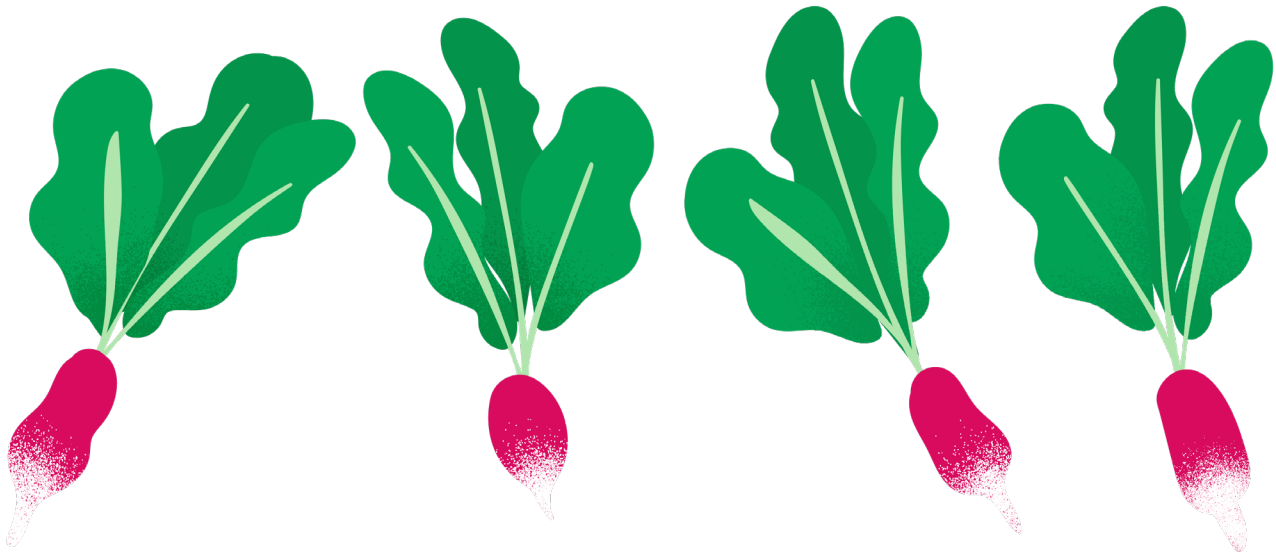
Way Too Cool for School

Year 3 – Science
Year 5 – Science



(Science; Yr 3, ACSSU046)
A change of state between solid and liquid can be caused by adding or removing heat

(Science; Yr 5, ACSSU077)
Solids, liquids and gases have different observable properties and behave in different ways

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Way Too Cool for School

Changing the way water freezes into ice...

Water freezes into ice. It happens when the temperature goes below zero, right?

Yes! And, no...

Depending on what we add to the water, the solution's temperature can go way below zero before it freezes. Cooks take advantage of this knowledge to create ice cream made up of tiny ice crystals, i.e. ice cream with the smoothest possible texture!

Equipment:

4 plastic food boxes (1L are good) or takeaway containers with lids

A label for each lid and a marker pen

Access to a freezer with room for all 4 boxes at the same time

A thermometer to test the temperature of liquid

Kitchen scales and a plastic jug

600g caster sugar

1.5 – 2L water

400mL warm water (optional)

Dinner forks (metal is best)

Notebooks and pencils for recording data

Duration:

45 minutes

Location:

The science classroom or a kitchen

Getting started

Watch **The One with the Granita**

- Ask students what they know about how ice forms. Questions can include:
  - Does ice form all at once or slowly?
  - What does a half-formed ice cube look like?
  - Has anyone ever picked up the 'sheet' of ice that's formed across a bucket of water on a cold night?
  - Does ice form in the middle of a surface first or around the sides of a container?
  - Why do you think this is?
- Explain that we're going to test what effect sugar has on water as it freezes. This will help us understand the science of ice cream, sorbet and gelato.
- What do students think will happen when we add sugar to water? Will freezing take more time, or less?
- Discuss their thoughts and record a class prediction

Doing the experiment

From Alice: Considering that this isn't a competitive cooking show with blast-chillers on hand, this experiment will take longer than a standard lesson. If you don't have time for a dash to the staffroom freezer, think about setting this as a homework task instead. Get students to note their results and observations. Encourage them to get creative (comic strip, photo-story, flowchart etc.) and compare notes the next day.

- Set up the equipment and explain that the variable we'll be changing is the ratio of sugar to water.
  - Container 1: students measure and mix sugar and water at a 1:1 ratio, i.e. 250g sugar to 250mls water. Stir until the sugar dissolves.
  - Container 2: students measure and mix sugar and water at a ratio of 2:3, i.e. 200g sugar to 300mls water. Stir until the sugar dissolves.
  - Container 3: students measure and mix sugar and water to a ratio of 1:4, i.e. 100g sugar to 400mls water. Stir until the sugar dissolves.
  - Container 4 is the control. Students measure 500mls water into this container.
  - Students test the temperature of all four solutions and record this data.
  - Students label and seal each container then place them in a freezer.
- Take the temperature of the solutions every 30 minutes until all four containers are frozen solid. It should take no more than two hours (1.5 hours is normal).
- When the solutions are all frozen, remove them from the freezer and inspect the blocks of ice. Can you see any differences between containers 1 to 4?
- Students use the metal forks to scratch at the surface of the blocks (it's easier if they've been out of the freezer for 5 to 10 minutes first). Is one of them easier to scrape into flakes like granita than the others?
- Record the class's observations, revisit your original prediction and state your conclusion.
- What does this have to do with ice cream? Sugar slows down the formations of ice crystals, so sorbets and ice creams with more sugar are generally softer and 'chewier' than granitas and ices that contain less sugar.
- Follow this class with a fun hands-on granita-making session!

Tip: (optional)

Sugar dissolves much quicker in warm water. Try warm water for the sugar solutions. Use a thermometer to ensure all four containers are resting at the same temperature before putting them in the freezer.

90 mins Skills! Natural Makes 8 shares at home (or 30 tastings for the classroom)

Cool Cucumber Granita

Stuff

Peeler and **knife** and **citrus juicer** and **scales or measuring jug** and **cups** and **spoons** and **blender** and **freezer-friendly tray** and **fork**

(for tasting: 30 small chilled glasses, 30 metal teaspoons)

What

2 continental cucumbers, peeled and cut into chunks (this should yield about 4 cups)

40ml (2 tablespoons) lime juice

6 mint leaves

60g (1/4 cup) caster sugar

250ml (1 cup) cold water

How

- Place the cucumber chunks, lime juice, mint leaves, caster sugar and water in the blender.
- Grown Up Eyeballs! Place the lid on and blend on high for 2 minutes until very smooth and the sugar has dissolved.
- Pour mixture into your tray and place in freezer.
- Every 30 minutes for 1.5 hours scrape down the frozen granita in a raking action with a fork. You'll start to see large ice crystals to start off with, then the icy crystals will get smaller and smaller until you have what looks like pale green snow.
- Spoon into chilled glasses and serve immediately.

Think about this!

- Find out the natural sugar content of your favourite fruits and vegetables (try carrot, strawberry, pumpkin or mango).
- Purée (blend) or mash the ingredient of your choice and freeze it.
- What happens when you scrape the frozen mixture with a fork? How does it compare to the solutions in your experiment?
- Could you design an experiment to determine the best ratio of sugar to fruit/veg of your choice in order to make a frozen dessert that is not too hard to scoop out with an ice cream scoop?
- What other factors might be involved in getting a smooth texture?