LESSON 8

Changing Matter and Mass

A glacier in Alaska calves a new iceberg. The iceberg weighs thousands of tons. What happens to the mass of its matter when it melts?

INTRODUCTION

In Glacier Bay, Alaska, 12 giant glaciers meet the sea. As the seawater undermines and melts these huge rivers of ice, icebergs break off, or "calve." Chunks of ice, some more than 60 meters (200 feet) high and weighing thousands of tons, plunge with a huge splash into the sea. Because ice is less dense than water, the icebergs float. For a few weeks in the summer, they may provide floating islands for the local wildlife before becoming part of the sea themselves. What happens to the mass of a 50,000-ton iceberg when it melts? For that matter, what happens to the mass of a melting ice cube in a cup of soda, the mass of water as it freezes in the refrigerator, or the mass of boiling water in a kettle when it turns into steam?

What happens to the mass of matter when it changes phase? In this lesson, you will discuss and try to answer this question.

OBJECTIVES FOR THIS LESSON

Discuss what happens to the mass of substances when they change state.

Conduct an experiment to investigate whether any changes of mass occur when ice melts.

Discuss sources of experimental error within your experiment.

Design an inquiry to test your own prediction about any changes of mass that may occur when water freezes.

At this hot spring in Yellowstone Park, what happens to the mass of water when it evaporates? Does the water vapor have the same mass as the liquid water that formed it?

Getting Started

1. What happens to the mass of matter when it changes phase? Write in your science notebook your prediction of what will happen to the mass of the matter in the following situations:

- the mass of an ice cube when it melts
- the mass of the water in an ice cube tray when it freezes
- the mass of the water in a tea kettle when it boils

2. Your teacher will record your predictions. Be prepared to contribute your predictions for each phase change.

MATERIALS FOR LESSON 8

For you

1 copy of Student Sheet 8.1: Investigating Mass and Melting
1 copy of Student Sheet 8.2: Investigating Mass and Freezing

For you and your lab partner

1 plastic soda bottle with screw cap
1 250-mL beaker
1 paper towel
2 ice cubes, crushed
Access to an electronic balance

Inquiry 8.1
Investigating Mass and Melting

PROCEDURE

1. One member of your group should collect the plastic box containing the apparatus. Divide the apparatus equally between each pair in your group.

2. In this inquiry, you will work with your partner to test your prediction about what will happen to the mass of ice when it melts. Examine your apparatus carefully. Discuss with your partner how you could use this apparatus, crushed ice, and an electronic balance to test your prediction.

3. Under Step 1 on Student Sheet 8.1, write the procedure you will use to investigate what happens to the mass of ice when it melts.

4. Your teacher will ask some pairs of students to share their procedures with the whole class. Be prepared to contribute your ideas to the discussion.

5. During the discussion, the class will agree on a procedure for the experiment. Write the class procedure under Step 2 on the student sheet.

6. Design a result table under Step 3 on the student sheet.

7. Begin the procedure. Record all of your results in your results table.

8. While the ice is melting, complete Steps 1 and 2 in Inquiry 8.2.

9. When the ice melts, measure the mass of the bottle and water (as outlined in the class procedure) and record the mass of the apparatus in your results table. Don't forget to wipe any condensation off the *outside* of the beaker with a dry paper towel.

10. Answer the following questions in Steps 4a and 4b on Student Sheet 8.1: What happened to the mass of the ice when it melted? Why did you use a sealed container for this experiment?

11. You will be asked to contribute your results to a class results table. Use the data from all the pairs to complete Table 1 on Student Sheet 8.1.

12. Did all of the pairs obtain the same result? Complete Step 6 on Student Sheet 8.1.

13. Participate in a class discussion on experimental error.

14. Compare the measurements you entered in Table 1. Use them to complete Steps 7a through 7d on the student sheet: Which measurements are very different from the others? Eliminate the very different measurements and use the remaining measurements to calculate the average change in mass. What was the most frequent measurement obtained for change of mass? What do you conclude from these results?

Inquiry 8.2
Investigating Mass and Freezing

PROCEDURE

1. Do you think any change in mass occurs when water freezes? Discuss your ideas with your partner.

2. How could you find out whether any change in mass occurs when water freezes? Design an experiment to answer this question. Describe your ideas for a procedure under Step 1 on Student Sheet 8.2.

3. Your teacher will ask you to describe your procedure. After a discussion, one student in your class will do the experiment based on the class procedure. Under Step 2 on the student sheet, record the mass of the sealed bottle of water used in the experiment.

4. You will revisit this experiment in a later lesson. When you have the results of this experiment, complete Step 3 on Student Sheet 8.2.

REFLECTING ON WHAT YOU'VE DONE

1. Be prepared for a class discussion on the conservation of mass.

2. Write a paragraph in your science notebook explaining how conservation of mass applies to melting.