



Lesson Extension

Chemistry 11: States of Matter

In class, we observed the states of matter – solid, liquid, gas, and plasma – and the transitions between them. We talked about how the transitions can happen when heat energy is added to or removed from a material. In this activity, you'll remove some heat energy from liquid cream (sweetened and flavored, of course!) to make it go through the transition *freezing* to very tasty result: solid ice cream!

Make Your Own Ice Cream!

Anybody can buy ice cream at the store, or make it with a special machine, but you can do it yourself with simple materials and science! Normally, ice melts at 32°F (0°C), which isn't cold enough to freeze the cream. But by using salt to lower the temperature at which the ice melts (just like we do on the roads in winter), you can create a "freezer" in a plastic can, with temperatures down to about 14°F (-10°C)!

The freezing point of salt water depends on how much salt is in it – the more salt, the colder it gets! So you can experiment with different quantities of salt in the ice mixture, and see how it affects the texture of the ice cream (though if you use too little, the ice cream won't completely freeze, and stay like melty soft-serve).

This experiment calls for rock salt, which is convenient because it doesn't cost much. If you don't have it, regular salt will also work – salt is salt! Since you're not making a very big batch of ice cream for this experiment, it won't be too expensive. One thing to keep in mind if you're using table salt is that, since the grains are smaller, a tablespoon of table salt will have more salt and less air in it than a tablespoon of rock salt. So you'll need fewer tablespoonsful of table salt.

Materials:

- Large (1 gallon) plastic container or coffee can with a lid that won't come off, or a 1-gallon zipper-lock bag
- 2 quart-size zipper-lock bags
- ½ cup of half & half
- Crushed ice (or snow in the winter!)
- 6 Tbsp rock salt (or other salt)
- Vanilla
- Sugar
- Towel (or winter gloves)

Procedure:

1. Fill the plastic container about half full with crushed ice.
2. Add about 6 tablespoons of rock salt to the ice (or try just 4 tablespoons if you're using table salt). Seal the plastic container and shake the ice and salt for about five minutes. You'll need to wear your gloves when you're handling the container. If you're curious as to why you have to wear gloves, measure the temperature of the mixture with a thermometer. Brrr!
3. Use one quart-size zipper-lock bag to mix the following ingredients:
 - ½ cup of half & half
 - 1 tablespoon sugar
 - ½ teaspoon vanilla extract – or experiment with other flavorings!
 - Seal tightly, allowing as little air to remain in the bag as possible. Too much air left inside may force the bag open during shaking.
4. Place this bag inside the other quart-size bag, again leaving as little air inside as possible and sealing well. By double-bagging, the risk of salt and ice leaking into the ice cream (yuck!) is minimized.
5. Place the two quart-size bags inside the plastic container (or 1-gallon bag) with the ice and seal the container/bag. Wrap the container/bag in the towel or put your gloves on. Shake, rock, roll, and mix! It helps to



have a friend do this with you – you can take turns shaking. You'll be glad to have a buddy – the shaking process takes a while to freeze the cream. Your ice cream should be ready after about 15-20 minutes.

6. Once mixed, remove the inner bags from the container/1-gallon bag and rinse them well with water. You don't want any salt water accidentally getting into your ice cream.
7. Get a spoon (or two if you're sharing with a friend!) and enjoy your treat!

Additional Resources:

The recipe and instructions for this activity are adapted from Steve Spangler Science. The original contains some fun historical facts about ice cream as well:

- <http://www.stevespanglerscience.com/lab/experiments/homemade-ice-cream-sick-science>

Many students were interested in doing additional experiments with dry ice. Here are some ideas for more things to try: (Don't forget – you need an adult to help you, both to be safe and to buy the dry ice.)

- <https://www.continentalcarbonic.com/dry-ice-experiments.html>