

Designer Ice Cream Activity – Learning Facilitator’s Guide

In this activity, participants will be acting as food chemists as they create ice cream from scratch. They will learn about the chemistry involved in making this cold, sweet treat. **Food Scientists** are the scientific and creative minds behind how our food is formulated, manufactured and packaged.

More information on careers in food science can be found at:

<http://www.ift.org/knowledge-center/learn-about-food-science/day-in-the-life.aspx>

https://learn.org/articles/What_Does_a_Food_Scientist_Do.html

The participants will be focusing their design efforts primarily on two aspects of the ice cream design.

1. Freezing Point Depression – They will experience how a little salt on ice depresses or lowers the freezing point. Additional salt will depress the freezing point further.
2. The STEM big idea is phase change.
Phase change is the process by which forms of matter are altered. For example, when liquid freeze and become a solid, it goes through a phase change.

Materials:

This activity can be done individually or in teams of two or three. With three team members each will get about 2/3 to a cup of ice cream which is equivalent to a large scoop. If working alone cut the recipe in half or plan to share! It takes energy to shake the ice bath and freeze the ice cream. Taking turns among team members will avoid any one person's hands getting too cold. Working alone will require persistence.

1. Materials

Ice Cream

- 1 pint of half & half (two cups)
- 1/2 cup granulated sugar
- 2 teaspoons vanilla extract
- 4 zip-lock bags- sandwich size (split the recipe into two bags & double bag)
- Medium sized bowl
- Mixing spoon
- Spoons and bowls for tasting

Ice Bath

- 1 Medium/Large plastic storage container (~ 96 fl oz.)
- 4-5 cups ice
- 1/2 cup salt
- Digital thermometer

Safety Note

Participants with dairy allergies should not work with the dairy products or taste the ice cream. Also, the ice bath in the container the participants will be shaking will get cold- very cold. Protect hands with a towel or gloves. Take turns shaking if multiple participants.

Timing- if 75 minutes is allocated for this activity, the breakdown of the time should be:

15 minutes- introduction

45 minutes- preparing and making the ice cream

15 minutes- reflection

Knowledge and Skill Builders:

The STEM big idea for this activity is phase change. In this activity the heat energy is being transferred out of the creamy solution resulting in the liquids going through a phase change to a cold, solid state. Participants will experience this phase change when they cool their mixture in the ice bath to make ice cream!

A very cold ice bath is required to freeze the ice cream mixture. The ice cream mixture will not freeze at 32 F.

Freezing point depression is explored as participants create an ice bath that is sufficiently cold to convert the liquid ice cream mixture to a solid. Participants will add salt to ice and will observe the temperature drop substantially. They add additional salt and will observe the temperature drop further. They will then use this ice/salt/water mixture to chill their ice cream mixture. The temperature should be less than 15 F to freeze ice cream in ~10 minutes.

For those that live in cold climates they may have seen trucks distributing salt on icy roads which melts the ice, making it safer to drive.

A very cold ice bath also will help the ice cream to freeze quickly and avoid the formation of crystals which make the ice cream grainy. Vigorously shaking the container will insure the ice cream mixture is cooling at a consistent rate throughout the bag and avoid pockets of crystal formation. Participants are instructed to "Keep it Moving!"

Self-Quiz!

Based on what you read on the previous page, answer the following questions:

1. Why is it important to lower the temperature below 32 F?
 - The lower the temperature of the ice/salt/water mixture, the faster the ice cream will freeze.
 - The lower the temperature of the ice/salt/water mixture, the slower the ice cream will freeze.
 - The higher the temperature of the ice/salt/water mixture, the faster the ice cream will freeze.
2. What happens when the mixture is not kept in motion?
 - Melts and separates into its original condition
 - Stays the same temperature and consistency
 - lumps and crystals form

The Design Challenge Notes:

1. When mixing the ingredients, make sure all the sugar is dissolved. It settles to the bottom of the bowl, so participants should be able to feel the grittiness of the sugar with their spoon if it is not dissolved.
2. Testing of the ice cream shaker will require physical shaking of the ice container, it will cause a loud noise... alert those who may not like loud noises.
3. In teams of three, each person will get 2/3 cup of ice cream which is equivalent to a large scoop. Plan your supplies and consider the ice cream quantities as you set up.
4. Note:
 - a. Mixing the salt well into the ice will give better results when lowering the freezing point of ice bath.
 - b. Holding the lip of the shaker makes shaking easier, as holding the bottom, the participants' hands will get cold.
5. Low temperature and shaking vigorously will result in creamy ice cream. Ice crystals will form if mixture freezes slowly and/or is not vigorously mixed
6. The goal is to make solid ice cream but if participants are short on time or tire of shaking they may choose to quit once their ice cream is soft serve consistency. It will lower their score in the design criteria but not their enjoyment!
7. To aid in serving the ice cream participants may snip a large piece off one corner of their bag and pipe the ice cream into their bowl.
8. The criteria that will be utilized to evaluate the designs:

Design Criteria			
Criteria	One	Two	Three
Temperature	The ice cream is still liquid	The ice cream is like soft-serve	The ice cream is solid
Consistency	Has crystal formation	Has little crystal formation	Creamy texture, without crystals
Taste (after removing ice cream from shaker)	Could be better	Not bad	Delicious
Temperature of the salt/ice/water mixture	Temperature is 32F	Temperature is between 32 F and 15 F	Temperature is 15 F or lower.

Reflection:

As with all the engineering activities, the reflection part is crucial to the learner's experience. They will reflect on what they learned through the process of making ice cream.

Final notes:

If time allows or if additional sessions can be scheduled, three important aspects of engineering can be addressed:

1. Sharing of ideas and designs. Participants can share their designs and discuss their work and what was helpful and what was not.
2. Engineering is iterative. It would be great if participants could go back and "try again:" modify their design, use new ideas – ultimately try to improve on their work.
3. What it's like to be a food scientist.