Shell Education Service

Activate

Adults and Children Together Investigating Virtually Anything That Exists

Foreword from James Smith, Chairman Shell UK

At Shell we believe that science is fundamental to meeting many of the pressing challenges faced by society today, including sustainable energy.

We know, in the UK, that we don't have enough of our school children and students studying science. We know too that it is vital to stimulate the interest of children in science and technology from an early age.

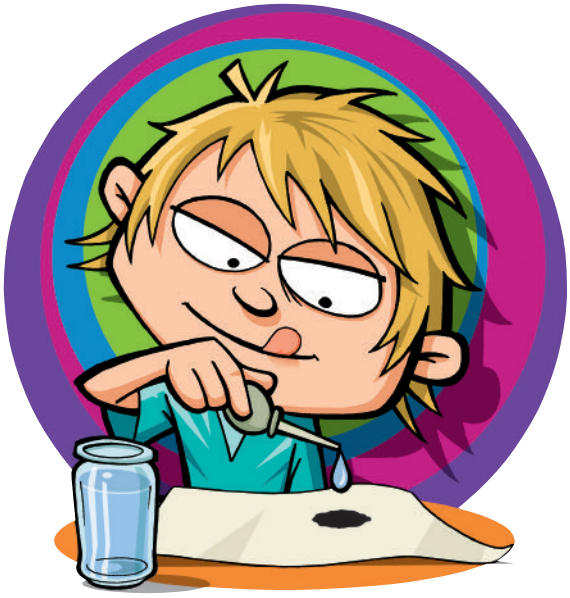
That's why, since 1998, the Shell Education Service has run science workshops for primary school children across the UK. Every year over 50,000 children take part in our workshops that encourage them to explore and question science through hands-on investigations. The workshops, run by expert tutors, are unique in focusing on primary education with curriculum-based support for teaching on physical processes together with materials and their properties.

The Shell Education Service has been contributing to education in schools since the 1950s. In addition to our workshops, there are science fun days with local communities, encouraging parents and grandparents to take part in science activities with the children. It also supports trainee teachers, to build their confidence in teaching science.

This drive to support science learning is complemented by Shell's £2m sponsorship of the Science Museum's "Launch Pad" – a world-renowned, hands-on children's gallery.

I hope this booklet will capture the imagination of the budding scientists within your own family and will encourage your children on the path to scientific discoveries of their own. Each of the investigations has been designed to be performed at home with everyday objects and the assistance of adults.

I hope you'll agree that science investigation can be fun for the whole family.



Parent's guide

This guide has been written for children of all ages, but is particularly suitable for those at primary school. Each investigation has a section for you to read. This covers some suggested factors which you can encourage your child to investigate, as well as any safety implications.

The back page of this booklet contains a worksheet recording template. We suggest you photocopy or print out extra versions of this. This booklet is available online at www.shell.co.uk/activate.

The worksheet sets out a recommended set of questions that your child should be considering when carrying out their investigation. By filling in each box they will begin to learn how to properly structure investigations to explore the world around them.

We'd encourage you and your child to follow up your home investigations with further research. To assist you each investigation includes a suggested selection of terms that you and your child can follow up in the library or online.

Science is a core component of the National Curriculum in England, Wales, Scotland and Northern Ireland. In England and Wales the curriculum is split into four attainment targets: Scientific enquiry (Sc1); Life processes and living things (Sc2); Materials and their properties (Sc3); Physical processes (Sc4). This guide is to help you support your child with Sc1 activities at home.

The main focus of Sc1 is to enable children to think through and carry out scientific investigations themselves, rather than jumping through tried and tested hoops. To succeed, your children will need to devise their own experiment using our suggestions as a start. The investigations in this pack have been chosen so that they can be done at home with minimal resources. We'd encourage you to work closely with your children as they carry out their investigations, and if necessary, prompt them with the following questions:

- **For each investigation, what question is the child asking?**
  What are we hoping to find out?
- **What variables (or factors) are involved?**
  Anything that can be altered to affect the outcome is a factor. Children should be encouraged to identify as many as possible.
- **Which factor is to be investigated?**
  Children need to choose the factor that they consider most important or the one they can investigate most easily. Start with the one that can be investigated most easily.
- **How will the other factors be kept constant?**
  Only one factor should be investigated at a time otherwise no one will know which one(s) produced the observed results. Keeping everything else the same every time is the only way to construct a fair test.
- **What safety concerns are there (if any)?**
  Children should be encouraged to work carefully and tidily. Failing to keep equipment and tools in order might lead to injuries.
- **What needs to be observed?**
  By observation, scientists mean using all their senses to find out what happens. Even taste can be used under the right circumstances, although children should not be encouraged to eat the samples used in other investigations as these may not be at all clean.
- **How will the observations be recorded?**
  They could be written, drawn, photographed or discussed.
- **How will you know when the experiment has finished?**
  It is very important to know what the expected end point is or the children could sit there all day!
- **Do the results answer the original query?**
  If not, can the investigation be adapted (in the light of experience) to achieve that? Or could you ask a different question?
  Feedback in this way is often something children find difficult so it's a really good idea to discuss it.

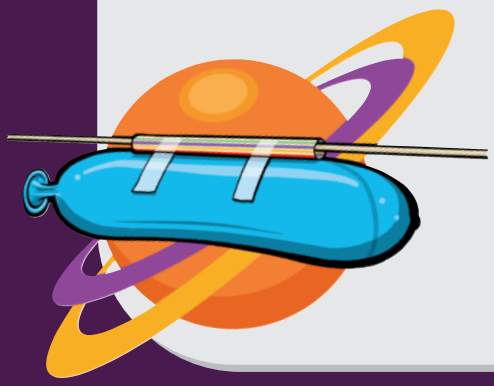
Investigation 1

Rocket science

Children

Have you ever made a simple rocket? Attach one end of a piece of string to one wall. Blow up a balloon, hold the end shut (don't tie it up) and tape a straw to one side. Thread the string through the straw, hold the string taut and release the balloon. How do you make it go the way you want it to go? How fast can you make it travel? How far can you make it go?

- Where will you set up the string?
- What size of balloon will you use? And how much will you inflate it?
- Would a different size balloon make a difference? Or the sort of string? Or could you add cardboard fins?



Parents

Factors: degree of inflation; balloon (size, material); string; size/shape of cardboard fins.
What you need: balloons; string; tape; cardboard; scissors.
Safety: care not to over-inflate balloon. Care with scissors

Key words for further research

Air resistance, air pressure, streamline

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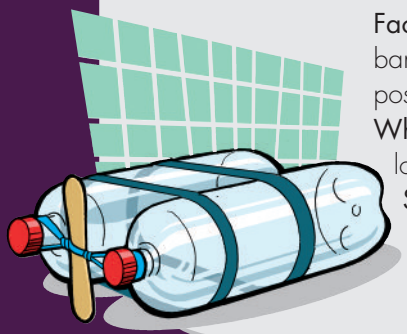
Investigation 2

Paddle Boat

Children

Have you ever made a simple paddle boat? Get two empty plastic bottles and attach them together lengthways with elastic bands. Put another band around the mouths of the bottles and insert a small lolly stick. Twist the lolly stick round a few times, put the boat in water (e.g. in the bath), let go of the stick and see what happens.
Can you make your boat go in a straight line?
How far can you make your boat go?
How fast can you make your boat go?



Parents

Factors: length/size of bottles; strength of elastic bands; number of twists; size of lolly stick; exact position of each bottle relative to each other.
What you need: empty plastic bottles; elastic bands; lolly sticks; somewhere to test them.
Safety: supervise small children near baths and pools

Key words for further research

Potential energy, kinetic energy

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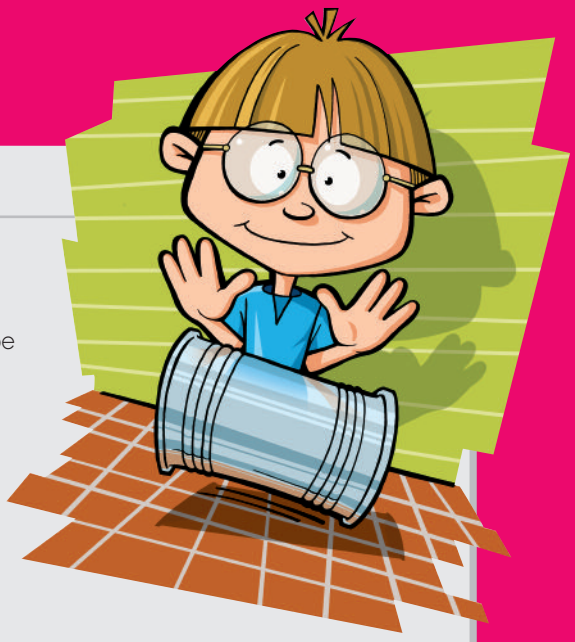
Investigation 3

Rolling cans



Children

Have you ever noticed if you drop something on the floor it doesn't always stay where it fell? What happens probably depends on the shape or contents. For example, do all cans roll along the floor at the same speed? Or in the same direction? Do you need a slope? You'll probably need a slope to start your cans rolling

- Which cans could you try out?
- Where, exactly, will you test them?
- Will you need to measure something?

Parents

Factors: can dimensions; floor surface(s); strength of push when starting the cans rolling or angle of slope; shape of the can (lid, rim); weight of the contents.
What you need: cans; clear floor space; something to make a slope (e.g. books or and a small plank).
Safety: care to avoid bowling people/pets over!

Key words for further research

Mass, weight, specific density, momentum

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Investigation 4

Fizzy drinks

Children

Have you ever noticed that some fizzy drinks keep their bubbles longer once you've poured them out? And if you forget to tighten the cap back on, some drinks very quickly stop being fizzy altogether. So, are all fizzy drinks as fizzy as each other?

- Which drinks could you try out?
- How will you know how fizzy a drink is? Is there something you can measure?
- When does a drink stop being fizzy?

Parents

Factors: type of fizzy drink (and even brand); containers
What you need: drinks; containers (bottles, tumblers, etc); timer.
Safety: care to avoid shaking drinks up beforehand and spraying the drink everywhere.

Key words for further research

Gas solubility, partial pressure, carbon dioxide

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Investigation 5

Kitchen orchestra

Children

An orchestra is a collection of many musical instruments, grouped together by how they work e.g. wind instruments that you blow, stringed instruments that you pluck or strum and percussion instruments that you hit. Perhaps you can think of some items in your kitchen that might make good instruments and would work in the same way.

- What instruments could you make for your orchestra?
- e.g. different water levels in glass containers; pan pipes made from straws
- How will you tune them up so they can make music together?

Parents

Factors: length/height of whichever part is producing the sound (water, straw, string, air space); strength of blow, what is hit, and what is doing the hitting.
What you need: bottles, cans, straws, spoons, pencils, scissors.
Safety: care with glassware and scissors.

Key words for further research

Sound waves, vibration, resonance

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Investigation 6

Watching Paint Dry

Children

Have you ever noticed how long you have to avoid a freshly-painted surface? Unless you want to get paint all over your clothes and annoy your parents! But do all paints take the same length of time to dry?
What paints could you investigate?
How will you test them?
Where will you test them?

Parents

Factors: surface that is painted; type of paint; thickness of layers; temperature of wherever the paint is left to dry.
What you need: paints; brushes; paper/card to paint; timer.
Safety: fumes from certain types of paint in enclosed spaces. Avoid non-washable paints on hands and clothes!

Key words for further research

Solvent, solute, solution, evaporation

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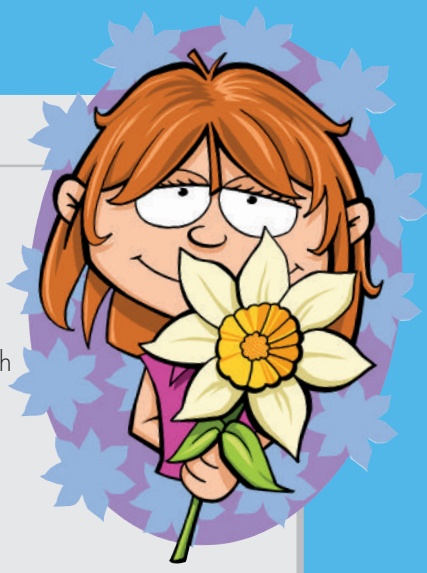
Investigation 7

Flower power



Children

Have you ever noticed that cut flowers need to be kept in water to stay alive? And have you ever wondered why the water is needed and where the water goes? Here's a way of finding out.

Add a few drops of food colouring to some water. Put a cut flower into this water and watch what happens to the flower. This works best with a white flower. You could even ask an adult to cut along the stem so that half could go into one colour and half into another.

- Does it make a difference how much colour you put in the water?
- What part of the flower become coloured?
- Is it different with different flowers?

Parents

Variables: type of flower; amount of food colouring used; number of divisions the stem can be cut lengthways into (perhaps up to four). Try other plants such as celery.
What you need: cut flowers; food colouring; containers for the flowers.
Safety: care not to spill the food colouring; cutting along the flower stem.

Key words for further research

Capillary action, xylem tubes, phloem tubes

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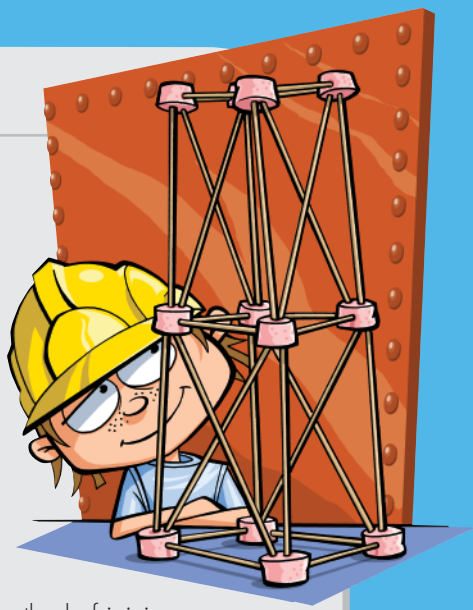
Investigation 8

Tallest tower



Children

Modern cities are being built ever higher with more and more towers appearing on the skyline. But engineers have to think very carefully about how they build these towers so that they can support all their weight and remain standing in severe weather conditions. Using spaghetti (uncooked of course!) and marshmallows but nothing else, what's the tallest tower that can be built? It needs to be freestanding and stable.

- Do the designs of any existing towers give you ideas for building yours?
- Does it matter what shapes you make out of the spaghetti and marshmallows as part of the whole structure?
- What's the minimum number of items you need to get a stable tall tower?

Parents

Factors: number and size/length of marshmallows and spaghetti; method of joining them together; shapes used in overall structure.
What you need: spaghetti; marshmallows (you might like to set an upper limit on each of these).
Safety: the marshmallows can be eaten afterwards (if not too dirty by then!).

Key words for further research

Compressive strength, tensile strength

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Investigation 9

Acid Test

Children

There are over ten million known chemical substances so scientists find it very useful to be able to sort them into groups. One way of classifying them is whether a substance is acid, alkali or neutral. To do this we can use an indicator – a coloured substance that changes colour according to the substance it meets. You can make an indicator very easily by using a weak solution of red cabbage juice or beetroot juice. Just squash up a bit of shredded red cabbage or a slice of cooked beetroot.

By putting a few drops of your indicator into a small sample of something you know is acid (e.g. vinegar), you will see which colour your indicator becomes when it is combined with an acid. Then try something you know is an alkali (e.g. bicarbonate of soda) to find out that colour. Use tap water for 'neutral'.

- What substances around your home are acids or alkalis or neutral? Check each substance with an adult before you handle it.
- How easy is it to carry out these tests fairly?
- Does anything prevent you testing a substance?

Parents

Factors: strength of solutions made; solubility of test substance; colour of test substance.
What you need: clean containers; red cabbage and/or beetroot; variety of substances to test (best if small samples are used).
Safety: Do not eat any test item. Don't allow children to test unsupervised anything which is not a foodstuff.

Key words for further research

Capillary action, xylem tubes, phloem tubes

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Investigation 10

Colour Writing

Children

Can you imagine what the world around us would look like if there was no colour? If everything was in black and white? Wouldn't it be boring? Did you know that most colours we see are actually made from mixing other colours together. Chromatography (which is Greek for 'colour writing') is a method of finding out how pure a colour actually is, or how many other colours it is made up of.

Put a concentrated spot of a colour (try something like a washable black felt tip pen to start with) onto a piece of coarse paper and carefully add a drop of water to it from above. Let the water soak through the paper and then add another drop of water. Once that has soaked in, add another. Continue doing this until the water has spread out almost to the edge of the paper. You will now be able to see if the original colour is made up from different colours.

- Does it matter what type of paper you use?
- Does it matter if the water is added more quickly?
- Can all coloured materials be analysed like this?

Parents

Factors: paper type; felt pens (if used) are not always water-soluble and so will not work.
What you need: variety of colours (felt pens, fibre pens), extracts from petals, fruit and vegetables; different types of coarse paper (e.g. filter paper, coffee filters, paper towel); water; method of adding drops of water (e.g. pipette).
Safety: not to eat any test item; care with dropping water

Key words for further research

Pigment, dye, chromatography, adsorption, absorption

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Worksheet Recording Template

What question am I asking?

What do I need?

What will I do?

What will I change?

How will I do this safely?

What happened?

What variable factors(s) made a difference?

What could I change to improve the investigation if I were to do it again?

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Activate

Link your Activate investigations to the BA (British Association for the Advancement of Science) CREST ★ Investigators Award scheme

What is CREST ★ Investigators ?

CREST ★ Investigators is a new award scheme from the BA which is available from September 2007 and replaces First and Young Investigators. This award scheme is aimed at teachers, club leaders and families looking for exciting, practical science activities requiring minimal preparation time. Children can work on a wide range of science topics. When they have carried out the investigations, children can be entered for the **CREST ★ Investigators** national awards and receive a certificate and enamel badge to recognise their achievement.

By completing the Activate investigations each child in your family will gain credit to the equivalent of 4 themes of the BA **CREST ★ Investigators** award scheme.

They only need to complete another 2 themes from the BA **CREST ★ Investigators** award scheme pack to be eligible for a Super Star award!

For further information on **CREST ★ Investigators** award scheme and how to apply please contact:
Jessica Paton at jessica.paton@the-ba.net or visit www.the-ba.net/resourcesforlearning