



I Scream, You Scream, We All Scream For Ice Cream!

Topical Unit of Instruction: Solutions-Colligative Properties

Teacher's Edition

Rehab
the LAB

Introduction

No harmful chemicals are used in this lab and it's a lot of fun!

Time

50 Minutes for data collection

15 minutes for analysis and calculations

Objectives

Preparation

1. Cut tops off pop bottles leaving bottoms that are about 5 inches deep.
This is not easy to do, but using large sharp scissors helps. Do not have students do this.
2. Make ice cream mix. If you have a favorite old family recipe, use it as long as it does not call for raw eggs. It may be easier to make the mix at home and transport to school in clean gallon milk jugs. This is a great recipe if you need one:
Ice Cream Mix
 - 6 c. whole milk
 - 1 T. vanilla
 - 1 t. salt
 - 1 c. sugar
3. Collect dishpans of ice a couple of days beforehand and store in freezers around school.

Materials

(For a class of 32 students working alone)

- 32 - 2L pop bottle bottoms
- 32 - 8 or 12 oz. clear plastic disposable cups
- 32 plastic spoons
- 1 - 2 clean dishpans of ice
- 5 lbs. rock salt
- 1 gallon ice cream mix
- 32 thermometers



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Typical Results

Data Table:

Temperature of Ice/Rock Salt Mixture: -12°C

Analysis and Calculations

1. $\Delta T_f = K_f \cdot m$

$$12^{\circ}\text{C} = 1.86 \cdot m$$

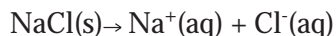
$$m = 6.5 \text{ moles/kg}$$

$$500 \text{ g}/1000 \text{ g/kg} = .50 \text{ kg}$$

$$m = \text{moles/kg}$$

$$6.5 = \text{moles}/.50 \text{ kg}$$

$$\text{moles} = 3.25 = \text{moles of particles}$$



Therefore, every mole of salt produces 2 moles of dissolved ions.

$$\text{Moles of NaCl} = 3.25/2 = 1.6 \text{ moles NaCl}$$

$$\text{Moles} = \text{g/molar mass}$$

$$\text{Molar Mass} = \text{Na: } 1 \times 23.0 = 23.0$$

$$\text{Cl: } 1 \times 35.5 = 35.5$$

$$58.5$$

$$1.6 \text{ moles NaCl} = \text{g}/58.5$$

$$\text{g NaCl} = 94$$

- Adding salt to ice on sidewalks or roads lowers the freezing point below 0°C . This will allow the ice to melt even when the ambient air temperature is considerably below freezing.
- The canister is filled with a solution. The normal freezing point of the solvent is depressed by adding solute. Before use, the canister must be subjected to the very cold temperature of the freezer for a day or so.

Disposal

- Ice and rock salt can be washed down the drain.
- Rinse pop bottles and reuse – do not run through dishwasher.
- Plastic cups and spoons can be run through the dishwasher and reused for years.

Hints

- Make sure lab area is scrupulously clean. Perhaps you can use the cooking classroom if it is available.
- Try to find pop bottles with the extra black or dark green bases. They seem to work better, probably because they insulate somewhat from warm room air. If you cannot find these, try using two pop bottle bottoms, one inside the other, for each student.

