
LESSON 7

A Dissolving Race: Two Forms of Sugar

Overview and Objectives

Having investigated what happens when they mix various solids with water, students are ready for a more detailed study of dissolving. In this lesson, students compare two forms of the same substance—a sugar cube and granulated sugar. They observe that both forms are sugar and differ only in the overall size of their pieces. After dropping a sugar cube and an equal volume of granulated sugar into two separate cups of water, students observe that sugar dissolves faster when it is in smaller pieces and when it is stirred. This activity prepares students for Lesson 8, in which they examine another factor that affects the dissolving of sugar—the temperature of the water.

- Students compare and discuss the properties of two forms of the same solid—a sugar cube and granulated sugar.
- Students investigate how granulated sugar and a sugar cube dissolve in water.
- Students record and discuss their observations.

Background

The speed at which a dissolvable solid dissolves in water depends on three primary things: whether and how the mixture is stirred, the size of the solid, and the temperature of the water. Students will explore two of these variables in this lesson. They will explore the third variable (temperature) in Lesson 8. In this lesson, students discover that small grains of sugar dissolve in water faster than a sugar cube does.

To make this investigation a fair test, encourage students to stir their two mixtures at the same time and in the same way. This is easily done if the same student stirs both cups simultaneously; what one hand does, the other will follow. Keeping these variables the same will allow students to make a fair comparison between dissolving time of the sugar cube and the granulated sugar.

When discussing their results as a class, students may wonder why the granulated sugar of one student pair dissolved faster than that of another. Encourage students to discuss why this might be. Help them understand that some students may have stirred at a different speed or in a different manner, causing their sugar to break apart faster or slower.

Materials

For each student

- 1 copy of **Record Sheet 7-A: A Dissolving Race: Two Forms of Sugar**

For every two students

- 1 paper tray, 18 × 24 cm (7 × 9½ in)
- 1 small clear plastic cup with lid, 30 ml (1 oz), containing granulated sugar
- 1 small clear plastic cup with lid, 30 ml (1 oz), containing one sugar cube
- 2 large clear plastic cups with lids, 270 ml (9 oz), half filled with water
- 1 measuring spoon, 2.5 ml (½ tsp)
- 2 hand lenses
- 2 wooden coffee stirrers
- 1 piece of black construction paper, 15 × 23 cm (6 × 9 in)

For the class

- “Changes Observed” class chart (from Lesson 5)
- 2 resealable plastic bags, 10 × 15 cm (4 × 6 in)
- Granulated sugar
- 1 sugar cube
- Water
- 1 permanent black marker
- Stapler
- Assorted colored markers
- Masking tape
- Cleanup supplies

Preparation

1. Make one copy of **Record Sheet 7-A: A Dissolving Race: Two Forms of Sugar** (pg. 91) for each student.
2. Put a sugar cube in a resealable bag. Place a sample of granulated sugar in another bag. Seal the bags tightly. Use the black marker to label each bag with its contents. Staple the bags to the left-hand column of the “Changes Observed” chart. Write the words “Sugar cube” and “Sugar grains” in the same column near the respective bags (see Figure 7-1).



Management Tip: It is recommended that you refer to granulated sugar as “sugar grains” or “grains of sugar” so students can more easily grasp that this form of sugar has small pieces.

3. Write the following questions on the chalkboard (or on sentence strips):
 - What does the solid look like? Describe its shape and size.
 - How does the solid smell?
 - How does the solid feel?
 - Compare the sugar cube and the sugar grains. How are they alike? How are they different?
4. For each pair of students, prepare the following materials:
 - Use the measuring spoon to place 2.5 ml (½ tsp) of granulated sugar in a small plastic cup.
 - Put a sugar cube in a second small plastic cup.
 - Place a lid on each cup.

Figure 7-1

Adding to the
"Changes
Observed" chart

| CHANGES OBSERVED | | |
|---|--|---|
| SOLID | PROPERTIES | CHANGES WITH WATER |
|  GRAVEL | gold, rough, bumpy, grainy, small, hard, pours | sank to bottom of cup, moved when I stirred it, it looked darker, it really didn't change |
|  TOILET TISSUE | white, soft, rips easily, torn, smells pretty | got mushy looking, some of it fell apart, spread out in the cup, fluffy like clouds |
|  SALT | white, rough, crystals, sharp, hard, breaks | fell in the cup like rain, most of it disappeared when I stirred it, can see tiny bits of salt left |
|  SUGAR CUBE | | |
|  SUGAR GRAINS | | |

- Pour water into two large plastic cups until they are half full.
- Check the pieces of black paper from Lesson 4. If any are no longer usable, cut replacement pieces.

Procedure

1. Show students the two samples of sugar you have added to the "Changes Observed" chart. Let them know they will describe the two new solids and observe the changes that occur when they mix each one with water.
2. Review **Record Sheet 7-A: A Dissolving Race: Two Forms of Sugar** with students.
3. Ask one student from each pair to pick up all materials from the distribution center except the two cups of water.
4. Have students place their sugar cube on the black paper and, without crushing it, examine its properties using a hand lens. Ask partners to discuss their observations. The questions on the chalkboard can guide them.

Figure 7-2

Observing solids



5. Ask students to put a spoonful of sugar grains on the black paper. Have them examine the sugar's properties, as shown in Figure 7-2. Invite students to discuss their observations with their partners. How are the sugar cube and the sugar grains alike? How are they different?
6. Invite students to share their observations with the class. Record their responses on the "Changes Observed" chart in the "Properties" column. Ask students what other solid on the chart has properties similar to those of sugar grains. Can they predict how sugar grains might mix with water? (The properties of salt and sugar are similar.)
7. Challenge students to make a prediction. Which form of sugar will dissolve faster—the cube or the grains? Let students know they will hold a "dissolving race" to test their predictions. (See **Extension 5** if students question whether one form of sugar is "bigger than the other" or has "more sugar.")
8. Distribute two cups of water to each pair of students. Guide students as they complete the following steps:
 - Select one partner to be the "stirrer." The stirrer will stir both cups of water at the same time. (You may want to discuss why this is important.) The partner not stirring today should hold the two cups in place. That person can be the stirrer in Lesson 8.
 - Put the sugar cube in one cup of water.
 - Pour the sugar grains from the small cup into the other cup of water. To make a fair test, fold the sheet of black paper into a chute and pour the extra grains of sugar into the same cup of water as well. (You may need to demonstrate this process. See Figure 7-3.)
9. To avoid competition among students, remind them that they are not racing against each other; they are racing one of their solids against the other one to determine which one dissolves first.
10. When everyone is ready to begin, ask the stirrers to stir both cups of water at the same time. Each stirrer should stop stirring both cups *as soon as the sugar in one of the cups has dissolved*. You may want students to raise their hand or give another signal when they have stopped stirring.
11. Encourage partners to discuss what they observe. Then ask them to record their findings on **Record Sheet 7-A: A Dissolving Race: Two Forms of Sugar**.

Figure 7-3

Folding the black paper into a chute



Final Activities

1. Invite students to share with the class their observations of how each solid changed when it was stirred in water. Record their observations in the “Changes with Water” column of the “Changes Observed” chart.
2. Ask students to think about how each solid dissolved in water during the dissolving race. Encourage a discussion by asking questions such as the following:
 - Which solid won the dissolving race?
 - Why do you think that solid won?
 - How is the sugar cube different from the sugar grains?
 - What happened to the sugar cube while you stirred?
3. Ask students to look at their sugar cube-and-water mixture. If any of the sugar cubes have not yet dissolved, ask students how they might help them to dissolve. Discuss with students how stirring the water helps break the cube into smaller pieces and mixes the sugar with the water. Have students test this idea on their own.
4. Ask students to think about why some students’ sugar grains may have dissolved faster than those of others. (Students can also compare the sizes of their sugar cubes.)
5. Let students know that in the next lesson they will explore another factor that affects how fast sugar dissolves in water—the temperature of the water.
6. Have students clean up. Remind them to save their sheets of black paper for Lesson 9, if they are still usable.

Extensions

LANGUAGE ARTS

1. Read *The Little Red Hen*, by Paul Galdone (see Bibliography) to the class. Try to find some whole-grain wheat at a natural foods store. Have students observe the wheat grain and describe how the hen in the story broke it into small pieces.

SCIENCE

2. Encourage students to visit the mixing center. Challenge them to create a mixture that includes water and a solid that dissolves in water. Have them create mixtures with solids that do not dissolve in water.

LANGUAGE ARTS

SCIENCE

3. Have students create edible experiments that require mixing and dissolving. You can refer to a book such as *Science Experiments You Can Eat*, by Vicki Cobb (see Bibliography).

MATHEMATICS

4. Students can repeat the investigation in this lesson using a clock or stopwatch. How long does it take the sugar cube to dissolve? Compare this time with the time it takes for the sugar grains to dissolve.

MATHEMATICS

5. You may want to show students that sugar grains make up the sugar cube. To do this, place a sugar cube in a resealable bag. Using an unsharpened pencil or a book, demonstrate what happens to the cube when it is crushed. Then, to help students understand that the cube and the grains in their investigation contained the same amount of sugar, ask students to crush a sugar cube and measure the amount of crushed sugar. How does it compare to the amount of sugar grains used in the lesson? (Both should be around 2.5 ml, or $\frac{1}{2}$ teaspoon.)

Preparation for Lesson 8

You will need two 900-ml (32-oz) thermos bottles for Lesson 8, one to store very cold water and one to store very warm water.

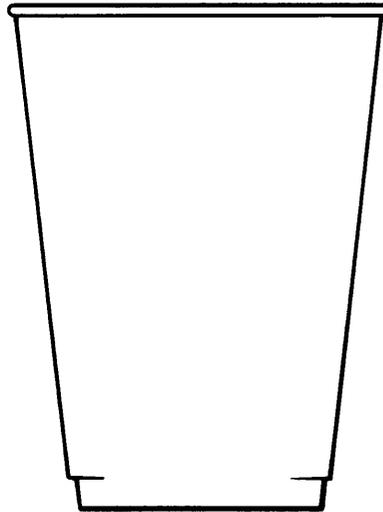
Record Sheet 7-A

Name: _____

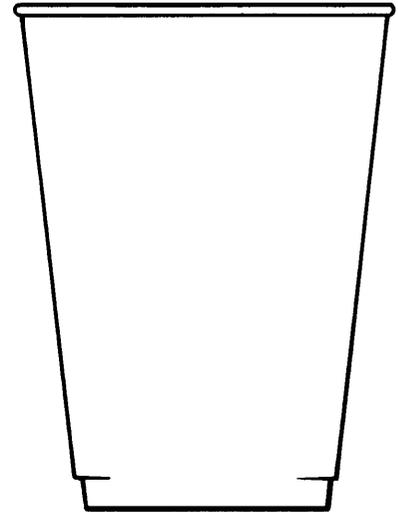
Date: _____

A Dissolving Race: Two Forms of Sugar

1. Put each solid in a separate cup of water. Stir.



Sugar Cube
and Water



Sugar Grains
and Water

2. Draw what
you see.

3. Which solid won the race?

I think it won because