1. A Pinch of Salt

Children investigate the use of salt on icy roads. Cartoon character, Chris, finds a container of salt near his new house at the top of a steep road. He does not know what the salt is for. This prompts the children to plan an investigation into the effect of adding salt to ice.

OBJECTIVES

- To describe changes that occur when materials are mixed.
- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs

RESOURCES

Copies of Activity sheets S3-S4, salt, freezer compartment, baking trays, tidy trays, ice-cube trays, stop clocks or stopwatches or egg- timers, funnels, plastic jugs, yogurt pots, 20 ml plastic measuring cylinders (or teaspoons, as non-standard or 5 ml measures), range of weights (100-500 g). Other resources, depending on the children's planned investigations.

Activity sheet S3 provides the stimulus for this activity and is intended to promote class discussion once children have completed the final box. The cartoon introduces the character Chris, who is featured throughout the activities. Chris moves to a new house at the top of a steep road and discovers a container of salt nearby. Chris does not know what the salt is for.

Children fill in the final box of the cartoon with their suggestion for the salt's use. Most children are aware that such containers of salt are used to de-ice roads in winter and will have drawn this option in the final box. The teacher can also complete a cartoon strip, which can be used if children have not thought of the possibility of de-icing. The children will enjoy seeing the teacher's artwork, good or bad!

Activity sheet S4 prompts an investigation into the use of salt on roads. On this sheet Mum tells Chris that salt is put on icy roads in winter. Children plan a test to find the answer to Chris's question, "What good will that do?" They are guided through the planning stages, by considering resources, 'fair' test conditions, and what and how they will measure and record.

During planning the children must decide on quantities of salt and ice, whether to stir the mixtures, drain water away, add more salt at regular intervals, etc. If children want to change their investigation once they have started, they should give the teacher a valid reason before doing so.

RECORDING THE ACTIVITY

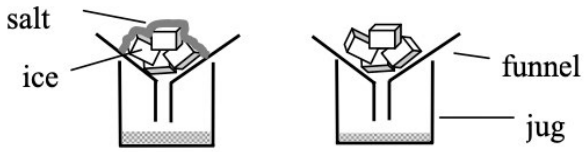
Results are best initially jotted down in a table during the test. During quieter moments of the investigation, the results can be transferred to a bar chart or a line graph (see page 65). The choice of graph will depend on the ability of the children. Different coloured bars or lines can represent the ice with and without added salt.

N.B. *Children prepare their table layout before beginning their investigation. Some children will require support to achieve this, or the teacher may prepare blank tables for those with learning difficulties.*

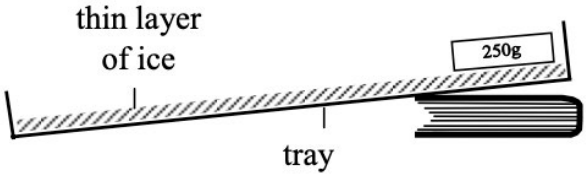
The following ideas for investigations may be used with children who have difficulties with open-ended tasks of this nature. They are **not** intended to be given to children before they have tried to devise an investigation.

Two yogurt pots containing equal numbers of ice-cubes, one covered with salt. The time taken for both tubs of ice to melt can be measured.

Two funnels containing ice cubes resting above two jugs, one covered with salt. The *volume* of the drained water is measured at regular *time* intervals.



Modelling a real situation is popular with children, but can result in an investigation which is difficult to carry out successfully. Slide objects (such as 250 g weights) down two trays coated with a thin layer of ice (see hint 4), one with salt added and one without. Children collect and measure the *volume* of water at regular intervals. Alternatively, the objects are released together, and children observe which one reaches the end of its tray first.



HANDY HINTS

1. To prevent the ice melting before the tests begin, carry out tests close to the freezer or collect the ice at the latest opportunity. Ice can be kept in a cool box in the classroom.
2. The smaller the quantity of ice, the faster the experiment. For example, 1 ice-cube will melt in about an hour, whereas 4 ice- cubes in a funnel take 5-6 hours to melt! Crushed ice can be used, made with a liquidizer.
3. Adding salt at regular intervals makes a marked difference to the results, especially in the funnel test, as a lot of salt drains away during melting.
4. If preparing ice-filled trays, they must be horizontal in the freezer, so the water freezes evenly. A layer of sandpaper stuck to the bottom of the tray before the water is added can represent road friction.

N.B. *The focus of this activity is the speeding up of the melting process, and not on the resulting temperature change. The concept of the salt solution being a liquid at sub-zero temperatures is very difficult for children to understand, and should not be tackled. An explanation of the change in temperature is provided in Appendix 1 for teachers.*

EXTENSION ACTIVITY

The children find out if other substances (sugar, flour and sand) speed up the melting of ice in a similar way to salt. They can research the advantages and disadvantages (e.g. costs) of using these substances on the road.

Discuss the fact that rock salt can also provide friction for car tyres on icy roads.

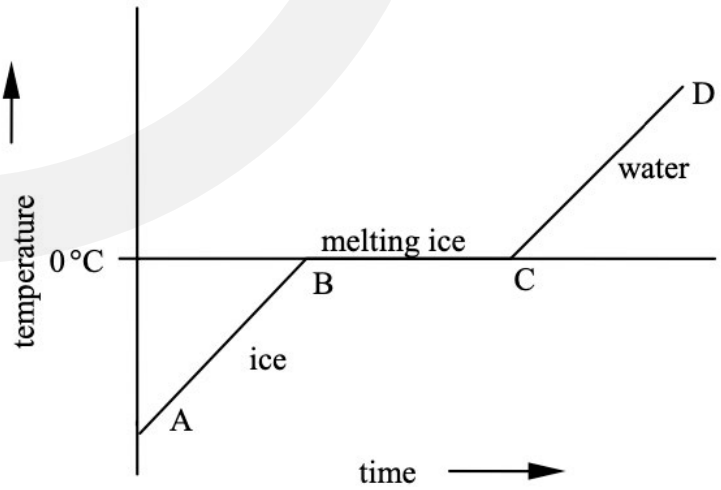
Appendix 1: The melting of ice

At low temperatures, water molecules (particles) have so little energy that they cannot move in relation to each other. They are therefore held in a crystalline structure called ice, and the crystalline structure explains the beautiful shapes which some ice particles, particularly snow flakes, possess.

In order to become liquid the molecules must obtain enough energy to break the bonds which hold them in a crystalline structure. When ice warms up, the molecules obtain more energy and the ice is converted to water. The temperature of the ice and water which it produces remains 0°C until all the ice is melted. The process can be shown by the equation:

ice + energy (heat) = water (at 0°C)

The melting process is represented by the line B to C in the graph below.



This process is reversed when energy is removed from water by placing it in an environment which is below 0°C (refrigerator freezer compartment) in which case the equation is:

water - energy (heat) = ice (at 0°C)

Normally ice is converted to water by adding energy in the form of heat, but ice can be converted into water by other processes such as compression or by the addition of chemicals such as salt.

ADDING SALT TO ICE

The addition of salt to water converts it to brine. Since the melting (freezing) point of brine is less that 0°C, frozen water is converted to liquid brine. In other words, the ice is converted to water without the addition of heat.

Energy is lost, and so the temperature falls. This can be measured by placing a thermometer in the ice, to which salt is added. This effect can be observed with other water soluble materials.