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Science Notes - Ice Cream: An Edible Experiment in Thermodynamics

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SCIENCE NOTES

Ice Cream: An Edible Experiment in Thermodynamics

Ice keeps things cold because it absorbs energy from its surroundings, melting as it does so. The temperature at which a solid melts, called its melting point, is the same temperature at which the liquid form freezes. For pure water, this is 0° or 32° F. However, if some other substance, such as salt, is added to the water or ice, the freezing/melting point temperature is lowered. Thus, you can use salted ice to freeze liquid water.

In this activity, salt is added to ice in a large plastic bag. A second, sealed plastic bag containing the ingredients for ice cream is placed into the bag with the salty ice. The large plastic bag is then sealed. The bag assembly is kneaded until the ice cream mixture freezes.

The energy in the ice cream mixture is transferred to the salted ice, which melts as a result. The temperature of the ice cream mixture is lowered to the temperature of the ice brine, and this is cold enough to freeze the ice cream.

Precautions

Hands can become painfully cold during this activity. Students should use gloves or mittens, or the bags must be wrapped in thick towels or placed into coffee cans. Towels may be most useful in case it is necessary to mop up spills.

Materials per class of 30

- at least 5 1/4-cup-measure scoops or cups
- at least 5 plastic measuring cups
- 5 sets of measuring spoons
- 1 gal milk (2% and reduced lactose milk will also work)
- 1 gal whipping cream or non-dairy creamer
- 8 cups sugar
- 1 bottle vanilla (at least 3 oz.)
- 30 1-quart or sandwich-sized zipper lock bags (freezer weight suggested)
- 30 spoons
- 3 gal crushed ice
- 10 lb food grade salt (this is much cleaner than rock salt)
- nuts, fruit or chocolate syrup, as desired
- ski mittens/gloves, thick bath-size towels, or 1 lb. coffee cans (1 pair or 1 per student)
- paper towels

Procedure

1. Measure 1/4 cup of sugar. Transfer the sugar to the small plastic bag.
2. In a separate container, mix 1/2 cup milk and 1/2 cup whipping cream. Add 1/4 tsp. vanilla (Younger students may need assistance with this step.)
3. Add milk mixture to the small plastic bag with the sugar. Close the bag **securely**, squeezing out most of the air before closing. There is no need to stir the contents.
4. Place the small plastic bag inside the large plastic bag.
5. Surround the smaller bag with a few cups of crushed ice.
6. Pour 1/2 to 3/4 cup of salt over the crushed ice and seal the larger bag securely.
7. Put on mittens or wrap the bag in the thick towel, or place the bag into the coffee can. Knead or roll back and forth on a table or on the floor. Be careful not to put too much pressure on the bags.
8. After 10 minutes, check to see if the mixture is frozen. If not, continue kneading and rolling.
9. When the mixture is frozen, remove the smaller bag. Wipe the brine from the zipped edges of the bag, then eat the ice cream directly from the bag. Add nuts, fruit or chocolate syrup if desired.

Reprinted from the January 1994 issue of Connecting with Chemistry. David Franz of Lycoming College in Williamsport, Pennsylvania developed this procedure from information presented by Kimberly Granatire and Philip Murray at the 1991 Chemistry Activities Workshop at Miami University, Ohio.

Papers Solicited for Biology Curriculum Workshop

A workshop focusing on "Integrating Biology Across the Curriculum" will be held September 23-24, 1994. Educators are invited to submit abstracts describing exemplary integration strategies and information about successful and unsuccessful programs.

A \$30 conference fee will cover two lunches, and overnight accommodations will be arranged.

Abstracts and requests for further information should be addressed to Philip J. McCrea, 385 Winnetka Ave., Winnetka, IL 60093. The deadline for submitting abstracts is June 30.