States Of Matter

Physical Science | Lesson Guide

5th Grade

Photo Description

This image shows a blue water valve and an orange traffic cone positioned near a sidewalk, grass, and a body of water. The valve appears to be part of the town's water system infrastructure, and there is visible water pooling or leaking around the area. This represents an everyday example of how water moves through human-made systems in our communities.

Scientific Phenomena

Anchoring Phenomenon: Water leaking from an underground utility valve system.

Why This Is Happening: Water stored in underground pipes is under pressure to deliver water throughout a community. When a valve ages, rusts, or develops cracks, water escapes from the system and flows onto the ground surface. This demonstrates that water is a liquid that always flows downhill and spreads to fill available space. It also shows how humans try to control water movement through infrastructure—and what happens when that system fails. This is a real-world connection to the properties of liquids and the importance of water management in our towns and cities.

Core Science Concepts

* Properties of Liquids: Water is a liquid that takes the shape of its container and flows downward due to gravity. When water escapes its container (the pipe), it spreads across the ground.

* Water as a Resource: Communities depend on underground pipe systems to deliver clean water to homes and businesses. This image shows what happens when the system leaks—water is wasted and may cause damage.

* States of Matter: The water here is in its liquid state. Students can observe that liquids have no fixed shape and will flow to fill low areas on the ground.

* Human Engineering & Problem-Solving: The traffic cone represents human attempts to warn others about the problem and control the situation. This connects to how engineers design systems to move and protect water.

Pedagogical Tip:

Use this real-world image to make states of matter relevant to students' daily lives. Rather than only demonstrating liquids with beakers in a classroom, anchor the lesson in their community's actual infrastructure. Ask: "Who fixes this?" and "Why does our town need this system?" This builds curiosity and shows that science isn't just in textbooks—it's in every sidewalk and street.

UDL Suggestions:

Provide Multiple Means of Representation: Some students may struggle with abstract concepts. Offer a video tour of a water treatment plant or invite a local utility worker to speak. Use photos, diagrams, and physical demonstrations. For English learners, use bilingual vocabulary cards. For students with visual processing needs, provide high-contrast images and simplified diagrams of the water system.

Provide Multiple Means of Action & Expression: Allow students to demonstrate understanding through drawing the water cycle, building a model pipe system, or writing an explanation. Some may prefer to create a poster warning about water leaks; others might build a working model of a valve.

Zoom In / Zoom Out

Zoom In: The Molecular Level
If we could shrink down and look at water molecules through a microscope, we'd see tiny particles (molecules) moving and bouncing around constantly. When water is trapped in a pipe under pressure, these molecules are packed tightly together, pushing against the pipe walls and each other. But the moment a crack forms in the pipe, those molecules rush out through the opening because they're always moving and looking for space to spread out. The water molecules don't "know" they're escaping—they're just following the laws of physics! This invisible molecular motion is why liquids always flow and spread, even when we want them to stay inside our pipes.

Zoom Out: The Watershed & Community Water Cycle
Now imagine zooming way out to see the entire water system in your town and region. The water leaking from this valve came from a faraway source—maybe a river, lake, or underground aquifer miles away. It was cleaned at a treatment plant, then pumped through hundreds of miles of underground pipes to reach neighborhoods like yours. When it leaks here, it's lost from the system that serves thousands of people. That water might soak into the ground and rejoin the groundwater, flow into the nearby storm drain (shown in the photo) and eventually reach rivers and wetlands, or simply evaporate. This leak shows how interconnected water is—from distant sources, through our community's pipes, back into the environment. Understanding this helps students see that protecting water infrastructure is protecting the entire community's water supply.

Discussion Questions

1. What do you observe happening to the water around the valve? (Bloom's: Remember | DOK: 1)

2. Why do you think the water is flowing downhill and spreading across the ground instead of staying in one spot? (Bloom's: Explain | DOK: 2)

3. If you were an engineer fixing this leak, what would you need to know about how water behaves as a liquid to design a better solution? (Bloom's: Analyze | DOK: 3)

4. How might this water leak affect the community, and what steps could be taken to prevent it? (Bloom's: Evaluate | DOK: 3)

Potential Student Misconceptions

Misconception 1: "Water only flows if we pour it."
Clarification: Water flows on its own due to gravity and pressure, even without someone pouring it. In this photo, the water is flowing out of the broken valve because the water in the pipes is under pressure from pumps at the treatment plant. The pressure pushes the water forward, and gravity pulls it downward. Help students understand that liquids are always "ready" to flow—we just usually contain them in pipes and containers.

Misconception 2: "This is a waste, but it's not a big problem because there's lots of water."
Clarification: While Earth has a lot of water, most of it is salty ocean water that we can't drink. Only a tiny amount of Earth's water is freshwater that communities can use. When we leak water from our pipes, we're wasting a precious resource that required energy and money to clean and pump to our homes. One small leak might waste thousands of gallons per year! Help students calculate: If one leak wastes 100 gallons per day, how much is wasted in a week? A month? This makes the scale of the problem real.

Misconception 3: "The water will just disappear or stay in one place."

Clarification: Water doesn't disappear—it changes location and state, but it's always part of Earth's water cycle. The water leaking here will either soak into the soil (where it may filter down to groundwater), flow into the storm drain and eventually to a river or ocean, or evaporate into the air as water vapor. Help students trace the water's journey by asking: "Where do you think this water will go next?"

Extension Activities

1. Build a Model Water System: Provide clear plastic tubing, cups, water, and clay or tape. Have students design a simple water delivery system from a "reservoir" (cup) to a "home" (another cup), then deliberately create a leak with a pinhole. Ask: "How does the water behave? Where does it go? How would you repair it?" This hands-on model makes the abstract concept of piping concrete and memorable.

2. Community Water Audit: Take students on a safe neighborhood walk to identify water infrastructure (fire hydrants, drainage grates, water meters, sprinkler systems). Have them photograph or sketch these features and discuss: "Where does water come from? Where does it go?" Return to class and create a map showing the water system. Discuss why maintenance and repair are important jobs.

3. Liquid Properties Investigation Station: Set up four stations where students test liquids (water, cooking oil, honey, milk) by observing how they flow, spread, and behave in different containers. Create a chart comparing properties: Does it flow fast or slow? Does it keep its shape? Students record observations and connect back to the leaking valve image—all liquids behave this way, but we want to control them in our pipes!

Cross-Curricular Ideas

Math Connection: Data & Measurement
Have students research or calculate water loss from leaks. Provide the scenario: "A water leak loses about 1 gallon per minute. How many gallons leak in 1 hour? In 1 day? In 1 week?" Create a data table or graph showing water loss over time. Extend this by finding the average cost of water in your community (usually available on water bills or city websites) and calculate: "How much money does this leak cost the city per day/week/month?" Students can present findings as bar graphs or pie charts.

ELA Connection: Persuasive Writing & Communication
Have students write a persuasive letter to the city council or water department explaining why it's important to fix water leaks quickly. Alternatively, students could create a public service announcement (poster, short video script, or social media post) warning their community about water waste and encouraging leak reporting. They might research and interview a local water utility worker about what they do and write an informative paragraph or short article titled "Meet a Water System Hero!"

Social Studies Connection: Community Infrastructure & Civics
Investigate the history of water systems in your town or region. When were the pipes installed? How old are they? Has the community had major water problems? Have students create a timeline of water infrastructure development or research how their city government manages water resources. Discuss: "Who pays for water? Who decides when to fix leaks? What jobs are needed to keep our water system running?" This connects to local government, taxes, and community planning.

Art Connection: Design & Engineering Challenge
Challenge students to design a better valve, warning sign, or repair system for water leaks. Provide art supplies (paper, markers, clay, recycled materials) and ask them to sketch or build a prototype. Students could also create a detailed illustration or comic strip showing the journey of water from the treatment plant to homes to the leak site, labeling key parts of the system. Display designs with explanations of how they solve the leak problem.

STEM Career Connection

Water Systems Technician / Utility Worker
These professionals maintain and repair the underground pipes, valves, and pumps that bring water to homes and businesses. They locate leaks (like the one in the photo!), repair broken pipes, test water quality, and make sure the system runs smoothly. It's a hands-on job that requires understanding how water moves through pipes and using tools to dig, test, and fix problems. Many technicians work for city or county water departments and have regular schedules, though some are called for emergencies like major leaks.
Estimated Average Annual Salary: $48,000–$62,000 USD

Environmental Engineer
Environmental engineers design and improve systems that protect water and manage resources. They might design new water treatment plants, plan how to reduce water leaks in old pipe systems, or figure out how to clean polluted water. They use science and math to solve big problems like "How can we deliver clean water to more people?" or "How do we repair aging pipes without wasting water?" This job involves a lot of planning, testing, and problem-solving.
Estimated Average Annual Salary: $88,000–$115,000 USD

Civil Engineer (Water Infrastructure Specialist)
Civil engineers plan and design the large systems that communities depend on, including water pipes, treatment plants, and drainage systems. They use computers and math to figure out where pipes should go, how big they need to be, and how to keep them working for many years. If they were designing the system in the photo, they'd make sure the pipes are strong enough, the valves are reliable, and the whole system can handle the water needs of the growing community.
Estimated Average Annual Salary: $87,000–$130,000 USD

NGSS Connections

Performance Expectation:
5-PS1-3: Make observations and measurements to identify materials based on their properties.

Disciplinary Core Ideas:
* 5-PS1.A Matter and its Interactions – Properties of materials can be observed and measured to identify them.
* K-PS2.B Motion and Stability: Forces and Interactions – Water flows and spreads; gravity pulls objects downward.

Crosscutting Concepts:
* Systems and System Models – Water systems have inputs (sources), storage (pipes/reservoirs), and outputs (leaks/usage).
Cause and Effect – When pipes age or break, the cause is structural failure; the effect* is water leaking out.
Structure and Function – The valve's structure (seal) determines its function* (stopping or allowing water flow).

Science Vocabulary

* Liquid: A state of matter that has a definite volume but no definite shape; it flows and takes the shape of its container.

* Valve: A device that controls the flow of water or other liquids through a pipe by opening or closing.

* Leak: An unwanted hole or crack that allows a liquid to escape from a container or pipe.

* Infrastructure: The basic systems and structures (like pipes, roads, and bridges) that a community needs to work properly.

* Gravity: The force that pulls objects downward toward Earth.

* Pressure: The force that pushes on an object; in pipes, pressure pushes water through to reach homes and businesses.

External Resources

Children's Books:

Water is Water* by Miranda Paul (Exploring the water cycle and water systems)

The Water Cycle* by Rebecca Olien (Simple explanation of how water moves in nature and through communities)

Down the Drain: A Book About Water* by Elaine Moore (Focuses on water conservation and infrastructure)

Teacher Tip: This is an excellent anchoring phenomenon for a multi-week unit on states of matter, water systems, and engineering. Return to this image multiple times as students deepen their understanding of how liquids behave and why infrastructure matters to communities.