LOUISIANA STATE UNIVERSITY

ICEBERGS AHEAD!

Materials

For each group of 3-4:

- 2 8-ounce paper cups
- 1 glass measuring cup
- 4 glass beakers (400 ml size)
- water
- mud or fine clay
- graphite or charcoal dust
- cork stopper
- balance

National Standards

A: Science as Inquiry
B: Physical Science

Source

taken from http://www.pbs.org/wgbh/nova/shackleton/classroom/w2icebergs.html)

This activity demonstrates the density of ice and how this affects how icebergs float in water.

Background

The density of the ice is so close to that of water that when ice floats more than 90 percent of its volume is under the water. In contrast, a piece of wood--whose density is 0.5 g/ml--will float with half its volume under water since its density is half that of water. A piece of cork with a density of 0.2 g/ml will float with only 20 percent of its volume under water. While this activity demonstrates how much of an iceberg actually exists under water, the coffee cup-sized iceberg model differs from actual Antarctic icebergs in several major aspects: its composition (mud and water), its shape (cylindrical), its formation (the ice was not created under great pressure), and its temperature (O°C, not below negative 50°C as are actual icebergs).

Antarctica's ice sheets and ice shelf continuously discharge icebergs into the Antarctic sea. These icebergs often have unusual shapes due to the weathering effects. Some of these icebergs are almost as large as the state of Connecticut.

Procedure

1. The day before students do the floating iceberg activity have them make a mixture of water and mud or water and fine clay. Then have each group label the two paper cups and the glass measuring cup. Fill the cups with the following contents:
   - paper cup 1: fill to the top with the water/fine clay or mud mixture
   - paper cup 2: fill half full with the water/fine clay or mud mixture
   - cup 3 (glass measuring cup): fillwith water to the 275 milliliter mark
2. Once cup #3 has been filled, have students weigh it and record its mass and water volume and put the three cups into the freezer overnight.
3. The next day, have students weigh cup #3 again, record its mass, and record the volume of ice in it. What happened to the volume of the liquid water as it froze? What happened to the mass? (The density of a substance is defined as the mass of substance per unit volume.) Now consider a different scenario: If you take the same volume of both water and ice, say exactly 1 cup of each, which of the two has more "stuff," i.e., water molecules, in it?
4. Have students remove the ice from the cups so that cups 1, 2, and 3 now are just the frozen "icebergs." Put the "icebergs" into three separate beakers that are half filled with water. Have students observe the three icebergs. Do they float in a similar manner? Are there differences? What are they? Where is most of the ice located, above or below the surface of the water? Have students estimate how much volume of ice is above the water. Is it approximately the same for all the three icebergs?
5. Sprinkle soot, graphite powder, or charcoal dust on iceberg #1. Put all 3 icebergs outside in the sun (or under a heat lamp). Observe the melting behavior of the three. Which melts the fastest? Does melting occur in the water or just in the air? Have students discuss the possible consequences of industrial pollution settling out on the polar ice caps.
6. Have students put the cork stopper on top of the water in the fourth beaker. How does its flotation differ from that of the "water" icebergs? Have students estimate how much volume of the cork stopper is above the water. Have students propose some possible reasons as to why when floating most of the cork is above the water while most of the iceberg is below the water.