

INTERACTIONS

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The mission of OSEE is to support and inspire educators teaching environmental education in Ontario.

Ice Sun Catchers – An Investigation in Freezing and Melting

By Sherri Owen

In this activity, students will create ice discs with found natural objects embedded. These discs can be left in the sun outside and their melting observed. During this process students will have opportunities to make predictions about freezing and melting, and then compare their predictions to observations.

Background Information:

Freezing Physics

(Gretchen Noyes-Hull, Education Place from Houghton

Mifflin www.eduplace.com/kids/hmxs/g6/weatherwater/cricket/sect2cc.shtml)

This article describes the details of why and how substances freeze and gives an explanation for why solutions freeze at lower temperatures than pure substances. As a bonus, there is an ice-cream recipe at the end!

Q&A: Why Do Liquids Freeze?

(Mike Weissman, 10/22/2007, Ask the Van: Department of Physics, University of Illinois at Urbana-Champaign, <https://van.physics.illinois.edu/qa/listing.php?id=162>)

Curriculum Expectations:

Grade 2, Science

Understanding Matter and Energy: Property of Liquids and Solids

Overall Expectations

- investigate the properties of and interactions among liquids and solids;
- demonstrate an understanding of the properties of liquids and solids.

Grade 5, Science

Understanding Matter and Energy: Properties of and Changes in Matter

Overall Expectations

- conduct investigations that explore the properties of matter and changes in matter;
- demonstrate an understanding of the properties of matter, changes of state, and physical and chemical change.

Grade 7, Science

Understanding Matter and Energy: Pure Substances and Mixtures

Overall Expectations

- investigate the properties and applications of pure substances and mixtures;
- demonstrate an understanding of the properties of pure substances and mixtures, and describe these characteristics using the particle theory.

Materials:

All Grades:

- Water
- Measuring cups or graduated cylinders
- Round aluminum foil cake tins
- String
- Found materials (twigs, small cones, leaves, flowers)
- Access to the outdoors during below zero temperatures

Grade 5/7:

- Salt
- Baking soda
- Sugar
- Rubbing alcohol

Optional:

Food colouring

Procedure:

1. Show the students an example of the ice disc 'sun catcher'. Inform them that the class will be making more discs using natural materials found outside. Have them imagine what they would like to include in their own.
Possible questions:
 - What would you like to include in your disc?
 - What is available this time of year?
– *In the winter materials will be limited, many plants are under the snow, leaves and flowers will be brown and dead.*
 - What will we be able to find on our walk?
– *Are you going to a forest? meadow? The place you go will determine what will be available.*
 - How much can we include in each disc?
– *Only about a handful, there is no need to gather more than can be used.*
 - Can we gather live material?
– *You may choose to limit gathering to dead material only. You may choose to allow the gathering of live material within certain limits. Limits may include taking only one of something, each person taking from a different plant, taking only very small samples of live material.*
2. Go outside and gather materials
 - If students are working in groups, divide them up before going out
 - Review gathering rules and boundaries
3. Have students put their gathered objects into their cake pans
4. Making predictions
 - Grade 2: Each pan will be filled with a measured amount of water
 - Grade 5/7: Each pan will be filled with the same amount of water, or, a solution of water and another material
 - See Predictions Chart
 - The groups must predict how long it will take for each amount of water to freeze
Possible questions:
 - Which pan will freeze first?
 - Which pan will freeze last?
 - Why do you think this will happen?
5. Fill the pans
Grade 2: Write the amount of water used for each pan on a piece of tape
Grade 5/7: Write the material added to the water on a piece of tape
 - Use a waterproof ink if possible. Fold the tape over a 15 cm length of sturdy string or twine
 - Fill the pans with water and place the ends of the string in the water and a loop hanging out. This loop can be used to hang the disc as well as holding the tape showing how much water was used. Arrange the natural materials in the water. Add a few drops of food colouring if desired.

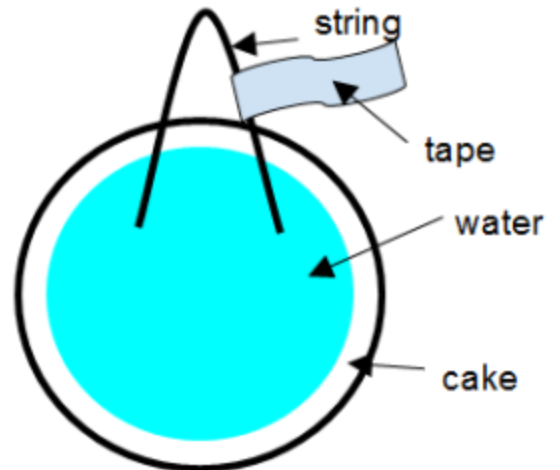
6. Place pans outside to freeze
 - Choose a sheltered location that won't be disturbed during recess
 - If possible, place the pans near the classroom window so the students can watch through the day
7. Observe
 - During breaks, check the pans to see which has frozen and record
 - See the observations chart
8. Discuss
 - Once the pans have all frozen, or at the end of the day, look over the predictions and observations

Grade 2:

 - Which pans froze the quickest?
 - Probably the pans with the least amount of water
 - The greater the amount of water (mass) the longer it takes for the heat in the water to conduct (travel) into the air and ground lowering the temperature of that water to freezing

Grade 5/7:

 - Which pans froze the quickest?
 - The solutions will freeze more slowly
 - It is more difficult to make a mixture of different molecules crystallize (or freeze) than a sample of pure molecules. When the molecules of water are mixed with the molecules of another material in solution, it makes it more difficult to make the liquid freeze, requiring a lower temperature. (See the University of Illinois Physics Department 'Ask the Van' website at van.physics.illinois.edu/qa/listing.php?id=1598 for a fuller explanation)
 - Were your predictions accurate? Why or why not?
 - Note: Pans with more objects may freeze more slowly, especially on a sunny day, as dark objects will transform the light energy of the sun into heat energy and warm the water slightly
9. Hang the pans as 'sun catchers' outside
 - Using the strings frozen into the ice discs, you can hang them in the sun
10. Predict melting
 - If you wish to continue this activity, you may set up a prediction chart on the order that the discs will melt
 - In the case of melting, the thickness of the disc (determined by the amount of water used) and the material put in solution is a factor, but so is the amount of dark material frozen in. Dark objects in the ice will convert the sun's light into heat more effectively than the clear ice and melting will occur more quickly in that spot.



Possible Assessment Questions:

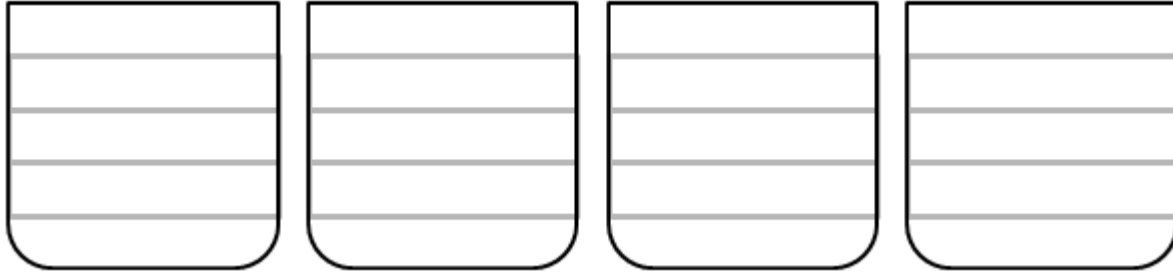
Grade 2

Circle in **red** the bucket that will freeze first

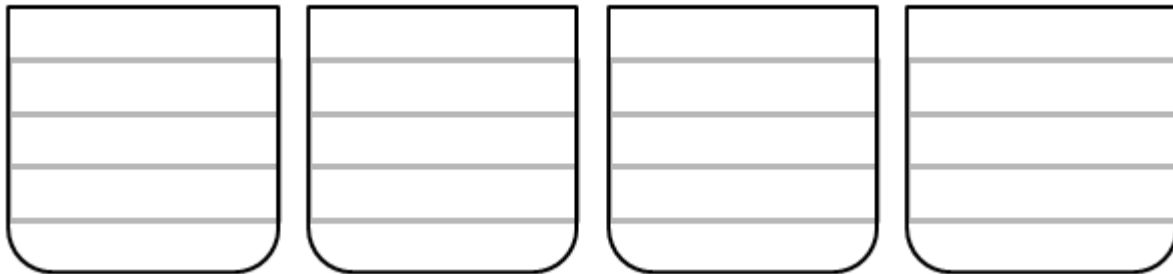
Circle in **green** the bucket that will freeze last



You must colour in 8 bars of water in these glasses. Fill them in so that the water would all freeze as quickly as possible.



You must colour in 5 bars of water in these glasses. Fill them in so that the water would all freeze as slowly as possible.



Grade 5

1. Two glasses containing the same amount of liquid are put into a freezer. One contains pure water, the other contains a solution of water and sugar. Which will freeze first? Why?
2. Why do people add antifreeze to the liquids in their car engine?
3. Why would you spread salt on an icy path?
4. If you don't have salt, what else could you spread or pour on an icy path?
5. Which will freeze first, the ocean or a freshwater lake?