Into the Outdoors
Discussion Guide: Know your H_2O

Grade Levels

Middle School – Grades 6-8

Enduring Knowledge

Students will know where and how people obtain fresh and safe drinking water.

Learning Targets:

After viewing the video, students will be able to

1. Summarize how evaporation, condensation, and precipitation form the water cycle.
2. Give examples of water sources that provide drinking water including aquifers, lakes, rivers, and streams.
3. Describe how water is filtered to remove bacteria, sediment, silt, and any source of pollution found in the water.
4. Explain that water quality is determined by testing the water for the amount of nitrates, metals, minerals, and microorganisms present.
5. Tell how sand is a filter found in nature.
6. Explain how infrastructure is the way water is stored and distributed in urban areas, and it includes wells, pumps, reservoirs, and water towers.
7. Describe how people in rural areas use wells and water softeners to get clean drinking water.
8. Give examples of careers associated with water storage and distribution such as engineers, operators, and maintenance workers.
9. Describe challenges associated with distributing water to people like computer glitches and pipe corrosion.

Teacher Background:

Did you know that three million people in the world die each year due to water related diseases? *Know Your H_2O* teaches viewers about the water cycle and water sources, as well as how water is cleaned, tested, and stored. Viewers also explore careers and challenges associated with distributing fresh and safe drinking water to people.

Water Cycle and Sources

The water cycle is broken into three steps: evaporation, condensation, and precipitation. Evaporation occurs as the sun's energy heats the surface of lakes, rivers, plants, and soil, transforming water from a liquid to a gas known as water vapor. This gas rises into the sky and cools, forming water vapor particles. This process is called condensation. The water particles congregate together in clouds forming droplets, and as they become heavier, the droplets fall to the ground as precipitation.

Once on the ground, water can travel to lakes, rivers, streams, and oceans, or it can seep into the soil as groundwater. People collect ground water by drilling wells into aquifers, which are underground layers of rock that have openings liquids and gases can pass through. At a water processing plant, water from a water source, such as an aquifer or lake, passes through a filtration system to remove any sand, iron, and manganese. Chlorine is put into the water during filtration to help kill any bacteria present. Next, fluoride is added, and the water goes into a reservoir. After testing and the purification processes are complete, the water is distributed to people for drinking and their daily activities.

Science of Water

Water quality is determined using chemistry. If water contains too high levels of substances such as nitrates and metals like lead, it can be unsafe for humans to drink. Minerals such as calcium and manganese can also be found in water, and they provide flavor to the tasteless liquid. But water needs to be tested to make sure the mineral levels are within a safe drinking range. Water is also tested for coliform and other microorganisms that may be present.

Water Storage and Distribution

In urban areas, infrastructure is used to store and distribute water. The distribution process begins when water is pumped from the ground. It is then filtered and stored in a reservoir—either a tank or water tower. Water is then sent to homes, hospitals, fire hydrants, etc. Ground-level water tanks use pumps to distribute water, and water towers use hydrostatic pressure, or water pressure. People living in rural areas obtain water from private wells, and a water softener is often used to treat the water.

Challenges and Careers

Engineers, maintenance personnel, and operators work together to ensure infrastructure is working properly. The engineers do direct service on water mains, fixing them when they break or corrode. Computer glitches can sometimes occur, so maintenance workers make sure electronics and mechanical aspects of the pumps work correctly, while operators watch the whole water system to ensure all parts are working properly. In addition, billing and financial people send residents and businesses bills for using the water.

Vocabulary:

aquifer: an underground layer of rock that has openings that liquids and gases can pass through

condensation: the process of changing a gas to a liquid

evaporation: changing a liquid to a gas

filter: removing unwanted substances

H_2O: the chemical name for water; *H* represents hydrogen, and *O* is oxygen

infrastructure: the people, buildings, and equipment required for a system

microorganisms: a living thing such as bacteria that one cannot see without using a microscope

precipitation: water falling to the earth as hail, mist, rain, sleet, or snow

reservoir: a place where something is stored

water cycle: the continuous movement of water on, above, and below the Earth's surface; also known as the hydrologic cycle

water vapor: gaseous form of water

Special Considerations:

This activity is richest when completed with discussion shared within the whole class. It may be helpful to provide students with a graphic organizer or a guide with headings and questions for notes to aid students in picking out significant information.

Before Viewing the Video:

Give each student a blank piece of paper. On one side, have them draw and label the water cycle. On the other, have the students draw and label two more diagrams—one of how people in urban areas obtain water and one showing how people in rural areas access water. The students will redraw these diagrams after watching the video, making modifications as needed.

Viewing and Discussion Guide:

Water Cycle and Sources

1. Name and describe the three stages of the water cycle.
    a.
    b.
    c.
2. Another name for the water cycle is _____.
3. What is an aquifer?
4. Describe how water is processed using the following terms: filtration system, sand, chlorine, fluoride, and reservoir.

Science of Water

1. List five things that can be harmful to humans if found in water at too high of levels:
   a.
   b.
   c.
   d.
   e.
2. What is water quality and why is it important?
3. What are microorganisms and why do we test water for them?
4. Describe how Mother Nature filters water and why it works.

Water Storage and Distribution

1. What infrastructure is as described in the video?
2. How do people in rural areas get ground water?
3. Name the four parts of urban water infrastructure.
   (Answer: wells, pump, reservoir, water tower)

Challenges and Careers

1. Describe two challenges that can occur in the water distribution process.
2. Name two careers associated with water distribution.

Evaluation:

Students can be informally assessed from their notes while viewing the video and from their participation during the class discussion.

After watching the video, students can also be instructed to draw diagrams of the water cycle, an urban water infrastructure, and a rural home's well. For each of the diagrams, the students can then write a three to five sentence paragraph explaining the process shown. This can serve as a formal assessment of the students understanding of where and how people obtain fresh and safe drinking water.

Extended Learning:

1. Instruct students to create a multimedia presentation about a career associated with water quality, distribution, or storage. Some careers include water quality specialists, engineers, and bottled water sales representative.
2. Students can contact the local water utilities company and report to the class how water is tested, stored, and distributed in their community.
3. Have students work in small groups and research social issues that arose when safe drinking water was not present. They can then share their findings with their peers.

Standards:

Wisconsin Model Academic Standards for Science, Grade 8

Content Standard Science Standard E - Earth and Space Science

E.8.6 Describe through investigations the use of the earth's resources by humans in both past and current cultures, particularly how changes in the resources used for the past 100 years are the basis for efforts to conserve and recycle renewable and non-renewable resources

Content Standard Science Standard G - Science Applications

G.8.3 Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life

G.8.5 Investigate a specific local problem to which there has been a scientific or technological solution, including proposals for alternative courses of action, the choices that were made, reasons for the choices, any new problems created, and subsequent community satisfaction

Content Standard Science Standard H - Science in Personal and Social Perspectives

H.8.3 Understand the consequences of decisions affecting personal health and safety

Next Generation Science Standards

Ecosystems: Interactions, Energy, and Dynamics

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services

Earth's Systems

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity

Earth and Human Activity

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes