John Adams

AGE 10+

CHEMISTRY SET

WARNING! ONLY FOR USE BY CHILDREN OVER 10 YEARS OLD ● TO BE USED SOLELY UNDER THE STRICT SUPERVISION OF ADULTS THAT HAVE STUDIED THE PRECAUTIONS GIVEN IN THE EXPERIMENTAL SET ● CONTAINS SOME CHEMICALS WHICH ARE CLASSIFIED AS A SAFETY HAZARD ● READ ALL INSTRUCTIONS BEFORE USE, FOLLOW THEM AND KEEP THEM FOR REFERENCE ● DO NOT ALLOW CHEMICALS TO COME INTO CONTACT WITH ANY PART OF THE BODY, PARTICULARLY THE MOUTH AND EYES ● KEEP SMALL CHILDREN AND ANIMALS AWAY FROM EXPERIMENTS ● STORE THE CHEMISTRY SET OUT OF REACH OF SMALL CHILDREN ● EYE PROTECTION FOR SUPERVISING ADULTS IS NOT INCLUDED.

100 Amazing Experiments

Action Science®

CHEMISTRY SET

CHEMICALS		CAS NO	EINECS NO
Copper (11) Sulphate ($CuSo_45H_20$)	HARMFUL IF SWALLOWED. IRRITATING TO EYES AND SKIN. VERY TOXIC TO AQUATIC ORGANISMS, MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT. DO NOT BREATHE DUST. THIS MATERIAL AND ITS CONTAINER MUST BE DISPOSED OF AS HAZARDOUS WASTE. AVOID RELEASE TO THE ENVIRONMENT. REFER TO SPECIAL INSTRUCTIONS/SAFETY DATA SHEET.	7758-98-7	2318476
Ammonium Chloride (NH_4Cl)	HARMFUL IF SWALLOWED. IRRITATING TO EYES. DO NOT BREATHE DUST.	12125-02-9	2351864
Calcium Hydroxide $Ca(OH)_2$	IRRITANT.	1305-62-0	2151373
Sodium Carbonate ($Na_2CO_310H_20$)	IRRITATING TO EYES. DO NOT BREATHE DUST. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.	497-19-8	2078388
Sodium Hydrogen Sulphate $NaHS0_4H_20$	RISK OF SERIOUS DAMAGE TO EYES. AVOID CONTACT WITH SKIN. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.	7681-38-1	2316657
Aluminium Potassium Sulphate $K_2S0_4Al_2\ (S0_4)_324H_20$)		10043-67-1	2331413
Zinc (Zn)	CONTACT WITH WATER LIBERATES EXTREMELY FLAMMABLE GASES. SPONTANEOUSLY FLAMMABLE IN AIR. VERY TOXIC TO AQUATIC ORGANISMS, MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT. IN CASE OF FIRE USE A DRY CHEMICAL POWDER EXTINGUISHER. IF SWALLOWED, SEEK MEDICAL ADVICE IMMEDIATELY AND SHOW THIS CONTAINER OR LABEL. THIS MATERIAL AND ITS CONTAINER MUST BE DISPOSED OF AS HAZARDOUS WASTE. AVOID RELEASE TO THE ENVIRONMENT. REFER TO SPECIAL INSTRUCTIONS/SAFETY DATA SHEETS.	7440-66-6	2311753
Calcium Carbonate ($CaCO_3$)	IRRITANT.	471-34-1	2074399
Ammonium Iron (III) Sulphate $FeNH_4(SO_4)_212H_20$	IRRITANT.	10138-04-2	2333824
Iron (II) Sulphate($FeS0_4$)	HARMFUL IF SWALLOWED. IRRITATING TO EYES AND SKIN. IF SWALLOWED, SEEK MEDICAL ADVICE IMMEDIATELY AND SHOW THIS CONTAINER OR LABEL.	7720-78-7	2317535
Sodium Thiosulphate ($Na_2S_20_3$)		7772-98-7	2318675

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...

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 10 years old.
- 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, alkalis 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.
- Do not eat, drink or smoke in the experimental area.
- Do not allow chemicals to come into contact with the eyes or mouth.
- Do not replace food-stuffs in original containers. Dispose of immediately.
- Dispose waste in waste drain with plenty of water for liquids.
- Dispose other experiments in household waste bins.

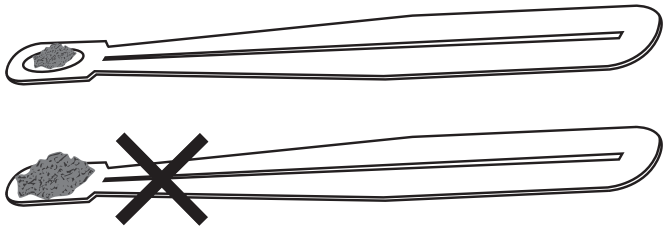
GENERAL FIRST AID INFORMATION

- In case of contact with eyes: rinse out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.
- If 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.

GENERAL PREPARATION

Whilst chemistry is fun, it can also be extremely dangerous. It is most important that you read and understand all of the safety instructions before you start performing any experiments. Be sure to wear safety goggles at all times when handling chemicals and / or conducting experiments.

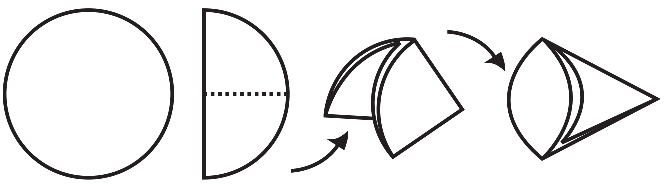
- All real chemists carefully record their findings and observations in a book or on a notepad. This helps them to find new solutions.
- It can be a good idea to mark chemical preparations with stickers and a marker pen.
- When storing chemicals in tubes within the rack, always fit a solid cork to prevent accidental spillage. Do not fit a solid cork to a tube that is warm or contains mixtures that are still reacting.
- Always store the chemicals in their original containers and ensure that the lids are well fitted. Never mix chemicals in their original containers.
- The Glass Rod should only be used for stir solutions. Never heat the rod and always clean and dry it after each use.
- 'One Heaped Spatula' of any chemical should be as per this illustration

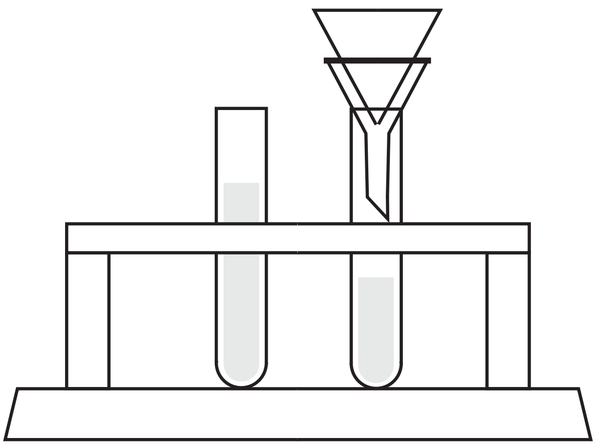


SETTING UP A FILTER FUNNEL

In some experiments it is necessary to use apparatus called a filter funnel. This apparatus consists of the plastic funnel and the filter papers.

1. Fold the filter paper in half, and then half again to create a quarter of a circle shape.
2. With your fingers carefully divide the filter paper to create a cone shape.
3. Place the cone into the funnel as shown in the illustration.

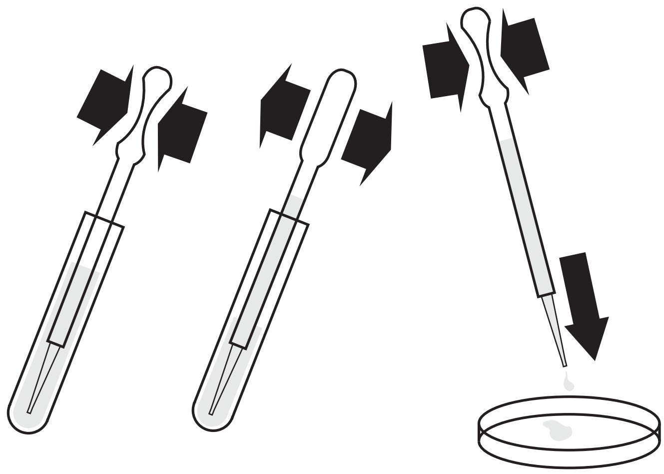




USING THE PIPETTE

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

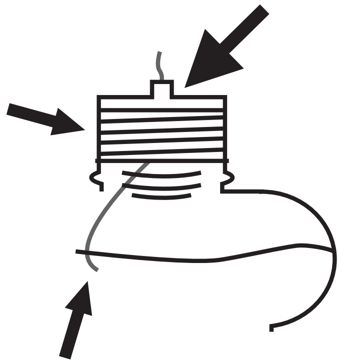
1. Ensure that the container and its contents are both cool.
2. Slightly tilt the container, and insert the tip of the pipette below the surface of the liquid.
3. Gently squeeze the top of the pipette and then release, the liquid is then sucked into the shaft of the pipette,
4. To drop the liquid again, simply hold the pipette over the container and gently squeeze until the desired amount of liquid is dispensed.
5. Only use the pipette with one chemical at a time and always wash well between uses.

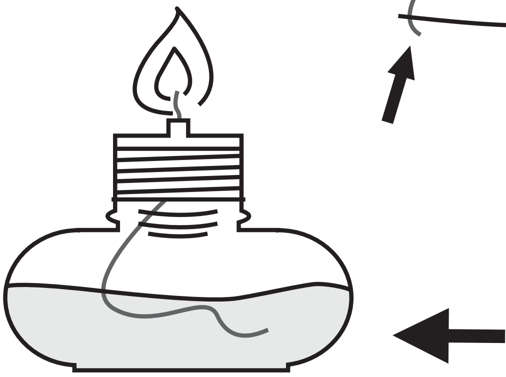


USING THE SPIRIT BURNER

The Spirit Burner is used for heating chemicals, and if not used correctly can be extremely dangerous. The Spirit Burner uses Methylated Spirits as a fuel, and UNDER NO CIRCUMSTANCES should any other fuel be used. Adult supervision is essential at all times when using the Spirit Burner.

1. Unscrew the cap, and three quarter fill the glass jar with Methylated Spirits. Replace the cap, and ensure that 3-5mm of wick is protruding above the cap.
2. Replace the lid of the container of Methylated Spirits and store well away from the burner. Clean up any spillage immediately, and dry the outside of the burner.
3. Place the burner in the centre of a metal baking tray or large metal lid with a lipped edge.
4. Light the wick at arms length using matches or a lighter.
5. The burner can be extinguished at any time by placing the open end of a test tube over the flame. If the burner appears to go out of control extinguish it immediately. If the outside of the burner appears to be flaming, a water saturated cloth can be placed over the burner to extinguish all flames.
6. After use, allow the burner to cool down for at least 5 minutes before replacing any unused Methylated Spirits to the original container.
7. If the wick becomes frayed, ask an adult to trim with a sharp pair of scissors.

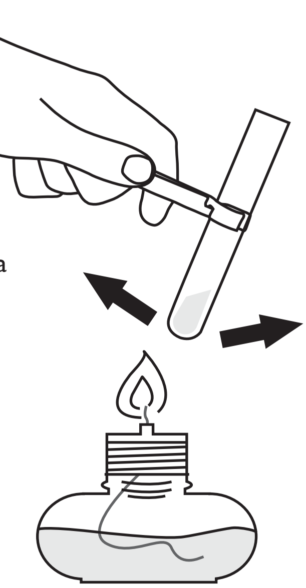




HEATING TEST TUBES

Test tubes are heated using the Spirit Burner. Under no circumstances should any other heat source be used in these experiments. Occasionally chemicals may 'spit' when they are heated. Follow these instructions for the safe heating of tubes.

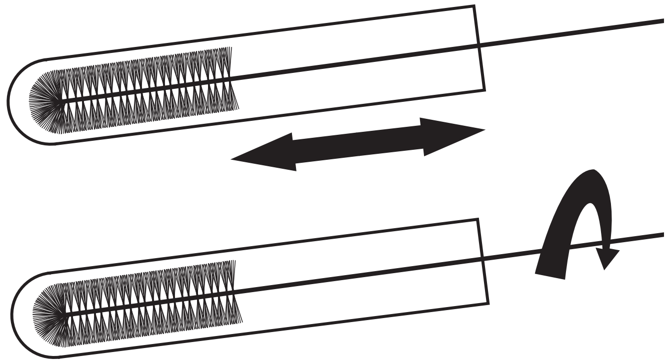
1. Always use the metal tongs provided to hold test tubes over the flame. To hold a tube, push the handles together to open the jaws of the tongs, and insert the tube to be heated. Release the handles to grip the tube.
2. When heating tubes, always point the open end away from yourself and others.
3. Only hold one tube at a time with the tongs. If you need to heat two tubes at the same time use two pairs of tongs.
4. Hold the tube above the flame at a slight angle. Keep moving the tube over the flame in order to heat the sides as well as the base. If you do not keep the tube moving there is a danger that it may crack. Take particular care when heating solids.
5. Never heat a tube when fitted with a solid cork.
6. Never exceed 3cm of liquid or 0.5cm of a solid in a test tube when heating.
7. Stop heating the tube when it starts to make a spitting noise, the content has reached boiling point.
8. Never put hot test tubes in water, as they will crack. Always allow tubes to completely cool before placing them in the rack.



MAINTAINING YOUR EQUIPMENT

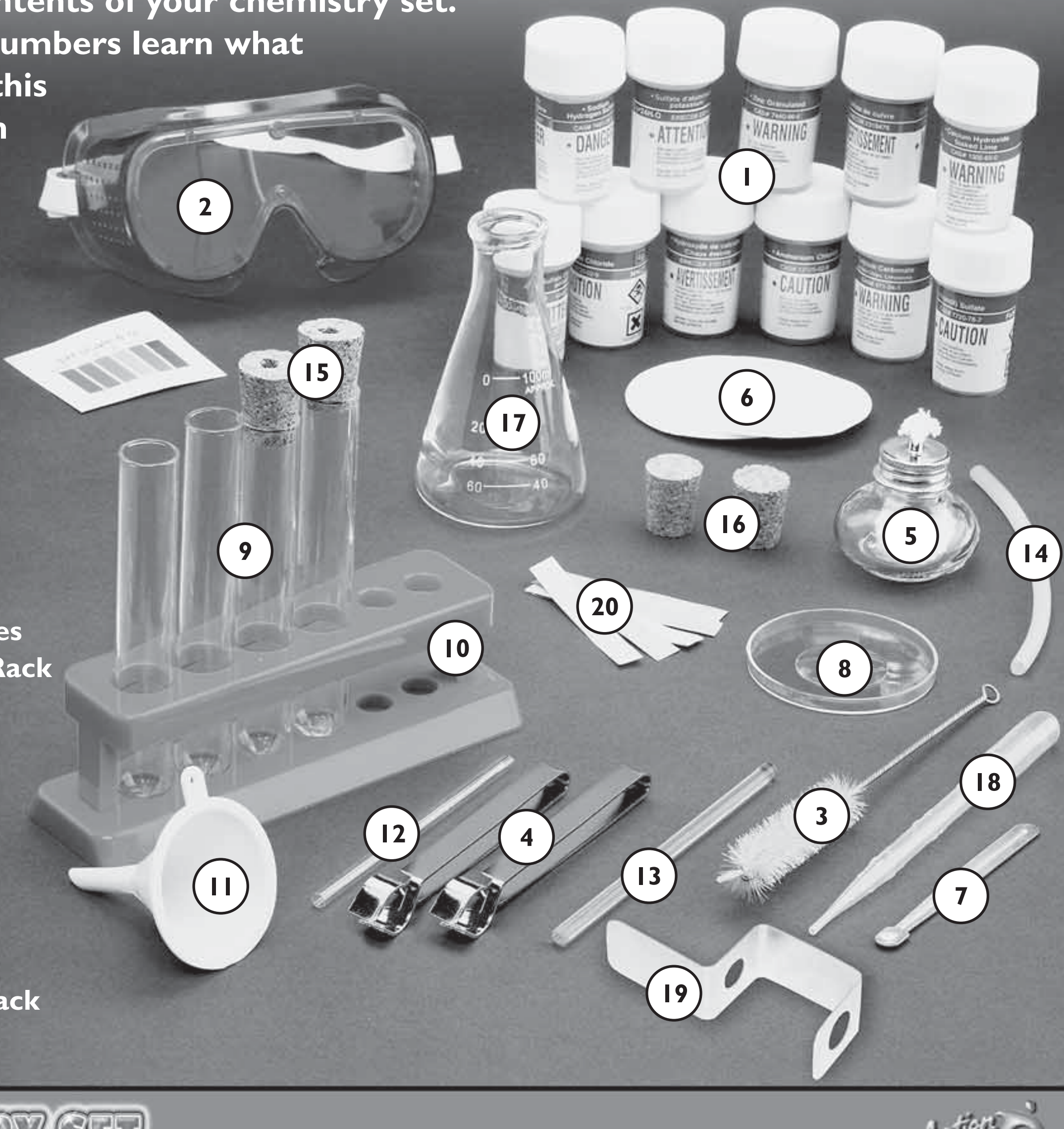
It is most important that all of your equipment is well maintained and cleaned between experiments. Dirty and damaged equipment can cause a serious safety hazard and affect the results of the experiments.

1. Always clean all equipment between experiments. Be sure to dry all parts after washing.
2. Test tubes and flasks can be cleaned by scrubbing their inner walls with the test tube brush, and a little washing up liquid. Be sure to rinse tubes well to avoid contamination with cleaning agents.
3. Dispose of spent (used) chemicals by flushing down the sink with plenty of fresh water. Tubes and flasks should be left to dry naturally if possible.
4. Always dispose of damaged equipment immediately. Never use a cracked or chipped test tube.



CONTENTS OF THE CHEMISTRY SET

Before you start any experiments, please look carefully at this photograph which shows the contents of your chemistry set. Using the identity numbers learn what each part is called, this will make things run much smoother once you get going.



1. **11 x Chemicals**
2. **Goggles**
3. **Test Tube Brush**
4. **Metal Tongs**
5. **Spirit Burner**
6. **Filter Papers**
7. **Spatula**
8. **Watch Glass**
9. **4 x Glass Test Tubes**
10. **Plastic Test Tube Rack**
11. **Plastic Funnel**
12. **Glass Tube**
13. **Glass Rod**
14. **Rubber Tubing**
15. **2 x Holed Corks**
16. **2 x Solid Corks**
17. **Glass Flask**
18. **Pipette**
19. **Metal Test Tube Rack**
20. **Litmus Paper**

GLOSSARY OF CHEMICAL TERMS

ACID
A substance which has a sour taste and turns litmus paper red – Do not taste acids unless you are sure it is safe to do so.

ALKALI
A substance which can neutralise an ACID.

AMORPHOUS
A gem which does not have a distinct crystalline structure.

ANALYSIS
To research and record the properties of a chemical or reaction.

ATOM
The smallest part of an ELEMENT.

BASE
A COMPOUND that is usually bitter to the taste, and has the ability to turn litmus paper blue.

CATALYST
A chemical that helps to accelerate chemical reactions.

REACTION
A change in the arrangement of ATOMS or molecules to produce substances of different compositions.

CHROMOTOGRAPHY
A method of separating the mixtures of different coloured substances in a liquid using absorbent paper.

COMPOUNDS
A substance that is formed by two or more ELEMENTS.

CRYSTAL
A solid substance that can be identified by its arrangement of regular atoms or molecules. Usually has an angular shape.

CRYSTALLISATION
The process of converting a liquid to a solid to form CRYSTAL solid matter.

CRYSTALLINE
A rock that consists entirely of CRYSTALS or CRYSTAL fragments.

DISTILLATION
To EVAPORATE a liquid in order to separate its different liquid forms, and to collect the evaporated portion.

ELEMENT
The simplest of substances that cannot be broken down any further by chemical means.

EMULSION
A combination of two liquids that will not entirely mix. Usually one liquid is suspended within the other in the form of droplets.

ENDOTHERMIC
The absorption of heat by a chemical or mixture.

EXOTHERMIC
A chemical REACTION that develops heat.

EVAPORATION
The process of turning a liquid into a gas or vapour.

FILTRATION
To remove solid particles from a liquid using a filter paper.

HETEROGENEOUS
A substance made up from non compatible elements.

HOMOGENEOUS
A matter that has uniform properties throughout.

IMMISCIBLE
Liquids that will not blend or mix together.

INDICATOR
A substance used to identify ACIDS and ALKALIS by changing colour when exposed.

MIXTURE
Two or more substances that when combined retain their own chemical structures.

NEUTRALISATION
The result when ACIDS and ALKALIS are mixed to a neutral solution.

OXIDATION
Allowing a substance to come into direct contact with OXYGEN.

PRECIPITATE
To cause a solid to separate from a liquid usually in the form of a crust.

REACTANTS
The chemical components required to form a reaction.

RESIDUE
The solid matter that remains on the filter paper when separating solids from liquids, or during EVAPORATION.

RESPIRATION
The process where animals take in oxygen and pass out carbon dioxide.

SATURATED
A solution that cannot take in any more dissolved solid.

SOLUTION
A solid dissolved within a liquid.

SUBLIMATION
To convert a substance into a vapour and then into a solid without becoming a liquid.

SUSPENSION
A mixture of a solid substance and a liquid where the solid does not dissolve but the particles float within the liquid.

AN INTRODUCTION TO CHEMISTRY

Chemistry is one of the oldest sciences, indeed every substance known to man is made from chemicals of one sort or another. Chemistry is the science of understanding how we can develop new materials and processes using the basic building blocks of life.

Scientists use chemistry for everything from developing new materials for our clothes to finding new fuels to send rockets into space. It is widely accepted that there are few boundaries when it comes to chemistry.

Every chemical is made up from a group of just over 100 elements or very basic building blocks. These elements are naturally solids, liquids or gases, but under the right conditions they can all change to take an alternative form. For example rock can melt to form liquid lava (a liquid) and water can freeze to make a solid.

Chemicals which consist of more than one element are called compounds, obviously there are many more than 100 compounds, in-fact the list of potential compounds is enormous.

Your home is full of chemical compounds, below is a list of the more common ones along with their chemical names.

Baking Soda	**-**	**(Bicarbonate of soda)**
Epsom Salts	**-**	**(Magnesium sulphate)**
Sand	**-**	**(Silicon dioxide)**
Sugar	**-**	**(Sucrose)**
Salt	**-**	**(Sodium chloride)**
Vinegar	**-**	**(Ethanoic acid)**
Washing Soda	**-**	**(Sodium carbonate)**

Compounds can be split down into their elements, and elements can join to make compounds. When two or more compounds swap elements with one another you get a chemical reaction. Chemical reactions happen all the time around us. Even cooking your breakfast is a chemical reaction!

So on with the chemistry – let's develop some reactions of our own!

CHEMICAL REACTIONS

We rely on chemical reactions every day. Most chemical reactions occur when two or more chemicals or substances are mixed together. Some reactions are man-made and others occur naturally. Some common examples of everyday chemical reactions include a nail going rusty when it is exposed to air and water, a loaf of bread rising in the oven and the running of a car engine.

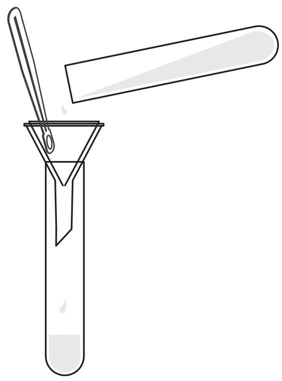
In this set of experiments we are going to create our own chemical reactions and observe what happens. You can develop a record of your findings on a form like the one illustrated below.

MIXTURE OF				REACTION
	&		=	
	&		=	
	&		=	
	&		=	
	&		=	
	&		=	
	&		=	
	&		=	

1. Quarter fill two test tubes with fresh tap water and place in the test tube rack. Place one heaped spatula measure of copper sulphate into one of the tubes and one heaped spatula measure of sodium carbonate into the other. Carefully pour the sodium carbonate solution into the copper sulphate solution. A blue precipitate or solid layer of a new chemical called copper carbonate will form. This is a chemical reaction. Keep this in the test tube rack for the next experiment.

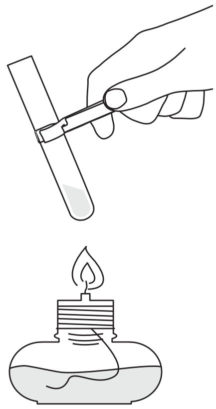
2. Take another test tube and quarter fill with fresh tap water, and add one heaped spatula of sodium hydrogen sulphate to make a solution. Pour this solution into the solution from experiment 1. The copper carbonate precipitate will dissolve.

3. Make up another test tube of copper carbonate solution as in experiment 1. Prepare the filter funnel by following the directions in the GENERAL PREPARATION section. Place the funnel assembly into a clean test tube and pour the copper carbonate solution into the funnel. Allow the liquid to drain through the funnel. The residue left on the filter paper is copper carbonate. Using the spatula scrape off a little copper carbonate and place in another clean test tube. Set up the spirit burner by following the direction in the GENERAL PREPARATION section and holding the tube with the tongs gently heat the copper carbonate until a black copper oxide is produced. Allow the tube to completely cool and place in the test tube rack.



4. Follow the directions in experiment 2 to produce some sodium hydrogen sulphate solution, and pour over the copper oxide residue from the previous experiment (3), the copper oxide will dissolve.

5. Place two heaped spatulas of ammonium chloride into a clean and dry test tube and using the spirit burner gently heat it holding the tube with the tongs provided. The ammonium chloride quickly turns from a solid to a gas. This reaction is called 'sublimation'. Sublimation occurs in Comets when they are heated as they approach the sun, this is what gives a comet its distinctive tail.



6. Place two heaped spatulas of ammonium chloride and two heaped spatulas of calcium hydroxide into the same clean and dry test tube. Holding the tube with the tongs, gently heat the mixture over the spirit burner. Using your hand gently wave over the tube to lift the gas from the tube towards your nose, do not breath the gas directly, you should smell the strong ammonia Gas that is created.

7. Next we are going to find out to clean some dirty coins using a chemical reaction. Half fill a glass with vinegar, and add 3 teaspoons of table salt. Stir the solution until the salt has fully dissolved. Drop in a few dirty pennies and leave for 5-10 minutes. The coins will be beautifully cleaned!

REAL LIFE SCIENCE

Chemical reactions can help make dirty objects clean – detergents clean your clothes and soap cleans your body, these both rely on chemical reactions!

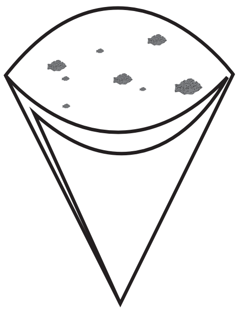
MIXTURES AND SEPARATION

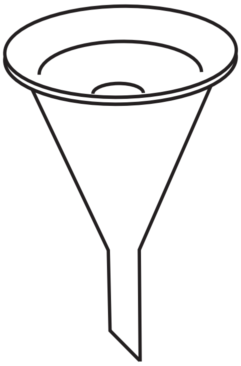
Mixtures are as common as reactions. A mixture can be made up by combining two or more substances. The substances can consist of elements or compounds or a mixture of both. An element is a simple substance that cannot be broken down and a compound is a mixture in its own right. Mixtures can be broken down into their basic elements or purified by a process known as separation. There are a number of ways of performing 'separation' and several are shown below.

You will need some additional items from around the home to conduct these experiments. You need to find:

- Small amount of Sand (play sand or building sand)
- A teaspoon of Sugar
- A dessert spoon of Milk
- Some water based Ink (available from stationers)
- Some liquid Food Colouring (available from the supermarket)
- A small Ruler

1. Place one heaped spatula of copper sulphate into a clean and dry test tube. Add half a teaspoon of dry sand and half fill with warm tap water. Place a bung on the tube and gently shake until the copper sulphate is fully dissolved, you have now made a mixture.
Set up the funnel assembly (see GENERAL PREPARATION section) with a clean filter paper and place over a separate clean test tube. Pour the copper sulphate and sand mixture into the funnel. The water and copper sulphate pass through the filter paper and the sand remains in the funnel. This separation process is known as FILTERING.



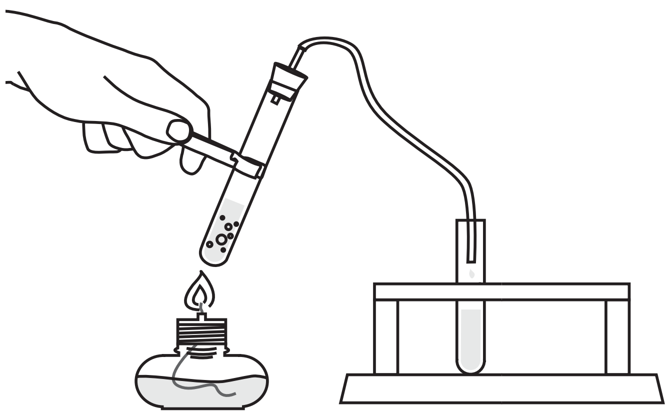


2. Repeat experiment 1, but this time instead of using copper sulphate use a little sugar. The result is the same, and the sand and sugar are separated. Just think how long it would have taken you to separate the sand and sugar any other way!

3. Place two heaped spatulas of calcium hydroxide into a clean test tube. Add half a test tube of fresh tap water and fit a solid bung. Gently shake the tube until the water turns milky. Pour the solution through a fresh filter paper in the funnel and into another clean test tube. The liquid should turn clear with the calcium hydroxide remaining on the filter paper.

4. Repeat experiment 3 but this time instead of filtering the calcium hydroxide solution, try filtering milk – does it work?

5. Measure 2.5cm of water into a clean test tube. Add half a spatula of copper sulphate to make a blue liquid called copper sulphate solution. Take the long glass tube and push it into one of the bungs with a hole in the centre. Slide the rubber tube over the top of the glass tube and fit the bung to the tube of copper sulphate solution. Place the free end of the rubber tube into another clean test tube in the rack. With the tongs hold the copper sulphate solution over the spirit burner to gently heat the liquid. The liquid will start to boil and produce a steam that will pass through the glass and rubber tubes and into the clean tube. This steam will condense to produce clean water. The copper sulphate will remain in the first tube. This separation process is known as DISTILLATION and is used in the production of many alcoholic drinks.

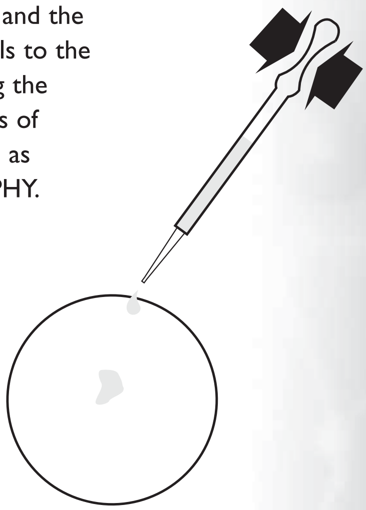


6. Repeat the previous experiment, but instead of using a copper sulphate solution, try using a little water-based ink. The result will be that the colourants and water in the ink will be separated in much the same way.

7. Mix two heaped spatulas of table salt with 2.5cm of fresh tap water in a clean test tube. Add a solid bung and shake until the salt has completely dissolved. Remove the bung, and using the tongs and spirit burner heat the solution. The solution will boil and the water will turn to steam and leave the tube. The salt will remain in the tube as a solid residue. This process of separation is known as EVAPORATION. This is how sea salt is commercially removed from sea water.

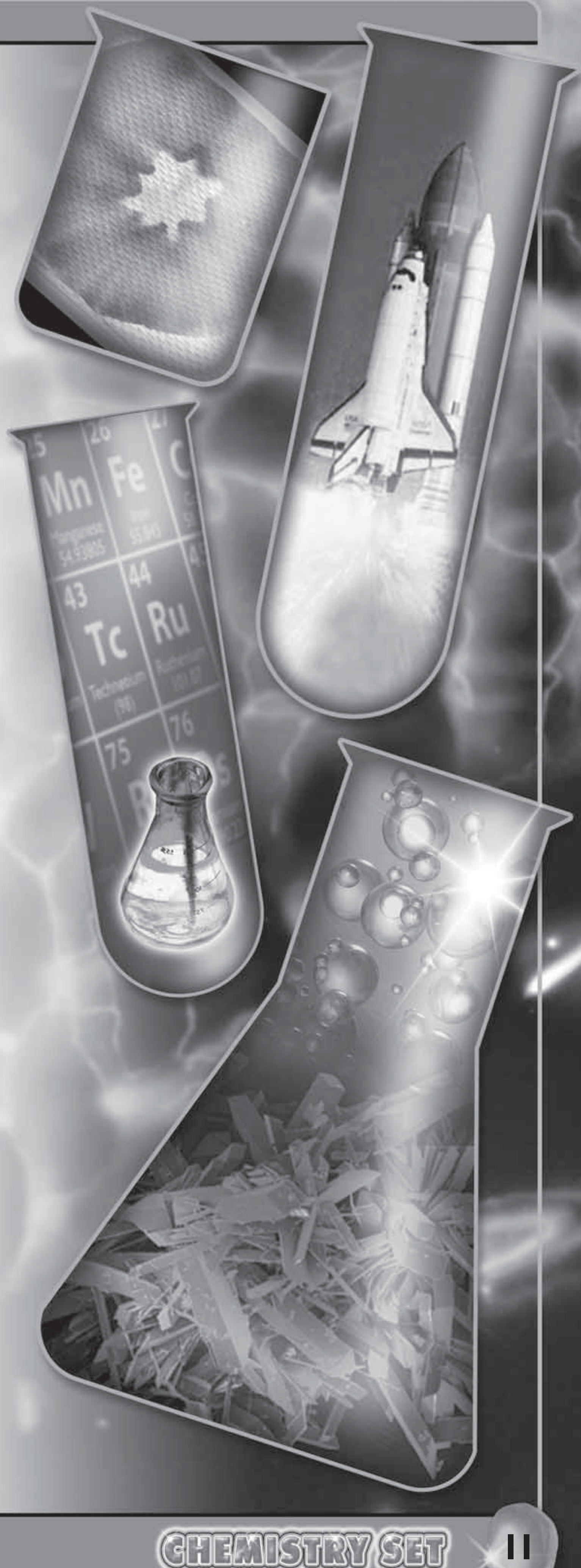
8. Repeat the previous experiment, but instead of using salt, try using two heaped spatulas of copper sulphate instead. Again the water evaporates as steam, but this time you are left with the solid copper sulphate in the tube.

9. Quarter fill a test tube with tap water and place in the rack. Add 4 drops of green food colouring and 6 drops of pink or red food colouring. Fit a solid bung and gently shake to mix up the liquids. Remove the bung, and using the pipette supplied drop a few drops of the mixture onto the centre of a clean filter paper. Keep adding drops of the mixture until the filter paper cannot absorb any more. You will notice that the green colouring stays near the centre of the paper and the pink colouring travels to the edge thus separating the colours. This process of separation is known as CHROMOTOGRAPHY.



REAL LIFE SCIENCE

Different separation techniques are used in everyday life. The coffee you drink in the morning is often filtered and all our raw sewage is filtered to provide clean drinking water. The water that comes from your tap was almost certainly sewage at some point before it was filtered!



SOLUTIONS, SUSPENSIONS AND EMULSIONS

Solutions, suspensions and emulsions are all forms of mixtures but are known as HETEROGENEOUS mixtures. A heterogeneous mixture is made up from two or more compounds, but the result does not form a new substance as such. The components of a heterogeneous mixture can always be identified as separate parts. A mixture of sand and sugar is a heterogeneous mixture, as the parts (sand and sugar) can always be identified as separate parts. In these experiments we are going to make a number of interesting mixtures.

You will need some additional items from around the home to conduct these experiments. You need to find:

- Rock Salt (available from the supermarket)
- Cooking Oil • A Drinking Straw
- Soap Powder • Milk • Syrup

1. Quarter fill a test tube with fresh tap water. Add to the water a single heaped spatula of any chemical from the set. Watch to see if the chemical dissolves. If the chemical does not dissolve, fit a solid bung to the tube and gently shake – does the chemical dissolve now?

SUBSTANCE	DISSOLVES Y/N
Tea Leaves	
Coffee	
Sugar	
Salt	
Pepper	
Baking Powder	
Washing Powder	
Sand	

2. Draw up a record chart like the one illustrated, and find different chemicals from around the home and using the method in the previous experiment record which ones dissolve and which ones don't. Try washing powders, tea leaves, coffee granules, gravy granules, sugar, salt, pepper etc.

3. Find 6 equal sized large pieces of rock salt. Using the back of a spoon crush 3 of the rocks to form small grains of salt. Half fill two test tubes with fresh tap water and place in the test tube rack. Drop the three un-crushed rocks in one tube and the salt grains in the other. After a little while the salt in both tubes will dissolve – which one dissolves the fastest?

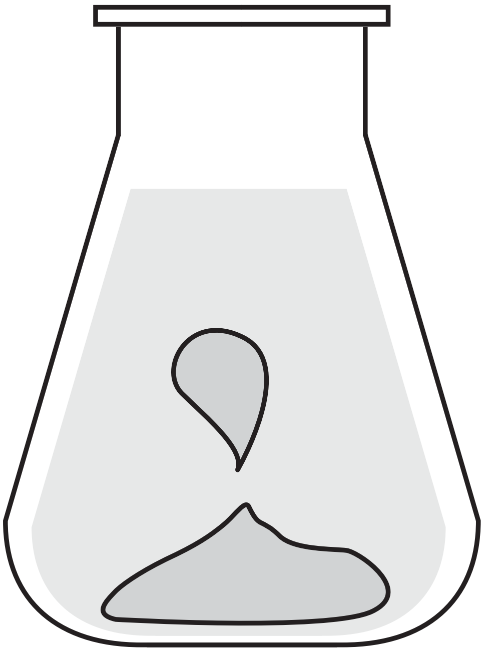
4. Half fill one test tube with cold water and another with warm water. Drop an equal pinch of crushed rock salt into each. The salt in both tubes should dissolve in around the same time.

5. Quarter fill a test tube with fresh tap water and add a quarter of a heaped spatula of copper sulphate. In a few minutes the copper sulphate will dissolve giving the water a blue tint. This solution is a homogenous solution. Homogenous solutions are made up from similar or uniform parts, and so has a regular consistency throughout. Keep this solution for the next experiment.

6. Take the homogenous copper sulphate solution from the previous experiment, and add one heaped spatula of copper sulphate. Fit a solid bung to the tube and gently shake until the copper sulphate is fully dissolved. Keep adding more copper sulphate one spatula at a time until it won't dissolve any more. This is now called a SATURATED SOLUTION. This simply means that the water cannot dissolve any more of the given chemical.

7. Quarter fill the flask with fresh tap water and add some cooking oil until the flask is half full. Put your hand over the top of the flask and gently shake. You will notice that the two liquids will not mix. The oil will always float on the surface of the water, this is because it is lighter than water. These liquids are known as IMMISCIBLE LIQUIDS and cannot be mixed. Keep this flask and its contents for the next experiment.

8. Take the flask from the previous experiment, and add a quarter of a flask of syrup and 5 drops of food colouring. Put your hand over the top of the flask and gently shake. The water, syrup and oil all separate, where does the food colouring go?



9. Repeat experiment 7, but instead of using cooking oil try using washing up liquid. This time they do appear to mix, but if you look very carefully you will notice that there are lots of tiny oil like particles floating around, this mixture is known as an EMULSION and is a partial mix.

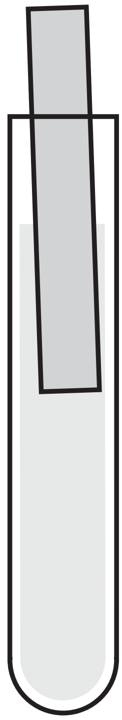
10. Repeat the previous experiment, but this time try using some soap powder. Again, if you look very carefully you will see oily droplets floating around – again you have made an emulsion.

11. Milk, salad cream and mayonnaise are all emulsions. Half fill one test tube with milk and half fill another with fresh tap water. Add a heaped spatula of sodium hydrogen sulphate to the test tube of water and mix. Pour a little of the sodium hydrogen sulphate solution into the tube of milk and watch as a precipitate or solid layer of casein is formed. This casein has been extracted from the milk.

12. Quarter fill a test tube with fresh tap water and add a single heaped spatula of calcium carbonate. The calcium carbonate appears to dissolve and gives the water a cloudy appearance. Gently blow into the liquid using a drinking straw - magically the liquid clears.
TAKE GREAT CARE NOT TO SUCK ON THE STRAW.

13. Half fill a test tube with fresh tap water, and add one heaped spatula of sodium hydrogen sulphate, add a solid bung and gently shake to make a solution. Now add a single heaped spatula of calcium carbonate. The reaction is incomplete because of the low solubility of the sulphate.

14. Quarter fill a test tube with fresh tap water, and add a single heaped spatula of calcium carbonate. Dip a strip of the blue litmus paper into the solution – does it change colour? Now dip a strip of the red litmus paper into the solution, does this change colour? If there is acid in the solution the blue litmus paper should turn red. If there is alkali in the solution it should turn the red paper blue – is the solution acid or alkali? Neutral chemicals will not affect the litmus paper.



REAL LIFE SCIENCE

Lava lamps that were very popular from the 1960's onwards work on the principle of immiscible solutions where two liquids can't mix!

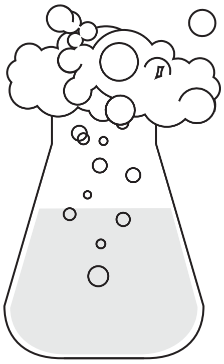
INDICATORS

Chemists use a huge variety of indicators to determine whether chemicals are acids, alkalis or neutrals. Indicators come in many forms, but always change colour if acids or alkalis are present in a chemical.

You will need some additional items from around the home to conduct these experiments. You need to find:

• Ripe Cherries • Fresh Red Cabbage • Lemon Juice
• A Jar of Pickled Cabbage • Baking Powder • Rose Petals
• Vinegar • Milk Of Magnesia (available from chemists)

1. Drain the juice from a jar of pickled cabbage into the flask until it is half full. Take two teaspoons of baking powder, and add to the cabbage juice. Watch as the cabbage juice fizzes and gradually changes colour. Keep this flask and its contents for the next experiment.



2. Take the flask and its contents from the previous experiment, and add two teaspoons of vinegar – what happens now? The mixture fizzes and changes colour once more. This happens because the cabbage juice acts as an indicator and baking powder is an alkali and the vinegar is an acid.

3. Finely chop up the head of a fresh red cabbage and place in a pan of hot water for a couple of hours. Drain off the red juice and store in the flask. Quarter fill each of four clean test tubes with the cabbage juice and place them all in the rack. To the first tube add a little lemon juice (acid) and the juice turns bright red. To the second add a little distilled water (neutral) and the juice doesn't change colour. To the third tube add a little baking powder (weak alkali) and the juice turns blue. To the fourth tube add a little milk of magnesia (strong alkali) and the juice turns green.

4. Quarter fill a clean test tube with cabbage juice. Quarter fill another test tube with fresh tap water and add a single spatula of sodium hydrogen and mix to form a sodium hydrogen solution. Pour a little of the solution into the tube of cabbage juice – what happens? Is sodium hydrogen solution an acid or an alkali?

5. Take 5 ripe cherries and finely chop them up and place in the flask. Add some hot water ensuring that the cherries are fully immersed and leave for 20 minutes. Drain off the solution and quarter fill two test tubes with the solution. Take another two test tubes and quarter fill with fresh tap water. Add a single heaped spatula of sodium hydrogen sulphate (acid) to one tube and a heaped spatula of calcium hydroxide (alkali) to the other. Carefully pour a little of each solution into the tubes containing the cherry juice – what happens? – Have you made another indicator?

6. Repeat the previous experiment, but instead of using cherries, try using rose petals. Rose petal juice is another naturally occurring indicator.

7. LITMUS PAPER is a refined form of indicator. Using the litmus paper provided and the chart below, find out what substances around the home are acids, alkalis and neutrals. Record your findings on the chart.

SUBSTANCE	ACID	ALKALI	NEUTRAL

REAL LIFE SCIENCE

When traffic and chimney fumes mix with rain, they can make it as acidic as lemon juice, and it is known as Acid Rain. Acid Rain can destroy buildings and trees.

ACID	pH = 0	dark red
	pH = 1	red
	pH = 2	red/orange
	pH = 3	orange
	pH = 4	orange/yellow
	pH = 5	yellow
	pH = 6	grey
NEUTRAL	pH = 7	black
	pH = 8	pale green
	pH = 9	green
	pH = 10	dark green
	pH = 11	green/blue
	pH = 12	blue
	pH = 13	blue/purple
ALKALINE	pH = 14	dark blue

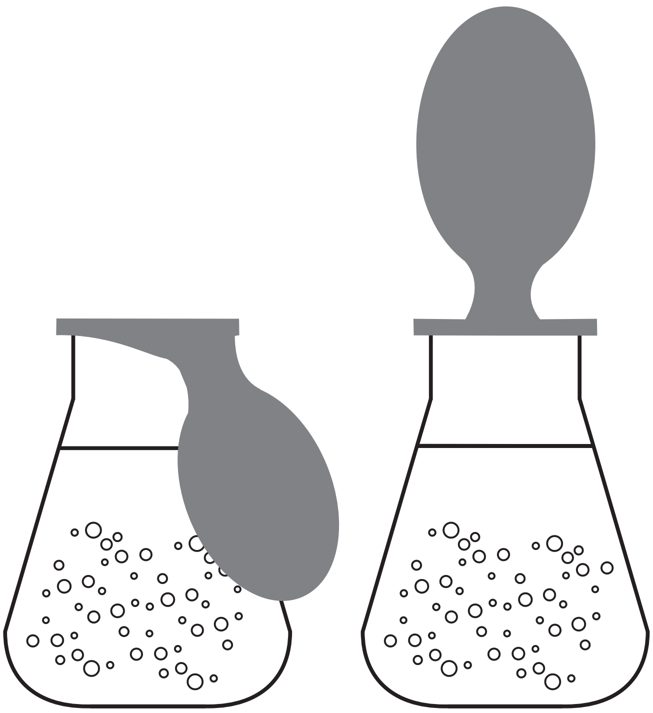
GASES

The mixing of certain chemical combinations causes a reaction and the development of gases. In these experiments we are going to create our own gases.

You will need some additional items from around the home to conduct these experiments. You need to find:

• A Balloon • Vinegar • Baking Powder • Food Colouring
• An Egg • A Small Glass or Jam Jar • Toothpaste
• Carbonated Drink • Lemon Juice

1. Half fill the flask with vinegar. Take the balloon, and carefully pour in around 2 teaspoons of baking powder. Stretch the neck of the balloon over the neck of the flask containing the vinegar allowing the balloon to flop over the side preventing the baking powder from dropping into the vinegar. When you are ready lift the balloon to allow the baking powder to drop into the vinegar. The baking powder and vinegar react and produce a gas called carbon dioxide, which inflates the balloon.



2. Place an egg in the glass and pour over enough vinegar to cover the egg, and leave for a few days. Look at the egg every so often and you may notice little bubbles of carbon dioxide coming from the eggshell. Eventually the eggshell will disappear completely.

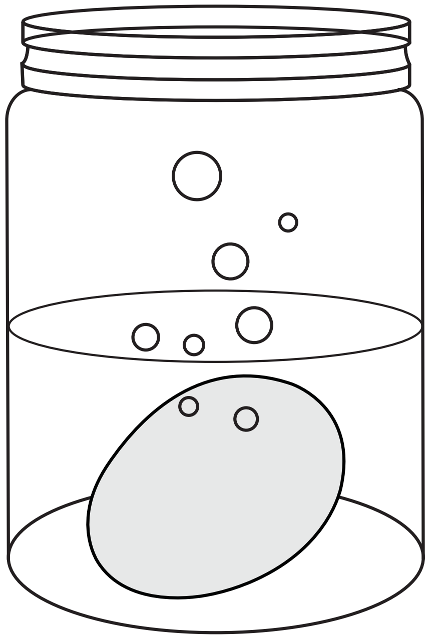


DIAGRAM FOR EXPERIMENT 2

3. Place a little toothpaste into a clean test tube. Half fill the test tube with a fizzy drink. You will notice lots of tiny bubbles form. These are full of carbon dioxide, and are formed because the toothpaste contains baking soda and the drink contains carbon dioxide.

4. Half fill the flask with fresh tap water. Add a teaspoon each of sugar and baking powder, then add a few drops of food colouring, and gently shake the flask to mix the contents. When you are ready, squeeze the juice of a lemon into the flask and watch as it bubbles and foams. The water is now carbonated.

5. Repeat the previous experiment, but instead of adding lemon juice try adding a little vinegar – what happens? Does this produce more or less foam and gas?

REAL LIFE SCIENCE

Fizzy or 'carbonated' drinks were invented by a British man called Joseph Priestly in the 1700's. He found that bubbling carbon dioxide through water gave it a sparkling taste!

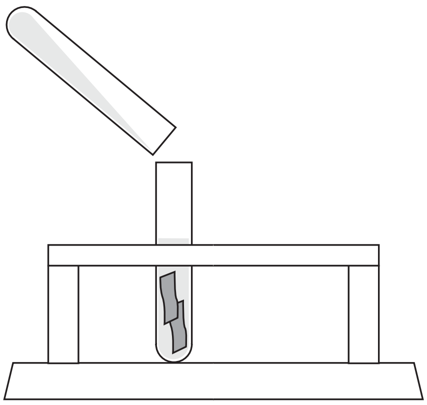
METALS

Numerous metals exist in the world, many are simply purified naturally occurring ores and others have been chemically blended in order to enhance their qualities for different purposes. Different metals react in varying ways and some react more strongly than others. Here we find out how different metals react.

You will need some additional items from around the home to conduct these experiments. You need to find:

• Kitchen Foil • Vinegar • Piece of Steel • An Iron Nail
• A Wax Crayon

1. Half fill a test tube with fresh tap water and add a single heaped spatula of copper sulphate to make a copper sulphate solution. Tear a few thin strips of aluminium foil and drop into another clean test tube, and pour over half of the solution. The aluminium foil reacts with the solution and starts to displace the copper from the copper sulphate solution to form a new chemical called aluminium sulphate. This experiment shows that the aluminium foil is more reactive than the copper. Keep the remaining solution for the next experiment.

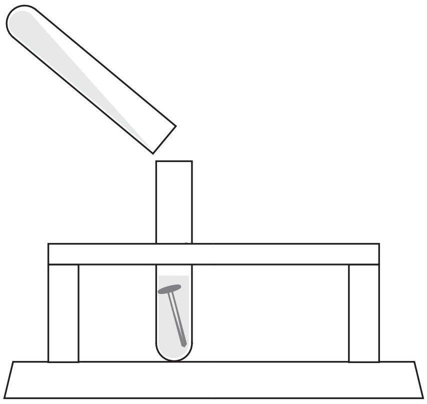


2. Place a heaped spatula of granulated zinc into a clean test tube. Pour over a few drops of the copper sulphate solution left over from the previous experiment – what happens? Which material is more reactive?

3. Place a small iron nail into a test tube and pour over a little more of the copper sulphate solution – which is more reactive the iron or the copper?

4. To find out the order of reactivity of aluminium, zinc and iron, first place a thin strip of aluminium foil into a clean test tube and pour over a little vinegar. Monitor and record the reaction result, and move onto the next experiment.

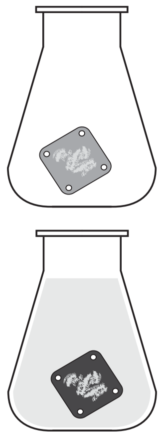
5. Place a heaped spatula of granulated zinc into another clean test tube and pour over a little vinegar, again monitor and record the reaction.



6. Place a small iron nail in a third test tube and again pour over a little vinegar. Compare this reaction with the previous two to determine the order of reactivity.

7. Place a heaped spatula of granulated zinc into a clean test tube and pour over a little copper sulphate solution. The reaction should be much faster than the reaction in experiment 5 as the copper sulphate acts as a catalyst and accelerates the process.

8. Using a wax crayon draw a pattern on a piece of uncoated steel such as a steel picture hook or bracket. Place two heaped spatulas of sodium hydrogen sulphate into a clean test tube and half fill with fresh tap water to make a solution. Place the piece of steel into a shallow dish and pour over the solution. After a few moments the solution will eat away the steel, but the area covered in wax remains untouched.



REAL LIFE SCIENCE

The thread of a spiders web is stronger than steel of the same thickness. Spiders web is one of the strongest natural materials known to man!

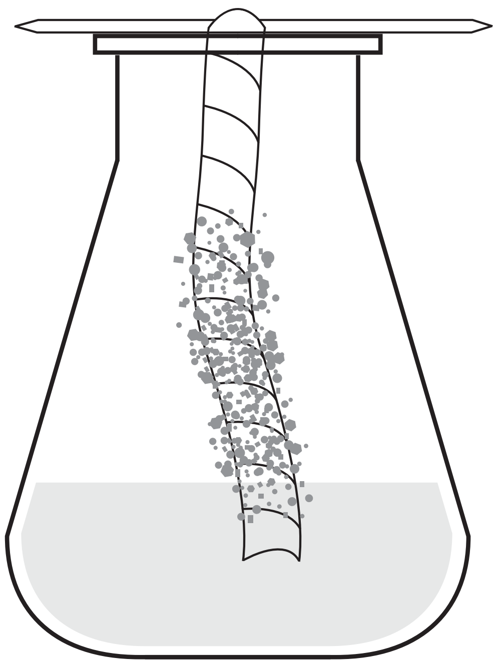
CRYSTALS

Crystals occur naturally, or can be man made using a variety of chemical methods. All crystals are made from solids, and have one basic thing in common – their particles are always arranged in a geometric pattern. In this section we will grow some crystals of our own.

You will need some additional items from around the home to conduct these experiments. You need to find:

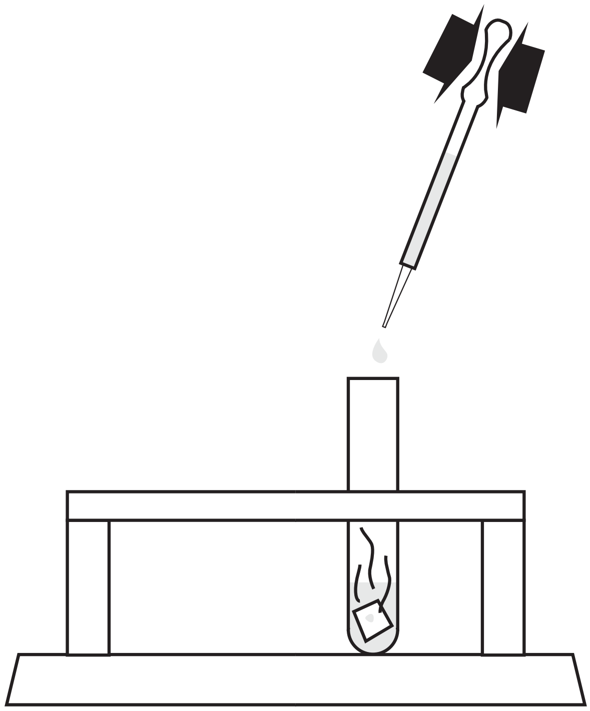
• A Cocktail Stick • Some Cotton Thread or String

1. Place 6 heaped spatulas of copper sulphate into the flask, and quarter fill with fresh tap water. Gently shake the flask until all the copper sulphate has dissolved. Tie the cotton string to the centre of the cocktail stick and place over the neck of the flask with the string hanging in the solution. After a few days the water from the solution will evaporate and beautiful blue copper sulphate crystals will have formed on the cotton string.



2. Place a few of the copper sulphate crystals from the previous experiment into a clean and dry test tube. Using the tongs and spirit burner very gently heat the crystals until they turn white. They turn white when the last remaining water parts are evaporated from the crystals. The evaporated water is known as 'water of crystallisation'. Keep these crystals in the tube ready for the next experiment.

3. Ensure that the tube from the previous experiment has totally cooled, then using the pipette, drop a few drops of fresh tap water into the tube covering the white crystals – what happens? You should see a chemical reaction, where the water penetrates the crystals and they heat up and turn blue once again.



4. Place three heaped spatulas of sodium carbonate into a clean test tube. Using the tongs and the spirit burner, gently heat the tube and observe what happens to the sodium carbonate.

5. Potassium aluminium sulphate can also be used to create crystal formations. Repeat experiment 1, but substitute the copper sulphate for potassium aluminium sulphate. How do the crystals differ from those in experiment 1?

REAL LIFE SCIENCE

Just about every non-living thing on the planet is made from crystals. Rocks, snowflakes, sand, salt and sugar are all made from crystal formations.

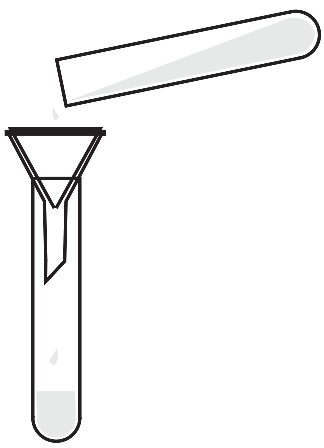
CARBON DIOXIDE AND OXYGEN

Without Oxygen and Carbon Dioxide all life on our planet earth would cease to exist. All animals require oxygen to breathe, and most plants require carbon dioxide to survive. Animals breathe in oxygen and breathe out carbon dioxide, plants on the other hand take in carbon dioxide and turn it into oxygen – a very healthy balance for sustaining life.

You will need some additional items from around the home to conduct these experiments. You need to find:

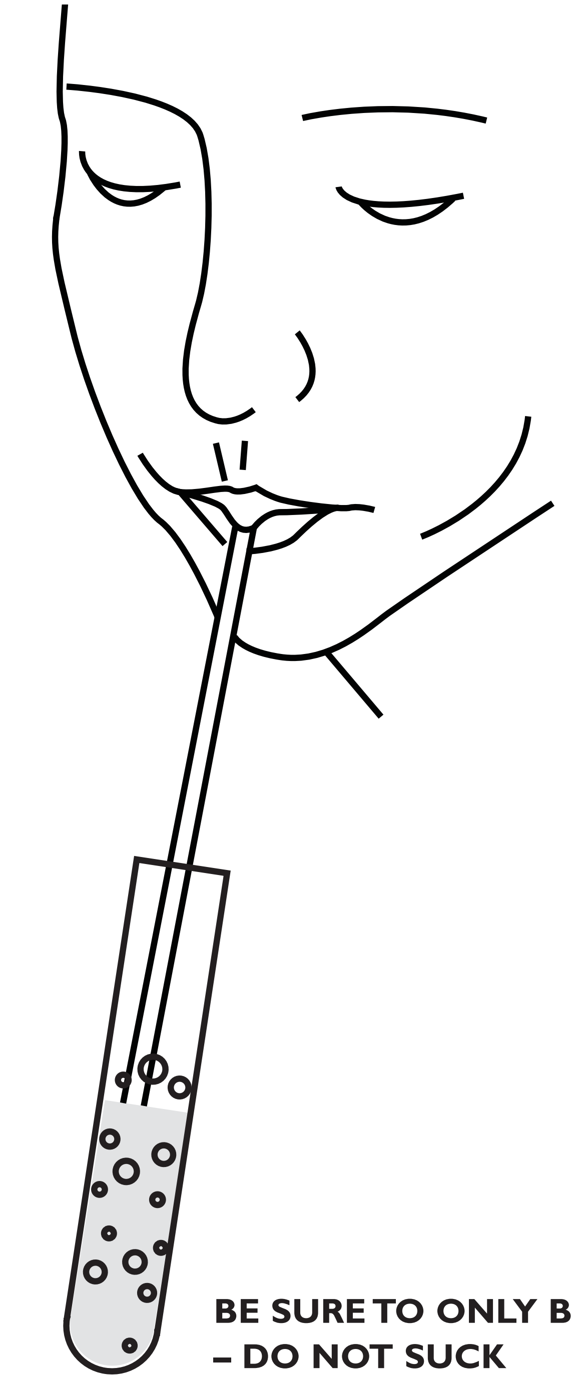
- A Drinking Straw
- A Household Plant with Green Leaves
- A Clear Polythene Bag
- An Iron Nail

1. You can find out if carbon dioxide is present in a chemical by using another chemical called lime water. In this experiment we will make enough lime water for the next few experiments. Place one heaped spatula of calcium hydroxide into a clean test tube and then half fill with fresh tap water.
Fit a solid bung and shake for a few moments. Using the funnel and filter assembly (see GENERAL PREPARATION), pour the solution through the filter and into another clean test tube. The filtered liquid is called lime water. The filter paper contaminated with residue can be disposed of.



2. Take the test tube of lime water and using a drinking straw blow bubbles in the liquid. BE SURE TO ONLY BLOW – DO NOT SUCK! As you blow, the lime water turns cloudy, this signifies that carbon dioxide is present in your breath. If you continue to blow into the Lime Water it eventually turns clear once more.

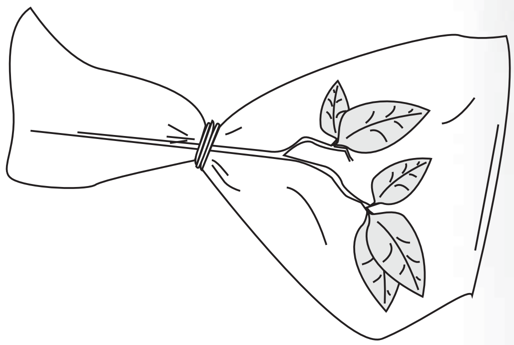
3. Now take the test tube of lime water and add a single heaped spatula of sodium hydrogen. This causes a reaction that produces small bubbles of carbon dioxide.



BE SURE TO ONLY BLOW – DO NOT SUCK

4. Pour a few drops of the lime water into the Watch Glass and leave it in the open air. After a while a film of calcium will develop, this demonstrates that the atmosphere also contains carbon dioxide.

5. You can prove that plants produce carbon dioxide very easily. Tie a clear plastic bag around the leaves of a green house plant or shrub in the garden and leave for a couple of days. Carefully remove the bag preventing the air from escaping. Then pour in a little of the lime water, and see what happens. If the water turns cloudy, you know that carbon dioxide is present.



6. Do the previous experiment, but this time keep the plant in a dark place, and then test for carbon dioxide, this time there will be no carbon dioxide, because plants require sunlight to produce carbon dioxide.

7. Fill the Watch Glass with water, and partially submerge a clean iron nail and leave for a few days. If you now observe the nail you will find that it has developed a coating of rust. This rust is chemically known as Iron Oxide and is produced when the nail is exposed to water and air.

8. Water that sustains life such as fish and plants must contain oxygen. This is why most fish tanks contain plants or air pumps and often both. You can check for the presence of oxygen by supporting a test tube half filled with fresh tap water over a water plant. After an hour or so tiny oxygen bubbles will begin to appear in the test tube of water.

9. You can repeat the previous experiment, but, this time keep the fish tank in the dark. Few or no bubbles of oxygen will appear again, proving that the plants require sunlight in order to produce oxygen.

REAL LIFE SCIENCE

Cows are responsible for producing massive amounts of carbon dioxide and methane when they pass wind. Some people believe this is contributing to Global Warming!

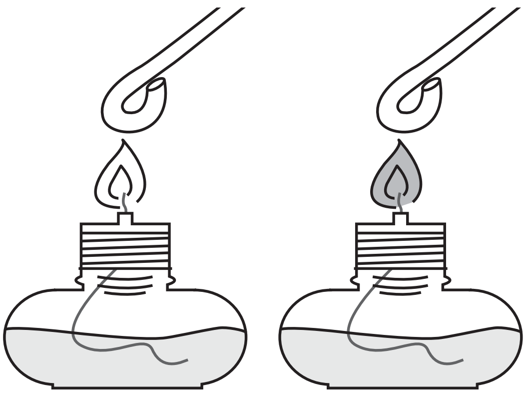
REACTIONS

Many chemicals are made up from atoms and molecules that are so small it is extremely hard to determine exactly what they contain. A great way of determining the presence of different chemicals is to use a process called flame testing. Flame testing is when you burn a chemical and observe the flame and reaction of the

You will need some additional items from around the home to conduct these experiments. You need to find:

- 10cm Of Fuse Wire (available from DIY stores)
- A Small Piece Of Clean Steel
- Some Wood Shavings (available from pet stores)

1. Before you can perform a flame test, you need to make a support from the length of fuse wire. Straighten the fuse wire, and at one end form a tight loop about the size of a match head (you could bend the wire around a match stick to form the loop). Set up the spirit burner and place a large granule of sodium carbonate on the loop and hold over the flame. The resulting flame should be orange in colour confirming the presence of sodium.



2. Allow the fuse wire holder to completely cool and the repeat the test this time using a few granules of sodium hydrogen sulphate, again the flame should turn orange as the chemical contains sodium.

3. Repeat the test a third time, but now use a few granules of sodium thiosulphate – what happens now?

4. Sodium chloride is better known as 'table salt', use the flame test to find out whether table salt contains sodium?

5. Chemicals containing calcium will burn with a red flame. You can confirm this by repeating the flame test with a little calcium hydroxide.

6. As its name suggests, calcium carbonate also contains calcium, you can confirm this by conducting another flame test – what colour is the flame?

7. Copper burns with a green flame. You can confirm the presence of copper in copper sulphate using the flame test.

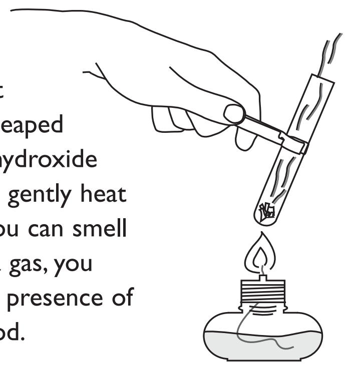
8. Potassium burns with a purple flame. Confirm the presence of potassium in the potassium aluminium sulphate using the flame test.

9. Ammonium chloride is different to all the chemicals tested so far in that it does not contain a metal. Try a flame test – does it burn with a coloured flame?

10. Using the tongs carefully hold a new shiny steel nail in the flame. The colours of the flame are caused by the presence of oxides in the iron.

11. Most printing inks contain chemicals that show up in the flame tests. From a glossy magazine cut postage stamp sized portions of different coloured print and using the tongs, conduct a flame test on each different colour to see if you can determine the presence of different chemicals and make a list.

12. Take a few fine wood shavings and place in a clean test tube. Add a single heaped spatula of calcium hydroxide and using the tongs gently heat over the flame. If you can smell a pungent ammonia gas, you have confirmed the presence of nitrogen in the wood.



REAL LIFE SCIENCE

In this section you found out how different metals burn with different colours. Firework and rocket makers use these different metals to create different pyrotechnic effects!

SOAPS AND DETERGENTS

We all know that soap gets us clean and most of us use it every day, but in this section we are going to see a more interesting side to this seemingly boring substance!

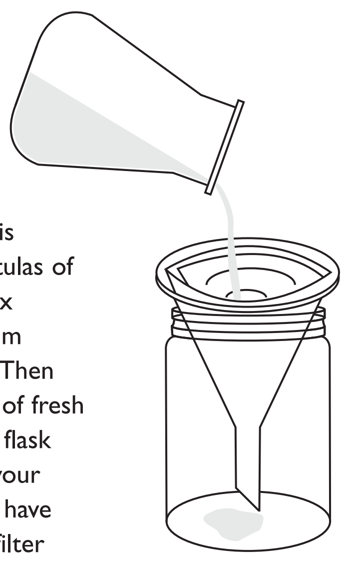
You will need some additional items from around the home to conduct these experiments. You need to find:

- Soap Flakes (available from the supermarket)
- A Bar of Soap (ideally non fragranced)
- A Piece of Absorbent String
- Some Fat or Lard
- A Clean Jam Jar
- Vinegar

1. Using a blunt knife shave off a few thin slices from a bar of soap and place in a clean test tube half filled with fresh tap water and shake. In another clean test tube place one heaped spatula of calcium hydroxide and half fill with fresh tap water, gently shake to dissolve. Filter this solution through a fresh filter paper and funnel assembly (see GENERAL PREPARATION section) and into another clean test tube. The clear liquid in the second tube is lime water. Pour a little lime water into the tube containing the soap / water solution. Place a solid bung on the tube and gently shake. You will notice the formation of a scum, this is called calcium stearate.

2. Prepare another tube containing the soap / water solution. This time add a heaped spatula of sodium hydrogen sulphate and mix. These chemicals now react to form a new chemical by the name of stearic acid.

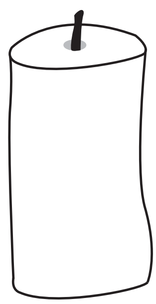
3. A key ingredient of soap is a chemical called sodium hydroxide. You can make your own sodium hydroxide from the chemicals in this kit. Place six heaped spatulas of sodium carbonate and six heaped spatulas of calcium hydroxide into the flask. Then add three full test tubes of fresh tap water and shake the flask covering the neck with your hand until the chemicals have dissolved. Using a clean filter paper and the funnel assembly, filter the solution into a clean jam jar. The resulting liquid is sodium hydroxide. Retain this liquid for the next few experiments.



4. Place a single heaped spatula of fat or lard into a clean test tube, then add about 2.5cm of the sodium hydroxide that you made in the previous experiment. Using the tongs and spirit burner boil this solution for about 15 – 20 minutes, then drop in a large pinch of salt. Allow the mixture to completely cool for 5 – 10 minutes. Once the substance is cool, lift a little out of the tube using the spatula and feel the soapy substance that is in fact soap!

5. Place a few soap flakes into a clean test tube and half fill with fresh tap water. Using the tongs and the spirit burner, warm the mixture until the flakes have completely dissolved. Then using the pipette drop in a few drops of vinegar. A new substance will float to the surface. This substance consists mainly of fatty acids. Retain these fatty acids for the next experiment.

6. Take the fatty acids from the previous experiment and place on a piece of absorbent kitchen towel to dry. This substance can be used as a form of wax in the production of candles. Carefully form the fatty acids into a tall cylindrical shape, make a central hole with a thin nail or pin, insert a piece of string and you have a fully functional candle.



7. Prepare a copper sulphate solution by placing a single heaped spatula of copper sulphate into a clean test tube and half fill with fresh tap water. Then add a few drops of the sodium hydroxide that you made in experiment 3 to form a precipitate of copper hydroxide.

REAL LIFE SCIENCE

The average persons morning hygienic routine of shaving, showering, applying deodorants / perfumes, and make up puts them in direct contact with over 100 chemicals before breakfast. The human skin can absorb up to 60% of applied chemicals – yuk!

HEAT REACTIONS

As we have already discovered different chemicals have different properties. Another way of seeing the differing properties is to monitor their reactions to heat, and to see how combinations of chemicals can generate their own changes in temperature.

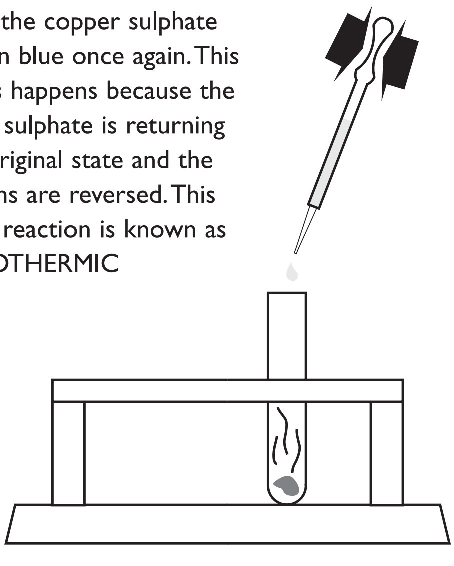
You will need some additional items from around the home to conduct these experiments. You need to find:

• Aluminium Kitchen Foil • Table Salt
• Old Tin Lid (from a paint tin or similar) • Ice Cubes

1. Half fill a clean test tube with fresh tap water. Add 5 heaped spatulas of ammonium chloride. Fit a solid bung to the tube and gently shake. You will notice that the tube becomes very cold. The ammonium chloride absorbs the heat from the water when it dissolves. This process is known as an ENDOTHERMIC REACTION.

2. Take a clean test tube, and place two heaped spatulas of copper sulphate into the tube. Using the tongs and the spirit burner, gently heat the copper sulphate until it turns white. The copper sulphate turned white as the water contained within, was extracted by the heating process. The white copper sulphate is known as 'anhydrous copper sulphate'. Keep this tube and its contents for the next experiment.

3. Ensure that the tube from the previous experiment has completely cooled down. Using the pipette, drop a few drops of fresh tap water onto the anhydrous copper sulphate, and observe what happens. The tube will warm up and the copper sulphate will turn blue once again. This process happens because the copper sulphate is returning to its original state and the reactions are reversed. This kind of reaction is known as an 'EXOTHERMIC REACTION'.



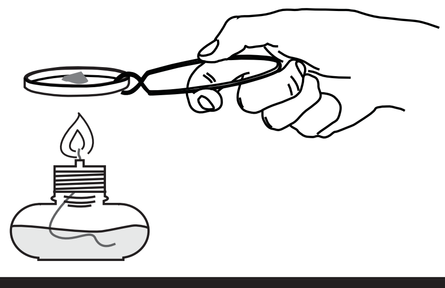
4. Using a rolling pin carefully crush a few ice cubes (or take some frost from inside the freezer). Place equal amounts of the ice in two clean test tubes. To one of the tubes add a large pinch of table salt. Hold each tube in the palms of your hands. The tube containing the salt will be cooler than the other.

5. Carefully cut a few thin strips of aluminium foil and place inside a clean test tube. Using the tongs and the spirit burner gently heat the aluminium strips and watch as they melt and oxidize. The material left behind is called aluminium oxide.

6. Repeat the previous experiment, but instead of using the aluminium strips, add two heaped spatulas of iron sulphate, and very gently heat for a few moments – observe what happens.

7. Repeat the previous experiment, but this time heat the iron sulphate more until it changes form. The iron sulphate becomes iron oxide, and releases acidic gases during the change. You can confirm the presence of acids in this gas by holding a piece of blue litmus paper in the gas stream – what colour does it change to?

8. Find a clean paint free lid from a tin. In the centre of the lid place two heaped spatulas of calcium carbonate. Heat the calcium carbonate over the spirit burner holding the lid with the metal tongs. Watch as the calcium carbonate re-forms into calcium oxide.



REAL LIFE SCIENCE

Space scientists rely heavily on Exothermic Reactions to help them develop new fuels to drive spacecraft efficiently into the sky!

CHEMISTRY OF FOOD

Food is made up from many different chemicals and food scientists can conduct a number of tests to determine the sugar content of different foods. In these experiments you too can find the sugar content of various foods.

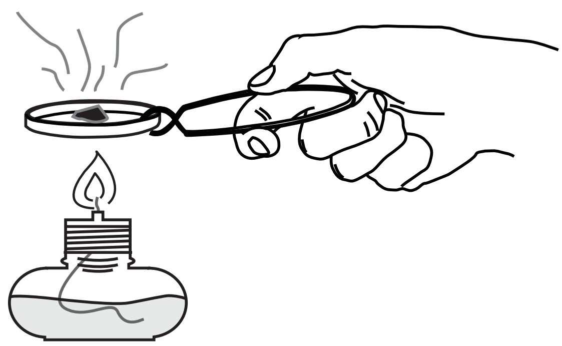
You will need some additional items from around the home to conduct these experiments. You need to find:

• Cream of Tartar • Sugar • Cold Tea • Cotton String
• Wooden Toothpick
• Old Tin Lid (from a paint tin or similar)

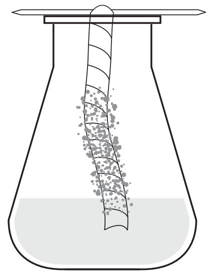
1. Place 2.5cm of fresh tap water into a clean test tube, and add four heaped spatulas of sodium carbonate. Next add two heaped spatulas of cream of tartar, fit a solid bung and gently shake to dissolve the contents. Take another clean test tube and add 2.5cm of fresh tap water plus 2 heaped spatulas of copper sulphate and dissolve. Pour the contents of both tubes into the flask and mix. A blue-green mixture will appear. This mixture is used for testing for the presence of sugar, and is called FEHLINGS solution. To test this solution pour a little into a clean test tube, and drop in a half a teaspoon of sugar and gently heat using the tongs and spirit burner - see what happens.

2. Take a clean test tube and pour in 2.5cm of fresh tap water, add one heaped spatula of sodium hydrogen sulphate and a quarter of a teaspoon of sugar, mix up and boil for 5 minutes. Allow this mixture to cool. Next mix 1.5cm of this solution with 1.5cm of your Fehlings solution, and heat gently with the tongs and spirit burner. Watch as a precipitate is formed as the sugar is hydrolysed.

3. Take an old small unpainted tin lid and place a teaspoon of sugar in the centre. Using the tongs heat the sugar, and watch as a vapour is released. The sugar eventually turns into a black substance that is carbon.



4. You can use sugar to form crystals in a similar way to the earlier crystal experiments. Half fill the clean flask with fresh tap water, and one teaspoon at a time, add sugar and mix. Keep adding sugar until it wont dissolve anymore – this is a saturated sugar solution. Tie the length of string around the centre of the toothpick and suspend the string in the sugar solution. Over the next few days a beautiful sugar crystal will form on the string as the water evaporates.



5. Take a clean test tube and add 2.5cm of cold tea. Add a single heaped spatula of ammonium sulphate and mix. After a little while a precipitate of iron tannate will form.

6. You can check to see whether different foods are acids or alkalis using the litmus papers in the kit. Using the form below test the different foods and mark your results. You can duplicate the form and add other foods to make a more concise list. For directions on using the litmus paper refer to the indicators section of this instruction manual.

FOOD	ACID	ALKALI	NEUTRAL

7. Repeat the previous experiment, but this time instead of using litmus papers, try using the red cabbage indicator that you made in experiment number 6 in the indicators section – do you get the same results?

8. In section 9 we found out how to test different materials for the presence of metals using a flame test. Using a similar form to that above, test different foods using the flame test and record your results.

REAL LIFE SCIENCE

Although an emulsion is a form of paint, it is actually any liquid that has tiny droplets of another liquid suspended within it. To make butter you whip cream so much that the droplets of butterfat collapse and rejoin the cream to form butter!

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