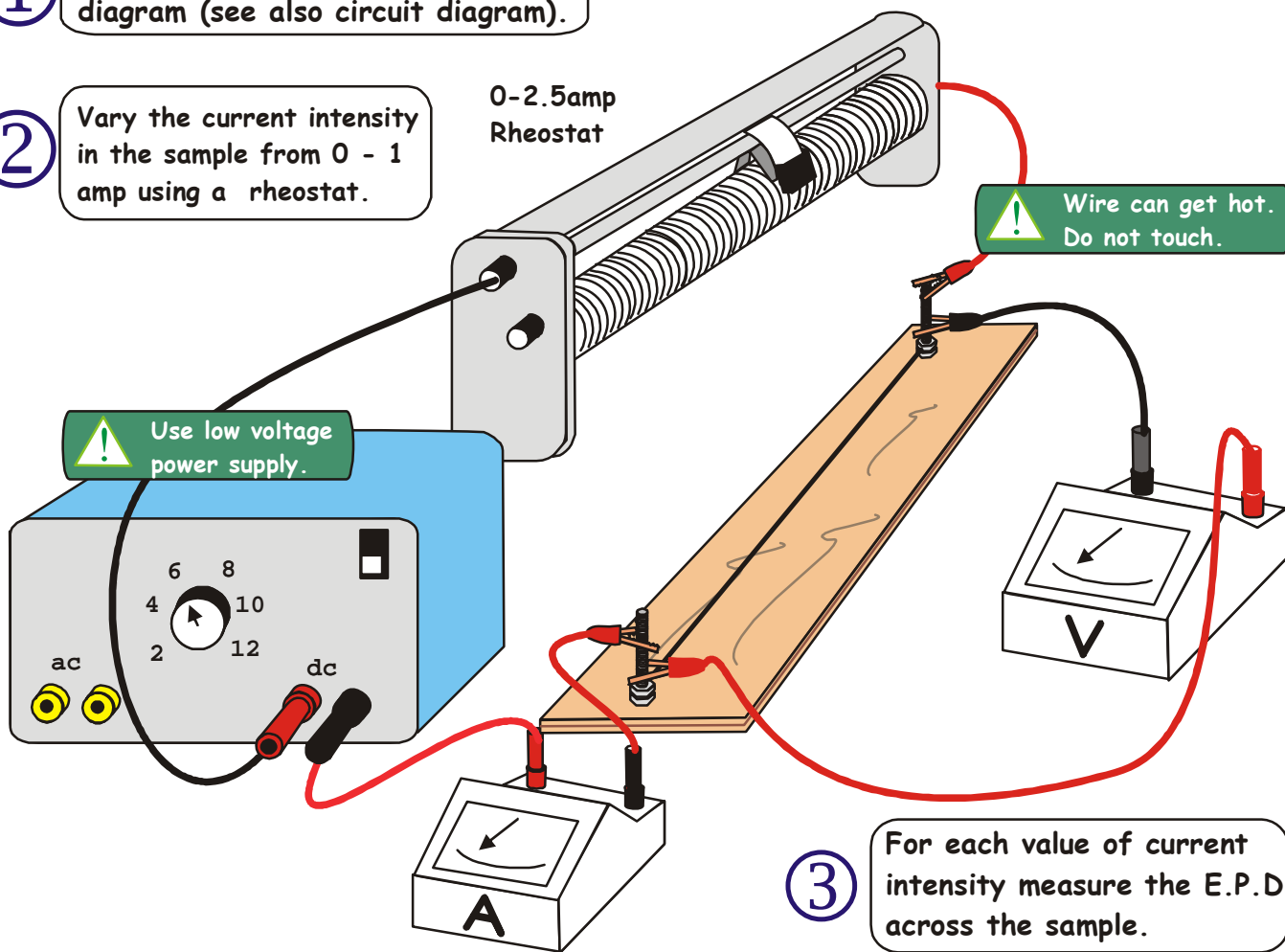
	Unit 9I: Energy and Electricity
	How is energy involved in doing useful things?
9I1	Survey of energy changers
	How does electricity transfer energy?
9I2	Monsieur Coulomb: an introduction
9I3	Monsieur Coulomb: the cell
9I4	Monsieur Coulomb: current intensity
9I5	Monsieur Coulomb: energy transfer
9I6	Investigating a voltaic cell - the electrodes
9I7	Inside a 4.5V flat pack battery
9I8	Inside a dry cell
9I9	Series circuits
9I10	Parallel circuits
9I11	Investigation of Ohm's law
9I12	Ohm's law for a light bulb
9I13	Find the hidden resistance - using Ohm's law
9I14	Find the hidden resistance - quick method
9I15	The resistor code
9I16	Resistance of a conductor I
9I17	Resistance of a conductor II
9I18	Resistance of a conductor III
9I19	Resistance and heat: teacher demo
	What are we paying for when we use electricity?
9I20	Monsieur Coulomb: energy transformed by a component
9I21	Energy transformation in light bulbs
9I22	Calculate your energy bill
	Where do we get electricity from?
9I23	Energy changers - the dynamo
9I24	Connecting solar cells in series
9I25	Connecting solar cells in parallel
9I26	Build a solar panel
9I27	From power station to plug socket

9I11 Investigation of Ohm's law

Low voltage P/S Rheostat 0- 2.5 amp Cables + clips Voltmeter Ammeter Constantan cable 0.2 mm diam.

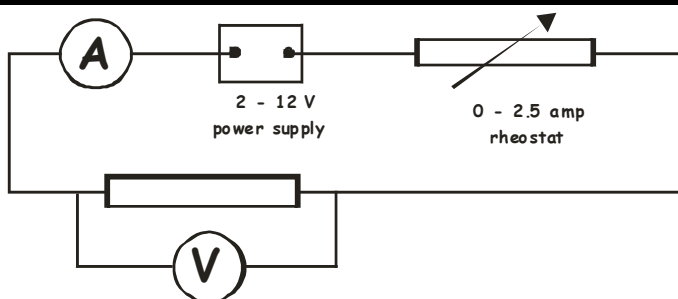
① Set up the circuit as shown in the diagram (see also circuit diagram).

② Vary the current intensity in the sample from 0 - 1 amp using a rheostat.



③ For each value of current intensity measure the E.P.D across the sample.

Vary the current in steps of 0.1 amps by adjusting the rheostat contact. For each current reading measure the electrical potential difference (E.P.D) across the resistance in the table below:

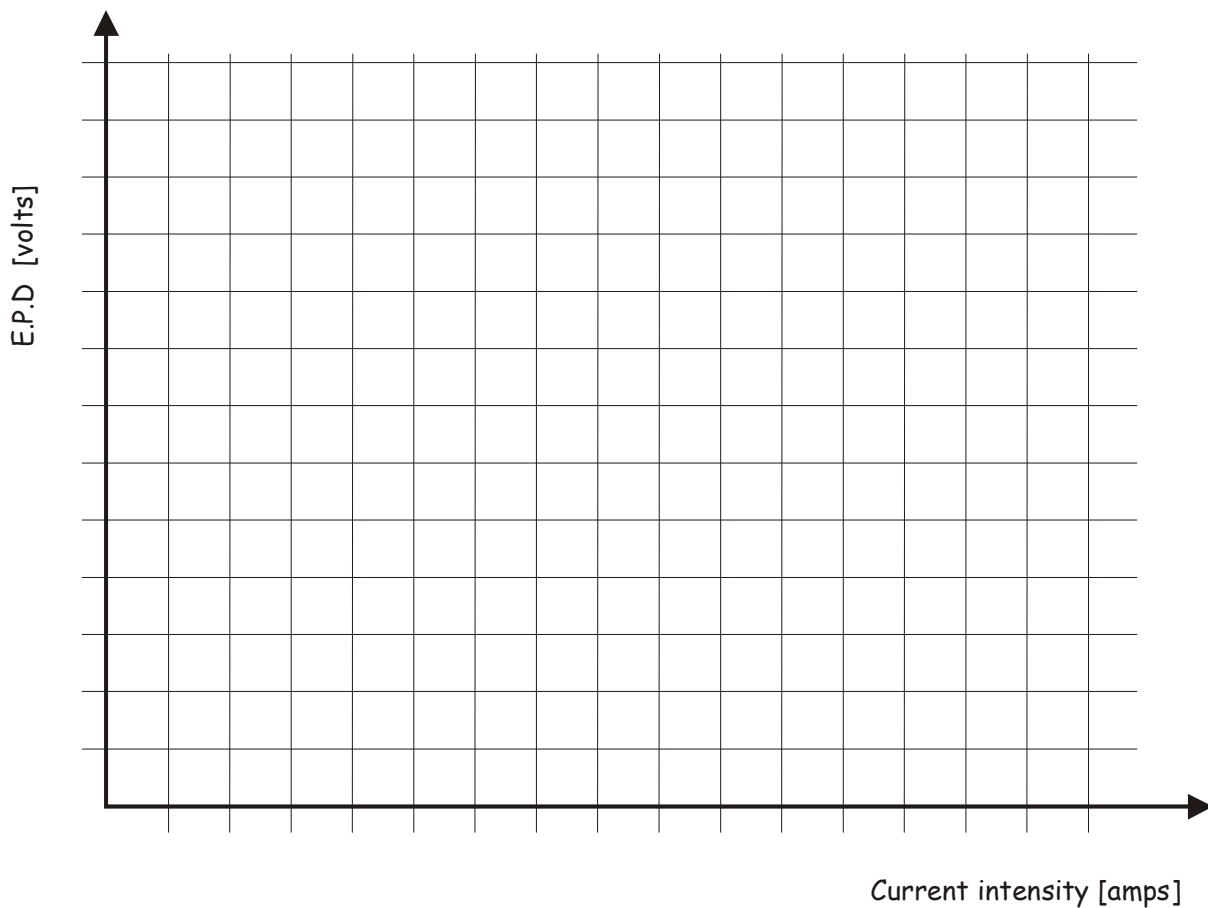
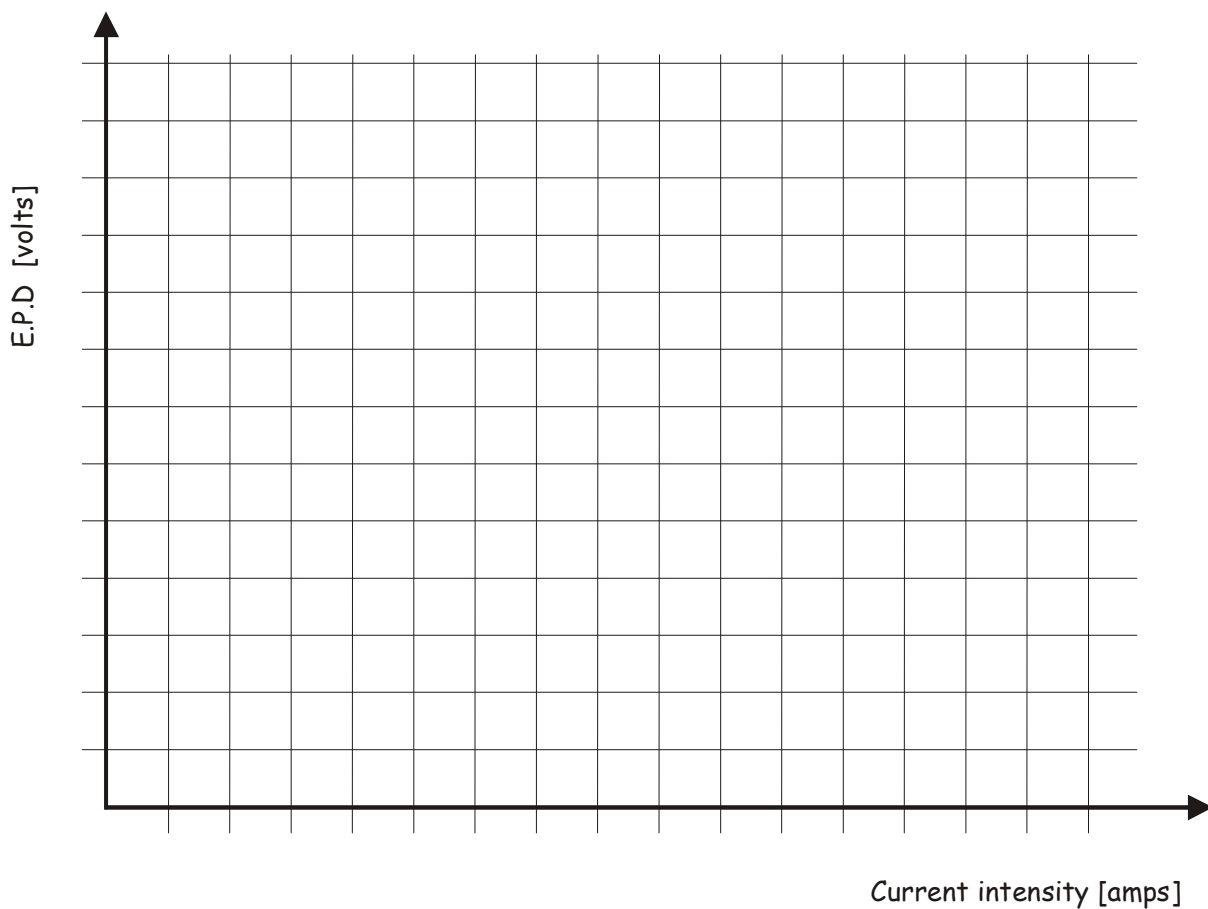


Current Intensity (amps)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
E. P. D across resistance (Volts)											

Plot a graph of the variation of current intensity with electrical potential difference across the resistance.

Use the graph to estimate the resistance of the sample.

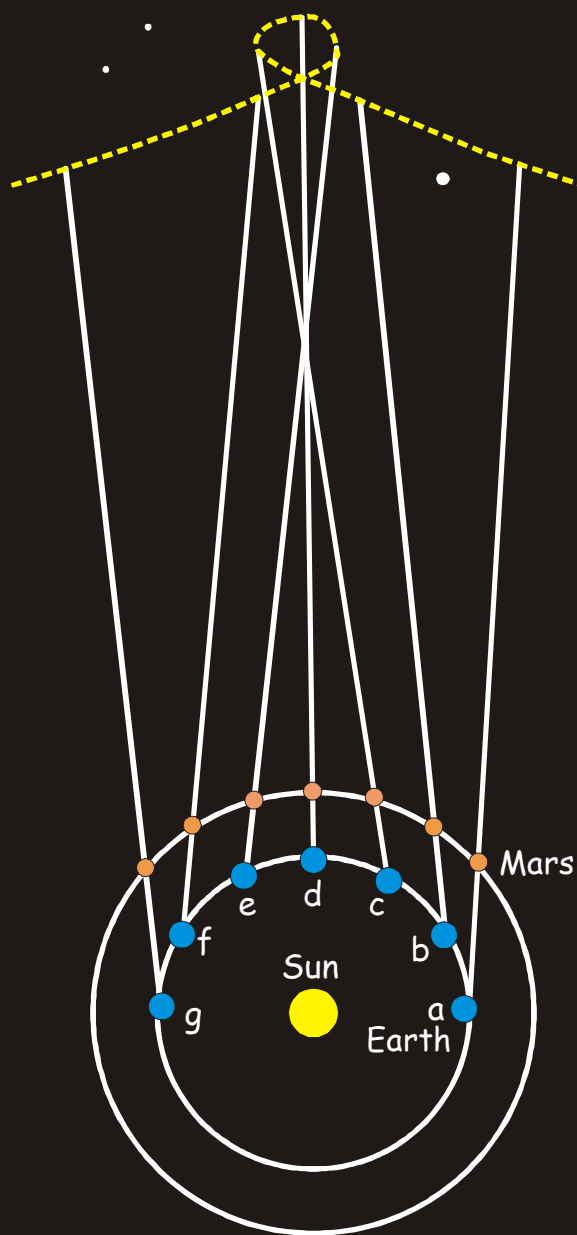
9I13 Find the hidden resistance - using Ohm's law



	Unit 9J: Gravity and Space
	What is gravity?
9J1	Gravity and inertia
9J2	The hammer and feather experiment
9J3	Measuring the acceleration due to gravity I
9J4	Measuring the acceleration due to gravity II
	How does gravity change?
9J5	Internet survey: gravity on different planets
	How have our ideas about the solar system changed?
9J6	The Geocentric model: Aristotle and Ptolemy
9J7	Anomalies I: The apparent motion of Mars
9J8	Anomalies II: The phases of Venus
9J9	The Heliocentric model: Copernicus
	What keeps the planets and satellites in orbit?
9J10	Newton's thought experiment
9J11	Escape velocity
9J12	What keeps a satellite in orbit?

9J7 Anomalies I: The apparent motion of Mars

IWB Print and photocopy work sheet on the [following page](#)



①

Use **the template** on the following page. This shows six positions of the Earth and Mars in their orbits around the Sun.

②

To view the apparent movement of Mars draw lines of equal length through the six positions of Earth and Mars and join up the ends of each line.

What is meant by:

a) an Anomaly?

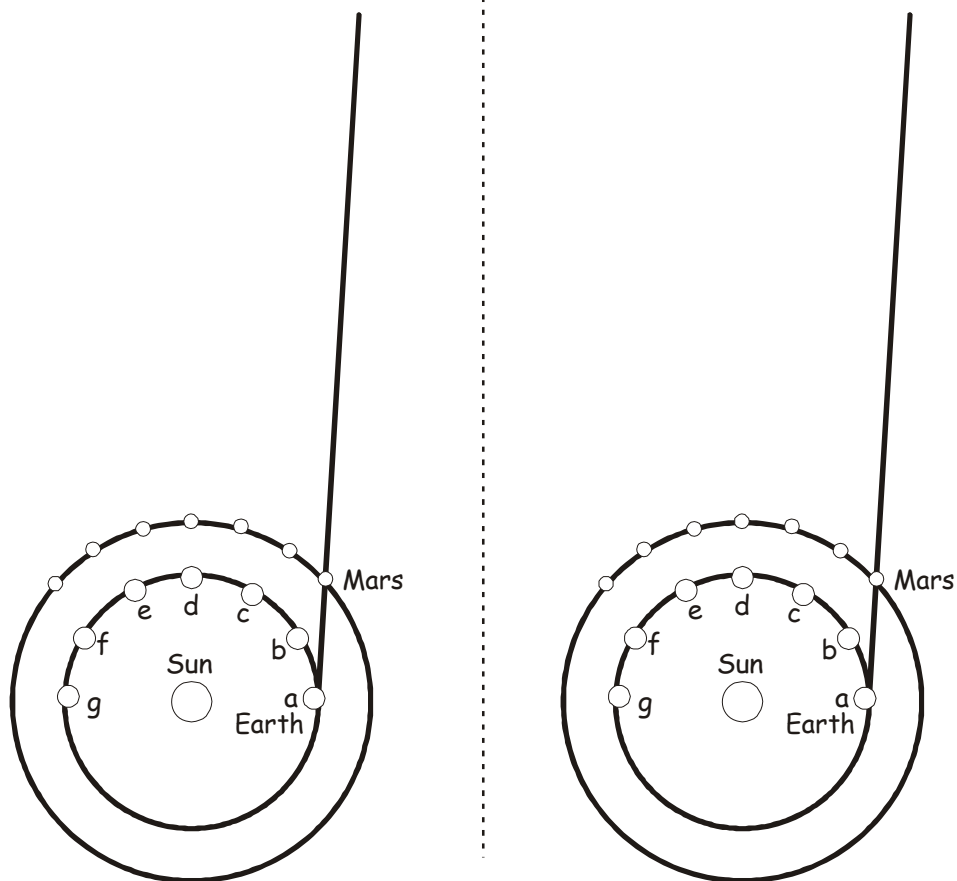
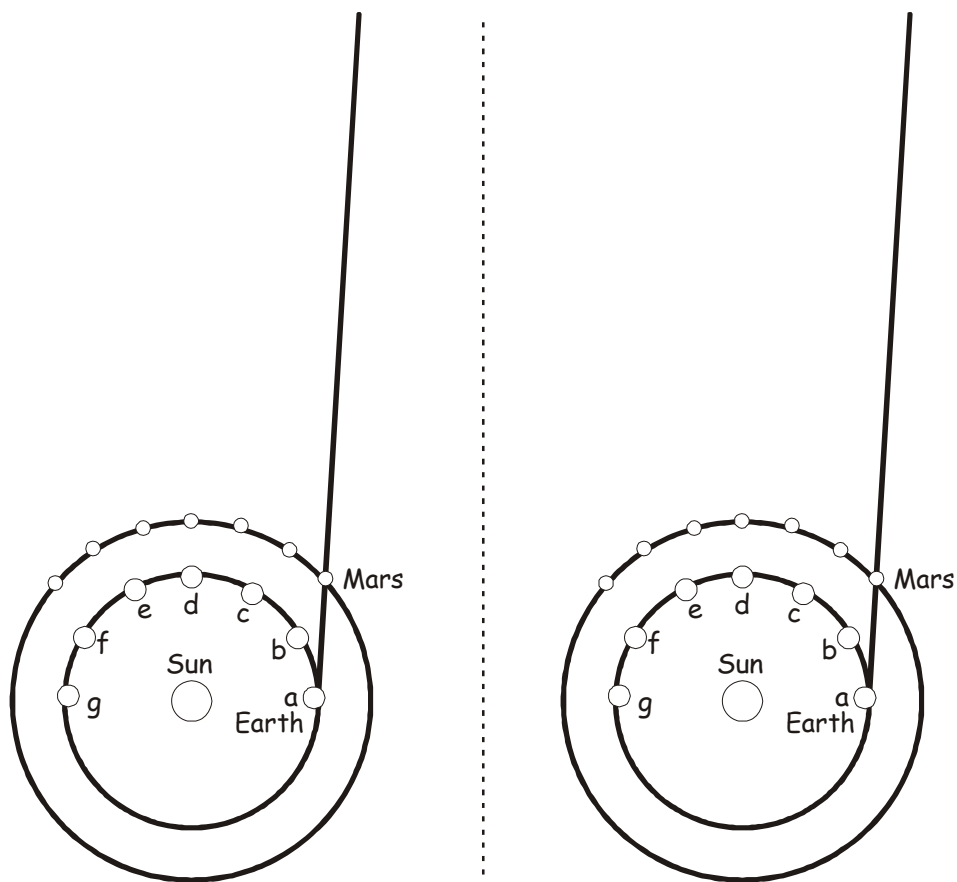
b) Apparent motion?

Why did this "odd" behaviours of Mars present a problem for the *Geocentric Model* of the Universe?

.....

.....

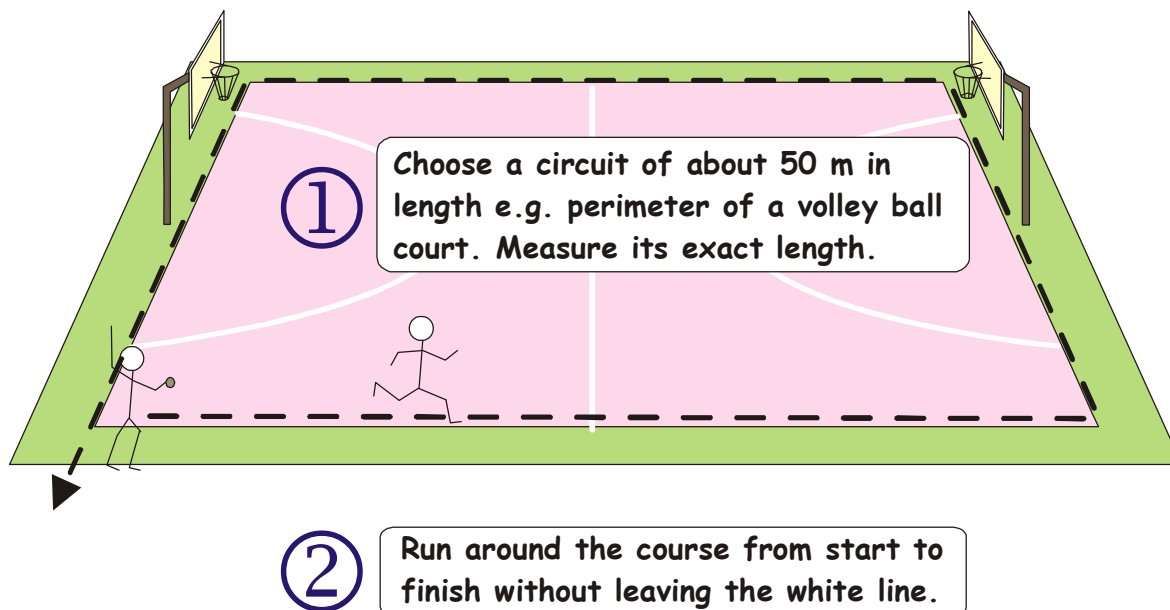
9J7 Anomalies I: The apparent motion of Mars



	Unit 9K: Speeding Up
	How fast is it moving?
9K1	The average speed
9K2	Investigating motion using a ticker tape timer
9K3	School speed trap
	How do forces affect speed?
9K4	Four effects of a force
9K5	Speeding up
9K6	Slowing down
9K7	Stopping distances and speed
9K8	Stopping distances and inertia
9K9	Investigating air resistance I
9K10	Investigating air resistance II
9K11	The speed of a falling object
9K12	Faraday effect
9K13	Build a water propelled rocket
	How can we increase speed?
9K14	Investigating water resistance
9K15	Inertia I
9K16	Inertia II
	How do parachutes work
9K17	Build a parachute
9K18	Investigating parachutes

9K1 The average speed

Stopwatch Tape measure



Write an expression (opposite) for the average speed in terms of the distance covered and the total time taken:

Average Speed =

Fill in the table below for the members in your group:

Student	Time	Average speed	
		m/s	km/h

The table below shows some typical times that might be recorded in an Olympic stadium. Calculate the average speeds in each case and compare with your own.

Event	Time	Average speed	
		m/s	km/h
100m	9.9s		
200m	19.8s		
800m	1m 42s		
5000m	13 min		
Marathon	2h 5m		

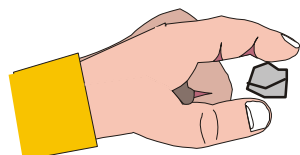
Unit 9L: Pressure and Moments	
	What is pressure?
9L1	Are pins really pointed?
9L2	Pressure of nails
	What are pneumatics and hydraulics?
9L3	Pascal's principle
9L4	Pneumatic press
9L5	Hydraulic press
9L6	Direction of pressure in fluids
9L7	Pressure in fluids I
9L8	Pressure in fluids II
9L9	Pressure in fluids III
9L10	How to make a syringe pump
9L11	How to make a suction pump
9L12	Transmission of pressure I
9L13	Transmission of pressure II
9L14	Compressing liquids and gases
9L15	Archimedes Diablo I
9L16	Archimedes Diablo II
9L17	Air pressure and flow I
9L18	Air pressure and flow II
9L19	How to make a barometer
9L20	Atmospheric pressure I
9L21	Atmospheric pressure II
9L22	Removing air from a bell jar containing marshmallows
9L23	Bernoulli's principle
	How do levers work?
9L24	Investigating levers
	How do things balance?
9L25	Stand up straight boy/girl!
9L26	Centre of gravity of an irregular shape
9L27	How to build a water balance
9L28	Measuring mass with a water balance
9L29	How to build a beam balance
9L30	Calibrating the beam balance
9L31	Using the beam balance
9L32	A hammer trick

9L16 Archimedes Diablo II

Aluminium foil Plastic bottle 500 ml

1

Roll some aluminium foil into a small ball and squeeze it so that it JUST floats in the water.

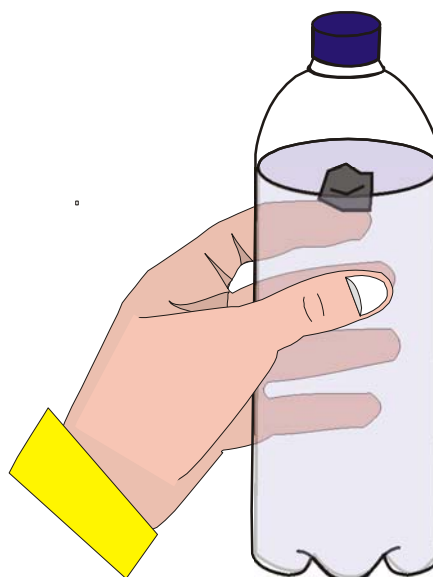


Ball only just floating on water



2

Screw the top on the bottle and squeeze tightly. Observe what happens to the ball.



What happens to the Diablo when you increase the pressure?.....

What happens to the Diablo when you decrease the pressure?.....

Note what happens to the volume of the Diablo as the pressure changes.

Explain your results in terms of changes in the density of the Diablo.

Why does this effect work with a Diablo but not with a block of wood, for example?.....