Shake it Up!

No need to chase the ice cream truck! This activity, provided by the Shell Summer Intern Program, will explore the science behind homemade ice cream, using a little salt and a whole lot of motion.

Materials Needed

- Measuring spoons
- Measuring cups
- Sugar
- Half and half, milk, or whipping cream
- Ice
- Kosher or table salt
- Vanilla extract
- Gallon-sized sealable bags
- Pint or sandwich-sized sealable bags
- Towels or oven mitts
- Extra towels for clean-up
- Spoons
- Toppings (optional)
- Bowls (optional)

Content:
- Energy transformations
- Physical/Phase changes

Questions:
- Why does salt melt ice?
- How can motion energy help the freezing and melting process?

Grades:
3-5 and fun for older students, too!

Time:
30-45 minutes

Safety Notes:
- There may be spills, leaks, or excess water created during shaking. Use caution on floor surfaces to prevent slips and falls and have towels available for clean-up.
- Have excess towels or oven mitts available for holding the bags. The ice can become cold on hands.
- Wash your hands before and after this activity.

Procedure

1. In a small sealable bag, combine 1/2 cup of milk product with 1 tablespoon of sugar and 1/4 teaspoon of vanilla. Squeeze out most of the air from the bag and seal it tightly.
2. Place at least 3 to 4 cups of ice into a large resealable bag. Add 1/2 cup of salt to the bag.
3. Place the smaller sealed bag of milk into the larger bag. Seal the larger bag.
4. Hold the bags with towels or oven mitts to prevent hands from getting too cold.
5. Shake the bags vigorously for 5-10 minutes, checking occasionally on the smaller bag to see if freezing has occurred.
6. Remove the smaller bag and spoon the ice cream into bowls. Top with toppings, if desired. Enjoy!
7. Clean and dry any spills, leaks, or condensation that may have landed on the floor.

How Does it Work?

The bag with the salt and ice cubes should start to melt when you begin shaking. Shaking helps this happen faster because it exposes the ice to the salt more quickly. The shaking motion also adds friction as the ice cubes bump together and into the bags. As the ice cubes melt, the bag should also start to feel colder. As the outer bag becomes colder, the mixture inside the smaller bag starts to cool as well, and over time it will freeze into ice cream. The cold, salty water is helping to draw the thermal energy (heat) out of the milk mixture. The ice cream may not freeze if the bags aren't in motion.

Adding salt to the ice lowers the freezing point of the ice (solid water), melting it back into a liquid. This is called freezing point depression. Salt prevents water from freezing at its normal temperature and keeps it as a liquid at temperatures below 32 degrees Fahrenheit (0 degrees Celsius). This is the same thing that happens in cold climates when icy and snowy roads are salted. Trucks spread salt to lower the freezing temperature for water, making sure ice and snow melt to keep roads less slippery.

Going Forward!

- Create a scientific experiment by repeating the activity, but this time use one bag with ice and salt and another bag without the salt!
- Explore how different milks freeze differently. Does using skim milk, whole milk, or half and half change the results? Will milk alternatives (almond, coconut, oat) freeze more or less quickly?
- Make a sorbet! Try recreating the experiment with fruit juice instead.
- Try doing the activity with different types of salt. Is there a difference in the freezing/melting with rock salt, table salt, kosher salt, or Himalayan salt?
- Explore how the starting temperature of your smaller bag affects its freezing time.