

De-icers and antifreeze

On cold winter mornings, the school caretaker often spreads salt onto footpaths, to melt away ice. They probably spread it onto playground ice-slides too, much to some people's annoyance! (Remember, the caretakers are not changing the outside temperature.)

To see what happens, put some crushed ice in a beaker and stir in some salt. You should soon see water trickling to the bottom of the beaker as the ice melts. What do you think is happening to the temperature as the ice begins to melt? Check your prediction by putting a short thermometer into the mixture.

You could try various types of investigations! The left hand column suggests different sorts of things you could study. The right hand column shows different sorts of experiments you could do as part of each study – you may be able to think of even more.



Some questions you might ask

Does it matter how much salt you use?

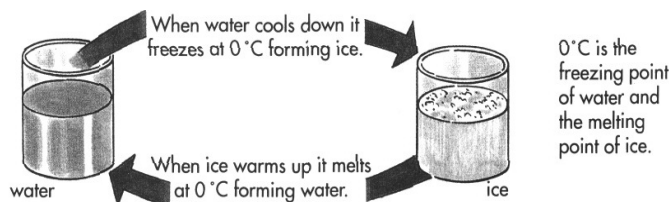
Try different proportions of salt and ice.

Can you use anything else, apart from salt?

Find out (from books, the local council, your teacher) whether any other substances apart from salt are used to de-ice roads. Also find out what is used in anti-freeze for car radiators, for de-icing aeroplane wings or airport runways. Make a list of substances you can test to see how they compare with salt. How expensive are they? **Are they easy/safe to handle?** (Be certain you have checked on all HAZARDS before you touch any chemicals.) How much do they affect plants growing near the roads? (You could test dilute solutions of the 'de-icing' substances to see how they affect the growth of barley or mung bean seedlings.)

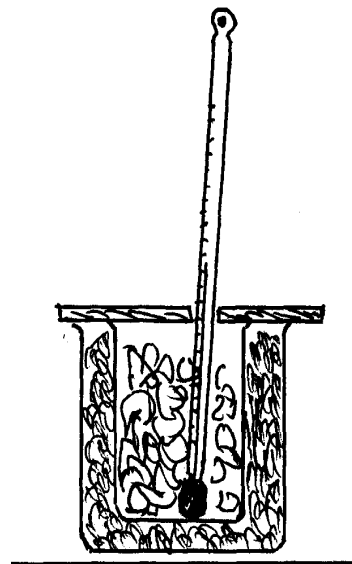
Some experiments you might try

For all these experiments, you need a supply of ice, crushed into tiny pieces.



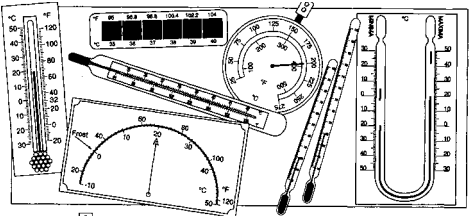
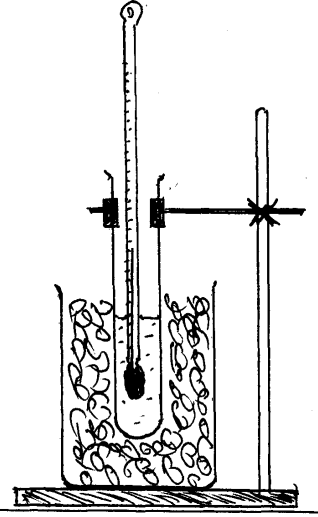
How cold can you get it?

Put some cotton wool into a large (250cm³ or 400cm³) beaker. Push a small (100cm³) beaker inside so that it is surrounded by the cotton wool. Put a measured amount of ice in the beaker, add the solid you are testing, and put in a short thermometer. Use part of a ceiling tile as a lid for the beaker. Stir gently with the thermometer and record the temperature every minute.



Check all experimental plans with your teacher BEFORE you begin any practical work!

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| Some questions you might ask | Some experiments you might try |
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| <p>How much do substances change the freezing point of water? You can try all sorts of different substances. How will you make fair comparisons between them? Cool the solutions and find the temperature at which they begin to freeze.</p> <p>How many ways can you find of measuring temperatures? You might like to try using other types of thermometer, or different types of sensors to check your results.</p>  | <p>How quickly does the ice melt? Do the experiment exactly as above, but get ready a measuring cylinder with a plastic funnel in the top of it. Put a small plug of loose cotton wool in the funnel. After a fixed time (how long?), pour the contents of the small beaker into the funnel. How much melt water runs through?</p> <p>How much does a substance lower the freezing point of water? Carefully make up the solution you will test. Put about 5cm depth into a wide test tube. Put a thermometer into the tube and clamp it upright in a 250cm³ beaker which contains crushed ice, a little water and a lot of salt, all well mixed. Stir your solution gently round and round with the thermometer and read the temperature every minute until ice forms in the test tube.</p>  |
| <p>Check all experimental plans with your teacher BEFORE you begin any practical work!</p> | |