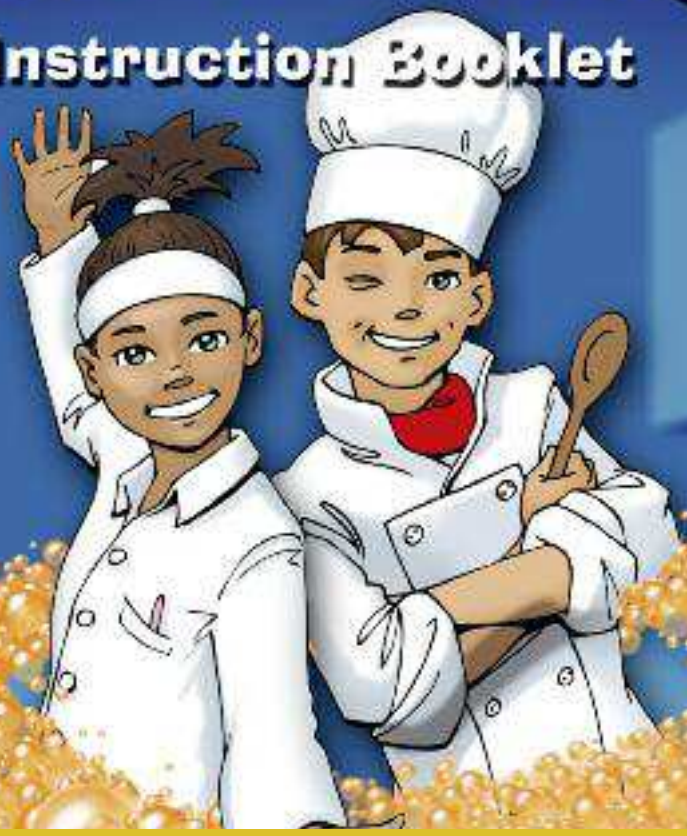
John Adams®

AGE 8+

Kitchen Chemistry

Instruction Booklet



WARNING! ONLY FOR USE BY CHILDREN OVER 8 YEARS OLD. TO BE USED SOLELY UNDER THE STRICT SUPERVISION OF ADULTS THAT HAVE STUDIED THE PRECAUTIONS GIVEN IN THE EXPERIMENTAL SET ● READ THE INSTRUCTIONS BEFORE USE, FOLLOW THEM AND KEEP THEM FOR REFERENCE ● DO NOT ALLOW CHEMICALS TO COME INTO CONTACT WITH ANY PART OF THE BODY, PARTICULARY MOUTH AND EYES ● KEEP SMALL CHILDREN AND ANIMALS AWAY FROM EXPERIMENTS ● STORE THE CHEMISTRY SET OUT OF REACH OF CHILDREN ● EYE PROTECTION FOR SUPERVISING ADULTS IS NOT INCLUDED ● SAFETY GOGGLES MUST ALWAYS BE WORN WHEN CARRYING OUT EXPERIMENTS ● CONTAINS FOOD COLOURING AND A PEN THAT MAY STAIN FABRIC OR CLOTHES.

John Adams

Kitchen Chemistry

AGE 8+

SAFETY

SAFETY ADVICE FOR SUPERVISING ADULTS

- Read and follow these instructions, the safety rules and the first aid information and keep them for reference.
- The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.
- This chemistry set is for use only by children of 8 years old and over.
- Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. (The instructions should enable supervisors to access any experiments to establish its suitability for a particular child).
- The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments. Particular attention should be paid to the safe handling of acid, alkalies and flammable liquids.
- The area surrounding the experiments should be kept clear of any obstructions and away from the storage of food. It should be well lit, ventilated and close to a water supply. A solid table with a heat-resistant top should be used.

SAFETY RULES

- Do read these instructions before use, follow them and keep them for reference.
- Do keep young children, animals and those not wearing eye protection away from experimental area.
- Do always wear eye protection.
- Do store experimental sets out of reach of young children.
- Do clean all equipment after use.

- Do make sure that all containers are fully closed and properly stored after use.
- Do wash hands after carrying out experiments.
- Do not use equipment which has not been supplied with this set, unless instructed to do so specifically in these instructions.
- Do not eat, drink or smoke in the experimental area.
- Do not allow hazardous chemicals to come into contact with the eyes or mouth.
- Do not replace food-stuffs in original containers. Dispose of immediately.
- Dispose of non oil-based liquids in waste drain with plenty of water.
- Dispose of other experiments waste (including cooking oil in a sealed container) in household waste bins.
- Dispose of waste immediately.
- Do not heat (place in the oven or otherwise expose to a naked flame) any of the containers/test tubes or other kit contents.
- Do make sure all equipment is clean, especially when in contact with ingredients - food or drink.
- Do make sure you only use non harmful substances. Do not use bleach, toilet cleaner, oven cleaner or anything similar.

GENERAL FIRST- AID INFORMATION

- In case of contact with eyes: rinse out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.
- If a hazardous substance is swallowed: rinse out the mouth with water, drink some fresh water.
  Do not induce vomiting. Seek immediate medical advice.
- In case of inhalation: Remove person to fresh air.
- In case of skin contact and burns: wash affected area with plenty of water for 5 minutes.
- In case of doubt: seek medical advice without delay. Take the chemical and its container with you.
- In case of injury: always seek medical advice.

DISPOSAL OF CHEMICALS SHOULD BE IN ACCORDANCE WITH LOCAL REGULATIONS.

YOUR NEAREST TOXICOLOGY CENTRE - Take the chemical and its container with you.

ADDRESS: . . . . . .

TOWN: . . . . . .

TEL: . . . . . .

Kitchen Chemistry

Kitchen Chemistry is an experimental kit complete with a booklet and equipment to guide you through 40 fun, educational and safe experiments that can be carried out using ingredients and household products found in the kitchen. This booklet groups experiments under 10 topics. Grouping them in this way will help you to understand an area of science much better. Breaking up the kit in this way also means you can do a section at a time in any order you like! Each section is colour coded and numbered.

Section 1: Chemical Substances
Chemical States
Chemical Reactions

Section 2: Dissolving
Absorbing
Evaporating & Condensing
Separating

Section 3: Changes:
Chemical and Physical

Section 4: Density

Section 5: Liquid Properties

Section 6: Mixing the impossible

Section 7: Enzymes

Section 8: Nature's Laboratory

Section 9: Metal Magic within the kitchen

Section 10: Spot the Hazards – including poster activity

WHAT'S IN THE BOX?

- Goggles
- pH strips
- pH card
- Powdered red and blue food colouring
- Sand
- Cress
- Funnel
- Test tubes x 3
- Test tube bung
- Cardboard test tube holder
- Black card (for use in an experiment)
- Plastic pipette
- Paintbrush
- Plastic spoon
- 50ml measuring beaker
- 100ml beaker
- Activity mat
- Pen- for use with the activity mat
- 'Spot the hazards' safety poster

To do the full range of experiments in the kit you will require some common household ingredients. Necessary equipment/ingredients not included in your kit are listed under each individual experiment.

Here are some examples of the sorts of things you will need - lemon, vinegar, bicarbonate of soda, soap, salt, pepper and eggs.

We suggest you wear old or protective clothing and cover the work surfaces with newspaper and use your wipe clean activity mat as some experiments can be messy. The food colouring may stain fabrics, which should be soaked in cold water. Food colouring on the skin may need to be washed several times before it fades.

Introductions

LET'S GET STARTED

Did you know that your kitchen is a laboratory? Whenever you mix substances together you are creating chemical reactions. Even making a cake is a scientific experiment!

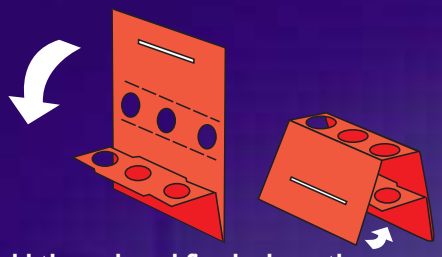
Every scientist needs his laboratory.
Use the activity mat included in this kit to keep things clean and tidy. To flatten your mat: Unravel and roll up the other way before lying it down flat on your work surface. Make it your own by using the pen to fill your name in the box.

HANDY HINT

Use some damp kitchen towel to erase the pen and wipe clean the activity mat.

MAKE UP YOUR TEST TUBE HOLDER

The diagram below will help you:



Fold the red card firmly down the creases, bend into an A-shape and tuck the lip into the slot. For extra strength secure the lip in the slot with sticky tape.

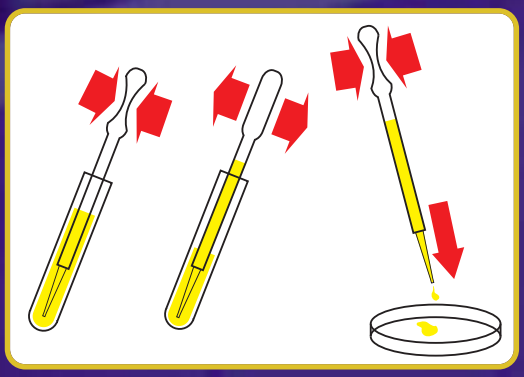
Now place the holder on your activity mat in the labelled space and put your three test tubes into the holes.

LEARN TO USE YOUR PIPETTE

You can use the pipette to transfer small quantities of liquid from one container to another in the form of drops.

1 Ensure the liquid is cool enough beforehand, insert the tip of the pipette, then gently squeeze the top of the pipette and release - The liquid is sucked into the shaft of the pipette.

2 To drop the liquid, simply squeeze the top gently until the right amount has dropped.



Only use the pipette with one liquid at a time and always wash between uses.

TO USE YOUR FOOD COLOURING

Ask an adult to unscrew the cap of the food colouring bottle and remove the dropper nozzle. Using your pipette, carefully squeeze cold water onto the powdered food colouring in the bottle until it is three quarters full. Replace dropper nozzle and cap securely and shake well.

IMPORTANT NOTE TO SUPERVISING ADULTS!

Once mixed with water, use food colourings within 2 days.

KITCHEN CHEMISTRY CODES

Codes are displayed along side some experiments. See below for the code meanings:

Always ensure that all your equipment and work area's spotless and washed properly when doing an experiment with an edible outcome. Unless this code is shown beside an experiment do not eat!

Find out more about the environment with these links.

Pay attention to these hazard symbols as they display important information.

This code means the supervising adult needs to carry out part or all of the experiment.

This code will help you find out which experiments take longer than others.

Fact links teach you more about a subject.

The hazards and adult supervision codes will help keep you safe as they clearly display important information so please make sure you pay attention to them.

Now all you need to do is check you have the ingredients handy for the experiments you want to do (these are listed at the top of each experiment), then pop your goggles on and we can get started!

Chemical Substances 1

There are three important chemical substances that you will find in the kitchen – acids, bases and salts. How do you know which is which?

WHAT ARE ACIDS?

Acids usually have a strong smell.

Some acids are very powerful, an example of a powerful acid is Sulphuric acid in a car battery. Powerful acids must never be touched as they can burn your skin and are poisonous!

Less powerful acids can be found in the kitchen. Lemon juice and vinegar are mild acids that are safe to be eaten. Acidic food substances that you can eat usually have a sour taste.

WHAT ARE BASES/ALKALIS?

Bases usually have soapy qualities.

Some bases are poisonous. Bleach and other cleaning materials are poisonous bases. Poisonous bases must always be treated with great care and kept in a safe place away from food.

There are some non-poisonous bases that you can eat and can be used in cooking. These edible bases usually taste bitter, an example being Bicarbonate of soda which is a base used in cooking to make things rise.

Bases that dissolve in water are called alkalis. Bicarbonate of soda is an example of an alkali.

Acids and alkalis are chemically opposite to one another.

WHAT ARE SALTS?

When you mix acids and bases the result is called a salt.

INDICATORS

We can tell if a substance is an acid or an alkali by using an indicator. An indicator changes to different colours when testing different substances and will be one colour in an acid solution and another in an alkaline solution.

There are different types of indicators to test whether a substance is acid or alkaline. In the following experiments you will be using 2 different types of indicator to test substances yourself. One indicator you will make in the kitchen and one is supplied in your kit. You will see how the methods of testing the pH with the 2 indicators are different!

EXPERIMENT 1

Test pH with Natural Indicator

STAGE 1

Make a chemical indicator using red cabbage

Be sure to ask an adult to do stage one.

Hot water and sharp knife (for adult use only!)

HOUSEHOLD ITEMS YOU WILL NEED:

Red cabbage, a kitchen knife, a chopping board, a medium saucepan, a sieve, 2 jam jars with lids and a collection of safe kitchen substances – for example lemon & bicarbonate of soda (more suggestions in stage 2).

1 Ask an adult to chop up a quarter of red cabbage.

2 Place the chopped cabbage in a saucepan of cold water, bring it to the boil, simmer for 5 minutes and then leave it to cool.

3 Once cool, pour the cabbage water through a sieve into 2 jam jars. You can pour the rest down the sink! The bright purple water you are left with will act as your indicator. Pretty cool hey?!

HANDY HINT:

If you put a lid on the jar, your indicator will keep for several days in the fridge.

If you are a cabbage lover like me, you can always eat the cabbage instead of chucking it. But don't say I didn't warn you of the possible whiff!!

STAGE 2

It's time to be a Kitchen Detective!

Follow the instructions below to discover which safe substances in the kitchen are acids and which are alkalis. Use one of the jam jars of natural indicator and keep the other for the next experiment.

1 Collect together lots of safe substances that you can find within the kitchen, these will ideally be both liquids and powders. Here are a few suggestions - Vinegar, salt, liquid soap and water.

IMPORTANT NOTE TO SUPERVISING ADULT

These must be substances that are non-harmful. Do not use bleach, toilet cleaner, oven cleaner or anything similar.

2 Using your pen write down all the things you are testing on the activity mat pH results chart in the 'Kitchen Substances' column.

3 Using what you've learnt about both acids and alkalis, list whether you think the substance will be acid or alkali in the 'ACID or ALKALINE' column - this is your prediction.

REMEMBER: Acids usually have a strong smell and alkalis have soapy qualities.

4 To start, use your pipette to squeeze natural indicator into each test tube until they are half full and then replace them in the rack.

TOP TIP!

Have a Control to compare against:

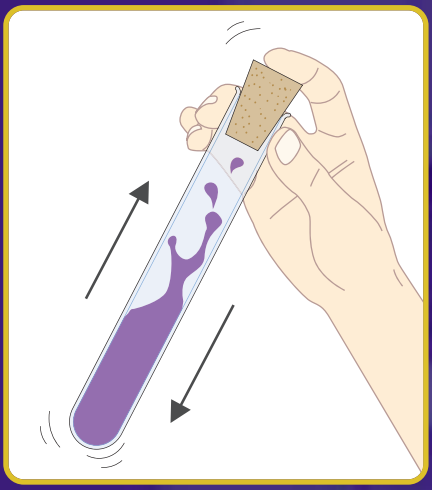
You may find when testing the pH of the substances you've collected that some colour changes are hard to see. For this reason it is good to have plain indictor to compare against.

Therefore do not add anything to the left hand test tube, leave this as a plain indicator. This is what is called a control because it helps keep your results accurate.

5 Test a substance's pH by adding a small amount to the indicator in the test tube. If testing a powdery substance use your funnel to help add it to the test tube. If the liquid you're testing is not in a squeezy bottle use your pipette to add it to the test tube.

6 Once the substance has been added to the natural indicator in the test tube secure the bung in the top of the test tube.

Making sure you hold the bung in place, shake the test tube to mix the substance and indicator properly.



RESULTS

If the substance you are testing is:

- An acid, the indicator should turn pink or red.
- A base, it should turn blue.
- If it is neutral, the indicator will not change colour.

7 What colour has the indicator changed to? Is it an acid, alkali or neutral? Note down your findings on your activity mat chart. Was your prediction correct? If not rub it off with damp kitchen towel and correct it.

Repeat the experiment as many times as you like with different safe substances.

REMEMBER: To give the test tubes a good rinse between tests and to use fresh indicator for each test.

If you are stuck for other substances to test try the following:
Lemon juice
Bicarbonate of soda
Milk

EXPERIMENT 2

Reversible colour change

Beware of possible allergy to washing powder. Do not allow contact with the skin.

HOUSEHOLD ITEMS YOU WILL NEED:
Washing powder and vinegar.

1 Add a teaspoon of washing powder (alkali) to the red cabbage indicator in the second jam jar using the plastic spoon in your kit

It should turn green.

2 Now add a teaspoon of vinegar (acid). This should reverse the pH change and turn it back to its original red colour.

STRENGTH USING PH NUMBERS:

Not all acids are the same strength, neither are all alkalis. We can tell the strength of acidity or alkalinity of a substance by using pH numbers.

If you look at the pH card in your kit you will see a range of colours. Paired with each colour is a number, this is the pH number which is its strength.

PH NUMBERS

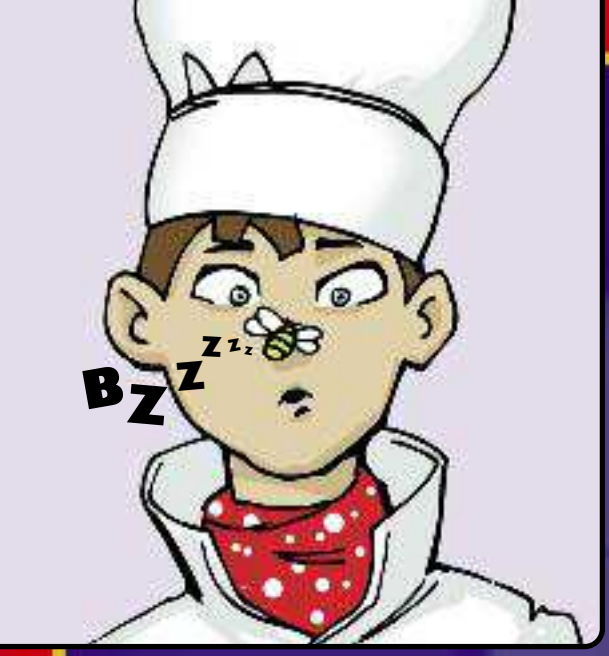
- Acids — pH numbers between 1 and 6
- Neutral — pH number 7
- Alkalis — pH numbers between 8 and 14

pH number 1 is the strongest acid strength on the scale and 6 is the weakest acid strength.

pH number 14 is the strongest alkaline strength and 8 is the weakest.

pH Strips are an indicator – You'll find these strips in your kit. Like the indicator you have made today these strips also contain a natural ingredient - algae.

After testing each substance with the pH strips in the following experiment, you will be able to match the colour of the pH strip to pH number on the pH card.



Here is something to remember: a bee sting is acidic; you can make it less painful (neutralise it) by increasing its pH number by rubbing on bicarbonate of soda (a base).


Bee


Wasp

A wasp sting is alkaline so treat it (neutralise it) by lowering it's pH number with vinegar (an acid).

EXPERIMENT 3

Testing pH strength with pH strips

Only use safe substances.

HOUSEHOLD ITEMS YOU WILL NEED:

A saucer, water and a collection of safe kitchen substances – for example lemon & bicarbonate of soda

Place your pH card face-up on top of the pH card image on your activity mat.

1 Take one of your pH strips and place it in a saucer.

2 Pour a few drops of one of the safe kitchen substances you used in experiment 1 onto the strip.

HANDY HINT:

If the substance is a powder or a thick liquid like toothpaste, pop it in a test tube beforehand and use your pipette to add a little water to it, you can then pour the contents of the test tube into the saucer over the pH strip.

3 Watch the colour of the strip change.

4 Find out the pH number of the substance by holding it up against colours on the card until you find the closest match.

5 When you have found a colour match record the pH number on your activity mat alongside your other findings.

Repeat the experiment as many times as you like with different safe substances.

IMPORTANT NOTE TO SUPERVISING ADULT

These must be substances that are non-harmful.

Do not use bleach, toilet cleaner, oven cleaner or anything similar.

CHEMICAL STATES

There are three different kinds of matter: solids, liquids and gases:

SOLIDS - *have a definite shape of their own*
LIQUIDS - *take on the shape of their container (e.g. a jug)*
GASES - *can fill any space*

Solids, liquids and gases can change from one state to another. You can cause this change by heating them up or making them colder.

FREEZING AND MELTING

Water (liquid) turns into ice (solid) when it gets cold. Ice melts and becomes water again when it warms up.

EXPERIMENT 4

How fast to freeze?

1 Fill the 50ml beaker to the 25ml level and place it in the freezer.

2 Check it every half hour to see how long it takes to become solid? When it has become frozen solid, note down the freezing time on the notes section of your activity mat.

3 When the water has frozen, does it take up more or less space in the cup than before? If the level of frozen water is higher than the 25ml level then it now takes up more space!

4 Now take the beaker out of the freezer. How long does it take for the ice to melt? Does the melted water level reach the 25ml level?

NOTE:
Water is one of the few liquids that expands when it freezes – When water freezes the tiny molecules become bigger solid crystals which then move away from each other taking up more room.

This explains why an ice cube floats in a glass of water and how giant icebergs float in the sea because the water in the ice cube has expanded during freezing and the molecules have moved away from each other becoming less dense than water.
We will explain density later on in its very own section!

EXPERIMENT 5

Freezing times Pure water versus salt solution

Caution uses water from hot tap.

HOUSEHOLD ITEMS YOU WILL NEED:
Table salt and water.

1 Ask an adult to fill your 100ml beaker with warm water – making sure it is not hot.

2 Fill 2 of your test tubes with the warm water using your pipette – make sure it is the same level in both tubes.

3 Now pop them in your test tube rack. Measure out a teaspoonful of salt using your plastic spoon, place your funnel into one of the test tubes and pour the salt down the funnel into the test tube. Place the bung on the test tube and then holding it in place, shake to mix the salt and water properly.

4 Label your test tubes with your pen, use the letter 'S' for test tube with the salt added, and the letter 'W' for the pure water.

5 Place the test tubes in the rack and carefully place into a compartment within the freezer.

6 Check them every ten minutes to see which freezes first. Is it the pure water or salt solution?

HANDY TIP:
To check if they have frozen, push your pipette down each test tube to check!

EXPERIMENT 6

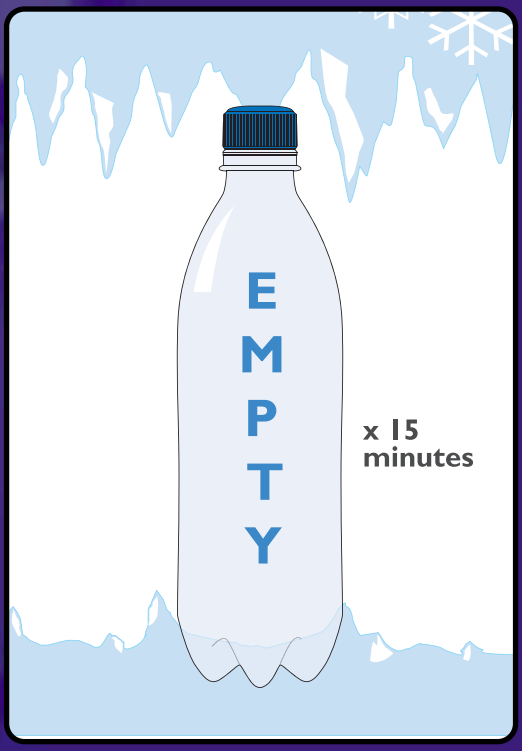
The effect of heating air

HOUSEHOLD ITEMS YOU WILL NEED:
An empty plastic bottle with screw cap and a 2 pence or 10 pence coin.

This experiment is great to show the effect of heating air.

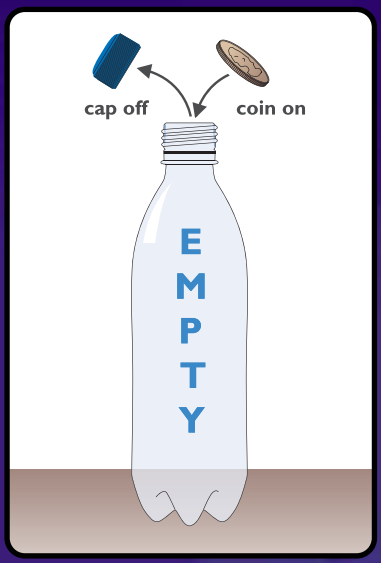
1 Ask an adult to find you a plastic bottle with its cap.

2 Making sure the bottle is completely empty, screw the cap on and leave it in the freezer for 15 minutes.

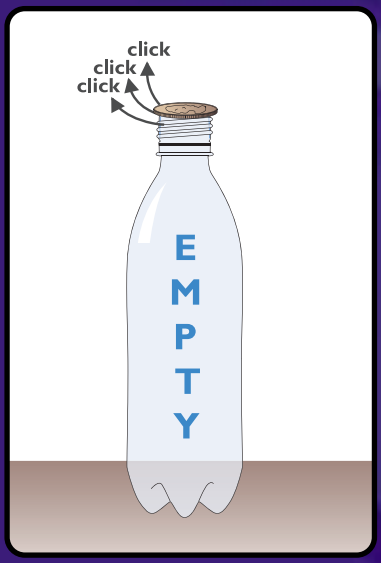


3 Before removing the bottle from the freezer, fill one of your beakers with water and find a 2 pence or 10 pence coin.

4 Take the bottle out of the freezer.



5 Dip the coin in the beaker of water, unscrew the cap of the bottle and immediately place the coin over the mouth of the bottle.



Within seconds you should hear a clicking noise. This noise is caused by the coin jumping as the cold air heats up and expands. Cooling the bottle had caused the air inside it to contract which means it took up less space! The air is now expanding again as it returns to the temperature it was before freezing. The clicking noise is the pressure of the air pushing one side of the coin up.

EXPERIMENT 7

Salt the natural melting aid

We know from experiment 5 that salt water freezes at a lower temperature. Salt also has great melting properties – This experiment will show how you can use salt to perform the impossible task of fishing for ice cubes!

HOUSEHOLD ITEMS YOU WILL NEED:
30cm of wool/string, table salt, water and an ice cube tray.

1 Freeze some ice cubes.

2 Fill one of your beakers up with cold water and wet a piece of string or wool approximately 30cm long by dangling it into the beaker.

3 Place an ice cube on your activity mat and rest the middle of the wet string over the top of it.

4 Sprinkle salt over the ice cube and string. You should see that the ice around the string melts and that the string becomes attached to the ice cube.

Leave for a few minutes and you should be able to lift the string up and pick the ice cube up – Good catch!

5 Try adding more cubes to the string. I know it's not quite an igloo but it's a start! You may want to use your paintbrush to drop small amounts of water into the gaps between the ice cubes and the string to help melt them together.

f We often put salt on roads and pavements in the winter when it's icy because it helps melt the ice making them safer to walk and drive on!

CHEMICAL REACTIONS

A chemical reaction is a process that changes one substance into another. Chemical reactions produce all the substances in the world, as a reaction between two different substances means parts of them can join together and form new substances.

Here is a more detailed explanation: There are over 100 pure chemical elements and each is made up of tiny particles that we call atoms. When these atoms group together they are called molecules. Molecules can either contain atoms from a single chemical, or they can be a collection of atoms from different chemical elements.

A chemical equation is a way of showing what happens in a chemical reaction.

Here's an example of a chemical reaction within the kitchen: When you make toast the heat you use causes a chemical reaction! Here's an explanation of this reaction - Bread is made of carbohydrates and these turn into black carbon when the bread is heated. We see this black carbon forming on the surface when we toast bread.

Water also forms when toasting bread because carbohydrates are made up of hydrogen and oxygen as well as carbon. The Hydrogen and oxygen join together when heated and make water. This water escapes from the toast as vapour.

In this section there are some great experiments with chemicals that react when they are mixed together.

MAKING FIZZY STUFF

When you mix certain acids and alkalis, you cause a chemical reaction that produces a gas called carbon dioxide. The fizzing of the solution is the carbon dioxide escaping.

The fizzing is called Effervescence. We've broken this word up to help you pronounce it: eff-er-ves-cence.

EXPERIMENT 8

Volcano

This experiment uses food colouring that can stain. Make sure you use your activity mat and cover all work surfaces with old newspaper.

MESS ALERT

Please be aware that this could get messy. Make sure an adult is supervising and that there is no carpet in sight!

Get ready to cause an eruption.

Place your beaker in the centre of your activity mat before you start.

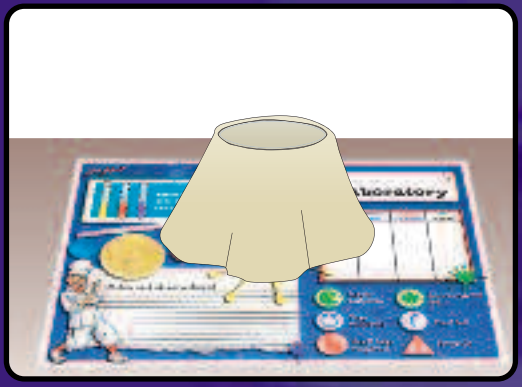
FOR A REALISTIC VOLCANO:

HOUSEHOLD ITEMS YOU WILL NEED:

Table salt, plain flour and water.

1 Make up some salt dough in a mixing bowl by following the recipe in experiment 20 (in the Changes - Chemical versus Physical section).

2 Place your 100ml beaker upright in the middle of your activity mat.



3 Now mould your salt dough into a volcano shape around it. Do not cook the salt dough in this experiment.

4 When you are satisfied you have a good volcano shape follow the instructions for the eruption:

FOR AN ERUPTION:

Caution uses water from the hot tap.
Food colourings may stain.

HOUSEHOLD ITEMS YOU WILL NEED:

Washing up liquid (alkali), baking powder (alkali), vinegar (acid), water, an extra teaspoon from the kitchen.

1 Half fill the 100ml beaker with warm tap water and add 4 or 5 drops of red food colouring.

2 Add 3 drops of washing up liquid to the water and give it a stir with your plastic teaspoon in your kit.

3 Measure 15ml of vinegar in your 50ml beaker.

4 Using a clean and dry teaspoon from the kitchen measure a teaspoon of baking powder and add it to the liquid in the 100ml beaker and give it a quick stir to mix. The mixture will start to fizz.

5 Slowly and carefully pour the vinegar in your 50ml beaker onto the fizzing mixture in the 100ml beaker – stand back and watch the lava fizz.

Did this do the trick and cause an eruption?

VOLCANO EXPLANATION

You may be wondering how and why volcanoes erupt, well here's the answer - Molten rock called Magma moves through the earth's crust under pressure, when this pressure becomes too great below the earth's surface it can cause a volcano eruption. When a volcano erupts it spills out some of this molten rock.

EXPERIMENT 9

Prevent a cut apple from going brown

Sharp knife (for adult use only!)

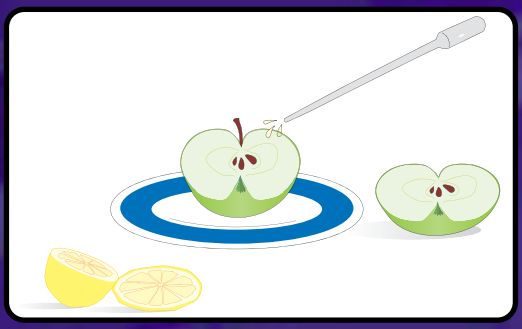
HOUSEHOLD ITEMS YOU WILL NEED:
An apple, a lemon, a small bowl, a saucer and small table knife.

1 Squeeze the juice of half a lemon into a small bowl.

2 Now ask an adult to cut an apple in half.

3 Leave one half of the apple bare, place the other on a saucer and using your pipette squeeze lemon juice over the fleshy surface.

4 Leave them both uncovered for an hour or two and return. When you return, which is brown and which isn't?



Oxygen in the air reacts with chemicals in the apple causing the browning on the half without the lemon. The vitamin C in the lemon juice stops the oxygen in the air reacting with chemicals in the apple and keeps the apple looking fresh! This is often why fruit juice is added to fruit salad because we wouldn't want to eat brown mush would we!

f Have you ever noticed how old newspapers are often yellow? The reason for this is because the paper that newspapers are printed on was originally yellow, but has a chemical added to it before printing to turn it from yellow to a more crisp looking white.

After time on the coffee table sunlight causes the paper to heat up and this heating allows oxygen to react with the chemicals in the paper that have kept it looking white. This reaction turns the white paper back to its yucky yellow colour again.

Dissolving 2

When you mix different chemicals, some will dissolve, some will remain entirely separate and some will react to produce a new substance. When a soluble substance is mixed with a liquid it will disappear. When you make a cup of instant coffee you are proving this. This process is known as dissolving.

EXPERIMENT 10

Soluble or insoluble that is the question?

Only use safe substances.

HOUSEHOLD ITEMS YOU WILL NEED:
Coffee granules, other safe soluble household products and water.

STAGE 1

1 Fill your 50ml beaker half full with water (the solvent) and stir in half a teaspoon of coffee granules (the solute).

QUESTION:
What has happened?

ANSWER:
The solid coffee granules have disappeared and the two have become a solution.

2 How many other soluble kitchen ingredients can you find? Repeat this experiment with a clean beaker and a different solute to find out!

IMPORTANT NOTE TO SUPERVISING ADULT
These must be substances that are non-harmful. Do not use bleach, toilet cleaner, oven cleaner or anything similar.

STAGE 2

1 Using your funnel pour half a teaspoon of sand into a test tube of water and shake with the bung held tightly on.

2 Leave the test tube to stand in the holder for 10 minutes.

QUESTION:
What has happened to the sand?

ANSWER:
Sand is insoluble and will not dissolve in water.

Did you find any other insoluble ingredients when you were carrying out stage 1 of this experiment?

EXPERIMENT 11

Solubility – cold versus warm water

Caution uses water from hot tap.

HOUSEHOLD ITEMS YOU WILL NEED:
Table salt and water.

1 Fill your 50ml beaker to the 50ml mark with cold water and pour this water into the 100ml beaker.

2 Now ask an adult to fill your 50ml beaker to the 50ml mark with warm water from the hot tap.

Both beakers now have the same amount of water in them.

3 Stir 2 teaspoons of salt into each beaker being very careful not to touch the warm water.

QUESTION: Does the salt dissolve more quickly in warm or cold water?

EXPERIMENT 12

Does adding sugar make water rise?

Caution uses water from hot tap.

HOUSEHOLD ITEMS YOU WILL NEED:
Sugar and water.

1 Ask an adult to half fill your 100ml beaker with warm tap water.

2 Using your pen, draw a line on the outside of the beaker where the water level is.

3 Now stir a tablespoon of sugar into the warm water.

QUESTION: Has the water level got higher or is it the same? Check against your pen mark.

ANSWER: You will see that adding sugar has not increased the level of the water very much. This is because the sugar has dissolved in the water, which means instead of increasing the volume of liquid the sugar molecules have filled up the gaps that exist in between the water molecules.

EXPERIMENT 13

Saturation

Caution uses water from hot tap.

HOUSEHOLD ITEMS YOU WILL NEED:
Sugar and water.

STAGE 1

1 Half fill your 100ml beaker with cold tap water.

2 Slowly add a teaspoon of sugar stirring with another teaspoon at the same time to help it dissolve.

3 Continue adding sugar with your teaspoon until the water cannot dissolve any more sugar – this will be clear because you will see the granules of sugar that cannot be dissolved in the water. At the stage where the solution cannot dissolve any more sugar make a note of the number of teaspoons that have easily dissolved on your notes section of your activity mat (this may only be one teaspoon!)

When a liquid cannot dissolve any more we call it a 'saturated solution'.

STAGE 2

1 Ask an adult to repeat the experiment above using warm water.

2 Make a note of the number of teaspoons that can be dissolved before the solution becomes saturated (cannot dissolve any more sugar) and compare to the number in stage 1. You will see that by raising its temperature water is able to dissolve more sugar!

f When you've been unlucky enough to get caught out in the rain and your clothes are wet through, someone could describe you by saying 'you're saturated'. They would mean you could not possibly be any wetter, as you're clothes have absorbed all the water they can! This is often an exaggeration but a really good way of describing being really wet!

EXPERIMENT 14

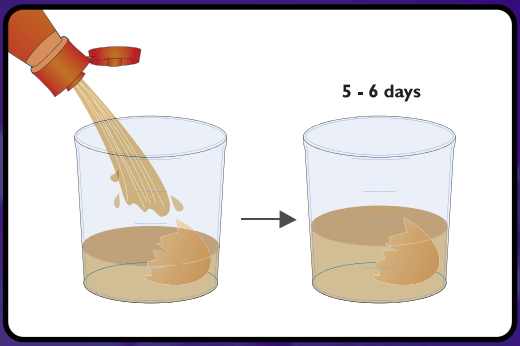
Disappearing egg – An Eggshell vanishing act

This experiment uses raw eggs.

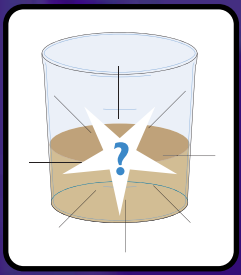
HOUSEHOLD ITEMS YOU WILL NEED::
An egg and vinegar.

1 Crack open an egg into a clean bowl. We will only be using the shell so the white and yolk could be used for an omelette!

2 Place half the egg shell in your 100ml beaker and cover it with vinegar.



3 Leave the beaker for 5 - 6 days and see what happens.



Egg shells are made of calcium amongst other things. This is not a magic act! The acid in the vinegar dissolves the calcium in the egg shell causing it to disappear!

Adult to dispose of vinegar solution immediately.

ABSORBING

The best way of describing absorbing is to look at the way a sponge soaks up water. A sponge is absorbing water. If you spill something and mop it up with kitchen towel, the kitchen towel is absorbing water!

EXPERIMENT 15

Baking powder deodorizer

Beware of the suffocation hazard of polythene bags. Sharp knife (for adult use only!)

HOUSEHOLD ITEMS YOU WILL NEED:

Baking powder, a plastic container with a lid (we suggest an empty ice cream tub), two small polythene bags (sandwich bags are ideal), an onion, a kitchen knife and a chopping board.

1 Ask an adult to slice up an onion and place it on a saucer.

2 Fill your 50ml beaker with baking powder and pour it into the bottom of a plastic container with an airtight lid (an ice cream tub is ideal). Spread the baking powder out evenly.

3 Again fill your 50ml beaker with baking powder and carefully pour it into one of your polythene bags and ask an adult to knot the top.

4 Now place the onion saucer on top of the baking powder in the container, replace its lid and leave it over night.

5 The next day remove the plastic container's lid and onion saucer.

6 Throw the onion away and very carefully pour the Baking powder from the container into a separate (second) polythene bag and knot the top.

7 The moment of truth. Open the first polythene bag (from yesterday) and smell the contents – there should be no strong smell. Now open the second bag that you have just filled and smell the contents – there should be a strong whiff of onions!

This experiment has proved that baking powder absorbs smells.

EVAPORATING & CONDENSING

Evaporating and Condensing - Heat makes water disappear, by turning it into vapour, or gas. This is called evaporation. The heat of the sun dries the washing hanging on the line in just this way.

The vapour turns back into water again when the air cools down. Rain is an example. This is called condensation.

After your mum has been boiling potatoes ask her to show you the saucepan lid. Be careful it may still be very hot, so make sure you don't touch it!

You will see that the inside of the lid is wet when it hasn't even touched the water in the pan. This is due to condensation - steam has turned back to water when it has hit the lid of the pan.

SEPARATING

How can you separate chemicals that have been mixed up? Here are two experiments involving different substances.

EXPERIMENT 16

Separate sand from water

To separate sand from water is easy because sand is not soluble.

1 Using your funnel pour half a teaspoon of sand into a test tube of water and leave it for ten minutes to settle.

2 Now simply pour the water carefully into one of your beakers and you will see you are left with just the sand in the test tube.

EXPERIMENT 17

Separate salt from water

Caution uses water from the hot tap.

HOUSEHOLD ITEMS YOU WILL NEED:
Table salt, water and a saucer.

STAGE 1

To separate salt from water first you have to mix them together.

1 Measure 25ml of table salt using your 50ml beaker and pour the salt into your 100ml beaker.

2 Now ask an adult to add warm tap water to the 100ml beaker until it is three quarters full.

3 Use your plastic spoon to carefully stir the solution until all the salt has dissolved.

4 Once the salt's dissolved ask an adult to pour a little of this solution into a saucer. Use the rest of the solution for stage two.

5 Leave the saucer of salt solution on a radiator or in another warm place - Water will gradually evaporate.

The warmer the radiator and the surrounding air the quicker the water will evaporate. Once the water has evaporated you will be left with just salt crystals.

STAGE 2 BLOW AWAY INK

You can use the remaining solution in the beaker to make salt crystal ink using the paint brush in the kit and the black square of card.

1 Keep stirring the solution with your spoon otherwise the salt may sink and settle on the bottom of the beaker.

2 Write a short message on the black card (supplied in your kit) like 'Magic!' or 'Hello!' using your paint brush. Ask an adult to stir the solution while you write. Retrace the outline of each letter with more salty water to form the letters properly on the glossy paper. Make sure you dip your paintbrush deep into the solution between each letter.

3 Once you have finished writing ask an adult to carefully place the card on top of the radiator and leave it there until the water has evaporated (the card may need to be left overnight). You should be left with a salt crystal message that shows up on the black card.

4 Once you have read your message make it disappear by gently rubbing it with kitchen towel to loosen the crystals and giving it a blow!

Changes: Chemical and Physical 3

CHEMICAL CHANGE: Baking a cake is a chemical change.
PHYSICAL CHANGE: An ice lolly that has melted has undergone a physical change.

CHEMICAL CHANGE

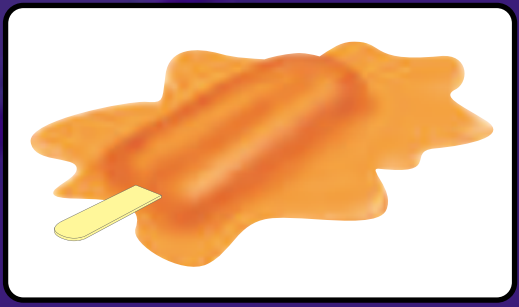
Baking a cake is a chemical change.

Once cooked a cake no longer tastes like its ingredients, it is chemically different. You cannot change it back to raw eggs, flour, butter and sugar. Most chemical changes are permanent or irreversible.

It has also changed physically from raw mixture to fluffy sponge that you can eat – Yummy!

A PHYSICAL CHANGE

An ice lolly that has melted has undergone a physical change, changing from solid to liquid and it can always be refrozen to become solid again!



EXPERIMENT 18

Denaturing; Making meringues

Hot oven.

Make sure equipment and preparation area is spotless.

Eat only when cooked as contains raw eggs.

HOUSEHOLD ITEMS YOU WILL NEED:
An egg, castor sugar, a hand whisk, a clean metal teaspoon, a baking tray (greased & lined with baking parchment) and oven gloves.

You can change the shape of molecules by the way you treat them - This is called Denaturing.

1 Ask an adult to preheat your oven to 150 degrees Celsius, then ask them to help you grease and line a baking tray.

Change the shape of molecules in an egg white:

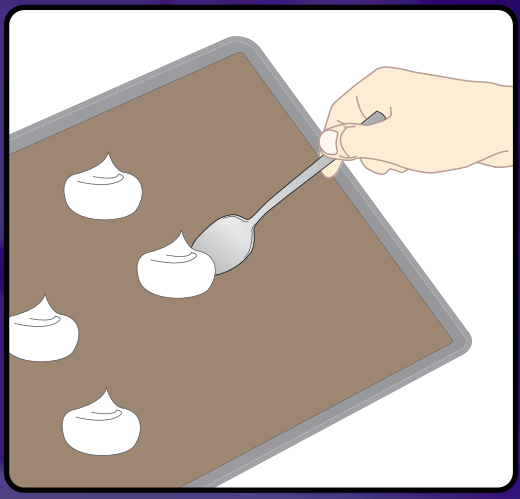
2 Put an egg white in a large bowl and whisk it with a hand whisk for about 5 minutes – You will see how it gradually changes its nature. It changes from being a slimy liquid to light and frothy because the beating action has trapped air amongst the molecules.

3 Make sure your 50ml beaker is really clean and fill it with castor sugar.

4 Pour half of the sugar into the frothy egg and beat it again for 30 seconds.

5 Add the rest of the sugar and beat.

6 Fill the beaker up with more caster sugar. Repeat steps 4 and 5 and beat the mixture until stiff.



7 Now put large teaspoons of the mixture onto your lined baking tray – Aim for 6-8 mixture blobs.

8 Ask an adult to use oven gloves to place the tray into the centre of the preheated oven and bake the meringues for 45-50 minutes – Ovens will vary so please ask an adult to check after 35 minutes. The meringues should be hard but not brown.

9 Once the meringues are cooked turn off the oven and leave the meringues to cool inside.

10 Allow them to cool before eating!

QUESTION:
How has the mixture changed through cooking?

ANSWER:
One thing that has happened is that you have made meringues, hard on the outside and sticky on the inside; delicious with fruit and ice cream!

EXPERIMENT 19

Making gluey stuff for paper sculpture

Be very careful with scissors.

HOUSEHOLD ITEMS YOU WILL NEED:
Mixing bowl, plain flour, water, scissors and different coloured paper.

When you mix plain flour and water, you create a new substance. This is called a colloidal suspension.

In more detail, a colloidal suspension is a mixture of two substances where the particles of one of the substances are small enough to float and stay still within a second substance. The flour floats within water. In other words the flour is suspended in the water.

Use your 100ml beaker in this experiment:

1 Mix 1 beaker of plain flour and half a beaker of water together in a mixing bowl.

2 Stir the flour and water until you have made a smooth mixture.

3 Try making a face by cutting some shapes out of coloured paper. Use the flour and water paste to glue the eyes, nose and other features to the face using your paintbrush. Does it work?

Flour and water paste makes good glue for card and paper projects as it sets hard when it dries.

After you have finished, give your brush a good wash, as the paste can set like concrete!

EXPERIMENT 20

Making doughy stuff

Possible use of oven.

HOUSEHOLD ITEMS YOU WILL NEED:
Plain flour, table salt, water, a mixing bowl and a large spoon.
Optional – acrylic paint and PVA glue.
Optional - A baking tray greased & lined with baking parchment.

You can make your own salt dough modelling material with flour, water and salt. Use your 100ml beaker for this experiment:

1 In a mixing bowl mix 2 beakers of plain flour and 1 beaker of salt.

2 Add 1 beaker of water and stir the mixture well with a large spoon.

3 After mixing it, check how sticky the mixture is with your hands. If it is so sticky it's clinging to your hands ask an adult to help you add a little more flour until it no longer sticks to your hands.

4 Remove the mixture from the bowl and transfer it to your activity mat.

Place in the centre and knead it with your hands for about 5 minutes until it is smooth and pliable.

5 Now you are all set to make some models with your dough. Use your activity mat as your work station and get model making!

6 Once you are happy that your models are finished you can either:

OPTION 1

Ask an adult to cook your models on a baking tray lined with baking sheet in a very cool oven (120 degrees celsius) for about 2 hours. Larger models may take up to 4 hours as the dough is thicker! – Make sure an adult checks if they are cooked or not.

OPTION 2

Leave them in a warm place for 2 or 3 days to dry out instead of baking them.

7 Once your models are dry, you can decorate them with paint using your paintbrush. Once the paint has dried, you can use watered down PVA glue as varnish creating a thin layer over the top – ask an adult to help!

Do not eat the models.

EXPERIMENT 21

Milk flakes; changing state

Hot milk – This experiment works in cold milk but not nearly as well, so make sure you ask an adult to do this experiment.

HOUSEHOLD ITEMS YOU WILL NEED:

1 pint of whole milk, a small saucepan, vinegar, a wooden spoon and a sieve.

1 Ask an adult to heat half a pint of full-cream (whole) milk in a saucepan.

2 When it starts to simmer, take it off the heat and add 4 teaspoons of vinegar.

3 Stir slowly with a wooden spoon off the heat until solid flakes start to be formed.

4 Strain the mixture through a sieve, so that any liquid is poured away down the sink.

5 When it has cooled, rinse it in cold water and you can touch the solid flakes.

The milk has changed from a liquid to a solid.

The process above is called curdling. The curdling process is used in a similar way when making cheese! The watery stuff left over is called Whey and the solid lumps are known as curd.

EXPERIMENT 22

Invisible ink; Lemon juice and heat

Hot iron (for adult use only!)

Did you know that lemon juice can act as an invisible ink? The following experiment will show you how!

HOUSEHOLD ITEMS YOU WILL NEED:

A piece of white paper, lemon juice, an iron and kitchen towel.

1 Squeeze some lemon juice into a saucer and write a message using your paintbrush on a piece of white paper. As it dries your message will become almost invisible.

2 Once dry ask an adult to iron the paper on the wrong side. Protect the ironing board by placing a couple of pieces of kitchen towel underneath.

3 Make sure you allow the message to cool before touching it -The heat has reacted with the lemon juice and your message has appeared again. Magic!

Density 4

Density is a measurement of something's mass relating to its volume, the following

EXPERIMENT 23

Density explained

Dispose of leftover liquid responsibly. Do not drink!

HOUSEHOLD ITEMS YOU WILL NEED:
A tablespoon, golden syrup, cooking oil, water and small non precious objects.

This experiment explains density by looking at the different levels of golden syrup, cooking oil and water.

1 Using a clean tablespoon, spoon golden syrup into your 100ml beaker until it is a quarter full.

2 Now slowly and carefully pour cooking oil over the top of this until the beaker is half full.

3 Finally, use your funnel to slowly add water until the beaker is three quarters full.

You will notice that the syrup, oil and water do not mix and they stay at different levels. This is because they all have different densities. We have poured approximately the same volume of each into the beaker meaning they each take up approximately the same space. However the golden syrup has the greatest density, weighing the greatest for the volume and sinks to the bottom. The oil has the lowest density, weighing the least for the volume and floats on top of both the syrup and the water.

4 To understand a bit more about density try dropping solid objects into the beaker of liquids. Choose these objects carefully because they will get sticky! Try for instance a ping pong ball, a paper clip and a one pence piece!

As well as liquids and solids, gases will also float or sink because of their density.

EXPERIMENT 24

Make an egg float and sink

Caution uses water from hot tap.

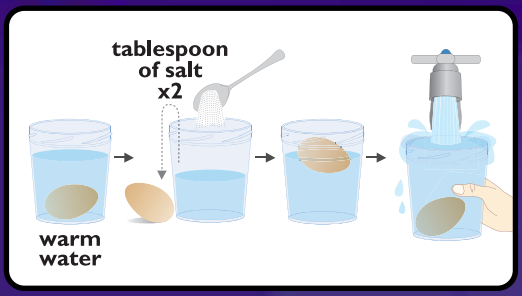
HOUSEHOLD ITEMS YOU WILL NEED:
An egg, a jam jar, table salt and water.

Before you start this experiment - Lukewarm water is water that is not warm, not cold but somewhere in between!

TO MAKE A FRESH EGG FLOAT:

1 Fill a jam jar with luke warm water from the tap until just over half way full and carefully lower the egg in. You should observe that it sinks.

2 Take the egg out and add 2 tablespoons of



salt to the water and stir until dissolved. The slightly warmer temperature of the lukewarm water helps the salt dissolve (as we proved earlier).

3 After adding the salt, carefully lower the egg back into the jar. Is the egg now floating?

4 To make the egg sink again - Hold the jam jar with the floating egg inside under cold running water – hold it there and watch.

The salt solution is being diluted and becoming less dense than the egg. This makes the egg sink again.

Throw the egg away as it has been in warm water and shouldn't be eaten!

EXPERIMENT 25

Make your own iceberg

HOUSEHOLD ITEMS YOU WILL NEED:

An ice cube and a glass of water.

This is a lot simpler than it sounds:

Simply plop an ice cube from the freezer into a glass of water. You will notice it floats near the surface.

Ice is less dense than water and floats. This is because as water freezes and becomes ice it expands (gets bigger). When water becomes ice its molecules become bigger, solid crystals and move away from each other. Therefore ice takes up more volume, but it is still the same weight as the frozen water it is made up of – as a result it is less dense and floats.

EXPERIMENT 26

Sultana submarines

HOUSEHOLD ITEMS YOU WILL NEED:

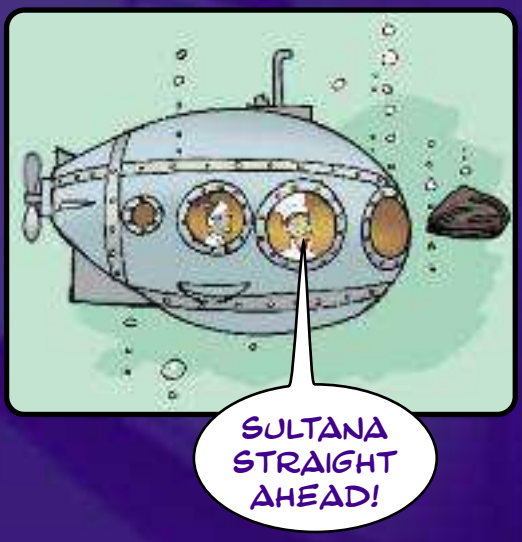
A glass, some fizzy lemonade and a few sultanas.

1 Pour yourself a glass of fizzy lemonade. Did you know that the bubbles are carbon dioxide?

2 Now drop a few sultanas into the glass and watch what happens during the next few minutes!

The carbon dioxide bubbles are less dense than water and rise to the top of the glass causing the fizz. On the way they attach themselves to the sultanas, causing them to rise too.

When they reach the surface, some of the bubbles disappear into the air, so the sultanas sink. They will go on rising and sinking until all the bubbles have escaped!



EXPERIMENT 27

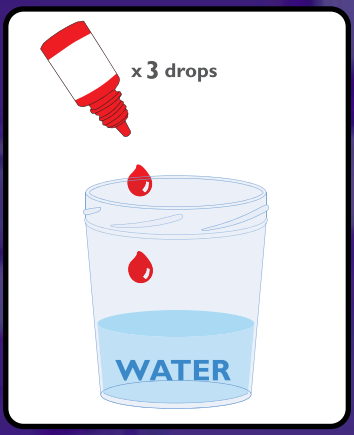
Lava Eruption

Adults please dispose of leftover liquid responsibly.

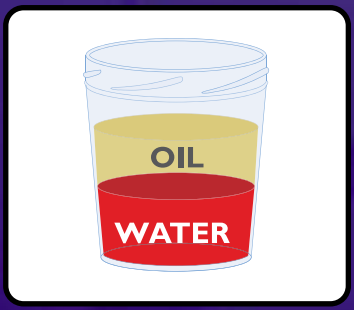
HOUSEHOLD ITEMS YOU WILL NEED:
A tall glass/jam jar, water, cooking oil and a fizzy vitamin C tablet.

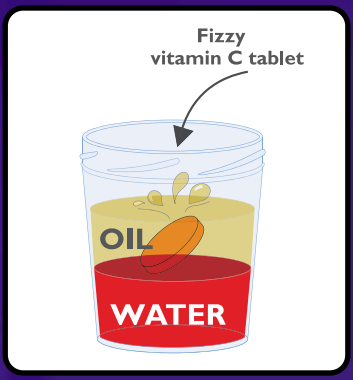
You can use a jam jar or a tall glass for this experiment. A tall glass will get the best results!

1 Fill your glass/jam jar a third full with water and add a few drops of red/blue food colouring (or both for a purple effect!)



2 Carefully pour cooking oil on top stopping approximately 3cm from the top - This leaves an important gap at the top for the effects of the fizz!





3 Place the glass/jar on your activity mat and drop an effervescent (fizzy) vitamin C tablet into the liquid – effervescent means something that dissolves with a fizz giving off bubbles of gas.

4 The tablet will sink to the bottom. Now pay attention as the fizz will cause movement straight away. Can you see the water droplets rise and fall?

This effect looks similar to a type of groovy lamp known as lava lamps that were popular in the 1960's!

5 Ask an adult to dispose of the liquid in the jar carefully and responsibly once you have finished the experiment. It is important that you do not pour the liquid down the sink because oil doesn't mix with water and can cause blockages.

Do not drink!

Liquid properties 5

This section guides you through several experiments that explore the way water acts and its properties.

EXPERIMENT 28

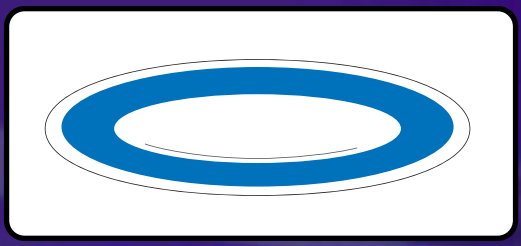
Liquid's skin ; Pepper walks on water

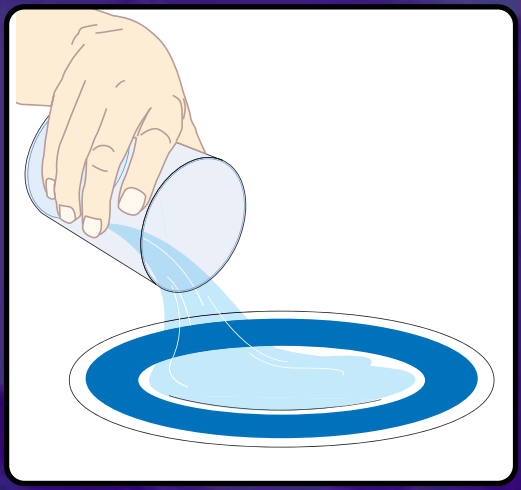
HOUSEHOLD ITEMS YOU WILL NEED:
Fine grain pepper or talcum powder, a clean dinner plate, water and a bar of soap.

This experiment will work with either fine pepper grains or talcum powder.

1 **Fill one of your beakers with water from the cold tap.**

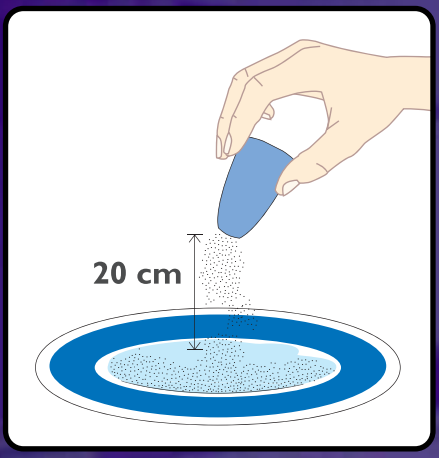
2 **Carefully pour a little water onto your plate until it has covered the whole plate with a thin layer. Now leave the water to settle.**





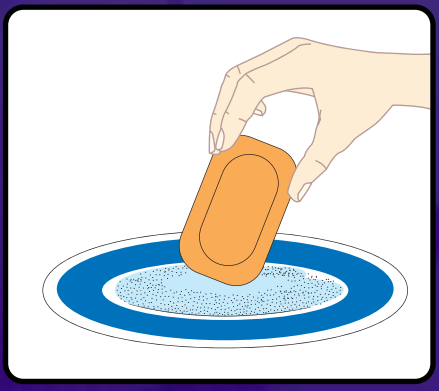
3 Wait until the water is very still and gently sprinkle a small amount of pepper (using a pepper pot) over the surface of the water, or if using talcum powder gently sprinkle a pinch of powder using your fingers.

TOP TIP!
If you keep your hand 20cm above the plate as you are sprinkling, the grains or powder are more likely to float because they rest more gently!



You should see that the pepper grains or powdery talc rest on the water. This is because water has a property called surface tension. This is a special chemical property which creates a kind of skin on liquids where they touch the air.

4 To change the surface tension, keep the plate very still and using a bar of soap gently touch the centre of the water.



WHAT HAS HAPPENED?

The pepper/talc has stayed on the surface, but moved away from the soap, this is because the soap has broken the surface tension in the middle. The pepper/talc is being pulled towards the surface tension that still exists around the outside of the plate.

EXPERIMENT 29

Liquid's Skin; Make a needle float

Needle point

HOUSEHOLD ITEMS YOU WILL NEED:
A cereal bowl, water, a tissue and a sewing needle.

Now using surface tension try making a needle float!

1 Fill a cereal bowl with water and wait till it settles and is completely still.

2 Now break off a piece of tissue and very gently and carefully place it on top of the water.
The tissue should float, if it doesn't float try again until it does.

3 Now try your luck at gently dropping a needle on top of the floating tissue without making the tissue and needle sink.

If successful, you have managed to make a needle float! A metal needle would normally sink in a bowl of water because metal is more dense than water. However the tissue is held at the surface by surface tension and holds the needle at the surface.

EXPERIMENT 30

Water can act as a magnifier

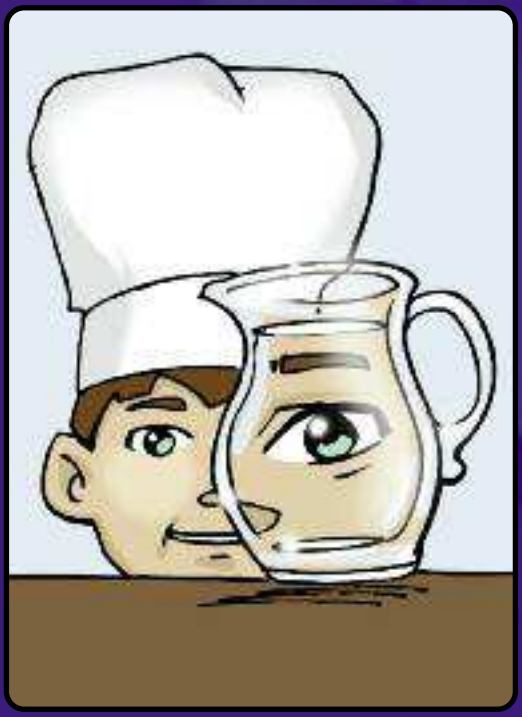
HOUSEHOLD ITEMS YOU WILL NEED:

Junk mail/scrap paper (not newspaper) with small printed text on it and water.

1 Using your pipette, carefully drop one droplet of water onto a bit of the text on the paper.

2 Look at the text under the water droplet and the text around the droplet carefully. In comparison to the normal text, the text under the droplet should look larger. This is because the water droplet is curved and acts like a glass lens. A glass lens works by bending the light reflected from an object and this enlarges what you see.

The magnifying effect works best when the droplet is smaller as the surface of the droplet has a greater curve and bends the light better making the image bigger!



EXPERIMENT 31

The motion of water

HOUSEHOLD ITEMS YOU WILL NEED:

A jug and water.

This experiment introduces you to atoms and molecules. Atoms are so small they cannot be seen, but all matter in the world is made up of atoms. Often atoms will join together to make molecules. Water contains molecules.

In this experiment we will explore water molecules and how they move, or in other words 'their motion'. We are therefore investigating molecular motion.

1 Fill a large clear jug with cold tap water.

2 Carefully add two drops of red food colouring and two drops of blue food colouring into the water. Add the coloured drops at opposite sides of the jug so they don't mix.

If you have kept the jug very still you should see the food colouring sinks, leaving a trail in the water.

3 Leave the jug for a few hours without moving it, you will see that the movement of the molecules in the water has spread the colourings evenly throughout the water turning it a purple colour!

Mixing the impossible 6

Mixing the impossible – Sometimes when we try to mix two very different chemicals, they refuse to mix. We call things that don't mix "immiscible". Oil and water are immiscible ingredients. Adding a third substance can help to blend or emulsify them.

EXPERIMENT 32

Breaking up oil and water

Adults please dispose of leftover liquid responsibly.

HOUSEHOLD ITEMS YOU WILL NEED:
Cooking oil, water, washing up liquid and a clean teaspoon.

STAGE 1

1 Half fill a test tube with water and place it in its holder.

2 Add a teaspoon of cooking oil to the test tube using your funnel.

QUESTIONS:
Which is on top the oil or the water?
Have the oil and water mixed together?

STAGE 2

3 Block the opening of the test tube with the bung and holding the bung in place shake the test tube (over the kitchen sink in case of spills).

You will see that because these are two such different chemicals they do not mix, even after shaking there are still little blobs of oil suspended in the water!

STAGE 3

4 Remove the bung and add a few drops of washing up liquid, now replace the bung and carefully shake again.

You will see that the washing up liquid (detergent) helps to break up the oil blobs and the whole mixture has become cloudy.

The fact that oil and water do not mix makes the disaster of an oil spill at sea slightly easier to deal with as some oil can be skimmed off the surface of the sea.

Oil can have an awful effect on the marine life around. Sea birds for example can be covered in oil after a spill at sea which can lead to death. There are often clean up operations to help reduce damage to the environment after oil disasters. Washing up liquid is not only useful for washing up dishes, as it is also used in these clean up operations to wash the oil off the feathers of affected birds!

EXPERIMENT 33

Milk Marbling

HOUSEHOLD ITEMS YOU WILL NEED:
Half a pint of whole milk, a cereal bowl and washing up liquid.

1 Fill a cereal bowl with whole milk.

2 Add a drop of the red and a drop of the blue food colouring to the milk at opposite sides of the bowl.

You will see that the way the food colouring acts in milk is very different to how it acts in water. The drop of colouring in the milk is clearly visible on the top whereas it sinks in the water. The reason for this is because milk contains drops of fat; similar to oil this fat refuses to mix with the watery food colouring.

3 Now add a drop of washing up liquid on top of each of the food colouring drops.

This should break up the drops of fat in the milk around the food colouring and allow the milk and food colourings to mix. It will make some great swirly patterns at the same time!

Do not drink!
Dispose of liquid immediately.

EXPERIMENT 34

Making salad dressing

Make sure equipment and preparation area are completely clean before you start.

HOUSEHOLD ITEMS YOU WILL NEED:
A clean tablespoon, olive oil, vinegar, salt, pepper and a clean jam jar with lid.
Optional - mustard powder.

Now let's see how we cooks use chemistry in the kitchen to make a salad dressing – Wait till you are having salad to do this one!

1 Find yourself a clean jam jar – make sure it is squeaky clean because you'll be eating what you make in it.

2 Put 4 tablespoons of olive oil and 2 tablespoons of vinegar into the jam jar.

3 Add a pinch or two of salt and pepper – you may even want to add a tiny pinch of mustard powder, to add to the taste.

4 Screw the lid on tight and shake.

You have now made a tasty dressing for your salad!

5 Look carefully - The oil and vinegar have mixed as much as they can, but you will still see separate globules of oil in the vinegar.

6 Check after a while to see if the ingredients have separated - You'll need to give the mixture another shake just before sprinkling it over your salad!

Enzymes 7

Enzymes speed up reactions. There are lots of enzymes naturally in our bodies. Within the human body enzymes help with the breaking down of food in the digestive process as well as performing other important jobs. Different enzymes help with different processes.

A type of enzyme is added to some washing powders because they are good at attacking and help the powders to break down dirt and dissolve away oil on dirty laundry. Washing powders to which enzymes have been added are called biological washing powders.

EXPERIMENT 35

or should we say Eggsperiment 35

Caution boiling water used.

3 days

Beware of possible allergy to washing powder. Do not allow contact with the skin.

This experiment must be handled solely by a supervising adult.

HOUSEHOLD ITEMS YOU WILL NEED:

An egg, biological and non biological washing powder, a table knife, 2 jam jars (with lids) and water.

1 To prepare for this experiment ask an adult to hard boil an egg for you.

2 Now fill 2 jam jars with luke warm water.

3 Put 3 teaspoons of biological washing powder in one jar and 3 teaspoons of non biological washing powder in the other and stir. Label the biological jar B with your pen so you can remember which one is which.

4 Once the hard-boiled egg has cooled, carefully de-shell it and cut it in half with a table knife.

5 Place one half of the egg in the jar with the biological powder and the other in the non biological jar and screw the lids on.

6 Place the jars beside a radiator or in a warm place for 3 days.

7 Being careful not to touch the contents - Unscrew the jam jar lids over the sink and remove the pieces of egg from one jam jar and then the other with your spoon – Make a note of what has happened to each egg from the different jars. Throw the eggs away immediately! You will find that the enzymes that are in the biological powder have eaten away at the egg, while the egg in the non biological powder is still the same size.

8 Wash hands and equipment thoroughly.

Due to bacteria an adult must safely dispose of the contents of the jar immediately after the experiment is complete.

RAW OR COOKED?

If you can't remember whether an egg with its shell intact is hard-boiled or raw try spinning it!

If it wobbles it's raw, if it spins it's hard boiled! Have a go next time you're unsure, but be careful it doesn't fall on the floor or you may get a very quick answer!

Nature's laboratory 8

Nature's Laboratory - Have you ever stopped to think what makes grass grow? Or even how trees, flowers, vegetables and fruit grow too? When you place seeds in the earth, plants grow by a process called photosynthesis. They take minerals and water from the earth and carbon dioxide from the air. The other vital energy source they need is light.

EXPERIMENT 36

Growing cress

STAGE 1
HOW DOES CRESS GROW BEST?

1 week

HOUSEHOLD ITEMS YOU WILL NEED:
Three saucers, kitchen towel and water.

Let's do some experiments with cress, which is very easy to grow indoors all year round:

1 Find 3 saucers from your kitchen cupboard.

2 Place 2 layers of kitchen towel in each (this takes the place of earth).

3 Wet the kitchen paper in 2 of the saucers with water (you can use your pipette for this).

4 Scatter a few seeds in all 3 saucers.

5 Place one of the wet saucers in the sunlight on the windowsill and keep it damp (keep an eye on it you may need to add water daily!)

6 Place the dry saucer on the windowsill but do not water it.

7 Keep the final wet saucer damp but put it in a dark cupboard.

Check the saucers every day for signs of growth for 7 days.

QUESTION: Does this experiment help prove that water and light are neded for plants to grow properly?

STAGE 2
PLANT'S SECRET SENSES

1 week

8 Continue growing the cress in the damp saucer on the windowsill by keeping the tissue paper damp and the saucer in the sunlight.
IMPORTANT - Whilst it is growing do not move the saucer.

9 When it has reached approximately 5cm you should notice that it has begun to lean outwards towards the window. When this happens turn the saucer around so that the cress heads now face into the room and away from the window.

10 Continue watering as usual for the next few days.

QUESTION:
What happens to the direction of the cress? Does it change again?

ANSWER:
The answer should be yes. If it is healthy the cress should slowly move again to face the window. This is because plants always turn to the light to help them grow through photosynthesis!

EXPERIMENT 37
Photosynthesis: Pondweed produces oxygen

BEWARE OF THE DANGER OF PONDS!

2 days

HOUSEHOLD ITEMS YOU WILL NEED:
2/3 strands of Canadian pondweed (which has broad leaves), a cereal bowl and 4 large balls of sticky tack (each ball of sticky tack to be about 1cm).

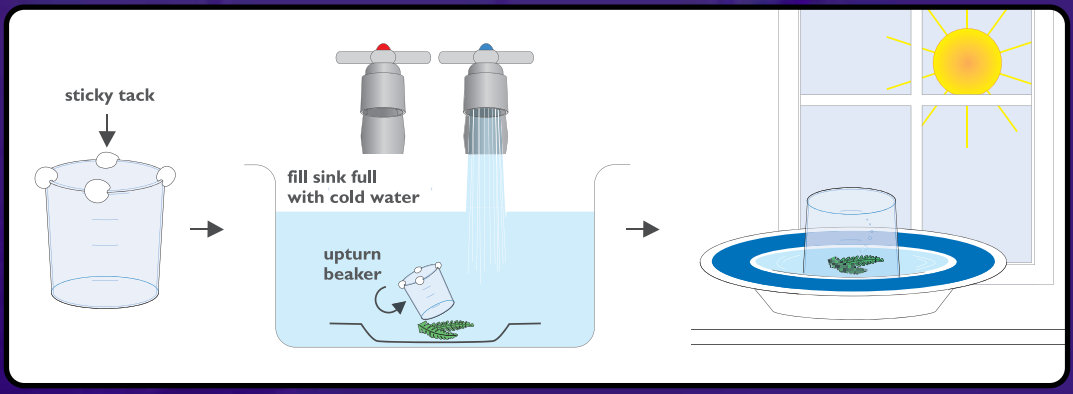
In the process of growing, plants make oxygen by photosynthesis this can be proved by the following experiment:

1 First things first, you need to find yourself some pondweed. You may have some in the pond in the back garden or alternatively you will need to buy some from a garden centre - 2 strands will be enough.
IF YOU HAVE A POND MAKE SURE YOU ASK AN ADULT TO FISH SOME OUT FOR YOU - DO NOT DO THIS YOURSELF.

2 Once you have your pondweed fill a sink with cold tap water.

3 Stick your 4 pieces of sticky tack around the rim of your 100ml beaker.

4 Now place the cereal bowl under the water and hold the 2 strands of pondweed in the centre of the bowl.



5 Now push your beaker in its upright position under the water so it completely fills with water.

6 Next upturn your beaker under water (so no air gets in it) and trap the pondweed within the beaker (the sticky tack should give the beaker tiny stilts!).

The pondweed should now be trapped between the upturned beaker and the bowl.

Make sure there are no trapped air bubbles!

9 With the help of an adult carefully remove all the equipment from the sink holding them in their position so the bowl and beaker continue to be filled with water.

At least a small part of the beaker needs to be out of the water. If the bowl is deeper than the height of the beaker, hold the beaker to the bowl and pour a small amount of water out of the bowl so the beaker is taller than the water level around it.

10 Place the equipment on a sunny windowsill and leave.

The beaker will gradually fill with air bubbles. This air is oxygen produced by the pondweed in photosynthesis. You should be able to see small bubbles forming on the pondweed which escape and rise to the top of the upturned beaker, because the oxygen is a gas it rises and takes the place of the water that was filling the beaker.

11 Check the beaker every hour for 3 hours to see how much oxygen is being produced, then leave the beaker on the window sill for a couple of days and check it again.

You could repeat the experiment on a really sunny day and then on a really cloudy dull day to see if it makes any difference to the amount of oxygen being produced!

EXPERIMENT 38

Water's route up a stem

Be very careful with scissors.

2-3 hours

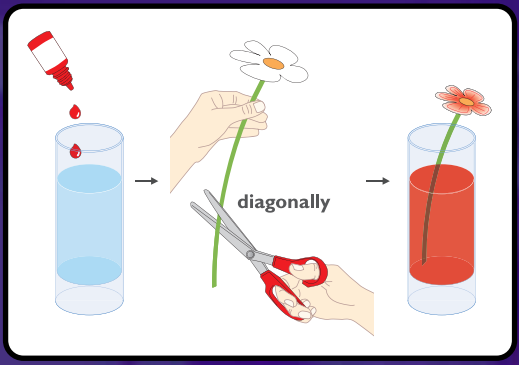
HOUSEHOLD ITEMS YOU WILL NEED:
2 tall glasses, 2 white flowers (Carnations are the best), scissors and water.

Water is also needed in the process of photosynthesis. This experiment will help you see how water travels up the stem of a plant to the leaves and petals:

1 Fill 2 glasses 3 quarters full of water.

2 Add a few drops of red food colouring to one of the glasses.

3 Take two identical white flowers and snip 2cm diagonally off the end of their stems with scissors.



4 Now pop 1 flower in each of the glasses.

5 Be patient as the water may take a while to travel up the stem, but you might see the food colouring has reached the white petals if you check the next day.

For quicker results try the same experiment with celery stalks!

Plane trees in London fight pollution that can block the pores in their trunks by shedding bark. Not all trees shed bark and so this explains why plane trees still appear to look healthy in heavily polluted areas. This is another example of the clever tricks plants have to survive!

Metal magic within the kitchen 9

EXPERIMENT 39

Copper cleaner

HOUSEHOLD ITEMS YOU WILL NEED:
1 pence or 2 pence coin, table salt, vinegar and a jam jar with a lid.

1 Drop your coin (1p or 2p piece) into a jam jar.

2 Scatter a teaspoon of table salt on top of the coin.

3 Pour vinegar over the coin until it is completely covered.

4 Screw the lid onto the jam jar and rattle the coin around.

5 Leave on your activity mat for 3 minutes and then unscrew the lid.

The vinegar acts as a powerful cleaner and has cleaned the old coin to a nice shine.

f Vinegar was used in the old days to clean all sorts. For example vinegar can be mixed with water or used full strength to clean windows, glass and mirrors. The one problem is it's smelly (as you may have found out!)

EXPERIMENT 40

Copper plating

HOUSEHOLD ITEMS YOU WILL NEED:
15-20 1 or 2 pence coins, table salt, vinegar, 2 jam jars with lids, a steel nail, wire wool and water.

1 Place 15-20 copper coins into a clean jam jar.

2 Sprinkle with 2 teaspoons of salt and then cover them with vinegar. Screw the lid on and gently rattle the coins around.

3 When they have become bright and shiny, pour the vinegar solution into another jam jar.

4 Find a steel nail and clean it well with a wire wool pad (it's important that it is clean for the experiment to work).

5 After cleaning the nail rinse it with water and then drop it into the jar of vinegar solution.

6 Leave the nail in the jam jar for about 15 minutes. When you return it should have turned a coppery colour. This is because the copper that was removed when cleaning your coins was suspended in the vinegar solution and has been attracted to the steel nail and attached itself to it!

Spot the hazards 10

'As a trainee cook I'm in the kitchen a lot and so I know from experience the importance of being safe. Learn more about being safe in the kitchen with me by colouring in the poster in this kit and spotting the hazards!'

Colour in the hazards poster and circle the hazards you can see. Use the handy hints below if you need any help finding them all:

1 Monkeys love these, but don't slip on the one left on the floor.

2 You'd expect these to form outside on a rainy day not in the kitchen!

3 Electricity and water shouldn't be mixed.

4 This is a dangerous alkaline used for cleaning and should be kept out of harms way.

5 You open these (because things are stored inside) but usually shut them afterwards.

6 Used to chop food, this sharp utensil is a hazard.

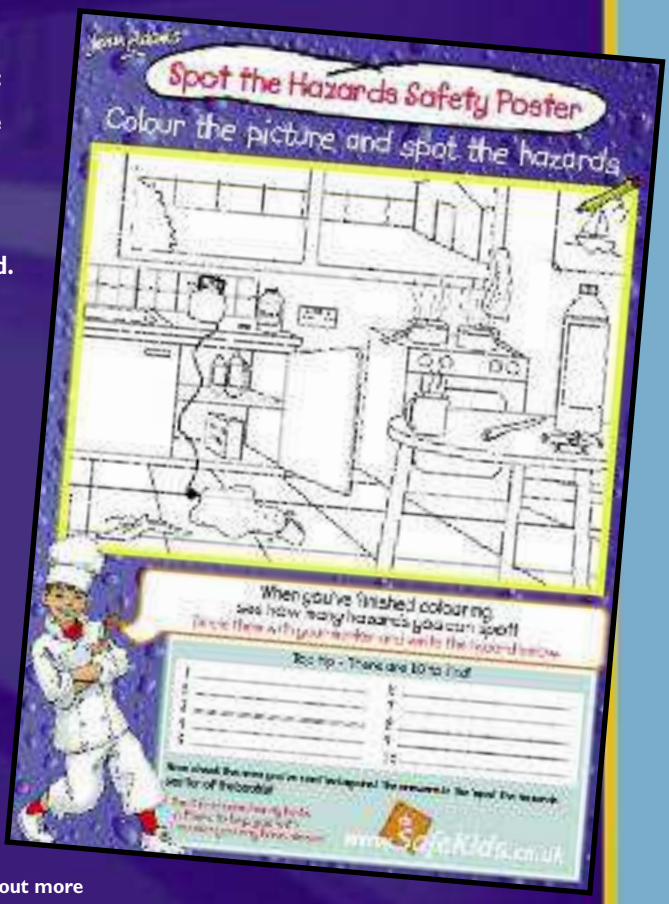
7 Don't knock hot chocolate.

8 It would be tricky not to get a sleeve caught on these scalding handles.

9 We all love these sugary treats but swallowing them whole is a hazard.

10 We dry dishes with this, but should hang it somewhere safer!

Answers on the next page.



With thanks to Safe kids. If parents would like to find out more about children's safety within the home please visit www.safekids.co.uk. 'Safe Kids' is an organisation that offers useful resources to help teach children about the importance of safety.

ANSWERS

1 Banana skin – Slip hazard

2 Puddle on the floor – Slip hazard

3 Plug near water – Electrocution hazard

4 Bleach with cap off – Harmful substance hazard

5 Open cupboard door – Trip hazard

6 Unguarded knife – Hazard, sharp utensil

7 Hot drink near edge of table – Hot liquid, scalding hazard

8 Overhanging pan handles – Boiling hot liquid, scalding hazard

9 Sweets – Choking hazard

10 Tea towel over the hob – Fire hazard

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