2. In the melting pot

Children investigate the difference between the processes of melting and dissolving by predicting, then finding out, what will happen when a sealed bag of salt and a sealed bag of grated candle wax are added to hot water. Cartoon character, Chris, then hypothesizes that 'There's still some salt on the road because the water is so cold. If the sun warms up the water, more salt will dissolve'. The children plan an investigation to test if he is correct.

OBJECTIVES

- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- Demonstrate that dissolving, mixing and changes of state are reversible changes
- 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 S5-7, salt, candle, transparent freezer bags, transparent and heat-resistant bowl, flask of hot water or kettle, cold water, grater, teaspoons, stop clocks or egg-timers, transparent containers, alcohol-filled thermometers.

INTRODUCTION TO DISSOLVING

The introduction to this activity requires the children to follow carefully the instructions on Activity sheets S5-7 and complete the relevant sections as the activity progresses. The instructions can be recorded on a tape-recorder for children to play back. This will assist those who have reading difficulties or who are visually impaired.

The children are asked to predict what will happen when a sealed bag of salt and a sealed bag of grated candle wax are added to hot water. The children then try this and compare their observations with the prediction. This procedure is repeated for adding a teaspoon of grated candle wax and a teaspoon of salt to about 500 ml cold water.

Safety note

It must be emphasised that children need close adult supervision during this activity. The temperature of the hot water must be no hotter than 60°C. The children should be warned of the dangers of burns and scalds.

N.B. *The candle wax is grated to eliminate the possibility of children thinking that the wax does not dissolve because it is in one large piece. It also makes the melting wax easier to observe.*

The children should explain their observations and be introduced to the word 'dissolve' if they do not offer this word during discussion.

With more able children, the teacher can introduce the idea that salt can melt, and ask them to discuss what would be needed to make this happen. Some children may appreciate that much higher temperatures than those achievable in their classroom or home are required for the salt to melt. Salt melts at 801°C.

REINFORCING THE CONCEPT

Additional activities may help some children to understand the differences between melting and dissolving. Other substances can be tested in a similar way to salt and wax, and the children make predictions before putting the substances in water. Suitable substances include sugar and coffee for dissolving, and chocolate and margarine for melting. Saucers of different substances can be left in a warm place, and a prediction made as to whether any will dissolve or melt. This should reinforce the concept that dissolving requires water, but melting does not.

EFFECT OF HEAT ON DISSOLVING SALT

Activity sheet S7 provides the children with Chris's hypothesis that "There's still some salt on the road because the water is so cold. If the sun warms up the water, more salt will dissolve." They are asked to find out whether Chris is right, and are encouraged to think about:

- The equipment they need (thermometers, teaspoon, hot water, etc.).
- The variables/factors they will control or keep the same (the volume of water, the number of stirs or shakes, the size of spoon used to add the salt).
- What they will change (the water temperature) - independent factor.
- What they will measure (quantity of salt added) – dependent factor.

Investigations may range in complexity from counting the spoonfuls of salt added to jugs of cold and hot water, to recording how many grams of salt will dissolve in water at a variety of different temperatures (e.g. across a temperature range of 0-60°C, with 10°C intervals).

Carrying out a more complex investigation provides children with the opportunity to record results in tables and bar charts or line graphs. Pages 63-65 provide support for this activity.

The children should find that Chris's hypothesis was a good one, and that more salt will dissolve in water with an increased temperature.

HANDY HINTS

1. The children may confuse cloudy water with undissolved salt. They should look for undissolved salt granules on the bottom of the container, once the mixture has settled after any stirring or shaking.
2. A large jug of water at 60°C can be mixed by the teacher using hot and cold water. The children can then collect smaller quantities of water from the teacher's jug as it cools, to test water at 50, 40 and 30°C.
3. The teacher can freeze a bottle half-filled with water. This can then be brought in to the classroom and filled to the top with cold water. This allows children to test water at 3-4°C, and also at 10 and 20°C, by mixing warm water with the cold water.
4. Spoons larger than a teaspoon should not be used, as the quantity added each time is too great. If half or quarter teaspoon measures are available, these give a more accurate measurement of dissolved salt.

EXTENSION ACTIVITIES

The molten wax can be poured into a mould to regenerate the candle with which they started.

The children think of an alternative hypothesis for the salt left on the road, i.e. that too much salt was added for the amount of ice/water on the road.

Children formulate another hypothesis about the dissolving of salt, e.g. stirring the salt and water helps the salt dissolve faster, grinding the salt into a powder helps the salt dissolve faster, or that the evaporation of water leaves salt on the road when the sun comes out. They could then carry out an investigation to prove their hypothesis.

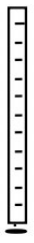
N.B. *The last hypothesis forms the basis for the next activity.*

A range of substances can be investigated to find out which ones dissolve. These substances could include coffee, tea, flour, custard powder, sand, sugar, etc.

N.B. *Substances such as flour and custard powder will be suspended in (floating in the middle of) the water, thus forming a suspension. These substances have not dissolved, as the particles can still be seen in the water. The substances which dissolve cannot be seen, but the solution may change colour.*

More able children can be asked "Could salt in water help things float?" (see page 117 for links with geography).

These children plan an investigation to answer this question. They can be given suggestions for making a suitable float, e.g.



A thin strip of balsa wood with a drawing pin to add weight to the end. Mark with a permanent marker pen.

A straw sealed with plasticine, marked with a permanent marker pen.

The children consider aspects of fair-testing, e.g. keeping the type of container and the amount of water the same, changing the amount of salt added to the water, and measuring the floating position of the floater with each addition of salt.

The children should observe that the floater will be higher in the water with increasing amounts of salt. This is because salty water is denser than fresh water. The more salt in the water, the denser it becomes.

N.B. *Due to the focus on density in this activity, it is advisable that it is used as an extension activity to challenge more able children.*

The investigation can be extended further by finding out whether other substances that dissolve have a similar effect on floating objects.