

## LIVING IN A FROZEN LAND

### Overview:

In this lesson, students explore indigenous beliefs about the land and traditional uses for permafrost. Students learn about indigenous people and researchers collaborating to better understand permafrost and build a model that shows how permafrost affects berry growth.

### Objectives:

The student will:

- identify traditional uses and understandings of permafrost by different Alaska Native cultures;
- describe how the inclusion of traditional knowledge has impacted science; and
- model and interpret traditional understanding of permafrost health and berry growth.

### Targeted Alaska Grade Level Expectations:

#### Science

- [9] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
- [9] SG1.1 The student demonstrates an understanding of changes in historical perspectives of science by identifying those perspectives (i.e., cultural, political, religious, philosophical) that have impacted the advancement of science.
- [10] SG1.1 The student demonstrates an understanding of changes in historical perspectives of science by describing how those perspectives (i.e., cultural, political, religious, philosophical) have impacted the advancement of science.

### Vocabulary:

**sigluaq** – traditional Inupiaq ice cellar

### Whole Picture:

Permafrost is the foundation of the Arctic landscape. It has shaped conceptions about the land for the indigenous people who have lived in the Arctic for thousands of years. Thawing permafrost could result in fundamental changes to this landscape as well as to modern and traditional infrastructure like homes and ice cellars.

### Materials:

- 2-liter bottles (two per group)
- Water
- Utility knife
- White sand
- Blue food coloring
- 100 mL graduated cylinders (one per group)
- Rulers (one per group)
- Permanent markers (one per group)
- MULTIMEDIA FILE: "Living in a Frozen Land"
- STUDENT WORKSHEET: "Living in a Frozen Land"
- STUDENT WORKSHEET: "Permafrost and Berries"

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### Activity Preparation:

Water for the permafrost models may be frozen beforehand. If so, make sure the the bottles are filled to a variety of levels so that each group will have two bottles with different levels of ice (permafrost.)

### Activity Procedure:

1. Explain students will view a multimedia file and create a model to explore ideas about permafrost and how it is connected to traditional lifestyles. Students will also explore how researchers and people in northern communities are working together to address concerns about permafrost health.
2. Distribute STUDENT WORKSHEET: "Living in a Frozen Land" for student completion. Students will need to access MULTIMEDIA FILE: "Living in a Frozen Land" on the UNITE US website to complete the worksheet. When completed, discuss students' responses.
3. Distribute STUDENT WORKSHEET: "Permafrost and Berries." Review the information on the sheets and divide students into groups. Groups of three will allow one person to film or photograph, one person to explain the process of creating the model and the concept being displayed and one person to complete the task associated with building the model.
4. As a conclusion, discuss the model and highlight how the it is similar to and different from actual permafrost. (Permafrost is made of frozen soil and rock and not just made of ice.)

### Ideas for Filming:

NOTE: Students will complete a short film about permafrost for the final project associated with this UNITE US unit. Each lesson leading to the final project contains ideas about what students might film as they compile clips. Students are not limited to the list and are encouraged to use their imagination and creativity when filming.



Film the activity for STUDENT WORKSHEET: "Permafrost and Berries" and explain how this model compares to real permafrost and berry growth.



Interview local people about berries and how permafrost is related to berries.



Interview local people about traditional forms of storage that include underground storage.

### Answers:

#### STUDENT WORKSHEET: "Living in a Frozen Land"

1. B. The center of Earth is made of ice.
2. A. ice under the ground
3. A. Sunshine  
B. Rain  
C. Snowmelt  
D. Permafrost
4. In the coastal Inupiaq area, the cellar would be cleaned out every year to honor the whale. Other subsistence foods would be stored as well. In the Athabaskan area, berries, fish and other subsistence foods were stored in birch baskets under moss in underground caches.
5. Researchers bring their science background and Indigenous peoples bring their local and traditional knowledge into learning more about permafrost. These combined perspectives bring greater understanding.
6. A. Researchers interviewed Ron Brower Sr., about erosion he has witnessed around his cabin on the Meade River.



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- B. The people of Point Hope told researchers that they were concerned about warming temperatures impacting their traditional ice cellars and causing food to spoil. They explored ways to improve food storage.
- C. Researchers worked with local people of Lorino study how toxins spread more easily when permafrost thaws.

### STUDENT WORKSHEET: Permafrost and Berries

1. Answers will vary.
2. Answers will vary.
3. permafrost
4. the active layer
5. Answers will vary.
6. The bottle with the thinner active layer (sand) became more saturated.
7. Answers will vary.
8. Some answers include: Permafrost is not just made of ice, it also consists of frozen soil and rock. Ground saturation can also depend on slope.
9. Answers will vary.
9. Answers will vary.

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**Directions:** Access the MULTIMEDIA FILE: "Living in a Frozen Land," at the UNITE US website ([www.uniteusforclimate.org/multimedia](http://www.uniteusforclimate.org/multimedia)). Navigate through the file to answer the following questions.

1. What does Jules Jetté's quote reveal about Koyukon beliefs on the center of the Earth? Circle the correct answer.
- A. The center of Earth is made of molten rock.      C. People emerged from the center of the Earth.  
B. The center of Earth is made of ice.              D. The moon is made of cheese.

2. Which description of permafrost is the most common among Alaska Native languages? Circle the correct answer.
- A. 'ice under the ground'                              C. 'glacier'  
B. 'frost'    D. 'always frozen'

3. List four factors of berry growth as described by Elders.
- A. \_\_\_\_\_ C. \_\_\_\_\_  
B. \_\_\_\_\_ D. \_\_\_\_\_

4. Describe how permafrost is used for storage in different areas of Alaska.

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5. Describe how combining western and indigenous perspectives creates a deeper understanding of permafrost.

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6. Describe the permafrost issue for each location.

A. Meade River, Alaska: \_\_\_\_\_  
\_\_\_\_\_

B. Pt. Hope, Alaska: \_\_\_\_\_  
\_\_\_\_\_

C. Lorino, Russia: \_\_\_\_\_  
\_\_\_\_\_

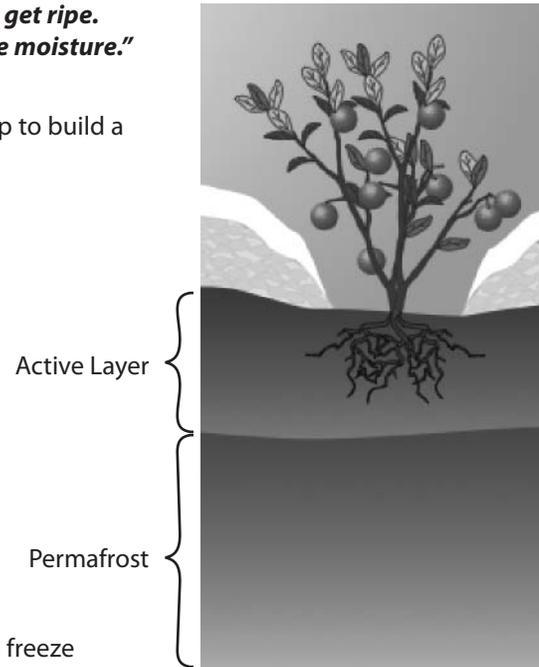
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PERMAFROST AND BERRIES

***“When the permafrost thaws out more, the blueberries don’t get ripe. Blueberries like permafrost next to the surface because of the moisture.”***  
***~Benedict Jones, Koyukuk, Alaska.***

In the following activity, you will work with a partner or a group to build a model that shows this concept.

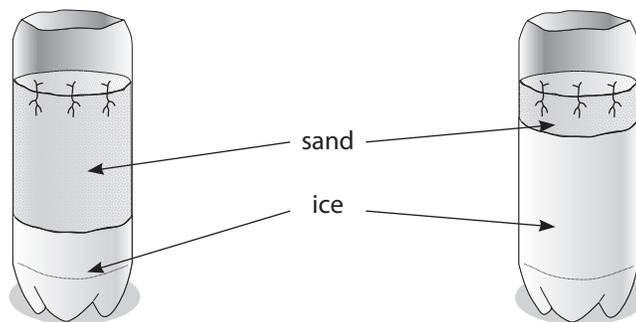
**Materials:**

- Two 2-liter bottles
- Water
- Utility knife
- White sand
- Blue food coloring
- 100 mL graduated cylinder
- Ruler
- Permanent marker



**Procedure:**

- STEP 1. Fill two 2-liter bottles with different depths of water and freeze them. This is the “permafrost.”
- STEP 2. After the bottles are frozen, draw a line at the top level of the “permafrost” around the bottle.
- STEP 3. Carefully cut the top off the bottles using the knife.
- STEP 4. Fill the bottles with white sand so the bottles are filled to the same level. Draw a line around the top of the sand so that it stands out. This is the “active layer.” Draw roots in the active layer to represent berry plants.



1. Record the depth of each active layer in millimeters (mm).  
A. Bottle A: \_\_\_\_\_ B. Bottle B: \_\_\_\_\_
2. What is the difference in depth (in millimeters) between the two bottles? \_\_\_\_\_
3. In the model, the ice represents \_\_\_\_\_.
4. In the model, the sand represents \_\_\_\_\_.

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**PERMAFROST AND BERRIES**

5. In STEP 5, you will add equal amounts of blue water to each bottle. Write a prediction of what will happen to the “active layer” and “permafrost” in each bottle:

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STEP 5. Use the blue food coloring to turn 200 mL of water blue. Pour 100 mL of water all around the top of each bottle.

**Answer the following questions.**

6. What is the difference in saturation within the active layers of the two bottles after you poured in the water?

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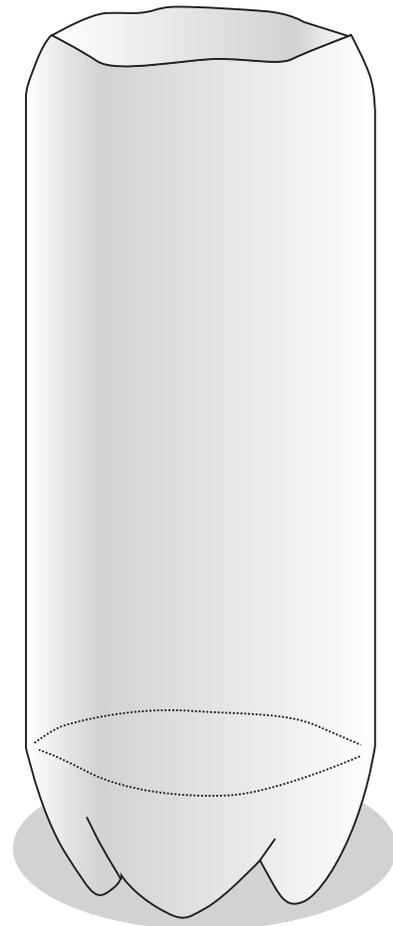
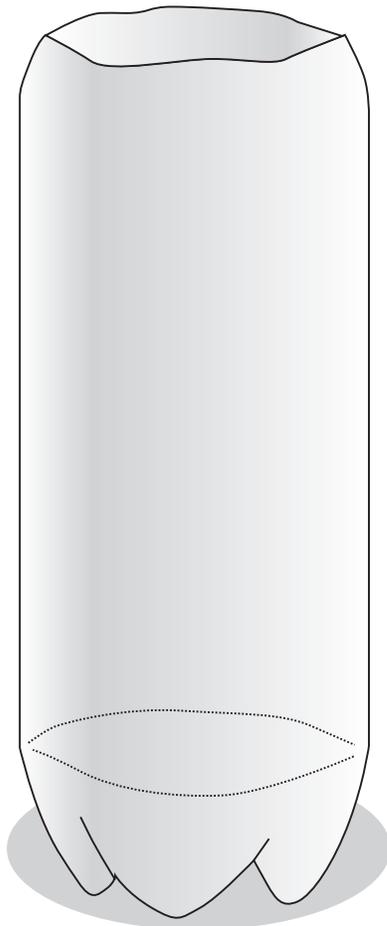


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7. Make labeled diagrams of your results for both bottles.



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**PERMAFROST AND BERRIES**

8. How is this model different from a real permafrost setting with berries growing above it?

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9. How was your prediction different from what you observed?

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10. What would happen to the blue water in the active layer if the containers were left out until the permafrost layer melts?

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