



Science and Engineering Experiments for Kids

UNIVERSITY OF CAMBRIDGE
DEPARTMENT OF MATERIALS SCIENCE AND
METALLURGY
New Museums Site
Pembroke Street
Cambridge CB2 3QZ
England



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SeeK Workshop at Cambridgeshire Network of Out of School Clubs Play Away Day 2005

We hope you have enjoyed our *SeeK* workshop today and welcome any feedback, including ideas for different activities. We will try to include any suggestions on our website in the future, so do not hesitate to contact us using the details above.

In this pack you will find:

- information on the activities discussed, in case you do not have easy access to an internet connection;
- suggestions of where to source material;
- an estimate of cost for the activities;
- safety issues and general tips.

Please don't forget there are plenty of other ideas on our website which you might incorporate into your activity programme. We are always happy to answer any questions about how to do things or how things work, or even to give help if you are having difficulty trying to source materials.

Lastly, we are always happy to come to visit your Out of School Club to help with science activities as workshops for children are what we do best! We usually get heavily booked up during term-time but are often able to accommodate people in the school holidays.

A handwritten signature in black ink that reads 'Lianne'.

Lianne Sallows

A handwritten signature in black ink that reads 'Rob'.

Rob Wallach

P.S. We will put this booklet onto our website so that your colleagues may download a copy.



Where do I find the materials and equipment you have used today?

To get you started there is a list of scientific/education suppliers on the *links* page of our website www.seekscience.org.

Most of our materials are bought from shops in and around Cambridge but you should be able to source the materials in equivalent places near you. You may also be able to order some items from the larger suppliers through your local school or in conjunction with other clubs, if you have links with them. This way, you may be able to add your items to a larger order to save money on the postage.

If you find other good cheap suppliers please let us know so we can share this information with other clubs. Also don't forget, we might be able to help you source these items if you have difficulty.

Full details of the suppliers mentioned below are found at the end. Consumable materials include the sellotape/masking tape/glue/kitchen foil/ paper clips/ elastic bands etc. Some re-usable equipment or easy to source items are not included e.g. felt-tip pens, scissors, batteries etc.

Egg Towers - Approx 40p(standard) or 60p(jumbo) per tower for the consumable materials

- Paper Artstraws – Standard size (1800 straws, 4 mm diam) or Jumbo size (900 straws, 6 mm diam). Both approx £11.00 excluding VAT and postage (makes 90 towers with standard and 45 towers with jumbo) – Philip Harris Education. Can also get from art shops etc but Heffers Art Shop can no longer get them.
- Eggs – Approx £0.99 for 15 eggs - go for the value brands in the supermarket!
- Newspaper – get people to save this for you.

Egg Parachutes - Approx 25p (standard straws) per parachute for the consumable materials

- As for Egg Towers – get approx 360 parachutes from 1 box of standard straws.

Fun House – Approx £1 for the consumable materials and £3-8 for the outlay on reusable equipment per small group of children

- 2x AA Battery holder – approx £0.40 each from Maplins.
- 5 – 6 crocodile clip wires – approx £5 for 10 from Maplins, or approx £1.60 for 10 from Philip Harris Education (plus VAT and delivery)
- 2.5 V 3 Amp bulb and holder - approx £0.60 for each item from Maplins, or £3 for 10 of each item from Philip Harris Education (plus VAT and delivery)
- 3 V buzzer – approx £1.50 each from Maplins, or approx £0.80 each from Philip Harris Education (plus VAT and delivery)
- Wooden lolly sticks / tongue depressors – approx £2 for 100 – Philip Harris Education (plus VAT and delivery) or could try Heffers Art Shop.

- Paper straws – see Egg Towers or make rolls of paper using A4 sheets of paper.
- Salt crystals – need actual granules for grinders or crystal salt, such as Maldon Sea salt
- Plastic tanks/bowls could be bought from a pet shop for approx £2-3 each.
- 30 x 30 cm of mount board – sheet of A1 card approx £2.95 (can get about 9 –12 pieces out of this) – Heffers Art Shop.

Materials Detectives – Approx 20p for the consumable materials and £9-15 for the outlay on reusable equipment per small group of children

- Samples of different materials – packs can be bought from specialists like Griffin and George Education for approx £20 for a selection of similarly sized metals/woods/plastics (there is a Materials Set for Magnetism & Electricity) or you may be able to think of more creative ways of sourcing these items.
- Electric circuit equipment – see Fun House.
- Magnet – can source these from Philip Harris Education and or places like H. Gee’s for about £2 each.
- Plastic beakers – these could be bought from Philip Harris Education or similar or you could use a sturdy plastic drinks cup
- Items for the crime solving section: Bicycle lights – 2 pack of standard lights approx £5-8 from any bike shop, hand-held fans – approx £1 each – from Woolworths or similar, floppy disk – approx £5 for a pack of 10 new ones from PC World or similar or ask people to save old floppy disks for you – most people don’t use them anymore so may have a number of redundant ones.

Kosmic Kaleidoscopes – Approx 20p per kaleidoscope for the consumable materials

- Cardboard tubes – use kitchen rolls cut in two – ask parents to collect.
- Tracing paper - high quality is best, e.g. Goldline Tracing paper, 63 gsm. Approx £6 per pad of 50 sheets A4 (makes ~300 squares) - Heffers Art Shop
- Mirrored card – Silver Mirri card. Approx £2.50 per A2 sheet (makes ~28 sets of 3 strips) – Heffers Art Shop.
- Black paper – can use what you like, e.g. black sugar paper. Approx £2.95 per roll of 50cm x 10 mtr 100 gsm (makes ~500 squares) - Heffers Art Shop.
- Plastic mirrors – cost depends on size you get - buy from an education/scientific supplier e.g. Philip Harris Education.

Café Wall Illusion – Approx 5p per sheet for the consumable materials

- Glue and photocopying/printing are the only real costs for this activity.

Addresses

<p>H. Gee 94a Mill Road Cambridge CB1 2BS</p>	<p>Phone: 01223 358019 (In row of shops just before bridge on right-hand side as you go away from town)</p>
<p>Heffers Art and Graphics Shop 15-23 King Street Cambridge CB1 1LH</p>	<p>Phone: 01223 568495</p>

<p>Maplins 46-48 St. Andrews Street Cambridge CB2 3AH</p> <p>OR</p> <p>Maplins Beehive Centre Coldhams Lane Cambridge CB1 3ET</p>	<p>Phone: 01223 369758</p> <p>Phone: 01223 368632</p> <p>Web address: http://www.maplin.co.uk/</p>
<p>Philip Harris Education Findel House Excelsior Road Ashby Park Ashby de la Zouch Leicestershire LE65 1NG</p>	<p>Phone: 0845 120 4520 Fax: 01530 419 492 E mail: sales@philipharris.co.uk Web address: http://www.philipharris.co.uk/</p> <p>Postage fee applicable for minimum price order – please check for current rates.</p>
<p>Griffin and George Education Bishops Meadow Road Loughborough Leicestershire LE11 5RG</p>	<p>Phone: 01509 233344 Fax: 01509 231893 E mail: griffin@fisher.co.uk Web address: http://www.griffinandgeorge.co.uk/</p> <p>Postage and VAT may be applicable to prices – please check current policy.</p>



Safety Issues and General Tips!

If you are having trouble doing any of the activities, please let us know and we may be able to help you resolve problems.

As with all arts and crafts activities these creative science activities have safety issues with the use of scissors and risk of cuts and minor injuries. Do not forget that the children need supervising at all times when using such equipment.

Egg Towers

- Try to prevent the children from cutting the straws before they have decided what they are going to make. The children have a habit of just cutting away without thinking.
- Try to not squash the straws too much or else what is built will be really weak.

Egg Parachutes

- Try to not cut the straws before deciding what is going to be made. The children have a habit of just cutting away without thinking.

Fun House

- Each gadget consists essentially of the same electric circuit but with a slightly different switch. E.g. two bits of kitchen foil that touch together when some other part of the circuit moves.
- It is a good idea to test all the equipment (wires, batteries, buzzers etc) to ensure are all are working. Do this by making a simple circuit and eliminating each component in turn until it works – if it still doesn't work it's the batteries!
- Ensure all equipment is disconnected after use including removing the batteries from the holder in case a short circuit is caused – the batteries can heat up quite a lot.
- Also ensure the batteries are removed from the holder since if the wires on the battery holder (with batteries in place) touch for a prolonged time, such as when being stored, contact point of the wires can get quite hot – we have melted a hole in a plastic tray before!

Materials Detectives

- Risk of scalding from the very hot water used in the heat conductivity test. Supervise children at all times to reduce the risk of injury. An adult should heat the water in a kettle and pour it into the beaker. The beaker should not be placed near the edge of the work surface use.
- Risk of cuts from possible sharp edges on the samples of different materials. The edges of the samples can be checked and filed down if necessary. It is quite likely that there will be very few sharp edges if you buy a set of samples from one of the educational suppliers.

- As for the Fun House, ensure all equipment is disconnected after use including removing the batteries from the holder in case a short circuit is caused – the batteries can heat up quite a lot.
- Also ensure the batteries are removed from the holder since if the wires on the battery holder (with batteries in place) touch for a prolonged time, such as when being stored, contact point of the wires can get quite hot – we have melted a hole in a plastic tray before!
- If large samples are used for the density test, take care that the more heavy samples are kept on the work surface to avoid dropping them on fingers and toes.
- When carrying out the crime element of this activity and taking apart the floppy disk ensure that care is taken to reduce the risk of cuts from sharp plastic edges and the edge of the protective metal slider.
- Also, take care when dismantling the bicycle light and hand-held fan as there will be small parts.

Kosmic Kaleidoscopes

- Some people have issues with using toilet roll tubes due to hygiene. We prefer to use kitchen rolls tubes which have less of a stigma attached to them.
- Not all mirrored card gives good results - the silver Mirri card from Heffers Art Shop is the best we've found.
- If you use plastic mirrors as part of the activity the sharp edges can be eliminated by sticking electrical insulating tape along the edges.
- Make sure that the black paper is sellotaped onto the tube. If an elastic band is used there is a risk of it coming off and going into the child's eye whilst they are using the kaleidoscope.

Café Wall Illusion

- General risks of cuts from scissors and paper cuts.
- Best to use Pritt Stick or similar glue as less messy than using PVA to stick the thin strips of paper.
- Younger children may need assistance in sticking the strips in the correct places.
- The illusion is best viewed from a distance.
- Other optical illusions can be found through doing an internet search or perhaps look in your local library for books that you can photocopy from.



SeeK Workshop
at
Cambridgeshire Network of Out of School Clubs
Play Away Day 2005



Activity Details

The following pages give full details for the activities you have tried for yourselves and seen demonstrated today. They are printed directly from our website <http://www.seekscience.org/> .

If you have access to the internet we welcome you to use the site as there are additional illustrations and relevant web links to supplement the activities which can be viewed online.

Egg Towers – theme: Forces

AIM:

To introduce stability, centre of gravity, strong shapes and construction.

CURRICULUM LINK:

KS2: Sc4 Physical Processes, Forces and Motion. 2(b)

TIME:

30 - 35 minutes for 5 - 7 towers built in groups in a class of 30.

(20 minutes to build, and 15 minutes to test and discuss)

MATERIALS REQUIRED:

Per Group:

- 20 paper modelling straws
- 2 rolls of masking tape
- scissors

Per Class:

- enough raw eggs for 1 per group
- lots of newspaper
- tape measure
- black rubbish sack
- tissue for cleaning up messy egg!

METHOD:

- In groups (4-6 children per group is ideal) get the children to build a tower using the straws which can support an egg as high as possible.
- Get them to think about the designs of towers they have seen and about where the centre of gravity of the tower will be.
- Testing: Lay out a big newspaper covered area for the test area.
- The towers should be judged on the height of the egg, not the height of the tower.
- Bring all the groups together and in turn ask them to test their towers.
- Once the egg is in place, count to 10 to see how long the tower stands. You could record the information of a results chart.
- At the end, discuss what makes a good tower design.

THEORY:

- **Stability and centre of gravity.** The centre of gravity (close to the relatively heavy egg) must be over the base to support the egg. This means that wide bases and low centres of gravity are best.
- **Strong shapes.** Triangles are more rigid than squares. The construction of the towers could be compared to real buildings e.g. the Eiffel tower used triangular sections and cross bracing.

- **Static forces.** Although the towers are standing still, there are some forces acting on them. Gravity, action and reaction (Newton's third law) could be discussed. The forces could be shown by placing large arrows on the towers or on diagrams.

Egg Parachutes – theme: More Activities

AIM:

To introduce the concept of air resistance and how we can reduce the impact of force.

CURRICULUM LINK:

KS2: Sc4 Physical Processes, Forces and Motion. 2(b) and (c)

KS3: Sc4 Physical Processes, Forces and Motion. 2(g)

TIME:

25 minutes total for 6-10 parachutes in a class of 30.

(15 minutes to build the parachutes. 10 minutes to test the parachutes.)

MATERIALS REQUIRED:

Per group or child:

- 30 cm sellotape
- 5 paper straws
- scissors
- 1 sheet of newspaper
- 1 raw egg

Per Class:

- metre rule (or other means of measure 1 m)
- lots of newspaper for testing area
- black rubbish sack
- tissue for cleaning up messy egg!

METHODS:

- Get the children to think about parachutes and how they protect the parachutist when they are landing on the ground.
- Discuss how fragile things are protected during transportation. e.g. wrapping parcels in bubble wrap and packing-chips, etc.
- Get each group or child to use the materials to build a carrier to protect the egg so that it can be dropped from a height of 1 metre without breaking.
- Lay out a test area by covering the floor with newspaper and test the carriers in turn.
- Discuss the different designs and how successful they were.

THEORY:

- The parachute provides air resistance and so the parachutist does not fall through the air as fast as he/she would without a parachute.
- The parachutist can control the speed at which they fall so that they can land safely on the ground.

- Packing-chips, bubble wrap, etc, protect fragile items by spreading any forces applied throughout the packaging.
- The full force is no longer on the fragile item and so there is less chance that it will break. The air gaps in between the packaging cushion the item from the force.
- Most cars have crumple zones which are designed to crush or crumple when they are hit. This means the force of a crash is spread throughout that area so that the force applied on the people inside the car is less, protecting them from serious injuries.

Fun House - theme: Electricity & Magnetism

AIM:

To introduce the concepts of series and parallel circuits and some of their uses.

CURRICULUM LINK:

KS2: Sc4 Physical Processes, Electricity. 1(a) and (b)

TIME:

30-35 minutes for a class of 30

(20-25 minutes to make circuits, 10 minutes to show them to the rest of the class)

MATERIALS REQUIRED:

For all Circuits (per group):

- 2 x 1.5 V AA-cell batteries + holder with wires
- Crocodile clips and wires
- Kitchen foil (approx. 30 cm x 30 cm)
- Roll of sticky tape
- Cardboard (approx. 30 cm x 30 cm. similar to mounting board or a bit thinner)
- Paper clips (dozen)
- Scissors (couple of pairs)

For Specific Circuits (per group):

Burglar Alarm

- 1 cardboard doormat prop
- 1 x 3 V buzzer
- paper straws (25 or so)

Rain Detector

- 1 x 3 V buzzer
- salt crystals
- plastic dish (approx 10 cm x 10 cm x upto 5 cm deep)
- elastic bands (various)
- wooden lolly-pop sticks

Fridge Light

- 1 cardboard fridge prop
- 1 x 2.5 V 3 A bulb + holder

Burglar Alarm for Picture

- 1 cardboard framed painting prop
- 1 x 3 V buzzer
- elastic bands
- lolly pop sticks

Burglar Alarm for Precious Trophy

- 1 plastic trophy prop (could be plastic wine-glass sprayed silver)
- 1 x 3 V buzzer
- 1 x 30 cm ruler
- a lump of plasticine

Water level Detector

- 1 plastic tank/beaker (approx. 15 cm x 15 cm x 20 cm deep)
- 1 x 3 V buzzer
- Polystyrene packing foam (approx. 7cm x 7 cm x 7 cm; to fit on beaker)

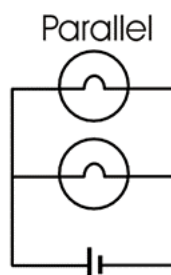
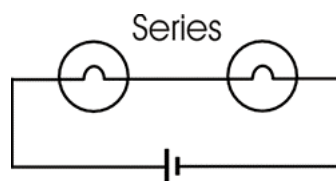
METHOD:

Building circuits:

- Divide class into 6 groups
- Assign each group a circuit to build (e.g. fridge light, burglar alarm etc.)
- Ask them to build the circuit with the equipment provided
- Get each group to explain to the rest of the class how they have constructed their circuit.

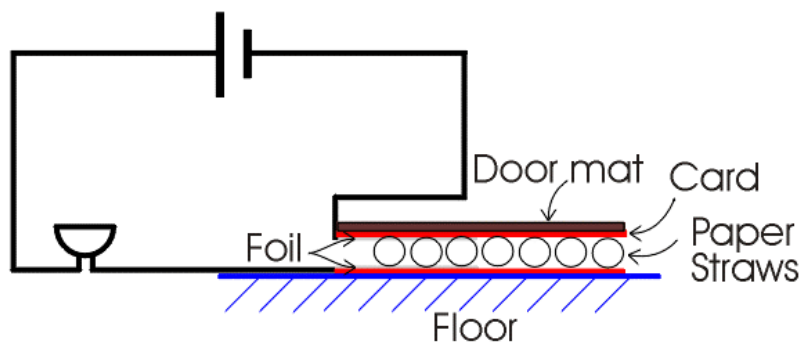
THEORY:

- **SERIES** circuits - when the light bulbs are in series there is only one path for the current.
- The wires in the light bulb act like a resistor and so the current is reduced twice so the bulb is not very bright.
- Also, if the wire in one bulb breaks, the circuit is incomplete and so the current can not flow so the other bulb will not light up.
- If the battery in the circuit is increased, then the amount of current is larger to start with and so will not be reduced as much. Therefore, the bulbs will shine brighter.
- **PARALLEL** circuits - when the light bulbs are in parallel there are two paths for the current.
- On one bulb is in each path and so the current is not reduced as much as in the series circuit. The bulbs are brighter.
- If the wire in one of the bulbs breaks then there is still another path creating a complete circuit, so the other bulb remains on.
- Most of the circuits built will be very similar. The difference is in the kind of switch built. Some ideas of how to construct the gadgets are found at the end of these instructions.

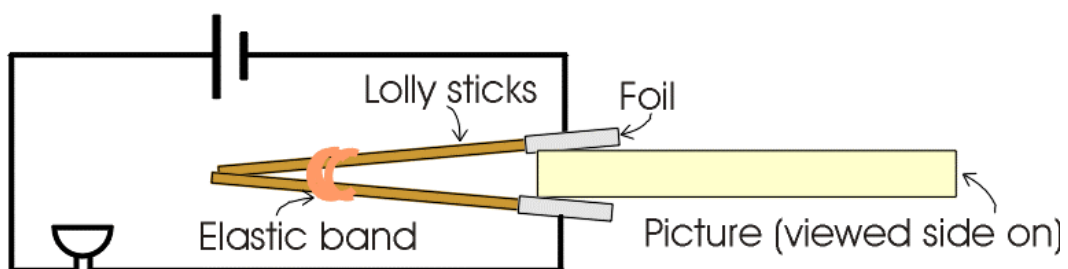


Ideas for Circuit Construction

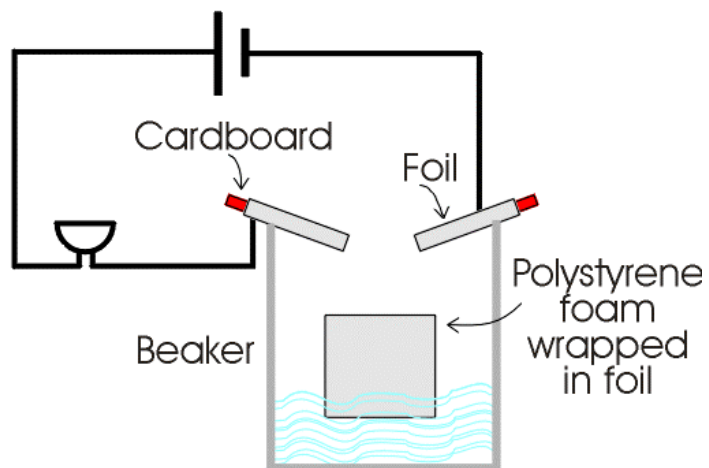
Burglar Alarm



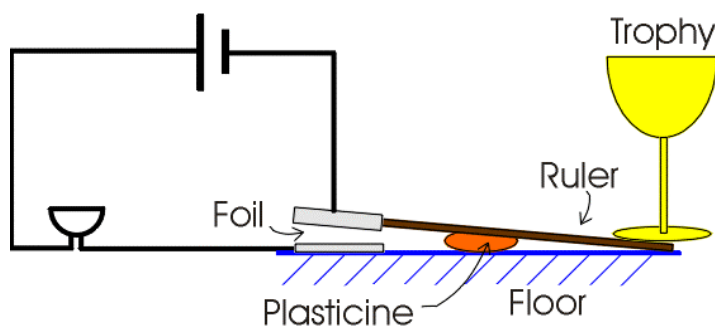
Picture Alarm

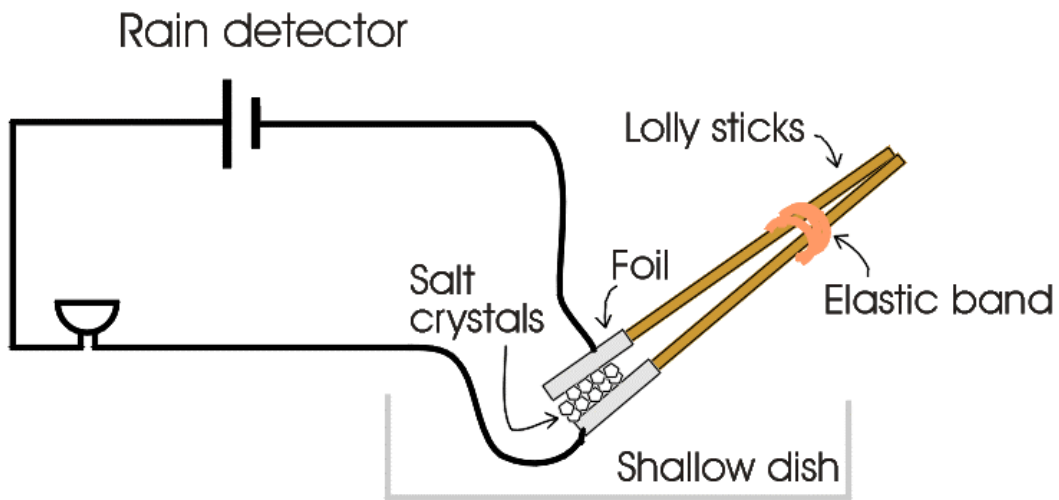


Water level detector

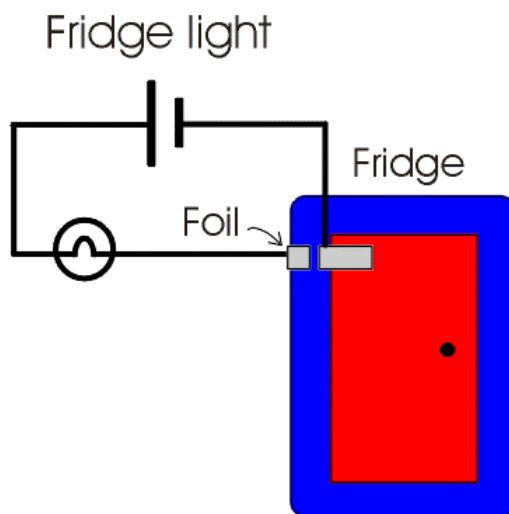
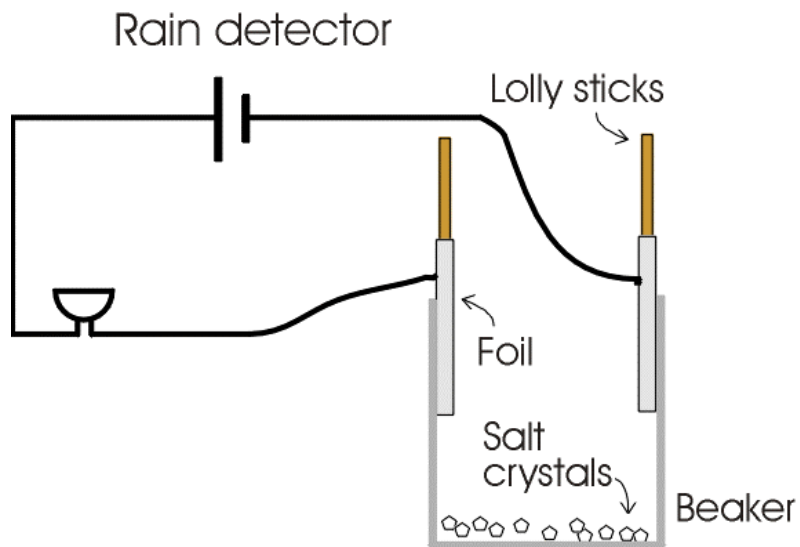


Trophy alarm





OR



Materials Detectives – theme: Materials

AIM:

To investigate the properties of different materials

CURRICULUM LINK:

KS2: Sc3 Materials and their Properties, Grouping and Classifying Materials. 1(a) - (c)

KS1: Sc3 Materials and their Properties, Grouping Materials. 1(c) and (d)

TIME:

40 minutes. 30-35 minutes to investigate materials, 5-10 minutes to solve crime. Start each group on a different property and rotate at intervals.

MATERIALS REQUIRED:

Per group:

- Results table (see end of instructions)
- Security Department Fax (see end of instructions)
- Testing kit (2 x AA batteries, battery holder with wires, a 3 V buzzer or bulb in a holder, crocodile clips/wires, magnet)
- Samples pack - all equally sized (e.g. 5 mm x 5 mm x 120 mm) (wood, polythene, perspex, brass, copper, steel, aluminium)
- Bicycle light
- Old floppy disc
- Small battery operated hand-held fan

Per class:

- Heat conductivity test station: plastic beaker half-filled with hot water, butter, tissue
- Density/mass test station: wooden seesaw, large samples of the materials listed above (e.g. 100 mm x 150 mm x 20 mm)

METHOD:

- In their groups, allow the children to investigate the properties of materials provided in order to complete the results table (details of the tests below)
- When finished give each group a copy of the fax from the Security Department.
- Allow the children to investigate what materials each of the items are made of by taking them apart and ask each group to deduce who the main suspect is

Hardness:

1. Systematically scratch one sample with another to deduce an order for the hardest material through to the softest material.

Density:

2. Using the larger samples and the see-saw deduce the order in which the materials increase in weight.

Heat Conductivity:

3. Add a small knob of butter to the end of each of the samples. Each child in the group should hold 1-2 of the samples. Have the beaker of hot water at the ready and then stand all the samples in the beaker, butter up, at the same time. Watch to see which of the materials conducts the heat the quickest and melts the butter first.

Electrical Conductivity:

4. Construct a simple circuit to test the components. Following on from this test each of the samples to see if they conduct electricity.

Magnetism:

5. Test each material for its magnetic properties by placing the magnet near each sample.

THEORY:

- Hardness: Metals are harder due to their structure. The atoms are very close together in a tightly packed arrangement. The forces between the atoms are strong so that the atoms can stay close together. This makes the metals hard materials. The different strength forces keep the atoms together and so some metals are harder than others. Plastics and wood are softer as the forces between these atoms are weak and so it is easy to scratch these.
- Density: The close packing of atoms in metals mean that there are more atoms in the same volume when compared to the plastics and wood. Different types of atoms are different sizes and masses and so the density (the mass per volume) will vary between different metals.
- Heat Conductivity: Metals conduct heat well due to their structure too. The heat from the water makes the atoms vibrate more in the end of the sample dipped in the water. The atoms bang into their close neighbours and some energy is transferred making the neighbours vibrate more and so this carries on along the sample. The metals do not all conduct heat the same as the atoms are different in each metal and their arrangement varies very slightly. The plastics and wood do not conduct very well at all as their atoms are further apart, so the energy can not be transferred between them.
- Electrical Conductivity: In order for electricity to be conducted through materials there must be electrons available to carry the charge. In metals there are many electrons available for this purpose, unlike plastics and wood. Some metals have more electrons than others and so are able to conduct more electricity than other.
- Magnetism: In the case of this experiment, only steel is attracted to a magnet. This is because steel is comes from processed iron. Iron is a well known naturally occurring metal that is attracted to a magnet. Magnetism is related to special properties of the atoms known as the electronic structure.

- Materials Detectives results sheets (see end of instructions). There will be some variation in the ranking of the metals for the hardest material and the best conductor of heat. The polythene, perspex and wood conduct heat poorly and any melting of the butter is probably due to any steam rising from the hot water.
- The exercise enables the children to choose fair tests to distinguish between the different properties of the materials investigated improving their scientific thought processes.

	Hardness	Density	Heat	Electricity		Magnetism	
	Which material is the hardest?	Which material is the heaviest?	Which material conducts heat the best?	Does the material conduct electricity?		Is the material attracted to a magnet?	
				Yes	No	Yes	No
1							
2							
3							
4							
5							
6							
7							

	Hardness	Density	Heat	Electricity		Magnetism	
	Which material is the hardest?	Which material is the heaviest?	Which material conducts heat the best?	Does the material conduct electricity?		Is the material attracted to a magnet?	
				Yes	No	Yes	No
1	Steel	Brass	Brass	Brass		Steel	
2	Brass	Steel	Aluminium	Steel			Copper
3	Aluminium	Copper	Copper	Copper			Aluminium
4	Copper	Aluminium	Steel	Aluminium			Brass
5	Perspex	Polythene	Polythene		Perspex		Perspex
6	Polythene	Perspex	Perspex		Polythene		Polythene
7	Wood	Wood	Wood		Wood		Wood

**Security Department
Heathrow Airport
London**



Dear Detective,

Yesterday a serious crime was committed at Heathrow airport. We have arrested 3 suspects. Each suspect was carrying a different item when they were arrested.

Suspect:

Person A
Person B
Person C

Item:

Floppy disc
Bicycle light
Electric fan

Each person's bag was put through the metal detector **but** this information has been lost.

To help us solve our crime please investigate which metals are inside each item of evidence.

***** NEWS FLASH *****

It is now known that the crime was committed by someone carrying some brass.

Who committed the crime?

Yours faithfully

Mr S.E. Curity

**Security Department
Heathrow Airport
London**



The crime was committed by someone carrying some brass.

Suspect :	Item:	Metals:
Person A	Floppy disc	Steel
Person B	Bicycle light	Brass & copper
Person C	Electric fan	Steel

Main Suspect: Person B

Kosmic Kaleidoscopes – theme: Light

AIM:

To introduce the concept that light can be reflected from surfaces. For example, mirrors.

CURRICULUM LINK:

KS2: Sc4 Physical Processes, Light and Sound. 3(c)

TIME:

35 minutes total. 5-10 minutes for mirrors, 25 minutes kaleidoscopes

MATERIALS REQUIRED:

Per group:

- 3 large sturdy plastic mirrors (A4 size or larger for full benefit)
- Masking tape
- A few 2p coins
- Sellotape
- Scissors
- Elastic bands
- Colouring pens

Per child:

- 1 cardboard tube (toilet roll or half a kitchen roll tube) per child
- 3 strips of silver mirror card to fit inside the tube per child (strip size approx. 3.5 x 11 cm)
- 1 square of tracing paper to fit over end of tube per child (approx. 10 x 10 cm)
- 1 square of black paper to fit over end of tube per child (approx. 10 x 10 cm)

METHODS:

- Get the children to investigate the number of reflections they can see with 1, 2 and then 3 mirrors in different arrangements - use the masking tape to hold them together.
- You can use the coins so they can count the amount of money they can see in the reflections.
- Use the 3 mirrors to make the internal part of a kaleidoscope - let them play with this for a short while to investigate the way in which the images are reflected.
- Each child can then make their own kaleidoscope to keep.

To Make the Kaleidoscope:

1. To make the kaleidoscopes, cut the strips of mirrored card to the length of the cardboard tube and stick them together with the sellotape to make the same arrangement as the 3 mirrors used beforehand. Fix this in place inside the tube.
2. Cut a piece of black paper big enough to stick over one end of the tube. Snip a small hole in the centre and stick in place.
3. Cut the tracing paper big enough so that it can be fixed in place over the other end of the tube with an elastic band. Use the coloured pens to draw patterns before fixing in place.

4. Hold the completed kaleidoscope up to a window and look through the hole. Carefully turn the tracing paper end and watch the changing patterns.

THEORY:

- If more than one mirror is used you will see reflections of reflections, perhaps continuing on forever into the distance.
- In the kaleidoscope you can see reflections of reflections of the patterns on the tracing paper as the light illuminates the image

Cafe Wall Illusion – theme: More Activities

AIM:

To introduce the ideas about how the brain can make assumptions about what is seen and give you false information about what you see.

CURRICULUM LINK:

No direct link

TIME:

20 minutes

MATERIALS REQUIRED:

Per child:

- glue
- 1 worksheet (see end of instructions)
- scissors
- coloured pens (must include black)

METHODS:

- Get the children to look at a number of different optical illusions before doing this task.
- Colour in every other column of blocks in the grid with the pens provided.
- Cut the grid into strips so that the blocks alternate *coloured plain coloured plain.....etc.*
- Glue the strips carefully onto to the assembly grid.
- Place the ‘cafe wall’ 1 metre away. Do the lines of blocks look straight and/or parallel?
- Does changing the colour of the blocks change the effect seen?

THEORY:

- It all seems so effortless: we open our eyes or ears and let information from the world enter our brains. Yet anything we see, hear, feel, smell, or taste requires billions of nerve cells to send urgent messages to our brains.
- You can think of the sensory systems as little scientists that generate ideas about the world. Where did that sound come from? What color is this, really?
- The brain makes an educated guess, based on the information at hand and on some simple assumptions stored in your memory. Sometimes the brain also creates shapes from incomplete data.
- The cafe wall illusion works best when you use black and white rectangles. It happens because the black and white rectangles are not directly above one another.

- You can clearly see the horizontal grey space between the black and the black. However, the horizontal grey between the white and the black rectangles is not so clear.
- Your visual system decides this space is not real, so shrinks it. This has the effect of producing lots of wedge shapes, which your brain puts together and decides you are looking at non-parallel wavy lines.
- If you use colours which have low contrast, e.g. yellow and white, the illusion effect is smaller or can not be seen.

Café Wall Illusion

Tile Grid

Colour these columns * (every other one)

*		*		*		*		*	

Assembly Grid

Notes