

TEMPERATURE - MELTING ICE

SENSOR(S) - External temperature

INVESTIGATE

- That the freezing temperature of water is 0°C (Celsius)
- That objects cool or warm to the temperature of their surroundings when left.
- To form a prediction and compare this to the result to create a conclusion



INTRODUCTION TO THE INVESTIGATION

Having introduced the idea of temperature and how it is measured the pupils can use their measurement skills to look at the melting point and boiling point of water.

Before looking at this investigation it is important that the pupils already know that materials can be classified as solids, liquids and gases. They also need to understand terms such as ‘melting’, ‘freezing’, ‘boiling’, ‘state’, ‘change’ etc..

This investigation and its extension activities, should enable the pupils to name and describe examples of the main processes associated with water changing state and that these processes can be reversed. The pupils will also investigate that objects cool or warm to their surroundings

RESOURCES

- Explorer datalogger, datalogging software, computer, LogIT computer link cable.
- Explorer external temperature sensor
- Glass (heat proof) beaker.
- Ice cubes or similar - preferably made from purified water.
- Access to a refrigerator for extension activity.
- Bunsen burner stand and burner or suitable heat source for extension activity.
- Salt for extension activity.

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WHAT TO DO

- Plug the external temperature sensor into the Explorer datalogger (avoid over plugging the internal temperature sensor as this is 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 120 minutes, depending on the time available). **
- Place the ice in the beaker.
- Place the sensor in the ice ensuring that it does not touch the bottom or sides and that when the ice melts it will still be covered by water.
- Add a small amount of water to help start the melting process.
- Start the software logging.
- While logging the experiment can be discussed and pupils asked to predict what will happen.
- At the end of the experiment stop the computer logging, save and print the graph
- Discuss and/or write up the Findings

** This investigation is best 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. However, if computers are available it does enable the investigation to be monitored and discussed at regular intervals.

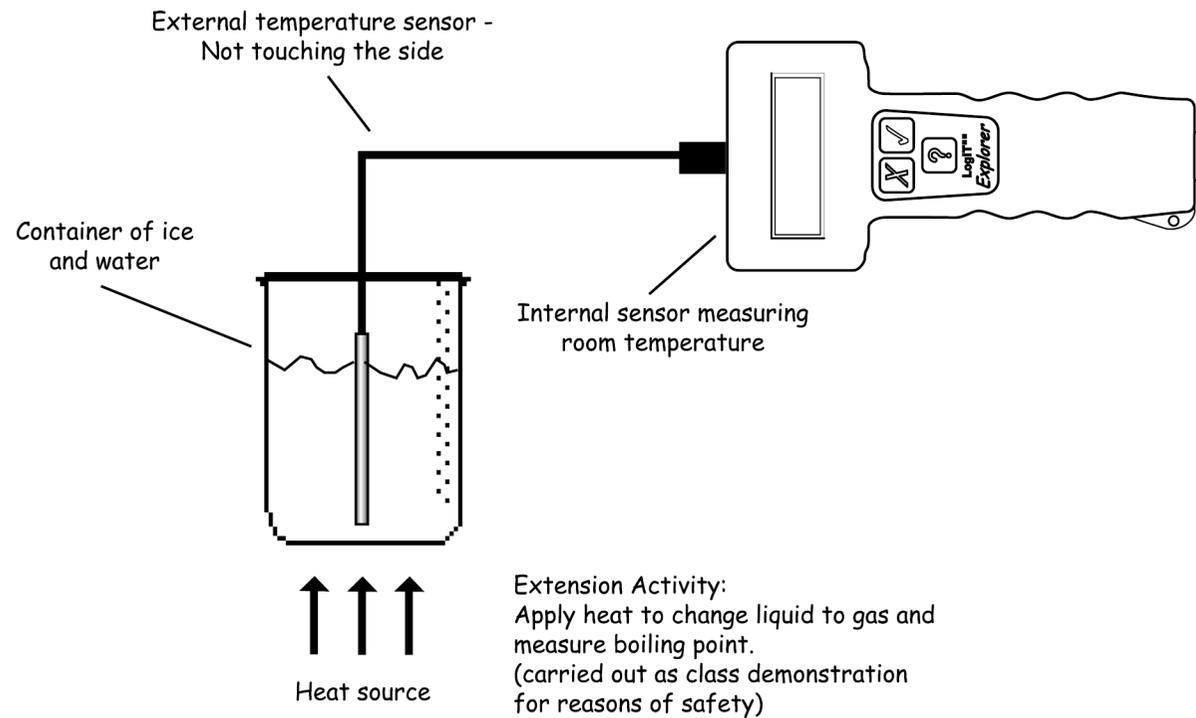
SAFETY



- Liquids and electrical items do not mix so ensure that a tray is used to catch spillage and that paper towels are on hand to mop up accidents.
- Avoid pupils handling ice and containers directly from a freezer as it is possible to get freezer burns.
- Do not allow the pupils to eat ice cubes or drink the water as this encourages unsafe laboratory practices.

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DIAGRAM



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ABOUT THE RESULTS

- Discuss how it was made a fair test ? - was the sensor touching the beaker, was the sensor at the same height in the ice and the water, should the sensor be in the middle of the beaker ?
- What temperature did the ice begin to melt at ?
- Was there a flat area of the graph ? What is happening during this time ?
- What temperature did the water end up as ? – if left long enough this should be room temperature, this point can be discussed.
- Ensure that the pupils are aware that the ice point (freezing point) of water is 0°C. The purity of water can cause results not to exactly match this point and may require discussion.
- Did the investigation match the pupils predictions ?
- Discuss that the solid state of water (ice) has been changed to the liquid state by an increase in temperature.

EXTENSION ACTIVITIES

- Look at how the change from a solid to liquid can be reversed by placing the beaker of water into the freezer (the freezer takes heat out, it does not put cold in) – this freezing process can be measured using the Explorer and an external temperature sensor – it is not recommended that the Explorer is placed in a freezer or refrigerator.
- Look at how the liquid can be turned into a gas (steam) by heating further – this should be done as a class demonstration for safety reasons. The Explorer can be used to show that the water boils at 100°C (as with freezing this point is affected by the purity of the water). It is important that pupils observe that even if it is heated further the temperature will not increase.
- Once the water is boiled a sheet of ClingFilm can be carefully held over the beaker (gloves should be worn) to show how the gas condenses back into water i.e. the change of state from liquid to gas can be reversed by cooling.
- When talking about water turning into a gas it should be pointed out that the steam is in fact colourless and that the ‘white cloud’ we normally say is the steam is in fact water vapour as the steam (gas) turns back to a liquid. This can be shown by looking at a boiling kettle, there is a gap between the kettle spout and the cloud of water vapour, this gap is in fact the gas. It is sometimes possible to demonstrate this to a class by shining a light behind the kettle so that its shadow is shown on a screen or wall – this need some ‘playing’ with and the right sort of kettle.