

Photo Description



This fountain has water flowing down from the top through three different levels. The water starts at the top and falls down to each bowl below it. Ice has formed on the edges of each level, creating white icicles hanging down like frozen waterfalls.

Scientific Phenomena

The Anchoring Phenomenon here is the freezing of moving water in a fountain during cold weather. This occurs when the air temperature drops below 32°F (0°C), causing the water molecules to slow down and form solid ice crystals. The flowing water continues to move due to the pump system, but as it splashes and sits on the fountain's edges, it freezes and accumulates into icicles. This demonstrates the physical change between liquid and solid states of matter, which happens when thermal energy is removed from water.

Core Science Concepts

1. States of Matter: Water exists in different forms - liquid water flows through the fountain while solid ice forms the icicles
2. Physical Changes: The water changing from liquid to solid (freezing) is a reversible physical change, not a chemical change
3. Temperature and Heat Transfer: When air temperature drops below water's freezing point, thermal energy transfers from the warmer water to the colder air
4. Gravity and Motion: Water flows downward from level to level due to gravitational force

Pedagogical Tip:

Start the lesson by having students observe ice cubes melting in warm water, then connect this reverse process to what they see in the fountain photo. This concrete experience helps them understand that freezing and melting are opposite processes.

UDL Suggestions:

Provide multiple ways for students to explore states of matter: visual diagrams showing water molecules in different states, hands-on ice experiments, and kinesthetic activities where students act out how molecules move differently in solids versus liquids.

Zoom In / Zoom Out

1. Zoom In: At the molecular level, water molecules in liquid form are moving freely and sliding past each other. When temperature drops, these molecules slow down and arrange themselves into rigid, organized patterns to form ice crystals.

2. Zoom Out: This fountain is part of a larger water cycle system. The water that freezes here will eventually melt, possibly evaporate, and contribute to precipitation that refills groundwater sources or surface water bodies in the community.

Discussion Questions

1. What do you think would happen to these icicles if the temperature got warmer? (Bloom's: Predict | DOK: 2)
2. Why do you think some parts of the fountain have more ice than others? (Bloom's: Analyze | DOK: 3)
3. How is the water in this fountain similar to and different from the ice? (Bloom's: Compare | DOK: 2)
4. What other places have you seen water change into ice in nature? (Bloom's: Apply | DOK: 1)

Potential Student Misconceptions

1. Misconception: "Ice is not water anymore" ! Clarification: Ice is still water, just in a different state. It's the same substance with the same chemical properties.
2. Misconception: "Only still water can freeze" ! Clarification: Moving water can freeze too, but it often takes colder temperatures or longer exposure to freezing air.
3. Misconception: "Water always freezes at exactly 32°F" ! Clarification: While pure water freezes at 32°F, moving water or water with dissolved substances might freeze at slightly different temperatures.

Cross-Curricular Ideas

1. Mathematics - Measurement & Patterns: Have students measure the length of icicles on the fountain using non-standard units (like paper clips) or a ruler. Create a graph showing how icicle lengths change over several days as temperatures warm up. Students can predict patterns: "If the temperature goes up 5 degrees, what will happen to the icicles?"
2. English Language Arts - Descriptive Writing: Ask students to write a sensory poem or short story about the frozen fountain. Encourage them to use vivid adjectives (sparkling, crystalline, delicate, frozen) and action verbs to describe how the water becomes ice. They could even write from the perspective of a water droplet's journey!
3. Social Studies - Community Resources: Discuss how fountains are part of public spaces in cities and towns. Students can research or discuss why communities build fountains and how weather affects public places. Connect this to local landmarks: "Are there fountains in our town? What happens to them in winter?"
4. Art - Ice Sculpture & Nature's Design: Examine the beautiful patterns and shapes created by the icicles. Students can create their own "ice sculptures" using paper, white paint, or salt dough to replicate the fountain's frozen formations. Discuss how nature creates art through freezing water.

STEM Career Connection

1. Hydrologist (Water Scientist): A hydrologist studies water in all its forms - rain, rivers, ice, and groundwater. They help us understand how water freezes, melts, and moves around Earth. Hydrologists work to keep our water clean and predict weather patterns like snowstorms. Average Annual Salary: \$80,000 - \$85,000
2. Landscape Designer: Landscape designers plan and build outdoor spaces like parks, gardens, and plazas that might include fountains. They think about how weather affects their designs and choose materials that won't crack in freezing temperatures. They use science to create beautiful spaces that work well in different seasons. Average Annual Salary: \$48,000 - \$52,000

3. Mechanical Engineer: Mechanical engineers design machines and systems, including fountain pump systems that keep water flowing even in cold weather. They solve problems like: "How can we keep water moving so it doesn't completely freeze?" and "What materials work best in freezing conditions?" Average Annual Salary: \$88,000 - \$95,000

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
- 5-PS1.A - Matter of any type can be subdivided into particles that are too small to see

Crosscutting Concepts:

- Patterns - Patterns in the natural world can be observed and used as evidence
- Cause and Effect - Simple tests can be designed to gather evidence to support or refute student ideas about causes

Science Vocabulary

- * Freezing: The process when liquid water becomes solid ice due to cold temperature
- * Physical change: When matter changes its form but stays the same substance
- * Temperature: A measure of how hot or cold something is
- * State of matter: The form that matter takes, such as solid, liquid, or gas
- * Thermal energy: The energy that comes from heat and makes molecules move

External Resources

Children's Books:

- Water by Frank Asch
- The Magic School Bus Wet All Over: A Book About the Water Cycle by Joanna Cole
- Solid, Liquid, or Gas? by Fiona Bayrock