CurriculumVisions 2D Science@School

Grouping and changing materials

Teacher's Guide CD

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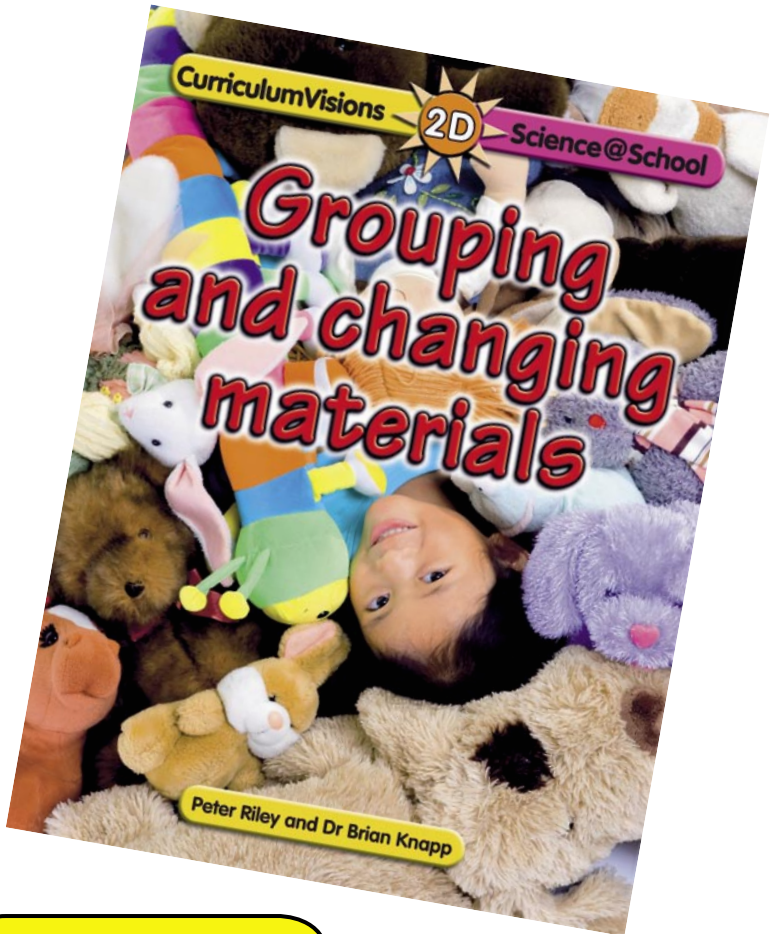

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Curriculum Visions

A CVP Teacher's Guide

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Contents

Introduction

The pupil's book

The Key stage 1 Science@School series is a series of twelve books. Each one addresses one of the QCA units in the Key Stage 1 science curriculum.

Each spread in the book addresses one or more objectives in a QCA unit by providing photographs, simple text and questions to stimulate discussion.

Each book has an illustrated glossary and a simple index for finding information.

The teacher's guide

It may be that you already have a scheme of work and wish to use the books to support it. Alternatively you could use the books, this CD ROM and the **CurriculumVisions.com** web site, which provides support material in the form of extra text (with audio option), pictures, captions, activities and demonstration videos to build a new scheme. Whichever way you choose, the notes in this teacher's guide have been set out as if you were using each page or spread as the basis for a lesson. You may follow each set of notes in their entirety to build up your lesson or take parts of the notes to fit into your scheme.

The teacher's notes contain information about practical work. You should check your school policies on practical science work and only select activities for which you are confident to take responsibility.

The book *Be Safe!* published by the ASE (ISBN 978–0–86357–324–8) provides useful guidance on carrying out science activities.

The structure of the notes

The notes for each page or spread follow the same structure, which is outlined here.

Objectives

These may be linked to the QCA objectives or build on them to enrich the topic.

Resources and preparation

Suggestions may be made for building on the visual display of the books with posters and models.

There are also pictures (aka flashcards) at the end of the notes to each lesson, which may be printed off and used as triggers to start the lesson or used in the plenary as revision. When the pictures have been used they could be displayed on a wall and others added as the subsequent lessons are completed. This will make a colourful summary of the work which could be used as a final revision resource when the book is completed.

If you are using the **CurriculumVisions.com** web site log in, go to Science, Year 2, Unit 2D Grouping and changing materials.

There may be some suggestions for building practical work into the use of the pages in the book and these include a list of requirements (simple, readily available materials) and advice on preparing the requirements for use in the lesson.

Introduction

Starting the lesson

Each lesson begins with a short activity, which helps settle the children and focus them on the work ahead.

Activities with the page

These may be reading activities, observing and discussing the pictures or answering a question. There may also be practical activities which are designed to develop a range of practical science skills from making observations to carrying out fair tests.

Differentiation

There are suggestions for providing help and activities for children of different abilities.

Assessment

There are suggestions for assessing the children's work. There are three assessments for you to print off at the end of this guide. These are for use with lesson 2 (page 55), lessons 3/4 (page 57) and after completing lessons 6/7/8/9 (page 59), or you could use all three together as an end of unit test. Guidance for the answers is given in the assessment section of the lesson notes.

Plenary

The work done in the lesson is reviewed in this section and there may be a further activity to help secure the children's knowledge.

Outcomes

These may be linked to the QCA objectives or build on them to enrich the topic.

1 Teacher's sheet 2D

Materials

Objectives

- To know that everything is made of materials.
- To know the names of a wide range of materials.
- To know materials have properties and these can be used for sorting them.
- To distinguish between an object and the material or materials from which it is made.

Resources and preparation

Piece of wood, sponge, handkerchief, piece of writing paper, paper towel, scarf, plastic straw, plastic cup, eraser, balloon (not inflated), metal paperclip, copper coin, piece of aluminium foil, piece of brick, pebble. The following materials should be in sealed clear plastic containers – sand, cement, gravel, water, a piece of concrete, flour, sugar, butter, chocolate, milk, an egg.

Starting the lesson

Show the children a piece of wood and ask them to tell you about its properties. You may have to help them with the concept of a property as a feature that a material possesses and say that, for example, the wood is brown. When they have suggested other properties such as hard, strong, smooth, etc, show them a range of materials and ask the children to sort the materials into groups according to their properties.

Activities with pages 4 and 5

- Read the introductory sentence with the children and ask them to look at their rulers and tell you what they are made of.
- Read the first two lines of the paragraph. Tell the children that they will find out more about natural materials in the next lesson and check their understanding of the word 'factory' as a place where things are made.
- Read the next sentence and challenge the children to think of the names of more materials.
- Complete the paragraph and move on to look at the pictures and captions. After reading the caption about the camera ask the children why the lens is made of glass and not metal like the camera case. Look for an answer about the glass being transparent and being able to let in the light to make a photograph.
- When looking at the light bulb point out that the bulb is made of glass and the support inside is made of glass but the part that is glowing is made from metal. You could tell the children that electricity is flowing through the metal and heating it up so much that it is glowing.

1 Teacher's sheet 2D

- Look at the flow chart showing the materials used in making concrete and show the children the containers of water, sand, gravel and cement. Tell the children that when these materials are thoroughly mixed and left for a while they produce concrete and show them the container with the concrete inside.
- Read the caption about computers and say that inside a computer are small slices of a material called silicon. These slices are called silicon chips and are made from a rock that formed from sand grains.
- Move on to the picture of the cookies and read the caption. Show the children the sealed containers of the ingredients and say that when these are mixed and heated they form the cookies. The children may have made cakes or bread as an activity in another part of the curriculum and you could remind them of it and invite them to discuss what they did.
- Look at the boots with the children and read the caption. Ask them to answer the question on page 5 by looking at their own shoes.

Differentiation

Less confident learners may need help in thinking of criteria for sorting the materials. More confident learners can be given extra materials to sort such as a ball of cotton wool and a small piece of soap.

Assessment

The children can be assessed on their ability to sort the materials into groups.

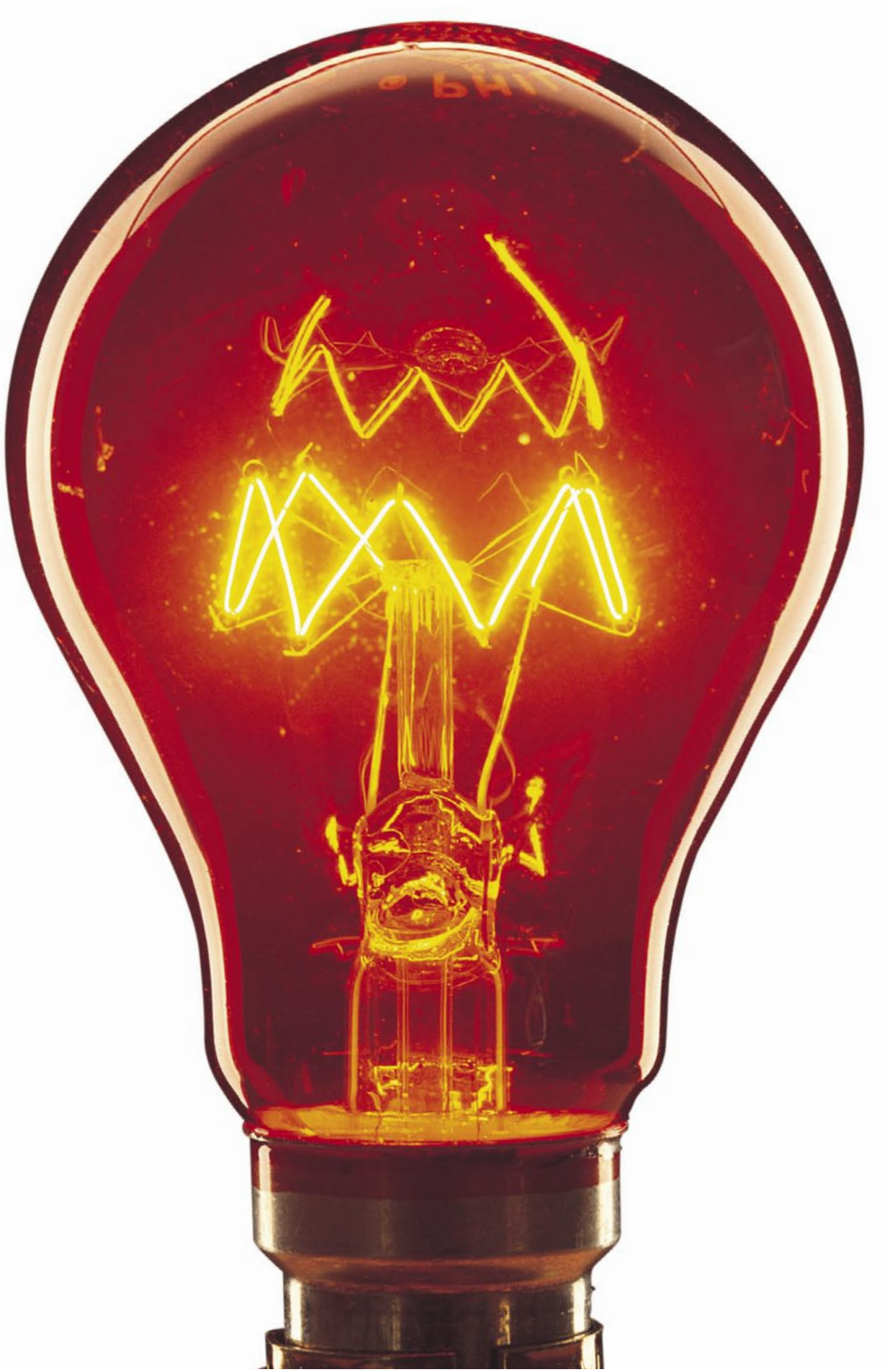
Plenary

Review the children's concept of a material and its properties. Hold up different materials and ask the children to describe their properties. You may like to use the sand, flour and sugar in your examples. Review the look between materials and objects by saying that objects are made from materials but materials are not made from objects. Check that children know that an object may be made from several materials by showing them a coat or anorak and pointing out the cloth, thread holding it together, plastic buttons, metal zip, Velcro fasteners, elastic cords, etc.

Outcomes

The children:

- Know that everything is made of materials.
- Know the names of a wide range of materials.
- Know materials have properties and these can be used for sorting them.
- Can distinguish between an object and the material or materials from which it is made.



Natural materials

Objectives

- To know that some materials occur naturally.
- To know that natural materials were the first materials to be used.
- To know that people who are stranded on desert islands have to use natural materials to survive.

Resources and preparation

A piece of a branch about half a metre long and 6 cm in diameter. Pieces of yarn and magnifying glasses.

Starting the lesson

Tell the children that the first people used the things around them to help them live. Show the children the part of a branch and ask them what material it is made from and look for an answer about wood. Ask the children where wood comes from and look for an answer about trees. Demonstrate using the branch that it could be used as a club or a spear when hunting animals, or used as a pole to make part of a shelter. Ask the children what other material they could have used and look for an answer about stone.

Activities with pages 6 and 7

- Read the introductory sentence and remind the children of the natural materials that they have discussed at the start of the lesson.
- Read the first line of the paragraph with the children, then ask them to look up stone in the glossary. Ask the children if they can think of anywhere locally where there is a stone wall.
- Read the rest of the paragraph with the children and ask them about materials they have looked at which need changing to make them useful. Look for answers about the components of concrete and the ingredients of cookies.
- Let the children look at the buildings and read the caption. Ask them about the link between rock and stone and if they struggle refer them back to the glossary.
- Move on to the picture of the chair and its caption and point out that the object is made from two natural materials.
- Look at the top picture on page 7 and read the caption with the children. Ask the children about how the wood is used in the making of the building and look for answers about the walls, roof and shutters for the windows. Ask them about the uses of stone and look for answers about the walls and the steps at the front door.

Teacher's sheet

- Let the children look at the pictures and captions about wool. You may like to remind them that wool is really fur and is made from hairs. When the sheep is sheared it is like us having a very close cropped hair cut.
- Show the children some strands of yarn and let them unravel it a little and examine it with a magnifying glass.

Differentiation

Less confident learners may need help about imagining living on a desert island and the use of materials. More confident learners could write about the properties being used when a material is used for making something. For example – wood is used in a raft because it floats, creepers are used to tie things up because they are flexible, palms are used for the roof because they are waterproof.

Assessment

Ask the children to imagine that they are living on a desert island and think about the materials they would use to help them live. They could make a labelled drawing of themselves and their friends living on the island and using materials. The picture could include wood for a hut, coconuts as cups and palm leaves for the roof or a shelter. Creepers to make nets for catching fish or tying things together. Logs and creepers could be used to make a raft. There is an assessment sheet at the end of the guide (page 55).

Answer guidance

Wood is brown, made from trees, can be cut easily and is used for furniture and buildings.

Stone is grey and very hard and comes from the ground and is used for making buildings.

Wool is made from long thin hairs that grow on sheep, and is used to make clothes such as pullovers and socks.

Plenary

Begin by asking the children to answer the question on page 7 and then ask them to display their pictures about living on a desert island. The children could discuss what changes they had to make to the materials to use them. Note that most of the changes involve cutting to make spears, roofs and poles and not changing the materials into a new material as with the concrete and the cookies.

Outcomes

The children:

- Know that some materials occur naturally.
- Know that natural materials were the first materials to be used.
- Know that people who are stranded on desert islands have to use natural materials to survive.

3 Teacher's sheet 2D

Metals and glass

Objectives

- To compare the processes in making metal and glass.
- To compare the properties of metal and glass.
- To explore the uses of metal and glass.

Resources and preparation

Iron nail, steel paperclip, aluminium foil, piece of brass, magnet, a glass marble and a steel ball bearing.

Starting the lesson

Ask the children what they know about metals. Look for answers about metals being shiny, feeling cold, being hard, metal wire is bendy, metals are used to make cars. If someone answers that metals are magnetic show the children an iron nail, steel paperclip, aluminium foil, piece of brass and let them test the metals with a magnet. They should find that only steel and iron are magnetic. Move on and ask them what they know about glass. Look for answers about it being hard, smooth, shiny, transparent, and brittle. You may like to add that broken glass can cut easily and should be cleared away by an adult.

Activities with pages 8 and 9

- Read the first introductory line about metals coming from rocks then move to the first paragraph and read the sentence. Ask the children to learn more about ore by looking it up in the glossary.
- Look at the copper ore with the children and read the caption. Look at the iron ore on page 9 with the children and read the caption. Ask the children how the ores are similar in appearance and look for an answer about the ores being orange brown and red brown and being lumpy.
- Move back to page 8 and read the second sentence in the paragraph. The heating up of the metals does not simply melt them but allows chemical reactions to take place, which release the metals. You may say that the heating causes changes in the ore, which lets the metal out.
- Read the last sentence in the paragraph then look at the copper and the tram and Blackpool tower and read the caption on page 9.
- Let the children answer the question on page 9 about metals by drawing the metal objects and naming them.
- Look at the Statue of Liberty with the children and read the caption. Ask the children if they can think of any other metals, which change, when left out in the air and look for an answer

about rust. (The children will perform an investigation on rust in year 3 if using the Science@School books.)

- Move back to the second introductory line on page 8 about glass then read the paragraph on page 9 with the children. Let the children find out about the word 'melt' in the glossary.
- Read the caption about glass blowing with the children and ask them about the property of molten glass that allows it to be blown. Look for an answer about stretchiness. Look at the picture of the teapot with the children and discuss how it might have been made. Look for answers about the body of the teapot being blown separately from the spout and then the two pieces being joined together. The handle may not have been blown but just melted into a curved shape.
- Ask the children to name other things that are made of glass and make a list on the board. The answers should include, tumbler, jug, bowl, dish, window, decorative object, light bulb, chandelier, glass in front of a picture, glass in computer or TV screen.
- Ask the children to answer the part of the question about glass on page 9 by drawing the objects and naming them.

Differentiation

Less confident learners may need help in looking around the classroom and recognising metals and glass. More confident learners could add a caption to each picture describing how the metal and glass is being used. For example, in a radiator the metal is giving out heat from the hot water inside, a paperclip is holding pieces of paper together, and a window is letting light into the room.

Assessment

The children could be assessed on the presentation of their pictures and caption. There is an assessment sheet for use after this lesson and after lesson 4 at the end of the guide (page 57). The answers are in the assessment section of lesson 4.

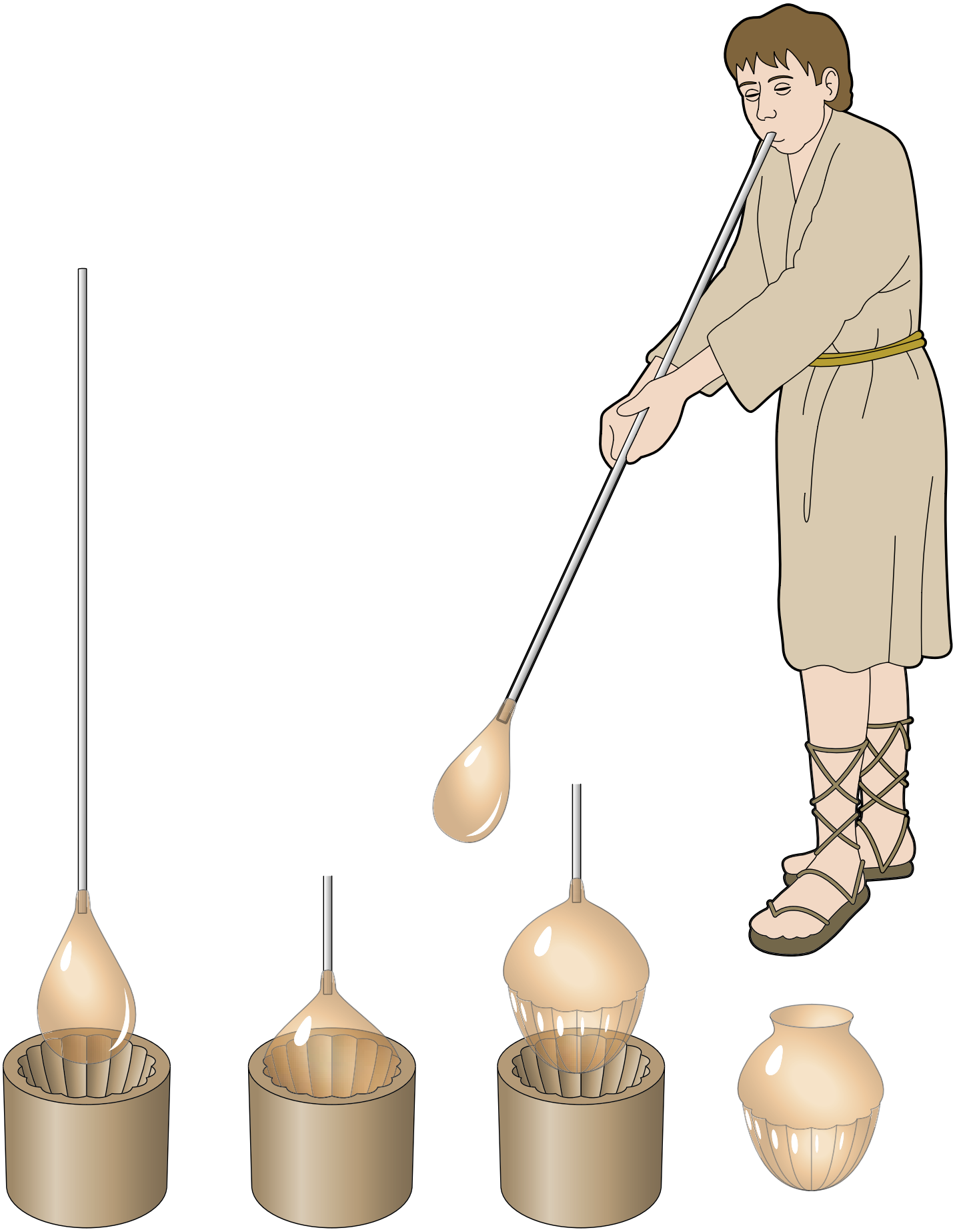
Plenary

Let the children display their pictures. Ask them about the properties of the materials that are being used. You could explore ideas like glass being waterproof as well as transparent and keeping out the rain. Show the children a ball bearing and a glass marble. To compare how the materials are similar (hard, smooth, shiny) and different (opaque and transparent). You may test them with a magnet and show that the ball bearing is attracted to it and ask the children what metal the ball bearing is made from. Look for an answer about the ball bearing being made from steel.

Outcomes

The children:

- Can compare the processes in making metal and glass.
- Can compare the properties of metal and glass.
- Can explore the uses of metal and glass.



4 Teacher's sheet 2D

Plastic and paper

Objectives

- To know how plastics are made.
- To know about the uses of plastics.
- To know how paper is made.
- To know about the uses of paper.

Resources and preparation

A tin of treacle and a dish, a plastic cup, a pottery cup, a plastic ruler, a wooden ruler, a plastic bag, a piece of paper, a branch (from lesson 2), newspaper, soft toilet tissue paper, kitchen roll, each group of children will need a plastic bowl, a jug of warm water, a sieve, a piece of cloth (such as an old tea towel), a rolling pin.

Starting the lesson

Review what the children know about plastic. They may say that it is hard and shiny and bendy and that most is opaque but some is transparent. Review what the children know about paper and look for answers about it being bendy, smooth, opaque and tearing easily.

Activities with pages 10 and 11

- Read the introductory sentence with the children and ask them to name two other materials that are not natural and have to be made in a factory. Look for an answer about metal and glass.
- Move to the first paragraph and read the first line. Ask the children to find out more about oil by looking in the glossary. The dead sea creatures from which oil is made are microscopic and formed the plankton in ancient seas. When they died their bodies fell to the ocean floor in huge numbers and became covered in sand, which eventually formed rock. The bodies did not decompose completely but formed oil, which became trapped in the rocks. Open the tin of treacle and pour some into the dish. Tell the children that oil which comes out of the ground looks and behaves a little like treacle.
- Read the next two sentences and ask the children where they may have heard about boiling before. Ask them to look it up in the glossary. Tell the children that all liquids boil and when oil boils one substance does not escape from it like steam from water but lots of substances escape and one is important for making plastics.
- Read the last line of the paragraph and say that when the substance cools down it forms small lumps called chips.
- Move on to the next paragraph and read the first sentence. Ask the children what happens when something melts and ask them about another material in which melting takes place as it is being made. Look for an answer about glass.

4 Teacher's sheet 2D

- Read the last sentence and ask them to name other processes that are used in making plastic objects and look for answers about stretching and pressing.
- Let the children look at the pictures on page 10, then move to the first part of the question on page 11. Ask the children to answer by drawing and naming the objects and writing down the objects used as a caption.
- Move on to page 11 and read the first line. Hold up the branch and a sheet of paper and explain they are going to read how you could change the branch into a piece of paper.
- Read the rest of the paragraph with the children and ask them about the processes in making paper. Look for answers about mixing the wood with hot water, separating the wood fibres, pressing the fibres and drying them.
- Move on to the last paragraph and let the children look at the pictures and compare the branch with their books.
- Ask the children to answer the second part of the question on page 11 (have newspaper, toilet paper, kitchen roll and blotting paper present but not prominently displayed so the children have to search a little for them). Write the children's answers on the board.
- Ask the children about what happens to most of the paper and look for an answer about it being thrown away. Ask what might happen to the trees if we just threw the paper away. Look for an answer about the trees would be used up and there would be no forests in which animals could live. Ask the children how the problem could be solved and look for an answer about recycling the paper.
- Ask how the paper should be treated to be recycled and look for answers about mixing with hot water, separating and pressing.
- Tell the children they are going to recycle some paper by following these instructions. Cut the toilet tissue paper into the smallest pieces that they can, half fill a bowl with water and add the pieces of paper. Stir the paper and water together with a spoon to make a pulp. Pour the watery pulp into a sieve then spread it on a cloth with a plastic knife. Press the pulp by rolling it with a rolling pin to make a sheet then leave it to dry on the cloth for at least a day. Carefully peel the dry sheet off the cloth. See if you can write your name on it.

Differentiation

Less confident learners may need help in identifying plastic objects. They could be given a plastic cup and pottery cup, a plastic ruler and a wooden ruler, a plastic bag and a piece of paper to help them distinguish the materials and focus on the properties of plastic. More confident learners could extend their drawing and writing work on plastics to include objects found in the home. Less confident learners will need help with each stage in the recycling of paper exercise.

4 Teacher's sheet 2D

Assessment

The children could be assessed on the presentation of their pictures and captions and the quality of their recycled paper. There is an assessment sheet for use at the end of lesson 3 and this lesson at the end of the guide (page 57).

Answer guidance

Metal comes from ore and is used for making coins, trams, roofs, statues, lampposts, towers.

Glass is made from sand and is used to make jugs, jars and tumblers.

Plastic comes from oil and is used to make cones, building blocks, balls, cups.

Paper comes from wood and is used to make books, writing paper and newspapers.

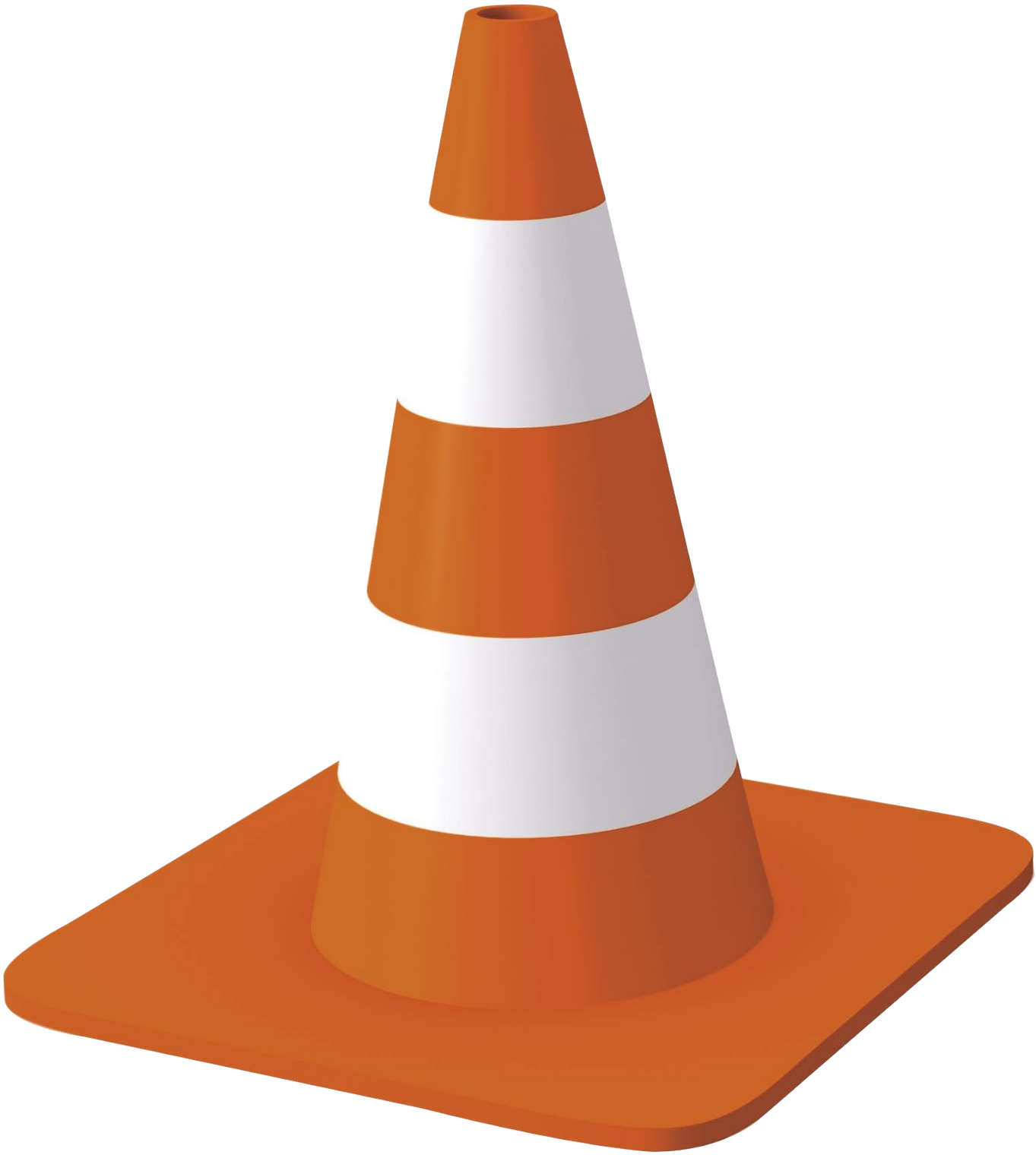
Plenary

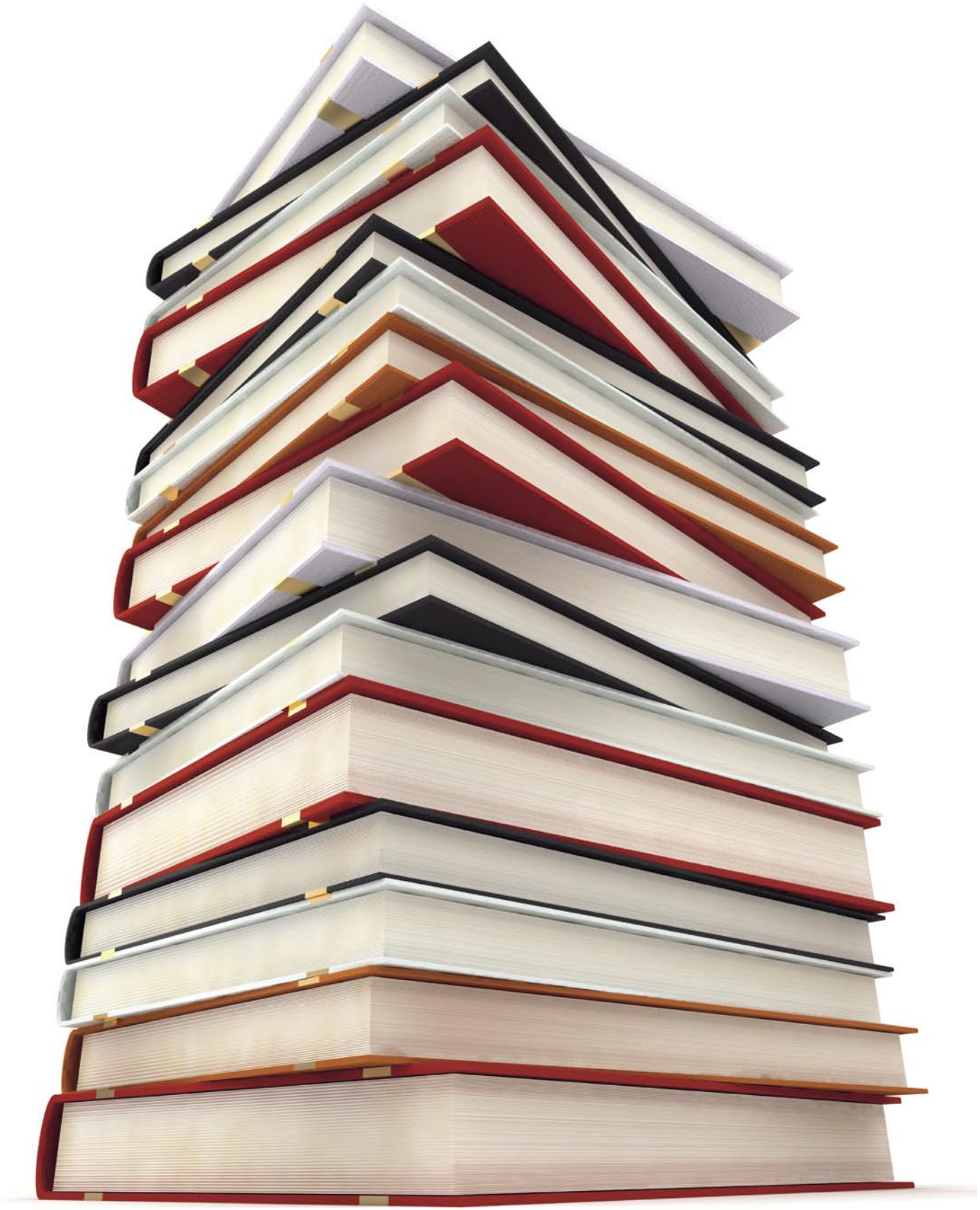
This could be deferred until the recycled paper is ready to be tested. The children could then display their work about plastic and peel off their recycled paper sheets and write on them. They could repeat the recycling experiment with newspaper and kitchen roll and predict whether the recycled paper will be a better or a poorer quality paper than that made from toilet tissue before they begin.

Outcomes

The children:

- Know how plastics are made.
- Know about the uses of plastics.
- Know how paper is made.
- Know about the uses of paper.
- Can follow instructions to make a product.
- Can carry out a fair test.
- Can make comparisons.





5 Teacher's sheet 2D

Changing shape

Objectives

- To know that objects made from some materials can be changed by cutting or filing the material.
- To know that objects made from some materials can be squashed, bent, twisted or stretched to change their shape.

Resources and preparation

A block of hard cheese, a chopping board, a knife and a cheese grater, electrical cable, paperclip. Each child will need a small ball of Plasticine. Each group will need a teacher helper for the children to discuss their ideas with. Each table will need a large piece of Plasticine to make part of a class model in the plenary.

Starting the lesson

Show the children the piece of cheese and put it on the chopping board. Ask them how you could change the shape of the cheese and look for an answer about cutting it. Produce the knife and cut the corners off the block to change its shape. Produce the cheese grater and ask how you could use it to change the shape of the cheese. Look for an answer about rubbing the cheese on the grater and then try it to round off the cut corners of the cheese. Tell the children that they are going to find out more about changing shapes.

Activities with pages 12 and 13

- Read the introductory sentence and reflect on how easy it was to change the shape of the piece of cheese.
- Read the first two lines of the paragraph and ask the children to look up filing in the glossary. Ask the children where they have seen a process similar to filing recently and look for an answer about grating the cheese. Ask the children to compare filing and grating and look for answers about in filing the object is held steady and the file is rubbed on it and in grating the grater is held steady and the object is rubbed.
- Read the last two sentences of the paragraph with the children and then look at the electrical cables and read their caption. Ask the children if they can see any cables in the classroom and look for answers about cables being connected to the computer and to the television and whiteboard projector.
- Let the children look at the picture of the paperclips and read the caption. Demonstrate the bendiness of copper and steel by bending an electrical cable which is not plugged in and unbending a paperclip.
- Move on to page 13 and look at the Plasticine models and read the caption.

5 Teacher's sheet 2D

- Issue the balls of Plasticine and ask the children what shape they will produce if they squash it. They may look at the picture of the dough to help them. Let the children test their predictions.
- Now ask them to predict the shape if they stretch it. Let them test their prediction.
- Ask the children to predict the shape when they twist the Plasticine and let them test their prediction.
- Ask the children to predict the shape of the Plasticine when they bend it and let them test their prediction.
- Ask the children to make a model of a dog and think about the processes they use such as rolling, squashing, bending, twisting and stretching. Do not let them use pencils to poke holes in the model as the use of pushing in this way is addressed in Lesson 2 of Science@School 2E Forces and movement.
- Let the children describe to you or your helpers the actions they used to shape the Plasticine dog.
- Move on to the picture of the boy and read the caption about clothes. Remind the children about looking at the fibres in yarn with a magnifying glass in lesson 2. If they did not do this activity, they could do it now.
- Ask the children to answer the question on page 13 and look for answers about elastic bands, foam sponges and paper.

Differentiation

Less confident learners may need help in predicting the changes in shape of the Plasticine balls. They may also need help making their model dogs. More confident learners may make a more complicated model but must discuss the processes they used in its construction.

Assessment

The children could be assessed on the way they describe the processes they use as they make their models.

Plenary

The children could display their models and perhaps decide upon a large model to make. The children on each table could make a part of the larger model, which can then be assembled. A spokesperson from each table can explain the processes they used in shaping their part of the model. Keep a few models for work with Science@School 2E Forces and movement, Lesson 2.

Outcomes

The children:

- Know that objects made from some materials can be changed by cutting or filing the material.
- Know that objects made from some materials can be squashed, bent, twisted or stretched to change their shape.
- Can describe the processes taking place in the construction of a model.

6 Teacher's sheet 2D

Heating materials

Objectives

- To know that materials often change when they are heated.
- To make observations and comparisons.
- To make a table and fill it in.

Resources and preparation

Chopping board, a large potato, potato peeler, knife.

Starting the lesson

Show the children a potato and ask them if it is ready for eating. They should warn you not to eat it. Tell the children that you are going to try and change the potato's shape and peel it. Show the children the potato and ask them if its shape has greatly changed. Look for an answer that its shape is still the same but smaller. Produce the knife and tell the children that you are going to cut up the potato to eat it. Cut up the potato into chips. Ask the children if the chips are ready to eat and look for an answer instructing you to cook them. Ask the children how cooking the chips will make them better to eat. Look for an answer about making them softer and also tell them that the heat brings about changes in the potato, which allows our bodies to digest it. Ask the children what happens when an egg is fried and look for an answer about the clear runny part turning white and solid.

Activities with pages 14 and 15

- Read the introductory sentence, the first paragraph, and then the first sentence of the second paragraph.
- Look at the picture of the sliced loaf and remind the children of how you cut up the potato to make it easier to put in the mouth.
- Let the children look at the pictures of the toasted slices and describe to you the colour changes as you move from left to right.
- Read the caption and tell the children that this information can be put into a table. Write the title 'Bread' and draw a table on the board with two columns. The heading of the left hand column is 'Before heating' and the heading of the right hand column is 'After heating'.
- Ask the children what should be written in the left hand column and, following their instructions, write in white, soft, bendy in the left hand column and brown, hard and brittle in the right hand column. Ask the children to find out what 'brittle' means in the glossary.
- Move back to the last sentence in the second paragraph and then on to the pictures and captions about the clay.

6 Teacher's sheet 2D

- Ask the children to write a table about 'How clay changes' in the style of the table you prepared about bread. Let the children make a table and fill it in. It should have the title 'Clay' and in the left hand column should be soft and bendy. In the right hand column should be hard and brittle.

Differentiation

Less confident learners will need help in making their table and filling it in. More confident learners could make a table about dough after looking at the picture of dough on page 13 and the loaf on page 14. They should put the title 'Dough' and in the left hand column write grey, squashy and stretchy. In the right hand column they should write brown, white, squashy and tears into pieces (you may like to help them with the last one by asking them what they do when they feed bread to ducks on a park lake).

Assessment

The children can be assessed on the presentation and detail in their tables. There is an assessment sheet at the end of the guide for use when lessons 6, 7, 8 and 9 have been completed (page 59). The answers are in the assessment section of lesson 9.

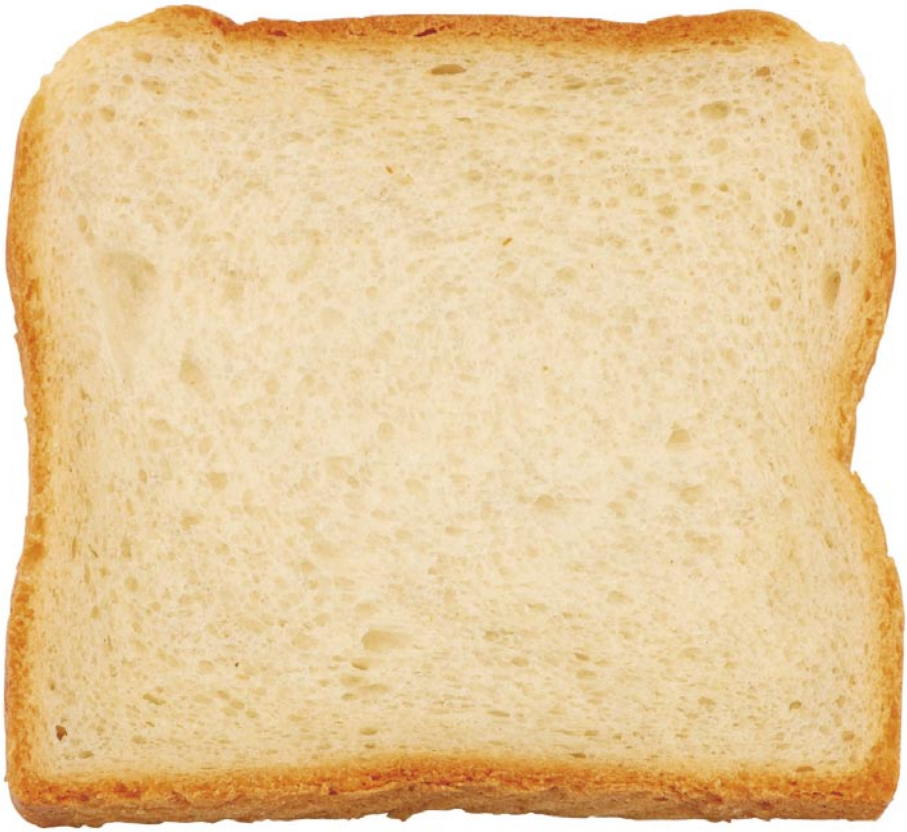
Plenary

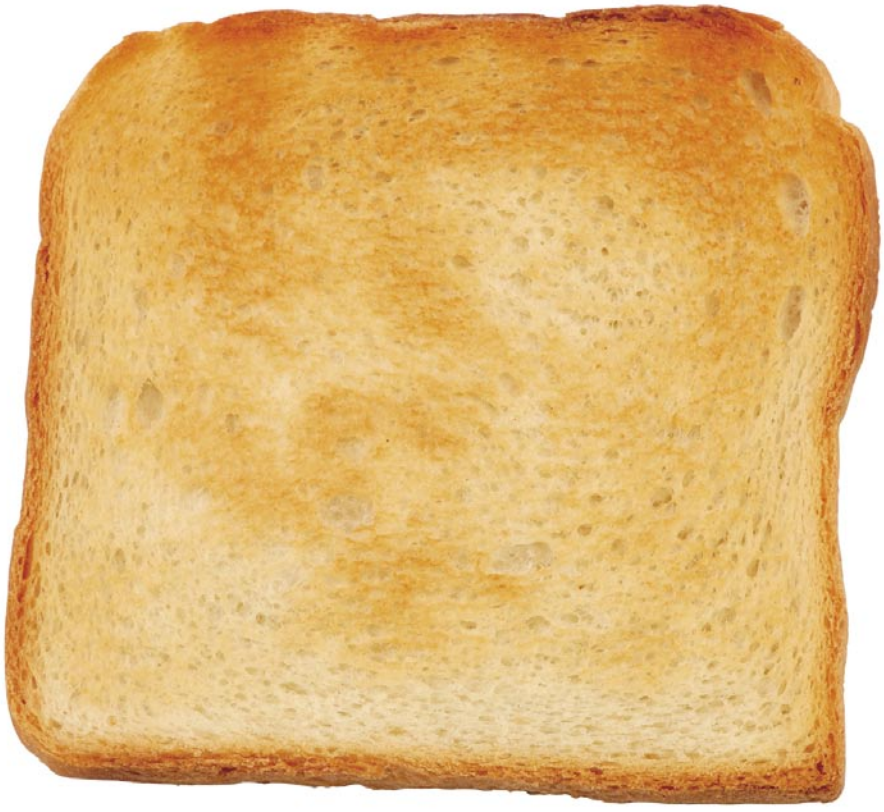
The children can display their tables. Ask them to answer the question on page 15. Their answers should include cups, saucers, jugs, plates, ornaments and plant pots.

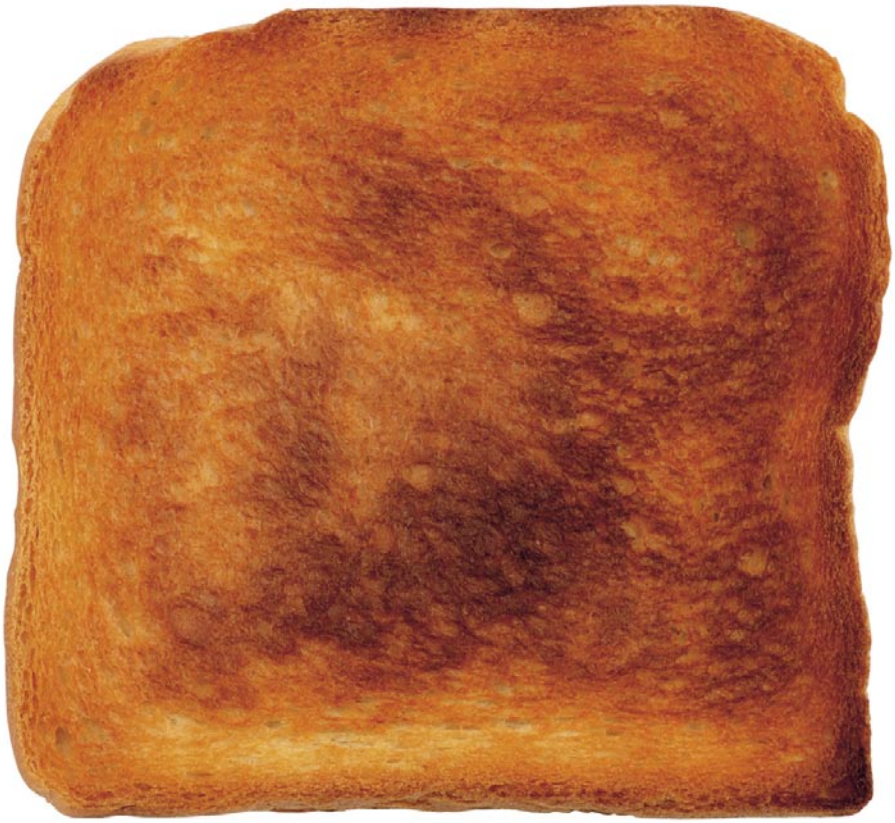
Outcomes

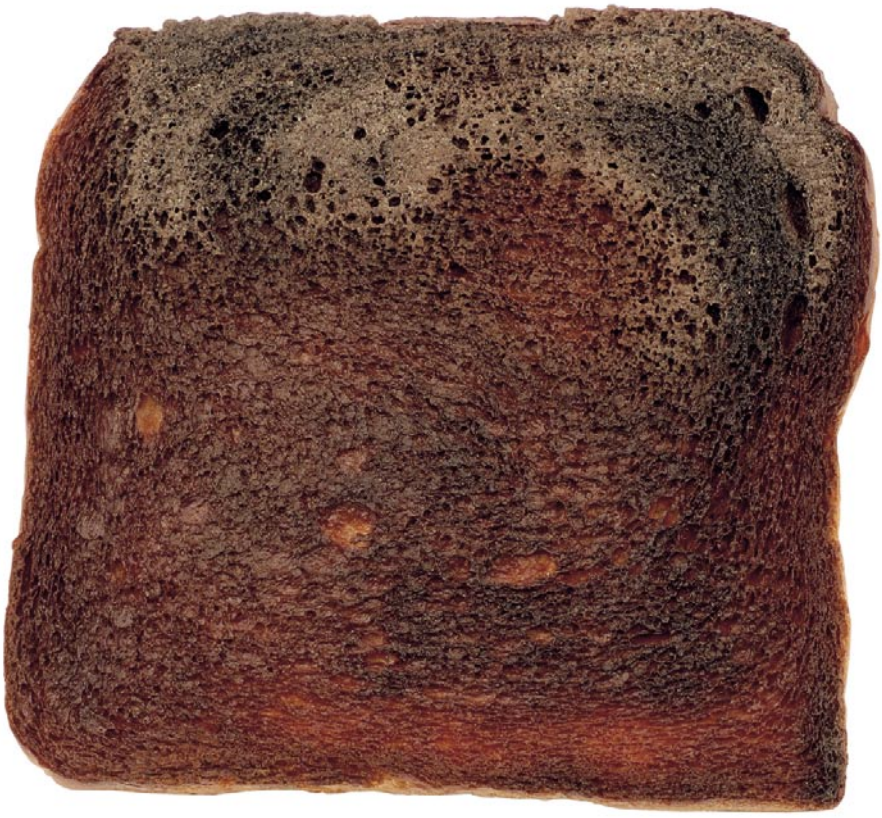
The children:

- Know that materials often change when they are heated.
- Can make observations and comparisons.
- Can make a table and fill it in.









7 Teacher's sheet 2D

Melting and freezing

Objectives

- To know that ice and water are two forms of the same material.
- To know that liquids freeze and form solids and solids melt and form liquids.
- To know that melting and freezing occur because of changes in temperature.

Resources and preparation

Ice cubes, a bowl, a piece of kitchen roll, a selection of solids (such as a brick, a wooden block, a plastic ruler, metal paperclip, a pottery cup), a selection of liquids (such as water, cooking oil, syrup), a bowl, a jug and a measuring cylinder to show how liquids change their shape, a fever strip (a forehead thermometer), a wall thermometer (a second wall thermometer – optional), a picture of a snowflake (see flashcards).

Starting the lesson

Show the children the bowl, kitchen roll and ice cubes. Tell the children that you are going to make an ice tower of ice cubes. Place the kitchen roll in the bowl (it stops the bottom ice cube sliding about) and pile ice cubes one on top of another as a child would do to make a tower of bricks. Ask the children to predict what will happen to the tower as you go through the lesson. Look for an answer about it melting and ask them what will happen as it melts. Look for an answer about getting smaller or falling over and let the children support one of these two predictions. Ask the children who have predicted that it will fall over to say how many minutes it will be before the tower falls. Let the children draw the tower or take a photograph of it. Repeat the drawings (on separate sheets of paper with the time marked on) or photographs every three of four minutes. Be prepared for the tower to fall in ten minutes.

Activities with pages 16 and 17

- Read the opening two lines with the children and show them a collection of solids and liquids. Ask the children how they can tell them apart and look for answers about liquids flowing and solids staying in one place. You may like to point out that solids have a fixed shape that does not change and liquids take up the shape of any container into which they are put.
- Read the first line of the paragraph and emphasise that ice is a solid and water is a liquid and the change from solid to liquid is all to do with temperature. Show the children a fever strip and let one of the children put it on their forehead. Let the children read the temperature displayed. Tell the children that the

temperature is measured in units called degrees centigrade. Also tell the children that our bodies work best at a certain temperature and they try to keep to it. If we have a fever our temperature rises and we feel ill.

- Show the children a wall thermometer and point out its scale of degrees. Tell them about the liquid in the thermometer that swells and shrinks as the temperature changes. Say that when it is very cold the liquid shrinks down to the zero on the scale and at this temperature water freezes and changes into ice. Tell the children that when it becomes a little warmer the temperature rises above zero and the ice melts.
- Return to the paragraph and read the rest of it with the children. Emphasise that the third and fourth sentences confirm what you have been telling them.
- Let the children look at the wall thermometer again and show them that the scale goes below zero. Ask the children what it would be like if the temperature was below zero and look for an answer about it being very, very cold.
- Move on to the picture and let the children look at the icicles and the scene. Ask them what they can see on the roofs of the buildings and look for an answer about snow.
- Read the first two lines of the caption with the children and ask them if they think the air around them is above or below zero. Look for an answer about it being above zero because there is liquid water.
- Read the last line of the caption and ask the children about the temperature of the air and look for an answer about it being below zero because the water has turned to ice.
- Move on to page 17 and look at the first two pictures and their captions. Let the children compare the condition of the ice cubes that formed the tower with the ice cubes in the photograph. If there is a difference in the two samples of ice cubes, ask them to account for it. Look for an answer about one sample having been melting for longer or one sample having warmer conditions than the other.
- Read the first two paragraphs about snow and let the children look at the picture of the snowman and the caption. Show the children a picture of a snowflake and point out that it has six arms. If the temperature is about zero the flakes pack together and make wet snow, which is good for making snowmen and snowballs. If the temperature is below zero the snow is drier and like powder and cannot be used for making snowmen and snowballs.
- Read the last paragraph and let the children look at the remains of the ice tower. Ask them to answer the question on page 17 and make sure they know that ice and water are the same material.

7 Teacher's sheet 2D

Differentiation

Less confident learners could look at the tower more frequently to notice changes but make drawings at the same time as other children. More confident learners could read the wall thermometer in the classroom every fifteen minutes, make a table with the column headings time and temperature (in °C) and fill it in. If you have two wall thermometers and a place on a window ledge where a thermometer can be placed and easily read from inside you may like the more confident learners to record changes in the outside temperature too.

Assessment

The children could be assessed on the accuracy of their drawings and sequencing. They could be assessed on their ability to read the temperature on a fever strip and on a wall thermometer. There is an assessment sheet at the end of the guide for use when lessons 6, 7, 8 and 9 have been completed (page 59). The answers are in the assessment section of lesson 9.

Plenary

Tell the children that a wall thermometer is used to tell the temperature of the air. Put the thermometer on a classroom wall and let the children read the temperature. Ask them if they think the temperature of the air inside the classroom is the same as the temperature of the air outside. Check their answer by taking the class outside, letting the thermometer settle for couple of minutes and then checking the temperature. Tell the children that scientists who study the weather keep their thermometers outside and measure the changes in the air temperature to help them forecast the weather. You may like to integrate this work into a simple study of the weather.

Outcomes

The children:

- Know that ice and water are two forms of the same material.
- Know that liquids freeze and form solids and solids melt and form liquids.
- Know that melting and freezing occur because of changes in temperature.
- Can sequence the stages of melting.
- Can read a wall thermometer.

8 Teacher's sheet 2D

Cooling and warming

Objectives

- To know that many materials gradually soften and melt as they get warmer.
- To know that many materials gradually harden and become solid as they cool.
- To know that the temperature of the surroundings affects the speed at which a material changes.

Resources and preparation

For starting the lesson take a sample of water from the cold tap and measure its temperature with a thermometer. Fill a jug with warm water (do not make it too hot as you will need a jug of warmer water for the plenary) and take its temperature.

Each group of children will need two plastic cups, one half full of cold water and one half full of warm water, and a stop clock. The warm water should be supplied from a jug and have had its temperature taken. You will need a supply of ice cubes of a similar size to drop into the cups for the children. For activities with the book – butter, knife, kitchen foil, bowl of ice cubes, bowl of warm water, smaller metal bowl to put in the larger bowl. Tray of sand, birthday candle, match.

Starting the lesson

Show the children a clear plastic cup of water and ask them what would happen if you put an ice cube in it. Look for answers about the ice cube melting because the temperature is above zero as there is water present. Ask the children what you should do to make the ice cube melt faster. Look for an answer about using warmer water and ask them how this idea could be tested. Construct a fair test with them establishing that two cups are required (with the same amount of water in them) but one cup containing warmer water than the other. The children should realise that ice cubes of the same size should be used and a stop clock should be used to record the time. Give out the cups of water and clocks to the groups of children. Take the temperatures of the two water samples and go round and drop one ice cube in each cup. The children should set the stop clock going and look at the ice cubes every minute, and more regularly as the one in the warmer water starts to melt quickly. It may take some time for the ice cube in cold water to melt so the children could use this time to write an illustrated account of their experiment.

Activities with page 18 and 19

- Read the opening statements with the children and move straight on to the paragraph.

8 Teacher's sheet 2D

- Look at the picture of the butter with the children and read the caption. You could take some butter, wrap it in kitchen foil and place it on top of some ice cubes in a bowl and ask the children to predict how the butter will change. You could also put some butter in a small metal bowl and place it in a bowl of warm water and ask the children to predict how the butter will change. You could leave the conclusion of this experiment until the plenary.
- Move on to page 19 and read the paragraph about chocolate with the children. Look at the photo of chocolate and read the caption. Ask the children if they have had any problems when carrying or eating chocolate. The children may tell you about chocolate melting in their pockets or their hands or if left in the sunshine.
- Ask the children how they can tell who has written a letter to them and look for an answer about the letter being signed. Tell the children that signatures can be copied so in the past to make sure a letter was not a fake, the writer melted wax, sealed the letter with it and pressed an object like a ring into it. The object made a mark, which could not be copied so the person who received the letter knew exactly who it had come from.
- Look at the picture of the seal and read the caption with the children. Let the children find out more about wax in the glossary.
- Move on to the picture of the candle and read the caption. Set a birthday candle securely in a tray of sand and light it. Let the children watch it from a safe distance and point out when the candle makes wax icicles.
- Ask the children to answer the question on page 19 and look for an answer about stone, brick, metal (as in an oven).

Differentiation

Less confident children may need help in describing and drawing their experiment. They may need to be shown to look closely to see the ice melting. More confident learners could present the experiment as a sequence of events such as filling the cups with water and recording their temperatures, receiving the ice and starting the clock, noting the time when each ice cube melted. They could write their own conclusion.

Assessment

The children could be assessed on their behaviour in carrying out the experiment and its presentation. There is an assessment sheet at the end of the guide for use when lessons 6, 7, 8 and 9 have been completed (page 59). The answers are in the assessment section of lesson 9.

8 Teacher's sheet 2D

Plenary

Ask the children what would happen if you used water that was a few degrees, perhaps ten degrees, warmer than in the first experiment. Look for an answer about it melting faster. Ask the children to predict how long it would take the ice cube to melt in the warmer water and then repeat the experiment as a class demonstration and let the children compare their predictions with the result.

Outcomes

The children:

- Know that many materials gradually soften and melt as they get warmer.
- Know that many materials gradually harden and become solid as they cool.
- Know that the temperature of the surroundings affects the speed at which a material changes.
- Can make a report on an experiment.

Steam

Objectives

- To know that steam is produced when water boils.
- To know that steam cannot be seen.
- To know the white clouds people call steam are really made from tiny drops of water.

Resources and preparation

A kettle, a plate kept in the fridge, an oven glove, a model steam engine, a picture of a wind turbine on a wind farm, a toy windmill (as bought at the seaside).

Starting the lesson

Ask the children what they can tell you about steam. They may mention that it comes from kettles and pans in the kitchen and it fills a bathroom after someone has had a hot shower or bath. Some children may tell you about a trip on a steam train. Tell the children that what they call steam is really something else and real steam is invisible.

Activities with pages 20 and 21

- Read the introductory sentence with the children and ask if anyone mentioned boiling when they were talking about steam at the start of the lesson.
- Read the first paragraph with the children and look at the picture of the pan and its caption. Let them consolidate their ideas about boiling by looking it up in the glossary. Ask the children what they can see inside the bubble and steer them to an answer that nothing can be seen in the bubbles. Ask the children to say what they would see if steam was really the white cloud that everyone thinks. Look for an answer about the bubbles being full of the white cloud.
- Read the second paragraph with the children and look at the photograph of the kettle and read the caption. Point out that there is a small gap between the kettle spout and the start of the white cloud and that steam is in that gap. Tell the children that as the steam shoots away from the spout it cools very quickly and forms the tiny water droplets.
- Keep the children at a safe distance and set a kettle boiling. Put on the glove and show the children the dry plate. When the white cloud appears, put part of the plate into it for a few moments and then take it out. Switch off the kettle and remove to a safe place before showing the children the water on the plate. Tell the children that the water has come from the droplets in the white cloud.

- Move on to page 21 and read the first two lines then look at the picture of the geyser and read the caption about it. Remind the children that the white cloud is made of tiny water droplets and that steam is very close to the opening of the geyser like the steam was very close to the opening of the spout of the kettle.
- Read the remainder of the paragraph and look at the steam train and caption with the children. Ask them to find out more about pressure in the glossary. Show the children the model steam engine and tell the children that the steam can be made to blow along pipes to the pistons and push them backwards and forwards to turn the wheels.
- Show the children the picture of a wind turbine and tell them that as the blades turn they make electricity in a machine called a generator which is behind them on the tower. Ask the children why the wind turbine might not make electricity every day and look for an answer about some days being still.
- Tell the children that inside a power station there is a boiler which is like a giant kettle and it produces huge amounts of steam both day and night. The steam is led to turbines connected to generators and as it spins the generators they make electricity.
- Tell the children that they can pretend to be a power station by blowing on a windmill. The air they blow out of their mouth is like steam rushing out of the boiler and the windmill is like the turbine connected to the generator. Pass the windmill round and let each child pretend to be a steam driven power station.

Differentiation

Less confident learners may need extra help in understanding that steam cannot be seen. More confident learners could use secondary sources to find out about steam engines and steam ships.

Assessment

The children could be assessed on their contribution to the discussions about steam and the research into steam engines and steam ships. There is an assessment sheet at the end of the guide for use when lessons 6, 7, 8 and 9 have been completed (page 59).

Answer guidance

1. Bread becomes browner and crisper.
2. Clay becomes hard and brittle.
3. Butter melts and becomes soft.
4. Chocolate melts and becomes soft.
5. Wax melts and changes into a liquid that flows.
6. Ice melts and changes into liquid water.
7. It changes into steam.
8. Tiny water droplets (not steam).
9. It freezes and turns to ice.

Plenary

Review the children's knowledge of steam. Remind them about how water turned into a solid – ice – when it froze and tell them the temperature at which it froze was 0°C and is called the freezing point of water and the melting point of ice. Remind them about the temperature of the warm water they used in the experiments in lesson 8 and tell the children that the water doesn't boil when it is 30, 40, 50, 60, 70, 80 or 90 degrees but at 100°C. This temperature is known as the boiling point of water. You may mention that other materials have different freezing and boiling points from water. Ask the children to answer the question on page 21 and remind them that their body works best at a certain temperature – about 37°C. They should answer that as steam is at such a higher temperature than the body it can harm the body and should be avoided. You may wish to mention that steam can scald the skin and children should keep away from places where water is boiled.

Outcomes

The children:

- Know that steam is produced when water boils.
- Know that steam cannot be seen.
- Know the white clouds people call steam are really made from tiny drops of water.

Assessment

Name: .....

Natural materials

Describe the following materials and say what they are used for.

Wood

.....

.....

Used for .....

Stone

.....

.....

Used for .....

Wool

.....

.....

Used for .....

Assessment

Name: .....

Metals and glass/ Plastic and paper

Where do the following materials come from and what are they used for?

Metal

Comes from .....

Used for .....

Clay

Comes from .....

Used for .....

Plastic

Comes from .....

Used for .....

Paper

Comes from .....

Used for .....

Assessment

Name: .....

Heating, melting, freezing, cooling, warming and steam

1. How does bread change when it is heated?

.....

2. How does clay change when it is heated?

.....

3. What happens to butter when it is warmed?

.....

4. What happens to chocolate when it is warmed?

.....

5. What happens to wax when it becomes hot?

.....

6. What happens to ice when it becomes warm?

.....

7. What happens when water boils?

.....

8. What makes white clouds above a kettle?

.....

9. What happens when water gets very cold?

.....