Matter

Physical Science | Lesson Guide

3rd Grade

Photo Description

Long, white icicles hang down from the edge of a roof like frozen spears. The icicles are different sizes and shapes, with some being thick and others thin. They formed when water dripped and froze over and over again during cold weather.

Scientific Phenomena

This image represents the Anchoring Phenomenon of ice formation and the water cycle in action. The icicles form through a repeating process: snow or ice on the roof melts due to heat (from the sun or building), the liquid water drips down, and then freezes again when it meets the cold air. This cycle continues, building up layers of ice that create the long, pointed icicles we see. This demonstrates matter changing states from solid to liquid and back to solid again.

Core Science Concepts

1. States of Matter: Water exists in three forms - solid (ice), liquid (water), and gas (water vapor). The icicles show the transition between solid and liquid states.

2. Temperature and Heat Transfer: Heat from the sun or building warms the ice/snow above, causing it to melt. When the liquid water meets cold air, it loses heat and freezes again.

3. Gravity: The liquid water drips downward due to gravitational force, creating the downward-pointing shape of icicles.

4. Patterns in Nature: Icicles form in predictable ways based on temperature, water flow, and time, showing how natural processes create observable patterns.

Pedagogical Tip:

Use the "Think-Pair-Share" strategy when introducing icicles. Have students first think individually about what they notice, then discuss with a partner, and finally share with the class. This builds confidence and allows all learners to participate.

UDL Suggestions:

Provide multiple ways for students to represent their understanding: drawing the icicle formation process, acting out water molecules changing states, or creating a digital presentation. This supports different learning preferences and abilities.

Zoom In / Zoom Out

1. Zoom In: At the molecular level, water molecules are moving faster when heated (liquid state) and slower when cooled (solid state). The molecules arrange themselves in organized patterns when they freeze, creating the crystal structure of ice.

2. Zoom Out: This icicle formation is part of the larger water cycle that moves water around Earth. The same water that forms these icicles will eventually melt, flow into streams and rivers, evaporate into clouds, and potentially fall as precipitation elsewhere.

Discussion Questions

1. What do you think would happen to these icicles on a warm, sunny day? (Bloom's: Predict | DOK: 2)

2. How are icicles similar to and different from ice cubes in your freezer? (Bloom's: Compare | DOK: 2)

3. Why do you think some icicles are longer than others? (Bloom's: Analyze | DOK: 3)

4. What evidence do you see that tells you water was involved in making these icicles? (Bloom's: Evaluate | DOK: 3)

Potential Student Misconceptions

1. Misconception: "Icicles form because it's cold outside."
Clarification: Icicles need both warming (to melt ice/snow) AND cold temperatures (to refreeze). Just cold weather alone won't create icicles.

2. Misconception: "Ice is not the same thing as water."
Clarification: Ice IS water, just in a different state. The same H ,O molecules are present whether water is liquid or frozen solid.

3. Misconception: "Icicles grow from the bottom up."
Clarification: Icicles grow from the top down as new water drips and freezes onto the existing ice formation.

Cross-Curricular Ideas

1. Math - Measurement and Comparison: Have students measure the lengths of different icicles using non-standard units (like paper clips or craft sticks) or standard units (centimeters). Create a bar graph showing which icicles are longest, shortest, and medium-length. This connects to 3.MD.B.3 (Represent and interpret data).

2. ELA - Descriptive Writing: Ask students to write or draw a story about the "life of an icicle" from formation to melting. They can use descriptive words like "sparkly," "pointy," "cold," and "dripping" to bring their writing to life. This supports 3.W.3 (Write narratives with descriptive details).

3. Art - Nature Sculptures: Have students create their own icicles using white paint, glue, or paper strips hanging from a piece of blue or white poster board. They can explore color, texture, and symmetry while learning about natural ice formations. This connects to observational drawing and three-dimensional art creation.

4. Social Studies - Weather and Community: Discuss how icicles and winter weather affect people in your community. Talk about how roads get icy, school closures, and how people prepare for cold weather. This helps students understand how science connects to their daily lives and local environment.

STEM Career Connection

1. Meteorologist (Weather Scientist): A meteorologist is a scientist who studies weather and helps predict if it will be cold, rainy, snowy, or sunny. They use special tools to measure temperature and watch for dangerous ice storms or freezing conditions. Meteorologists help keep people safe by warning them about severe winter weather. Average Salary: $97,000 per year

2. Civil Engineer: Civil engineers design and build things like roads, bridges, and buildings. They need to understand how ice and cold weather can damage these structures, so they plan ways to keep roads safe in winter and make sure buildings don't get damaged by icicles or ice buildup. Average Salary: $88,000 per year

3. Climate Scientist: A climate scientist studies long-term weather patterns and temperature changes on Earth over many years. They investigate how and why winters are getting warmer or colder, and how this affects ice formation in different parts of the world. This helps us understand our planet better. Average Salary: $104,000 per year

NGSS Connections

- Performance Expectation: 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties
- Disciplinary Core Ideas: 2-PS1.A - Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature
- Crosscutting Concepts: Patterns - Patterns in the natural world can be observed and used as evidence

Science Vocabulary

* Icicle: A hanging piece of ice formed by dripping water that freezes
* Freeze: When liquid water becomes solid ice due to cold temperatures
* Melt: When solid ice becomes liquid water due to warm temperatures
* State of matter: The form that matter takes, such as solid, liquid, or gas
* Temperature: How hot or cold something is
* Drip: Small drops of liquid falling one at a time

External Resources

Children's Books:
- The Magic School Bus: Wet All Over by Joanna Cole
- National Geographic Readers: Weather by Kristin Baird Rattini
- Ice Boy by David Ezra Stein