

Unit 4C Keeping warm

Adapted from QCA Science Unit 4C

ABOUT THE UNIT

Through this unit children build on their ideas about temperature as a measure of how hot or cold objects are and learn about thermal insulators as materials which can help to keep things warm or cool.

Experimental and investigative work focuses on:

- turning ideas into a form that can be investigated
- using thermometers to make careful measurements of temperature
- identifying and suggesting explanations for patterns and trends in results and using results to draw conclusions.

Children also have opportunities to use IT (see IT Units 3C and 4D) to collect, retrieve and present information and to use their understanding of science to explain everyday phenomena about keeping warm and cooling down.

This unit takes approximately 10 hours.

WHERE THE UNIT FITS IN

Builds on Unit 2D 'Grouping and changing materials', Unit 3C 'Characteristics of materials' and Unit 4F 'Circuits and conductors'

Children need:

- to know that metals are good electrical conductors
- to be able to identify materials
- to be able to measure some quantities *eg length* in standard measures.

Links with Units 3F, 4A, 4D, 5C, 5D, 6A and geography.

VOCABULARY

In this unit children have opportunities to use:

- words and phrases related to warmth and cold *eg temperature, thermometer, degrees Celsius, thermal conductor, thermal insulator*
- related nouns and verbs *eg conductor/conduct, insulator/insulate*
- phrases with specific scientific meaning *eg room temperature*
- words which have a different meaning in other contexts *eg conductor.*

RESOURCES

- thermometers
- [NNS interactive program: thermometer](#)
- containers for water *eg beakers, metal cans*
- IT temperature sensor
- [LogIT Live software](#)
- access to a source of ice
- a variety of materials *eg bubble wrap, sponge sheeting, aluminium foil, woollen (or other) blanket, cotton, paper, polystyrene wrap, polythene*
- wooden, plastic and metal spoons
- metal saucepan with wooden or plastic handle

EXPECTATIONS

at the end of this unit

most children will:

recognise that temperature is a measure of how hot or cold objects are; identify some materials that are good thermal insulators and some everyday uses of these; recognise that the same materials keep cold objects cold as keep warm objects warm; use thermometers to measure temperatures; suggest how to investigate a question; construct tables for their results and offer simple explanations for results

some children will not have made so much progress and will:

recognise that temperature is a measure of how hot or cold objects are; identify some everyday uses of thermal insulators; use thermometers to measure temperature and present results in tables prepared for them

some children will have progressed further and will also:

recognise that objects cool or warm to the temperature of their surroundings when they are left; recognise that metals are both good thermal and good electrical conductors

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
<ul style="list-style-type: none"> that the sense of touch is not an accurate way of judging temperature 	<ul style="list-style-type: none"> Present children with an ice cube, bowls of water at room temperature and warm water and ask them to judge how hot they are. Ask them to judge the temperature of something after having their hand(s) in hot water, then to judge the same thing after having their hand(s) in cold water. Ask them whether it is always easy to tell using their sense of touch and how they could make a better judgement. Ask the children how we can judge temperature more accurately – i.e. using a thermometer. Ask the children where and when thermometers are often used. 	<ul style="list-style-type: none"> identify touch as a method of telling whether things are hot or cold and suggest it is not very accurate, particularly when differences are small 	<p>SAFETY – Children should not touch ice immediately after it is removed from a freezer. Water should not be uncomfortably hot, just warm.</p>
<ul style="list-style-type: none"> to use a thermometer to make careful measurements of temperature using standard measures that temperature is a measure of how hot or cold things are and that something hot will cool down and something cold will warm up until it is the same temperature as its surroundings to explain temperature and temperature changes using scientific knowledge and understanding 	<ul style="list-style-type: none"> Ask children to explore how thermometer readings change <i>eg when they hold it in their hand, blow on it, put it under a cold running tap.</i> Demonstrate to children, using a container of water at room temperature, how to use a thermometer safely and to an appropriate degree of accuracy. Ask children to make readings from the large-screen NNS thermometer displayed on the computer. Provide children with containers of water at a range of temperatures (including below room temperature) and ask them to find the temperature of each. Ask children to take the temperatures of the bowls of water after about an hour. Record the results, and compare with the original readings and ask children to suggest what has happened. While children are waiting practise reading thermometer scales from models, drawings or the NNS interactive program. 	<ul style="list-style-type: none"> use a thermometer correctly to make readings of temperature given the temperature of a room, correctly predict the final temperature of an initially cooler or warmer container of water read correctly the temperature indicated on models or drawings of thermometers 	<p>Children will need to have access to thermometers which can be read to $\pm 1^{\circ}\text{C}$.</p> <p>SAFETY – Mercury thermometers are not suitable for use in primary schools because of the problems of clearing up toxic mercury if they are broken. <i>(We have alcohol thermometers.)</i></p> <p>SAFETY – Care is needed with hot water. If hot water is poured into containers made of some plastics they may soften, spilling the water. Keep children well back if water is more than hand hot. <i>(Should not be above 60°C.)</i></p>

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<ul style="list-style-type: none"> to use IT to collect, store and retrieve temperatures and to explain trends and patterns in results in terms of scientific knowledge and understanding 	<ul style="list-style-type: none"> Ask children to draw a plan or map of the classroom showing which areas they think are hot and which are cold. Ask them to explain their suggestions and to guess the temperature of their classroom. Use children's suggestions to choose two or three suitable places in the classroom and use the temperature sensor or thermometer to record the temperature in these places over a period of 24 hours. Ask children to compare the results obtained with their suggestions and to suggest reasons for any differences. 	<ul style="list-style-type: none"> explain why they think some parts of the classroom will be warmer than others and recognise that the temperature of the classroom is usually around 20°C identify differences in the recorded temperatures and, with help, explain these in terms of day and night and the characteristics of the place 	<p>Children sometimes use the word 'heat' and 'temperature' interchangeably. These are two distinct concepts and it is important for teachers to use the words correctly.</p> <p>A sensor linked to a computer can be used to display the temperatures at regular time intervals as water cools. This provides an opportunity for children to begin to interpret a line graph. Our equipment is the LogIT Live box.</p> <p>Thermometers can also be used and records of temperature made at regular intervals during the day so the children can have confidence in the computer readings but realise that it is easier for the computer to do this routine task.</p>
<ul style="list-style-type: none"> to turn an idea about how to keep things cold into a form that can be investigated to decide what evidence to collect to make a table and to record results in it to draw conclusions from their results 	<ul style="list-style-type: none"> Ask children to suggest ways things are kept cool <i>eg cold drinks as part of a packed lunch, or taking frozen food home.</i> Ask them to think about how they could find out in school about possible ways to keep something cold <i>eg using an ice cube as a cold object and trying out different wrappings (bubble wrap, sponge sheeting, aluminium foil, polythene), what they would do and what apparatus they would use eg leave all the wrapped ice cubes for half an hour, look at them every fifteen minutes.</i> Ask children how they will know whether their method works (i.e. keeps the cube solid longer than expected) – e.g. leave one (some) ice cubes out unwrapped. Help children to write a plan for the experiment noting how the test will be fair. Help children to think about what they will record and ask them to make a table for their results. Ask children to make a record of what they did in drawing and writing. 	<ul style="list-style-type: none"> with help children suggest a way of testing how to keep cold things cold and what observations they are going to make with help children write a plan for their experiment record results clearly in a suitable table using drawing or writing identify which materials are effective in preventing the ice cube melting and some common features of these <i>eg all the materials that stopped the ice cube melting were thick</i> 	<p>Children will sometimes suggest that the material will keep the cold in rather than prevent the surroundings warming up the ice. It is important to avoid implying that this is so. It is also important to try to avoid implying that 'heat' is like water or air.</p> <p>SAFETY – Check children's plans carefully for safety <i>eg use of hot water.</i></p>

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<ul style="list-style-type: none"> to turn an idea about how to keep things warm into a form that can be investigated to plan a fair test deciding what to change, what to keep the same and what to measure to make careful measurements of temperature at regular time intervals to record results in a table and to use these to draw conclusions that some materials are good thermal insulators 	<ul style="list-style-type: none"> Ask children to think about the sort of materials they use to keep themselves warm in winter and how they could investigate which materials help keep things warm. Ask how they will judge whether something is keeping warm or not. Help children to plan an investigation (<i>and write down their plan</i>) to find out what materials will keep <i>eg a container of water</i> warm for the longest time. Ask children to suggest how the test will be kept fair and how often to take the temperature. <i>Ask children to record these details as notes on their planning sheet.</i> Ask different groups of children use different materials. Help children to record their results in tables and to interpret what they show. 	<ul style="list-style-type: none"> carry out a fair test <i>eg using the same sort of container with the same volume of water in it</i> make careful measurements of the temperature of liquid in containers at regular time intervals and present results in a suitable table interpret their results to make comparisons of how well different materials kept the water warm identify some materials as good thermal insulators 	<p>This activity, and the previous one, offer children opportunities to carry out a whole investigation. It may be helpful to concentrate on the aspects of investigation highlighted in the learning objectives.</p> <p>Some children may be ready to interpret results from this activity presented as line graphs.</p>
<ul style="list-style-type: none"> that good thermal insulators keep cold objects cold and warm objects warm 	<ul style="list-style-type: none"> Discuss with children whether their investigations showed that similar sorts of material kept ice cubes from melting and liquids from cooling. Remind them about using flasks for hot and cold drinks. 	<ul style="list-style-type: none"> compare the results of the two investigations and identify a material that kept the ice cube from melting and prevented water cooling quickly 	<p>Children may find it difficult to accept that the same types of material help keep cold objects cold and warm objects warm. Concept cartoons could be used to introduce ideas about keeping things cool or warm and to stimulate suggestions.</p>

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<ul style="list-style-type: none"> that metals are not good thermal insulators but that wood and plastics are that materials such as metals which are good electrical conductors are often good thermal conductors 	<ul style="list-style-type: none"> Place long handled spoons made of metal, plastic, wood (or metal, plastic and wooden rods) in a container of hot water and ask children to feel how warm the handles are after five to ten minutes. Discuss the results and ask children to suggest why saucepans often have wooden or plastic handles. Record explanations in drawing and writing. Remind children of work on electrical conductors and ask them which types of material are good electrical conductors. Introduce the terms: <i>good conductor of heat, poor conductor of heat</i> 	<ul style="list-style-type: none"> state that the metal spoon feels hotter than the plastic and wooden spoons explain that the wooden and plastic spoons are insulators but the metal spoon is a conductor saying <i>eg the metal spoon lets heat travel along it so it feels hot at the end</i> generalise that metals are both good electrical and good thermal conductors 	<p>SAFETY – Care is needed with hot water. If hot water is poured into containers made of some plastics they may soften causing water to spill. Keep children well back if water is more than hand hot.</p>
<ul style="list-style-type: none"> to recognise a range of uses of thermal insulators 	<ul style="list-style-type: none"> Prepare a class presentation about keeping things warm or keeping things cool <i>eg by making a display of packaging, wrapping, pictures, clothing</i> with explanations of their purposes. 	<ul style="list-style-type: none"> identify a range of everyday ways in which <i>eg food, drinks, people, animals</i> are kept, or keep, cold or warm 	