



# Solids, Liquids and Gases

## Student Objectives

- Predict whether melting icebergs have the same impact on rising sea level as melting glaciers.
- Conduct an experiment to discover the effect of melting icebergs on sea level.
- Write a conclusion about the role of melting glaciers and icebergs on rising sea level.

## Materials

- *Elements of Chemistry: Solids, Liquids, and Gases* video
- computer with Internet access
- newsprint and markers
- paper and pencils

Decide beforehand how you would like to handle distributing the materials for the investigation. One student from each group can come up to a central area to collect the materials, or you can hand out the materials to each group. Each group will need the following:

- graduated cylinder
- water
- one chip of ice

## Procedures

1. Begin the lesson by asking students to write on a piece of scrap paper whether they think there is a difference between ice melting on land, or glaciers, and ice melting on water, or icebergs. If possible, have students write down any scientific evidence they know of in support of their ideas. Then ask students to put the piece of paper away until the end of the lesson.
2. Pose this question to students:  
Scientists are worried about the effect of polar ice melting. The melting ice will cause ocean cooling and a decrease in the saltiness of the water. Also, melting ice will raise the sea level and could flood low-lying areas, including cities. However, scientists are less concerned about melting icebergs than about melting glaciers. Why is this the case?
3. Tell students that they will work in small groups to answer the question. Then divide the class into groups. Give them a few minutes to think about the question and discuss their initial ideas. Ask students to predict why melting glaciers are more serious than melting icebergs. You may want to give students the following hint: *Glaciers are on land, and icebergs float on water. Why does this make a difference?*
4. Explain to students that they will conduct a short experiment to help them answer the question. Make sure that the groups have the necessary materials and ask them to follow these directions:
  - Put water in a graduated cylinder.
  - Then put a piece of ice in the water. Note what happens.
  - Observe the ice. What happens when it melts?
  - Observe the level of the water. Has it changed?
  - What does this experiment tell you about icebergs?
5. After students have completed the investigation, give them time in class to think more about what the experiment shows and what it tells them about melting glaciers and icebergs. To add to their knowledge, have them watch the segment "Understanding Ice" in the video *Elements of Chemistry: Solids, Liquids, and Gases*. Students also visit the following Web sites for additional information.
  - [http://www.uncw.edu/tc/antarctica/questions2\\_8.htm](http://www.uncw.edu/tc/antarctica/questions2_8.htm)
  - <http://www.factmonster.com/ipka/A0781668.html>

- <http://www.nasa.gov/centers/goddard/news/topstory/2003/1023esuice.html>
  - <http://whyfiles.org/238earthday/index.php?g=2.txt>
6. During the next class, have a discussion about the question posed at the beginning of the lesson and the investigation. Make sure students understand the following:
    - The melting of glaciers is of greater concern to scientists than the melting of icebergs because they are on the land. While heat from the sun is reflected equally by ice on the land and on the water, the land tends to hold onto the heat longer than the water does. As a result, the loss of ice on land is more significant because sunlight that previously had been reflected by the ice is now absorbed. As the planet absorbs more heat, the temperature rises, causing more melting and more heat. The end result is a warmer planet with greater potential for rising sea levels.
    - Icebergs floating on the water create a different situation. Because much of the iceberg is underwater, the sea level doesn't rise significantly as it melts. The ice in the graduated cylinders was a good model. But if the temperatures increased enough to cause significant melting of icebergs, glaciers on land would melt, resulting in higher sea levels.
  7. During the next class period, spend more time reviewing the experiment and what it reveals about the effect of melting on ice in water. Give students time to ask questions and discuss these ideas.
  8. Conclude the lesson by asking students to revisit the notes they recorded at the beginning of the lesson. Now that students know more about ice and how it melts on land and water, ask them to consider modifying their initial ideas. Do students have any new ideas they would like to add to their sheet?

## Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students made a thoughtful prediction about the difference between melting glaciers and melting icebergs; conducted the experiment carefully and made precise observations; and applied conclusions from the experiment accurately to a real-world situation.
- **2 points:** Students made a reasonable prediction about the difference between melting glaciers and melting icebergs; conducted the experiment satisfactorily and made some observations; and applied conclusions from the experiment somewhat accurately to a real-world situation.
- **1 point:** Students had difficulty making a prediction about the difference between melting glaciers and melting icebergs; had difficulty conducting the experiments and making observations; and had difficulty applying conclusions from the experiment to a real-world situation.

## Vocabulary

### calving

*Definition:* The breaking off a piece of ice from a glacier, which often lands in the sea and becomes a floating iceberg

*Context:* Calving can result in icebergs in the ocean, which can pose danger to ships.

### glacier

*Definition:* A large body of ice that moves slowly over the land, changing its surface

*Context:* During very cold periods known as ice ages, large glaciers covered much of the surface of Earth.

### global warming

*Definition:* The slow increase in Earth's temperature thought to be caused by human activities; the release of large amounts of gases that trap the sun's heat, resulting in change in climate

*Context:* While some scientists are convinced that global warming is taking place, others think that the increase in temperature is a result of natural fluctuations in climate.

**iceberg**

*Definition:* A large ice mass floating in the sea

*Context:* Because icebergs are about 90 percent submerged in water, their melting does not cause a significant rise in sea level.

**rising sea level**

*Definition:* An occurrence that could take place as a result of the rising temperatures on Earth and the melting of glaciers; less ice means that more heat is absorbed, causing the water levels in the sea to rise

*Context:* The rising sea level is of great concern because it could affect coastal topography and the people living in many areas.

**Academic Standards****National Academy of Sciences**

The National Academy of Sciences provides guidelines for teaching science in grades K–12 to promote scientific literacy. To view the standards, visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>.

This lesson plan addresses the following national standards:

- Physical Science: Properties and changes of properties in matter
- Physical Science: Structure and properties of matter

**Mid-continent Research for Education and Learning (McREL)**

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K--12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.

This lesson plan addresses the following national standards:

- Earth Sciences – Understands atmospheric processes and the water cycle
- Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media