

# 2.1

## GLACIER DYNAMICS

# How do snowflakes become ice without melting?

Activity Time: 15 minutes

### Background

Snow in Antarctica does not remain frozen snow; instead it becomes part of a large frozen body of ice called an ice sheet. Most snow particles in Antarctica do not melt to become ice as in warmer climates. Since the weather is so cold and dry, snow layers remain intact and are compressed by the weight of each accumulating layer. The intermediate stage between snow and glacial ice is called firn. It is formed under the pressure of overlying snow by the process of compaction, recrystallization, localized melting, and the crushing of individual snowflakes. This takes about one year. Further compaction of firn at a depth of 45 to 60 meters (150 to 200 feet) results in glacial ice.

### Directions

1. Discuss snow in Antarctica (95% of the continent is ice, snow fall average is 2 inches (5 cm) in the interior and 10 inches (25 cm) in the coastal areas).
2. Ask why the continent is ice covered if the snowfall is so low. (Kansas gets that much snow yearly and Kansas does not have an ice sheet!)
3. Give students 3 marshmallows each.
4. Ask students to make two layers of snow by putting one marshmallow on top of another and measure the height. Push down on top marshmallow. Measure height.
5. Add the third marshmallow and push again.
6. Ask questions in the discussion below as students are smashing their marshmallows.
7. Using 3 large or small marshmallows (one on top of the other), demonstrate how one layer of "snow" pushes on another layer of "snow" and flattens the marshmallows. The snow layers lose their air much like the marshmallows.
8. If snow is available, fill the jar half way with snow and ask students to smash it down. Continue this until it becomes ice.
9. Layers of snow can be shown by adding food coloring to each layer as it is smashed.

### Discussion

- What happens to the marshmallows as you press down on them?
- What happens to the shape of the marshmallow?
- What happens to the height of the marshmallow tower?
- If able to use snow, why does the snow turn into ice? (*It loses its' air and changes the shape of the crystal*)
- What force did you use to change the snow into ice? (*pressure*)
- How is ice different than snow?

### Assessment

Complete **How do snowflakes become ice without melting?** (2.1)

### Extension

- Design another experiment using a different procedure to smash marshmallows, snow or shaved ice.
- "Meet Mr. Snowflake" 2.1
- Make snow, firn, and ice layers by making snow cones with shaved ice and add a different colored cool-aid to each layer.

### Materials

- 3 large or small marshmallows per student
- Snow if available
- Potato Masher
- Large (gallon) clear jar
- Metric ruler

### Related Activities

- What happens to a glacier under pressure? (2.3)

### Vocabulary

**Firn:** the intermediate stage between snow and ice.

**Glacier:** an ice mass that continuously accumulates from compacted snow that deforms under its own weight and slowly moves.

### ALIGNMENT TO NGSS:

#### Scientific and Engineering Practices

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

#### Crosscutting Concepts

- Cause and effect
- Scale, proportion and quantity
- Systems and models
- Stability and change

#### Disciplinary Core Ideas

- K-5: ESS2A; ESS2.C
- 6-8: ESS2A; ESS2.C