

2.3

GLACIER DYNAMICS

What happens to a glacier under pressure?

Activity Time: 30 minutes

Background

This demonstration shows students one reason a glacier moves. A glacier is a large mass of ice that acts like a river, flowing downhill under the influence of gravity. As snow layers accumulate and gather weight, the pressure builds up on the bottom layer. This causes the bottom layer of ice to melt and it becomes soft and pliable. This warmer layer reduces the friction with the ground underneath and allows the glacier to move faster. The melting of the ice due to pressure and its refreezing is called regelation. The softer ice moves outward like thick honey. The snow layers continue to compress and add weight and pressure to the layers below which cause continuing regelation, and therefore movement.

Directions

1. Place the boxes about 20 cm apart and put the metal or wood boards on top of them like a bridge.
2. Leave an inch or so between the 2 pieces of the bridge.
3. Set the block of ice on the metal or wooden boards.
4. Place a thin wire over the ice and between the two pieces of the bridge.
5. Tie a heavy weight to each end of the wire (the weights will be dangling on either side of the ice block). *(See video for help with set up.)*
6. Place a drip pan under the ice.
7. Observe what happens to the wire and what happens to the ice. (This begins to happen quickly, but takes 20-30 minutes to be able to pick up the ice block without the wire.)
8. Ask students to touch the ice block where the wire has sliced through.

Discussion

- What happened to the wire? *(The wire sank slowly through the ice.)*
- What happened to the ice? *(The ice under the weighted wire melted.)*
- Why did the ice not break in 2 pieces? *(The ice refreezes above the wire.)*
- How does ice melt normally? *(By a raise in temperature)*
- How did ice melt at the wire? *(By pressure)*
- Where on the ice block does it become a liquid? *(where the wire cuts)*
- If glaciers do not have a change in temperature, how do they melt at the bedrock? *(From the weight of the snow and ice above it. The weight applies pressure and produces heat to melt the ice)*

Assessment

Ask each student to write an **Exit Ticket 2.3** that explains why glaciers melt when the temperature is below freezing.

Extension

Ask students to design another experiment using pressure to melt ice. Different wires and weights could change the results of this lesson.

Materials

- A loaf pan of ice, 2 cm or more thick
- 2 bricks or weights
- Thin metal wire
- 2 boxes the same height, at least 50 cm above the floor
- 2 30-cm wooden or metal scraps to hold up ice block between boxes
- 1 Dishpan or cookie sheet to catch drips

Related Activities

- How do glaciers move over bumpy bedrock? **[2.4]**

Vocabulary

Regelation: the melting of ice due to pressure and its refreezing.

ALIGNMENT TO NGSS:

Scientific and Engineering Practices

- Asking questions
- Using models
- Planning and carrying out investigations
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts

- Cause and effect
- Systems and models
- Stability and change

Disciplinary Core Ideas

- K-5: ESS2.A; ESS2.C; PS3.C
- 6-8: ESS2.A; ESS2.C; PS3.C