



Inquiry Science – Rolling Ice! Teacher Guide

Overview

In this inquiry based activity, students will work in teams to investigate how different variables affect a simple ice cream making process. Given a basic set of materials, students will make predictions, design a set of experimental trials and make observations about their results.

Materials (per student)

Divide up the materials with your class in advance, so that everyone brings something that can be shared with other groups, and so that everything you need is available!!! Each of the suggested amounts may be changed depending on how the students design their experiments. Everything can be changed EXCEPT the two plastic bags.

- 1 quart size zip-close plastic bag – freezer strength
- 1 large zip-close plastic bag - freezer strength
- 2 Tbsp sugar
- 1/2 cup milk or half & half
- 1/2 tsp vanilla
- 2 tsp chocolate syrup or 1/2 to 1/4 cup berries
- 12 ice cubes
- 1/2 cup salt (rock salt works best!)

Materials (per team)

- Insulating material (fleece, towel, newspaper, etc.)
- Tasting spoons (if ok to eat)
- Measuring cups
- Measuring spoons
- Thermometer or temperature probe (optional)
- Scale (optional)

Getting Ready

Set-up the ice cream ingredients in one or two designated areas of the classroom. Gather the team materials and place them in a container for easy distribution and clean-up.

Procedure

Introduce the activity by telling students that they will be working as both chefs and scientists today to make a tasty treat. Their task is to figure out the best recipe and to record it so that others might be able to repeat their procedure.

Show students the available materials wherever they are located in the classroom. Let students know that all of the ingredients are important but they will have to determine the amounts and some of the directions for making their ice cream. Review the general procedure with the students below. All groups will follow this basic procedure. Ask students to identify what is missing from the directions (*the amounts of the ingredients.*) Tell the class that each team will choose a variable they would like to test. They will vary the amount of material/time/technique and record their results.

General Procedure:

1. Add the sugar, milk, and flavoring/fruit to the smaller plastic bag.
2. Gently squeeze the air out of the bag and seal it completely.
3. Add the ice and salt to the larger plastic bag.
4. Put the small sealed plastic bag inside the large bag and remove all the air. Seal the large bag completely.
5. Wrap the plastic bags in your choice of insulating material and start mixing until the contents inside the smaller bag thicken.

Before going any further, you will need to discuss with students the importance of only changing one variable at a time. The variable could be the amount of something (e.g, how much salt or ice). It could be using milk vs. half and half. Students might test the presence or absence of syrup, fruit, or vanilla. Or, students could alter the mixing technique or the type of insulating material. However, stress the idea that **ONLY ONE THING** can change and that all other conditions must remain constant.

Allow students time to meet with their group members and decide which variable they want to investigate (*their independent variable*) and what they will observe or measure (*their dependent variable.*) Once the independent and dependent variables have been determined, students should write out their proposed procedure on their student handout.

Review each group's procedure **BEFORE** allowing them to experiment. Once you have OK'd the procedures, allow students to conduct their experiments.

Discussion

After all teams have completed their experiments, ask students to share their results with the class. Compile a recipe for the "best ice cream" using the students' findings and if time permits, make one last batch and allow all students to taste.

Explanation

If the contents of the small bag were simply water, it would need to reach a temperature of 0 degrees Celsius in order to turn to ice. However, the small bag contains a variety of different substances and, in order for the ice cream to form, the ingredients need to be at a temperature below -3 degrees Celsius. The ingredients also need to be constantly mixed as the freezing is happening. If the ingredients are simply combined and placed in a freezer, the result would be a large, hard, icy lump uncharacteristic of ice cream. The constant mixing prevents large ice crystals from forming and it also whips a small bit of air into the ice cream to add to the light, fluffy texture.

The salt plays a very important role in reaching our desired cold temperature. Adding salt to the ice lowers the temperature of the mixture below the normal freezing point of water and allows us to attain a temperature below -3 degrees Celsius. This is a principle called freezing point depression. Because our ice cream ingredients are surrounded by the ice/salt/water combination, they are also cooled to below -3 degree Celsius and the phase change from liquid to solid is able to occur.



Inquiry Science – Rolling Ice! Student Guide

Overview

In activity, you will work in teams to investigate how different variables affect a simple ice cream making process. You will be given a basic set of materials and you will then design a set of experimental trials, make and test your predictions, and observe your results.

Materials

- 1 quart size zip-close plastic bag – freezer strength
- 1 large zip-close plastic bag - freezer strength
- 2 Tbsp sugar
- 1/2 cup milk or half & half
- 1/2 tsp vanilla
- 2 tsp chocolate syrup or 1/2 to 1/4 cup berries
- 12 ice cubes
- 1/2 cup salt
- 2 Tasting spoons (if ok to eat)
- Insulating material (fleece, towel, newspaper, etc.)
- Measuring cups
- Measuring spoons
- Thermometer or temperature probe (optional)
- Scale (optional)

General Procedure

The directions listed below are general guidelines for how to make the ice cream.

1. Add the sugar, milk, and flavoring/fruit to the smaller plastic bag.
2. Gently squeeze the air out of the bag and seal it completely.
3. Add the ice and salt to the larger plastic bag.
4. Put the small sealed plastic bag inside the large bag and remove all the air. Seal the large bag completely.
5. Wrap the plastic bags in your choice of insulating material and start mixing until the contents inside the smaller bag thicken.

Designing Your Experiment

Your group is responsible for choosing **one** variable that you'd like to investigate in order to see what effect it has on the ice cream making process. The variable could be the amount of something (e.g, how much salt or ice). It could be using milk vs. half and half. You might test the presence or absence of syrup, fruit, or vanilla. Or, you could alter the mixing technique or the type of insulating material. Whatever you choose, remember that you **can only change one thing**. All other amounts, techniques, and times must stay the same from one trial to the next. Talk with your group and fill in the Data Sheet on the next page.



Inquiry Science – Rolling Ice! Student Data Sheet

DEFINING OUR VARIABLES:

1. What we choose to change = our **Independent Variable**: _____
 2. What we will observe/measure = our **Dependent Variable**: _____
 3. What conditions will you keep constant from one trial to the next? _____
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PROCEDURE

Modify the general procedure from the previous page so that ANYONE could duplicate YOUR experiment. Make sure you give exact quantities and say what you will observe and measure.

Our group changed the procedure to study the effects of our Independent Variable (_____):

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

PREDICTION/HYPOTHESIS

What will be the result of your two conditions? (Dare to be wrong. Don't say "I think". Instead say "The bag with the ___ will ... while the other bag with the _____ will ..."

Why do you think that will happen?

EXPERIMENT

Once your teacher has checked over your procedure, conduct your experiments and record your observations in Table 1 about the conditions inside the large and small bags.

RESULTS

Table 1: Ice Cream Experiment Results

	Condition 1		Condition 2	
Time (min)	Description of Large Bag	Description of Small Bag	Description of Large Bag	Description of Small Bag
0				

Summary of Results

State what happened in paragraph form by describing what your experiment results revealed.

CONCLUSION

Did your results support your hypothesis?

Why do you think that is the case? If you have time, perform research (read articles, search online, or do more experiments – yummy!) and use the information to justify your explanation and to learn more. For instance, how could you end up with a thicker end product?