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Keeping warm and cool

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Key to interactive features

Press on Teacher's Resources title above to go straight to Contents.
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You will also find yellow arrows throughout that allow you to:

- go back to previous page
- go forward to next page
- go back to contents

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Curriculum Visions

A CVP Teacher's Resources
Interactive PDF

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Contents

Section 1: Resources

Welcome to the Teacher's Resources for *Keeping warm and cool*. The resources we provide are in a number of media:

1 Keeping warm and cool is the full-colour paperback book that introduces the concepts of heat and temperature. The way heat moves is examined in detail and each method of heat transfer – conduction, convection and radiation, is presented by clear diagrams and fascinating experiments.

3 You can buy various Science @School sets, for example Year 3 set, KS2 class book set, KS2 TG set or the complete Book Box set.

2 Our Learning Centre at

www.curriculumvisions.com

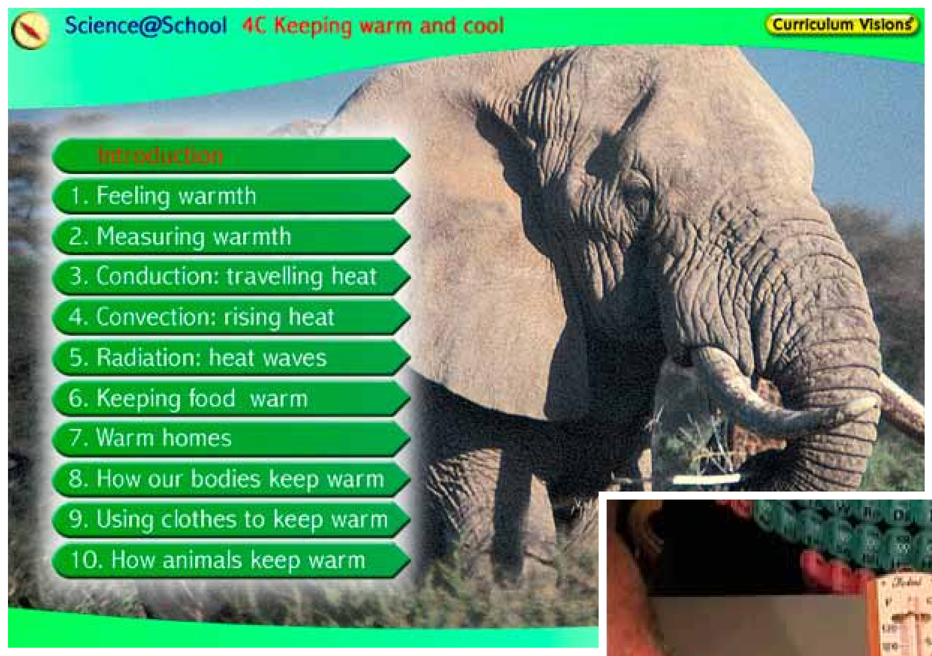
has almost everything you need to teach your primary curriculum in one convenient Virtual Learning Environment.

You can use support videos, e-books, picture and video galleries, plus additional Creative Topic books, graphic books called Storyboards, and workbooks. Together they cover all major curriculum areas.

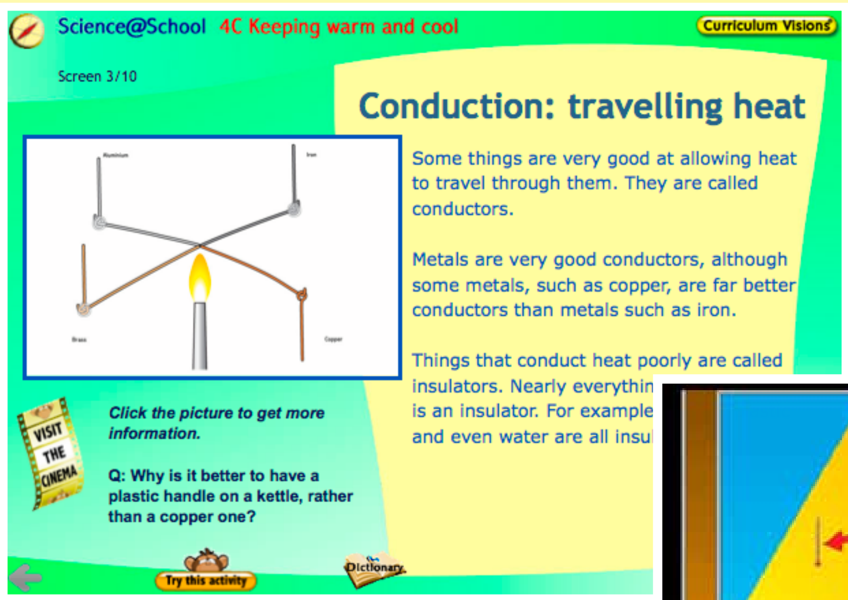
All topics are easily accessible, and there is a built-in context search across all media.

You can also use our printed student books online as part of your subscription to the Learning Centre. There page-turning versions of every printed Curriculum Visions book for use on your whiteboard.

▼ The Keeping warm and cool home screen



▲ 'Classroom cinema' video



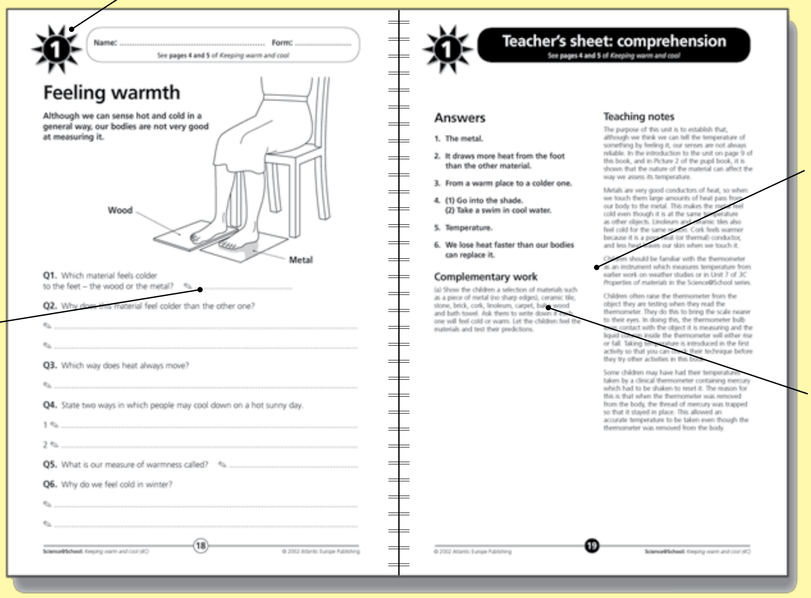
▲ Web site page

▶ Web site caption

▼ ***Each unit has one comprehension worksheet and one activity worksheet, each with a teacher's sheet.***

▶ ***The photocopiable comprehension worksheet and supporting teacher's sheet.***

Unit number.

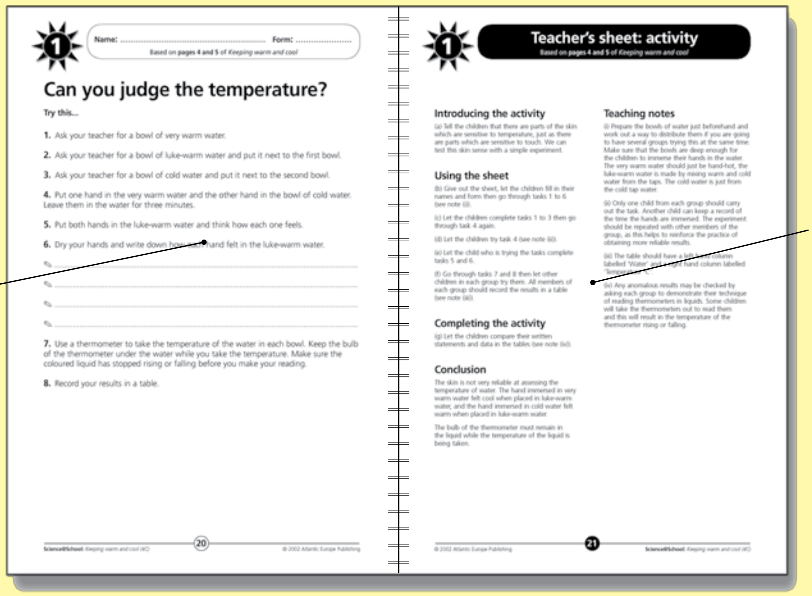


Left hand page is to photocopy and hand out to pupils.

Right hand page is the teacher's sheet and provides answers, suggestions for complementary work and teaching notes.

Resources needed to support the complementary work are shown in List 2 on page 15 of this Teacher's Guide.

▶ ***The photocopiable activity worksheet and supporting teacher's sheet.***



Left hand page is to photocopy and hand out to pupils. For some activities, pupils will also require additional sheets of paper.

Right hand page is the teacher's sheet and provides a detailed activity plan, conclusion and teaching notes. *Resources needed to support the activity worksheet are shown in List 3 on page 15 of this Teacher's Guide.*

Matching the curriculum

This book covers the keeping warm component of the curriculum in a way that is highly relevant to work in the lower junior classes of a primary school. It extends the introduction made in *3C Properties of materials* on insulation and builds a firm foundation for later work on materials and how they change.

The children are first introduced to the concept of themselves as heat detectors, then the thermometer is revealed as a more reliable device. In order for the children to understand thoroughly how heat moves, each of the methods of heat transfer is presented.

Heat is vital to all living things and the way our bodies, and the bodies of other animals, control it to survive completes the study.

While covering the subject matter of the curriculum, *Keeping warm and cool* also facilitates the development of investigative skills both in the pupil's book and the *Teacher's Guide*.

The pack is fundamentally built around the idea that heat flows through our environment, and we have ways of detecting and controlling heat that help us survive.

Section 2: The pupil book explained unit by unit

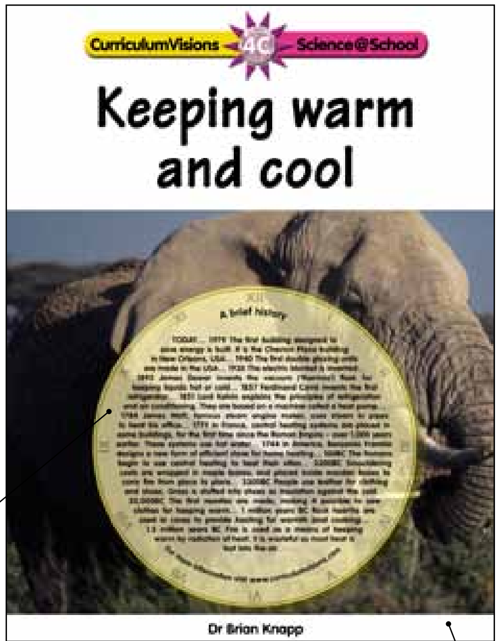
Although the pupil book – *Keeping warm and cool* – is clear and simple, a great deal of care and thought has been given to the structure and the content of each double page spread or unit. The worksheets and activities in this *Teacher's Guide* also link directly to the pages in *Keeping warm and cool*.

It is possible to use *Keeping warm and cool,* and the worksheets and activities, without reading this section, but we would strongly recommend that you take a short time to familiarise yourself with the construction of the pupil book.

The units are arranged in sequence, to help you with your lesson planning. In this section, a brief description of the content of each unit is given, together with hints on how to start or support it. List 1 (Starting a unit with a demonstration) on page 15 sets out the resources that you could use to do the demonstrations where suggested. The activity associated with each unit is also briefly described to help you see how the unit and activity work together.

Title page

The book begins on the title page (page 1). Here you will find information about science and technology in the form of a clock. You may want to use this to set the scene for the study of the book's contents. You may choose to focus on an event which ties in with your work in history, before moving onto the rest of the book. Alternatively, you may wish to skip over this page and return to it later. It is not a core part of the book, but helps the children see how the work they are doing now fits in with the work of scientists and engineers in the past. It may also be used to stimulate more able pupils to research the people and events that are described here.



A time clock giving additional historical information about the topic.

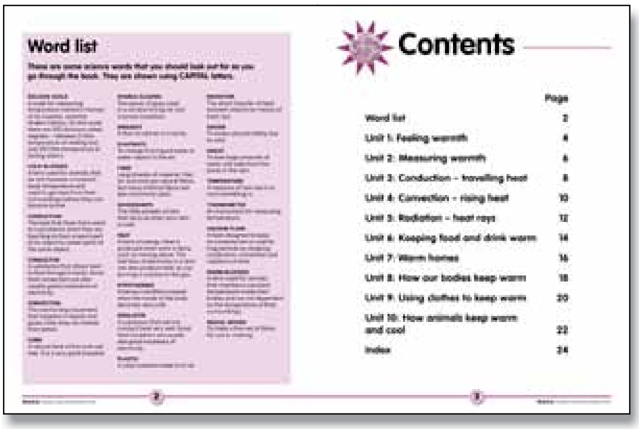
The picture shows an elephant and links to page 23.

Word list and contents

The core content of the book begins with a word list on page 2. This is a glossary, brought to the front for the pupils' attention. Pupils could be encouraged to look at the list and see how many of the words they already recognise.

One of the important things about science is the precision with which words are used. However, many scientific words are also common words, often used in a slightly different way from how they would be used in science. The word list presents the opportunity for pupils to consider the words they already know, and the meanings they are familiar with.

When your teaching unit has been completed, you may want to invite pupils to revisit this list and see if their understanding of the words has been enhanced or changed in any way. A visual dictionary is also given on the CD.



The entire contents are shown on page 3. It shows that the book is organised into double page spreads. Each double page spread covers one unit.

The units

Heading and introduction

Each unit has a heading, below which is an introductory sentence that sets the scene and draws out the most important theme of the unit.

Body

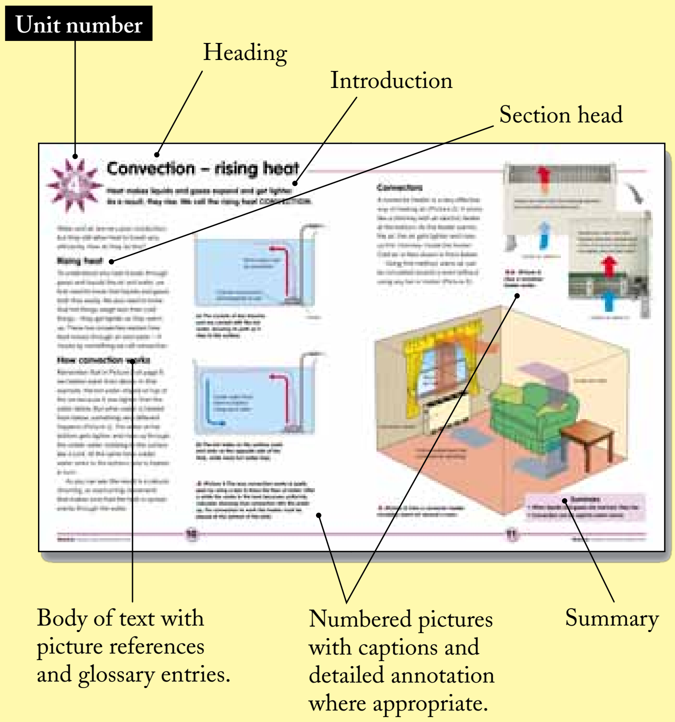
The main text of the page then follows in a straightforward, easy-to-follow, double column format.

Words highlighted in bold capitals in the pupil book are defined in the word list on page 2. A visual dictionary is also given on the CD.

The glossary words are highlighted on the first page on which they occur. They may be highlighted again on subsequent pages if they are regarded as particularly important to that unit.

Summary

Each unit concludes with a summary, highlighting and reinforcing the main teaching objectives of the unit.

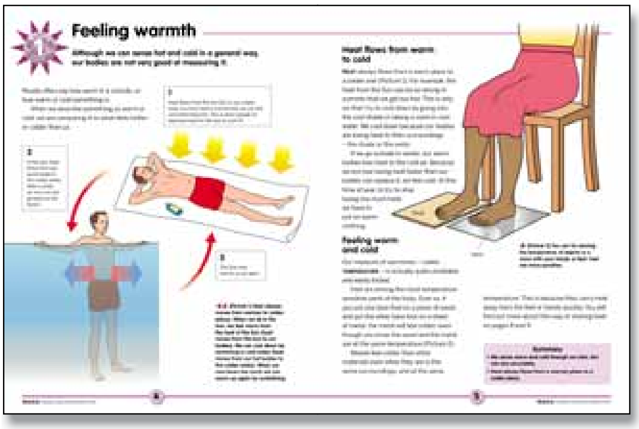


1 Feeling warmth

You may wish to introduce this unit by holding up a metal drink can and one coated in polystyrene. Ask the children to predict which one feels colder and to write down their prediction. Pass the cans round the class so the children can feel them, then ask how many made the correct prediction. Conclude this introduction by asking the children what this experiment tells us about our skin. Look for the answer that it can tell us if things feel hot or cold.

The unit begins by introducing the idea that we determine whether something is hot or cold by comparing it to how hot or cold we feel. The text moves on to establish that heat always flows from a warm place to a cooler place. The unit concludes that metal draws more heat from us than many other materials and this makes it feel cold even though it is at the same temperature as other materials.

The unit is supported by complementary work in which the children predict how warm different materials will feel before they touch them. In the practical activity the children discover how the skin can deceive them when detecting heat. They also learn the correct way to take the temperature of a liquid.

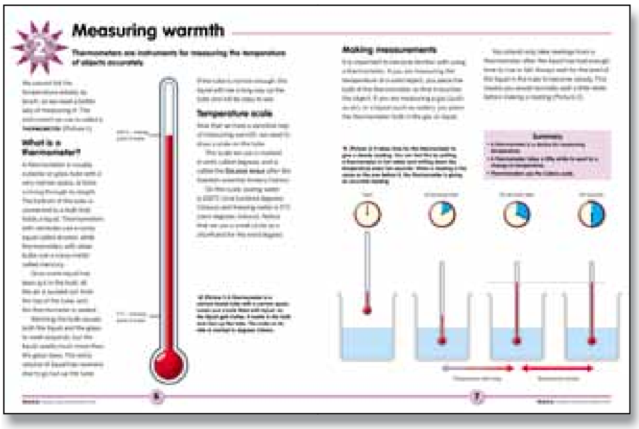


2 Measuring warmth

This unit builds on the last by introducing the thermometer as a reliable way of measuring temperature. You may like to begin by showing the children a fever strip, and by letting some children try them. You can discuss the advantages and limitations of the strip and compare it with a school thermometer, which allows a wider range of readings. If you broaden the discussion to taking body temperature, you may mention the clinical thermometer and newer devices which record the temperature in the ear.

The unit begins by describing the two kinds of liquids commonly used in thermometers – mercury and coloured alcohol. The text moves on to introduce the Celsius scale, and the freezing point and boiling point of water, before providing instructions on how to take accurate readings.

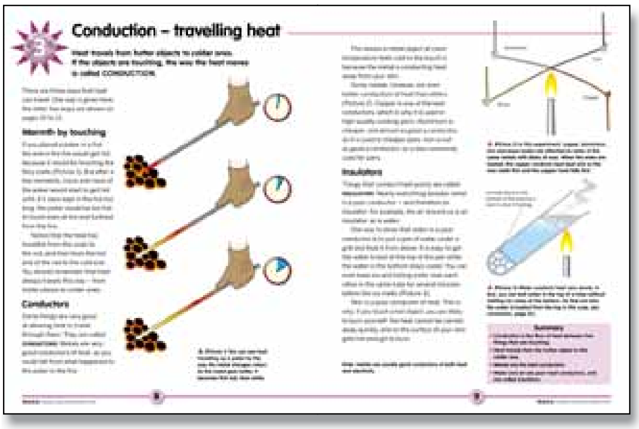
In the first complementary activity, the children take the temperature in different places around them. In the second complementary activity, they can use secondary sources to find out more about Anders Celsius. In the practical investigation, the children discover how the temperature of cold water, and warm water, changes to that of room temperature over a period of time.



3 Conduction – travelling heat

You could begin by showing the children a set of cooking utensils such as spoons, slotted spoon, ladle, fish knife, fork and tongs. Make sure they have wooden or plastic handles. Ask the children why the utensils do not have metal handles, and look for the answer that the materials in the handles do not get hot. Show the children a wooden spatula or spoon and ask why it is only made from one material. Look for the answer that the wood does not let heat pass through it from the pot to the hand.

Begin the unit by formalising the transfer of heat between objects that are touching as conduction. The conduction of heat along a poker clearly illustrates how heat travels by conduction. The term conductor is introduced, and an experiment to compare the heat conduction in four metals is described. The term insulator is also introduced and is illustrated by an amazing experiment in which ice and boiling water can share the same test tube.

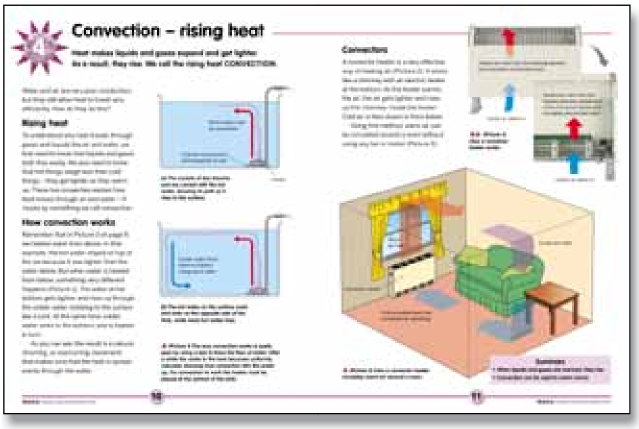


In the complementary activities, the children research pan design and use mime to show how heat is transferred by conduction. In the practical investigation, the children compare the conduction of heat through spoons made from different materials by seeing how long butter takes to melt in each one.

4 Convection – rising heat

Light a night light candle in a sand tray and ask a child to put his or her hand about forty centimetres above it. Ask the child to move their hand to the left and right, and to tell the class when their hand feels hot or cold. The child should say that the hand felt hot directly above the candle flame but cooler on either side. You could then say that if the heat was travelling by conduction, the air all around the candle would be hot, so another way of moving heat must be taking place. If you light an extra long cook's match and blow it out, you can show smoke to the children. This rises straight up and suggests that it is carried by the air.

The unit begins by stating that air and water are both bad conductors of heat, then moves on to explain the process of heat transfer by convection. This is illustrated by following the path of a dye in a tank of water. The working of a convection heater is described in text and photographs, and the circulation of air in a room by convection currents is clearly illustrated.

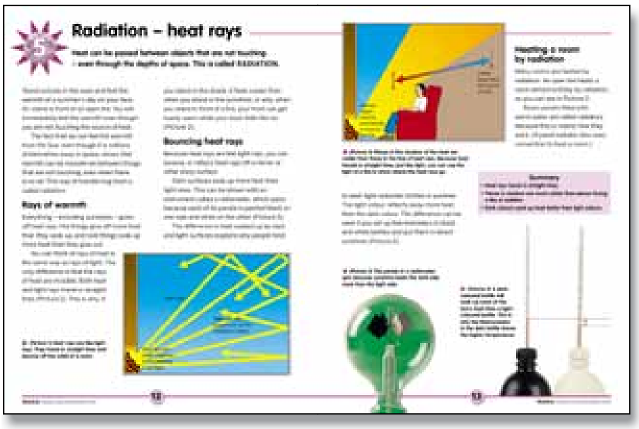


In the complementary work, the children mime the movement of the air and set up a 'convection current'. In the practical activity, the children make a convector detector and use it to find warm, rising air.

5 Radiation – heat rays

Show the children a desk lamp with the bulb turned upwards. Ask the children what they might feel if they held their hand above the bulb. They should tell you that their hand will feel hot because of warm air rising from the bulb by convection. Now turn the bulb to point downwards and ask the children what they will feel this time. Some children may say that it will be cold because the warm air is not rising from it. Ask a few children to hold their hand about twelve centimetres below the bulb. They should feel the heat. Say that this heat passes from the bulb to the skin by radiation.

The unit begins by describing how heat from the Sun reaches us by radiation, and makes the point that radiation can pass through both air and space. The text goes on to explain that everything gives off heat by radiation, and compares the way heat rays and light rays move. The different absorbing powers of dark and light surfaces are compared, and the way a room can be heated by radiation is discussed and illustrated.



In the complementary work, the children can mime the action of radiation and show how a body receiving heat by radiation becomes hot. The practical activity allows the children to compare the absorbing power of black and white plastic by making plastic and margarine 'sandwiches'.

6 Keeping food and drink warm

The children may have already studied insulation in their work on the properties of materials. If they have, you could remind them of this, then set the context in the study of keeping foods warm or cool. You could fill a thin-walled plastic cup and a thick-walled plastic cup with very warm water, challenge the children to predict which one will cool down first, then let children take temperatures of the water in the cups at regular intervals.

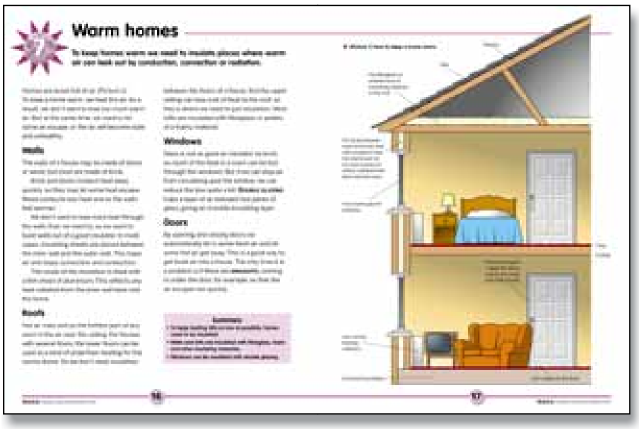
The unit begins by reminding the children about the three ways that heat can travel. It then moves on to look at how we can control heat flow to keep foods warm or cool, such as by using egg cups. You can use plastic cups to take this idea further (compare thin plastic, foamed plastic and hollow plastic). The vacuum flask is introduced by considering how Sir James Dewar experimented with controlling heat flow. The structure of the flask is clearly illustrated by a photograph of the inside of the flask, and a labelled diagram.

In the complementary activity, the children can use secondary sources to find out about the life of Sir James Dewar. The practical activity allows the children to plan and carry out an investigation into how different materials slow down the melting of ice cubes.

7 Warm homes

You could begin by asking the children to estimate the temperature of the classroom in °C. Ask them to write down their estimate, then show the children a thermometer which has been resting on your desk. The children may say that the temperature varies inside the room, so issue thermometers to let the children test this idea. They may find that their idea is correct. This activity could be extended to examine the temperatures in different parts of the school, and to compare these temperatures with the temperature outside.

The unit begins by describing the home as made of boxes of air. The text moves on to balance the need to keep the air warm, with the need to prevent the air becoming stale and unhealthy. The role of the walls, roof, windows and doors in keeping rooms warm is described, and the arrangement of insulating materials in the home is illustrated by a clear, full-page diagram.

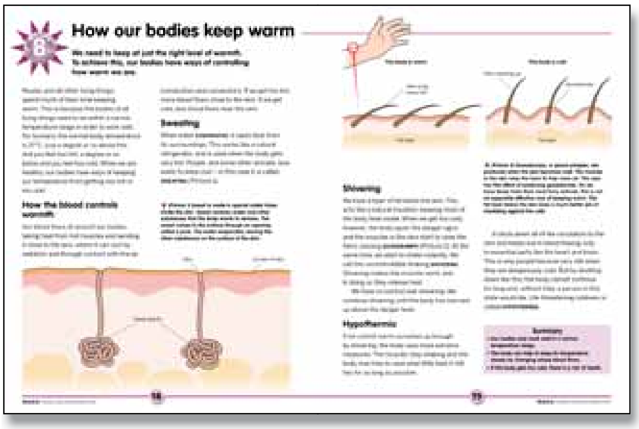


In the complementary activity, the children use secondary sources to research how homes in different parts of the world are designed to keep warm or cool. In the practical activity, the children investigate the effect of insulation in the wall of a model room.

8 How our bodies keep warm

You may like to begin by asking some of the children to put water from the cold tap on the back of their right hands. They should leave their hand a minute, so the water can warm up, then gently blow on the back of first their left hand, and then their right hand. They should find that the back of their right hand feels colder than the back of their left hand. Tell the class that they don't really need to cool off because their body does it for them.

The unit opens by describing how the human body needs to stay at a certain temperature to work properly. The text moves on to describe how the blood controls the body's warmth and how sweat is used to cool us down. The role of fat as a natural insulator is described. The raising of goosebumps as an early sign that we are too cold is discussed and illustrated, then the purpose of shivering is explained. The unit ends by discussing hypothermia and how the body changes as it responds to life-threatening coldness.



In the complementary activities, the children use secondary sources to find out about how the blood moves round the body and how muscles work. In the practical activity, the children investigate how the size of the body affects the way it loses heat, and why special care has to be taken to keep babies warm.

9 Using clothes to keep warm

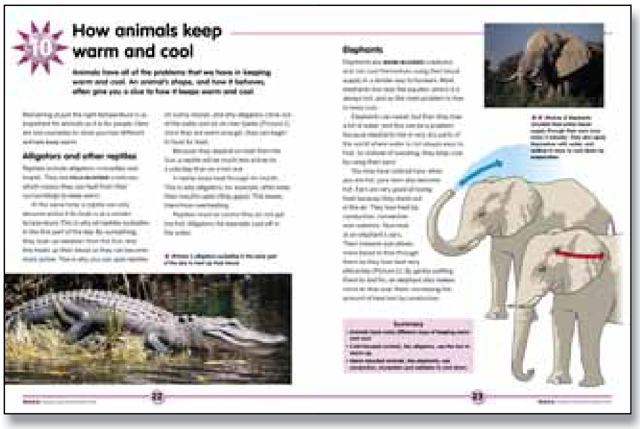

Using clothes to keep warm

Begin by taking the view that clothes which have holes and air spaces in them will not be much good at keeping in heat. Ask some children to remove their socks from their left feet. Give each child a plastic carrier bag and ask them to wrap it round their foot like a sock. They can use sticky tape to hold the bag in place. The children can put their shoes on again while you begin to read the unit.

The unit begins by saying that keeping our bodies warm is more complicated than keeping homes and food warm because we have to think about comfort as well as warmth. When you have read this, ask the children with the shopping bag 'socks' if they are comfortable and carry on reading the next section. This deals with wearing plastic and as you read it some of the children may agree with the author that wearing plastic is uncomfortable. At this point let the children remove the bags and feel their feet to see if they are clammy, as the text suggests. When the children have put on their proper socks again, read the sections on letting clothing breathe.

In the complementary work, the children can find out how people in different parts of the world keep warm. In the practical activity, the warmth-holding properties of different cloths are compared.

10 How animals keep warm and cool


How animals keep warm and cool

Ask the children if they can remember the temperature of a healthy human body. Use a fever strip to check the temperature of one child and then ask the class what would happen if they put the fever strip on a reptile. Show the class a large beaker of water that has been on your desk for sometime and say that it represents a reptile such as a lizard or crocodile. Ask a child to apply the fever strip to it. The range of the fever strip is too limited to give an accurate reading, so put a thermometer in the water to take the 'reptile's' temperature. Ask another child to take the temperature of the air in the classroom. Both temperatures will be similar. From this, establish that a reptile's temperature is the same as its surroundings.

The unit opens by stating that it is just as important for animals to have their bodies at the right temperature as it is for us. This is developed by showing how cold-blooded animals, such as alligators, control their body temperature. The temperature-controlling activities of the elephant, a warm-blooded animal, are also described and illustrated.

In the complementary activities, the children can investigate the temperatures above and below the surface of the ground, and use secondary sources to find out how mammals survive when they hibernate. In the practical activity, the children make a model reptile and mammal, and investigate how body covering conserves body heat.

Index

There is an index on page 24.

Section 3: Using the pupil book and photocopiable worksheets

Introduction

There is a wealth of material to support the topic of keeping warm and cool in the pupil book and in the *Teacher's Guide*. On this and the following three pages, suggestions are made on how to use the worksheets and their associated teacher's sheets on pages 18 to 57, and how to integrate them for lesson planning. On the page opposite you will find the resource lists for introductory demonstrations, the complementary work and the activity worksheets. The learning objectives are shown on pages 16 and 17.

Starting a unit

Each unit in the pupil book forms the basis for a lesson. You may like to start by reading it with the class, or begin with a demonstration (see pages 7 to 13 and List 1 on page 15). Always begin the unit by reading the introductory sentences in bold type. This helps focus the class on the content of the unit and to prepare them for the work.

The first part of the main text introduces the content, which is then developed in the headed sections. The illustrations are closely keyed to the main text, and the captions of the illustrations develop the main text content (*see* 'The units' at the bottom of page 8).

With less skilled readers, you may prefer to keep to the main text and discuss the illustrations when they are mentioned. With more skilled readers, you may want to let them read the captions for themselves. Each unit ends with a summary. The children can use this for revision work. They can also use it to test their understanding by trying to explain the points made in the summary.

You can find the learning objectives for each unit on pages 16 and 17 of this *Teacher's Guide*.

The style and content of the unit also make it suitable for use in literacy work, where the needs of both English and science are met. You may wish to use the unit as a topic study in literacy work, or you may want to perform an activity in science time and follow it up with a study of the unit during literacy work.

Using the comprehension worksheets

Each unit in the pupil book has one photocopiable comprehension worksheet in this *Teacher's Guide* to provide a test. The learning objectives on page 16 are for these comprehension worksheets and relate directly to the knowledge and understanding component of the science curriculum.

The comprehension worksheets begin with simple questions and have harder questions towards the end.

The worksheets may be used singly, after each unit has been studied, or they may be used along with other worksheets to extend the study.

The teacher's sheet, which is opposite the comprehension worksheet, shows the answers and background information to the unit. This teacher's sheet also carries a section on work complementary to the study topic. This work may feature research using other sources. It may also have value in literacy work.

Using the activity worksheets

The activities are designed to develop skills in scientific enquiry. The learning objectives for practical skills associated with each unit are given on page 17. The activities may be small experiments, may focus on data handling or comprise a whole investigation.

Each activity section is a double page spread in this *Teacher's Guide*. On the left hand page is a photocopiable activity worksheet to help the children in practical work, or it may contain data for the children to use or interpret. The page opposite the worksheet is a teacher's sheet providing a step-by-step activity plan to help you organise your work. Each plan has a set of notes which provide hints on teaching or on the use of resources. The activity plan ends with a conclusion, which you may like to read first, to help you focus on the activity in your lesson planning.

Planning to use a unit

The materials in this pack are very flexible and can be used in a variety of ways. First, look at the unit and activity objectives on pages 16 and 17. Next, read the unit in the pupil book, and the associated worksheet and activity units in this *Teacher's Guide*. Finally, plan how you will integrate the material to make one or more lessons. You may wish to add more objectives, or replace some of the activity objectives with some of your own.

Safety

The practical activities feature equipment made from everyday materials or available from educational suppliers. However, make sure you carry out a risk assessment, following the guidelines of your employer, before you do any of the practical activities in either the pupil's book or the *Teacher's Guide*.

Resources

The three lists below show the resources needed to support the photocopiable worksheets.

- List 1 shows resources for demonstrations suggested for starting a unit.
- List 2 gives resources needed for the complementary work featured on the teacher's sheet associated with each comprehension worksheet.
- List 3 details those resources needed for the 10 activity worksheets.

List 1 (Starting a unit with a demonstration)

▼ UNIT

1. Metal drinks can, similar drinks can coated in polystyrene.
2. Fever strips.
3. Kitchen and barbeque utensils such as a spoon, slotted spoon, ladle, fish knife, fork, tongs. They need to have different materials such as wood, or plastic, for handles. Some may have metal handles. A wooden spatula or spoon.
4. Night light candle, sand tray, match, cook's extra long match.
5. A desk lamp that can have the bulb turned both upwards and downwards.
6. Cup made from thin plastic, cup made from thick plastic, thermometer, clock.
7. Thermometers for taking the temperature of the room, access to the rest of the school, and access to outside (optional).
8. Access to a cold tap.
9. Plastic shopping bags, sticky tape.
10. Fever strip (forehead thermometer), large beaker of water at room temperature, thermometer.

List 2 (Complementary work)

Each group will need the following items:

▼ UNIT

1. A piece of metal (no sharp edges), ceramic tile, stone, brick, cork, linoleum, carpet, balsa wood, bath towel.
2. A thermometer, secondary sources about Anders Celsius.
3. Access to a selection of pans – to include pans with handles made of metal, wood and plastic, a pan with a copper bottom, a cast iron pan or griddle. Six large pieces of red card.
4. Fourteen large red cards.
5. Six red bags, cushions or balls.
6. Secondary sources about Sir James Dewar.
7. Secondary sources about how homes around the world are designed to keep the occupants warm or cool.
8. Secondary sources about how blood circulates round the body, and how muscles work.
9. Secondary sources about the clothes people wear to keep warm in different parts of the world, and about weaving and knitting.
10. Trowel or spade, thermometer.

List 3 (Activity worksheets)

Each group will need the following items:

▼ UNIT

1. A bowl of hand-hot water, a bowl of lukewarm water, a bowl of cold water, a clock, a thermometer.
2. A bowl of cold water (ice cubes previously melted in it), a bowl of warm water (hand-hot or less), a bowl of water drawn recently from the tap, a thermometer, a clock.
3. A set of teaspoons or tablespoons (one made of metal, one made of plastic and one made of wood), a pat of margarine, a plastic knife, a ruler, a clock.
4. Scissors, thread, access to a table lamp (one with a shade which funnels hot air upwards is ideal).
5. Two pieces of black plastic sheet, two pieces of white plastic sheet (each sheet should be 7cm square), a pat of margarine, plastic knife, access to desk lamp, clock.
6. Selection of materials such as aluminium foil, plastic sheeting, cloth, bubble wrap, cling film, scissors, wooden or plastic blocks about the size of ice cubes you are going to use, ice cubes, clock, plastic bowls or cups to hold the ice cubes in their wrappings.
7. Two large containers, two smaller containers which can fit inside the larger containers, cotton wool or similar material, thermometer, clock, measuring jug with very warm water.
8. A large beaker and a small beaker (it is important that there is a large difference in size), very warm water, thermometer, clock.
9. A selection of pieces of cloth made by cutting up old clothes (the cloth could be from shirts, blouses, skirts, trousers, anoraks, jackets, coats, pullovers), sticky tape, three beakers or jars, thermometer, clock.
10. Two bottles, jars, pots or beakers, grease-proof paper, paints or felt-tip pens, fur, fabric or cotton wool, sticky tape, material for making animal heads, such as Plasticine. These could be mounted on corks if bottles are used, or mounted on cardboard if wide-mouthed containers such as jars, pots or beakers are used. Thermometer and clock.

Learning objectives

Comprehension worksheets

The table below shows the learning objectives for knowledge and understanding associated with each unit in the pupil book, using the comprehension worksheets in this *Teacher's Guide*:

Unit 1

- We sense warmth and cold through our skin, but not very accurately.
- Heat always flows from a warm place to a cold place.

Unit 2

- A thermometer is a device for measuring temperature.
- There are special techniques for taking a temperature accurately.

Unit 3

- Conduction is the flow of heat between two things that are touching.
- Metals are good conductors of heat.
- Poor conductors of heat are called insulators.

Unit 4

- Water and air can be warmed by convection.
- Liquids do not have a fixed shape and cannot be squashed.

Unit 5

- Heat can travel through air and space as heat rays.
- Heat rays behave like light rays in some ways.

Unit 6

- Hot food and drink can lose heat by conduction, convection and radiation.
- Insulation can reduce heat loss.
- The use of a vacuum flask can reduce heat loss.

Unit 7

- A home can be kept warm by using different forms of insulation.
- Insulating the home cuts fuel bills and helps improve conditions in the environment.

Unit 8

- Our bodies only work well in a narrow temperature range.
- Our body has mechanisms which help it keep a constant temperature.
- If the body gets too cold there is a risk of death.

Unit 9

- Clothing helps to keep us warm.
- Clothes must be designed to keep us warm and comfortable.

Unit 10

- Many animals cannot keep their body temperature constant. It changes with their surroundings.
- Some animals can keep their body temperature constant. They have means of losing heat if their surroundings get hot.

Learning objectives

Activity worksheets

The table below shows the learning objectives for practical skills associated with each unit in the pupil book, using the activity worksheets in this *Teacher's Guide*:

Unit 1

- Make observations using the senses.
- Record observations in written form.
- Use a thermometer.
- Make a table and record results in it.

Unit 2

- Make systematic measurements with a thermometer.
- Record results in a table.
- Display data in graphical form.
- Interpret results.

Unit 3

- Use simple equipment and materials with care.
- Record observations in written form.
- Make comparisons.
- Use scientific knowledge and understanding to explain observations.

Unit 4

- Use simple equipment and materials with care.
- Make comparisons.
- Use observations to draw conclusions.

Unit 5

- Take action to control risks.
- Carry out a fair test.
- Make a table and record results in it.

Unit 6

- Plan and carry out a fair test.
- Make a table and record results in it.

Unit 7

- Carry out a fair test.
- Record results in a table.
- Present data in graphical form.

Unit 8

- Make systematic measurements using a thermometer.
- Interpret results.
- Make comparisons.
- Identify a simple pattern.

Unit 9

- Make a prediction.
- Compare data with a prediction.
- Take systematic measurements with a thermometer.

Unit 10

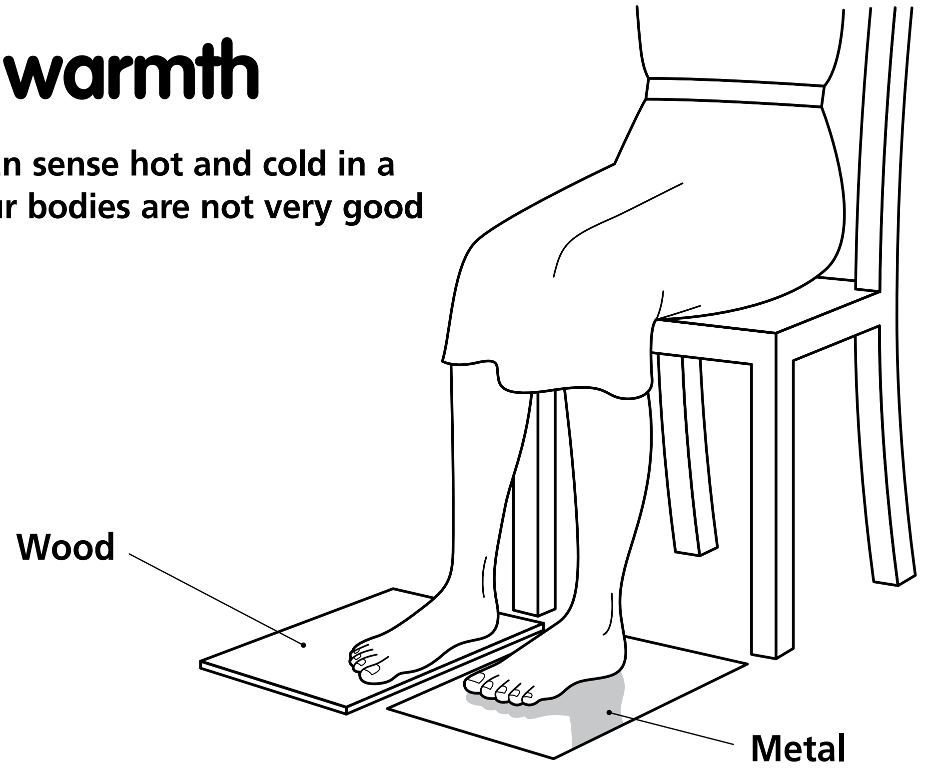
- Plan and carry out a fair test.
- Make a table and record results in it.
- Evaluate the investigation.

Name: .... Form: ....

See **pages 4 and 5** of *Keeping warm and cool*

Feeling warmth

Although we can sense hot and cold in a general way, our bodies are not very good at measuring it.



Q1. Which material feels colder to the feet – the wood or the metal? ✎..

Q2. Why does this material feel colder than the other one?

✎..

✎..

Q3. Which way does heat always move?

✎..

Q4. State two ways in which people may cool down on a hot sunny day.

1 ✎...

2 ✎...

Q5. What is our measure of warmness called? ✎...

Q6. Why do we feel cold in winter?

✎..

✎..

Answers

1. **The metal.**
2. **It draws more heat from the foot than the other material.**
3. **From a warm place to a colder one.**
4. **(1) Go into the shade.**
   (2) Take a swim in cool water.
5. **Temperature.**
6. **We lose heat faster than our bodies can replace it.**

Complementary work

(a) Show the children a selection of materials such as a piece of metal (no sharp edges), ceramic tile, stone, brick, cork, linoleum, carpet, balsa wood and bath towel. Ask them to write down if each one will feel cold or warm. Let the children feel the materials and test their predictions.

Teaching notes

The purpose of this unit is to establish that, although we think we can tell the temperature of something by feeling it, our senses are not always reliable. In the introduction to the unit on page 9 of this book, and in Picture 2 of the pupil book, it is shown that the nature of the material can affect the way we assess its temperature.

Metals are very good conductors of heat, so when we touch them large amounts of heat pass from our body to the metal. This makes the metal feel cold even though it is at the same temperature as other objects. Linoleum and ceramic tiles also feel cold for the same reason. Cork feels warmer because it is a poor heat (or thermal) conductor, and less heat leaves our skin when we touch it.

Children should be familiar with the thermometer as an instrument which measures temperature from earlier work on weather studies or from Unit 7 of *3C Properties of materials* in the Science@School series.

Children often raise the thermometer from the object they are testing when they read the thermometer. They do this to bring the scale nearer to their eyes. In doing this, the thermometer bulb loses contact with the object it is measuring and the liquid column inside the thermometer will either rise or fall. Taking temperature is introduced in the first activity so that you can check their technique before they try other activities in this book.

Some children may have had their temperatures taken by a clinical thermometer containing mercury which had to be shaken to reset it. The reason for this is that when the thermometer was removed from the body, the thread of mercury was trapped so that it stayed in place. This allowed an accurate temperature to be taken even though the thermometer was removed from the body.

Name: .... Form: ....

Based on **pages 4 and 5** of *Keeping warm and cool*

Can you judge the temperature?

Try this...

1. Ask your teacher for a bowl of very warm water.

2. Ask your teacher for a bowl of lukewarm water and put it next to the first bowl.

3. Ask your teacher for a bowl of cold water and put it next to the second bowl.

4. Put one hand in the very warm water and the other hand in the bowl of cold water. Leave them in the water for three minutes.

5. Put both hands in the lukewarm water and think how each one feels.

6. Dry your hands and write down how each hand felt in the lukewarm water.

✎..

✎..

✎..

✎..

7. Use a thermometer to take the temperature of the water in each bowl. Keep the bulb of the thermometer under the water while you take the temperature. Make sure the coloured liquid has stopped rising or falling before you make your reading.

8. Record your results in a table.

Teacher's sheet: activity

Based on **pages 4 and 5** of *Keeping warm and cool*

Introducing the activity

(a) Tell the children that there are parts of the skin which are sensitive to temperature, just as there are parts which are sensitive to touch. We can test this skin sense with a simple experiment.

Using the sheet

(b) Give out the sheet, let the children fill in their names and form then go through tasks 1 to 6 (see note (i)).

(c) Let the children complete tasks 1 to 3 then go through task 4 again.

(d) Let the children try task 4 (see note (ii)).

(e) Let the child who is trying the tasks complete tasks 5 and 6.

(f) Go through tasks 7 and 8 then let other children in each group try them. All members of each group should record the results in a table (see note (iii)).

Completing the activity

(g) Let the children compare their written statements and data in the tables (see note (iv)).

Conclusion

The skin is not very reliable at assessing the temperature of water. The hand immersed in very warm water felt cool when placed in lukewarm water, and the hand immersed in cold water felt warm when placed in lukewarm water.

The bulb of the thermometer must remain in the liquid while the temperature of the liquid is being taken.

Teaching notes

(i) Prepare the bowls of water just beforehand and work out a way to distribute them if you are going to have several groups trying this at the same time. Make sure that the bowls are deep enough for the children to immerse their hands in the water. The very warm water should just be hand-hot, the lukewarm water is made by mixing warm and cold water from the taps. The cold water is just from the cold tap water.

(ii) Only one child from each group should carry out the task at a time. Another child can keep a record of the time the hands are immersed. The experiment should be repeated with other members of the group, as this helps to reinforce the practice of obtaining more reliable results.

(iii) The table should have a left-hand column labelled 'Water' and a right-hand column labelled 'Temperature °C'.

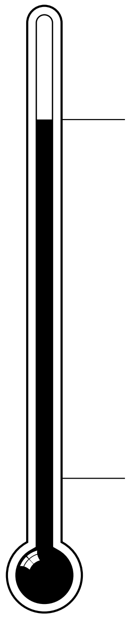
(iv) Any anomalous results may be checked by asking each group to demonstrate their technique of reading thermometers in liquids. Some children will take the thermometers out to read them and this will result in the temperature of the thermometer rising or falling.

Name: .... Form: ....

See **pages 6 and 7** of *Keeping warm and cool*

Measuring warmth

Thermometers are instruments for measuring the temperature of objects accurately.



A ✎..

B ✎..

Q1. Use Picture 1 on page 6 of your book to label A and B on the diagram above.

Q2. Some thermometers use a red liquid. What is the name of this liquid?

✎...

Q3. Some thermometers have a silver-looking liquid in them.

(a) What is the name of this liquid? ✎...

(b) What kind of material is this liquid? ✎...

Q4. The Celsius scale is named after a scientist.

(a) What is his full name? ✎...

(b) Where did he live? ✎...

Q5. When writing temperatures, we put a small circle in front of the C. What does this circle stand for? ✎..

Q6. How would you use a thermometer to take the temperature of a liquid?

✎..

✎..

✎..

Teacher's sheet: comprehension

See **pages 6 and 7** of *Keeping warm and cool*

Answers

1. **A is 100°C – the boiling point of water. B is 0°C – the freezing point of water.**
2. **Alcohol.**
3. **(a) Mercury, (b) a metal.**
4. **(a) Anders Celsius, (b) Sweden.**
5. **Degree.**
6. **Put the bulb of the thermometer in the liquid and wait for the level of the liquid in the thermometer to become steady.**

Complementary work

(a) Each child can use a thermometer to find out the temperature in their closed hand, the temperature of their breath when they blow on the thermometer, the temperature of tap water and the temperature of the room.

(b) Let the children use secondary sources to find out about Anders Celsius.

Teaching notes

Temperature is a measure of the hotness or coldness of a substance. It is measured on a scale which has two fixed points. In the Celsius scale the two fixed points are the freezing point and the boiling point of water. In between these two fixed points the scale is divided up into a hundred units called degrees. The scale can be extended above and below these fixed points. For example, many school thermometers have a scale going from –10°C to 110°C.

The thermometer compares the temperature of the substance it is touching with the freezing point or boiling point of water. For example, if the thermometer is left in the air in the classroom, it may record a temperature of 20°C. This means that the air temperature is 20° above the freezing point of water.

Temperature is often mentioned when heat is being discussed. They are not the same thing but are linked. Every substance is made up of particles which are moving. Solids are made of particles which hold tightly together but vibrate. Particles in liquids have a greater degree of movement, and particles of gas can move freely. All the particles move because they possess movement energy, or kinetic energy. When a thermometer is dipped into warm water the bulb is struck by fast moving particles which pass on some of their energy to the liquid in the thermometer. The particles in this liquid begin to move faster and cause the liquid to expand and move up the scale. The glass in the thermometer also expands, but not as quickly as the liquid.

Name: .... Form: ....

Based on **pages 6 and 7** of *Keeping warm and cool*

Measuring water temperatures

Try this...

1. Set up a bowl of cold water and label it A. Set up a bowl of tap water and label it B. Set up a bowl of very warm water and label it C.

2. Measure the temperature of the water in each bowl.

3. Record the temperatures in the first line of the table below.

Time (mins)	Water in bowl A °C	Water in bowl B °C	Water in bowl C °C
0			
5			
10			
15			
20			
25			
30			

4. Repeat step 2 every ten minutes and record the results in the table.

5. When you have completed the results for 80 minutes, leave all three bowls for a day and record the temperatures again.

Looking at the results.

6. Make a graph of your results for each set of temperatures.

7. What do your results for the whole investigation show?

✎...

✎...

Teacher's sheet: activity

Based on **pages 6 and 7** of *Keeping warm and cool*

Introducing the activity

(a) You can link the activity directly to the unit by saying you want the children to investigate water temperatures and to use the advice given on page 7 of the pupil's book to help them.

Using the sheet

(b) Give out the sheet, let the children fill in their names and form then go through tasks 1 to 4.

(c) Let the children work through tasks 1 to 4 (see note (i)).

(d) Let the children carry out task 1 (see note (ii)).

(e) Let the children carry out tasks 2 to 4 (see note (iii)).

(f) After the children have completed task 5 let them try task 6 (see note (iv)).

Completing the activity

(g) Let the children compare their data. Look for anomalous results and seek explanations for them (see note (v)).

Conclusion

Cold water increases in temperature until it reaches room temperature. Warm water decreases in temperature until it reaches room temperature. Tap water may change temperature a little to come to the temperature of the room, or it may already be at room temperature.

After a day, the temperature of the water in the three bowls will be the same, assuming they are in identical conditions in the classroom.

Teaching notes

(i) You may like to melt some ice cubes in the cold water prior to the lesson. The warm water should be hand-hot.

(ii) Check each set of bowls to see that they are labelled correctly.

(iii) Go round the groups and ask the children to demonstrate their use of the thermometer, to check on their technique.

(iv) The children could make bar graphs, or line graphs, according to their ability. Alternatively, you could use the results of one group to make a line graph for the whole class.

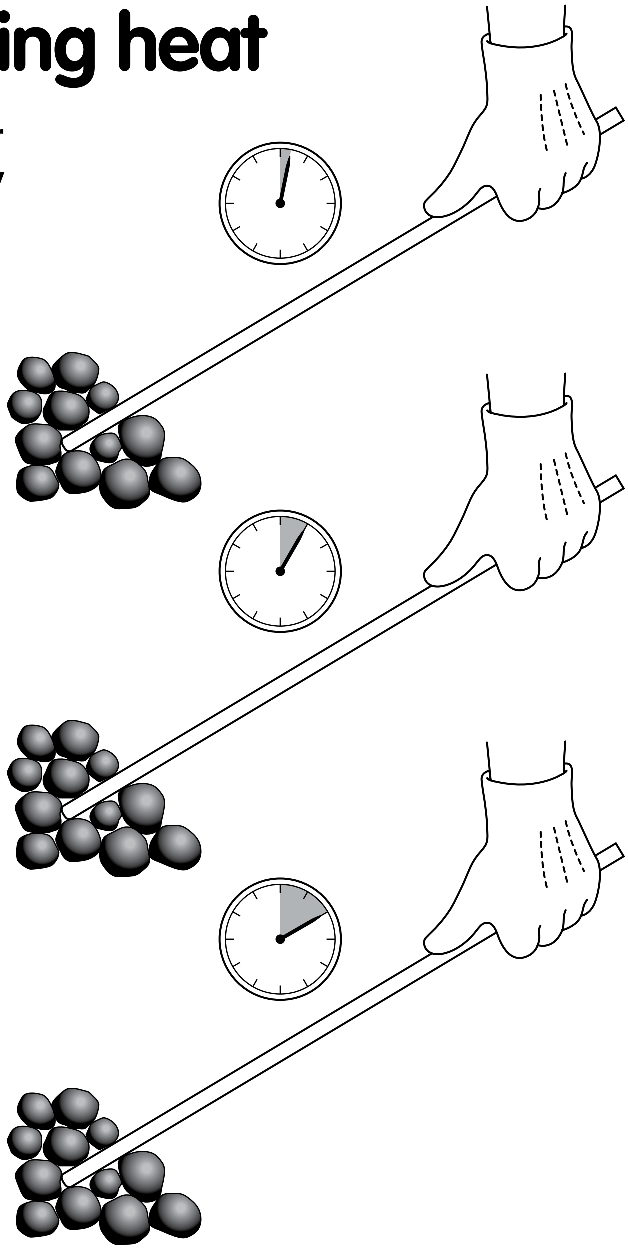
(v) Anomalous results are most probably due to faults with technique. Bowls left in a sunny window, or in a cool, draughty place, may show some differences from bowls in other sites in the class.

3

Name: .... Form: ....

See **pages 8 and 9** of *Keeping warm and cool*

Conduction – travelling heat



Heat travels from hotter objects to colder ones. If the objects are touching, the way the heat moves is called conduction.

Q1. The diagram shows a poker in a fire. Shade in how the cool part of the poker changes over the time the poker is in the fire.

Q2. What is burning in the fire to heat the poker?

✎...

Q3. What are conductors very good at?

✎...

✎...

Q4. Aluminium, copper and iron are conductors. Which one is the best conductor and which one is the worst?

Best ✎..

Worst ✎..

Q5. How is an insulator different from a conductor?

✎...

Q6. Why can you burn yourself if you touch a hot object?

✎...

✎...

✎...

✎...

Teacher's sheet: comprehension

See **pages 8 and 9** of *Keeping warm and cool*

Answers

1. **In the top poker, most of the poker is shaded. In the middle poker, a third of the poker is shaded. In the bottom poker, a quarter of the poker is shaded.**
2. **Coal.**
3. **Allowing heat to travel through them.**
4. **Copper is the best conductor and iron is the worst.**
5. **It conducts heat poorly.**
6. **The skin is an insulator. The heat cannot be carried away quickly, and so the surface of the skin gets hot enough to burn.**

Complementary work

(a) Let the children look at a selection of pans. Some of the pans may have wooden or plastic handles, some may not. There should be a copper-bottomed pan and a cast iron pan. Ask the children which handles will not get hot (the wood and plastic handles); which pan may transfer heat the most quickly (the pan with the copper bottom); and which pan may take longest to heat up (the cast iron pan).

(b) Let some of the children model the action of conduction in the following way. Line up six children. Give the child at one end of the line six large red cards. These symbolise heat. Ask the child to pass the cards one at a time up the line. The rest of the class should see the heat being transferred from one particle of a substance (a child) to another (a child further along the line).

Teaching notes

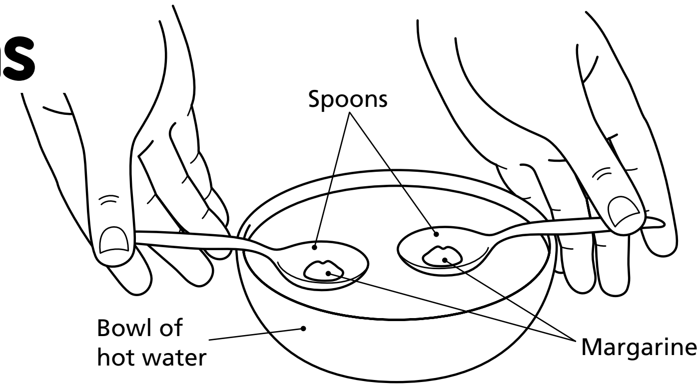
Conduction is a familiar way in which heat is transferred. When we touch anything to feel if it is hot or cold, we find out by the conduction of heat between the object and ourselves. In conduction, the particles can be thought of as passing the heat energy from one to another, as the second complementary activity shows. In reality, the particles at the hot end of a solid object are vibrating quickly and knock against more slowly vibrating particles further along. This makes the more slowly vibrating particles speed up and knock into particles further along the object.

Asking the children to mime this process could result in mayhem, so the simple demonstration (in complementary work (b)) is safer and shows the passage of heat more clearly. Similar demonstrations are also used to show the passage of heat in convection and radiation so you may like to try all three units on heat transfer then let the children do the three mimes together as a revision exercise.

Name: .... Form: ....

Based on **pages 8 and 9** of *Keeping warm and cool*

Comparing spoons



Try this...

1. Put a small amount of margarine in a plastic spoon and a metal spoon.

2. Set up a bowl of hot water.

3. Gently rest the spoons on the surface of the hot water. Hold the handle to make sure that the spoons do not sink or let in water to touch the margarine.

4. Watch the margarine in each spoon for two minutes or more.

5. When you have finished watching the margarine, remove the spoons and write down what you saw.

✎...

6. Try to explain what you saw.

✎...

✎...

✎...

7. Predict what would happen if you tried the experiment with a metal spoon and a wooden spoon.

✎...

8. Give a reason for your prediction.

✎...

9. Try steps 1 to 4 again with a metal spoon and a wooden spoon.

10. When you have finished watching the margarine, remove the spoons and write down what you saw.

✎...

11. How does the result compare with your prediction? ✎..

Teacher's sheet: activity

Based on **pages 8 and 9** of *Keeping warm and cool*

Introducing the activity

(a) Ask the children if they have ever touched a spoon in a drink and found the spoon too hot to hold. Tell the children that this is an example of conduction. The metal has conducted the heat from the drink to your hand. Say that the children are going to test how three spoons made of different materials conduct heat. Instead of using their skin to make the test, the children are going to use margarine.

Using the sheet

(b) Give out the sheet and let the children fill in their name and form then go through tasks 1 to 6 (see note (i)).

(c) Let the children perform tasks 1 to 6.

(d) Go through tasks 7 to 11 with the children then let the children try them (see note (ii)).

Completing the activity

(e) Let the children compare their observations to the first part of the investigation, then let them compare predictions, reasons and results.

(f) Ask for suggestions on how the test could be made fairer (see note (iii)).

Conclusion

The margarine melts faster in the metal spoon than the plastic spoon. This difference is due to metal being a better conductor of heat than plastic. The margarine melts faster in the metal spoon than the wooden spoon. This is due to metal being a better conductor of heat than wood.

Teaching notes

(i) Make sure the spoons are approximately the same size and thickness. They could be teaspoon or tablespoon size. The amount of margarine should be between one half and one centimetre across. They should use a plastic knife to cut up the pat of margarine.

If the children have done the previous activities in this book you could now let them collect hot water for themselves. Make sure that the water is only hand-hot.

(ii) When the children compare their result and predictions they should say whether their prediction matched or did not match the result. They should not uses phrases like, "It was O.K.".

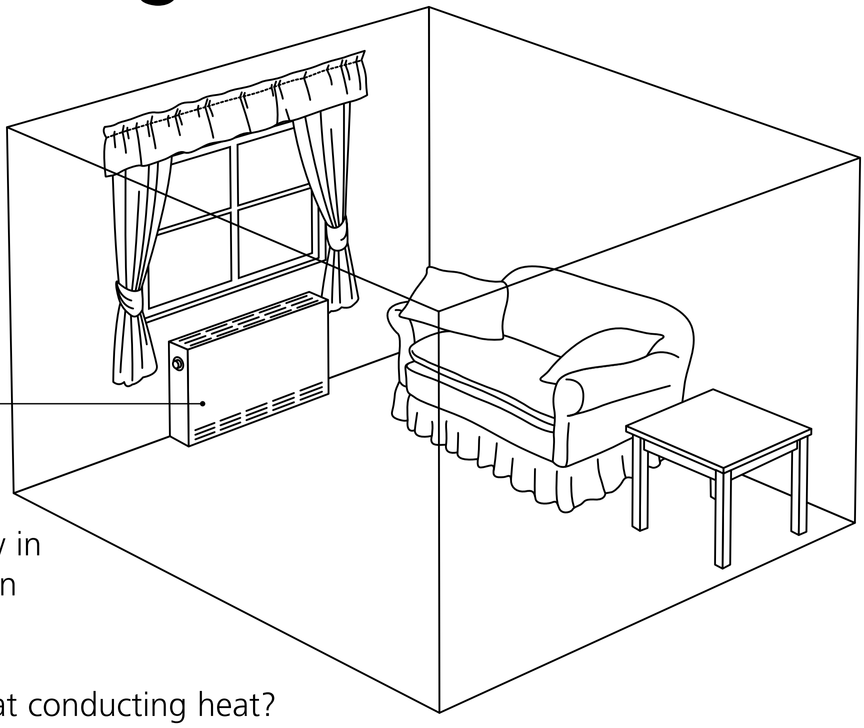
(iii) If the spoons do not have exactly the same dimensions, the children could suggest that spoons of identical size are found.

Name: .... Form: ....

See **pages 10 and 11** of *Keeping warm and cool*

Convection – rising heat

Heat makes liquids and gases expand and get lighter. As a result, they rise. We call the rising heat convection.



Q1. The diagram shows a room with a heater in it. Draw in arrows to show the direction in which the air moves.

Q2. Are water and air good at conducting heat?

✎..

Q3. What property do air and water have that helps them carry heat from one place to another?

✎..

Q4. What is used to make heat in a convector heater? ✎...

Q5. What can be used to show the path of warm water in a tank? ✎.......................

Q6. Where is the heater placed in a hot water tank? Explain your answer.

✎..

✎..

✎..

✎..

✎..

✎..

Teacher's sheet: comprehension

See **pages 10 and 11** of *Keeping warm and cool*

Answers

1. **An arrow should rise from the heater and bend to the right. Another arrow should point down by the opposite wall and bend to the left. The arrows may also be shown as in the pupil's book.**

2. **No, they are very poor conductors.**

3. **They both flow easily.**

4. **Electricity.**

5. **A dye.**

6. **At the bottom. This allows the greatest movement of warm water. If the heater was placed at the top, only water at the top of the tank would become hot. This is because the hot water is lighter in weight than cold water and would keep above it.**

Complementary work

(a) Stand eight children in a line. Give the child at one end fourteen large red cards. They symbolise heat. Let the child give one card to the next child in the line. This child then walks to the end of the line, puts the card on a table and joins the end of the line. The next child in the line is given a red card and also goes to the table, puts down the card and joins the back of the queue. This procedure is repeated with all the other children in the line. The first child can give out the 'heat' more quickly so that the 'convection current' moves faster.

Teaching notes

Convection occurs in liquids and gases. When one part of these substances receives heat, the molecules in the substance move further apart. This makes that part of the substance less dense than the surrounding cooler parts. The less dense part then rises through the cooler parts and takes the heat with it. A cooler part moves in to take its place. This part also becomes hot, less dense and rises. A convection current is set up by the rising warm parts of the substance and the sinking cooler parts of the substance. As the warm part rises, it loses heat and eventually cools. When this happens, it can sink back down to the source of heat to be warmed again.

In the demonstration in complementary work (a), each child is part of a pan of water or the air in the room. They are not particles like the particles in the conduction demonstration, but are groups of particles. The child who receives 'heat' represents a part of the air where the particles have spread out and the air is less dense (or weighs less). The child then 'floats' past the other cooler parts of the air to the table. This can represent either the water surface, or the ceiling of a room which receives the heat. The child then 'cools down' and joins the line of other 'cooler parts' of the substance that are waiting to be warmed.

4

Name: .... Form: ....

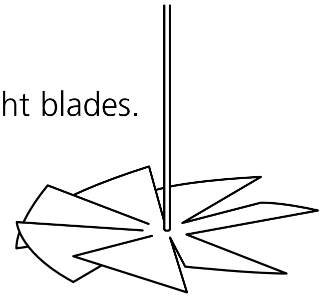
Based on **pages 10 and 11** of *Keeping warm and cool*

The convection detector

Try this...

1. Cut out the circle at the bottom of this sheet.

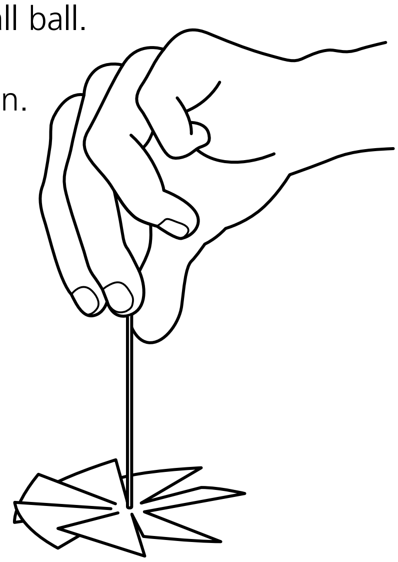
2. Cut along each dotted line. This will become a fan with eight blades.



3. Gently twist each blade to the left so that they are shaped like the fan in the diagram.

4. Make a small hole in the centre of the fan.

5. Tie several knots in the end of a thread until they make a small ball.



6. Thread the other end of the thread through the hole in the fan.

7. Push the fan down the thread until it rests on the knot ball.

8. Hold the fan as shown in the diagram. Raise your hand then lower it quickly.

9. What happened to the fan?

✎...

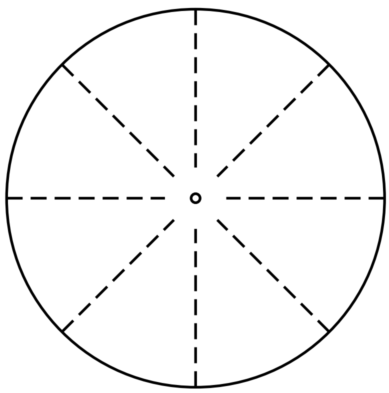
10. Try to explain what you have seen.

✎...

✎...

11. Hold the fan still above a lamp. Write down what you see.

✎...



12. Try to explain what you have seen.

✎...

✎...

✎...

Teacher's sheet: activity

Based on **pages 10 and 11** of *Keeping warm and cool*

Introducing the activity

(a) You may ask the children if they have seen hot air rising. They may say they have seen it at a camp fire or bonfire. In these places, the rising air can make objects on the other side of the fire difficult to see. Tell the children that they are going to make a fan which can detect rising hot air.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form then go through tasks 1 to 7 (see note (i)).

(c) Let the children perform tasks 1 and 2 then check their work.

(d) Let the children try task 3 then check their work.

(e) Let the children perform task 4 or do it for them.

(f) Let the children try tasks 5 to 7 (see note (ii)).

(g) Go through tasks 8 to 10 then let the children try them.

(h) Go through tasks 11 and 12 then let the children try them (see note (iii)).

Completing the activity

(i) Ask the children to predict what might happen if they held their convection detectors over a radiator, then let them try it (see note (iv)).

Conclusion

When the fan is lowered quickly through the air it spins. This is caused by the air passing upwards through the fan blades. When the fan is held over a table it does not spin because no air is rising through it. When the fan is held over a lamp it spins. This is caused by the hot air rising between the fan blades.

Teaching notes

(i) You need to go through each stage slowly and carefully. Perhaps you may like to make a fan first as a demonstration.

(ii) You may need to provide the knotted threads for some groups of pupils. Make them up before the lesson. The thread needs to be about 15 centimetres long. When the ball of knots is in place, the length of thread above the fan should be about 12 centimetres.

(iii) The fan may need to be about 10 centimetres above the lamp bulb to spin well.

(iv) If the radiator is a panel radiator (i.e. it does not have an open grill in the top like the convector on page 11 of the pupil book) all the children could hold their detectors over it. If the radiator is a convector heater like the one shown in the pupil book, you may like to perform the test to make sure that no fans fall through the grill into the heater. Alternatively, more responsible children could wrap the thread around their finger so the fan and thread will not fall.

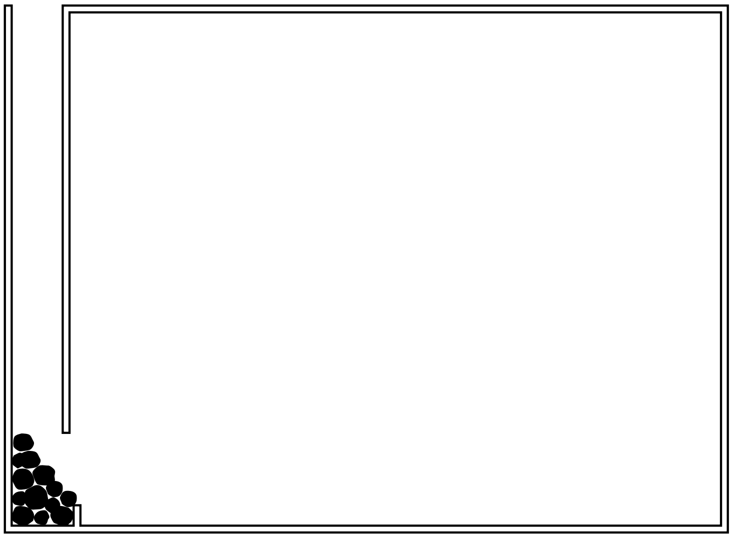
Name: .... Form: ....

See **pages 12 and 13** of *Keeping warm and cool*

Radiation – heat rays

Heat can be passed between objects that are not touching – even through the depths of space. This is called radiation.

Q1. The diagram shows a room with a fire in it. Draw in arrows to show how heat rays travel through the room.



Q2. What other kinds of rays travel in the same way as heat rays?

✎...

Q3. Why is it cooler in the shade than in the sunlight?

✎...

✎...

✎...

Q4. What can you use to reflect heat rays?

✎...

Q5. One kind of heater is made from a panel which is filled with warm water.

(i) What is it called? ✎...

(ii) How did it get its name? ✎..

✎...

Q6. Why do people tend to wear light-coloured clothes in summer?

✎...

✎...

✎...

Teacher's sheet: comprehension

See **pages 12 and 13** of *Keeping warm and cool*

Answers

1. **The rays should be in straight lines. The reflected heat rays from the wall should be shown.**
2. **Light rays.**
3. **Heat rays are not found in the shade. They only travel in straight lines and cannot go around an object that gets in their way.**
4. **A shiny surface such as a mirror.**
5. **(i) A radiator, (ii) It gives out most of its heat by radiation.**
6. **Light colours reflect more heat away than dark colours. They soak up less heat than dark colours.**

Complementary work

(a) Let two children demonstrate how heat travels by radiation. The children stand four or five metres apart. One child has some red objects (cushions, bags or balls) and throws them one at a time to the other child (the red objects are heat rays). The second child must catch them and then keep holding onto them, or put them in their pockets. In this way the second child simulates getting hotter.

Teaching notes

When heat moves by radiation, particles are not involved. The rays are made from waves that behave a little like magnets and a little like electricity. They are called electromagnetic waves. There is a huge range of waves. Each kind has a particular wavelength. The major groups of waves are radio waves, microwaves, infra-red waves, visible light, ultra-violet, X-rays and gamma rays. Heat rays are infra-red rays.

As particles are not needed to transfer the heat, radiation can take place in a vacuum, or in places where there are few particles – like outer space. All objects give out infra-red rays. The hotter the object the more rays it gives out. Some infra-red rays can pass through glass. They have short wavelengths. When they pass through the glass, into a greenhouse, for example, they are absorbed by the ground and rays of a longer wavelength are produced. These cannot pass through the glass and remain in the greenhouse where they warm up the air.

5

Name: .... Form: ....

Based on **pages 12 and 13** of *Keeping warm and cool*

Investigating radiation

Try this...

1. Put a lump of margarine in the middle of one sheet of black plastic. Cover it with a second black sheet. Do not press down on the margarine.

2. Put a lump of margarine in the middle of one sheet of white plastic. Cover it with another white sheet. Do not press down on the margarine.

3. Place the two sheet and margarine 'sandwiches' under a desk lamp and leave them for ten minutes.

4. Remove the sets of sheets from under the desk lamp and take off the top sheets.

5. Write down how the margarine looks on the black sheet.

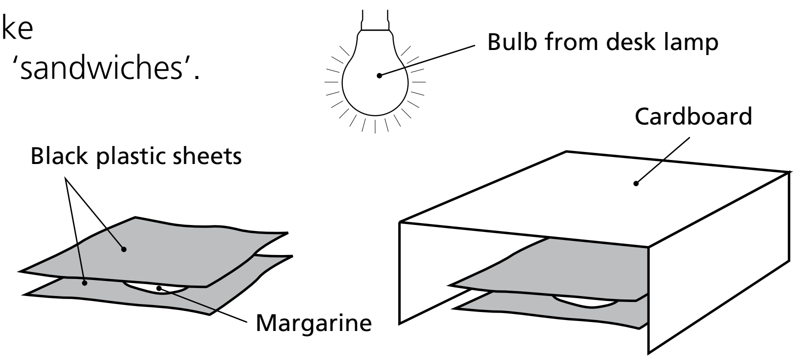
✎...

6. Write down how the margarine looks on the white sheet.

✎...

7. Repeat step one twice to make two margarine and black plastic 'sandwiches'.

8. Make a cardboard cover for one of the sandwiches by bending the edges of the cardboard sheet as the diagram shows.



9. Set up the sheets and cover as the diagram shows.

10. Predict what you think will happen to each lump of margarine in the sandwiches.

✎...

11. Give a reason for your prediction.

✎...

12. After ten minutes, look at the margarine in each sandwich and compare it with your prediction. ✎..

Teacher's sheet: activity

Based on **pages 12 and 13** of *Keeping warm and cool*

Introducing the activity

(a) You can introduce this activity after the children have read about bouncing heat rays on page 12.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form. Go through tasks 1 to 6 then let the children try them (see note (ii)).

(c) Go through tasks 7 to 9 then let the children try them (see note (ii)).

(d) Go through tasks 10 to 12. If the children are having trouble thinking of a prediction, go through picture 2, and the caption on page 13 of the pupil book.

(e) Let the children try tasks 10 to 12 (see note (iii)).

Completing the activity

(f) Let the children compare their work.

Conclusion

The margarine in the black sheets melted and the margarine in the white sheets did not melt.

The margarine in the sheets in the cardboard shade did not melt because the heat rays could not reach the sheets. The margarine in the sheets in the light melted because the heat rays reached them.

Teaching notes

(i) The lump of margarine should be between one half and one centimetre across. The children should use a plastic knife to cut up the margarine.

(ii) The cardboard should be about 15cm by 13cm. The shorter sides should be bent over to make 3cm walls, as the diagram shows.

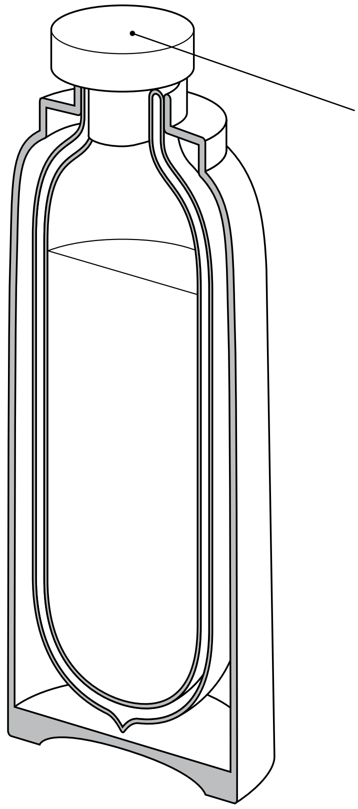
(iii) When the children compare their result and predictions they should say whether the prediction did or did not match the result. They should not uses phrases like, "It was O.K.".

Name: .... Form: ....

See **pages 14 and 15** of *Keeping warm and cool*

Keeping food and drink warm

To keep food and drink warm we need to keep it away from cold air.



Q1. The diagram shows a vacuum flask.
(i) Shade in the part which holds the vacuum.

(ii) What material can be used to make A?

✎..

Q2. What are the three ways in which heat can travel?

1 ✎..

2 ✎..

3 ✎..

Q3. Why does warm food go cold?

✎..

Q4. Who invented the vacuum flask, and where was he born?

✎..

Q5. How does the vacuum keep a hot liquid hot?

✎..

✎..

Q6. Name the three ways of losing heat that the vacuum flask tries to prevent.

✎..

✎..

✎..

✎..

Teacher's sheet: comprehension

See **pages 14 and 15** of *Keeping warm and cool*

Answers

1. **(i) The narrow walls around the central liquid should be shaded in. (ii) Cork or plastic.**
2. **Conduction, convection and radiation.**
3. **It loses heat to the air.**
4. **Sir James Dewar, Scotland.**
5. **Heat cannot pass through the vacuum by conduction.**
6. **It prevents heat from outside entering the flask. The heat is stopped by the same features that keep heat in. They are the vacuum, reflective silver walls and insulating properties of the glass and cork.**

Complementary work

(a) The children can use secondary sources to find out about the life of Sir James Dewar.

Teaching notes

This unit gives you an opportunity to revise the content of the previous three units about conduction, convection and radiation. The study of the vacuum flask is also useful as part of a technology project on keeping foods warm or cold.

Children seem readily to grasp that heat can be prevented from escaping an object that is wrapped up, but they have difficulty in understanding the effect of wrapping up a cold object. They may think the wrapping keeps the coldness in. Coldness does not flow out of the wrapping to a hot place. Instead, the wrapping prevents the heat passing in from outside and warming up the wrapped-up object.

Name: .... Form: ....

Based on **pages 14 and 15** of *Keeping warm and cool*

Investigating ice cubes

Try this…

1. Collect the materials you are going to use to keep ice cubes cold.

2. Use a wood or plastic block as an ice cube to test first how you will wrap up the materials.

3. Collect the containers you are going to use to hold each ice cube in its wrapping.

4. Write down a plan to compare how the different wrappings keep the ice cubes cold.

5. Show your plan to your teacher. If your teacher approves, try your plan.

6. Record your results in this space.

Looking at the results.

7. What do the results show?

✎...

Teacher's sheet: activity

Based on **pages 14 and 15** of *Keeping warm and cool*

Introducing the activity

(a) At the end of the unit in the pupil book, it is mentioned that the vacuum flask can be used to keep its contents cool as well as hot. Ask the children if they think that materials that we use to keep things warm could also be used to keep things cold. Challenge them to test their ideas by trying to stop ice cubes from melting.

Using the sheet

(b) Give the children the sheet and let them write their names and form on it, then go through tasks 1 to 3 with them (see note (i)).

(c) Let the children carry out tasks 1 to 3.

(d) Go through tasks 4 and 5 (see note (ii)).

(e) Let the children carry out tasks 4, 5 and 6 (see note (iii)).

Completing the activity

(f) Let the children try task 7 and compare their results.

Conclusion

Generally, ice cubes wrapped in thin materials will melt more quickly than ice cubes wrapped in thicker materials. Ice cubes wrapped in materials containing air pockets, such as bubble wrap, will melt more slowly than ice cubes wrapped in materials without air pockets.

Teaching notes

(i) Provide a selection of materials such as aluminium foil, cling film, bubble wrap, polythene sheeting, foam sheeting and cloth. Less able children may use only two or three materials, while more able children could use the full range. You may have to prepare materials cut to size for less able children, while more able children could use scissors to cut out the materials they need.

The wooden or plastic block should be about the size of the ice cubes you are going to use. They give the children a chance to have a 'dry run' – to see how they will fit the materials around the ice cubes.

You may use bowls or pots to hold the ice cubes in their wrappings.

(ii) The children need to write down, or draw a picture of, how they will set up the experiment and how often they will look at the ice cubes. They will need a clock to time the interval between inspections. Some children may wish to measure the tops of the ice cubes to give an indication of how much the cube has melted.

You may ask the children to predict the order in which the ice cubes will melt. You could also ask for reasons for their predictions.

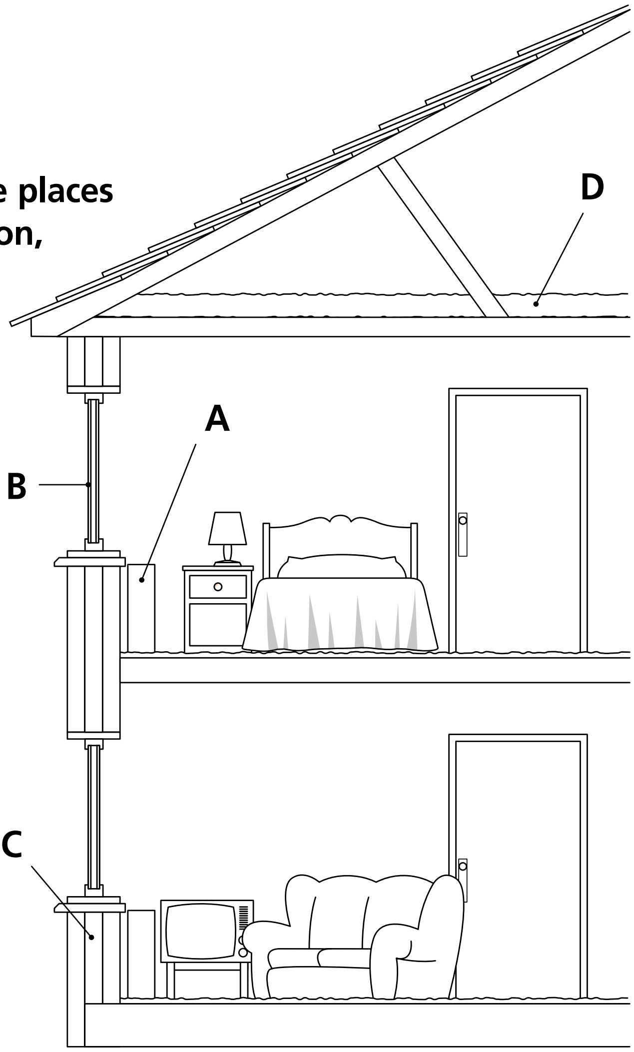
(iii) The children may present their results in a table, or as a written report.

Name: .... Form: ....

See **pages 16 and 17** of *Keeping warm and cool*

Warm homes

To keep homes warm we need to insulate places where warm air can leak out by conduction, convection or radiation.



Q1. Name the parts A, B, C and D in the diagram that help to keep the house warm.

A ✎..

B ✎..

C ✎..

D ✎..

Q2. Does a wood wall feel warmer than a brick wall? Explain your answer.

✎..

✎..

✎..

Q3. Where is the hottest air in any room? Explain your answer. ✎..............................

✎..

Q4. Why is there no insulation between the rooms on the lower floor and those on the floor above?

✎..

Q5. Where is much of the heat of the room lost?

✎..

Q6. (i) Why do rooms need fresh air? ✎...

✎..

(ii) How does fresh air get into a room? ✎..

✎..

Teacher's sheet: comprehension

See **pages 16 and 17** of *Keeping warm and cool*

Answers

1. **A = central heating panel, B = double glazed window, C = cavity insulation, D = fibreglass insulation.**
2. **Yes. Wood conducts less heat than brick.**
3. **Near the ceiling. Hot air rises.**
4. **The heat from the lower rooms can be used to heat the rooms above them.**
5. **Through the windows.**
6. **(i) In time, the air becomes stale and unhealthy. (ii) By opening and closing doors and windows. Some fresh air is let in by draughts.**

Complementary work

(a) The children can use secondary sources to find out about how homes around the world are designed to keep the occupants warm or cool.

Teaching notes

You may wish to extend this work and give it an economic or an environmental dimension.

If you wish to consider the economics of insulating the home you may introduce the children to fuel bills. You can make the figures simple, to help them follow how insulation can save money. For example, you could say that the cost of heating a home was £400 per year. When one method of insulating the home was used the fuel bill fell to £300 a year, so there was a yearly saving of £100. The children would also need to know that the method of insulation also cost money. For example, say it cost £200 to install the insulation, in order to save £100 a year. Balancing the cost of insulation against the yearly saving is called the payback time. In this simple example it would take two years to pay back the money spent on installing the insulation. This means that the payback time is two years. The payback time for installing each kind of insulation varies. Wall insulation, for example, may have a payback time of less than two years, while double glazing, which is the most expensive form of insulation, may have a payback time of 25 years.

If you wish to consider the environmental benefits of insulating the home, you may tell the children about how an insulated home takes less fuel to keep warm. This means that supplies of fuel are not used up as quickly, and less fuel is burnt so there is less pollution, and possibly less chance of global warming which could change the environment throughout the world.

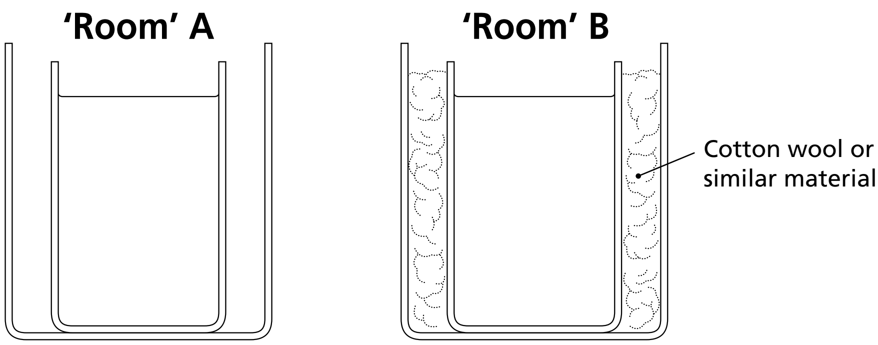
Name: .... Form: ....

Based on **pages 16 and 17** of *Keeping warm and cool*

Investigating wall insulation

Try this...

1. Set up four containers to make your two 'rooms', 'Room' A and 'Room' B – as shown in the diagram.



2. Pour the same amount of very warm water into the middle container inside each 'room'.

3. Take the temperature of the water in each 'room' and fill in the first line of the table.

Time (mins)	Temperature in 'Room' A °C	Temperature in 'Room' B °C
0		
5		
10		
15		
20		
25		
30		

4. Every five minutes, take the temperature of the water in each container and record it in the table.

5. Make a graph or chart of your results.

Looking at the results.

6. What do your results show?

✎...

Teacher's sheet: activity

Based on **pages 16 and 17** of *Keeping warm and cool*

Introducing the activity

(a) Begin by telling the children that sometimes, when scientists want to investigate something, they make a model. In this activity the children are going to investigate the effect of wall insulation using two model rooms. Tell the children that when scientists use models, they like to make the models as simple as possible. In this investigation, beakers filled with very warm water are models of rooms in a home.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form then go through task 1 (see note (i)).

(c) Let the children perform task 1.

(d) Go through tasks 2 to 4 with the children (see note (ii)).

(e) Let the children try tasks 2 to 4.

(f) Go through task 5 then let the children try it.

Completing the activity

(g) Let the children compare their results.

Conclusion

The 'room' with insulation material in the wall cavity did not lose heat as quickly as the 'room' without insulation.

Teaching notes

(i) You may use small beakers to hold the water, and larger beakers to represent the outside wall. Make sure that the children realise that the space between the wall of the smaller beaker and the larger beaker is the wall cavity. Let the children pack the cavity of room B with cotton wool or a similar material.

(ii) Remind the children that they must make the test fair. They could use a measuring jug to collect the very warm water from the tap. The bulb of the thermometer should be placed at the same depth in each container when the temperature is being read. The children may need to be reminded to wait until the liquid in the thermometer has stopped rising before they take the temperature.

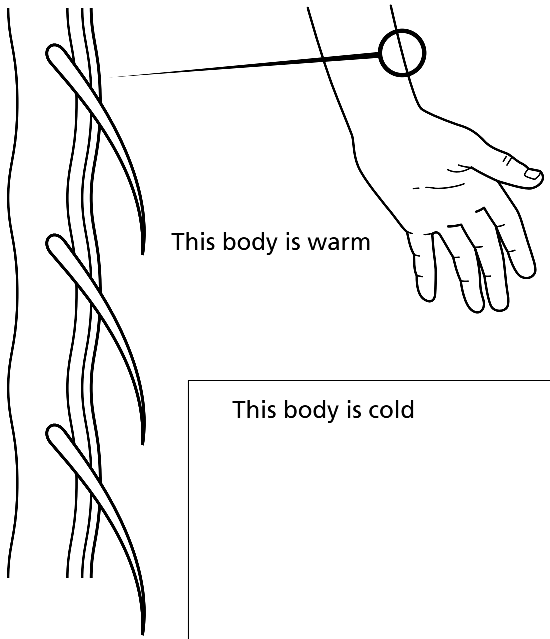
8

Name: .... Form: ....

See **pages 18 and 19** of *Keeping warm and cool*

How our bodies keep warm

We need to keep at just the right level of warmth. To achieve this, our bodies have ways of controlling how warm we are.



This body is cold

Q1. The diagram shows the skin of a person who is warm. Draw how the skin changes when the person is cold.

Q2. What is the normal temperature of the human body?

✎..

Q3. What carries heat around the body?

✎..

Q4. What is the natural insulator under our skin?

✎..

Q5. How does water in sweat help cool the body?

✎..

✎..

✎..

Q6. Why do people shiver? Explain your answer.

✎..

✎..

✎..

✎..

Teacher's sheet: comprehension

See **pages 18 and 19** of *Keeping warm and cool*

Answers

1. **The diagram should show the raised hairs and goosebumps.**
2. **37°C**
3. **Blood.**
4. **Fat.**
5. **When it evaporates from the skin it takes heat away and cools down the skin and blood.**
6. **They shiver because they are cold. When we shiver the muscles work and release heat which is used to warm the body.**

Complementary work

(a) The children can use secondary sources to find out about how blood circulates round the body and how muscles work.

(b) The children can use secondary sources to find out about how muscles work.

Teaching notes

The body has a range of mechanisms which help it to regulate itself. For example, when we exercise we breathe faster to take in more oxygen for our muscles. Our heart also beats faster so it can speed up delivery of oxygen-rich blood to the muscles. When we rest, our breathing rate and our heart rate slow down. We also need to keep our body temperature at 37°C for good health. All the life processes in our body are geared to work best at this temperature. Although this may seem to be a human biology topic, you can explain it in terms of physical science.

Blood carries heat around the body. If there is too much heat, the blood vessels in the skin open and allow the blood to flow close to the surface. Heat can then pass to the surface by conduction, and some leaves the body by radiation. When sweat is produced, it takes away large amounts of heat as it evaporates, and this cools the blood.

When the body is too cold, the blood vessels in the skin close. This makes it more difficult for the body to lose heat by conduction and radiation. Sweating also slows or stops, so less heat is lost by evaporation. In mammals and birds, the other animals which have constant body temperatures, the fur and feathers rise in cold weather to trap air and form an insulating layer. We possess this mechanism, which can be seen in our ability to produce goosebumps, but we have so little hair on our bodies that it fails to make a useful insulating layer so we use clothes to help us keep warm.

Name: .... Form: ....

Based on **pages 18 and 19** of *Keeping warm and cool*

Do small animals lose more heat than large ones?

Try this…

1. Set up a small beaker and a large beaker on your table. The small beaker is a model of a small creature, like a mouse, and the large beaker is a model of a larger one, like an elephant.

2. Fill each beaker with very warm water.

3. Take the temperature of the water in each container and fill in the first line of the table.

Time (mins)	Temperature of large beaker (°C)	Temperature of small beaker (°C)
0		
5		
10		
15		
20		
25		
30		

4. Every five minutes, take the temperature of the water in each container and record it in the table.

5. Make a graph or chart of your results.

Looking at the results.

6. What do your results show?

✎...

✎...

Teacher's sheet: activity

Based on **pages 18 and 19** of *Keeping warm and cool*

Introducing the activity

(a) If the children have done the previous activity, you can tell them that this activity also involves scientific modelling.

If the children have not done the previous activity, begin by telling them that sometimes when scientists want to investigate something, they make a model. When scientists use models they like to make the models as simple as possible. In this investigation beakers will act as models.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form then go through tasks 1 to 4 (see note (i)).

(c) Let the children try tasks 1 to 4.

(d) Go through task 5 then let the children try it.

(e) Let the children try task 6.

Completing the activity

(f) Let the children compare their results and answers.

Conclusion

A large body cools down more slowly than a small body of the same shape because its surface area to volume ratio is greater. This is also true of living things and, for example, small creatures tend to have to use more of their energy keeping warm than large ones.

Teaching notes

(i) The difference in the size of the beakers or other containers should be as large as possible in order to get a more striking result.

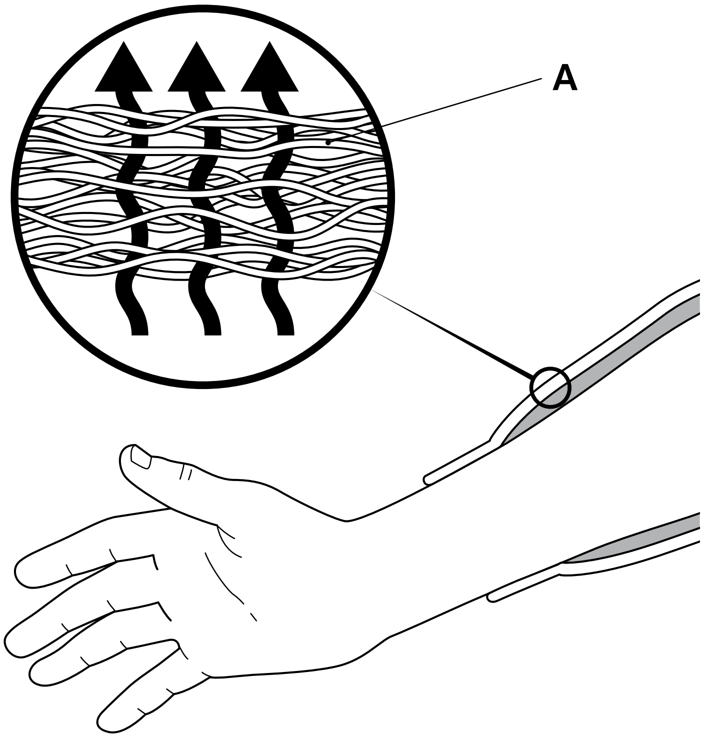
The thermometer bulb should be dipped into the centre of the water in each container.

Name: .... Form: ....

See **pages 20 and 21** of *Keeping warm and cool*

Using clothes to keep warm

To keep ourselves warm we need to stop too much heat from leaving our bodies.



Q1. (i) What substance does A trap?

✎............................

(ii) What substance moves as the arrows in the diagram show?

✎....................................

Q2. What is the easiest way to keep warm?

✎....................................

✎..

Q3. Why would plastic clothes be uncomfortable to wear?

✎..

✎..

✎..

Q4. What are used to make clothes warm and comfortable?

✎..

Q5. What is trapped in the cloth that helps keep us warm? ✎.................................

Q6. Why do woollen clothes keep us warm?

✎..

✎..

✎..

Teacher's sheet: comprehension

9

See **pages 20 and 21** of *Keeping warm and cool*

Answers

1. **(i) Air, (ii) moisture.**
2. **Stop cold air or water moving past our bodies.**
3. **They would trap moisture leaving the skin and this would make the plastic clammy, then wet.**
4. **Fibres woven together into a fine net.**
5. **Air.**
6. **They are made from curly and bulky fibres, which trap a lot of air when they are woven together.**

Complementary work

(a) Let the children use secondary sources to find out about the clothes people wear to keep warm in different parts of the world.

(b) Let the children use secondary sources to find out about weaving and knitting.

Teaching notes

If the children worked through Unit 7 of *3C Properties of materials*, you may like to remind them of their work now. In the earlier book the topic was more general. It was called 'Keeping the heat in' and referred to all materials, not just fabrics. It also dealt with keeping drinks warm, as well as keeping bodies warm. You may like to tell the children how the work in this topic deals with the subject again and gives them more detailed information.

There are several factors which are important in the design of clothes. For example, clothes need to be reasonably light in weight, otherwise it would be exhausting to wear them. They also need to be flexible, or the clothes would be uncomfortable. For example, a suit of armour was not worn for its comfort. Another aspect of comfort is the ability to dissipate body moisture in the form of sweat, so the material needs to let moisture pass through it. Finally, when clothes are made for warmth, the other factors must be considered too, so warm clothes must also be made of lightweight, flexible materials, which let moisture pass through them and also prevent heat escaping too quickly.

Many people think that it is the cloth fibres that form the insulation, but most of it is provided by the air trapped between the fibres. In the complementary work in Unit 7 of *Properties of materials*, an experiment was suggested in which two hot-water bottles were filled, a string vest was wrapped round one and both were then wrapped in a cotton or nylon material. After an hour the temperature of the bottles could be checked to demonstrate the insulating effect of the air in the string vest. If this work was not done in the past perhaps you may like to demonstrate it now.

C 9

Name: .... Form: ....

Based on **pages 20 and 21** of *Keeping warm and cool*

How slowly do clothes lose heat?

Try this...

1. Chose three kinds of cloth and write down their names in the column headings in the table, underneath the words 'Cloth A', 'Cloth B' and 'Cloth C'.

Time (mins)	Cloth A (°C) ✎	Cloth B (°C) ✎	Cloth C (°C) ✎
0			
5			
10			
15			
20			
25			
30			

2. Predict which one will lose heat most slowly, and which one will lose heat most quickly. Complete these sentences:

The cloth which will lose heat most slowly will be ✎...

The cloth which will lose heat most quickly will be ✎...

3. Wrap each cloth around a beaker or jar.

4. Pour the same amount of very warm water into each container.

5. Take the temperature of the water in each container and record the readings in the first line of the table.

6. Every five minutes, take the temperature of the water in each container and record it in the table.

Looking at the results.

7. How do the results match your predictions?

✎...

Teacher's sheet: activity

Based on **pages 20 and 21** of *Keeping warm and cool*

Introducing the activity

(a) Show the children a variety of different cloths. Tell the children that they are going to compare how the different cloths let heat pass through them.

Using the sheet

(b) Give out the sheet and let the children write their names and form then go through tasks 1 and 2 (see note (i)).

(c) Let the children try tasks 1 and 2.

(d) Go through tasks 3 to 6, then let the children try them (see note (ii)).

Completing the activity

(e) Let the children try task 7 (see note (iii)).

(f) As different groups may have used different cloths, let each group present their results to the rest of the class. Some groups may have used one or two of the same cloths. They could compare their results and assess each other's accuracy.

Conclusion

The cloths which are thickest and have the most air spaces will tend to lose heat most slowly. The cloths which are thin and have few air spaces will tend to lose heat most quickly.

Teaching notes

(i) The cloth could come from a selection of old clothes which have been cut up.

(ii) If the children have done several of the previous investigations, you may let them read the instructions and try the experiment for themselves. Keep a close watch to see that they can manage without your going through the tasks first.

(iii) The children should say whether their predictions match, do not match or partly match the results.

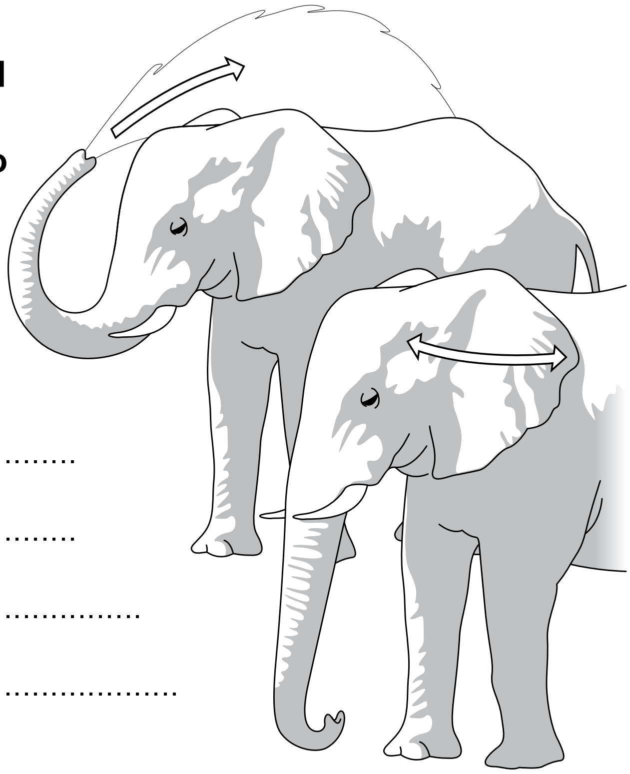
10

Name: .... Form: ....

See **pages 22 and 23** of *Keeping warm and cool*

How animals keep warm and cool

Animals have all of the problems that we have in keeping warm and cool. An animal's shape, and how it behaves, often give you a clue to how it keeps warm and cool.



Q1. These elephants are cooling themselves down in two ways. What are they doing?

✎..

✎..

✎...

✎...

Q2. Name three types of reptile.

✎.................................... ✎.................................... ✎....................................

Q3. How do reptiles warm themselves up?

✎...

Q4. What can reptiles do when they are warm?

✎...

Q5. (i) In which part of the world do elephants live? ✎...

(ii) What is the weather like in this place? ✎...

Q6. How do elephants lose heat without sweating?

✎...

✎...

✎...

✎...

Teacher's sheet: comprehension

See **pages 22 and 23** of *Keeping warm and cool*

Answers

1. **The one on the left is spraying itself with water. The one on the right is wafting its ears to and fro.**

2. **Alligator, crocodile and lizard.**

3. **By sunbathing in the first part of the day.**

4. **Hunt for food.**

5. **(i) The tropics (near the equator).**
   (ii) Hot.

6. **They gently waft their ears to and fro. This makes more air flow over them and carry away heat from the blood in their ears.**

Complementary work

(a) Many animals use burrows in the ground to escape from the heat of the day. Take the chidren outside and let them dig a hole and compare the temperature there with the temperature at ground level. They should find that it is cooler in the hole.

(b) Let the children use secondary sources to find out how an animal's temperature changes when it hibernates.

Teaching notes

Animals generate heat in their bodies when they use food. The liver and muscles use large amounts of food and generate heat. This circulates round the body in the blood. Some animals (mammals and birds) can conserve this heat and use it to keep their body temperature constant. These animals are often called warm-blooded animals. All other animals cannot conserve heat, and their body temperature changes with the temperature of their surroundings. These animals are often called cold-blooded animals, but the description is not accurate. In the tropics, when an animal has warmed up its body to that of its surroundings, it can have blood as warm as birds and mammals.

The advantage of having a constant body temperature is that the body can remain active in a wide variety of weather conditions. The disadvantage of a constant temperature is that the body only works within a small temperature range, and if the body temperature falls outside this range for any reason, the animal will die.

The advantage of having a body temperature which varies with the surroundings is that large amounts of food are not needed to provide the energy to heat the body. Small mammals like shrews lose a great deal of heat, especially in cold weather, because of their size, and can only maintain their body temperature by eating almost constantly. Lizards by comparison simply rest in cold weather. All the life processes slow down and food stored as fat is used slowly. The disadvantage of not having a constant temperature is that in cold weather, cold-blooded animals move slowly and are more easily caught by warm-blooded predators.

10

Name: .... Form: ....

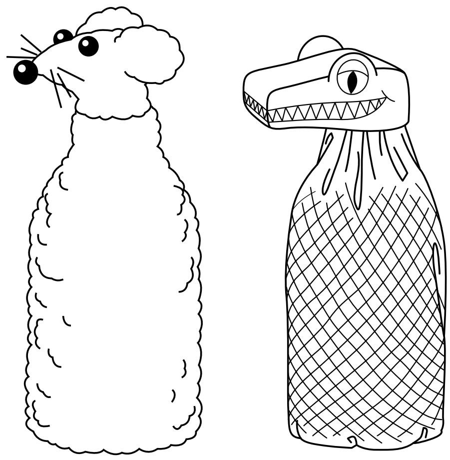
Based on **pages 22 and 23** of *Keeping warm and cool*

Reptile versus mammal

Try this…

1. Select two similar containers which you will use for the body of your animals.

2. Collect some grease-proof paper and paint a scaly pattern on it. Stick it onto one bottle. This will be the reptile.



3. Collect some fur, fabric or cotton wool and stick it onto the other container. This will be the mammal.

4. Make a head for each ‘animal’.

How will their heads help to keep heat in the containers?

✎...

✎...

5. Think of a plan to test which type of body covering keeps in the most heat and write it down here.

✎...

✎...

✎...

✎...

6. Make a table on a separate piece of paper to record your results.

7. Check your plan and table with your teacher before you use them.

8. Make line graphs of your results.

Looking at the results.

9. What do the results show?

✎...

Teacher's sheet: activity

Based on **pages 22 and 23** of *Keeping warm and cool*

Introducing the activity

(a) The children should do this activity after they have done one or more of the activities in Units 7 to 9 (see note (i)). The children should now be aware of the use of scientific modelling and this activity will allow them to add a little individuality to the investigation.

Tell the children that most mammals have a thick coat of fur, while reptiles are covered in scales (see note (ii)).

Using the sheet

(b) Give out the sheet and let the children fill in their names and form then go through tasks 1 to 4 (see note (iii)).

(c) Let the children try tasks 1 to 4.

(d) Go through task 5 and 6 then let the children try them (see note (ii)).

(e) Go through tasks 5 to 7 then let the children try them (see note (iv)).

(f) Go through task 8 then let the children try it.

Completing the activity

(g) Let the children try task 9 and then compare their results.

Conclusion

The model reptile cools down faster than the model mammal. The model reptile skin is not as good an insulator as the model mammal fur.

Teaching notes

(i) This will give them experience in planning the investigation, making a table for results and producing a line graph.

(ii) If your school policies permit, you may be able to obtain a moulted snake skin from a zoo. This has a papery feel to it and will help the children realise that grease-proof paper is slightly similar.

(iii) Check that the containers are suitable for holding very warm water. The children may use pots, beakers or bottles.

The children must realise that the heads are not just for decoration, but help to stop heat loss by convection, just like the stopper in the vacuum flask on page 15 of the pupil book.

(iv) The plan should mention using equal volumes of water that are at the same temperature, taking temperature readings at regular time intervals. The table should have three columns headed 'Time (mins)', 'Reptile °C' and 'Mammal °C'.

SAT STYLE QUESTIONS

Name: .... **Form:** ....

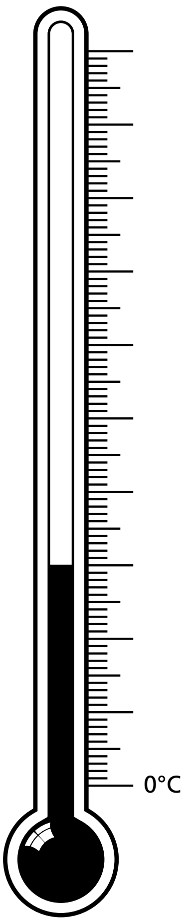
Q1. If you touched these four materials, which one would feel the coldest?

Tick one box: Metal ☐ Wood ☐ Paper ☐ Wool ☐

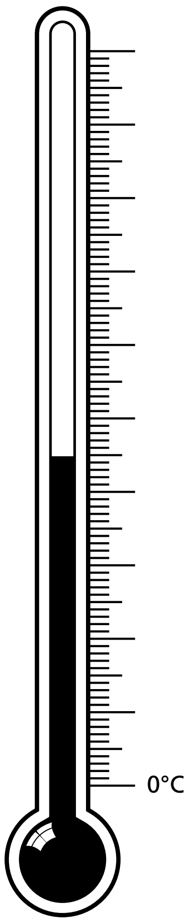
Q2. What are the temperatures shown by thermometers A, B and C?

Write the temperature shown by each thermometer in the space below it.

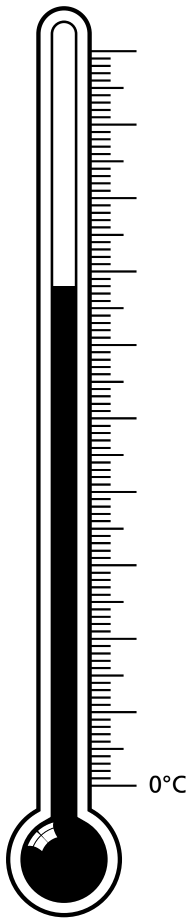
A



B



C



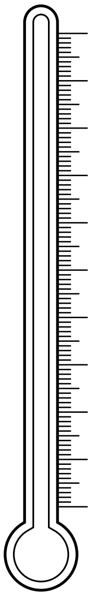
✎A....................... ✎B......................... ✎C ....

SAT STYLE QUESTIONS

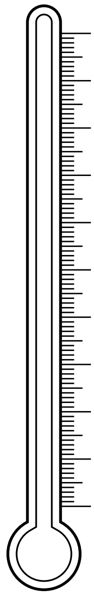
Name: .... **Form:** ....

Q3. (a) Colour in thermometer A to show the level of the liquid when the thermometer reads 50°C.

A



B



(b) Colour in thermometer B to show the level of the liquid when the thermometer reads 73°C.

Q4. What is the freezing point of water?

Tick one box: 0°C ☐ 10°C ☐ 50°C ☐ 100°C ☐

Q5. Ben put the bulb of a thermometer in some very cold water to find its temperature. He held the thermometer in the water for one minute, then read the thermometer while it was still in the water. What happened to the liquid in the thermometer?

Tick one box:

☐ It went up.

☐ It stayed the same.

☐ It went down.

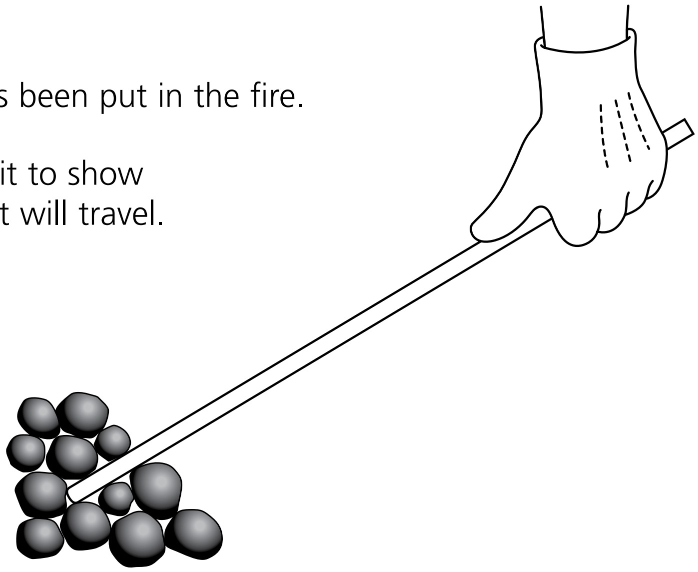
Q6. What word does the C stand for in '°C'? ✎..

SAT STYLE QUESTIONS

Name: .... **Form:** ....

Q7. This poker has been put in the fire.

Draw an arrow on it to show which way the heat will travel.



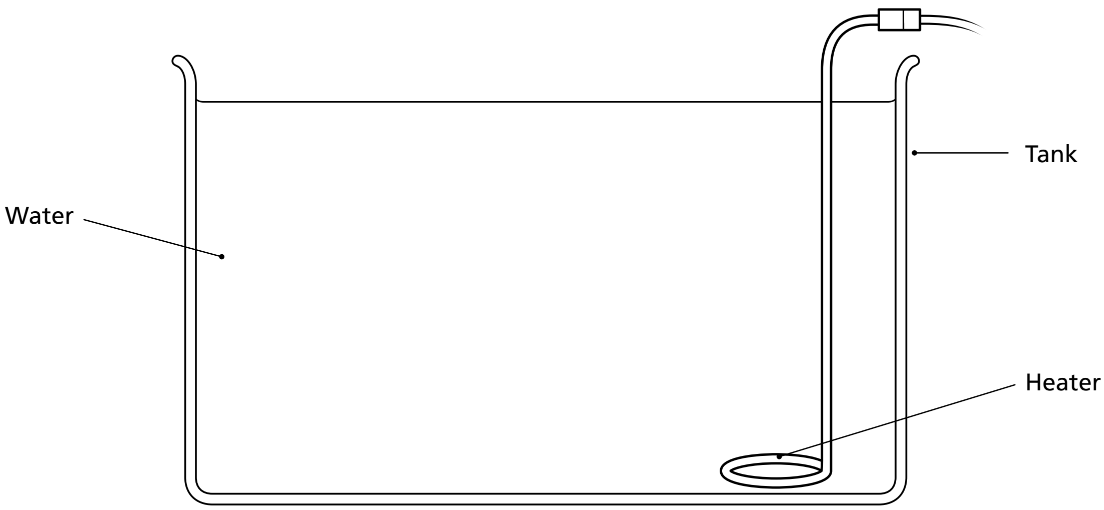
Q8. What word is used for materials that let heat pass through them?

✎...

Q9. What word is used for materials that do not let heat pass through them?

✎...

Q10. This tank of water has been set up with a heater in it.



(i) Draw how the water will move in the tank when the heater is switched on.

(ii) What is the name of the process by which the water moves in the tank?

✎...

SAT STYLE QUESTIONS

Name: .... **Form:** ....

Q11. Angela is wearing black clothes, Belinda is wearing grey clothes and Claire is wearing white clothes. They go for a walk in the sunshine.

(i) Who will feel hottest? ✎...

(ii) Who will feel coolest? ✎...

(iii) What is the process called in which heat travels from the Sun to the girls' clothes?

✎..

12. Arif took the temperature of the air in a room at four places. Here are his results.

Place	Temp (°C)
Floor	16
Table	18
Windowsill	14
Ceiling	20

(i) Which part of the room was the hottest? ✎...

(ii) Explain why this part of the room was the hottest.

✎..

(iii) Which part of the room was the coldest? ✎...

(iv) Suggest a reason why this part was the coldest part of the room.

✎..

✎..

✎..

SAT STYLE QUESTIONS

Name: .... **Form:** ....

Q13. What is the normal temperature of the human body?

Tick one box: 32°C ☐ 37°C ☐ 45°C ☐ 100°C ☐

Q14. Mina has been playing a hard game of netball and she is now hot. What will her skin make to cool her down?

✎...

Q15. Ben has been for a swim and has come out into the cold air. How will his muscles warm him up?

✎...

Q16. Jane put an ice cube in a jar and left it on her table. She set up another ice cube in a second jar, and wrapped the jar in her scarf. Later she saw that the first ice cube had half-melted.

(i) What happened to the second ice cube?

Tick one box:

☐ It was more than half-melted.

☐ It was less than half-melted.

☐ It will have all turned to water.

(ii) Which way does heat move through the scarf?

✎...

Tick one box:

☐ From the jar to the air. ☐ From the air to the jar.

SAT STYLE QUESTIONS

Name: .... **Form:** ....

Q17. Arif and Ben measured the temperatures of three jars of water.

Here are their results.

Time (mins)	Jar A temp °C	Jar B temp °C	Jar C temp °C
0	70	70	70
5	60	65	59
10	53	59	51
15	45	55	43
20	37	50	34
25	29	44	26
30	21	39	21
35	21	34	21

(i) Which jar cooled down quickest? ✎..........................

(ii) Which jar cooled down slowest? ✎..........................

(iii) The jars were different sizes. Which one do you think was the largest?

✎..........................

(iv) What happened to the temperatures of jars A and C in the last five minutes of the investigation?

✎..

(v) Why are the final two temperatures of jars A and C 21°C?

✎..

(vi) If the investigation had continued, how long do you think it would have taken for jar B to reach 21°C?

✎..

ANSWERS
SAT STYLE QUESTIONS

1. Metal. *1 mark*

2. (A) 30°C, (B) 45°C, (C) 68°C. *3 marks*

3. (i) Thermometer A coloured in up to the 50°C level. *1 mark*
(ii) Thermometer B coloured in up to the 73°C level. *1 mark*

4. 0°C. *1 mark*

5. It went down. *1 mark*

6. Celsius. *1 mark*

7. Arrow points away from the fire. *1 mark*

8. Conductors. *1 mark*

9. Insulators. *1 mark*

10. (i) Arrow rising above the heater; arrow going across the top and to the left; arrow going down the left side of the tank; and an arrow going across the bottom and to the right. *4 marks*
(ii) Convection. *1 mark*

11. (i) Angela. *1 mark*
(ii) Claire. *1 mark*
(iii) Radiation. *1 mark*

12. (i) Ceiling. *1 mark*
(ii) Hot air rises. *1 mark*
(iii) Windowsill. *1 mark*
(iv) Draught, or glass conducts heat away quickly. *1 mark*

13. 37°C. *1 mark*

14. Sweat. *1 mark*

15. They will make him shiver. *1 mark*

16. (i) It was less than half-melted. *1 mark*
(ii) From the air to the jar. *1 mark*

17. (i) C. *1 mark*
(ii) B. *1 mark*
(iii) B. *1 mark*
(iv) They did not change. *1 mark*
(v) They have reached room temperature. *1 mark*
(vi) 10 to 15 minutes. *1 mark*

Total marks: 35