



Helping Your Child with *Materials*

Introduction

As part of these sections of the National Curriculum for Science the children will learn a number of basic ideas about materials. The basic ideas they learn may seem obvious to us but children need to work hard to recognise differences and similarities and then to categorise materials. Any activities that reinforce these skills will help them develop the mental agility to deal with new skills in the future.

This sheet points out the sort of mental blocks that children sometimes have when learning about materials. There are also activities. These are opportunities when you might talk about things they notice around them at home or when they are out with the family. This will reinforce what they do at school and help them realise how their Science lessons relate to everyday life.

KS1 Year 1: Sorting and Using Materials

Useful Vocabulary

Names of materials (metal, plastic, glass, fabric, sand).

Words to describe materials (hard, soft, rough, smooth, shiny, magnetic, transparent).

Words for making comparisons (harder, softer, different from, same as).

Basic Ideas

- Ability to define/describe a material and compare materials e.g. fabric with wool, metal with wood.
N.B. children often confuse cotton thread with wool and the word fabric (textile) with material (more general use in science).
- Ability to explore materials – using senses other than sight.
Activity: describe or identify objects or materials blindfold or in a bag (or through a bag).
- Grouping objects made of the same of similar materials – and explaining why.
N.B. The skill of recognising similarities and differences and grouping (categorising) materials based on these is a very useful one to begin to develop at this stage.
- Why different materials are chosen for different purposes – often they don't think of this and take it for granted. Often they choose entirely inappropriate materials to make things – e.g. paper. They should begin to question whether a material is suitable and test it before use (linked to Design Technology later).

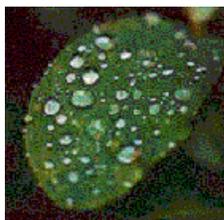
Activity: Ask children why a certain material is suitable for a purpose e.g. a towel, wrapping paper, cardboard. They need to begin to use the word 'because' in the correct way and identify what the material can do and therefore why it is appropriate e.g. strong, soft.

- That some materials are magnetic – but most are not.
N.B. children should learn that iron is attracted to a magnet but other metals are not (later they learn that a few others are).

Activity: Go round the house testing materials with fridge magnets

- That some materials are waterproof and what this means.

Activity: droplets of water on a waterproof material (umbrella, coat etc) will remain round droplets. Add a drop of washing up detergent and the water drop will suddenly spread across the material as its waterproofing is removed.



N.B. For older children it's interesting to ask them what 'wet' means. They can all use the word in the correct context but not find a synonym or other description for it. Not all liquids can wet a surface e.g. mercury (which they won't encounter in school due to Health and Safety Legislation). Wetting means molecules of liquid stick to molecules of the surface. The activity (above) on water proof fabrics shows this quite cleverly.



KS1 Year 2: Grouping and Changing Materials

Useful Vocabulary

Names of a variety of materials (clay, leather)

Words to categorise materials (natural and manufactured)

Words to describe changing materials (squash, bend, twist, stretch, heat, cool, freeze, melt, boil)

Comparisons (warm, warmer, warmest)

Basic Ideas

- Some materials occur naturally and others do not.
N.B. some children assume that materials that have been changed are not naturally occurring e.g. wooden furniture compared with a tree, wool compared with a knitted jumper.



Activity: list materials in the kitchen that are naturally occurring and those that are manufactured.

- Materials often change when they are heated. This is a good illustration of cause and effect. Some changes on heating are reversible (e.g. melted butter solidifies on cooling but an egg doesn't become runny again) however reversible and irreversible changes are covered in Year 5.

Activity: All cooking activities are an opportunity to ask questions on the effect of heating, asking what effects they observe before and after heating.

- Melting. Children are all familiar with melting (e.g. ice creams etc) but often do not attribute this to heating as there is no direct application of heat. To them the melting is simply a natural form of deterioration of an ice cream as you eat it. More able children should be able to see that the ice cream is being heated by the warmer air around it and this is why it melts. Reducing the temperature will stop the melting.

Activity: For older children put an ice cube in a glass and fill the glass as full as possible with water. The ice cube will float. (Titanic – 7/8 of the iceberg was underwater and 1/8 above). Ask whether the water level will overflow as the ice melts. In fact the water level shouldn't change. Ice is less dense than water so takes up more space (which is why some of it is above the surface). As it melts it takes up less space (gets more dense) so the water plus melted ice still fits into the glass.

N.B. Water is odd in getting less dense as it freezes. It is most dense at 4°C which is why fish-ponds don't freeze right through and the fish can survive sub-zero temperatures.

(More able children) Identify that water ice and steam are the same material. See how water is changed into ice and steam by freezing or heating. Recognise that these changes can be reversed

KS2 Year 3: Characteristics of Materials

Useful Vocabulary

Words to describe materials (strong, hard, flexible, absorbent, transparent)

Basic Ideas

- The properties of a material make it appropriate for a purpose. Children need to be able to describe/identify properties of materials.

Activity: have a range of objects and one player has to describe the properties of the material (hard, shiny, transparent, flexible) and the other has to identify it.

Activity 2: Test the absorbency of different materials e.g. paper towels compared with fabric cloths. (Gives them an excuse to get wet!)

N.B. One very important element of science is doing a fair test. Children have an innate sense of fairness so enjoy working out how to make a test fair. In activity 2 they need to keep the size of the towel the same for example.



Year 5: Changing State

Useful Vocabulary

Evaporation, condensation, boiling, temperature, change of state, solid, liquid, gas, water cycle.

This builds on the work on effects of heating in Key Stage 1.

Basic Ideas

- Evaporation is when liquid turns to gas
N.B. Children often think that water just 'disappears' when things dry as there is often no evidence of it still existing. It's useful to point out situations where water then reappears as condensation e.g. on the windows



or on kitchen cupboards around the hob when boiling water.

N.B. The distinction between evaporation and boiling isn't stressed at this stage. It is sufficient to say that the difference is that when a liquid is boiling you see large bubbles form. The outcome (liquid turning to gas) is the same so boiling is seen as causing rapid evaporation.

Activity: Ask where the water has gone when something has dried.

- Other liquids evaporate e.g. perfume and the solvents in nail-varnish, Tippex and paint. They can smell the liquid as it floats in the air after it has evaporated.

Activity: Ask why they can smell something e.g. perfume.

N.B. At this stage they do not need to have the idea of molecules so explanations of evaporation in terms of molecules of water escaping from the liquid surface are not required.

- How the rate of evaporation can be increased e.g. heating, blowing air across the surface, putting liquid into a wider container.

Activity: when hanging out washing ask whether it will dry quickly or slowly. Children should be able to think about the effect of temperature and the wind when judging this.

Activity 2: Ask why a hairdrier is faster than leaving hair to dry naturally, or why a tumble drier dries clothes faster than hanging them up to dry.

In both of these activities children are using background knowledge to deduce the answer – a very useful skill.

- Condensation is when gas turns to liquid (reverse of evaporation). This is far more difficult to explain as it requires children to see that water hits a cool surface and joins together in droplets – which is particularly confusing as they weren't able to see the water before this happened.

Activity: Ask where the water droplets have come from on the window in the bathroom or kitchen on a cold day. Children should be able to associate this water with water that has previously evaporated from a shower/bath or cooking. This ability to link two separate events is very important and may not be possible for some children at this stage.

Activity 2: More difficult is to ask why there is condensation on the cold tap but not on the warm tap after running a bath. They know that water has to be warm to evaporate and that it condenses after it has evaporated but some will then expect the condensation to appear on the hot tap as this provided the warm water. The fact they are missing is that the hot tap is too warm for the water droplets to land and condense on. The cold tap is cool enough so this is where the water droplets form and you see condensation. If they feel the two taps this helps the explanation.

- Water boils at 100°Celsius.

N.B. Temperature is best referred to in degrees Celsius rather than Centigrade for future work but both will do at this stage.

Often children expect that as you keep heating water its temperature will just keep rising with no upper limit. It comes as a surprise that it won't go above 100°C. In fact this is quite difficult to explain and they won't be expected to explain it until Secondary school level.

Activity: When cooking it's worth pointing out to them that once the water in a saucepan is boiling, there's no point in keeping the heat turned up as this just wastes energy (money). They assume that they can see the water boiling more vigorously therefore the vegetables must be cooking faster whereas, in fact, the temperature is no higher than 100°C however many bubbles you see. The only outcome is that the kitchen fills with steam more quickly!

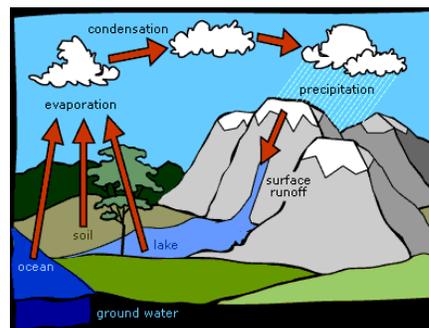
- Melting/freezing and boiling/condensing are reversible changes. They are introduced to the term 'change of state' at this point.

- The water cycle: water evaporating from lake, it cools as it rises and condenses to form clouds, falls as rain and drains back in to the lake. They will cover this again in secondary school.

N.B. Children find the idea that clouds are formed of billions of droplets of water very hard to grasp – especially when you tell them that the cloud is probably several tonnes in weight! Using terms like 'fluffy clouds floating' and making collages with cotton wool in toddler group gives them the impression that clouds are very lightweight.

Activity: Any questions about where the rain comes from or how clouds are formed will get them thinking about all the ideas in this topic.

N.B. Apparently air pollution is causing reduced rainfall as clouds are now forming with water droplets that are too small/light to fall as rain.



Web Resources

There is an enormous amount of material on the web. The site name may help give you an indication of the quality of the information. Sites ending in '.ac.uk' are usually UK universities, '.edu' are American (US) universities, whilst '.gov.uk', '.gov' and '.mil' are government or military organisations. You can find all sorts of things with a query to a search engine, but here are some to get you started:

<http://www.phys.soton.ac.uk/>

<http://www.chem.soton.ac.uk/>

<http://www.ecs.soton.ac.uk/>

<http://www.parents.dfes.gov.uk/discover/>

School of Physics and Astronomy

School of Chemistry

School of Electronics & Computer Science

Department for Education and Skills