

9-12 Environmental Science

Title of the Lesson: Water Quality and Conservation at Your School

Timeframe: 3 days

Standard/Indicator(s)

BIO.2 The student will investigate and understand that chemical and biochemical processes are essential for life. Key ideas include

a) water chemistry has an influence on life processes;

ENV.2 The student will investigate and understand that matter has fundamental properties and interactions. Key content includes:

(e) water has unique properties and characteristics which plays a critical role in the environment; and the distribution and movement of water across the Earth affects the biosphere, hydrosphere, lithosphere, and atmosphere.

ENV.8 The student will investigate and understand that Earth's resources should be conserved. Key content includes

- the trend in human consumption of energy will affect future availability of nonrenewable resources;
- the effects of natural and human-caused activities may either contribute to or challenge an ecologically sustainable environment;
- individuals can alter their own behavior to reduce their environmental impact; and
- availability of energy will affect society and human activities, such as transportation, agricultural systems, and manufacturing.

Enduring Understanding	Essential Knowledge & Practices
<p>BIO.2 The structure of an object or living thing determines many of its properties and functions.</p> <ul style="list-style-type: none"> • Water has chemical and physical properties that facilitate metabolic activities in living cells. Water is a solvent and dissolves chemicals, minerals, and nutrients that are used to support life processes. The polarity of water molecules causes them to be strongly attracted to one another and gives rise to surface tension and cohesion. Water is also a thermal regulator in living systems. <p>ENV.2 Water has chemical and physical properties that facilitate metabolic activities in living cells. Water is a solvent and dissolves chemicals, minerals, and nutrients that are used to support life processes. The polarity of water molecules causes them to be strongly</p>	<p>BIO.2</p> <ul style="list-style-type: none"> • Relate the chemical and physical properties of water that contribute to metabolism <p>ENV.2 relate the chemical and physical properties of water that contribute to metabolism</p> <ul style="list-style-type: none"> • analyze the pH of a solution and classify it as acidic, basic, or neutral. • determine the identity of an unknown substance by comparing its properties to those of known substances. <p>ENV.8</p> <ul style="list-style-type: none"> • Predict future availability of nonrenewable resources considering the trend of human consumption of energy.

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<p>attracted to one another and gives rise to surface tension and cohesion. Water is also a thermal regulator in living systems.</p> <ul style="list-style-type: none">● Acids make up an important group of compounds that contain hydrogen ions. When acids dissolve in water, hydrogen ions (H^+) are released into the resulting solution. A base is a substance that releases hydroxide ions (OH^-) into solution. pH is a measure of the hydrogen ion concentration in a solution. The pH scale ranges from 0–14. Solutions with a pH lower than 7 are acidic; solutions with a pH greater than 7 are basic. A pH of 7 is neutral. When an acid reacts with a base, a salt is formed, along with water. <p>ENV.8 The need to weigh the costs and benefits of resource extraction and utilization, and explore ways to promote responsible consumption of resources</p> <ul style="list-style-type: none">● Human activity and sustainability of the environment are interconnected	<ul style="list-style-type: none">● Research the effects of natural and human-caused activities that either contribute to or challenge an ecologically sustainable environment.● Demonstrate how individuals can alter their own behavior to reduce their environmental impact.● Forecast how changes in the availability of energy will affect society and human activities, such as transportation, agricultural systems, and manufacturing.
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Essential Question: Is your school a good steward of water's finite resources?

Materials and Safety (Always refer to the VDOE Safety in Science Teaching)

5 Gallon bucket

Thick towel to carry water on head (optional)

Leak measurements:

- Stopwatch
- Measuring cup that measures in fluid ounces
- Dry sponge
- Ziploc plastic bag
- Towel
- Scale that measures in grams
- Clipboard

Identify potential safety concerns: Slip hazard from water spillage

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Lesson Preparation

- ☐ Prior to lesson, obtain water data from maintenance/administration where necessary on the audit report.
- ☐ Locations for water measuring should be located and passes for specific locations created to minimize student wandering.
- ☐ Students may need a refresher on data collection and scale measurements

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Engage:

Option 1: Have a closed bucket or 5 gallon container with some water and have a student carry it down the hall. They can hold or if they want to use their head, they can cushion with a towel. Measure the distance the student walks down the hall carrying water or how long it takes a student to carry the water. Alternatively, students that like competition can see how fast they can carry the water for a certain distance (measured). Student discusses how it felt, how far they can carry etc.

Option 2: Watch this [video](#) of rural India on women carrying water to their village (1:10 minutes)

Teacher Directions	Additional Notes
<p>The teacher will provide the filled bucket ensuring a closed top to prevent spillage. Students will measure the distance/analyze time/speed and reflect on their experience. Watching the video allows discussion and culturally sensitive questioning opportunities.</p>	<p><i>5Cs: Communication is necessary with data collection, Collaboration between students with data collection, Creativity through student interpretation of carrying water/improvements in time and ways to carry water</i></p> <p><i>Other disciplines:</i> <i><u>History</u> - water scarcity, development of lands by water sources</i> <i><u>English</u> - literature around water, culture and water</i> <i><u>Math</u> - calculations, statistics</i> <i><u>Foreign Language</u> - specific cultures and water usage</i></p> <p><i>Preconceptions/misconceptions:</i></p> <ul style="list-style-type: none"> <i>Water is infinite since Earth has an abundance of water (only 3% of Earth's water is freshwater but 2.5% of that freshwater is locked in areas such as glaciers, atmosphere, ice caps & soil)</i> <i>Water is easily accessible through taps as is experienced in the United States</i>

Explore: Guiding question: **What would happen if Suffolk's water source ran out?**

- What things would cause Suffolk (insert your city/county) to run out of usable freshwater? (drought, natural disasters, overuse etc)
- In groups, students discover the source of Suffolk's water using the [2022 Water Quality Report](#) (Replace with your location's specific water quality report found on municipal websites)
- Using the [USGS Water Resource Map](#), students find the closest water supply to their home. Using the map scale, students will measure the distance to the water source and calculate how long it would take to walk to that location and back (average walking speed 2.5mph = 15 minutes per mile). Compile data [here](#)
(Teacher example can be from school to walk through how students find and calculate their information)

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Teacher Directions	Additional Notes
<p>Bold important vocabulary words in this section.</p> <p>Teacher led discussion begins with what happens when the area runs out of water? In groups, students will analyze the Water Quality Report to find out the specific source of water. Discussion can include municipalities that recycle wastewater into drinking water (often an interesting discussion).</p> <p>Students often need assistance with the USGS map and calculating the time.</p>	<p>5Cs: <i>Critical thinking - students obtain conclusions from the data that is collected, discussions around water recycling, Collaboration between students with data collection and interpretations</i></p> <p>Other disciplines: <u>History</u> - water scarcity, development of lands by water sources <u>English</u> - literature around water, culture and water <u>CTE</u> - computer data science for USGS resources, culinary capabilities in places where water is not easily accessible <u>Math</u> - calculations, statistics <u>Foreign Language</u> - specific cultures and water usage</p>

Explain: After reviewing class data and whole group discussion:

- how have students feel about getting water
- what time they would have to wake to get water for all members in their family (average water use per person in U.S. per day is 101.5 gallons)

Students list all the ways the school uses water and calculates how many gallons of water is needed a day. (number of students x distance to closest freshwater supply and back)

**Teachers can get student/faculty data for their school [here](#)

Teacher Directions	Additional Notes
<p>Teacher can expand student reflection regarding what time the student needs to wake up to get water for the family by inserting hypotheticals</p> <p>Brainstorming happens with all the ways the school uses water, knowledge can be obtained from custodial staff prior to the lesson</p>	

Elaborate: [School water use audit](#)

Student groups can be split to obtain data. Information in red needs to be obtained by teacher or have students interview appropriate person for information

1. Water collection sites will also be tested for quality measuring temperature, pH, coliform bacteria, nitrates, phosphates, dissolved oxygen
2. Completion of the MWEE is with an action plan. [Water Audit report](#)

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Students that create an action plan can be highlighted at [Project Wet's WaterStar Clean and Conserve program](#). Certificates can be [customized and printed/digitally](#) sent to students upon completion.

Extension for [virtual water usage in food](#)

Teacher Directions	Additional Notes
<p>Student groups obtain water usage data at specific points as directed by the teacher. Methods of water data collection needs to be reviewed for specific areas.</p> <p>Action Plans are completed once the water audit is completed and teacher can process certificates or could be presented at presentation.</p>	<p>5Cs: <i>Communication is necessary with data collection, Collaboration between students with data collection, Critical thinking with data analysis</i></p> <p>Other disciplines: <u>Math</u> - calculations, statistics</p>

Evaluate: Students present their project/findings to administration, specialist and facilities management (via prior invitation)

Teacher Directions	Additional Notes
<p>Teacher sets up administration attendance or students can film the presentation for review</p>	<p>5Cs: <i>Communication is necessary with data collection, Collaboration between students with data collection, Creativity through student interpretation of carrying water/improvements in time and ways to carry water</i></p> <p>Other disciplines: <u>History</u> - water scarcity, development of lands by water sources <u>English</u> - literature around water, culture and water <u>Math</u> - calculations, statistics <u>Foreign Language</u> - specific cultures and water usage</p>

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Suggested Post Instruction

Home usage water audits

[Virtual Water Usage in Foods](#)

[What is Your Water Footprint?](#)

Student Page(s)

[Water Use Audit](#)

[Water Audit Report Template](#)

[Kid Certificate](#)

[Class Water Distance](#)