

TEMPERATURE - INSULATION

SENSOR(S)

- Internal temperature
- External temperature

INVESTIGATE

- That some materials are better thermal insulators than others
- Compare everyday materials - investigate and discuss uses of materials
- That temperature is the measure of how hot or cold an objects is



INTRODUCTION TO THE INVESTIGATION

This investigation is a good introduction into the measurement of temperature and how it can be recorded using thermometers or temperature sensors. Before starting to discuss the investigation allow the pupils to experiment with the Explorer, software and temperature sensor to see what happens to the graph when the probe is heated and the temperature rises and what happens when it cools - encourage the children to describe what is happening. Talk about the unit of measurement that is displayed - °C (Celsius). The pupils could also look at other devices for measuring temperature.

Once the pupils have experimented with the sensor and the idea of temperature the class can discuss ways of changing temperature by cooling and heating and how to protect against different temperatures. Ask the children to think about the sort of materials they use to keep warm in winter. Discuss other things that we may want to keep warm such as drinks.

Talk about how an investigation could be designed to test different materials to see how well they keep things warm and also the issues of fair testing involved. You could look at testing clothing or house insulation, the investigation detailed here looks at the design of drinks containers.

This work can also be linked to technology work looking at the design of packaging and containers and selecting appropriate materials for products.

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RESOURCES

- Explorer datalogger , datalogging software, computer, LogIT computer link cable.
- Explorer external temperature sensors
- Electric kettle to heat water (CARE! - Water above 55° C can scold so BE CAREFUL)
- Measuring jug
- A range of different containers or a range of materials to wrap around containers
- Deep tray to place containers in to catch any spillage and plenty of paper towels or similar to deal with spillages

WHAT TO DO

- Plug the external temperature sensors into the Explorer datalogger (avoid over plugging the internal temperature sensor if only 1 or 2 external sensors are available as the internal sensor can be used to monitor room temperature).
- Connect the Explorer to the computer and run the datalogging software
- Set up the logging facility of the software (if necessary set the time span of the software to at least 20 minutes, depending on the time available).
- Place the containers in a tray and put one temperature sensor in each – if possible avoid the temperature sensor touching the side of the containers as it is the liquid temperature that needs to be measured (fair testing).
- Pour the same volume of hot water into each container (fair testing)
- Start the software logging
- While logging the experiment can be discussed and pupils asked to predict what will happen – get them to describe or draw the graph lines.
- At the end of the experiment stop the computer logging, save and print the graph
- Repeat the experiment with different containers or compare the results with other groups
- Discuss and/or write up the Findings – a class display could be created showing uses for cups and materials

If computers are limited the same investigation can be carried out using the Explorer's remote logging facility which is selected by using the blue button. Results can then be downloaded to a computer. By using remote logging the investigation can be left for a long period without tying up a computer.

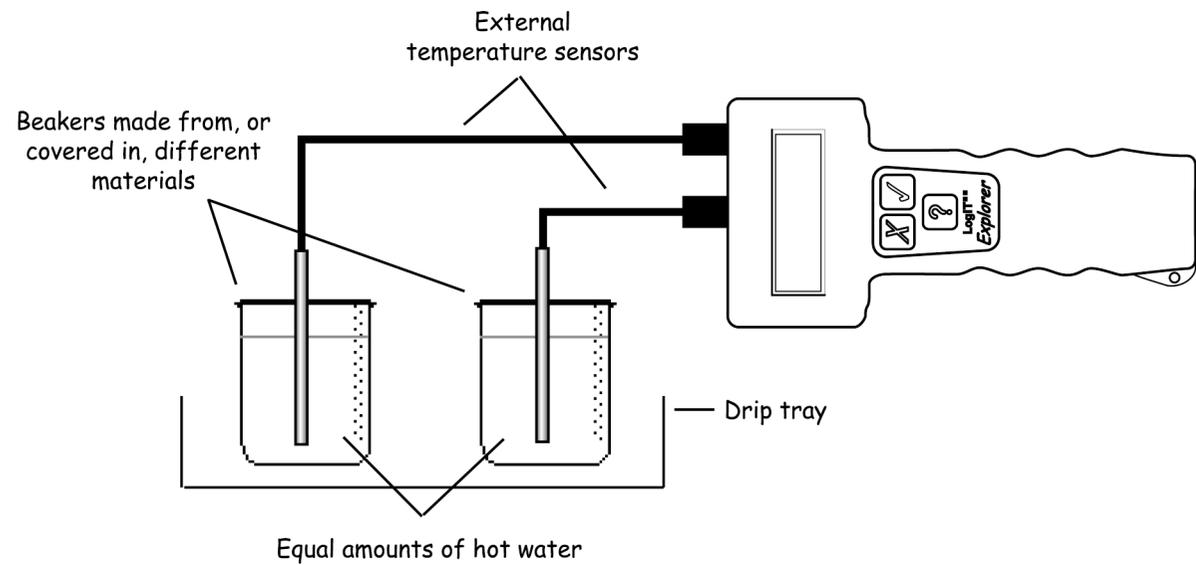
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SAFETY



- Extreme care is needed when using hot water.
- Hot water can soften some types of plastic containers causing water to spill.
- Children should be kept well back if water is more than hand hot.
- Liquids and computers do not mix so ensure that a tray is used to catch spillage and that paper towels are on hand to mop up accidents.

DIAGRAM



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ABOUT THE RESULTS

- Can any difference in temperature be seen after 15 minutes ?
- Get the pupils to describe what is happening to the graph lines
- Which material is acting as the best insulator ?
- Is this as predicted ?
- What would make the hot water cool down more quickly ? (such as blowing on it)
- Does the actual container become warm ?
- Where is the heat going ?
- Can something be added to slow the cooling even more ? (hint: think about the top)

EXTENSION ACTIVITIES

- Try out different thickness' of the same material by adding layers.
- Does the shape of the container make any difference ?
- Try different size containers.
- Does a container wrapped in 'wet material' cool down more quickly than a container wrapped in 'dry material'?
- Does the type of liquid make a difference e.g. does tea cool down more quickly than coffee ?
- Use a fan or hair dryer to act as the wind. Does this cause the hot water to cool down more quickly ? Can link to work on cooling by evaporation.
- Instead of looking at keeping drinks warm you can look at different materials for use in clothing by wrapping material around a bottle full of hot water and measuring the temperature of the water.
- Does it matter when you add milk to tea - 2 cups of hot water, add cold to one after a minute and cold to the other after 10 minutes.
- The 'opposite' investigation can be carried out by trying to stop ice cubes from melting – try the same materials as in the keeping warm investigation.
- If only two external sensors are used allow the containers to cool completely so that the pupils can investigate that objects cool or warm to the temperature of their surroundings when left.