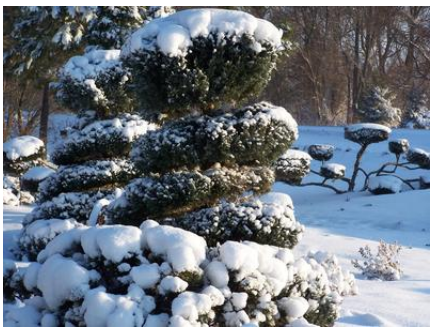
Winter Seasons

Earth & Space Science | Lesson Guide

5th Grade

Photo Description



This image shows evergreen trees heavily covered in snow during winter. The bright white snow clings to the dark green branches and needles, creating a beautiful contrast. You can see a frozen landscape in the background, with bare deciduous trees and a snowy ground, demonstrating how the environment changes during the coldest season of the year.

Scientific Phenomena

Anchoring Phenomenon: Snow accumulation on evergreen vegetation during winter

Why This Happens: When air temperatures drop below 32°F (0°C), water vapor in the atmosphere freezes into ice crystals that form snow. As snow falls and accumulates on tree branches, it sticks to the needles and branches of evergreen plants. Evergreen trees retain their leaves year-round (unlike deciduous trees that lose their leaves), so they provide more surface area for snow to collect and stick to. The weight of accumulated snow demonstrates gravity's effect on objects, while the persistence of snow on the ground shows that frozen water remains solid when temperatures stay cold.

Core Science Concepts

1. States of Matter & Phase Changes: Water exists in three states—solid (ice/snow), liquid (water), and gas (water vapor). Snow is frozen water that forms in the atmosphere and falls to Earth when conditions are cold enough.

2. Seasonal Temperature Patterns: Winter is the coldest season in temperate climates because the Northern Hemisphere (or Southern Hemisphere) is tilted away from the sun's direct rays, resulting in shorter days and colder temperatures that allow precipitation to fall as snow instead of rain.

3. Plant Adaptations: Evergreen trees keep their needles year-round, which helps them retain moisture and survive cold winters. Their needle shape and waxy coating help reduce water loss and allow snow to accumulate on branches.

4. Weather & Climate Conditions: Snow formation requires specific atmospheric conditions: cold temperatures, moisture in the air, and condensation nuclei (dust/particles) around which ice crystals form.

Pedagogical Tip:

Help students make personal connections by asking them to observe their own local winter conditions. Even if your region doesn't get snow, students can investigate what happens to water in cold temperatures by freezing water in ice cube trays or observing frost formation. This bridges abstract concepts to observable phenomena in their own environment.

UDL Suggestions:

Representation: Provide images of the same landscape in multiple seasons (spring, summer, fall, winter) so students can compare and contrast. Use video clips or time-lapse photography showing snow accumulation in real-time, which helps visual learners understand the process better than static images alone.

Action & Expression: Allow students to demonstrate understanding through multiple modalities—some might draw diagrams of the water cycle with snow, others might create physical models using cotton balls and branches, while others might write explanations or record video explanations.

Engagement: Connect to student interests by discussing winter sports, holiday traditions, or animals that adapt to snow. Ask students to share personal winter experiences from their own families and communities.

Zoom In / Zoom Out

Zoom In: Microscopic View of Ice Crystal Formation
When water vapor freezes in the atmosphere, it doesn't just randomly turn into ice. Instead, water molecules slow down and arrange themselves in a precise geometric pattern, creating six-sided ice crystals. Each snowflake that falls is actually millions of these tiny ice crystals stuck together! Under a microscope, you would see that each snowflake has a unique six-sided shape because the temperature and humidity levels change as it falls through the air, causing the crystals to grow in slightly different ways. The bumpy texture of the evergreen needles provides perfect spots (called nucleation sites) for ice crystals to attach and build up into the thick snow coat you see in the photo.

Zoom Out: Global Water Cycle and Climate Systems
This single snowy evergreen is part of an enormous planetary system called the water cycle. Water evaporates from oceans, lakes, and rivers around the world, rises into the atmosphere, and condenses into clouds. When conditions are right—when the air is cold enough during winter—that water falls as snow on landscapes across entire regions and continents. The snow you see in this photo is connected to evaporation happening thousands of miles away and will eventually melt, flow into streams and groundwater, and travel back to the ocean. Climate patterns, ocean temperatures, and Earth's tilt all influence whether your region gets snow or rain each winter, making this a global system that affects weather and life everywhere on the planet.

Discussion Questions

1. Why do you think snow sticks to the evergreen tree's branches better than it might stick to a smooth piece of glass? (Bloom's: Analyze | DOK: 2)

2. What would happen to the snow on these trees if the temperature suddenly increased to 50°F? Use what you know about states of matter to explain your thinking. (Bloom's: Evaluate | DOK: 3)

3. How do you think evergreen trees are different from the bare trees you see in the background, and why might these differences help them survive winter? (Bloom's: Analyze | DOK: 2)

4. If you could design a plant that thrives in snowy winters, what features would you give it and why? (Bloom's: Create | DOK: 3)

Potential Student Misconceptions

Misconception 1: "Snow is just frozen rain."
Clarification: While both snow and rain are forms of precipitation, they form differently in the clouds. Snow forms when water vapor freezes directly into ice crystals high in the atmosphere where it's very cold. Rain forms from liquid water droplets in warmer clouds. Snow doesn't fall as rain and then freeze on the ground—it's already solid ice crystals when it leaves the cloud. However, snow can melt into water if temperatures warm up after it falls.

Misconception 2: "All trees lose their leaves in winter, so trees without leaves are dead."
Clarification: The bare trees visible in the background of the photo are not dead—they're dormant, which means they're resting and conserving energy during the cold winter months. Deciduous trees drop their leaves to survive winter because it's hard to get water from frozen ground. Evergreen trees like the one in the foreground keep their needles year-round because their needle shape and waxy coating help them keep moisture even in cold, dry conditions. Both strategies help trees survive winter; they're just different adaptations.

Misconception 3: "Snow weighs very little because it's fluffy and light."

Clarification: While freshly fallen snow feels light and fluffy, the snow piling up on these tree branches actually has significant weight, especially when it accumulates over time. The photo shows how much weight these evergreen branches can support! This is why heavy snowstorms can sometimes break tree branches—gravity pulls down on all that accumulated snow with real force. The fluffiness is just because snow contains lots of air pockets between the ice crystals, but the ice itself is heavy.

Extension Activities

1. Seasonal Comparison Investigation: Have students collect or draw pictures of the same outdoor location (near your school, a local park, or a tree in the schoolyard) in all four seasons. Create a class poster or digital presentation showing how the landscape, vegetation, and weather change throughout the year. Students can write observations about which season had the most precipitation, which had the coldest temperatures, and how plants responded to each season.

2. Snow vs. Rain Experiment: Fill two clear containers with ice. Over one container, hold a strainer or cheesecloth and pour room-temperature water slowly (simulating snow falling and accumulating on branches). Over the second container, pour water directly without the strainer (simulating rain). Have students observe and measure which method resulted in more ice accumulation and discuss why. Connect this to how snow sticks to evergreen branches.

3. Plant Adaptation Design Challenge: Give students pictures of various winter plants (evergreens, dormant deciduous trees, winter grasses) and have them identify and sketch specific adaptations they notice. Then challenge them to design their own plant that would survive harsh winter conditions. Students should label at least three adaptations and explain in writing how each one helps the plant survive cold weather, snow, and reduced sunlight.

Cross-Curricular Ideas

Math Connection: Measuring Snowfall and Creating Graphs
Have students create a winter weather tracking chart where they measure or estimate snow depth over several weeks (or use historical weather data if your region doesn't receive snow). Students can create bar graphs or line graphs showing how snowfall changes over time and calculate the total accumulation. They can also measure the circumference of trees and estimate how much snow accumulation would add to the weight, introducing concepts of volume and mass in a real-world context.

ELA Connection: Winter Poetry and Descriptive Writing
After observing the photo, have students write descriptive paragraphs or poems about winter scenes, focusing on sensory details (how snow looks, feels, sounds, smells). Students can read and compare winter-themed literature like The Snowy Day by Ezra Jack Keats or winter poems by Robert Frost. Discussion and writing activities can explore how authors use figurative language (similes, metaphors) to describe snow and seasonal changes, while also building vocabulary related to winter phenomena.

Social Studies Connection: Regional Climate Differences and Human Adaptations
Use this photo to explore how different communities around the world experience winter differently. Some regions get heavy snow while others get none. Have students research how people in different climates (snowy regions like Canada or Russia vs. tropical regions near the equator) adapt their homes, clothing, transportation, and activities to their local winter conditions. Students can create comparison charts or presentations showing how winter weather influences culture, architecture, and daily life in different parts of the world.

Art Connection: Winter Landscape Mixed Media Project

Students can create mixed-media winter scenes using cotton balls (for snow), paint, markers, and collage materials to recreate snowy landscapes like the one in the photo. This hands-on project reinforces observational skills while allowing creative expression. Students can also explore how artists throughout history have depicted winter scenes and discuss why winter imagery appears in art, literature, and cultural traditions around the world.

STEM Career Connection

Meteorologist: The Weather Scientist
Meteorologists study weather and climate patterns, including when and where snow will fall. They use science to understand atmospheric conditions, make weather forecasts, and study climate change. A meteorologist might analyze data from weather satellites and weather stations to predict a snowstorm, or study why snow is accumulating differently in different regions. They help communities prepare for severe winter weather and understand long-term climate patterns. This career combines physics, chemistry, and Earth science. Average Annual Salary: $97,000 USD

Forest Ecologist: The Tree and Forest Expert
Forest ecologists study how trees and forests survive in different environments, including how evergreen trees like the ones in this photo adapt to snowy winters. They research plant structures, forest health, and how animals and plants interact in winter ecosystems. A forest ecologist might study why some tree species thrive in snowy regions while others don't, or investigate how climate change is affecting winter snow patterns and forest survival. Average Annual Salary: $63,000 USD

Civil Engineer: The Infrastructure Designer
Civil engineers design and build structures that can handle heavy snow loads, like the roofs of buildings, bridges, and roads in snowy regions. They must calculate how much weight snow can add to a structure and design accordingly so buildings and infrastructure don't collapse under snow weight. They also plan snow removal systems and ensure that roads, power lines, and water systems can survive harsh winter conditions. This career combines physics, mathematics, and practical problem-solving. Average Annual Salary: $88,000 USD

NGSS Connections

Grade 5 Performance Expectation:
5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen and that these particles are in constant motion.

Disciplinary Core Ideas:
- 5-PS1.A: Structure and Properties of Matter
- 5-ESS1.B: Earth and the Solar System (seasonal changes due to Earth's tilt)
- 5-LS1.A: Structure and Function (plant structures)

Crosscutting Concepts:
- Patterns (seasonal patterns in weather and plant behavior)
- Systems and System Models (water cycle as a system)
- Stability and Change (how matter changes state; how plants change seasonally)

Science Vocabulary

* Snow: Frozen water that falls from clouds as ice crystals when temperatures are below 32°F (0°C).

* Evergreen: A plant or tree that keeps its leaves or needles all year long, even during winter.

* Phase Change: When matter changes from one state to another, such as when water freezes into ice or ice melts into water.

* Accumulation: The process of something building up or collecting in one place over time.

* Precipitation: Water that falls from clouds to Earth, such as rain, snow, sleet, or hail.

* Temperature: How hot or cold something is, usually measured in degrees Fahrenheit or Celsius.

External Resources

Children's Books:
- The Snowy Day by Ezra Jack Keats (classic story about winter exploration and snow)
- Snow by Manya Stojic (explores snow from different perspectives across landscapes)
- Come On, Rain! by Karen Hesse (explores water cycle and precipitation, good for contrast with snow)