March 12, 2019 Chemistry Club

Ice Cream

Materials:

1. Quart-sized zip top plastic bag
2. Gallon-sized zip top plastic bag
3. Ice cubes
4. ½ cup salt
5. 1 cup of half and half milk
6. 2 tablespoons sugar
7. 1 teaspoon vanilla extract
8. Measuring spoons/cups
9. Towel or mitts

Procedure:

1. Measure and mix the milk, sugar, and vanilla extract in the smaller plastic bag.
2. Seal the bag well.
3. Fill the larger plastic bag about ⅓ full of ice cubes. Add salt to this.
4. Put the small bag with the ingredients into the larger bag with the ice cubes.
5. Use the towel or protective mitts when touching the bags, as they will become very cold and can damage skin. Gently churn the bags together until the ice cream begins to form (10 minutes).
6. Once icream has formed, take the smaller bag out of the ice cube bag and place it in a bowl to serve.
7. Add topings and done! Ice cream is ready.
8. PS: you can record the temperature of the ice cube bag with salt versus plain ice cubes and see the difference. Which is colder and why?

The Science behind it:

For those who have never tried making ice cream in a bag, it's one of the easiest and tastiest science experiments you can do at home, taking advantage of what chemists call Freezing Point Depression.

We say that pure water freezes at 32 degrees Fahrenheit (0 degrees Celsius), but it is actually an equilibrium point: at that temperature, liquid water freezes as quickly as ice melts, so to create ice, we have to continue to remove heat. When the water isn't pure, however, things are different. Other particles (for example, salt) disrupt the process of freezing because they disrupt the forming of the crystalline structure that is ice. Thus, the freezing temperature of a solution is lower than pure water.

When you add the salt to the ice cubes in this experiment, the salt particles interact with the water molecules, beginning the process of melting. But, the lower the freezing point of

something, the more energy has to be absorbed by it to melt; which is why, though it might seem strange, the moment you add salt, ice-and-forming-water's temperature drops to colder than freezing and starts absorbing heat from its surroundings. In fact, adding salt to ice water can lower the temperature to as low as -15 °C! To chemists, processes that require heat, like melting ice, are known as endothermic. Meanwhile, the water that is forming in the bag is just as cold — that is, below freezing. Because liquids conduct heat more readily than solids, the super-cooled water sucks heat away from the ice cream faster than the ice would alone, making it possible to make ice cream without the machine.

Questions:

1. What do you think the salt does?

2. What happens to the ingredients over time? When five minutes are up, how do the ingredients look? What about the ice cubes—how do they change over time and how do they look by the end?

3. What do you think will happen without using salt?

4. How does ice cream made in a bag with table salt compare with ice cream made with rock salt or some other type of salt? Can you explain your results?

5. How does making ice cream with half and half compare with using milk or heavy whipping cream?

More info:

- https://www.youtube.com/watch?v=s1CpSrXa1EI
- http://blogs.discovermagazine.com/science-sushi/2013/02/26/at-home-science-ice-cream-chemistry/#.XHyv8S2ZMlI
- https://www.scientificamerican.com/article/scrumptious-science-making-ice-cream-in-a-bag/
- https://engineering.oregonstate.edu/momentum/k12/july04/index.html
- https://www.stevespanglerscience.com/lab/experiments/homemade-ice-cream-sick-science/