

Primary Science & Technology *Bulletin*



Ideas and inspiration for teachers in Primary Schools and S1/S2

COOL IT!

Ice-cream making
for beginners



Cool it! Ice-cream making

Make the most of the wonderful summer weather by making some ice-cream in the classroom. This simple activity focuses on the change of state between solid and liquid and has links to a number of other areas of CfE [1].

Following the harsh winters we have experienced recently, learners may well be aware of the practice of spreading salt on icy roads, paths and even playgrounds. The addition of salt quickly melts the ice, making it safer to get around.

But how does this process work? This fun activity will seek to explain the concept behind this process and is a great way to engage learners in thinking about changes in the state of matter.

You will need

- 100 ml milk.
- 100 ml double cream.
- ¼ teaspoon vanilla extract (check that it contains no alcohol) - the milk, cream and vanilla can be replaced by a 200 ml carton of fruit juice to make a sorbet (see Figure 1). In the case of milk allergies soya milk or fruit smoothies could be used instead.
- 1 small re-sealable food bag.
- 1 large re-sealable food bag.
- 250 g crushed ice.
- ½ teaspoon sugar.
- 2 tablespoons salt.
- Suitable serving dishes and spoons.

What to do

- Wash hands and make sure all food preparation areas are clean. Check for any food allergies and follow Local Authority guidelines relating to food preparation in the classroom. Make sure that foodstuffs are stored correctly prior to use.
- Place the milk, cream, vanilla extract (alcohol free [2]) and sugar (or the fruit juice if using instead) into the smaller bag (Figure 2).
- Seal the bag removing as much of the air as you can while doing this.
- Tip the ice and the 2 tablespoons of salt into the larger bag (Figure 2).
- Now place the sealed smaller bag into the larger bag and seal that up too, again excluding as much air as possible from the bag (Figure 3).
- Grasp the tops of the two bags firmly and shake them vigorously for 5 minutes, keeping the smaller bag and contents in contact with the ice and salt. Gloves could be worn or the bags wrapped in a clean towel as the mixtures get extremely cold! However, in practice, if the tops of both bags are held there is no need for hands to come into contact with the coldest part of the bag. Take care not to burst either of the bags!
- After 5 minutes of shaking and agitating the contents, carefully open the large bag and remove



Figure 1 - Pre-prepared ice, table salt and carton of fruit juice.



Figure 2 - Large bag (on left) containing salt and ice, table salt, small bag (on right) containing cream, milk, sugar and vanilla extract.

for beginners



Figure 3 - Small bag (containing fruit juice) sealed and placed inside larger bag containing salt and ice.



Figure 4 - Frozen pineapple sorbet ready to eat!

the smaller one. Feel the mixture to check if it has frozen. If salty water gets onto the skin rinse it off with clean water. If the ingredients have not yet frozen then replace the smaller bag and keep on shaking for a few minutes more (you may need to add more ice and salt to the larger bag).

- Once the mixture is well and truly frozen it is a good idea to quickly rinse the smaller bag under cold running water. This removes any salt from the outside of the bag, be especially careful to rinse the closure area of the smaller bag - otherwise salty water could mix with the ice-cream when the bag is opened. If the ice-cream tastes at all salty discard and start again.
- Spoon the frozen mixture into a suitable serving dish and enjoy. (Figure 4).

Remember!

If food is to be prepared in the classroom for consumption practitioners will need to consult Local Authority guidelines on food handling and hygiene in the classroom.

Consult the ASE publication "Be safe" (4th edition) or alternatively consult SSERC for guidance.

How does it work?

When salt is added to water the temperature at which the water freezes is lowered, this is known as the depression of the freezing point [3]. Similarly, if salt is added to ice the temperature at which the ice melts is also lowered. Learners may well have observed that spreading salt onto ice causes it to melt. They will probably have witnessed this happening during cold weather when salt is spread onto icy roads and paths. Learners may even have investigated ice in the classroom; perhaps encountering ice balloons or looking at insulating materials [4, 5]. A simple activity could be devised to investigate the effect of sprinkling varying amounts of salt onto ice-cubes and measuring the time taken for the ice-cube to melt.

Ice has to absorb energy in order to melt, resulting in a change of phase from a solid to a liquid. When the ingredients for the ice cream or sorbet are placed into close proximity to the ice this energy for melting is absorbed from the ingredients, causing their temperature to decrease. However just placing ice in the bag next to the ingredients will not result in the temperature dropping low enough to freeze the mixture; we merely get a very cold liquid!

Adding table salt to the ice lowers its freezing point. Now even more energy has to be absorbed from the environment (and in this case the ingredients) in order for the ice to melt. As more energy is absorbed from the ingredients this lowers their temperature enough to cause them to freeze. Hence the cream or fruit juice turns into ice cream or sorbet!

Investigations into the time taken for the ice-cream to form could be carried out. The effects of rock salt, sea salt and table salt could be compared. The crystal size of the salt is an important factor which could be investigated.

If a data-logger is available then the temperature of the ice-cream mixture and the time taken to freeze could be investigated further. These portions of ice-cream would be for investigation only though and should not then be consumed.

Learners could be asked to make the ice-cream healthier, or devise different flavour combinations. The cost of making a portion of ice-cream could be calculated. ▶

Ideas for further exploration

- When was ice-cream first produced and by whom? How was it made before the invention of the freezer?
- Does the size of the salt crystals affect the temperature or the rate of cooling?
- Does the size of the ice cubes affect the temperature or the rate of cooling?
- Will sprinkling sugar crystals on the ice (rather than salt) cause the same effect?
- A sorbet does not contain any milk. Does changing the milk content (or type of milk) affect the freezing rate of the ice-cream? ◀

Acknowledgments

Thanks to Chris Lloyd for the photographs shown in Figures 5 & 6!

References

- [1] Curriculum for Excellence Experiences and Outcomes. Available at: www.educationscotland.gov.uk/thecurriculum/howisthecurriculumorganised/experiencesandoutcomes/index.asp (accessed May 14th 2012).
- [2] Vanilla Extract. Available at: www.vanillaworks.co.uk/extract.htm (accessed May 14th 2012), www.oetkeronline.co.uk/products/Natural-Vanilla-Extract.html (accessed May 31st 2012).
- [3] Freezing Point Depression in Solutions. Available at: www.hyperphysics.phy-astr.gsu.edu/hbase/chemical/meltpt.html (accessed May 14th 2012).
- [4] Ice-cream - it's in the bag. Available at: www.sciencemuseum.org.uk/educators/classroom_and_homework_resources/resources/ice_cream.aspx (accessed May 14th 2012).
- [5] Planning a practical activity. Available at: www.talking-for-success.open.ac.uk/pdfs/Activity_Lesson_4.pdf (accessed May 14th 2012).
- [6] www.vanilla.servolux.nl/vanilla_history.html (accessed May 14th 2012)



Figure 5 - Vanilla flower in bloom, photographed in Madagascar.



Figure 6 - Vanilla pods ripening.

Curricular Links

Sciences experiences and outcomes explored:

- *Planet Earth: Processes of the planet:*
By investigating how water can change from one form to another, I can relate my findings to everyday experiences - SCN 0-05a/SCN 1-05a.
- *Materials: Properties and uses of substances:*
By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed - SCN 2-15a.

Other aspects of the curriculum can be explored by looking at the production of ice-cream in more detail. Learners will be aware that vanilla (Figures 5 & 6) is a very popular ice-cream flavouring, but many will not know much about the origin of this interesting crop and its method of production [6]. If vanilla extract (or other fruits) are used to flavour the ice-cream further aspects of the curriculum can be explored:

- *Planet Earth: Biodiversity and interdependence.*
- *Through carrying out practical activities and investigations, I can show how plants have benefitted society - SCN 2-02b.*

Other aspects of CfE explored:

- *Health and Wellbeing: Food and Health: I explore and discover where foods come from as I choose, prepare and taste different foods - HWB 0-35a.*
When preparing and cooking a variety of foods, I am becoming aware of the journeys which foods make from source to consumer, their seasonality, their local availability and their sustainability - HWB 1-35a/HWB 2-35a.
- *Technologies: Food and textile contexts for developing technological skills and knowledge. Through discovery and imagination I can develop and use problem-solving strategies to meet design challenges with a food or textile focus - TCH1-11a/TCH 2-11a.*