



Ice!

Science, Mathematics, and Language Arts

Purpose

To learn how people obtained and preserved ice in the past and to learn principles of volume.

Time: 60-minutes

Level: appropriate/can be modified for grades 3-6

Materials

- The Sunset of the Farmer* by Ethel Ohlin Bradford
- Ice Cubes
- Small boxes of various sizes
- Sawdust (janitors often have some)
- Worksheet (attached)
- Ruler
- medium sized blocks
- computer/projector to play:

<http://www.youtube.com/watch?v=rKRGNdGQjCw>

Standards

- Utah Core Science Standard 2: Students will gain an understanding of Earth and Space Science through the study of earth materials, celestial movement, and weather.
- Language Arts Common Core Writing Standard 2 and Reading Informational Text Standard 1 (across grade levels, e.g. W.K.2-W.3.2)
- Mathematics Common Core: 5.MD.4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
This lesson teaches concepts about volume and can be modified to meet Common Core standards related to measurement.

Essential Questions

- What are the three phases of water? How are they manifested in different weather patterns?
- Why were precise measurements of the ice important for Mr. Wheeler's business?

Background

Until the 1930s, ice was a precious commodity, particularly in hot summer months. Wheeler Farm has two ponds that the Wheelers used for harvesting ice. This lesson is a hands-on activity helps students understand how ice is formed as part of the phases of water and seasonal changes and develops their concept of volume through learning about the process of storing ice.

Activity Procedures

1. To begin the activity, arrange students into groups of four. Give each group a small box, some ice cubes, and the sawdust. Give the students one minute to brainstorm ideas about what these objects could mean. After the minute is over, have students clean the area. Next, let the students share some of their ideas of how the materials could be used.
2. Explain to students that prior to the 1930s, commercial ice machines were not readily available. Farmers, like the Wheelers, irrigated water from the mountains into ponds that in winter months, became frozen. When there was enough ice, the Wheelers used saws, axes, and crowbars to cut the ice into blocks. The Wheelers would then move the ice into the ice house and would put sawdust between the ice blocks to insulate them and prevent them from freezing together. In the summer months, the Wheelers would sell the ice so that people could keep their food cool. Additionally, people would use the ice to make ice cream (a cherished treat at that time).
3. Read the following excerpt from *The Sunset of the Farmer* (p. 62-63). Have students listen for important details in the story.

Each spring, as the snow melted in the eastern canyons, the water came furiously down into the valley, filling the gullies, flooding the streams and gouging out new deep holes... When cold weather arrived the Farmer began paying close attention to the pond. Ice from it was an important farm crop, and, like other crops, had to be watched so that at the perfect time, not too soon, not too late, it could be harvested. When ready, he would scrape the snow off only as large as an area as he knew that he could take care of within one or two days. With a tool that looked like an old fashioned harrow, he and a horse would 'score' the ice field... Then men with large saws, sawed along the grooves, and with crow bars for levers, the big ice blocks were separated and floated free. They were then 'caught' by a claw attached to the end of a heavy rope and, so simple, but how precise, the horse hauled the blocks by a pulley, up the ramp into the ice house, where they were stored with plenty of saw dust over, under, and above them.

4. If technology equipment is available, this clip shows a process of cutting ice: <http://www.youtube.com/watch?v=rKRGNdGQjCw>
5. Review with students that when water freezes, it becomes ice. When ice is used in the summer months, it melts and becomes water again. These are two phases of water, the third being in a gaseous form.

6. Next, students complete the attached worksheet. Instruct students that they have to figure out how much ice to cut from the pond to fit in the ice house. The boxes are the 'ice houses' and the blocks are the blocks of ice.

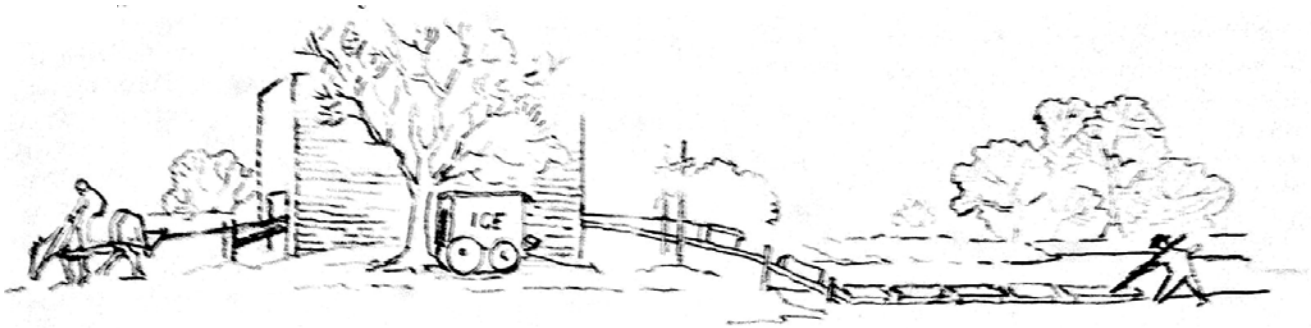
Students fill their boxes with blocks and multiply in order to find the formula for volume. Prior to this lesson, students should have an understanding of length, width, and height and be able to use a ruler to measure objects. Students measure both the dimensions of their box and the dimensions of their cubes. Next, students cover the bottom of their boxes with one layer of blocks. Model the following: Ask: How many blocks are in this layer? Put a second layer of cubes on top of the first layer. Ask: How many cubes are in the box now? Ask students to answer the following questions: How many layers of cubes are needed to fill the box? How many blocks are needed to fill the box? How did you find that answer? Point out that the blocks might not fill the boxes perfectly. Remind them too that they cannot have their blocks go above the box and that they need to leave extra room to account for the sawdust to provide insulation for the ice. For advanced students, bonus questions related to volume can be found at the end of this lesson plan.

Assessment

The assessment for this lesson comes from students' ability to contribute to the hands-on activity and discussion and their knowledge of the phases of water and volume demonstrated through their completion of the worksheet.

Name: _____ Date: _____

Filling the Ice House



“From Ice Pond to Refrigerator” by Beverly Wheeler Mastrim

1. Where did the water in the Wheeler’s ponds come from?
2. Explain the process of how the Wheelers cut and preserved ice. Include an explanation of how the ice formed.
3. How did the Wheelers and other families use the ice in the summer?
4. How does the ice change when it melts?

Fill in the chart with the following information related to your own ice house:

What are the dimensions of your box?	Length: _____	Width: _____	Height: _____
What are the dimensions of a block?	Length: _____	Width: _____	Height: _____
How many blocks fill the base layer of the box?			
Put a second layer of blocks on top of the first layer. How many blocks are in the box now?			
Put a third layer on top of the second layer. How many blocks are in the box now?			
What is the total number of blocks in the box (in other words, the volume of the box)?			

Filling the Ice House Bonus Questions

1. The approximate measurements of the original Ice House at Wheeler Farm were 40 feet by 32 feet with a height of 10 feet. Without calculating for space needed for sawdust etc., calculate the volume of the ice house. How many cubic feet of ice could Mr. Wheeler store in his house?

2. If each of the blocks measured 22 inches by 22 inches with a height of 6 inches, approximately how many blocks of ice could fit in the ice house?

Answers

1. Volume = length x width x height
40 feet x 32 feet x 10 feet = 12,800 cubic feet

2. Each ice block has a volume of:
22 inches x 22 inches x 6 inches = 2,904 cubic inches
 $2,904 \text{ cubic inches} \times \frac{1 \text{ cubic foot}}{12 \text{ cubic inches}} = 242 \text{ cubic feet}$

To find the total number of ice blocks that would fit in the ice house, divide the volume of the ice house by the volume of one ice block:

$\frac{\text{Volume of Ice House}}{\text{Volume of 1 ice block}} = \text{total number of ice blocks that can fill the ice house}$ $\frac{12,800}{242} = \text{approximately 53 ice blocks}$