States Of Matter

Physical Science | Lesson Guide

4th Grade

Photo Description

This image shows a blue fire hydrant and orange traffic cone positioned near a sidewalk, grass, and a canal or waterway. The hydrant appears to be releasing water, and there is visible water on the ground and in the nearby canal. This real-world scene demonstrates how water exists in different places in our environment and how it moves through systems.

Scientific Phenomena

Anchoring Phenomenon: Water in motion and water management in urban environments.

Why This Happens (Scientific Explanation): Fire hydrants are connected to underground water pipes that deliver pressurized water throughout a community. When a hydrant is opened or leaks, water flows out due to pressure in the system. The water visible on the ground and in the canal demonstrates how water moves through human-made and natural systems. Additionally, this image shows water in its liquid state—the form water takes when it flows freely. Some of this water may also evaporate into water vapor (gas state) due to sunlight and heat, completing part of the water cycle that Fourth Graders are beginning to understand.

Core Science Concepts

* States of Matter: Water can exist as a solid (ice), liquid (flowing water), or gas (water vapor). In this image, we primarily observe water in its liquid state, but we can discuss how some of this water will eventually evaporate.

* The Water Cycle: Water moves from place to place through evaporation, condensation, and precipitation. The water in this hydrant came from a water source (like a reservoir or treatment plant), and eventually it will cycle back through evaporation or drainage systems.

* Properties of Liquids: Liquids take the shape of their container and flow downward due to gravity. The water spreading across the ground and flowing into the canal shows these properties in action.

* Human Systems & Water Management: Communities use infrastructure (pipes, hydrants, drainage systems) to manage and distribute water safely.

Pedagogical Tip:

When teaching states of matter to Fourth Graders, use this real-world hydrant image as a concrete anchor before moving to abstract diagrams. Ask students to predict what will happen to the water on the ground—will it stay there forever, or will it disappear? This naturally introduces evaporation without requiring memorization. Allow students to observe and touch (safely) different states of water during hands-on exploration to build deeper understanding.

UDL Suggestions:

To support diverse learners: (1) Provide a labeled diagram of the image with vocabulary words pre-highlighted for students who need visual support; (2) Create a water cycle illustration with arrows and simple captions so visual learners can track water movement; (3) Allow students to act out the water cycle (one student is liquid water, another becomes water vapor, etc.) for kinesthetic learners; (4) Offer sentence frames for discussion: "The water is _____ because _____."

Zoom In / Zoom Out

Zoom In: The Molecular Level
If we could shrink down to a size smaller than a grain of sand and look at individual water molecules, we'd see tiny particles (made of hydrogen and oxygen atoms) moving around and bumping into each other. In liquid water, these molecules are close together but still moving freely—they're not locked in place like they are in ice. When the sun heats the water, the molecules move faster and faster until some break free and escape into the air as water vapor (gas). This invisible escape is evaporation! Even though we can't see individual water molecules with our eyes, understanding their movement helps us explain why puddles disappear on sunny days.

Zoom Out: The Community Watershed
This fire hydrant is just one small part of a much larger water system called a watershed. A watershed is all the land and water that drains into a river, lake, or ocean. When water leaks from this hydrant and flows into the canal shown in the photo, it becomes part of a bigger journey. That water might flow downstream into larger rivers, settle in wetlands where birds and fish live, or eventually reach the ocean. Communities also depend on water flowing into their area from upstream watersheds through rivers and rain. Understanding watersheds helps Fourth Graders see that the water they use at home is connected to natural systems and other communities—water doesn't just disappear; it moves through interconnected networks above and below ground.

Discussion Questions

1. "What do you think will happen to the water on the ground and in the canal over the next few hours or days?" (Bloom's: Predict | DOK: 2)
   - This prompts students to think about evaporation and the water cycle.

2. "Why do you think communities need fire hydrants and water pipes underground?" (Bloom's: Understand | DOK: 2)
   - This connects to water management and community systems.

3. "How is the water in this hydrant different from ice cubes or water vapor?" (Bloom's: Compare | DOK: 2)
   - This reinforces understanding of states of matter.

4. "If we collected all the water from this hydrant in a closed container where it couldn't escape, what changes might occur to the water over time, and why?" (Bloom's: Analyze | DOK: 3)
   - This pushes students to think about evaporation, condensation, and energy.

Potential Student Misconceptions

Misconception 1: "Water disappears when it evaporates."
- Clarification: Water doesn't disappear—it changes form! When liquid water evaporates, it becomes water vapor (an invisible gas), but the water itself is still there in the air. It hasn't been destroyed; it has just changed into a form we can't see. Later, when it cools down, it becomes liquid again (condensation). Help students understand this by comparing it to ice melting: the ice doesn't disappear, it just turns into liquid water. In the same way, liquid water doesn't disappear; it turns into a gas.

Misconception 2: "All the water from the hydrant stays in the canal/ground."
- Clarification: Water is always on the move! Some water will evaporate (turn into vapor and rise into the air), some might soak into the soil, some will flow into the canal, and some may be used by plants or animals. Water doesn't stay in one place forever. The water cycle is constantly moving water around Earth in different forms and locations.

Misconception 3: "The fire hydrant makes water; that's where water comes from."
- Clarification: The fire hydrant doesn't make water—it's just a connection point to water that already exists! Underground pipes bring water from sources like lakes, rivers, reservoirs, or groundwater (water stored in soil and rock) to the hydrant. The hydrant is like a faucet that lets people access the water that's already flowing through the pipes beneath the ground.

Extension Activities

Activity 1: "Evaporation Investigation"
Provide students with three cups of water placed in different locations: one in sunlight, one in shade, and one in a warm (but safe) area. Over 2-3 days, have students measure and record the water level daily using a ruler. Create a line graph showing which water evaporated fastest. Discuss why the sunny location had more evaporation (heat energy).

Activity 2: "Design a Water Management System"
Give students building materials (cups, straws, tape, funnels, string) and challenge them to design a system that moves water from one container to another, similar to how pipes move water through a community. Ask: "How can you move water uphill? What happens if your system has a leak?" This integrates engineering and systems thinking.

Activity 3: "States of Water Exploration Station"
Set up a station with ice (solid), liquid water, and a warm (not boiling) mirror held above warm water to show condensation (gas becoming liquid again). Students rotate through, observe each state, and record their observations on a worksheet with drawings. Include the guiding question: "What do you notice about how each state of water looks and behaves?"

Cross-Curricular Ideas

Mathematics Connection: Graphing Evaporation Data
Students can conduct the "Evaporation Investigation" extension activity and create bar graphs or line graphs to compare water loss in different locations over time. This reinforces graphing skills while collecting real data. Students could also measure water levels in millimeters and calculate the difference each day, practicing subtraction and measurement with standard units.

English Language Arts Connection: Water Cycle Narrative Writing
Have students write a creative first-person narrative from the perspective of a water droplet. The story follows the droplet's journey from the fire hydrant, through evaporation, condensation in clouds, precipitation as rain, and back underground. This integrates storytelling, sequencing, and scientific vocabulary while making the water cycle personally meaningful.

Social Studies Connection: Community Infrastructure & Civic Responsibility
Explore how communities manage and protect their water systems. Discuss why fire hydrants are important for safety, how water pipes are maintained, and what happens when infrastructure breaks (like the visible leak in this photo). Students could interview a local water department worker, create a map showing water infrastructure in their neighborhood, or design a poster about conserving water in their community.

Art Connection: States of Water Mixed Media Project
Students create a three-panel mixed-media artwork representing solid water (ice—using blue glitter and white paint), liquid water (blue watercolor and torn blue paper), and water vapor (light pencil marks or translucent white tissue paper). Display these alongside the fire hydrant photo to create a visual anchor for the water cycle unit.

STEM Career Connection

Water Treatment Plant Operator
These workers manage the machines and systems that clean water from rivers and lakes so it's safe for people to drink and use at home. They test the water to make sure it's clean, fix broken pipes and pumps (like if a fire hydrant leaks!), and sometimes help direct water to farms and communities during droughts. It's like being a "water doctor" for your whole city! Water Treatment Plant Operators earn an average annual salary of $48,000–$52,000 USD.

Civil Engineer (Water Systems Specialist)
Civil engineers design and build the underground water pipes, fire hydrants, drainage systems, and reservoirs that communities need. When you see a fire hydrant on your street, a civil engineer probably designed where it should go and how it connects to the water system. They solve puzzles like "How do we get clean water to everyone in the city?" and "Where should the water go after it's used?" Civil Engineers specializing in water systems earn an average annual salary of $65,000–$78,000 USD.

Hydrologist
Hydrologists are scientists who study water—how it moves through the ground, when it rains, where it comes from, and how it cycles through nature. They use science to help communities protect their water supplies, predict floods, and understand watersheds. A hydrologist might study the canal in this photo to understand how water flows through the neighborhood or how to prevent pollution. Hydrologists earn an average annual salary of $63,000–$75,000 USD.

NGSS Connections

Performance Expectation:
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Note: Evaporation involves heat energy changing water to vapor)

Disciplinary Core Ideas:
- 2-PS1.A Properties of Matter (states of matter and their observable characteristics)
- 2-ESS2.B Water on Earth (water cycle and its importance)

Crosscutting Concepts:
- Systems and System Models (Water systems within communities)
- Energy and Matter (Water changing states through heat energy)

Science Vocabulary

* Liquid: A state of matter that flows freely and takes the shape of its container (like water in a cup).

* Evaporation: The process where a liquid changes into a gas or vapor, usually due to heat from the sun.

* Water Cycle: The continuous movement of water from Earth's surface to the atmosphere and back again through evaporation, condensation, and precipitation.

* Hydrant: A metal pipe connected to underground water lines that firefighters and water workers use to access water.

* Pressure: A force that pushes on something; water pressure in pipes pushes water through the system.

* States of Matter: The three main forms that substances can take: solid, liquid, and gas.

External Resources

Children's Books:
- Water by Manya Stojic (explores water's journey through the water cycle with beautiful illustrations)
- The Water Cycle by Rebecca Olien (simple, age-appropriate explanation with diagrams)
- Come On, Rain! by Karen Hesse (narrative picture book that celebrates water in the community)

Teacher Tip: Use this hydrant photo as a "phenomenon card" on your bulletin board throughout the water cycle and states of matter unit. As students learn new concepts, encourage them to return to this image and add sticky notes with new observations: "I notice the water is a liquid because..." or "I predict this water will evaporate because..." This builds metacognitive awareness and shows how science applies to their community.