Making Ice Cream

In this activity, students will make ice cream by lowering the temperature of their ingredients below the freezing point of water. As an extension, students can also explore more about the transfer of heat energy using an ice cube.

Materials (for 30 people. *Italicized* items are consumables)

* Please determine first if any of your students are allergic to any of the food ingredients before starting the activity

- Sandwich-sized Ziploc bags, preferably the kind with leak-proof seals.
- One gallon of milk (soy milk can be substituted)
- Two cups of sugar
- Two pounds of coarse-grain or kosher salt
- Measuring cups/spoons:
  - One-cup measure for ice
  - One half-cup measure for milk
  - Two tablespoon measures for sugar/salt
  - One-quarter teaspoon measure for syrup
- Twenty pounds of crushed ice
- Small bottles of syrups/extracts—chocolate, vanilla, etc

Background

Water changes from a liquid to a solid when it hits its freezing point—the temperature of 32 degrees Fahrenheit. Milk and Soy Milk are made up mostly of water, so their freezing point is about the same. To turn these liquids into ice cream (or at least ice milk), you have to get the milk below its freezing point.
A freezer, which can mechanically keep itself cold, works well for this; but if you use ice it will warm up as fast as the milk will cool. Since ice is only a little colder than 32 F, if you try to use 32 F ice to freeze an equal amount of 50 F milk, the temperatures of the two would reach equilibrium of about 41 F. You need ice that’s colder than 32 F.

Adding salt to water lowers its freezing point, causing ice to melt into liquid at a temperature lower than 32 F. The melting process uses heat that was holding the ice together, and significantly lowers the temperature of the resulting salt water as a result. This cold salty slush can then be used to freeze milk, since the resulting intermediate temperature will be below the freezing point of the milk.

You might share with your students that many cities put salt on icy roads. In addition to lowering the freezing point, salt also lowers the melting point, thus causing the ice to melt at a lower temperature than normal. In this activity, have your students observe the change of a liquid into a solid and make a wonderful treat to eat, too!

**Procedure**

1) Set up measuring stations for each of the ingredients. Each station should include the ingredient, the measuring spoons or cup, and the instruction sheet stating the amount to be measured.

2) Divide the students into teams of two, and give each team two Ziploc bags. One student in each team will be responsible for measuring the ice cream ingredients into the Milk bag. The other student will measure the ice and salt into the Ice bag.

   **Milk bag:** ½ cup of milk, 1 tablespoon of sugar, and ¼ teaspoon of vanilla.

   **Ice bag:** 2 cups of crushed ice, 6 tablespoons of kosher salt

3) Each team should squeeze some of the air out of the Milk bag (you want a little left to mix with the milk. It’s the air mixed into the product that makes ice cream taste fluffy, and not just like a frozen block of milk) and seal it.
4) Then they should put the Milk bag inside the Ice bag and seal THAT.

5) Then the students should start shaking the Ice bag (with the Milk bag inside of it). The two students can alternate to give each other breaks. It will take 5-10 minutes. Shaking will mix the ice and salt together, which will chill the milk bag better; it will also mix air into the milk as it freezes.

6) Once the milk seems to be getting solid, open the Ice bag over the sink; extract the Milk bag and rinse it off with cold clean water; then open and enjoy.

Extensions

Why was the salt added to the ice? Debate this question with your students, then try measuring the temperature of two cups of ice, one without salt, and one with several tablespoons of salt mixed in. Take measurements every five minutes. What happens? How do the results explain why salt is measured when making ice cream?

Further Lessons:

Experimenting with Ice Cubes

1) Melting ice. Discuss why ice melts. Ask your students to predict how long it will take for an ice cube to melt. Brainstorm some ways to make an ice cube melt faster. Then divide your class into several groups. Give each group and ice cube in a container, and time how long it takes to melt it completely. Ask each group to record its method of melting the ice cube.

2) Keeping ice. Discuss ways to keep ice from melting. Provide an assortment of stuff such as Styrofoam, packing peanuts, paper, cardboard, aluminum folk, and plastic wrap. Ask the students to predict how long they can keep their ice cube from completely melting. Give each group an ice cube and let them experiment with materials and methods to keep the ice cube from melting. Time the experiment, and as above, ask your students to record their experience on paper and share it with the class.
3) What would happen if you changed the amounts of some of the ingredients? In one bag—the experiment bag—add a lot of sugar. In another bag—the control bag—set up the recipe as described in the activity above. How do they differ? Can your students think of reasons to explain what happened? What would happen if you add other things like raisins, cookies pieces, or berries?