Session 9: Secret Formulas for Ice Cream

Overview

In this scrumptious session, each student mixes ice cream ingredients in a cup, then pours them into a ziplock sandwich bag, following the procedure you modeled in the previous session, to create their very own ice cream. Students can now bring to bear all the experience they’ve gained throughout the unit, to help them with the delicate and delicious processes of measuring, mixing, recording, evaluating, and adjusting.

Each group of students adds rock salt to a freezer bag of ice, and all four students put their bags of ice cream ingredients into the freezer bag. Then they put their freezer bag into a T-shirt, grasp the ends of the T-shirt and shake! When their ice cream is frozen, they open the bags and enjoy.

After their ice cream is only a very happy memory, each student still possesses a carefully-recorded personal secret formula that they can use at home to re-create the same exact refreshing snack. But they also come away from this session and the entire unit with something even more valuable than that: a strong grasp of key scientific and mathematical skills, concepts, and processes; a variety of experiences that build toward more sophisticated understandings of experimentation and invention; and an overwhelmingly positive (and tasty) experience with “doing science.”

One teacher told us, “They were very excited about eating ice cream, so they were very careful about following directions and not spilling any of their ingredients.” Another said, “I saw their measuring skills improve greatly as compared to when they started out in Session 1.”
What You Need

For the class:
☐ access to a nearby freezer or cooler
☐ 1 gallon regular milk (allow about a quart per 10 students, plus a quart extra)
☐ 3 lbs. of white sugar (about 6 cups)
☐ 3 5-lb. bags of crushed ice (or ice cubes)
☐ 3 lbs. rock salt (about 4 cups)
☐ 6 small squeeze bottles of food coloring (two bottles each: red, blue, yellow)
☐ students' personal cups
☐ 16 oz. vanilla extract
☐ 16 oz. strawberry extract
☐ 1 roll or stack of paper towels
☐ 32 clean plastic spoons (for eating ice cream)
☐ a dozen extra ziplock sandwich bags
☐ a few extra ziplock gallon-size freezer bags
☐ 2 rinse buckets
☐ 1 black permanent felt marker
☐ stack of newspapers for spills
☐ sponges
☐ (optional) mop and bucket

For each group of four students:
☐ 1 cafeteria tray
☐ 3 color-coded plastic cups (blue, green, orange)
☐ 2 small, lightweight plastic spoons
☐ 2 droppers
☐ 2 popsicle sticks
☐ 4 plastic stirrers
☐ 1 red-dot cup with rock salt from Session 8
☐ 1 gallon-size ziplock freezer bag*
☐ 4 ziplock sandwich bags
☐ 1 T-shirt (adult-sized)
☐ 4 Ice Cream data sheets (master on page 97)
☐ pencils
☐ (optional) crayons or markers in blue, green, and orange

*We recommend using the more expensive, sturdier freezer bags, because regular gallon-size ziplock bags sometimes leak. It is also possible to rinse and re-use these stronger freezer bags. We know that the Glad brand of these freezer bags works well.
Getting Ready

Before the Day of the Activity

1. Decide where the students will shake their ice cream. During the first part of the session, students will work in their groups of four at tables, to mix ingredients. Later they need to stand up and shake their ice cream. (Every group will put their four individual ice cream bags into a large freezer bag of ice and rock salt, and put that into a T-shirt "sling" for shaking!) Not only is this bound to be a noisy activity, but the bags often drip salty water. Needless to say, the shaking should be done outdoors if at all possible! If you must stay indoors, have a mop and bucket available.

2. Arrange for adult volunteers. We strongly recommend that you arrange to have two or more adult volunteers in your classroom during this session. Plan for help during set-up and clean up too, if possible. It's nice to have two adults to distribute the drops of food coloring to the students and to check the seals on their bags before they shake. Extra adult supervision and more helpful hands will make the shaking activity easier for all.

3. Arrange for some extra ice cream to be made. Ask one of the volunteers to mix a few extra ziplock bags of ice cream ingredients during the activity. (Some groups of students can shake an extra bag along with theirs in the T-shirt.) This way, there will be extra ice cream to eat for students who accidentally get salt from the outside of their bags in their ice cream. See information about removing salt on page 95.

On the Day of the Activity

Materials on Trays

1. Prepare ingredient cups. Fill three color-coded plastic cups for each group of students, and put them on a tray.

   - blue-dot cup: about \( \frac{3}{4} \) cup of sugar
   - green-dot cup: about \( \frac{1}{4} \) cup vanilla extract (two ounces)
   - orange-dot cup: about \( \frac{1}{4} \) cup strawberry extract (two ounces)
2. Add droppers, popsicle sticks, and spoons. Put two small plastic spoons and two popsicle sticks in each blue-dot cup. Put a dropper into each cup of extract.

3. Add four stirrers to each tray. Each student will need a stirrer to mix their ingredients in their personal cup before pouring them into the ziplock bag.

Materials Not on Trays

1. Post the color key. Have the color key for ingredients from Session 8 on the wall where students can see it.

2. Prepare student data sheets. Make a copy of the Ice Cream data sheet for each student (master on page 97).

3. Replenish the red-dot cups from the previous session with rock salt. Fill each cup half full, and remove the spoon and stirrer. There should be one red-dot cup per group of four students. Each group will pour the entire half-cup of rock salt into their bag of ice. Have the red-dot cups near the ice bags, so that students can easily add the rock salt when they are ready to shake their ice cream. (The rock salt should not be on the group’s tray of materials, because of the complication that someone might think it’s an ingredient for the ice cream!)

4. Fill the ice bags. For each group of students, fill one ziplock freezer bag about half full of ice. If possible, keep the ice in a cooler or freezer until just before it is needed.
5. Put initials on small bags. Use a permanent marker to write each student's initials on a ziplock sandwich bag. Have them ready to distribute at the beginning of the activity.

6. Have personal cups ready. Have personal cups clean and ready to pass out.

7. Have milk ready to pour into personal cups. Keep the milk in a cooler until it’s time to pour.

8. Prepare rinse bucket(s) and waste container. Fill a rinse bucket (or two) half full with cold tap water, and put it in the area where students will do the ice cream shaking. Have an empty bucket or dishpan to use as a container for ice bags, T-shirts, and other materials at the end of the shaking activity.

9. Have food coloring ready for adults to distribute. Decide whether adult volunteers will come to student groups, or whether they will sit at a "color station" and students will go to them when they are ready for drops of coloring.


Reviewing Ingredients and Amounts

1. (Optional) Pass out Ice Cream data sheets, and have students color code the ingredients according to the color key. Remind students that first they’ll mix milk and other ingredients in their cups, then add the mixture to a ziplock bag.

2. Adding milk. Say that everyone will add the same amount of milk. Tell the students that you or another adult will pour milk into their personal cups up to the bottom of their initials.

3. Adding sugar. Say that after they add each spoonful, they can stir with a stirrer, and taste a little bit of the mixture to see if it is sweet enough. Remind them that ice cream is like cola; the more sugar they add, the sweeter it will be. Re--emphasize the five spoonful limit for sugar. Remind the students to circle the number of spoons of sugar they use on their Ice Cream data sheet.
4. Adding flavor. Review the two flavor choices. [vanilla and strawberry] Ask, “What’s the most vanilla and strawberry you can add?” [ten—five drops of each] Urge the students to smell the flavors before adding them. Tell them that it is a good idea to taste their mixture after adding each drop. Remind them that they cannot take out an ingredient once it’s in and to record the flavor on their data sheet.

5. Adding color. Review the color choices. [red, yellow, blue] Ask, “Are these colors also flavors?” [no, just colors] Explain that your adult helpers will add these drops for them. They will need to decide which color(s) and how many drops. In this case, they are limited to a total of not more than three drops. For example, they could pick one drop of each color, or two red drops and one yellow, etc. They’ll record their selections on their data sheets so the helpers can follow their recipe.

6. Pouring the mixture into the bag. Explain that, working with a partner, they will pour their mixture of ingredients into the bag with their initials on it. Demonstrate having a partner hold the bag until the mixture is poured, and the bag zipped up. Caution the students to be careful that their bag is sealed well before setting it down.

Explaining the Ice and Shaking Procedures

1. Explain that after they have poured their mixtures into their bags, all four of these bags will go into one big ice bag for their group. This means they must wait for their complete group of four to be ready before the ice cream can be shaken. Again, tell them to be sure their own personal ice cream bag is sealed well. (You may want to demonstrate sealing the bag and making sure all the air is out by placing the bag on a table, pressing to push the air out and sealing it, at first in an upright position, and then over the edge of the table. This will help ensure the bags do not pop open.)

2. Say that when their group goes to get their ice bag, they will also get one red-dot cup of rock salt to pour into their bag. (There is no need to layer the salt and ice, as in traditional ice cream makers.) Then they will put their group’s four small bags of ice cream ingredients into the ice bag. Say that they should zip the ice bag up very carefully.
3. Show the groups how to put the bag into the T-shirt. Have one student hold one end of the shirt closed and one student hold the other end, then tell them to start shaking the bags back and forth or up and down. Mention that the shaking does not need to be fast. Bags need to be shaken continuously for about five minutes.

4. Groups should share the shaking job. Two students could shake for a few minutes and then give their partners a turn. Some groups may find a way for all four students to shake at once. After a few minutes, they can check to see if their ice cream is getting frozen. If not, they need to keep shaking!

Let the Ice Cream Making Begin!

1. When you finish your introduction, and while students are thinking about which ingredients and amounts they will use, have a student from each group come and get a tray of ingredients.

2. Have several helpers pass out the personal cups and bags, and have an adult fill each student’s personal cup with milk, up to the bottom of their initials (approximately three ounces).

3. Circulate, making sure that students are recording their ingredients as they add them. As students finish adding the other ingredients, have an adult or two add food coloring, and help with sealing the bags.

4. Let the groups get ice bags, rock salt, and T-shirts, and begin shaking. Supervise the shaking, making sure everyone in a group gets a chance to participate.

5. As they finish, have students dip their small bags into the rinse tub and rinse them. After they rinse off the salt, the outside of their bag may still be a bit salty. Help students fold the top of their bag outward so that they will be less likely to get salt in their ice cream. IMPORTANT: Take all measures to ensure that salt does not get into ice cream. Using fingers and water, clean away all salt that may have settled near the seal. Have a few extra bags of ice cream made in case some students need it.

6. Hand out the spoons and watch them enjoy. Circulate and ask students how they think their secret formula for their very own special brand of ice cream came out.

7. Collect bags, spoons, and clean up.
Ice Cream

My secret formula for ice cream is:

- milk (3 ounces)
- sugar
- vanilla
- strawberry
- red
- yellow
- blue