

Ice Cream Chemical and Physical Changes

4th Grade

Jeremy White, Brent Greene, & Kathleen Waugaman

References:

- <http://www.science-house.org/learn/CountertopChem/exp15.html>
- <http://chemistry.about.com/cs/howtos/a/aa020404a.htm>
- Taken from a lesson prepared by Mary Allison Timby

Benchmarks:

PS-1, PS-2, PS-3 & PS-4 (Benchmark A & B): Identify characteristics of a simple physical and chemical change. Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects. Explain that matter has different states and that each state has distinct physical properties. SI-3, 4, 5, 6 (Benchmark C): Develop, design, and safely conduct scientific investigations and communicate the results.

Objectives:

In this lesson, students will describe physical properties of ingredients used to make ice cream. Students will use beakers and graduated cylinders to make volume measurements. Students will record in their science journal. In this experiment, they will use the lowered freezing point of water to chill another mixture (ice cream) to the solid state.

Materials:

- 1 quart plastic bag
- 1 gallon plastic bag
- ½ cup (125mL) Half and Half
- ½ cup (125mL) whipping cream
- ¼ cup (62.5mL) sugar
- ¼ teaspoon (1.25mL) vanilla flavoring
- sodium chloride or rock salt
- ice
- thermometer
- measuring cups or beakers (1, ½, and ¼ cups)
- Styrofoam cups
- Plastic spoons

Makes about 3-5 small servings

Initial Demonstration:

To demonstrate other physical changes that take place in the kitchen while cooking, other examples will be shown to the class. Begin by heating a small cooking plan on a hot plate. In a beaker, place a stick of butter and have the students pass it around to see what state of matter it is in. Make sure that the students understand that a change in state is about to take place with the butter, as it starts out as a solid. When the pan is hot, pour in the stick of butter and use a spatula to stir it around. During the cooking process, show the pan to the students so they can see the state change take place. Once the butter has melted completely, discuss as a class the results. Next, pour the butter into a small cup or beaker and place it in the refrigerator. Have the students predict what they think will happen. Following the main activity, retrieve the butter and have the students analyze what took place. Again discuss the physical change that occurred and any other physical changes that the students can think of in the kitchen.

Target Observations:

- Stick of butter is a solid to begin with, but becomes a liquid with heat.
- After the butter is cooled, it returns back to a solid because the heat is removed.

Target Model:

- A physical change requires a change in the size of the object, shape of the object, or the state of matter. Even though the liquid ice cream hardened up, it did not become a solid because it takes the shape of the container that it is in. The ice/salt mixture simply slowed the movement of particles in solution, thus making the mixture more viscous.

Procedure:

1. Place $\frac{1}{4}$ cup sugar, $\frac{1}{2}$ cup Half and Half, $\frac{1}{2}$ cup whipping cream, and $\frac{1}{4}$ teaspoon vanilla into a one-quart plastic bag
2. Securely seal the bag and mix well
3. Place 2 cups of ice into a one-gallon plastic bag
4. Using the thermometer, measure and record in your journal the ice temperature
5. Add between $\frac{1}{2}$ and $\frac{3}{4}$ cups of sodium chloride to the gallon bag
6. Place the sealed quart bag into the gallon bag, making sure to close the larger bag securely
7. Holding the large bag by the top seal, gently rock the bag from side to side. Do not hold the bag in your hands, because it will be cold enough to cause tissue damage to your hands
8. Continue rocking the bag until the contents of the quart bag have solidified (10-15 minutes)
9. Measure the temperature of the salt/ice mixture in the gallon bag and record the temperature

10. Remove the frozen contents from the quart bag into the Styrofoam cups.
11. Proceed to consume the contents of the cups

Target Observations:

- The initial temperature of the ice was higher than the final temperature.
- The contents of the inner bag begin to thicken over time.
- The salt makes the ice mixture much colder than regular ice.
- Physical and chemical changes can take place when preparing food.

Summary:

There are many different examples of physical and chemical changes that occur in the kitchen. Students have learned that even though ice cream appears to be a solid, it is really a liquid based on its physical properties. The ice/salt causes the ice cream to thicken, which then turns into a nice treat to eat after the experiment.