Ice Cream Lab

(7/2017)

Teacher notes:

This lab deals with colligative properties. Students will determine the molality of their ice/rock salt mixture. However, it can be a fun lab to do as an introduction to the Vernier equipment – just delete the calculation section.

Equipment from Science Express:

Temperature probes

Vernier interface (LabQuest, LabQuest 2, or LabPro or LabQuest Mini and laptops)

Edible ingredients (per group)

1 cup of milk (white or chocolate)

2-3 tsp sugar

½ cup whipping cream

1 tsp vanilla

Pinch of salt

1 quart zip-loc bag

1 gallon zip-loc bag

¾ cup rock salt

ice

Non-Lab Equipment

1 C measuring cups

½ cup measuring cups

Tsp measuring spoons

It will be easiest to set this lab up with stations to minimize the number of measuring cups and spoons needed. Students can move from station to station to fill their ice cream bag.

Clean the lab well before you begin this experiment to avoid any contamination. You can also cover the areas that will hold food items with heavy-duty aluminum foil.

It is a good idea to have students bring in gloves or a towel to handle the bags. The temperature can drop as low as -21 °C.

Show students how to shake the bag holding onto the top zipper of both bags to help the bag stay closed and to help them avoid handling the cold bag.

If a bag springs a leak, you can double bag it and keep going.

**Ice Cream Lab**

In this lab we will use rock salt and ice to create a solution with a freezing point that is lower than that of water. This ice/salt mixture will remove heat from a liquid ice cream mixture, causing it to freeze. Water has a heat of fusion of 334 J/g which means that for every gram of ice that melts, 334 J of energy will be absorbed from the surroundings. We will use a temperature probe to measure the temperature of this ice/salt mixture over time.

**Procedure:**

1. Attach the temperature probe to the interface. We will not use a program but simply read the temperature from the probe at the start of the experiment, at 1 minute, at 5 minutes, and when the ice cream is solid.
2. Quart bag - Add the following from the stations in your classroom.

1 cup milk

2-3 tsp sugar

½ cup whipping cream

1 tsp vanilla

Pinch of salt

1. Gallon bag – Add the following:

¾ cup rock salt.

Place the sealed quart sized bag in the gallon bag, keeping the “zipper” on top.

1. Add ice to the gallon bag and record the temperature. Only stick the probe into the outer gallon bag.
2. Seal the gallon bag.
3. Hold both the inner and outer zip lock bags by the top zipper. Shake the bags. Record the temperature of the outer bag at 1 minute and 5 minutes.
4. Continue to shake until the contents of the inner bag is solid. Then take the temperature of the outer bag.
5. The bag will be very cold. You can shake it by resting it on the table and holding on to the top of the bags. Do not hold the bag with your hands – it will get too cold.

**Data:**

|  |  |
| --- | --- |
|  | Temperature, °C |
| Ice |  |
| Rock salt/ice after 1 minute |  |
| Rock salt/ice after 5 minutes |  |
| Rock salt/ice when ice cream is frozen |  |
| Temperature change |  |

**Calculations:**

Rock salt is NaCl. What is the value of i? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the kf value for water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ΔT = Solvent freezing point – Tfinal

ΔT = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ΔT = kf m i (show work)

m = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Post Lab Questions:**

1. During the lab, what happened to the temperature of the ice/water mixture as the ice melted?
2. How much energy would 10 g of ice absorb as it melts?
3. If you added more rock salt to the ice/salt mixture, what would happen to the temperature change?
4. If the value of i had been 3, what would be true about the temperature change?
5. If you did this lab and your ice cream did not freeze, what are 2 changes you could make to your procedure?