

Cloverbud Investigators: STEM for Every Season



Shake, Rattle, & Roll Ice Cream



January

Background:

I scream, you scream, we all scream for Ice Cream! There is nothing better on a hot summer day than a cold bowl of ice cream! But do you know the history behind our favorite treat? The earliest recorded stories of ice cream were from the Roman Emperor Nero who lived between 37-68 A.D. The stories say that Emperor Nero demanded snow be fetched from the mountains to make his favorite treat. The collected snow was then mixed with fruit pulp, nectar, and honey to make it sweet. Another story about royalty and ice cream is told about King Tang of Shang who ruled China from 618-697 A.D. These stories speak of how the King kept “ice men” to heave large hunks of ice to the palace and used them to prepare a dish made of buffalo milk, flour and camphor which was served frozen.

It is believed that the idea of ice cream was brought from China to Europe, where it advanced into a sophisticated dish for the Italian and French royal courts. From Europe, ice cream made its way to what was then the colonies, which later became the United States. The first record of ice cream in the US was May 19, 1744, when the Governor of Maryland served ice cream to his guests. The sweet dessert was a favorite of many in the upper classes and was probably served well before this recorded event.

As ice cream evolved, so did the method of making it. Before modern refrigeration, the traditional “pot freezer method” was used to make ice cream. This design is still used today and is better known as “homemade ice cream”.

Today, we will make homemade ice cream. Using science to guide us we will answer the following questions: *How do you make ice cream? What is in it? How does it get cold?* We will also be using a new method of mixing that lets us have a bit of fun while we work. In the past you may have made homemade ice cream using an electric ice cream maker, or maybe you even made it by hand using two plastic baggies, ice and lots of shaking, but in today’s lesson we are going to shake, rattle and roll our ice cream using an ice cream ball! Now let’s get cooking!

Ice cream balls can be purchased at various locations, including Amazon and Target, for about \$30.00.



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



gallia.osu.edu

CFAES provides research and related educational programs to clientele on a nondiscriminatory basis. For more information: go.osu.edu/cfaesdiversity.

Updated by T. Winters, 1/2019

January's Mystery: Can we shake, rattle, and roll a ball to make Ice Cream?

Supplies:

- * Ice Cream Ball
- * Mixing Bowl
- * Measuring Cups & Spoons
- * Milk (whole milk, heavy cream, half and half or condensed Sweetened Milk) works best
- * Vanilla Extract
- * Sugar
- * Ice
- * Rock salt
- * Bowls & Spoons
- * Paper Towels
- * Ice Cream Topping (Optional)



Science Behind Shake, Rattle, & Roll Ice Cream:

The secret to good ice cream is the rich sweet flavor and the cool refreshing taste! By using the simple ingredients of milk, sugar and flavoring for taste and a combination of ice and salt for the freezing process, your students can learn about the physics behind freezing points while making a sweet treat to eat.

First, let's look at the freezing point of water, not all water freezes at the same temperature. For example, Ocean (saltwater) begins freezing at about 2 degrees below zero Celsius, where fresh water will freeze at zero Celsius. We can drop water's freezing point all the way to negative 20 degrees below zero Celsius by increasing the salt solution in the water. So why is this important? When we mix our liquid ingredients, together we need them to freeze in order for them to form the ice cream we all know and love. So, temperature is important to our finished product. So what is temperature? Simply put, it is the measure of how fast the molecules are moving in a substance. In order for something to be cold or frozen the molecules must slow down and allow bonds to form between them. When this happens to a liquid, it becomes a solid like water turning to ice.

In today's investigation, we will be trying to get the molecules of our "creamy liquid mixture" to slow down and build enough bonds that we get frozen ice cream. We are not using "pure water." We are using milk and sugars in our creamy mixture, which have more particles and can get in the way of our bonds. It will be harder for the bonding process to work, and we have to lower the temperature of the cream mixture until it reaches its freezing point. To do this, we are using

gallia.osu.edu



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



CFAES provides research and related educational programs to clientele on a nondiscriminatory basis. For more information: go.osu.edu/cfaesdiversity.

Updated by T. Winters, 1/2019

water in the solid form of ice and coarse rock salt to create a “freezing point depression” which will harden our creamy mixture into ice cream.

In order for our experiment to work, we have to remove heat from the cream mixture, which means our temperature must drop well below zero. We will have to send the heat from the cream somewhere else to be absorbed. To do this, we are going to use rock salt and mix it with the ice. At first, due to the warmer temperature of the cream, and the environment around the ice, some of the ice will begin to melt. When this happens some of the salt will be dissolved into the water, causing the water to become saltwater. Since saltwater can withstand colder temperatures without becoming a solid, it can absorb more heat. The process of ice melting and salt dissolving will continue to lower the freezing point of the saltwater solution. At the same time, the ice-cold saltwater will continue to pull the heat from the cream mixture because heat will want to flow from the warmer liquid to the colder liquid. With time the temperature of the saltwater mixture can reach -20 degrees C.

What to Do: (there are many recipes for ice cream, find the one that works for your group and adjust the supply list as needed. Please be aware of any allergies in your group.)

Step 1: Measure and pour 2 cups of Milk (this can be whole milk, cream, or a mixture with sweetened condensed milk) in a large mixing bowl. Stir in 1 teaspoon of vanilla extract (for vanilla ice cream) and 1/3 cup of sugar (sweetened condensed milk can be substituted for sugar). Pour mixture into the metal cylinder of the ice cream ball, leaving room at the top for expansion as the mixture freezes.

Step 2: Fill the outside container of the ice cream ball with ice and then add 1/2 cup of rock salt. (MEGA: Add 3/4 cup of rock salt).

Step 3: Hand tighten the lid. Then have a ball! Shake, roll, and pass it around as you mix and freeze the ingredients.

Hint: *Don't throw or kick the ball, because it is heavy and made from strong plastic.*

Step 4: After about 10 minutes (15 for the MEGA ball) open the ice cream end using the included plastic wrench. Scrape the sides of the cylinder to mix up the ice cream using a plastic or wooden spoon (don't use a metal spoon as it will scratch the cylinder).

Step 5: Then check the ice end. Pour out the excess water and add more ice and up to 1/3 cup more rock salt to enhance the freezing ability. Close the lids securely and continue having a ball for approximately 5–10 more minutes. (15 for MEGA)



Go Over Findings:

What purpose does the salt play?

What are we doing to the freezing point?

Where did the heat from the ice cream mixture go?

Do you think homemade ice cream taste or feels colder than store bought?

Does the homemade ice cream melt faster than store bought?

Some additional experiments to try: mix up different solutions of salt water by measuring and adjusting the amount of salt in each. Time which solution freezes fastest.

- **Melting ice with salt-** using ice cubes and table salt, time which melts faster, a plain ice cube or one with salt added to it. Do other ingredients make the ice cube melt faster? Like sugar, for example.

Sources:

Steve Spangler Science, Ice Cream Ball – Play,

<http://www.stevespanglerscience.com/lab/experiments/ice-cream-ball-play-and-freeze-maker/>

History of Ice Cream-The origins of ice cream can be traced back to at least the 4th century B.C.,

<https://www.thoughtco.com/history-of-ice-cream-1991770>

Developed by: Tiffany Sanders Riehm, Gallia County 4-H Program Assistant, OSU Extension, 4-H Youth Development, riehm.11@osu.edu. Reviewed and Edited by Tracy Winters, OSU Extension Educator Gallia County, 4-H Youth Development, winters.5@osu.edu and Michelle Stumbo, OSU Extension Educator Meigs County, 4-H Youth Development, stumbo.5@osu.edu . Adapted from Steve Spangler Science



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



CFAES provides research and related educational programs to clientele on a nondiscriminatory basis. For more information: go.osu.edu/cfaesdiversity.

gallia.osu.edu

Updated by T. Winters, 1/2019