

Sample Water Lesson Module
Healing Earth

Instruction Level	Approx. Time (min)	Activities	Materials Needed	Main Content Area(s)
ENGAGE	20	<p><i>Wonder and Awe of Water</i></p> <p>Provide detailed pictures of water in various forms (ice, liquid, steam, snowflake) through prints or on a projector. An example set of pictures will be included as an attachment. Ask students to take a few minutes to look through the photos and to write down their answers to the following questions for each photo: what do you think of when looking at this picture? What does this picture convey about water? After allowing the students to write down their thoughts. Ask them to pair off and share their answers to the questions. Then introduce the module, which will focus on the properties and uses of water. Book Reference: <i>A Drop of Water: A Book of Science and Wonder</i></p>	Pictures of water printed or on a screen	Spirituality, Science
EXPLORE	45-50	<p><i>How does water work on a molecular level?</i></p> <p><i>Science writing heuristic lab activity</i></p> <ul style="list-style-type: none"> - Have students investigate properties of water with the attached science writing heuristic and listed materials - Have students individually try to explain their observations about the behavior of water in a short writing assignment. - Consider asking students to talk in small groups and try to draw a picture model of what they think is happening on a molecular level in one of these demonstrations. Then, have students share and discuss their models. This discussion should reveal significant understandings or misunderstandings of water molecules. <p>Provide some lecture-based content on water at the molecular level, including: solvency, surface tension, polarity, physical states, why water is unique, and why water matters.</p>	Cups of water, paper clips, pennies, straws, glass slides, wax paper, paper strip with a marker dot, jean or cloth strip, glass test tube	Science

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EXPLAIN	45-50	<p><i>Hydrologic Cycles</i></p> <p>Prepare a content lecture focused on the hydrologic cycles, drawing on previous chapters as necessary, such as biomes.</p>	Lecture slides or notes	Science
EVALUATE	40 (More outside of class for student s)	<p><i>Part I: Human uses of water</i></p> <p>Activity adapted from Michael L. Roa’s <i>Environmental Science Activities Kit</i> Second Edition, activity 23.1 “‘Water’ We Going to Do?”</p> <p>Have your students predict how much water they use directly each day. Then do a more structured measurement over a day or a week, using the attached worksheet as an example. Compare to average water usage in other countries (http://healingearth-dev.ijep.net/water/photo/15-daily-capita-use-water-photo). Consider sharing your classroom’s average water usage data with the <i>Healing Earth</i> community on Facebook or the teacher forum. Present statistics about uses of water in your country and in the home, especially “hidden” water usage such as in clothing and agriculture (find a compelling infographic about water usage of food here). Discuss some ways to save water, and have students compare which options are more effective.</p>	Worksheets for water usage, projector or way to present statistics, <i>HE</i> science section	Science, Action, Global Awareness
	45	<p><i>Part II: How do different religions understand water?</i></p> <p>The chapter includes examples of a few religious understandings of water: the Hindu belief in the Goddess Ganga, Indigenous peoples’ beliefs in the power of water, Jewish and Christian ritual symbolism of water, and Muslim scripture references to water.</p> <p>Have students pick one of these religions or one not mentioned and research how water plays a role in more detail. This UNESCO site might be a good place to start: http://www.unesco.org/water/news/newsletter/122.shtml. In groups, have students create a poster or a video summarizing what they learned about this religion and about water. Allow students to view the</p>	Internet access for students, posters and supplies for drawing, video editing software (optional)	Spirituality, Global Awareness

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		<p>posters or videos in the classroom or on their own time.</p> <p>Close this activity with a brief discussion asking students to share one thing they learned about the religious connections of water. Also ask if any of their personal religious beliefs connect with something that they read.</p> <p><i>Spiritual beliefs directly impact ethical considerations. The Case Study in this chapter about the River Ganges and Mallika provides a transition piece between these religious and ethical activities. Have your students read the case study again or give a summary to introduce the next activity.</i></p>		
ELABORATE	45-60	<p><i>Is access to water a human right?</i></p> <p>Pose the question to students. Present definition of “human right:” Moral powers of human personhood by virtue of human dignity that call for a person or group’s immunity from unjust harm (e.g. the right not to have my bodily integrity abused, the right not to have my expression of ideas suppressed, the right not to have by practice of religion forbidden) and <i>entitlement to basic goods</i> necessary for life (e.g. my right to food, my right to shelter, my right to health care). Ask students to jot down some of their own thoughts first. Present a few paragraphs of specific opinions presented below, or others that you find. Some debate points can be found here: http://debatewise.org/debates/3045-water-resources-a-commodity/#yes4.</p> <p>“Treating water as a commodity that can be traded will be good for downstream states as it creates an incentive for upstream states to take account of their interests. By paying an appropriate rate for their water supplies, they can ensure regular flows and influence policy. For example, in order to profit from water as a commodity, upstream states may forego dam building, improve the efficiency of agricultural irrigation practices, and</p>	A projector or printout of the included quotes, Student notebooks	Ethics

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		<p>maintain large forest areas that are crucial to a healthy water cycle. Such leverage can only be achieved through treating water as a commodity; international agreements are too easily broken by new governments.”</p> <ul style="list-style-type: none"> – Debatewise.org http://debatewise.org/debates/3045-water-resources-a-commodity/#yes4 <p>“Water is a limited natural resource and a public good fundamental for life and health. The human right to water is indispensable for leading a life in human dignity. It is a prerequisite for the realization of other human rights... The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. An adequate amount of safe water is necessary to prevent death from dehydration, to reduce the risk of water-related disease and to provide for consumption, cooking, personal and domestic hygienic requirements.”</p> <ul style="list-style-type: none"> – UN Committee on Economic, Social, and Cultural Rights http://tbinternet.ohchr.org/_layouts/treatybodyexternal/Download.aspx?symbolno=E%2fC.12%2f2002%2f11&Lang=en <p>“Like gold and oil, water is a commodity – and it happens to be rather scarce... Recent years have seen an upswing in the demand for investments that seek to profit from the need for fresh, clean water. If the trend continues, and by all indications it will, investors can expect to see a host of new investments that provide exposure to this precious commodity and to the firms that deliver it to the marketplace.”</p> <ul style="list-style-type: none"> – James E. McWhinney http://www.investopedia.com/articles/06/water.asp <p>“Water will become something that is traded. There will be a market for it, and this could happen in the next decade... Water will become a commodity</p>		

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		<p>– but a very different commodity because it is also a basic human need. If you track economic growth and you agree that water is a vital input, then it will eventually become a commodity.”</p> <ul style="list-style-type: none"> – Usha Rao-Monari CEO of Global Water Development Partners http://www.telegraph.co.uk/finance/commodities/10979107/Commodities-Water-should-be-traded-on-financial-markets-to-avoid-global-crisis.html <p>“All citizens in the EU should have guaranteed water and sanitation services. At this moment there are still around 2 million people in Europe that do not have proper water or sanitation. There are also many people with low incomes that are threatened with disconnection, as they cannot afford to pay their bills.</p> <p>The European Commission should stop its constant push for liberalisation of water and sanitation services. Promoting the market to provide these services means that those who can afford more might get better services and those who can afford less will get worse services. ‘No money, no water’ is what a market for water services means. But water and sanitation are a human right. It is a government obligation and responsibility to provide these services to all people.</p> <p>Worldwide 800 million people still lack access to water and over 2 billion people do not have access to sanitation. Europe can do more and should do more to make sure that also in other parts of the world people can enjoy the human right to water and sanitation.”</p> <ul style="list-style-type: none"> – “Water is a Human Right” European Citizen’s Initiative (ECI) http://www.right2water.eu <p>Have students pick one of these opinions with which they agree and explain why in their notebooks using the ethical terms from class. Then, have them</p>		

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		<p>respond to an opinion with which they disagree and explain why. Consider having students draft a letter to a government agency (local, national, or international) about the issue of water as a human right.</p> <p>How can the moral virtues (Justice, Temperance, Generosity, Kindness, Prudence, and Gratitude) help transform the ways we use water individually and as a society?</p> <p>Finally, return to the pictures used at the beginning of the module. Ask students to take time again to look at the photos and to write down any additional thought or piece of information that the picture conveys to them after this water chapter.</p>		

Using the Science Writing Heuristic (SWH) Approach to Investigate the Properties of Water

Introduction:

The Science Writing Heuristic (SWH) is a framework for student-centered labs in which the students develop their own beginning questions, consider the safety of their experiment, develop a procedure to test their question, gather observations through experimentation, make claims based on evidence from their experiment, and summarize their learning through further reading and a written reflection. A helpful overview of an SWH approach can be found at <http://group.chem.iastate.edu/Greenbowe/sections/SWHtg.htm>. Students keep a science notebook throughout the experiment that is organized into these basic sections:

- Beginning questions
- Safety
- Procedures
- Data/observations
- Claims/evidence
- Reading/reflections

In this lab, students are asked to use this structure to investigate various properties of water.

Possible Materials:

Cups of water, paper clips, pennies, straws, glass slides, wax paper, paper strip with a marker dot, jean or cloth strip, glass test tube,

Vocabulary and Topics Included:

- Adhesion – a property characterized by one substance sticking or adhering to something else
- Cohesion – a property characterized by one substance tending to stick to itself and to form a single unit rather than separate pieces
- Surface Tension – the property of liquids which leads them to acquire the least surface area possible, normally by forming droplets
- Capillary Action – the property of a liquid to flow without the need of an external force, often in opposition to gravity.

Instructions for Students:

In your notebook, write down some ideas for a testable question involving each of the following properties of water: adhesion, cohesion, surface tension, capillary action, polar substance, and non-polar substance. How could you test each of these properties using the provided materials? Next, list in your notebook any safety concerns that might come up while using these materials. Then prepare a possible procedure of how you might test your beginning questions.

Write your testable questions on the board under each of the properties. Decide as a class the question that best evaluates each property of water. Modify your procedure according to the collective choice. Now, conduct the experiment, trying to demonstrate each of the properties with the given materials. Be sure to record your data and observations as you carry out the procedure. When you are finished with your own procedure, check in with your classmates and

see if they need any help demonstrating the water properties.

After collecting all of your data, begin to form some claims about how water interacts with other substances and itself. Did you demonstrate all of the properties? What evidence do you have from your experiment to support your claims? Prepare a chart to summarize your findings and to share your claims with your classmates.

Finally, in your notebook, reflect on the following questions from your experiment:

1. How have your ideas about the properties of water changed in this lab?
2. What new questions do you have about water?
3. How do your experimental results compare with those of your classmates?
4. Have you identified and explained sources of error from your experiment?
5. How does this experiment compare with what you have learned about water in class or through *Healing Earth*?
6. Are there any real-life applications that you can think of involving the properties of water that you explored today?
7. Have you researched or read any outside material connected with these topics, and have you cited those resources correctly?

Post-lab Questions

Answer the following questions after completing the entire lab:

1. Which property of water was the easiest to demonstrate? The most difficult?
2. Which materials that you tested are polar and which are non-polar? How could you use the properties of water to test the polarity of other substances?

Personal Water Use Worksheet

adapted from Michael L. Roa's *Environmental Science Activities Kit* Second Edition, activity 23.1 "Water We Going to Do?"

Predicted Water Use

Before measuring how much water you use in your daily life, predict how much water you think you use each day and each week.

I think I use about _____ gallons of water per day and _____ gallons per week.

Actual Water Use

For the next 24 hours, fill in the chart below to track your daily water usage. You may use the estimated gallons included or actually measure the amount of water used for each activity. Then use these data to estimate your weekly water usage.

Activity	Times Per Day	Water Used Each Time		Total Used	
		Estimated Gallons	Measured Gallons	Per Day	Per Week
Bathing		30 ⁽¹⁾			
Showering		2.5/minute ⁽²⁾			
Flushing toilets		5 ⁽³⁾			
Washing face/hands		5 ⁽⁴⁾			
Getting a drink		0.25 ⁽⁵⁾			
Brushing teeth		2 ⁽⁶⁾			
Cooking		10 ⁽⁷⁾			
Washing clothes		60 ⁽⁸⁾			
Washing dishes		30 ⁽⁹⁾			
Other					
Totals (include things that don't happen every week)					

- *estimate notes:
- (1) depends on how full the tub is
 - (2) 2.0 gal/minute with low-flow head
 - (3) 1.5 gal with water-saver toilet
 - (4) 2 gal if you turn water off
 - (5) includes running water to cool it
 - (6) 0.25 if you turn water off
 - (7) per meal, includes rinsing
 - (8) large load
 - (9) 10 gallons with dishwasher or if you use two 5-gallon pans