



Introduction

a. Modeling the Water Cycle

Do you realize that without the water cycle our health would suffer...in fact, forget about our health! Life could not survive on planet Earth without the water cycle. The recycling of water on the Earth allows for its continual use. The water that you drink, swim in, and see today is the same exact water that the dinosaurs used millions of years ago. It may sound funny, but the water cycle could not occur without heat, primarily from sunlight. In this activity students will have the opportunity to model and observe the driving force behind the water cycle – heat from the sun. They will also have the opportunity to learn about acid rain and how it can impact human health.

b. Water Quality & Human Health

Water quality is a serious issue worldwide. Nearly 1 billion people in the world do not have access to safe drinking water, and poor water quality accounts for more than 2 million deaths worldwide, most of which are children under the age of five. In this activity students will have the opportunity to test the quality of water from a fresh water source of their choice. Following the water quality test, students will have the opportunity to research and investigate the impact of water quality on our health.

Next Generation Science/Common Core Standards

Students who demonstrate understanding can:

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

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

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.

***Medical Application:** At different points in the water cycle organic and inorganic pollutants can enter water reservoirs and reduce water quality. The quality of water can have an adverse impact on human health.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. Develop a model to describe unobservable mechanisms. <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to provide evidence for phenomena. <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. 	<p>ESS2.A: Earth’s Materials and Systems</p> <ul style="list-style-type: none"> All Earth processes are the result of energy flowing and matter cycling within and among planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms. The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future. <p>ESS2.C: The Roles of Water in Earth’s Surface Processes</p> <ul style="list-style-type: none"> Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and 	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. <p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. <p>Stability and Change</p> <ul style="list-style-type: none"> Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.

	<p>precipitation, as well as downhill flows on land.</p> <ul style="list-style-type: none"> • Global movements of water and its changes in form are propelled by sunlight and gravity. • Water’s movements—both on land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations. 	
<p><i>Connections to other DCIs in this grade-band:</i> MS.PS1.A, MS.PS1.B, MS.PS2.B, MS.PS3.A, MS.PS3.B, MS.PS3.D, MS.LS2.B, MS.LS2.C, MS.ESS1.B, MS.ESS3.C</p>		
<p><i>Articulation to DCIs across grade-levels:</i> 3.PS2.A, 4.PS3.B, 4.ESS1.C, 4.ESS2.A, 4.ESS2.E, 5.PS2.B, 5.ESS2.A, 5.ESS2.C, HS.PS1.B, HS.PS2.B, HS.PS3.B, HS.PS3.D, HS.PS4.B, HS.LS1.C, HS.LS2.B, HS.ESS1.C, HS.ESS2.A, HS.ESS2.B, HS.ESS2.C, HS.ESS2.D, HS.ESS2.E, HS.ESS3.D</p>		
<p><i>Common Core State Standards Connections:</i></p> <p><i>ELA/Literacy –</i></p> <p>RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.</p> <p>WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.</p> <p>SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.</p> <p><i>Mathematics –</i></p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.</p> <p>7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</p>		

Learning Targets

By the end of this activity students will be able to:

- Develop a model to describe the cycling of Earth’s water and the flow of energy that drives the process
- Develop a model that demonstrates the effect of the sun and the force of gravity on the water cycle
- Test the quality of drinking water to determine its safety level
- Identify pollutants that can contaminate the water supply and adversely impact human health

Time

<i>Estimated Time</i>	<i>Actual Time (please make note below)</i>
04a. 1 day	
04b. 55-60 minutes	

Materials

Supply	Provided (P) or Needed (N)	Reusable? Yes/No	Quantity	Company/ Item #	Approximate Cost
04a. Modeling the Water Cycle					
Large plastic bags	P	Y	20	Grocery	\$3.00
Green food color	P	N	1	Grocery	\$2.50
Clear cup	P	Y	20	Grocery	\$3.00
Tape	N	N	1 roll	-	-
Marker	N	Y	10	-	-
Water	N	N	As needed	-	-

04b. Water Quality & Human Health					
Water test strips	P	N	10	Amazon/ B0053PQWEU	\$23.50
Water test strip sheet	P	Y	10	HASPI	Cost of copies
Thermometer	N	Y	10	-	-
Water samples	N	N	10	Students collect	-
Paper towels	N	N	As needed	-	-

Company Contact Information:		
Amazon www.amazon.com	HASPI www.haspi.com Download free online	Grocery <i>Can be found at any local grocery store</i>

Additional Information

Information	Page #	Location
Any color of food coloring can be used. The food coloring is simply present to demonstrate that most dissolved solutes do not evaporate.		04a
The bags can be left in each location longer and checked periodically. This would particularly be helpful if it is overcast during the lab.		04a
The water quality test results are reflective of freshwater sources only. Different types of test strips are needed to test salt water.		04b

Resources and References

- ACMP. 2008. Water Cycle Bag. UAF Geophysical Institute.
- Laiwalla, A. and McCabe. A. 2009. Water Investigation. UCLA SEE-LA GK-12 Program, UCLA.
- Posner, A.J. 2010. Water Quality in Freshwater Systems. National Geographic.
- USGS. 2010. Public Water Supply Use. <http://ga.water.usgs.gov/edu/wups.html>.
- WHO. 2015. Facts and figures on water quality and health. http://www.who.int/water_sanitation_health/facts_figures/en/.

Images

- <https://thinkbannedthoughts.files.wordpress.com/2014/05/water-cycle-art2a.png>
- <http://www.facegfx.com/psd/earth-and-water-psd>
- <http://pentagist.com/wpcontent/uploads/2014/08/>
- www.sydneywater.com.au
- https://c2.staticflickr.com/4/3381/3233464486_1c8f5907d0_m.jpg
- <http://mikerendell.com/wp-content/uploads/2012/05/water-jar.jp>

