Melting and dissolving

Critical teaching ideas - Science Continuum F to 10

Level: Moving to level 4

Student everyday experiences

For many students at this level, melting and dissolving are seen as indistinguishable. Although two materials are required for the dissolving process, children tend to focus only on the solid and they regard this process as similar to “melting”.

Because students have limited experience of materials solidifying at warmer temperatures they often consider that freezing of all materials only takes place at cold temperatures such as in the refrigerator or freezer.

Children consider that sugar melts when it dissolves in water. Often melting is considered to be substances turning into water. This is further reinforced because children see heat being involved in both processes - they know if you want to dissolve more sugar you warm up the water.

Because it is no longer possible to see the dissolved substance after dissolving, in many cases eg. salty water, sugar dissolving, students frequently consider the salt/sugar has just disappeared.

Frequently students will hold views such as: the dissolved substance (solute) in a solution is not taking up any space and only the taste and/or colour is left when something dissolves, not the substance itself or substances change into new substances when they dissolve

The scientific view

- Melting and freezing of materials is dependent on their temperature. When something melts the liquid is the same substance as the solid.
- Not all solids melt on heating (they may burn or decompose).
- When something dissolves an additional substance (the solvent) is needed.
- Dissolving can involve chemical changes (e.g. antacid tablets mixing with water, metal dissolving in acid).

Critical teaching ideas

- Melting and dissolving are not the same.
- In melting only one substance is involved and the liquid and solid are the same material. Heat is needed for melting to occur.
- Dissolving involves two materials; the resulting solution is a mixture of both.
- The dissolved substance is still present in the solution even though it can't be seen.
In your teaching you should aim to clarify differences between melting and dissolving. These are familiar concepts to students built up from everyday experiences. Teaching should aim to move their, often non-scientific, explanations to more scientific ones.

This can be done by providing children with lots of hands-on practical work and if their ideas are derived from a narrow range of evidence then providing more evidence.

Changes involving melting and dissolving a range of materials students are familiar with such as chocolate, cooking fat, candle wax and the use of common solvents such as turps, eucalyptus oil and acetone are likely to be beneficial.

Students’ ideas have been shown to be difficult to change and teaching should involve a several step process. Students need to be given time to articulate their preconceptions about melting and dissolving in activities such as Predict Observe Explain. Opportunities should be provided to explore their own and others ideas - this may involve group work and role play.

Students can then be encouraged to and reflect on and reconcile these ideas with new explanations.

**Teaching activities**

**Open up discussion via a shared experience and promote reflection on and clarification of existing ideas.**

Allow children to experience substances melting other than water and ice. Place fat, butter, wax, chocolate in four locations on a metal plate. Warm the base with a candle, note when each substance melts. Students can be asked to predict which one will melt first. Later, allow the plate to cool and again ask students to predict and observe the order in which they freeze.

Some use of analogies to explain melting eg. build a house with Lego and pull apart the bricks to form a pool

Dissolve coloured materials eg. copper sulphate (available from garden nurseries) and Condy's crystals (potassium permanganate) in water. Both of these give a strong colour.

Image adapted from:

Predict, Observe, Explain - Ask students to predict what will happen to the weight of the water when sugar is dissolved. Record changes in weight when sugar is added to water and stirred to dissolve. (You can show that the resulting solution has the same weight as the sugar and water separately).

Dissolving activities in other solvents eg. eucalyptus oil, acetone (nail polish remover)

Help students work out some of the “scientific” explanation for themselves. Students view computer simulations of melting and dissolving eg. http://bcs.whfreeman.com/chemistryinyourlife/

**Practice using and build the perceived usefulness of a scientific model or idea.**
Exposure to scientific explanations - students can be given written material explaining dissolving and melting and asked to put in some other form e.g. notes into diagrams or vice versa.

**Clarify and consolidate ideas for/by communication to others.**
Students in groups construct models / posters / PowerPoint slides to explain what happens in the dissolving and melting changes they have seen.

Short presentations to the class of the models / posters etc. followed by discussion of the ideas presented. (It is important here that all views be accepted initially and time is given for students' ideas to evolve).

Students role play some sugar being added to a hot cup of water, it is not stirred and slowly dissolves completely. Students become water and sugar.

Cold fat is put on a hot frypan, it melts. Students become the fat and physically represent what happens on melting.

**Promote reflection on how students’ ideas have changed.**
Students can be encouraged to reflect on how their views have changed during their investigations. A Journal or Thinking Book could be used to encourage students to record their ideas.

Students can more systematically record their observations during activities involving melting and dissolving. They can design experiments such as investigating different types of sugar to see which will dissolve the fastest or investigate how much sugar can dissolve in water at different temperatures. This will involve some control of variables. They can explain their procedures and justify the type of data collected and the equipment they used.