

British Wool LEARNING



Materials

Ages 7 to 11

Aims and objectives

- To develop understanding of heat transfer and conductors
- To make predictions and review investigation procedures by recording findings using drawings, labelled diagrams, keys, bar charts and tables etc.
- To ask relevant questions, use scientific enquiries to answer them and to draw simple conclusions from results
- To expand understanding of the materials used to make everyday items and to easily identify materials such as wood, glass, metal and wool
- To compare and group everyday materials according to properties, including their hardness, transparency and conductivity (electrical and thermal)
- To understand how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching
- To understand that certain materials are suitable for making certain objects due to their specific properties
- To understand the characteristics and properties of wool, including thermal properties
- To improve vocabulary and develop use of scientific language

Activity One - Thermal Insulation Investigation

An online thermal experiment.

Introduction

Children should explore, identify, discuss and raise/answer questions about materials. It is important they become familiar with the names of everyday materials and their properties. Experimenting with materials will help children to work scientifically, and using basic tests are an engaging way to discover the properties of materials such as wood, paper, plastic, foil and wool. Carrying out simple tests will also help to improve vocabulary and the use of scientific language.

Discussion

Establish what children already know about the idea that everything is made up of materials. When we want to make something we must consider the best material for the job. We can do this by looking at the properties of materials. Properties are something we can measure, see or feel. The properties (or characteristics) of materials help us to decide which ones to use.

Most materials have more than one property and can be natural (from nature) or man-made (made by people). Ask the children what types of properties a material might have. What words do they know that describe materials? A material might be strong, rough, brittle, soft, hard, transparent, opaque, magnetic or non-magnetic. Some materials are insulators and some conduct heat.

Ask the children to discuss what they know about the following words. Explain the words they do not fully understand or ask them to look them up in a dictionary.

- | | | |
|--------------------------|--|--------------|
| • Magnetic | • Absorbent | • Waterproof |
| • Transparent and opaque | • Thermal insulator and heat conductor | |

Thermal conductivity is a property – a property that refers to a material's ability to conduct heat. If you have ever wrapped your hands around a cup of hot chocolate, you have felt heat transfer through conduction. When hot water is poured into a mug the different temperatures create a heat transfer. Different materials conduct heat differently. Materials like wood and plastic do not conduct heat well.

Understanding the thermal conductivity of a material is very useful when designing items such as pans or radiators. Why do the children think this might be?

Online Activity

This online investigation helps children to understand that a thermal conductor is a material that allows heat to readily transfer through it and to recognise that heat is conducted at different rates through different materials.

Do the children know what heat transfer is? Warm air will always try to move to areas of cooler air. Some materials are good thermal conductors; this means that heat can easily transfer or pass through them. Other materials are good thermal insulators; this means they do not let heat pass through them easily. Properties of materials, such as thermal insulation, is something we can measure.

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You may decide to ask the children to use the following activity independently or to display it on a whiteboard to go through as a whole class.

The Thermal Insulation Investigation www.britishwoollearning.com/interactive/materials/thermal.php begins with a problem for the children to consider:

"We've had reports of some kids feeling very cold in the winter.
We want to make extra warm and cosy jumpers for them. We need you to carry
out investigations to find out which material we should use to make the jumpers."

The next activity screen explains that we will be carrying out an investigation to see which of the materials provided can keep the teacher's cup of tea warm for the longest time and is therefore the best insulator. The children are asked to begin by making a prediction from the list of materials provided. Which one will be the best material for the job?

There is the opportunity to display more information from this screen by using the 'click me' button at the top right corner of the screen. This will display a bonus screen to help explain how thermal insulators work and how we might use them. There are diagrams to help illustrate this. This screen closes by clicking on the 'click me' button again.

The Test

Point out to the children that room temperature during this experiment is 20°C which is cooler than the four cups of hot tea which all start at 70°C. The heat will transfer from the tea, through the mug and into the cooler room. The mugs have been wrapped in different materials to see which one will keep the tea warmer for longer and is therefore a better insulator. To make sure of a fair test, all the warm tea was added to the cups at exactly the same time and temperature and each mug only has one layer of each material around it. It takes 10 minutes for the tea to go cold without insulation.

Begin the test by clicking 'start' above the timer. The time will begin to run down and the temperatures will start to drop. When each one reaches room temperature a sticker telling the user that the tea is cold (reached room temperature) and the time taken for that to happen will be shown. At any time the test can be paused by clicking the 'stop' button which replaces 'start'. This will allow you to stop to answer any questions and for children to make any notes. Starting the timer again will continue the test. Once the test is complete it can be run again as many times as is necessary and always with the same results.

From the test we can see that:

- The mug covered in foil takes 16 minutes to reach room temperature
- The mug covered in newspaper takes 32 minutes to reach room temperature
- The mug covered in bubble wrap takes 45 minutes to reach room temperature
- The mug covered in wool takes 58 minutes to reach room temperature

The next screen displays these results in a table and also in a chart. Without showing the chart, there is the opportunity for the children to create their own bar chart of results.

Discuss the results with the class. Was their initial prediction correct? What do the results tell us? Which of these materials has the best properties for making a warm jumper? Why? Which one was not a good thermal insulator? Why? What might this material be good at instead?

Children could now write up the experiment and draw a diagram using the notes they have made. The method, equipment used and a table of results will allow the children to document and review the investigation.

Practical Activity

This activity can be extended to include art and design. Children can use the information they have about the properties of wool to design their own British wool jumper (and other products) using the **Product Design** worksheet and templates

www.britishwoollearning.com/pdf/designbritishwoolproduct.pdf

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Activity Two - Properties Test

Testing to discover which material has what it takes to be a jumper!

Introduction

Children should identify and discuss the uses of various everyday materials to become familiar with the ways in which materials can be used for more than one thing (metal can be used for coins, cars and knives, and wool can be used for making jumpers, carpets and household insulation) or that different materials can be used for the same items (spoons can be made from wood, metal or plastic). Children should think carefully about specific properties of materials and why a material may be suitable or unsuitable for a particular purpose. The following test helps children understand how the shapes of solid objects, made from a variety of materials, can be changed by squashing, bending, pulling, twisting and stretching.

Discussion

What is a force? Push and pull are both forces, for example. You can't see a force but you can often see what it does to an object. Forces can change the speed, direction or shape of materials. Some solids can be hammered or squashed into different shapes without breaking. They are known as malleable materials. Other solids, such as glass, will not bend when hammered or squashed, but will break and shatter. Materials such as glass are brittle. Testing the properties of a material using force can be helpful when trying to find out which material is right for a particular purpose or job.

Online Activity

The Properties Test activity www.britishwoollearning.com/interactive/materials/properties.php provides a problem for the children to consider:

"We've had reports of some children having to wear very uncomfortable jumpers."

The task here is to run each test to find out which material is best for making a soft jumper that is suitable to wear. The checklist at the top right of the screen tells the children what properties the material must have. It must be stretchy, it must twist and it must be soft and comfortable. Why do the children think the material will require these properties?

Materials are chosen from the horizontal list (above the images) and the pull test, twist test and push test can be run for each material by clicking the orange button below the image. The animations provide a basic visual reference for the test and the outcome is displayed in words when the animation is finished. It might be useful to provide the children with physical examples of the materials for them to see and feel. The materials in this activity have been purposely chosen as familiar everyday materials that are both easy to recognise and easy to obtain.

When all the tests have been run, the user can continue on to the next screen. This screen reveals a table showing the results of the materials properties tests. The children are encouraged to look at the table and to use the results to reach a conclusion. Which of the materials is best for making a jumper?

Children should be made aware that wool needs to be easy to work with. Raw wool from a sheep goes through many processes to make it ready for use. We do not take a jumper straight from the sheep! Wool is twisted and spun into yarns which are then used to make items such as jumpers. This is why, of all the materials given, wool is the only one that can be successfully used for the purpose. It has the best properties for the job!

If the children have the opportunity to feel the physical materials, can they twist any of them into a yarn or strong thread that they think could then be used to produce a jumper?

Extension Activity

More information on the processes wool must go through to be ready to be used to make a product can be found here: www.britishwoollearning.com/pdf/woolprocessingterms_factsheets.pdf These sheets contain useful information and include wool processing terms.

The online quiz at www.britishwoollearning.com/interactive/quizzes/wool/ also offers a fun way to learn or recap information on the processes wool must undergo to become ready to use.

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Activity Three - Reusing Materials

Can we reuse materials?

Introduction

Helping children to recognise the materials and processes used in making art, craft and design is a practical way to encourage them to consider materials more closely. Ask them to think about unusual and creative uses for everyday materials.

Discussion

Can the class think of any ways in which materials can be reused to create craft or artwork? What about using rubbish?

Waste is any material that we throw away or get rid of.

Waste affects our environment. The environment is everything around us including air, water, plants, animals, trees and man-made things. We need to live in a healthy environment, so it is important for us to think carefully about what we do with the materials that we have finished using and no longer need. When we throw something away it is taken to large sites called landfill where it can take a very long time to break down. This causes a lot of problems for the environment. What could we do with our rubbish apart from throw the used materials away?

Reduce - cut down on the amount of rubbish we have.

Reuse - find another use for the materials.

Recycle - making materials into other items.

Some artists and designers make artwork or useful objects out of things that might usually be thrown away. They reuse them to make new things. Which materials can you think of that could be used again and turned into a new object?

Activity

As an activity to demonstrate the use of old newspaper, try creating papier mâché sheep bowls with the children. This is a fun way to show how rubbish can be reused to make a useful object. You will find instructions on how to make one in the families and communities section of the www.britishwoollearning.com website.

Conclusion

When the children have completed their bowls, bring them back together to consider, as a class, what they learnt during the activity. What properties does newspaper have and have the properties changed now the newspaper has been made into a bowl? Ask the children how many materials they used to create this bowl and what might have happened to the newspaper if they hadn't reused it.

Activity Four - Material Characteristics

Information to help investigations into materials.

Discussion

Where do materials come from? Materials can be either natural or man-made. Natural materials include wood from trees and wool from sheep. Man-made materials include plastic and polystyrene.

The Material Characteristics Investigation activity www.britishwoollearning.com/interactive/materials/characteristics.php provides information to help children to conduct the other tests in the **Materials** interactive. The information on these screens can also be used to help explain where certain materials come from and how they are used.

Ask the children to look through the information or use it as an opportunity to discuss these materials with the whole class. The next page contains further information about each material to use with the class. Read the information provided on screen and ask children to answer or raise questions about the material. What else do they know about each of the materials? Encourage the use of scientific language and knowledge to describe the materials.

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Bubble wrap

A pliable transparent plastic material often used for packing fragile items. The air-filled bubbles provide cushioning. In 1957, inventors Alfred Fielding and Marc Chavannes were trying to make 3-D plastic wallpaper. Although that idea didn't work they did discover that they had made a brilliant packaging material!

Bubble wrap makes a lovely popping noise when the bubbles are squashed, many people use this as a source of amusement and some even think it can help them feel less stressed!

Foil

Foil is a thin, shiny sheet made of metal. It is often used in the kitchen when preparing and packaging food. The sheets can be around 0.2 millimetres thin and are made by rolling and re-rolling the sheets until they are the desired thickness.

Some foil is used for industrial purposes e.g. thermal insulation, cables and electronics. Metal foil made from tin was used as a filling for tooth cavities before the 20th century.

Newspaper

A newspaper is a publication containing news and other information. A newspaper is usually printed on cheap, low-quality paper. The paper is uncoated and coarse, and is made from wood pulp. It is a thin paper which makes it perfect for newspapers with lots of pages and lots of copies.

The word paper is derived from the Greek word pápyros, the name for the papyrus plant. This plant only grows on the edge of streams in the Middle East. The 'paper' from the papyrus plant was first used by the Babylonians and then by the Egyptians (around 3000 B.C.). Greeks and Romans also used papyrus.

Wood

Wood comes from trees. It is a hard, fibrous material found in the stems and roots of trees. Wood has been used for thousands of years for both fuel and as a material to build with. It is a natural material and when in a living tree it helps the tree to grow and to stand up by itself. It also transfers water and nutrients to the leaves and other parts of the tree.

Wool

Wool is a natural material obtained from sheep. A sheep grows a fleece of wool every year, which makes wool a renewable material. Wool is a resilient material and can resist tearing. It is also elastic and can stretch well due to the natural crimp in it. It is naturally flame-retardant which means that it will not catch fire as quickly as many other materials. It will not melt and does not produce toxic fumes.

Wool has a naturally high level of UV protection so wearing it offers much more protection from the sun than other materials such as cotton and synthetic materials.

Research Activity

Children might enjoy researching people that have developed new materials, for example Alexander Parkes, John Dunlop, Harry Brearley and John McAdam. They should consider the properties of the materials created by these people and how the materials are used. Did the new materials replace the use of other materials? If so, why? Groups could be given one name each to research and children could be brought back together to present their findings to the class.

Homework Activity

Pupils should work scientifically to compare the uses of everyday materials in and around the school with materials found in other places such as at home, the journey to school and in articles or stories. They should observe materials closely, identifying and classifying the uses of different materials, and recording their observations. They should research where the materials they have identified come from. Are they man-made or natural? What properties and characteristics do the materials have? Are there any other obvious uses for the materials?