How Do Lakes Freeze?

Welcome to NSTA's Daily Do

Teachers and families across the country are facing a new reality of providing opportunities for students to ***do*** science through distance and home learning. The **Daily Do** is one of the ways NSTA is supporting teachers and families with this endeavor. Each weekday, NSTA will share a sensemaking task teachers and families can use to engage their students in authentic, relevant science learning. We encourage families to make time for family science learning (science is a social process!) and are dedicated to helping students and their families find balance between learning science and the day-to-day responsibilities they have to stay healthy and safe.

What is Sensemaking?

Sensemaking is actively trying to figure out how the world works (science) or how to design solutions to problems (engineering). Students ***do*** science and engineering through the science and engineering practices. Engaging in these practices necessitates students be part of a learning community to be able to share ideas, evaluate competing ideas, give and receive critique, and reach consensus. Whether this community of learners is made up of classmates or family members, students and adults build and refine science and engineering knowledge together.

Introduction

Have you ever walked across a frozen lake? What about a frozen puddle? Did you notice if all of the water was frozen? If it wasn't "all-the-way frozen", was it because the water wasn't finished freezing yet or is there some other reason that water doesn't freeze when in large amount?

Today's task, *How do lakes freeze?* , students and their families engage in science and engineering practices and use patterns as a thinking tool to make sense of science ideas related to how water changes as it freezes.

Experiencing the Phenomenon

Tell students you have a video of an interesting phenomenon - a man walking across a lake - you want to share with them. Ask students, "What do you notice about this lake? What does it make you wonder?" Show students the Walking on a frozen lake video.

Ask students, "How do you think a lake freezes?" Share the following four claims with students.

Denise: I think all the water in a lake freezes at the same time.
Antaeus: I think water at the bottom of a lake freezes first.
Chris: I think water on the top of a lake freezes first.
Beatrice: I think water between the top and bottom of a lake freezes first.

Ask students to independently (Alone Zone) choose the student they most agree with and explain their thinking. Encourage students to use words, pictures and symbols to share their ideas. (This is a formative assessment probe. See the *Why is my shadow always changing?* Daily Do, "Tips for Talking to Children about Probes", for guidance on administering formative assessment probes.)

Give students an opportunity to share their thinking with a partner. The students should listen to and then revoice each other's ideas. The listener might respond to the speaker using the sentence starter, "I hear you say ___." Then, ask students to set their responses aside (do not ask students to share their ideas with the class at this time).

How does a Lake Freeze?

Ask students, "How could we use water, a plastic container, and freezer to design an investigation that would give us data that might yield evidence to support our claims of how a lake freezes? What data do you think we would need to collect? How could we collect the data (qualitatively or quantitatively)?

Give students independent thinking time to design an investigation (this plan can be more idea than step-by-step instructions) and determine what data they need to collect and methods they might use to collect the data. Then assign students to small groups to share their ideas and collaboratively plan an investigation. Designs might include (*suggested teacher responses)*

- placing a container of water, lid off, in the freezer and checking it at regular intervals to note where ice is forming (*What data will you record each time you check the container?)*
- placing a container of water with additional "lake" materials like rocks, bits of plants, or

sediment, lid off, in the freezer and checking it at regular intervals to note where ice is forming *(How will you decide what/the amount of materials to put in the water? Where are these materials located in the lake - all at the bottom, mixed throughout, at the top? How will you account for this in your investigation design? What data will you record each time you check the container?)*

- placing multiple containers with varying amounts of water in the freezer and checking them at regular intervals to note where ice is forming. *(What do the different amounts of water represent? What data will you record each time you check the container?)*

Students might use permanent markers to mark the location and/or thickness of ice in the container; use a ruler to measure the thickness of ice; and/or take pictures of the container to monitor the formation of ice over time.

Safety note: Leave at least an inch of space above the water in the container to help ensure the ice that forms does not break the container.

At the end of the investigation, support students in making sense of their data. You might ask:

- How is the container of water you used like a real lake? How is it different from a real lake?
    - Do you think the water temperature is the same throughout the lake? Why do you say so?
    - Do you the "stuff" in the lake water changes how the lake freezes? Why do you say so?
- How might the depth of the water in a lake affect how it freezes? (Do shallow lakes and deep lakes freeze in the same way?)

Note: You may consider allowing students to revise their experimental design and conducting the investigation a second time. How are the results alike? Different?

Ask students, "Do you think what we observed with our containers of water in the freezer is similar to what happens in a lake? How might we find out?" Students may suggest looking at lake data similar to the data they collected in their investigation (measurements of the location and thickness of ice developing in a lake over time). Other students may suggest looking for an article (scientific information) about how a lake freezes.

Tell students you found an article that may help support their claims about how a lake freezes. Share the article, How is Ice Created in Lakes? Consider using the **Connect, Extend, Question** reading protocol with students as a scaffold.

- **Connect** to prior knowledge. What information presented in the article did they already know?
- **Extend** prior knowledge. What information was new to them? How did this new information build on what they already knew?
- **Question.** What new questions about how lakes freeze do they have?

After students read the article, you might say, "So remember our question is how do lakes freeze. Let's stay focused on this question and see what we think we have figured out."

Ask students to get back into their small groups, and ask them to share something from the article that was new to them and how it helps explain their observations (data) of their investigation and/or the video of the man walking across the lake.

Then, ask students to return to the four student claims. Which student claim do they most agree with? Ask students to support the claim using relevant evidence from their observations (data) to support their claim and providing reasoning why the evidence supports the claim using scientific knowledge (prior knowledge and scientific information from the article).

NSTA Collection of Resources for Today's Daily Do

NSTA has created a *How do lakes freeze?* collection of resources to support teachers and families using this task. If you're an NSTA member, you can add this collection to your library by clicking ADD TO MY LIBRARY located near the top of the page (at right in the blue box).

Check Out Previous Daily Dos from NSTA

The NSTA Daily Do is an open educational resource (OER) and can be used by educators and families providing students distance and home science learning. Access the entire collection of NSTA Daily Dos.