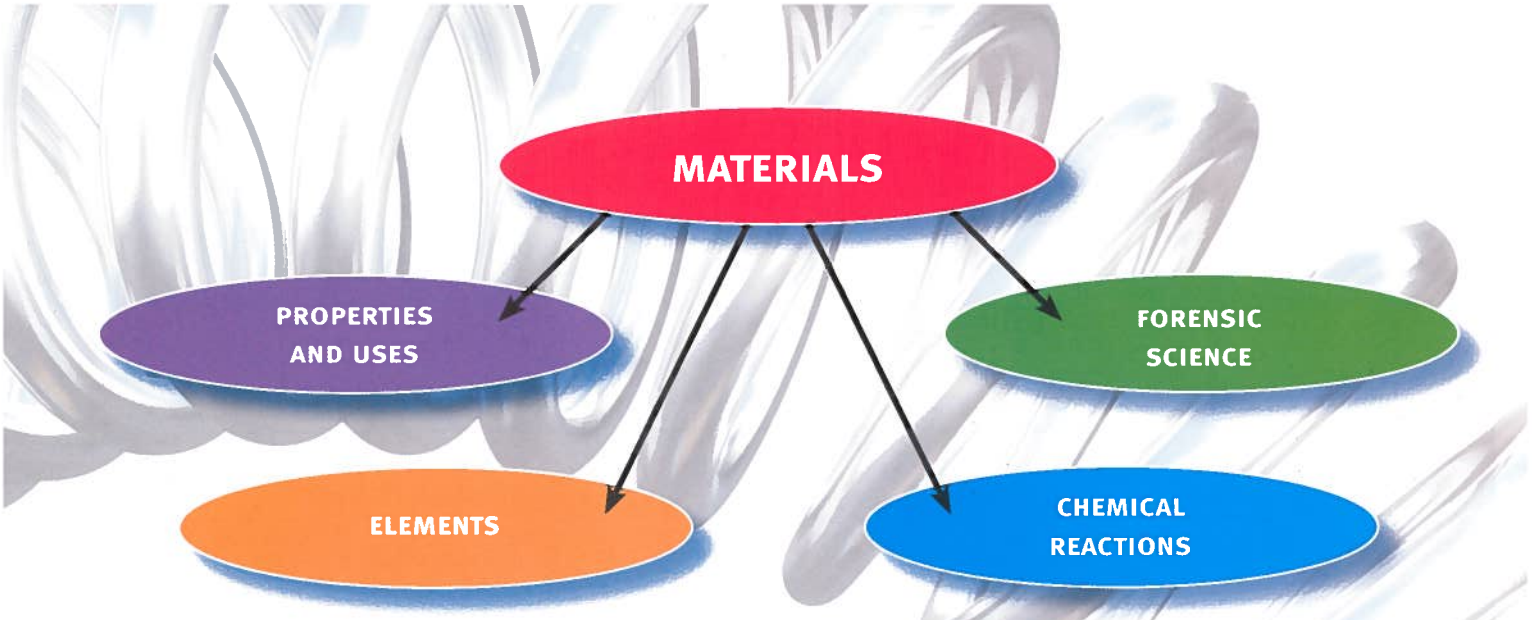
Primary Science & Technology Bulletin

Ideas and Inspiration for teachers in Primary Schools & S1 / S2

Materials

Bulletin Number 43

ISSN 1775-5698



What are Materials?

That's a big question – it is not just the bits of fabric, as children often think. In Science, materials are the basic substances that make up everything. They can be natural or man-made. There are now around 300,000 different known materials (if you named one every second, it would take you more than three days to get through the list!).

Walk and Talk

After observing and talking about the materials they have seen, both inside and outside the classroom, focus on why objects are made of a particular material. Why railings are made of metal and not plastic? Why is the matting under the climbing frame made of rubber? Why is the skate park made of concrete and why is its surface made of metal?

Properties and Uses **Early**

Through creative play I have experienced a range of different materials. I can show that different materials are useful for different purposes, giving reasons for my ideas.

SCN 013X

Explore materials and rank them according to their flexibility:

for Interactive Whiteboard Version: www.ise5-14.org.uk/PRIM3/Head2.htm

Flexible Friends

Can you decide how bendy/flexible these objects are?

Arrange them in the order you think from most flexible to least flexible

VERY FLEXIBLE → **NOT VERY FLEXIBLE**

Newspaper, Soft Toy, Pencil, Carrot, Toothbrush, Ruler, Crayons, Scissors

Something to think about...

How shall we find out how flexible things are? Would flexible scissors be a good idea? What about crayons?

Properties and Uses **First**

I have explored the properties of different materials and can use my experience to choose appropriate materials to solve a practical challenge.

SCN 115X

Sorting materials can generate discussion and be a useful assessment tool:

for Interactive Whiteboard Version: www.ise5-14.org.uk/PRIM3/Head2.htm

Sort these objects into the correct boxes

Waterproof and flexible	Waterproof and not flexible	Not waterproof and flexible	Not waterproof and not flexible


Rubber Duck


Bread


Scarf


Sugar Cube


Rain Hat


Screw


Eggs

How could we test to see if they are waterproof? What would we do?

Amazing Materials - Ultraviolet Beads

These UV-sensitive beads contain a pigment that changes colour when exposed to ultraviolet radiation from the sun. These beads are not affected by light from light bulbs because they do not give out ultraviolet light. So the beads will remain white if you shield them from sunlight or keep them indoors. The moment they get any sunlight though they will change colour very quickly. The solar-active pigment keeps the beads from permanently changing colour and speeds up the time it takes for the beads to change back to their original white colour.

Properties and Uses **Third**

By investigation and research, I have explored properties of novel materials and can convey my understanding of the innovative commercial and industrial applications of these materials and their potential benefits to society.

SCN 325X

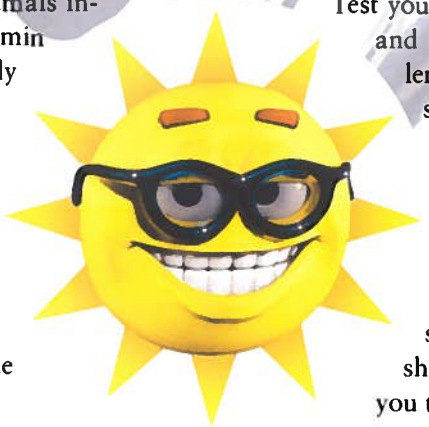
BEFORE SUNLIGHT **AFTER SUNLIGHT**

How can they be used in teaching?

Ultraviolet light is needed by many animals including humans to help them make vitamin D and also so they use calcium properly in the body.

Too much though can damage eyes and skin cells and may even cause skin cancer in some fair skinned people. Sunglasses and suntan creams can help protect the body form the harmful rays.

These beads can be used to show the presence and intensity of UV light.



EXPERIMENT

Test your sunglasses by placing them in the sunlight and covering a few of the UV beads with the lenses. If the beads remain white, then your sunglasses are blocking harmful ultraviolet rays.

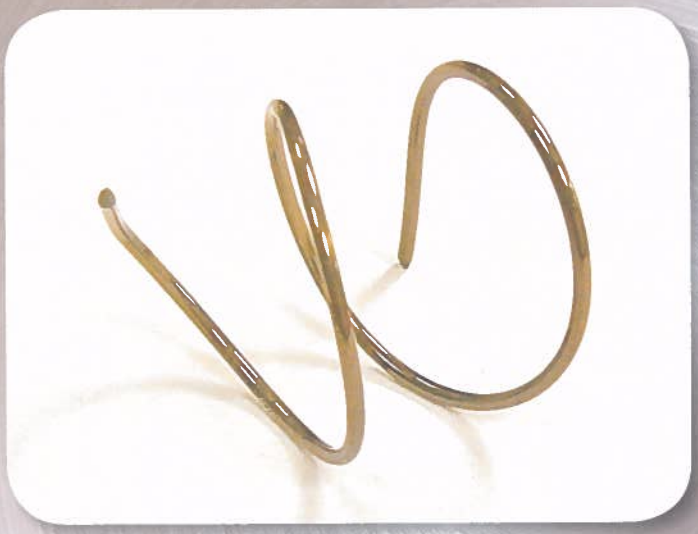
Test the effectiveness of your sunscreen by coating a few of the beads with the cream and placing them in the sunlight. If they change colour what does this mean? The sunscreen manufacturers suggest that you should throw away year old cream. How could you test to see if they are right?

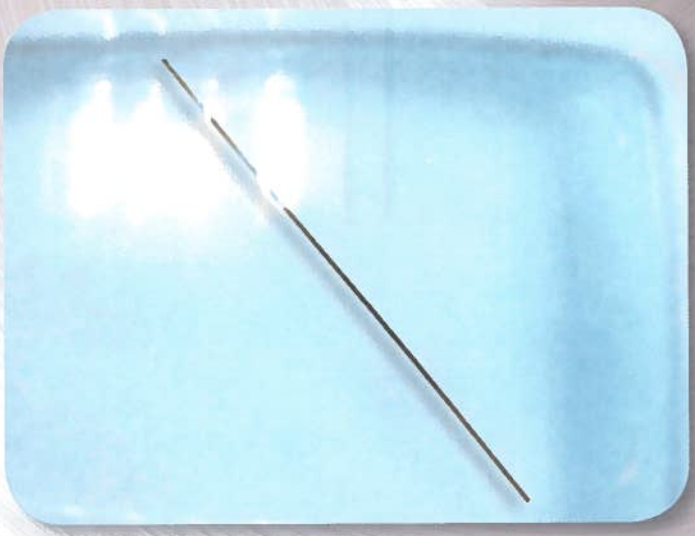
MEMORY METALS

Metals that remember to go back to their original shape.

Nowadays many spectacles are made from an amazing material that can be bent and squashed and still goes back to its original shape. It is called ***memoflex*** and contains the metal titanium.

There is another metal with similar bendy properties which can also return to its original shape however this time it depends on temperature. Shape memory metal is made from an alloy, such as nickel titanium, which can be easily bent out of shape when cold but when heat is applied it will 'remember' to return to its original shape.





EXPERIMENT

Take a piece of straight memory metal and coil it up as in the picture shown.

Wearing safety goggles put about 5 cm^3 of boiling water (it must be above 90° C) in a plastic container.

Carefully drop in the coiled metal; it can sometimes spring out of the beaker, and it will immediately change back into the original straight piece.

How is this helpful?

An Italian design company, Corpo Nove designs clothes incorporating this technology. They have woven shape memory metal fibres into shirts, which mean that just applying hot air with a hairdryer can smooth the creases out. Could this be the end of ironing? Let's hope so!

Shape memory metal can be used in many different ways, from clothing to aircraft. What applications can your class think of?

Forensic Science **Second**

I can use my knowledge on separation techniques to solve problems or challenges in a scientific way.

SCN 234AA

CSI: Primary Forensic Science Activity Challenge

In a crime scene scenario, examples of which can be found online, a written message was left, and when the suspects were searched, each one was found to have a black pen. These pens were all different so this gives us a chance to match up the ink in the pen with the ink left in the message.

Paper chromatography can be used to investigate the inks. Black ink often contains other colours too. We need to try and separate the colours in our inks.

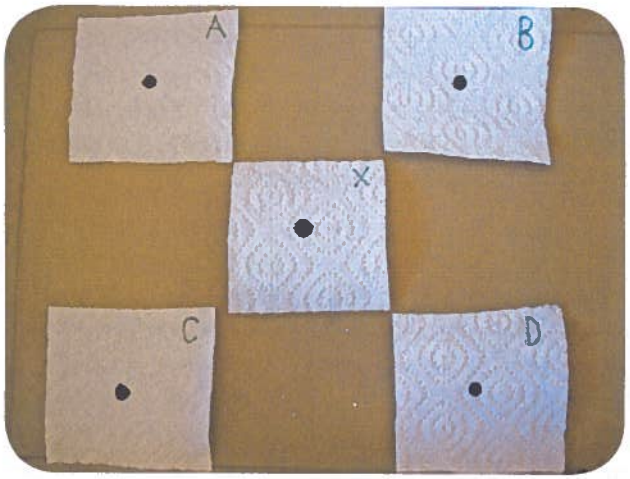
Useful websites for work on Materials:

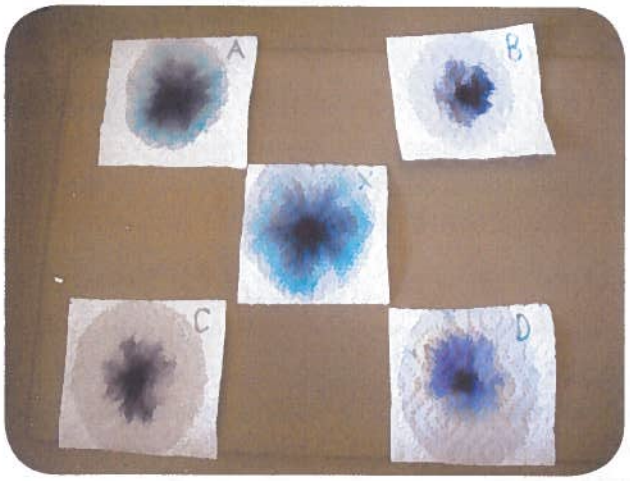
BBC Science Clips
www.bbc.co.uk/schools/scienceclips/index_flash.shtml
http://www.bbc.co.uk/schools/scienceclips/ages/7_8/characteristics_materials.shtml

Channel 4 Science Essentials
www.channel4learning.net/sites/essentials/science/material/index.jsp

EXPERIMENT

- Cut 5 squares from the kitchen roll (about 8 cm square).
- Label each piece of paper in a corner using a biro or permanent marker – A, B, C, D and X.
- Use Pen A to make a dot of ink in the centre of the square of paper labelled A.
- Do the same for samples B, C and D.
- Try to make the dots about the same size.
- Put your papers on a tray and add two drops of water on to each of the ink spots.



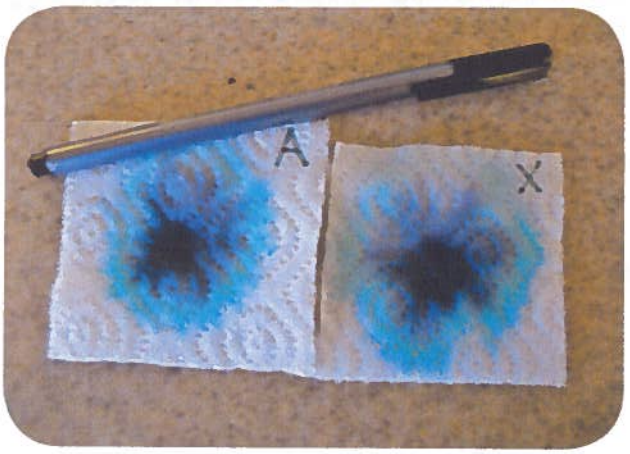


Now we need to investigate the sample from the message.

- Cut a small section of the message (about 3-4 mm). Try to just have black ink without too much white paper round it.
- Take the X-marked square of kitchen roll paper and carefully put the sample with the black ink in the centre, ink facing the paper towel. Put it on the tray and add two drops of water as before.
- The water will move out through the paper and will separate out any colours that might be in the ink.
- Different colours will be carried for different distances through the fibres of the paper.
- Leave these samples to continue moving.

Most felt tip pens have washable ink. This means that the ink will dissolve in water and be carried along with the water moving through the fibres of the paper. However, the coloured inks will each have different chemicals in them and this will affect the rate at which they move. If you are using a pen with ink that is not washable, you will find that the ink dot does not spread out with water. These pens may say "permanent ink" or "non-washable ink". You will notice that they smell different from the washable ones.

- Look at your five sample papers.
- Does sample X look the same as any of the others?
- Can any of the suspects be eliminated because their pen does not match?



It would appear that sample A and X are from the same pen.

Kitchen Chemistry

http://pbskids.org/zoom/games/kitchenchemistry/index.html
http://www.science-house.org/learn/CountertopChem/
www.alka-seltzer.com/as/experiment/student_experiment.htm

Material science

http://www.strangematterexhibit.com/whatis.html

Topical science

http://www.sciencenewsforkids.org
http://news.bbc.co.uk/cbbcnews - see the Sci/Tech section

Forensic Science

http://educ.queensu.ca/~science/main/concept/chem/c09/C09laae0.htm

Elements

Although Elements are not mentioned in the Curriculum for Excellence until the Third Level, we explored an introduction to Elements in a Drama Activity at the most recent Primary Science CPD event held at the Glasgow Science Centre. Moyra Boland, from University of Glasgow Education Department, conducted this session. We had picked about thirty common elements and had printed off a laminated sheet on each element. This gave some information about the properties of that element. Each person randomly received one of these sheets and then they were charged with developing a character for their given element. So, for example, if you were given the element lithium you might be a real soft touch being soft enough to slice and a genuinely good guy because it can be used to treat bipolar disorder.

Elements **Third**

I have taken part in collaborative research and investigations on some of the 92 naturally occuring elements. I have contributed to a presentation which demonstrates understanding of their physical properties, similarities, diversity and uses.

SCN 326Y

One book that can help with this activity is: *The Periodic Table: Elements with style!* (Paperback) by *Adrian Dingle* and *Simon Basher* published by Kingfisher for £6.99. The ISBN number is: 9780753415115

Each element has its own personal ad, wherein its individual chemical properties are phrased as personality traits, making a complex science fun and relatable. Brought to full-colour life by imaginative illustrations, the distinctive characterisations of these once abstract elements won't soon be forgotten.

Many children will have heard of many of the common elements. These might include: hydrogen, oxygen, iron, tin, copper, gold, silver, mercury, platinum, neon, helium, krypton, nitrogen, nickel, carbon, lead, arsenic, zinc, iodine.

Topical Science

In the Primary classroom there will be many ways of approaching Topical Science depending on a particular age group. These could include researching and talking about issues children may have heard about on local and national news channels. By looking at a variety of sources for an issue, children will begin to see that some sources are not as reliable as others. They may begin to be able to discriminate between someone's point of view and the facts in the story. Their research skills should help to develop their questioning skills and allow them to weigh up the evidence presented in the media.

The Topical Science line of progression provides opportunities for consideration of ethical issues and critical evaluation, for example, of media portrayal of scientific findings and offers possible opportunities for integrating outcomes from other areas in the curriculum.

Use BBC Children's NewsRound by watching or recording the program or go online on their website and explore the Science and Technology in the news. Another good website is **www.sciencenewsforkids.org**. It is a new website devoted to science news for children of ages 9 to 14. It includes timely items of interest to children, accompanied by suggestions for hands-on activities, books, articles, Web resources, and other useful materials.

Topical Science **First**

I have contributed to a class display of current scientific news items to help me develop an awareness of topical science.

SCN 116BB

Topical Science **Second**

Through research and discussion I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society.

SCN 235BB

Topical Science **Second**

I can report and comment on a current scientific news item to develop my awareness of topical science.

SCN 236BB

Topical Slime

Scientists at Heriot-Watt University in Edinburgh have discovered that the mucus secreted by giant African land snails might have important applications in medical science. They found that the snails' slime contains unusual crystals of Calcite - a commonly occurring mineral, which could lead to a new treatment for broken bones. They have also persuaded giraffes to dribble into glass jars but its all part of research into natural lubricants which may have crucial implications in the treatment for such diseases as cystic fibrosis. By discovering what enables a giraffe to digest the thorns on garden roses, the scientists will gain a better understanding of the causes of mucus-based health problems. This may, in time, lead to the design of improved engineering lubricants.

Professor Viney gets his saliva from a giraffe called Jade at Edinburgh Zoo

Chemical reactions

Slime in the Classroom – Gloop

To make Gloop you will need:

1 cup of corn flour, water to mix and food colouring. Add the water and food colouring slowly, to the cornflour, a little at a time, until it becomes a thick batter.

Mix the ingredients together in a large bowl, using your hands. Once combined, try to roll it, punch it, dribble it, throw it about! It's advisable to wear an apron when making Gloop. However, it is not recommended that the mixing of the ingredients be done around those that suffer from respiratory complaints such as asthma as the dust from the cornflour can irritate.

Why does the Gloop behave like this? Cornflour is made up of lots of long, stringy particles that don't dissolve in water. However, they do spread themselves out, which allows the Gloop to act as both a solid and a liquid. When you roll the mixture in your hands or apply any force to it, the particles join together and the Gloop becomes solid. But if you let the Gloop settle or hold it up to allow gravity to come into play, it dribbles about as the particles slide over each other in liquid form.

Activity Challenge

Describe how the Gloop feels when you put your hand into it.
What happens when you try to roll it into a ball?
What happens when you stop rolling?
Put some onto a plate. Drop a penny onto it, what happens?
How does this compare to water? What would happen if you smack the Gloop with your hand?

Chemical Reactions **Second**

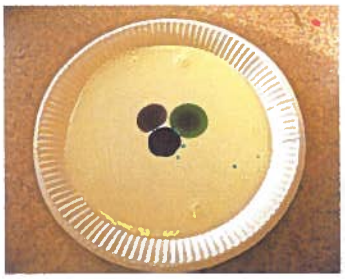
I have developed my skills in questioning, observation and recording by taking part in activities, which demonstrate simple chemical reactions safely using everyday 'kitchen chemicals'.

SCN 233Z

Colour Changing Milk

Milk contains both protein and fat molecules.

EXPERIMENT



Pour enough full fat or semi-skimmed milk to cover the bottom of a paper plate and allow settling. Add one drop of 3 or 4 different food colourings close together in the centre of the plate. Dip a cotton bud or a toothpick in the middle being careful not to stir, nothing should really happen. Now dip the cotton bud into some washing up liquid and try again. There should be an explosion of colour! Try placing the cotton bud at different places in the milk.

Milk is made up of water, minerals, vitamins, proteins, and tiny droplets of fat spread throughout the milk. Adding soap does a couple of things to the milk. First, it breaks up the fat globules and weakens the chemical bonds of proteins. This pushes and pulls the food colouring molecules every which way.

Colours also explode because milk is mostly water and it has surface tension much like water. Adding soap destroys surface tension by destroying bonds between water molecules. This causes colour to move and then move some more.

Challenge ideas:

Does it work using water?
What kind of milk gives the best results?

Return of the GAP task

Thirty delegates returned to the Glasgow Science Centre at the end of February where they were welcomed by the delightful staff in the form of Andy, Clare, Lindsay and Susan. They were able to try four of the taster sessions available for visiting school groups. These included forensics investigations, soldering electrical circuits, mini beasts and making a functioning vehicle from found materials. The teachers also examined six of the exhibits on the floors of the Centre and the following day creatively designed an activity using found materials such as cardboard rolls, string, cups, etc. The photographs illustrate some of the results of this innovative project work. Each of the participants also shared their work for the GAP task in truly innovative ways, whether it was using their puppets or exploring the issues found in the Let's Talk resources (lets.talk@btinternet.com). It is hoped that the connections made between teachers on these courses will continue in the school year.

SE 3-18: http://www.ise5-14.org.uk/PRIM3/head2.htm
SSERC: http://www.sserc.org.uk