

Home Water Assessment



Evaluate home water use, explore the ways water is used in daily life, and discover new ways to conserve water

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Curriculum Introduction

Welcome to the SEI Home Water Assessment Curriculum. This curriculum provides instructors with four interactive lessons to guide students through complete water assessments of their homes. Water is a scarce and precious resource, and a clear understanding of both natural water cycles and the water systems we use, is fundamental to responsible resource management. Our communities need well-educated citizens and professionals to manage and sustain our water systems, while serving as stewards of the environment.

In these project-based lessons, students learn about basic water science, the water cycle and the importance of water as a natural resource, explore the energy-water nexus, and quantify water consumption in their own lives. Then, students will conduct a water audit in their homes to identify ways to save water and energy at the same time.

This curriculum package includes:

- Comprehensive lessons covering the purpose, benefits, and design of home water assessments.
- Hands-on activities allowing students to explore chemistry, the water cycle, water careers, and more.
- Practical applications in research, design analysis, and data collection.
- Coverage of Next Generation Science Standards, Common Core ELA Standards, and Career Technical Education Standards

This curriculum was developed by Strategic Energy Innovations (SEI). SEI is a non-profit organization that provides sustainability consulting to cornerstone community institutions - schools, local governments, the workforce, and the housing. For more information, please visit us at <http://www.seiinc.org>.

Academic Content Standards

Next Generation Science Standards (NGSS)

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth’s systems.

HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on the Earth’s materials and surface processes.

California’s Common Core State Standards (CCSS)

Math

Numbers and Quantities: (N-Q)

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
2. Define appropriate quantities for the purpose of descriptive modeling.

ELA Literacy

Reading Standards for Informational Text (Grades 11-12)

7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Reading Standards for Literacy in Science and Technical Subjects (Grades 11-12)

3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Writing Standards (Grades 11-12)

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3.)
7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Speaking and Listening Standards (Grades 11-12)

1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners *on grades 11-12 topics, texts, and issues*, building on others’ ideas and expressing their own clearly and persuasively.
2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

California Career Technical Education Model (CTE) Curriculum Standards

Agriculture and Natural Resources

Pathway E. Forestry and Natural Resources Pathway

E2.6 Analyze the way in which water management affects the environment and human needs.

Energy, Environment, & Utilities

3.0 *Career Planning and Management*: Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11-12.2)

3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.

3.2 Evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success.

3.3 Explore how information and communication technologies are used in career planning and decision making.

3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.

3.5 Integrate changing employment trends, societal needs, and economic conditions into career planning.

3.8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates.

Materials List

Course developers have made every effort to keep costs of material requirements to a minimum. The instructor will need to acquire the following materials for conducting activities in this unit.

Tool	Price	Activity /Purpose	Where to Order
String	~\$5.00	Activity 1.1: Water Cycle Experiment	http://www.amazon.com/Regency-Natural-Cooking-Twine-Cotton/dp/B002NU6HOI/ref=sr_1_2?s=kitchen&ie=UTF8&qid=1443570934&sr=1-2&keywords=string
2 two-liter plastic soda bottles	–	Activity 2.1: Water filtration.	Found at grocery store or recycling center.
Food Coloring	~\$2.00	Activity 1.1: Water Cycle Experiment	Found in the baking section of grocery stores.
Alum	\$9.47/lb \$3.97/ 1.9oz	Activity 2.1: Promotes coagulation during water filtration.	http://www.amazon.com/Barry-Farm-Alum-1-lb/dp/B00016Q6BK Can also be found in grocery stores in the spice aisle.
Activated Carbon	\$8.99/ 900mL	Activity 2.1: Water filtration.	http://www.petco.com/product/5217/Marineland-Black-Diamond-Premium-Activated-Carbon.aspx Each group needs 1 cup.
Fine Sand	~\$3.50/ 0.4 cubic ft	Activity 2.1: Water filtration.	http://local.kmart.com/-White-Play-Sand/p-043W004185311007P?st=3531&sid=KDx20141117x00002x!pla#!/ Can be found at a local superstore or garden center. Each group will need 1 ½ cups.
Course Sand	~\$3.50	Activity 2.1: Water filtration.	Can be found at a local Osh or garden center. Each group will need 1 ½ cups.
Small Pebbles	~\$5.00/ 0.5 cubic ft	Activity 2.1: Water filtration.	Can be found at a local Osh or garden center. Each group will need 1 cup.
Coffee Filters	~\$1.50	Activity 2.1: Water filtration.	Found at a local grocery store.



Lesson Information

Estimated Time

2 class periods (90 minutes)

Standards Covered

NGSS: HS-ESS2-5

CCSS ELA: Reading Standards for Informational Text 7, Speaking and Listening Standards 2, Reading Standards for Literacy in Science and Technical Subjects 3

Objectives: Students will be able to:

- Understand the water cycle by observing condensation, evaporation, and precipitation in an experiment
- Identify and analyze the major ways we use water in our society
- Understand that water is a precious and limited resource

Handouts

- 1.1 Water Cycle Experiment
- 1.2 The Water Cycle
- 1.3 Human Water Usage

Preparation Time

30 minutes

Materials

- Water Cycle Experiment Materials: Large bowl, mug that fits in the center of the bucket, salt, food coloring, stirring rod or spoon, plastic wrap, string, pebble
- Post-it Notes
- Markers

Additional Resources

- Water Use in the United States, USGS: <http://water.usgs.gov/watuse/wuto.html>
- EPA Water Resources <http://www.epa.gov/climatechange/impacts-adaptation/water.html>

Lesson 1: Water - A Precious Resource

Water is a valuable natural resource: it is essential for all life on the planet; it is the foundation of every ecosystem; and humans need it for every day necessities. This lesson introduces students to the significant role water plays in our daily lives and in the ecosystem. Students will learn about basic water science and the water cycle through an experiment.

Then, students will brainstorm about the various ways we use water, both directly and indirectly, in our daily lives. Water is a precious resource and although we often take it for granted, accessibility, quality, and affordability of water are critical issues for many people around the world. While water may seem plentiful, students will learn about freshwater scarcity through a demonstration activity.

KEY WORDS

Water Cycle: The water cycle describes the continuous movement of water on, above, and below the surface of the Earth

Transpiration: Water within a plant that is released into the atmosphere through its leaves

Sublimation: The transition of a substance directly from the solid to the gas phase without passing through an intermediate liquid phase

Infiltration: The process by which water on the surface enters the soil

Surface Runoff: The flow of water that occurs when excess water from rain, meltwater (water resulting from melting snow and ice), or other sources flows over the earth's surface

Groundwater: The water located beneath the earth's surface in soil pore spaces and in fractures of rock formations

Scarcity: Short supply of a limited resource

Potable: Water that is safe for drinking and domestic uses

Wastewater: Used water that goes down the drain

PREPARATION

Prior to this lesson, review background material and become familiar with the Water Cycle Bucket Experiment and Water Scarcity Apple Demonstration. Gather materials.

SETTING THE STAGE: THE WATER CYCLE

Water is essential to all life on the planet. All animals and plants need to take it up into their cells, one way or another. Water is the foundation of all ecosystems on the planet, from oceans, to rainforests, to mountains – even deserts. Today, we will explore the **water cycle** to understand how water moves around the earth and observe the key processes of evaporation, condensation, and precipitation in action.

ACTIVITY 1: WATER CYCLE EXPERIMENT

Materials:

- Large bowl
- Mug that fits in the center of the large bowl
- Salt
- Food coloring
- Stirring rod or spoon
- Plastic wrap
- String
- Pebble



Depending on the number of students, this activity can be conducted as a single class experiment or in small groups of 5 students. Pass out a copy of Handout 1.1: Water Cycle Bucket Experiment to each student and have a volunteer read the directions aloud to the group. Now that the students are familiar with the procedure, give them a few minutes to silently consider and write down their own hypothesis on Handout 1.1. Once everyone has created a hypothesis, students can begin the experiment.

Procedure:

1. Gather all materials. In order for students to taste test the water in the mug at the end of the experiment, make sure all materials are clean.
2. Pour tap water into the large bowl until it is about $\frac{1}{4}$ full. To speed up the experiment, use hot water.
3. Place the large bowl in a sunny place outside or near a sunny classroom window.
4. Add salt and a few drops of food coloring to water in the large bowl. Using the stirring rod or spoon, stir well to make sure the salt dissolves.



5. Place the empty mug in the center of the large bowl. The mug needs to be heavy enough that it does not float. Be careful not to splash any water into it.



6. Cover the top of the bowl tightly with the plastic wrap.
7. Tie the string around the bowl to hold the plastic wrap in place.
8. Place a small pebble in the center of the plastic wrap so that the plastic wrap slightly dips in the center.



9. Make observations of the bowl in 10 minutes, and again at 15 minutes. Be sure to record these observations in detail, drawing pictures if necessary. Carefully remove the plastic wrap and make observations about what you see in the mug.

While students are waiting to make their observations, ask students to share their hypotheses. Once students have made their final observations, regroup as a class to discuss the results:

- Describe your observations. Was the mug empty at the end of the experiment?
- What does this experiment represent? The large bowl of water? The mug? The plastic wrap?
- Why did we add salt and food coloring to the water? What do these represent?
- What would happen if the plastic wrap was dirty, and what does this simulate?

DISCUSSION: THE WATER CYCLE

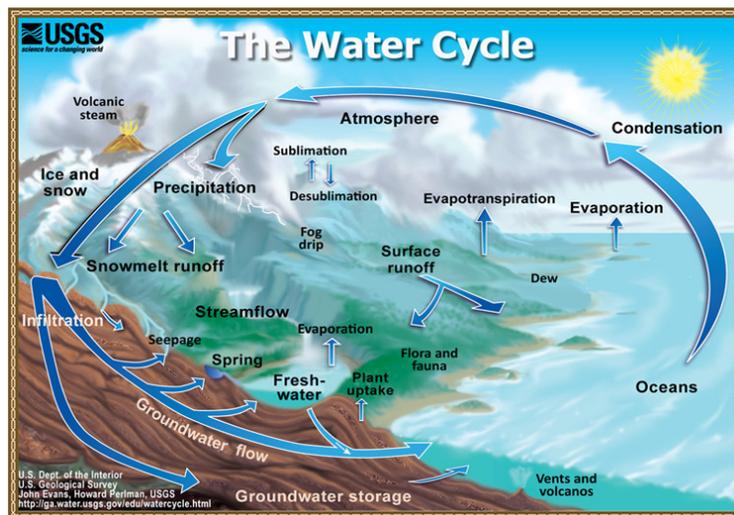
The water cycle is the natural flow of water on our planet from oceans, to atmosphere, to land, and into the ground. The water cycle naturally creates fresh water through evaporation, **transpiration**, condensation, and precipitation. Using Handout 1.2: The Water Cycle, guide students through the various ways water flows and moves around the earth, explaining key words.



Optional 7 minute Video, "The Water Cycle" by the National Science Foundation:

<https://www.youtube.com/watch?v=al-do-HGulk>

This National Science Foundation video uses animation, graphics, and video clips to illustrate and explain each of the flow and storage processes in the Hydrologic Cycle, more commonly known as the Water Cycle: precipitation, interception, runoff, infiltration, percolation, groundwater discharge, evaporation, transpiration, evapotranspiration, and condensation.



- Ask students what they notice about this diagram – is the diagram a complete description of the water cycle? Why or why not?
- Guide students to notice that this diagram does not show how humans interact with the water cycle. With increasing populations, humans are playing a larger role in the water cycle. In the following activity, we will brainstorm all of the ways humans use water.

¹ United States Geological Survey: The Water Cycle. <http://ga.water.usgs.gov/edu/watercycle.html>