Science For Families

Science for families

Science for Families is a 5 week science club designed for KS2 children and their carers. It brings together simple experiments and demonstrations of scientific phenomena from across the primary National Curriculum in an accessible and family friendly way.
Through the experiments, families are encouraged to explore science together and turn the 'I don't knows' into 'Let's find outs'. The course aims to spark scientific conversations amongst families and increase the confidence of both parents and children when thinking, talking and doing science at home.

Session 1

A cloud in a bottle
The visible spectrum
A wind sock
Delivery notes
Hazard identification

Session 2

Fingerprints
Plant dissection
Growing seeds
Delivery notes
Hazard identification

Session 3

A pooter
Minibeast hunting worksheets (1 and 2)
Delivery notes
Hazard identification

Session 4

Yeast balloons
Chromatography
Oobleck
Delivery notes
Hazard identification

Session 5

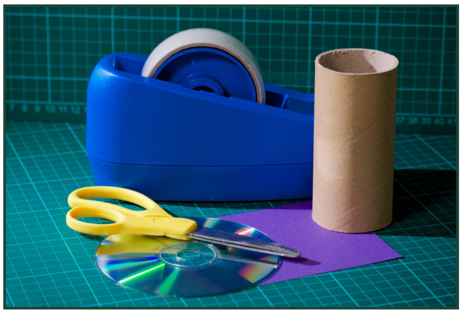
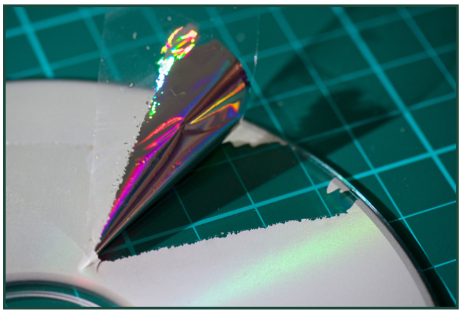
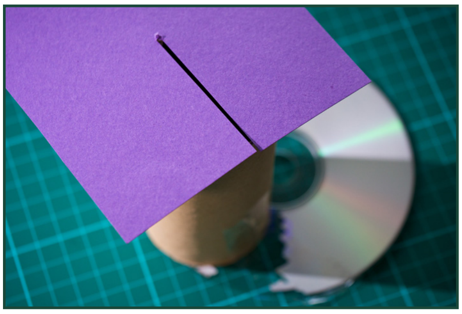
Talking tin cans
Cartesian diver
Static balloons
Delivery notes
Hazard identification

Workshop leader resources

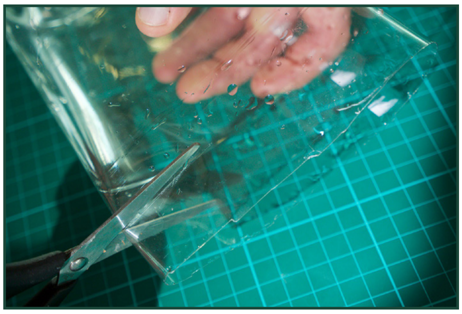
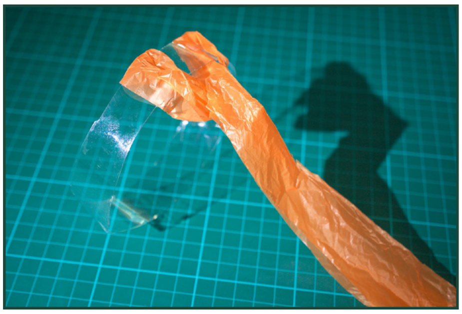
Running a session
Equipment list
Feedback forms

A cloud in a bottle


A spectroscope

A wind sock


Science For Families: A cloud in a bottle

For this experiment, you will need:

A clear plastic bottle (with a lid), some warm water and a match.

Step 1:

Gather your equipment together ready for the experiment.

Step 2:

Fill the plastic bottle with warm water up to a height of about 5cm.

Step 3:

Light a match and drop it into the bottle then put the lid on tightly.

Safe science - matches can be dangerous so ensure an adult is supervising at all times. Always strike a match away from you. Be careful when using hot water.

Thinking and talking about science

Squeeze the bottle really hard and then let go. Look at the air above the water in the bottle. What do you see? Does it remind you of anything? How do you think that tiny cloud has formed? What does your family know about clouds? What did the smoke from the match do?

Start experimenting

Try doing the same activity but use cold instead of hot water. Then try without using a match. Does the air in the bottle behave differently? Why do you think this is? What's going on?

Exploring further

You have created a cloud in a bottle. The water vapour in the air turns to tiny droplets when the bottle is released. These droplets cling to particles of smoke in the air and form the cloud you can see. When you see clouds in the sky, a similar thing is happening. Water droplets are clinging to dust in the air forming clouds.

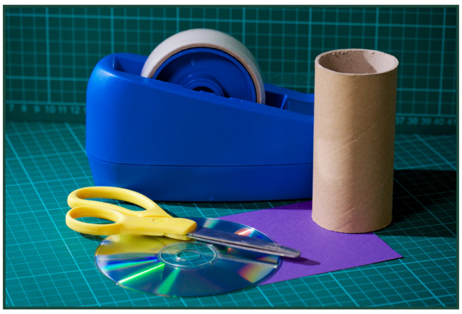
Scientists who study clouds and weather are called meteorologists. If you'd like to find out more and explore this science further at home, visit the Science for Families website: **thinkphysics.org/sffweather**

Science For Families: The visible spectrum

For this experiment, you will need:

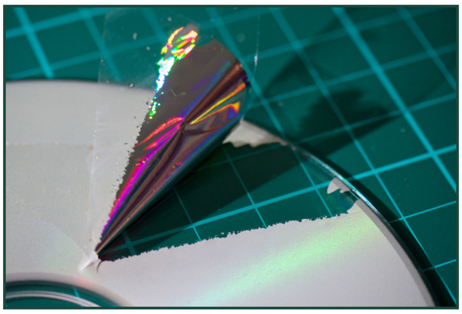
A cardboard tube, a CD, a pair of scissors, sticky tape and a piece of card.

Step 1:



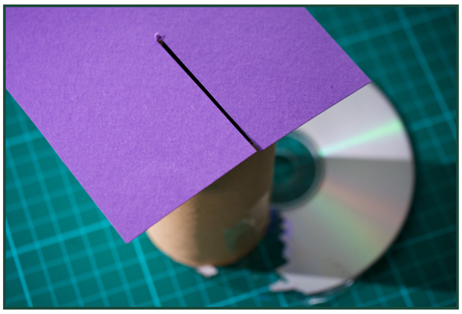
Gather your materials together ready for the experiment.

Step 2:



Make a scratch on the printed side of the CD. Use sticky tape to peel off the coating.

Step 3:



Cut a small slice into the card and then tape the CD, cardboard tube and card together.

Safe science - be careful when using the scissors to scratch the CD and cut the card. Never look directly at the sun; even when using your spectroscope.

Thinking and talking about science

You have made a spectroscope. Point it at a light and look through the CD end. What do you see? Do you recognise the pattern or colours? You should be able to see a rainbow. Where do you think the colours are coming from?

Start experimenting

Try looking at different types of light and different light sources: desk lamps, fluorescent tubes, TVs, mobile phone torches. Can you spot any differences in the patterns that you can see? Why do you think this is? What might be different about the lights you are looking at?

Exploring further

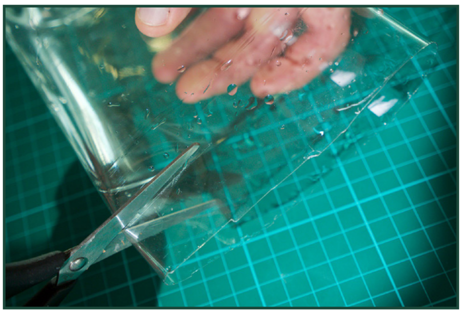
The spectroscope uses the slit in the cardboard and the CD to split visible light into the colours that make it up. You'll recognise these as the rainbow. Scientists call this the visible spectrum. The colours and patterns you can see depend on the type of materials that make the light. Each colour represents a different material, oxygen creates red and green colours. Astrophysicists use spectroscopes to look at stars and work what they are made of even though they are millions of miles away. If you'd like to explore this science further at home visit the Science for Families website: **thinkphysics.org/sfflight**

Science For Families: A wind sock

For this experiment, you will need:

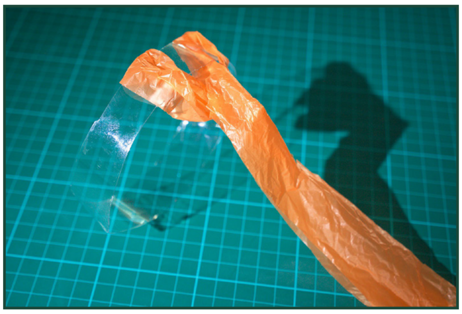
A carrier bag, some string, a pair of scissors, an empty 2 litre pop bottle.

Step 1:



Carefully cut a 3cm ring from your empty pop bottle.

Step 2:



Cut a long thin strip from your plastic bag and loop it around your ring of plastic.

Step 3:

Repeat step 2 until your plastic ring is covered, then tie a piece of string to the plastic ring.

Safe science - always take care when using scissors. Once the bottle has been cut, the plastic may be quite sharp. Remember that plastic bags can cause suffocation.

Thinking and talking about science

You have made a wind sock. Take it outside and hold it above your head in the air. What happens? Why? If it's a windy day, the wind sock should move. What do you think wind is? How could you use the wind sock to measure the speed and direction of the wind?

Start experimenting

When you get home, attach the wind sock to a pole or the washing line in you garden or outside. Each day, take a look at the wind sock to see how fast the wind is moving and its direction.

Exploring further

Wind is the movement of air around our atmosphere. Air moves from places of high pressure (where there's a lot of it) to places of low pressure (where there is less of it). Wind is extremely useful, we can use it to turn wind turbines which generate electricity for our homes. Birds use the wind to help them fly and some plants use it to spread their seeds over long distances. Scientist who study weather are called meteorologists. They use measurements like wind speed and direction to predict what the weather is going to be like. Want to experiment more? Visit **thinkphysics.org/sffweather**

Science as a family

Science for families encourages families to explore, observe and talk about science together. Working as a team they create experiments and demonstrations and try to answer scientific questions. Families should be encouraged to talk about what they already know and listen to each other, turning 'I don't know' into 'Let's find out'. The activities should be completed collaboratively sharing the responsibility and work.

Activity: Wind socks

Wind comes from two places. Surface temperatures are warmer near the equator. Air rises at the equator and travels north or south towards the poles where it cools and falls. Winds are also created due to the rotation of the Earth - the Coriolis effect. Air travels from places of high pressure (where there is more air) to places of lower pressure (less air). Wind is measured on the Beaufort scale from 0 (calm) to 12 (hurricane).

Activity: The visible spectrum

Light is made up of a spectrum of colours; a rainbow. In science, this is the visible spectrum. The spectroscope splits the light into its colours using the slit and the CD. The patterns of colours we see are a fingerprint of the light source that they came from. Different elements (oxygen, hydrogen, etc.) in a light source make different patterns. Astrophysicists use this to observe stars and understand what they are made of.

Activity: A cloud in a bottle

Some of the warm water evaporates (turns to gas) inside the bottle. When the gas is squeezed it is heated slightly. When released, the gas cools and turns into water droplets (condenses). The particles of smoke help the condensation to occur and the water vapour clings to the smoke creating a cloud.

Science at home and further resources

Encourage families to continue and repeat these demonstrations at home. Make sure that they take with them the demonstrations they have made. Ask them to take photos of the science they do at home and bring them to the next session. Keep an eye on the science stories in the news and share relevant stories with participants so they can continue to talk about science at home.

Equipment list

Wind socks:
Scissors
Plastic bags
2L pop bottles
String

The visible spectrum:
Cardboard tubes
CDs
Scissors
Sticky tape
Card

A cloud in a bottle:
Clear pop bottles
Warm water
Matches

General hazards

Trip hazards

Controls: regular monitoring of the workspace by the workshop leader. Participants are asked to be responsible for the tidiness of their work area.

A wind sock

Scissors - cut injury hazard

Controls: use child friendly scissors. Children should be supervised by adults at all times.

Plastic bags - choking / suffocation hazard

Controls: make participants aware of the hazard. Demonstrate correct use of the plastic bags.

The visible spectrum

Scissors - cut injury hazard

Controls: use child friendly scissors. Children should be supervised by adults at all times.

A cloud in a bottle

Matches - fire and burns hazard

Controls: adult supervision. Clear demonstration of correct use by workshop leader.

Water - slip and trip hazard

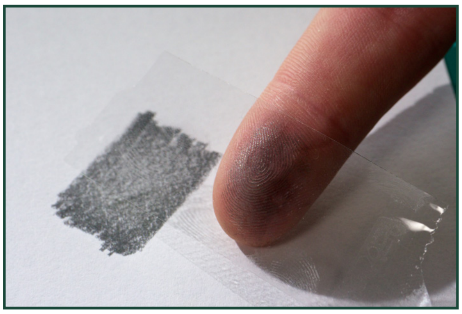
Controls: spillages to be reported and cleaned up immediately.

Hot water - scalding hazard

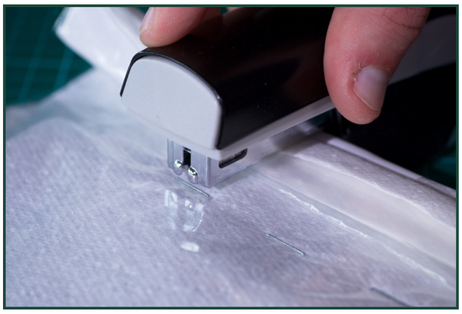
Controls: ensure that the water is warm (not hot). Clear demonstration of correct use by workshop leader.

This list is not exhaustive and may not cover all potential hazards. It should be used as a guide to ensure that workshop leader is able to fully risk assess any activity that they or participants are carrying out in a workshop.

Fingerprints


Growing seeds




Plant dissection



Science For Families: Fingerprints

For this experiment, you will need:

A piece of paper, a pencil, your finger and some clear sticky tape.

Step 1:

Heavily shade a square on the paper with the pencil. Place your finger on the square and rub.

Step 2:

Carefully place a piece of sticky tape onto you finger (sticky side touching your finger)

Step 3:

Remove the tape and stick it onto a clean part of the paper. Take a close look at your print!

Safe science - make sure you wash your hands thoroughly after completing this activity.

Thinking and talking about science

You've just taken your fingerprint! Have a close look at it. Do you see a pattern? Take the rest of your fingerprints. Can you spot any similarities or differences? Fingerprints are used by the police; do you know why this is?

Start experimenting

Try comparing your fingerprints to a family member's. Are there any similar patterns you can see? Here's a thought: do you have toe-prints? There's only one way to find out! There are three main types of fingerprint: loop, whorl and arch, which types do you have?

Loop Arch Whorl

Exploring further

Your fingerprints are unique, which makes them really useful to the police when solving crimes. If you'd like to find out how to dust your house for fingerprints, visit our website **thinkphysics.org/sffprints**

Science For Families: Growing seeds

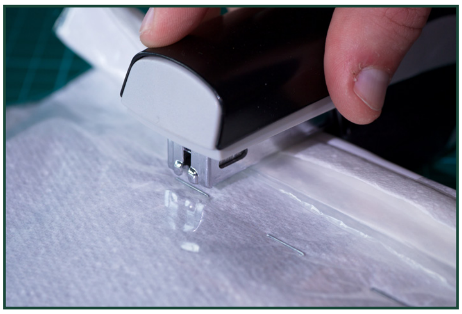
For this experiment, you will need:

A clear food bag, a stapler, some different seeds (broad beans work well) and a piece of kitchen paper

Step 1:

Fold the kitchen paper so that it fits neatly inside the food bag.

Step 2:



Make a line of 5 staples along the bag about halfway up - to stop the seeds from falling down.

Step 3:

Place different seeds into the bag. At home, fill with 3 cm of water and watch them grow!

Safe science - be careful when using the stapler. The seeds are small and may cause a choking hazard; make sure you don't put them into your mouth.

Thinking and talking about science

This is not a quick demonstration. It will take time for the seeds to grow. Have a close look at the seeds. What do you think the seeds need to start growing? When they do start growing, what will they produce? Have you heard of roots or shoots? What are they?

Start experimenting

Make another seed bag but this time don't add water. Watch what happens? You could also try putting the bag in a dark place to see if they grow. Find more seeds and try to grow them. Do all seeds grow in the same way?

Exploring further

Once you are home and your seeds have started to grow, you'll need to plant them. Put them in some soil, perhaps outside or in a plant pot (a mug or cup will do). Now you can watch as they grow into larger plants. You'll need to look after them carefully. Plants need light and water to grow successfully.
If your plant is growing well, you could try experimenting with it, go to the website **thinkphysics.org/sffplants** for some ideas.
If you are lucky and take good care of you plant, it may even produce its own seeds which you can plant again!

Science For Families: Plant dissection

For this experiment, you will need:

A flowering plant (lilies or daffodils work well) and a piece of plain paper.

Step 1:

Before you start dissecting, take a really close look.

Step 2:

Carefully start to take the flower apart one piece at a time.

Step 3:

Look closely at the different parts of the flower.

Safe science - make sure that you do not put any parts of the plant into your mouth, after the activity you should wash your hands. Take extra care if you are allergic to pollen.

Thinking and talking about science

It's time to get up close and personal with your dissected plant. Do you know the names of any of the parts? Can you work out what they are for? You should be able to spot these three parts:

The **carpel** - this is the female part of the plant. It is responsible for producing the seeds which will grow into new plants. Can you think of any types of seeds?

The **stamen** - this is the male part of the plant. It produces pollen. A plant is able to make seeds when the pollen reaches the carpel of another plant. How do you think this happens?

The **petals** - these are usually brightly coloured. Why do you think this is? How do you think the petals are involved in helping the plant to make seeds?

Exploring further

Botanists are scientists who study plants. When you get home, you could try dissecting a different type of flowering plant and compare it to the one you dissected today. If you want to experiment further, check out our website to find out how: **thinkphysics.org/sffplants**

Science for Families is created by Think Physics, Northumbria University in partnership with the North Tyneside Learning Alliance. For more visit: thinkphysics.org

Science as a family

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Activity: Fingerprints

A fingerprint is an impression left by the friction ridges on a human finger. Human fingerprints are detailed, unique and difficult to change, and durable over the lifetime of a person. This makes them useful for identifying people. There are three main types of fingerprint: arch, look and whorl. Some animals also have fingerprints; the koala has prints that are very similar to humans.

Activity: Plant dissection

A flower is made of several main parts: the stamen, the carpel, the petals and the ovary. The stamen is the male part of the flower which creates the pollen. The carpel is the female part of which receives the pollen (fertilisation). Seeds are created in the ovary after fertilisation. Petals attract insects which transport pollen from one flower to another (pollination). Flowers also produce nectar and sweet smells to attract insects.

Activity: Growing seeds

A seed is a potential plant which has grown due to fertilisation. To germinate (start to grow) it needs water (not light). It forms a root and a shoot. The root searches for nutrients and water , the shoot for light. Plants are usually green because of a chemical they contain called chlorophyll which enables them to photosynthesise (make their own food) using sunlight, water and carbon dioxide.

Science at home and further resources

At home, they should fill the grow bag with 2cm of water, seal it shut and tape it to a window. Encourage the families to take photos or record how quickly each of their seeds is growing. They could record measurements of the roots and shoots. Families could also grow a variety of different seeds and compare them. Once they have produced shoots and roots, they can be transferred to a plant pot or planted in the garden.

Equipment list

Fingerprints:
A piece of paper,
Your finger,
A pencil,
Some clear sticky tape.

Plant dissection:
Flowering plants (such as lilies or daffodils),
Plain paper.

Growing seeds:
Clear sandwich bags,
Paper towels,
A variety of seeds,
Staples and a stapler

General hazards

Trip hazards.

Controls: regular monitoring of the workspace by the workshop leader. Participants asked to be responsible for the tidiness of their work area.

Fingerprints

Scissors - cut hazard.

Controls: participants use age-appropriate scissors and are supervised by adults.

Plant dissection

Pollen - pollen allergies.

Controls: make adults and children aware that they will be working with flowers and pollen.

Growing seeds

Stapler - cut and stick injury hazard

Controls: adult supervision

Seeds - choking hazard

Controls: adult supervision. Children to be instructed not to put seeds up their noses or in mouths.

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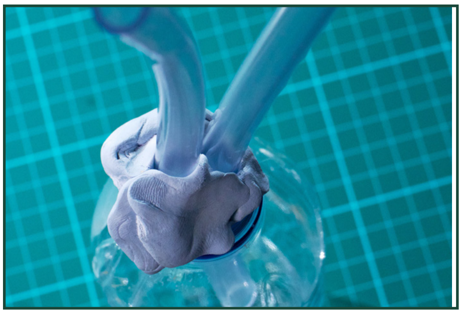
A pooter



Bug hunting

Science For Families: A pooter

For this experiment, you will need:

A clear plastic bottle, some blue-tack and two pieces of plastic tubing.

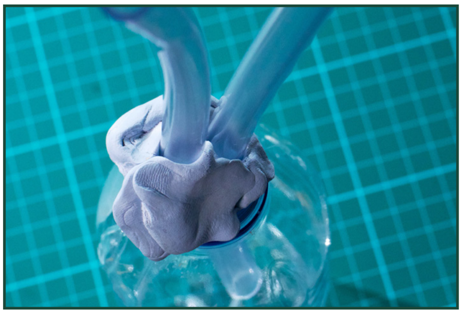
Step 1:

Cut the plastic tubing so that one piece is about 15cm long and the other is about 20cm.

Step 2:

Place both tubes into the neck of the bottle. The longer tube should be 5cm further in.

Step 3:



Fill the neck of the bottle using plenty of blue-tack to create an air-tight seal.

Safe science - children should be supervised when using a pooter as there is a choking hazard. Pooters must be emptied between uses to avoid bug inhalation.

Thinking and talking about science

The pooter you have made is used to safely collect small insects and minibeasts. To use your pooter, you need to suck on the shorter tube whilst holding the other tube near to an insect or minibeast. The minibeast will be captured in the bottle for you to look at closely. Next, you'll need to head outside and find a suitable place to hunt for minibeasts. Bushes, hedgerows, under rocks and around plant pots are good places to start your search. You could use a camera to take images of all the different creatures you find. Note down where you found them and their size - that's what entomologists do!.

Exploring further

With your pooter ready and working you've now become an entomologist, a type of scientist that studies the interesting world of insects. As you collect and study all the different species (types), you could record them in a notebook.

Your pooter is a great way of capturing insects, perhaps you could compare the different species that you find in different parts of your garden or local park. There are more minibeast hunting experiments and activities on the Science for Families website: **thinkphysics.org/sffpooter**

Science For Families: Minibeast hunting

Can you find all the common minibeasts below?

In each box make notes about: where you found the creature, its size, what it looked like and any other interesting characteristics it had.

Slug

Centipede

Ants

Earthworm

Snail

Spider

Woodlouse

Fly

Green Shield Bug

Now find your own minibeasts, you can sketch them in the box

In each box make notes about: where you found the creature, its size, what it looked like and any other interesting characteristics it had.

Science as a family

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Activity: Pooter

A pooter is a simple scientific instrument that entomologists (people who study insects) use to collect small animals so that they can study them closely. The suction provided by the user safely captures the animal inside the bottle so that it can be examined later. Any animals that are caught should be returned to the place where they were found. This is called returning them to their natural habitat.

Activity: Bug hunting

Hunting for bugs is an example of 'field work'. This is where scientists who study plants and animals head out to explore the natural habitats of various plants and animals. A habitat could be a desert or a rainforest, but it could also be a plant pot in your backyard or underneath a decaying log. These scientists will collect information about the varieties of animals in a habitat. Encourage the families to collect information too: they might use a ruler to measure a worm they have found, or make a note about the location they found it in. A type of animal is called a species, groups might be able to find several different species of the same animal. There are many different types of spider, worm and beetle that could be discovered in a back-garden - that's why it's important to keep a record of the ones that have been found. It's really important that the participants are in a safe area when bug hunting so make sure you have had a look at the outdoor space and have identified any hazards before you take the group out.

Science at home and further resources

Now that the families have a list of minibeasts that they have found, encourage them to go home and explore a different habitat (it doesn't have to be outside). A loft or behind the fridge are interesting places to look for more minibeasts. They could also compare the different animals they find in their backyard to those found during the session. Again photographs are a great way of recording any animals that have been found.

Equipment list

Pooter:
Plastic bottle (clear),
Blue tack,
Plastic tubing (or straws),
Scissors

Bug hunting:
A pooter,
An outdoor space,
The bug-hunting sheet.

General hazards

Trip hazards

Controls: regular monitoring of the workspace by the workshop leader. Participants are asked to be responsible for the tidiness of their work area.

A Pooter

Scissors - cut injury hazard

Controls: use child friendly scissors. Children should be supervised by adults at all times.

Bug hunting Activity Hazards

Using a pooter - choking hazard.

Controls: to prevent choking, only one animal at a time should sucked into the pooter. Pooters should be emptied between each use.

Bug hunting - cut or stick injury.

Controls: ensure that the area has been checked properly before the session. Explain to participants the potential dangers; finding broken glass.

Bug hunting - poisoning

Controls: tell the groups that they should not put anything in their mouths and they should wash their hands with soap and water after the activity.

Bug hunting - trip or fall

Controls: instruct the group to bring appropriate footwear and clothing. Highlight any areas that are dangerous or out of bounds and ensure that no-one enters these areas.

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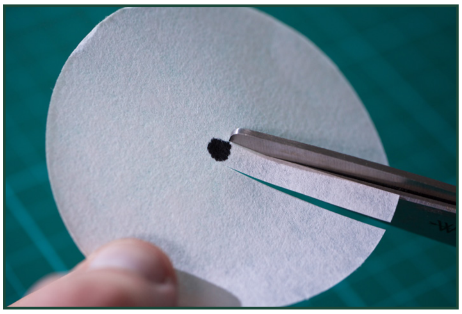
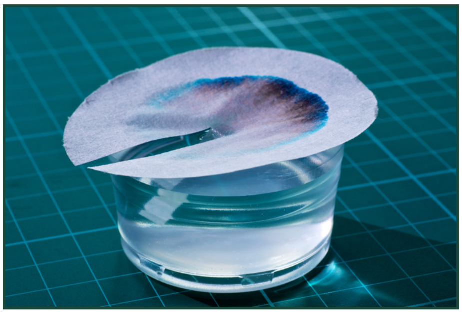
Yeast balloons



Chromatography

Oobleck



Science For Families: Yeast balloons

For this experiment, you will need:

A plastic bottle, a party balloon, a packet of fast-action yeast, a teaspoon of sugar, some warm water.

Step 1:

Half fill the bottle with warm water and then add the sugar. Shake to dissolve the sugar.

Step 2:

Add the packet of yeast to the bottle and mix gently.

Step 3:

Stretch a balloon over the top of the bottle and then watch and wait.

Safe science - although dried yeast and sugar are foodstuffs they should not be put into the mouth. Do not do this experiment if you are allergic to latex.

Thinking and talking about science

It can take a few minutes (sometimes up to ten) for the reaction in the bottle to get going. Whilst you wait, why don't you try predicting what will happen. Scientists make predictions all the time, at the start of every experiment they say what they think is going to happen. So, what do you think will happen? And why do you think that? Think about the different things that are in the bottle: the yeast, warm water and sugar - what do you think they do? How might they be interacting with each other? Keep a close eye on the experiment as you might notice some changes by now.

Exploring further

Yeast is a microorganism - it's alive! Once activated the yeast feeds on the sugar and begins to produce a gas called carbon dioxide. This is the same gas that we breath out. The gas causes the balloon to inflate. Yeast is used in baking because these gas bubbles cause food like bread to rise.

Start experimenting

Try the same experiment without using sugar or use cold water instead of warm water. Then compare your results to the original demonstration. Why do you think there is a difference, what is the sugar for, why use warm water?

Science For Families: Chromatography

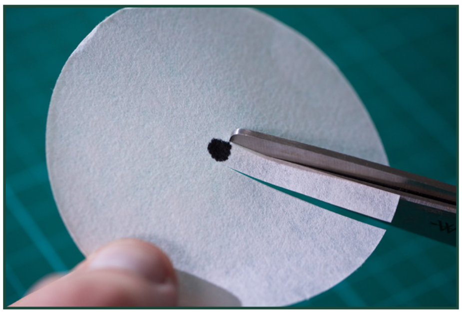
For this experiment, you will need:

A plastic cup, a coffee filter, some scissors, a black felt-tip pen, some water.

Step 1:

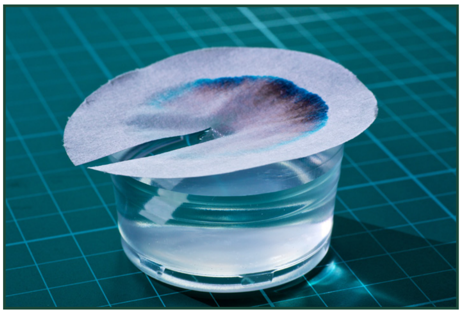
Cut the cup so there is about four centimetres left - enough to put the coffee filter on.

Step 2:



Put a dot of ink in the middle of the filter and cut two straight lines towards the centre.

Step 3:



Fill the cup with water and rest the filter on the top, let the paper tail dip into the water.

Safe science - be careful when using the scissors to cut the filter paper and the cup. Also make sure you report and spillages should they happen.

Thinking and talking about science

Watch and wait. You should see the water slowly travel up the paper tail to the spot of ink. Predict what you think will happen when the water reaches the ink? What colours can you see? Are they the same as the colour of the ink spot?

Start experimenting

Try again, but this time use a different colour of ink or use a different brand of felt-tip pen. What differences do you spot? What have you found out about felt-tip pen ink?

Exploring further

This is called chromatography (the word means colour writing it comes from Greek). It's a great scientific method for splitting up mixtures. In your experiment, you found out that a black felt-tip is actually made of several different colours of ink. Scientists use this method in lots of different ways; testing food quality and testing blood for illnesses. The type of scientist who might use this is called a chemical engineer. Chemical engineers use science to create new and exciting chemicals which could be used, for example, to cure disease (like medicines) or stick things together (like glues).

Science For Families: Oobleck

For this experiment, you will need:

A bowl, half a cup of water, a cup of corn flour and your hands.

Step 1:

Pour the half cup of water into the bowl. Add more at the end if the mixture is too thick.

Step 2:

Now add the cup of corn flour and stir the mixture with a spoon or your hands!

Step 3:

Not get your hands into the mixture and start exploring it.

Safe science - this is a messy experiment, make sure that you clear up any spillages.

Thinking and talking about science

Once you get your hands in the mixture describe the way that it feels. What happens if you stir it? You'll notice that it doesn't behave like a normal liquid; when you squeeze it what happens? You might notice that it turns into a solid. Oobleck is an example of a non-Newtonian fluid, which means it behaves differently to common fluids like water.

Start experimenting

Try adding more cornflour or water to see what happens. Can you think of anywhere that a fluid like this might be useful?

Exploring further

Non-Newtonian fluids are really interesting because they behave in a different way to what you would expect. When you squeeze (compress) them, they take on the properties of a solid. If you filled a swimming pool full of oobleck, you could walk across it. Visit **thinkphysics.org/sffoobleck** where there's a video. Oobleck is called non-Newtonian because it doesn't move in the way that the scientist Sir Isaac Newton described the movement of fluids. He's the scientist that also described the laws of gravity - that's the force that pulls us onto the Earth.

Science as a family

Science for families encourages families to explore, observe and talk about science together. Working as a team they create experiments and demonstrations and try to answer scientific questions. Families should be encouraged to talk about what they already know and listen to each other, turning 'I don't know' into 'Let's find out'. The activities should be completed collaboratively sharing the responsibility and work.

Activity: Yeast balloons

The yeast is a living microorganism. It breaks down the sugar, producing carbon dioxide gas. Yeast is most commonly used in baking, the carbon dioxide gas create bubbles in bread which causes it to rise. If you increase the temperature of the water in the experiment, the speed at which gas is produced should increase. But if the temperature gets too hot the yeast will die and won't produce any gas.

Activity: Chromatography

When the water reaches the ink spot, the ink dissolves and travels along the filter paper with the water. Black ink contains a mixture of different colours and each has a different mass (heaviness). Heavier inks leave the water solution at different points. As a result you can see the different colours that make up an ink. If you try with different brands you'll find that a 'black' pen contains many different colours.

Activity: Oobleck

This non-Newtonian fluid doesn't behave like a usual fluid (e.g. water). It will flow through your fingers but when it is squeezed the tiny particles of cornflour clump together and the liquid becomes solid. The effect is so dramatic that if you filled a swimming pool with oobleck, you would be able to walk across it without sinking! Custard and tomato ketchup are other examples of non-Newtonian fluids.

Science at home and further resources

At home, families could experiment by changing the temperature of the water in the yeast experiment. Encourage them to take photos of their experiments and share their results next time. The chromatography can be carried out at home using different colours of felt-tip pens. Once dried out these chromatograms (that's the name for them) could be displayed and compared.

Equipment list

Yeast balloons:
A plastic bottle,
A balloon,
A packet of fast-action yeast,
A teaspoon of sugar,
Some warm water.

Chromatography:
A plastic cup,
A coffee filter,
Some scissors,
A black felt-tip pen,
Some water.

Oobleck:
A bowl,
Half a cup of water,
A cup of corn flour,
Your hands.

General hazards

Trip hazards

Controls: regular monitoring of the workspace by the workshop leader. Participants are asked to be responsible for the tidiness of their work area.

Yeast balloons

Balloons - choking hazard

Controls: participants told not to put balloons into their mouths.

Balloons - latex allergy

Controls: make sure all participants are aware of the use of latex balloons. Anyone with a latex allergy should not come into contact with the balloons.

Water - slip and trip hazard

Controls: spillages to be reported and cleaned up immediately.

Chromatography

Scissors - cut injury hazard

Controls: use appropriate scissors. Children should be supervised by adults at all times.

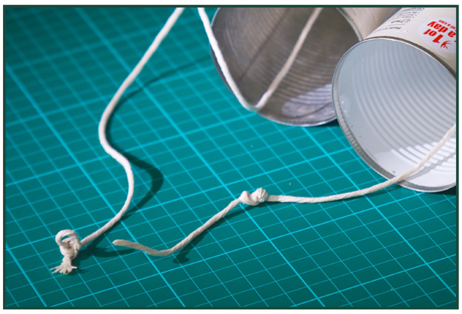
Oobleck

Water - slip and strip hazard

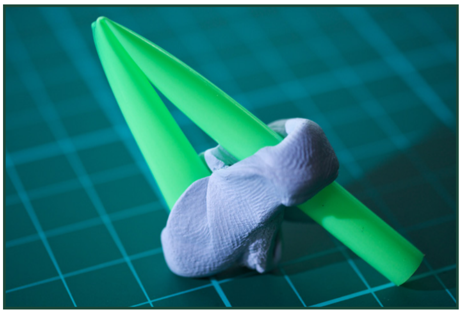
Controls: spillages to be reported and cleaned up immediately.

This list is not exhaustive and may not cover all potential hazards. It should be used as a guide to ensure that workshop leader is able to fully risk assess any activity that they or participants are carrying out in a workshop.

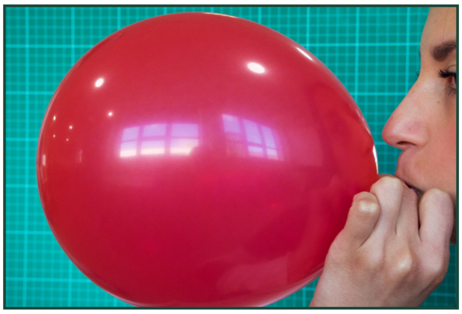
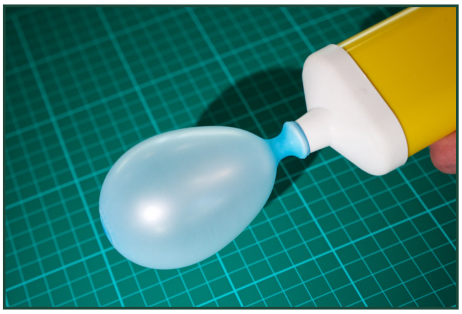
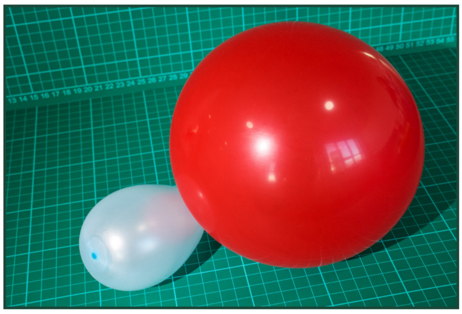
Talking tin cans




Cartesian divers


Static balloons

Science For Families: Talking tin cans

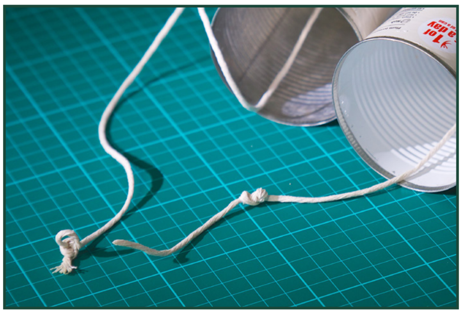
For this experiment, you will need:

Two tin cans, a long piece of string, some scissors.

Step 1:

Cut a piece of string about 5 times your height.

Step 2:



Thread the tin cans onto the piece of string. Make sure that the cans are bottom to bottom.

Step 3:

Tie large knots in both ends of the string. Pull the string tight to use.

Safe science - tin cans may have sharp edges, examine the cans carefully before use and return any that have sharp edges to the workshop leader.

Thinking and talking about science

You've made a telephone! Give one can to a family member and then walk away from each other until the string is tight. Then one person should talk into the can whilst the other listens. What happens?

Start experimenting

Now try to use the tin can telephone with a slack string - does it work? Why do you think this is? Tighten the string again and try touching it gently whilst you speak into the can. What can you feel? Why do you think this is? What happens if you attach a third can on a piece of string?

Exploring further

You're exploring the science of sound. Sound is made up of vibrations. When you speak you vibrate the air coming out of your mouth. This travels across the room and is picked up by the ears of anyone close enough to hear. The tin can collects those vibrations and passes them along the string - that's why you can feel the string vibrating. What happens to the vibrations if you shout or whisper? Here's a challenge - can you find a way of using the tin can telephone around a corner? If you want to see how to do it and try some more sound-related experiments visit: **thinkphysics.org/sffsound**

Science For Families: Cartesian diver

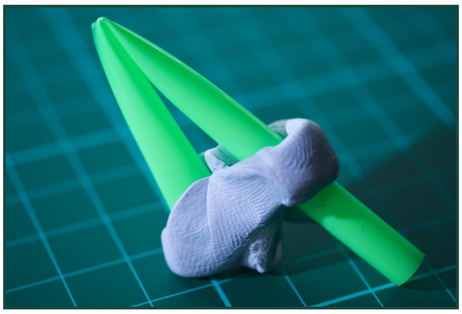
For this experiment, you will need:

A clear plastic bottle (with lid), a straw, some blue tack and some scissors.

Step 1:

Fill the bottle with water up to about 5cm from the top.

Step 2:



Cut a piece of straw about 10cm long and fold. Use blue tack to hold it together.

Step 3:

Place the straw in the bottle. If it sinks take off some blue tack and try again. Screw on the lid.

Safe science - make sure you are careful when using the scissors. If you spill any water let the workshop leader know so that we can clear it up quickly,

Thinking and talking about science

Hold your bottle upright and squeeze it very hard (make sure the lid is on tight!). Watch what happens. Then let go. Watch what happens. Can you explain what has happened? Why does the straw diver sink when the bottle is squeezed?

Start experimenting

Can you get the straw to hover in the water? How? The straw has some air trapped inside - does the diver work if the straw is filled with water? Try it out and see.

Exploring further

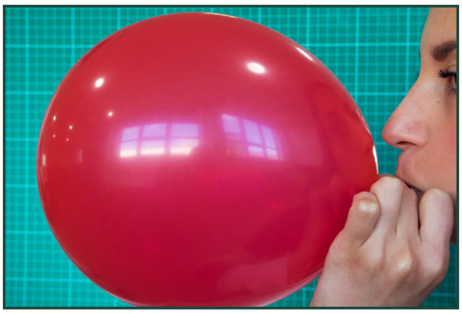
There is air trapped inside the straw. When you squeeze the bottle, that air is compressed (pushed into a small space). The same amount of air in a smaller space means the density of the straw has gone up. In fact it's now more dense than the water which means that it sinks! Marine engineers and naval architects use this idea when designing submarines. By compressing (squeezing) air into large water tanks they can make submarines float and sink. There's more floating and sinking experiments available at **thinkphysics.org/sfffloating**

Science For Families: Static balloons

For this experiment, you will need:

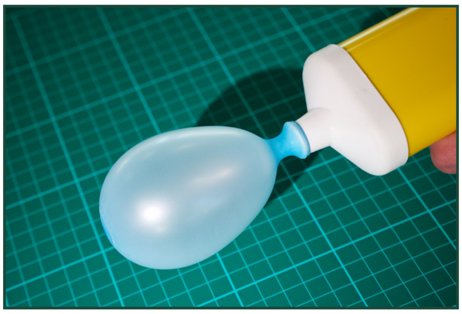
A party balloon, a water balloon, your lungs or a balloon pump.

Step 1:



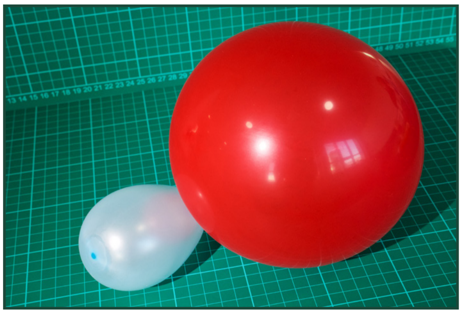
Inflate the large balloon and securely fasten the end.

Step 2:



Inflate the small balloon and securely fasten the end.

Step 3:



Place the two balloons next to each other and see what happens.

Safe science - these balloons are made from latex and shouldn't be touched by anyone with a latex allergy. Be careful when inflating the balloons as they are a choking hazard.

Thinking and talking about science

Start by taking the smaller balloon and rubbing it against your jumper. Then place the balloon on your forehead - what happens? Try the same with the larger balloon. What happens if you put the two balloons next to each other? Why do you think that is?

Start experimenting

Tear up some paper into little pieces and put them in a pile. Rub either balloon against your jumper and then bring it close to the paper. What happens? Can you make anything else move with the balloons?

Exploring further

You're exploring static electricity. When you rub the balloon it becomes charged up. This charge can be attracted to things like your forehead or it can repel (push away) things like the other balloon. At home, you could hold the charged balloon next to steady stream of water - watch what happens! Physicists are scientists who are interested in charges like those on your balloon. They use particle accelerators to smash these charges together and record what happens. They are trying to find out how the universe began using particle accelerators. Find out more at **thinkphysics.org/sffstatic**

Science as a family

Science for families encourages families to explore, observe and talk about science together. Working as a team they create experiments and demonstrations and try to answer scientific questions. Families should be encouraged to talk about what they already know and listen to each other, turning 'I don't know' into 'Let's find out'. The activities should be completed collaboratively sharing the responsibility and work.

Activity: Talking tin cans

When we speak the sound travels as vibration through the air. Louder sounds make bigger vibrations, higher-pitched sounds make faster vibrations. The vibrations are picked up by the eardrum and passed to an organ called the cochlea which converts the vibrations into electrical signals which are sent to the brain. In the tin can, the vibrations are passed along the string instead of through the air.

Activity: Cartesian divers

An object sinks if its density is greater than the fluid surrounding it. Density is a measure of how much mass is packed into a space. Squeezing the bottle compresses the air inside the straw making it more dense than the water so it sinks. Releasing the bottle expands the air in the straw making it less dense than the water so it floats back to the top.

Activity: Static balloons

Rubbing the balloon against a jumper builds up negative charges on the surface of the balloon. Charges that are the same repel so two charged balloons push away from one another. When the balloon is put next to a non charged object (your forehead), the negative charges on the balloon are attracted to the positive charges and so the objects stick together.

Science at home and further resources

Encourage the families to extend the talking tin cans at home, they should be able to string together 4 or 5 cans and it will still work. The families could also go home and teach other family members how to make a Cartesian diver. Passing a charged balloon next to a stream of water gives an interesting effect - challenge the families to try this at home and take a picture or video.

Equipment list

Talking tin cans:
Two tin cans,
A long piece of string,
Some scissors.

Cartesian divers:
A clear plastic bottle (with lid),
A straw,
Some blue tack,
A pair of scissors.

Static balloons:
A party balloon,
A water balloon,
Your lungs or a balloon pump.

General hazards

Trip hazards

Controls: regular monitoring of the workspace by the workshop leader. Participants are asked to be responsible for the tidiness of their work area.

Talking tin cans

Tin cans - cut hazard

Controls: inspect each of the cans before use and discard any with sharp edges.

Scissors - cut injury hazard

Controls: use child friendly scissors. Children should be supervised by adults at all times.

Cartesian diver

Water - slip and strip hazard

Controls: spillages to be reported and cleaned up immediately.

Straws - choking hazard

Controls: adult supervision. Children to be instructed not to put straws up their noses or in mouths.

Static balloons

Balloons - choking hazard

Controls: participants told not to put balloons into their mouths.

Balloons - latex allergy

Controls: make sure all participants are aware of the use of latex balloons. Anyone with a latex allergy should not come into contact with the balloons.

This list is not exhaustive and may not cover all potential hazards. It should be used as a guide to ensure that workshop leader is able to fully risk assess any activity that they or participants are carrying out in a workshop.

Preparing the workspace

Ensure that you have a workspace large enough to accommodate the group you will be working with. You should liaise with the school to ascertain which room you will be using. It is preferable to work in a space that has access to a tap and washing facilities. Ensure that each family group is given enough space to work comfortably and that you have enough resources for **every** individual (parent and child) to complete the activities.

Explaining the premise

Left to their own devices a family group will usually fall into one of two categories: either a parent will take over and do all the work for the child or a parent will spend time chatting to another parent and the child will end up working alone. When leading the sessions it is important to set out clear expectations at the start. Explain that cooperation within families will be important and that families should concentrate on their own work, rather than that of other groups. It is useful to highlight the fact that parents can often take over in situations like this and suggest that more can be gained by working together. Parents should also be told that they are expected to take part in all the experiments (no matter how messy) as this will allow for better exploration and discussion regarding the many scientific concepts that will be covered.

As activities take place, it is the role of the session leader to listen in to, and gently guide, the conversations that are taking place around the room. Ask questions of both the children and adults and praise groups where the families are working collaboratively. If it is clear that one individual is doing all the work in a group, join that group and model good practice regarding sharing tasks and having conversations.

Parents may be wary of the school environment and reticent to share their ideas with a large group (this goes for the children too), so it is best not to ask questions to the entire group and expect them to answer. You might find that during later sessions the families may have relaxed slightly and you are able to do this.

The aim of any session is to promote scientific conversation beyond the workshop. Each activity sheet has a few ideas of things that the groups could try out at home. Workshop leaders should encourage families to do these activities and suggest that they take photographs or make notes that can be shared at the next session. Make groups aware of this expectation at the beginning and throughout each session. This sort of evidence will show that your sessions are having an impact outside school.

A positive attitude towards challenges (from parents and children) is necessary throughout each workshop as some of the activities are tricky to complete and the science behind them can be quite challenging. Your role is to model this attitude and help support families when they find things challenging. It is important that you offer support so that families can successfully complete activities whilst still feeling that it was they that undertook and completed the challenge. Using open questions and only demonstrating rather than doing work for the parents will help to achieve this.

Delivering and supporting the activities

Each session is made up of 3 activities which should last for under 20 minutes each. This may feel too long at times, but on each worksheet there are plenty of extension experiments that can be completed.

Make sure that there are enough worksheets for each individual to have a copy and that you have ample resources for everyone to complete the activities. Worksheets should be printed in colour so as to make it easier to follow the instructions. You might need extra if some of the families are keen on exploring the science further. Be sure to draw attention to the fact that all the activities are completed using household items and therefore can be done at home in the kitchen with ease.

As a session develops, groups will find that they have a lot of equipment scattered over their workspace. Plan to give a little time between each activity to tidy up their work areas. To ensure that the groups are concentrating on the tasks in hand, only give out the equipment and worksheet necessary for a particular activity. Parents and children will become easily distracted if they can see what is coming up.

Many of the activities are linked to a scientific career, make sure that you draw attention to this. It will help the families to see the real-world relevance of the science that they are exploring together. It may also inspire our next generation of entomologists, meteorologists and physicists!

The hazard identification sheets are included to help you risk assess each workshop. The hazards identified are not exhaustive and should be used as a guide. You may find other hazards that are specific to the groups and schools that you are working with and you should risk assess accordingly. A school may ask to see your risk assessment before you complete the activities.

Promoting science beyond the session

At the end of each session make sure that everyone:

- takes their experiments home to show other family members.
- everyone takes their activity sheets home so they can do the activities and online extensions.

The aim of the course is to promote and increase the amount of science taking place outside of school so taking the experiments and worksheets home is very important.

You should explain to the entire group that you would like to see examples of the science they have completed at home. Encourage family groups to take pictures of them doing science at home - they could potentially email these to you before the next session so you can display them on a computer.

Some of the activities have an accompanying web resources - details can be found in bold at the bottom of each activity sheet. Highlight these to the group as a whole and to individual families during the activities. The web resources contain extra experiments, videos and supporting information for the families to explore the science further.

Resourcing Science for Families

Science for Families has been designed to use simple resources that can usually be found around the house. Most activities involve the use of some recycled materials. Please use the list below to resource your sessions. The list assumes a group size of 10 children and 10 adults.

Session 1

Matches
Small, clear plastic bottles x 20
Water jugs x 4
Plastic carrier bags x 20
Large plastic bottles x 10
String
Paper tubes x 20
Blanks CDs x 20
Card
Sticky tape x 10
Scissors x 10

Session 2

HB Pencils x 20
Plain paper x 20
Sticky tape x 20
Flowering plants (with 20 heads)
Sealable food bags x 20
Paper towels
Staplers x 10
Seeds (a variety)

Session 3

Small, clear plastic bottles x 20
Plenty of blu-tack
Plastic tubing (25cm per pooter)
Scissors x 10

Session 4

Party balloons x 40
Yeast sachets x 40
Small, clear plastic bottles x 20
Sugar sachets x 40
Coffee filters x 20
Assorted felt tipped pens
Plastic cups x 20
Scissors x 10
Cornflour (~200g per family)
Water jugs x 4
Mixing bowls x 10

Session 5

Party balloons x 20
Water balloons x 20
Balloon pumps x 4
Scissors x 10
Small, clear plastic bottles x 20
Plenty of blu-tack
Water jugs x 4
Drinking straws x 20
String
Tin cans x 20

Science For Families: Feedback

Thanks for attending the Science for Families course

We'd really appreciate it if you could complete this feedback form. It won't take long and it will help us to improve the course for future families.

1. Have you enjoyed the Science for Families sessions?

- ☐ Yes
- ☐ No

2. How many of the sessions did you attend?

1	2	3	4	5
☐	☐	☐	☐	☐

3. Have you repeated any of the experiments at home?

- ☐ Yes
- ☐ No

If yes, which ones?

4. Have you accessed any of the experiments on our website?

- ☐ Yes
- ☐ No

If yes, which ones?

5. Whilst completing the Science for Families course did you talk about or do science more at home?

- ☐ Yes
- ☐ No

Can you give any examples?

5. Do you feel more confident talking about and doing science at home with your child as a result of the course?

- ☐ Yes
- ☐ No

Thank you for taking the time to complete this survey. If you'd like to join our mailing list please write your email in the space below.