

## Introduction

This mini-project allows wide-ranging practical investigations and research on the effect of different solids on the melting point of ice. The study can lead in many directions, allowing individuals to explore different questions either independently or as part of a whole-class co-operative study.

## Requirements (per group)

Schools who are interested in using these activities should, in the first instance, contact the Science Education Group, FREEPOST (Y0264), YORK YO10 5BR for further information about materials and equipment. (Tel: 01904 432524 email: pen1@york.ac.uk)

Students will be finding out about de-icers and anti-freezes. Large quantities of ice, crushed into small (and preferably even) sized pieces will be needed for most of the experiments.

## Temperature sensing:

Thermometers for reading the low temperatures will also be needed. Philip Harris have relatively low-priced thermometers which will read down to  $-35^{\circ}\text{C}$  (and also some to  $-20^{\circ}\text{C}$ , which will be enough for most purposes). Thermometers with thickened glass bulbs are preferable, to reduce breakages when stirring. Temperature sensors based on thermistors are available with data-logging and computer sensing kits from several manufacturers. The SEP temperature logger also offers the opportunity to monitor temperature changes continuously during cooling and freezing. A limited number of these will be available from the address above for evaluation by schools.

## Materials to test:

- Materials used commercially for de-icing: common salt (sodium chloride); urea; CMA (calcium magnesium acetate, available from the address above); ethylene glycol; glycerine (**irritant**)
- Other materials which can be dissolved in water for lowering of freezing point experiments: sodium nitrate (**oxidising, irritant**); sodium sulphate; potassium chloride; potassium nitrate (**oxidising**); potassium sulphate; magnesium sulphate; iron(III) chloride (**corrosive**); sucrose; glucose.

## General apparatus:

Beakers of various sizes (or small troughs); wide test tubes; glass rods; stands and clamps; measuring cylinders; plastic funnels; cotton wool; pieces of expanded plastic ceiling tile to use as lids for beakers; access to balances.

## For studies of effects of de-icers on plants:

Petri dishes containing cress or barley seeds or mung beans spread on damp cotton wool; droppers; bottles to store solutions.

## Safety

Eye protection should be worn at all times when any of this practical work is in progress.

Water from the atmosphere condenses onto beakers containing freezing mixtures and can cause the beaker to freeze to the bench, causing difficulty if pupils try to move it. Beakers, flasks, etc should be stood on small mats. The mat may temporarily freeze to the beaker, but can be moved with it.

Freezing mixtures can reach very low temperatures. Pupils must not touch the mixtures, and should not touch parts of vessels which contain freezing mixtures (the skin can freeze to the glass). Containers should either be left in position until all ice has melted, for clearing away later, or wrapped in folded cloths for moving.

It should not be necessary to clamp thermometers, or push them into tight-fitting corks or bungs, all of which can cause accidents. Warn students not to lay thermometers where they may roll off the edge of the bench.