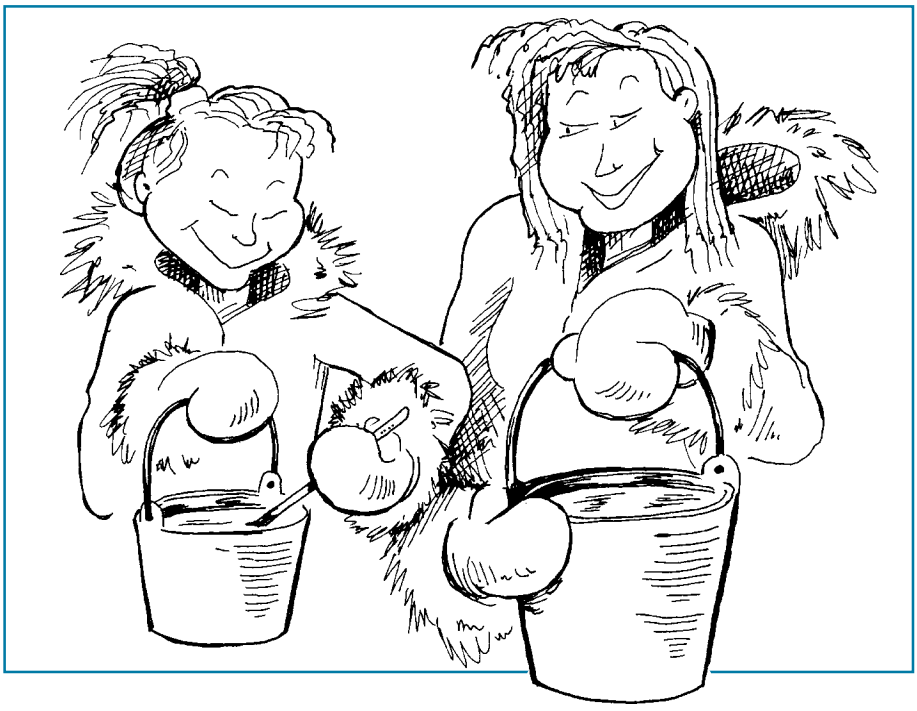
Does the Ocean Freeze?

1 EXTENSION



Section 1
TUNDRA ACTIVITIES

Grade Level: K - 4

State Standards: S B-1, S B-2, S B-5, Geo C-1

Subject: Science

Skills: Predicting, analyzing, observing,measuring

Duration: 30 minutes plus monitoring checks

Group Size:small

Setting: Indoors

Vocabulary: Cold, freezing point, heat, hypotheses, liquid, salinity, solid, temperature

Objective:

Students will be able to state how cold temperatures affect water bodies, including the ocean.

Teaching Strategy:

Students perform an experiment to illustrate the different temperatures of freezing for fresh and salt water.

Materials:

For each group: distilled water, 2 plastic beakers or cups, 2 thermometers, teaspoon, salt, freezer (or outdoors)

Background:

Why doesn't the ocean freeze solidly in the winter even when the air **temperature** drops below the **freezing point** of fresh water, 32°F (0°C)? Movement and **salinity** – saltiness – are two major characteristics of ocean water that help keep it from freezing at that temperature.

Moving water tends to hold **heat** longer than does still water. This can be seen in nature by the early freezing of a still pond compared with the later freezing of rushing river. In the deep ocean, currents are constantly moving water.

Wind also pushes water on the surface of the ocean. As water moves, it retains heat energy. The shallowness of ocean or river shores and beaches restrict the movement of water. "Shelf ice" often forms first along shorelines of beaches and rivers because the still water has less heat energy. The less water moves, the more quickly it freezes.

Salinity lowers the freezing point of ocean water below to 32°F.

Procedure:

1. Students keep a journal of the investigation. Younger students may draw pictures to record their observations. For older students, each page should include the date, the subject, a drawing of the investigation or the results, and two or three sentences describing the changes that were observed.

2. Review procedures for using thermometers and reading temperatures.

3. To illustrate the effects of salt on freezing, fill 2 plastic beakers or cups with distilled water. If one is available, place a thermometer in each container.

4. Ask a student to add salt, one teaspoon at a time to one of the containers of water. Stir the water after each teaspoon is added, making sure that all the salt is dissolved before adding the next teaspoon. Stop adding salt when it ceases to dissolve even when stirred.

5. Mark the first container "salt water sample" to show that it is saturated with salt. Mark the second container "freshwater sample." Put both containers in a freezer or outside, if appropriate. Record students' **hypotheses** (predictions) about what will happen to the two **liquids**.

6. Ask students to check their containers every 15 minutes until each one is at least half-frozen. Record observations on a chart. When the freshwater sample is about half-frozen, note the temperature reading and the amount of time it took to start freezing. Do the same for the salt solution.

7. Compare the time it took for each liquid to freeze **solid** and the temperature at which it froze. What happened? How do we see these differences demonstrated in nature?

Evaluation:

Students describe how cold affects the water around them.

EXTENSION:

Keep a freeze-up calendar. Keep a class calendar of daily high and low temperatures. Make a contest challenging students to observe the first sign of freezing (or thawing) in your local water bodies. Correlate the date of observation with changes in daily temperatures.

Credit:

This activity was modified by Jean Seaton, primary teacher from Chignik Lagoon.

Curriculum Connections:

(See appendix for full citations)

Books:

Scholastic's The Magic School Bus in the Arctic: A Book About Heat (Cole)

Snow and Ice (Steele)

Snow, Ice and Cold (Stonehouse)

Teacher Resources:

(See appendix)

Moving water tends to hold heat longer. Large, deep lakes freeze later than do small, shallow ponds. The salty ocean freezes later than do freshwater lakes.