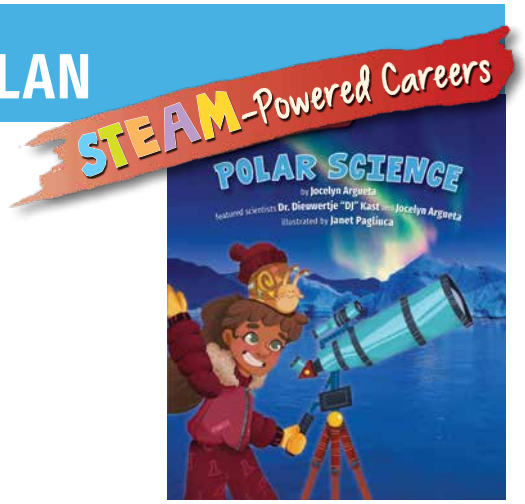
POLAR SCIENCE LESSON PLAN



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Subject / Grade Level: Polar Science / Lower elementary

Materials:

- dirt
- square plastic containers
- food coloring
- water
- ruler
- paper
- crayons

Preparation the night before:

- Add food coloring to the water.
- Use the water to wet the dirt so it's easy to pack on one side of the plastic container.
- Freeze overnight.

NGSS Essential Standards and Clarifying Objectives:

Disciplinary Core Idea:

- **2-PS1-4:** Constructing an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Crosscutting Concept:

- **Cause and Effect:** Events have causes that generate observable patterns.

Science and Engineering Practice:

- Planning and carrying out investigations

Lesson Objectives:

- Students will learn what permafrost is.
- Students will model what happens when permafrost thaws.
- Students will compare and contrast the Arctic with the Antarctic.

Differentiation Strategies to Meet Diverse Learner Needs:

- Think-pair-share, for students who learn through engaging with others
- Students will use visual and auditory input, for students who learn through the use of their senses

ENGAGEMENT

Part 1:

- Start by drawing Earth on the board and labeling the geographic poles: the Arctic and the Antarctic.
- Ask students what they know about these regions. What's the temperature like? Do any animals live there?
  - Responses may include: it's freezing, penguins, and polar bears
- Show students a picture of the Antarctic and one of the Arctic and ask them to identify the differences.
  - Responses may include: the colors, the Antarctic is covered in ice, while the Arctic has more grass and dirt

Room to Read

- Focus on the Arctic. Ask students if they think the soil is frozen and what is in the soil.
  - Responses may include: ice, rocks, water, bugs, roots, plants

Part 2:

- Question for students: What is the difference between the Arctic tundra and the Antarctic?

EXPLORATION

Part 1:

1. Each student or pair will receive a plastic container with frozen dirt that was prepared the night before and thawed for about 15 minutes before class.
2. Students will write down observations about the dirt: What does it look like? How does it feel?
3. Add about half an inch of cold water in the space next to the frozen dirt, to represent a lake.
4. Ask students: What do they think will happen to the frozen soil if it is left out during the class period? What will happen to the lake next to it?
    a. Responses may include: frozen soil will melt, the lake will get dirty

5. Have students make a drawing in their notebooks of how the frozen soil and lake look. This will be their “before” photo.
6. Have students use a ruler to measure the water line in centimeters.
7. Have students set aside the plastic container and work on Part 2 so the frozen dirt has time to melt.
8. After Part 2, return to the plastic container and have students make observations about what has changed. At this point, some of the soil will have thawed, and the “lake” next to it will have more water, dirt, and food coloring in it.
    a. Observations may include: what the soil feels like, physical changes, the color change in the lake

9. Have students make a drawing in their notebook of how the soil and lake look. This will be their “after” photo.
10. Have students use a ruler to measure the water line in centimeters and write down how it has changed.

Part 2:

1. Fold a sheet of paper in half and have students draw what they might see in the Arctic on one side and in the Antarctic on the other side.
2. Using their knowledge from the book, what kinds of activities or science experiments can they find in these locations?
3. If working in pairs, have each student draw one of the two locations.

EXPLANATION

Part 1:

- Have students share with their partners what they think happened to the soil and then record it in their notebooks.
  - Responses may include: as the soil melts, it will start to mix with the lake next to it; the soil may release "hidden" things like the dyed water
- Have students compare their measurements of the water lines from before and after with their partners.

Part 2:

- Have students share the differences between the Arctic and the Antarctic. If working in pairs, have students take turns presenting their drawings to each other.

ELABORATION

Vocabulary:

- **permafrost:** ground (soil or rock and included ice or organic material) that remains at or below 0°C for at least two consecutive years
- **thaw:** to return to an unfrozen state
- **microbes:** small living organisms, such as bacteria

Activity Summary:

- Every year, the layer of soil on top of the permafrost thaws during the summer months and refreezes in the winter.
- If temperatures are higher than expected, more layers of permafrost may thaw and seep into nearby lakes or other bodies of water.
- Sometimes things we can't see, like microbes, are frozen in permafrost and can end up in lakes.

EVALUATION

- **Part 1:** Have students present their "before" and "after" drawings using the new vocabulary words. Ask students: What is permafrost? What happens when permafrost thaws?
- **Part 2:** Have students label different elements in their drawings of the Arctic and the Antarctic.
  - Drawings for the Arctic may include: permafrost, grass, a lake, ice, people collecting water from the lake, animals such as musk oxen, a tent
  - Drawings for the Antarctic may include: ice, the South Pole station, the flags outside the station, a snowmobile, stars, the IceCube Laboratory, telescopes