Name _____ Date _____ Hour _____

Phase Change in a Bag
Ice Cream

Overview

Have you ever wondered what it is about throwing salt on ice that makes it melt? And just why does it melt? Where does the heat come from to melt the water? Why does it freeze on the road and sidewalks again at night? These questions and many more about freezing and thawing will be looked at in this lab.

To start you off though, let's talk about how energy flows in a system. When you studied osmosis as seventh grade students you found that things flow from areas higher concentrations to areas of lower concentrations. This is also true for heat. Heat flows from areas of higher heat to areas of lower heat. Thus there is no such thing as "coldness," only an absence of heat. Knowing this simple rule will help us to explain the phase changes that occur in the bags.

Materials:

- 1 - .9 L Ziploc freezer bag (quart size)
- 1 – 3.8 L Ziploc freezer bag (gallon size)
- 240 mL whole milk (1 cup)
- 720 mL ice cubes (3 cups)
- 30 mL coarse salt (2 TBS)
- 1 Celsius Thermometer
- 2.5 mL vanilla extract (1/2 tsp)
- 30 mL sugar (2 tbsp)
- 2 clean plastic spoons
- 2 – 4 oz. cups
- papertowels
- Optional
  - 10 mL chocolate syrup
  - gloves

Procedure:

1. Place the ice cubes in the 3.8 L Ziploc bag along with the thermometer. Leave in for 30 seconds. Record the temperature of the ice cubes in the data table.
2. Place the milk in the .9 L Ziploc bag and record the temperature in the data table.
3. Add vanilla flavoring, sugar, (and chocolate if desired) to the milk and record the temperature.
4. Add the salt to the bag with the ice. Seal and gently shake the bag for 30 – 45 seconds. Record the temperature in the data table. Also, record any observations about the ice and salt mixture that you may notice.
5. Empty most of the air out of the bag with the milk in it. Carefully seal this bag and nest it down in the ice bag making sure that the ice surrounds the milk mixture. Seal the outer bag tightly to prevent leaks, and removing the air as you did before. **VERY IMPORTANT! IF YOU DO NOT FOLLOW THIS STEP PROPERLY YOUR MILK WILL FOAM AND NOT SOLIDIFY.**
6. Gently shake the sealed baggies back and forth (in a side to side motion) in your hands to make sure that the ice mixture coats the entire surface of the milk bag.
7. Shake carefully until your milk mixture solidifies. The longer you shake the bags, the firmer your mixture will become.
8. Record your final time and temperature in the data table.
9. Carefully remove the inner bag and place it on paper towels. Wipe the salty water from around the opening.
10. Squeeze the product into the two cups.
11. Taste your product! (Add more sugar if desired.)
12. Be sure to dispose of the ice mixture and any left over product in the sinks. Dispose of the spoons, cups, paper towels, and baggies in the trash receptacles.
13. Wash your hands and work area thoroughly before leaving your work area.

Data Chart

Time (minutes)	Description	Measurement (°C)
0	Temperature of Ice in Ziploc bag	
0	Temperature of Milk	
0	Temperature of Flavor and Milk	
0	Temperature of Ice with the Salt Added	
	Temperature of the Frozen Milk Mixture	
	Temperature of the Saltwater	
Observations:		

Analysis and Application:

1. What state of matter was the milk when you began? _____
2. What state of matter was the milk when you were done? _____
3. Is the milk absorbing or releasing energy? _____ Explain your answer.

   _____

   _____
4. What happened to the heat energy that left the milk?

   _____
5. What state of matter was the ice when you began? _____when you ended?_____
6. Is the ice absorbing or releasing energy? _____ Explain your answer.

   _____

   _____
7. Where does the energy come from that causes the ice to change state? _____
8. By adding salt to the ice, a mixture of saltwater is formed. As a result the new material has new physical properties. The melting/freezing point of saltwater is different from the melting/freezing point of pure water (ice). Is the freezing point/melting point of saltwater higher or lower than ice? How do you know?

   _____

   _____
9. What is the advantage of having the ice turn to a liquid rather than keeping it as a solid?

   _____

   _____
10. Why did the outside of the bag get wet? (Assume that your bag did not spring a leak.)

    _____

    _____
11. What happened to the energy of the particles on the outside of the large baggie?

    _____

    _____
12. **Extension:** How does spreading salt on the roads before winter storms help?