

## Photo Description



This image shows tiny ice crystals covering a surface, sparkling in the early morning sunlight. The crystals look like a blanket of white, frosty sparkles that formed overnight when it was very cold outside. In the background, you can see bare trees and a house, which helps us understand this happens in winter.

## Scientific Phenomena

Anchoring Phenomenon: Frost formation through condensation and freezing.

Why it happens: When the air gets very cold at night (near or below 32°F/0°C), water vapor in the air turns directly into ice crystals without becoming liquid water first. This process is called deposition. The cold surface of the car provides a perfect place for these invisible water droplets in the air to land and freeze into the beautiful ice crystals we see in the photo. This is the same process that creates patterns on windows in winter!

## Core Science Concepts

- \* States of Matter: Water exists in three forms—liquid (water), solid (ice), and gas (water vapor in air). Frost shows us the solid state of water.
- \* Temperature and Change: When temperature drops below freezing, water changes from an invisible gas into visible ice crystals we can see.
- \* Heat Energy: Objects lose heat at night, making their surfaces cold enough for frost to form. The sun brings heat energy in the morning to melt the frost.
- \* Surface Properties: Different surfaces (like a car hood) are better at collecting frost than others because they cool down faster and hold onto coldness longer.

### Pedagogical Tip:

For Kindergarteners, avoid complex vocabulary like "deposition" in direct instruction. Instead, use the simpler phrase "water from the air turns into ice when it gets very, very cold." Use hand motions (pretend water vapor rising, then falling as ice crystals) to make the concept concrete and memorable.

### UDL Suggestions:

Provide multiple means of engagement by letting students experience frost firsthand: place wet cloths outside on a cold night, or create "frost" indoors using salt and ice in a clear container. Offer visual supports (pictures of frost, ice, and water) and allow kinesthetic learners to act out the water cycle with movement. Some students may benefit from a "frost hunt" during outdoor exploration to make the phenomenon personally relevant.

## Zoom In / Zoom Out

### Zoom In: The Invisible Water Molecules

Frost crystals look like tiny sparkles, but if we could zoom in even closer with a special super-magnifying glass, we'd see that frost is made of teeny-tiny water molecules that arranged themselves into beautiful geometric patterns. Each ice crystal is like a tiny building made of water "blocks" stacked in a special way. When water vapor in the air gets very cold, these invisible molecules slow down and lock together, creating the solid ice crystals we see. No two frost crystals are exactly alike—each one has its own unique pattern, just like snowflakes!

### Zoom Out: Winter Weather Systems and Seasonal Patterns

Frost is just one small part of Earth's big water cycle and seasonal weather patterns. When winter arrives and temperatures drop across entire regions, frost forms on countless surfaces everywhere—not just on one car, but on grass, trees, windows, and sidewalks across whole neighborhoods and cities. This happens because of larger weather systems (cold air masses moving south) and Earth's tilt, which brings winter to our part of the world. Understanding frost helps us see how local observations connect to global weather patterns and why winter always brings cold temperatures that freeze water.

## Discussion Questions

1. What do you see on the car in this picture? (Bloom's: Remember | DOK: 1)
2. Why do you think the frost looks shiny and sparkly? (Bloom's: Analyze | DOK: 2)
3. Where do you think the frost came from before it landed on the car? (Bloom's: Understand | DOK: 2)
4. What do you think will happen to the frost when the sun comes up and makes it warmer? (Bloom's: Predict | DOK: 3)

## Potential Student Misconceptions

Misconception 1: "Frost is frozen rainwater that fell from the sky."

Scientific Clarification: Frost doesn't fall from the sky like rain or snow. Instead, it forms right on the cold surface from water vapor (invisible water in the air) that freezes in place. The water was already in the air as a gas; it just became visible ice when the surface got very, very cold. Students can understand this by knowing that frost appears on surfaces overnight without any rain or snow falling.

Misconception 2: "Frost and dew are the same thing."

Scientific Clarification: Dew and frost both form when water from the air lands on cold surfaces, but dew is liquid water droplets (wet to the touch), while frost is frozen ice crystals (hard and crispy). The difference is temperature: if it's cold enough (below 32°F/0°C), the water freezes into frost instead of staying as wet dew. You can help students understand by having them observe both on different mornings and compare how they look and feel different.

Misconception 3: "The sun makes frost disappear, but it doesn't melt it—it just makes it invisible again."

Scientific Clarification: When the warm sun shines on frost in the morning, it actually melts the ice crystals into liquid water. The frost doesn't turn back into invisible water vapor; it first becomes liquid water (which might look like tiny water droplets or a wet surface), and then that water may evaporate into vapor. Students can observe this process: frost !' liquid water !' water vapor. The frost doesn't vanish magically; it changes form!

### Extension Activities

1. Frost Hunt Outdoor Walk: On a cold morning, take students outside to observe frost on grass, car windows, leaves, or playground equipment. Have them touch the frosty surfaces (safely) and describe what they feel. Ask: "Is it wet? Is it cold? Is it smooth or bumpy?" Create a simple picture chart of where frost was found.
2. Make Frost Indoors: Fill a clear cup with ice and salt, and place it in the freezer for 15-20 minutes. Remove it carefully and observe the frost forming on the outside. Students can draw or paint what they see using white paint on blue or gray paper to create a frost art project.
3. Daily Frost Observation Journal: On cold mornings throughout winter, have students check a designated car window or outdoor surface and draw what they observe. Create a simple pictograph showing "Frost Days" vs. "No Frost Days" to explore patterns in weather.

### Cross-Curricular Ideas

#### Math Connection: Patterns and Counting

Frost crystals form in beautiful, repeating patterns. Create a frost-inspired pattern activity where students observe pictures of frost and identify the repeating patterns. Then have them create their own frost patterns using white paint dots on blue construction paper, or practice one-to-one correspondence by counting ice crystals in close-up photos. Students can also graph "Frost Days" vs. "No Frost Days" on a simple pictograph throughout winter, practicing data collection and comparison skills.

#### ELA Connection: Descriptive Language and Storytelling

Read sensory-rich winter books like *The Snowy Day* and discuss words that describe frost (sparkly, shiny, cold, crispy, white, icy). Have students dictate or draw sentences describing frost using descriptive words: "The frost is sparkly and cold." Create a class "Frost Word Wall" with student-generated descriptive words, pictures, and simple sentences. Students can also create a winter narrative: "One cold night, frost came to visit my window. In the morning, I saw..."

#### Art Connection: Frost-Inspired Creative Projects

Create frost-inspired art using white paint, salt, glue, and watercolors. Students can paint blue or gray backgrounds and use white paint to create frost crystal designs, or sprinkle salt on wet glue to create a textured frost effect. Display these alongside real photos of frost for comparison. Students can also use cotton balls, white tissue paper, or white yarn to create three-dimensional frost sculptures, exploring how artists observe nature and recreate it through different materials.

#### Social Studies Connection: Seasonal Changes and Community

Discuss how frost and winter weather affect our community: people wear warm clothes, heating systems keep homes warm, salt is spread on roads, and school schedules may change for snow days. Take a winter neighborhood walk to observe how frost affects plants, trees, and outdoor spaces. Students can interview family members or community helpers (like road workers or farmers) about how they prepare for or respond to frost and cold weather, building understanding of how seasons impact daily life.

### STEM Career Connection

#### Meteorologist (Weather Scientist)

A meteorologist is a scientist who studies weather and helps predict what the weather will be like. They observe frost, snow, rain, and temperature to understand weather patterns and tell people when it will be cold, warm, rainy, or snowy. Some meteorologists work on TV to tell people the weather forecast, while others work in laboratories studying why frost forms and how weather changes. Meteorologists help keep us safe by warning us about dangerous weather!

Average Annual Salary: \$97,000 USD

### Climatologist (Climate Expert)

A climatologist is a special scientist who studies long-term weather patterns and how Earth's climate changes over many years. They look at information about frost, snow, temperature, and seasons from all over the world to understand how our planet is warming or cooling. Climatologists help governments and communities prepare for future weather changes and find ways to protect our environment. They use computers and special tools to collect and study weather data.

Average Annual Salary: \$104,000 USD

### Materials Scientist

A materials scientist studies how different materials (like metal, glass, and plastic) change when they get very cold or very hot. They investigate how frost and ice form on different surfaces—why frost sticks to some car windows better than others, or how to make materials that don't get damaged by freezing temperatures. These scientists help engineers design cars, buildings, and other products that work well even in cold, frosty winter weather.

Average Annual Salary: \$99,000 USD

## NGSS Connections

Performance Expectation: K-PS1-1 Plan and conduct an investigation to describe and classify different kinds of objects by their observable properties.

### Disciplinary Core Ideas:

- K-PS1.A Properties of Matter (observable properties of objects)
- K-ESS2.D Weather and Climate (observable weather patterns)

### Crosscutting Concepts:

- Patterns (Frost forms in patterns; it appears regularly in cold seasons)
- Cause and Effect (Cold temperature causes water to freeze into frost)

## Science Vocabulary

- \* Frost: Tiny ice crystals that form on cold surfaces when the air is very, very cold at night.
- \* Ice: Frozen water that is hard and slippery.
- \* Temperature: How hot or cold something is.
- \* Crystal: A shiny, solid piece of something with a special shape, like snowflakes or frost.
- \* Freeze: When liquid water turns into hard, solid ice because it gets very cold.

## External Resources

### Children's Books:

- The Snowy Day\* by Ezra Jack Keats (explores winter phenomena and ice)
- Come On, Rain!\* by Karen Hesse (water cycle and weather observation)
- Big Snow\* by Berta and Elmer Hader (seasonal weather patterns)