

## Photo Description



Long, white icicles hang down from the edge of a roof like frozen daggers. The icicles are different sizes and shapes, with some being thick and others thin and pointed. You can see a brick building and green trees in the background behind the curtain of ice.

## Scientific Phenomena

This image shows the Anchoring Phenomenon of icicle formation through repeated freeze-thaw cycles. Icicles form when snow or ice on a roof melts from heat (either from the sun or warm air from inside a building), creating liquid water that drips off the edge. When this dripping water encounters freezing air temperatures, it solidifies back into ice, creating these hanging formations. The process repeats as more water flows down and freezes, building the icicle layer by layer from top to bottom.

## Core Science Concepts

1. States of Matter Transitions: Water changes between solid (ice/snow) and liquid states based on temperature changes, demonstrating the reversible nature of physical changes.
2. Heat Transfer: Heat from inside buildings or solar energy causes snow/ice to melt, while cold outdoor air causes the liquid water to freeze again.
3. Gravity's Role: Liquid water flows downward due to gravitational force, determining where and how icicles form.
4. Temperature and Phase Changes: Water freezes at 32°F (0°C) and melts above this temperature, creating the conditions necessary for icicle formation.

### Pedagogical Tip:

Have students observe and sketch icicles at different times of day or weather conditions to notice how temperature changes affect their size and formation. This helps them connect abstract concepts to real-world observations.

### UDL Suggestions:

Provide multiple ways for students to demonstrate understanding: allow them to draw diagrams, create physical models with clay, or act out the water cycle process to accommodate different learning preferences and abilities.

## Zoom In / Zoom Out

1. Zoom In: At the molecular level, water molecules slow down and form crystal structures when temperatures drop, creating the solid ice formation. The molecules arrange themselves in hexagonal patterns that give ice its structure and strength.

2. Zoom Out: Icicle formation is part of the larger water cycle system, where water continuously moves between the atmosphere, land, and buildings through evaporation, condensation, freezing, and melting processes across entire watersheds and climate systems.

### Discussion Questions

1. What conditions do you think are necessary for icicles to form? (Bloom's: Analyze | DOK: 2)
2. How might the size and shape of icicles change if the temperature stayed below freezing for many days? (Bloom's: Predict/Synthesize | DOK: 3)
3. What would happen to these icicles if the outside temperature rose to 40°F for several hours? (Bloom's: Apply | DOK: 2)
4. Why do you think some icicles in the photo are thicker than others? (Bloom's: Evaluate | DOK: 3)

### Potential Student Misconceptions

1. Misconception: "Icicles grow from the bottom up like plants."  
Reality: Icicles actually grow from the top down as new water drips and freezes onto the existing ice formation.
2. Misconception: "Ice is always the same temperature."  
Reality: Ice can exist at many different temperatures below 32°F, and warmer ice near the melting point is more likely to change back to liquid water.
3. Misconception: "Icicles only form when it's snowing."  
Reality: Icicles can form from melting snow, rain that refreezes, or any source of dripping water in freezing conditions.

### 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 materials can be described by their properties
- Disciplinary Core Ideas: 5-PS1.B - Matter changes when heated or cooled
- Crosscutting Concepts: Patterns - Patterns in nature can be observed and used to make predictions
- Crosscutting Concepts: Cause and Effect - Events have causes that generate observable patterns

### Science Vocabulary

- \* Freezing: The process when liquid water turns into solid ice at 32°F.
- \* Melting: When solid ice changes back into liquid water due to warming temperatures.
- \* Temperature: A measure of how hot or cold something is.
- \* Physical change: When matter changes its form but stays the same material, like water becoming ice.
- \* States of matter: The different forms matter can take, including solid, liquid, and gas.

### External Resources

#### Children's Books:

- The Magic School Bus: Wet All Over by Joanna Cole
- National Geographic Readers: Weather by Kristin Baird Rattini
- Ice Is Nice! All About the North and South Poles by Bonnie Worth

### YouTube Videos:

- "States of Matter for Kids" - Simple explanation of solids, liquids, and gases with animations: <https://www.youtube.com/watch?v=ZpjBih-k0Zs>
- "How Do Icicles Form?" by SciShow Kids - Kid-friendly explanation of icicle formation: <https://www.youtube.com/watch?v=qBLMb3y9Bml>