

Where In The World Is Hydra Electron?

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Objective of the Lesson:

This exercise is designed to allow students to:

- ✧ Learn the water cycle.
 - ✧ Understand the many functions of water.
 - ✧ Apply this information to cause and effects of water quality.
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Standards Addressed:

Science

K-3	4-5	6-8
Standard 1 <i>Nature and Application of Science and Technology</i> A-1	Standard 1 <i>Nature and Application of Science and Technology</i> A-1	Standard 1 <i>Nature and Application of Science and Technology</i> A-1
Standard 5 <i>Earth's Dynamic Systems</i> A-3	Standard 5 <i>Earth's Dynamic Systems</i> A-3 C-1	Standard 5 <i>Earth's Dynamic Systems</i> A-4
Standard 8 <i>Ecology</i> A-1	Standard 8 <i>Ecology</i> A-1 B-3	_____

Materials Needed:

- ✧ Buckets or glasses to pour water into
 - ✧ A bucket or two of water (depending on the demonstrations you choose)
 - ✧ Miscellaneous objects of trash, toys, coins, etc.
 - ✧ A funnel
 - ✧ Cheese-cloth or similar material inside the funnel
 - ✧ Items to discolor water (food colors, condiments, syrups)
 - ✧ River Rocks (smooth rocks)
 - ✧ Broken rocks (rough edged rocks)
 - ✧ Two magnets and a small jar of iron flakes/iron filings
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Teaching Tips:

- ✧ This lesson is designed for students in grades 1-8.
 - ✧ This journey can take place inside or outside. If conditions are suiting, design a hike that visits different portions of the water cycle with pre-established stations for each portion of the journey. At each station, discuss the main point of the water cycle and provide an opportunity for the students to explore or interact with the topic being presented.
 - ✧ If the lesson is done inside, the group can move to the different stations if it is in a large room, or the stations can be pre-designed so each step is quickly and easily available below a table or designated area.
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Procedure:

The Journey

- ✧ You've just been flushed
 1. Everything goes down the drain.
 - ✧ Have the students make a list of some of the many things that may be flushed down the sink (e.g. paints, oils, food, paper, toys, money, cleaning products, misc. chemicals).
 - ✧ Refer to the list throughout the exercise as examples.
 2. Everything travels to the treatment plant.
 - ✧ Make the point that things don't just "disappear" once they go down the drain. Everything travels down enclosed pipes and the water is either cleaned to a certain standard (not 100% clean) before it is released, or the water is directly discharged (as during storm events) with everything still in it.
 - ✧ You can provide props of funny objects found in rivers, lakes, and oceans (shoes, tires, general trash items) as well as things to discolor water (i.e. food coloring as chemicals, syrups as motor oil).
- ✧ Scrub-a-dub
 3. Filter the solids.
 - ✧ Use cheesecloth, cotton, or a sand column to filter an overly chunky glass or bucket of water.
 - ✧ You may filter plastic toys, coins, etc. to demonstrate solids filtration.
 4. Scrub the liquids.
 - ✧ In a glass of water, add a "pinch" of soil, containing iron flakes and a small magnet.
 - ✧ Stir the water, and pull the magnet up (with another magnet on a stick or string).
 - ✧ This demonstrates the chemical additives in the waste treatment process that chelates or attracts those particles in the water with a magnetic charge.
- ✧ River Rafters
 5. Water leaves the treatment plant and is introduced to the river system.
 - ✧ Emphasize when the water leaves the plant, it must meet certain standards, which is not "pure" water – but is much cleaner than when it went into the treatment plant.
 6. Travel the paths of the water to the ocean and the earth.
 - ✧ Walk or hike to the next station.

- ✧ Solicit ideas for all the different places water goes once it leaves the treatment plant.
7. Functions of water in the river system.
- ✧ Ask for their ideas why water is important for river animals.
 - a. Rivers carry food for plants and animals.
 - o If time permits, look for aquatic bugs and animals in a stream or lake if it is available. Explain that the bugs eat tiny plants and animals as they float by in the water. The plants gain some of their nutrients they need to grow that the water brings with it down the stream or in the lake.
 - b. Rivers carry oxygen and other gasses for plants and animals.
 - o The same animals depend on healthy, oxygenated water to breath. Examples are animals that live underwater (e.g. fish, tadpoles, insects).
 - c. Rivers act as the home to many plants and animals.
 - o Integrate the two previous points to the need for a healthy place to live and reproduce for continued growth as a part of the larger ecosystem.
 - d. Water picks up and drops off most everything with which it interacts
 - o If outside, show examples of upland or stream bank erosion and how water carries soil away. Explain the differences between river stones to broken or fragmented stone and how water smoothes or carries away pieces of even very hard objects in addition to those easily carried away (chemicals or solutions).
 - o If inside, use water to dissolve liquids (food color), semi-liquids (syrups), , and solids (show river rocks vs. broken rocks). Show pictures of erosion, landslides, and sinkholes to exemplify how much material water is capable of moving.
- ✧ Ocean wanderers
8. Functions of water in the ocean system
- a. The ocean water is a permanent home for creatures.
 - o Similar to the above description. Many different animals (including some beloved mammals) and plants. Solicit a list of animals to get them thinking about the diversity of species.
 - b. The ocean water provides oxygen for these creatures.
 - o Same as above, with the fishes and plants.
 - c. The ocean provides food for these creatures.
 - o Emphasize the need for clean, healthy food. This can be an opportunity for comedic relief (e.g. offer your assistant a lollipop, accidentally dropping in the dirt, but offering it again).
9. Evaporation into the atmosphere.
- a. "Cleans" the water.
 - o Opportunity to explain the simplified physical premise that water evaporates as H₂O.
 - o Other solutions will evaporate as well or are in the atmosphere already (air pollution) that may affect water quality, but it is mostly pure when it evaporates.

- b. Rains on the earth.
 - o List all of the places water can go when it rains. Include inside the earth as well as on the earth. Don't forget about the ice caps and the water they contribute.
- ✧ The Wildlife.
 - 10. The amount of water decides the habitat
 - ✧ This is an opportunity to get the group critically thinking about their environment and taking clues from their surroundings to evaluate the relative quantity and possibly the quality of water wherever they are. For example, areas with less water or rainfall may be more sensitive to water pollution. Additionally, isolated areas distinctly devoid of plants or animals, as well as sickly growth conditions may be influenced by environmental contamination.
 - ✧ List the relative rainfall quantities and resulting plant and animal populations in each ecosystem:
 - a. Desert Zones
 - b. Temperate Zones
 - c. Tropical Zones
 - 11. Water grows the food they need
 - 12. Everyone needs fresh water to survive
- ✧ Journey to the underground rivers.
 - 13. Water is always moving.
 - ✧ Water, in general, is very dynamic. Whether above ground (fast moving – rivers, evaporation, precipitation) or below ground (fast in underground rivers or slow moving through soils or rocks), water is constantly moving. The following points will focus on the importance and functions of water in the earth.
 - a. Picks up most of what it comes in contact with.
 - b. Drops off or carries away what it has picked up.
 - 14. Travels through the soils to underground rivers and lakes.
 - a. Natural filtration if in a clean environment.
 - o The soil can act as a filter, which is what the treatment plants are modeled after. It integrates the dynamic processes of chemical attraction and repulsion, properties of the soils thickness, density, and contents. A sandy soil will allow water to pass very quickly and not adsorb many contaminants. A "typical" soil passes water slower and has more interaction with the water, adsorbing and releasing chemicals from the water to the soils.
 - b. Source of contamination if in a polluted environment.
 - o Water moving through a polluted soil will help to clean the soil, reducing the amount of pollution in the polluted soil, but the water carries those pollutants with it. The same dynamics as described above (chemical attractions and repulsions, soil thickness, density, and contents) will influence how much and what kinds of pollutants will be released to the water.

✧ The return home.

15. Water supply for our homes and communities.

✧ Get the students to think about where their water comes from and what things might influence the quality of water in that water source. Common sources are given below.

- a. Rivers and lakes above and below ground
- b. Direct sources - wells
- c. Indirect sources - municipal water supplies

16. Cycle starts again.

✧ Water comes from the tap, ready to be used again.

Check for understanding:

Possible Questions

1. How is water "cleaned" after it goes down the drain?
2. Name three functions of water for plants and/or animals.
3. Find those steps in the water cycle that are most susceptible to pollution and why.
4. What can we do individually to prevent water pollution around the home?

Suggested Answers

1. The water travels in pipes in the sewage plant. Large filters capture the solid materials that were flushed. Chemicals that act like magnets capture some of the waste materials in the liquids. When the water leaves the sewage plant, it is not pure water, but it is clean to a minimum standard to protect the animals, plants, and humans that depend on water.
 2. Three functions of water are to provide gases, liquids, and solids to all plants and animals. Gases, such as oxygen, allow fish and other aquatic animals to breathe. Liquids, such as water itself or the nutrients it is carrying, provide hydration and important minerals to plants and animals. Solids are the animals that live in water as food for others, or as ice caps that provide a habitat for animals such as polar bears, penguins, and seals.
 3. All steps in the water cycle are susceptible to pollution! Chemicals flushed down the drain; ineffective cleaning at the sewage treatment plant; water pollution in the rivers, lakes, and oceans; and air pollution contributing to acid rain.
 4. It is difficult to eliminate pollution, but it is possible reduce pollution. Simple acts such as recycling food waste; using a minimum amount of soap to wash hands, dishes, clothes, and cars; not throwing things down the storm drains; properly disposing of unwanted cleaners, paints, etc, at community collection offices specifically for household wastes.
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Summary of learned material:

This lesson was designed to get everyone thinking about what they are putting down the drain. Everything that goes down the drain has been introduced to the water cycle. If it is possible to dispose of something other than flushing it down the drain, choose the proper method rather than simply flushing and forgetting. Plants, animals, and humans all depend on having clean water. Even though it seems like there's a lot of it, we only have this water. No magical space ship is going to deliver a new batch of water when all of ours is polluted! We can all do a little to reduce how much we affect the water.

Additional Resources:

General sites:

<http://earthobservatory.nasa.gov/Library/Water/> - Printable article, nice images and diagrams.

<http://www.und.edu/instruct/eng/fkarner/pages/cycle.htm> - Good supplementary questions.

<http://www.kidzone.ws/water/> - Designed for younger students. Images and activity sheets as well.

<http://ga.water.usgs.gov/edu/followdrip.html> - Follow a drip through the water cycle.

<http://www.epa.gov/grtlakes/seahome/groundwater/src/cycle.htm#menu>