DIVE IN TO THE WATER CYCLE

GRADES 3-8

MATERIALS

White paper or cardstock
Drawing materials (pencils, markers, crayons, colored pencils)
Globe or map of the world

BACKGROUND

Water is in a constant cycle. It evaporates from oceans, streams, and rivers up into the clouds, which are made of water vapor. It then falls from the clouds in the form of precipitation, soaking into the ground (infiltration), running across the land into bodies of water, or evaporating back into the air due to the heat of the sun. Some of the water that goes into the ground is taken up by the roots of plants and some of it moves through the ground, called groundwater.

Water is very important to humans; it is involved in every area of life. The average American uses about 2000 gallons of water every day, which is twice what people in some other countries use (1). The average human being would die if they went a week without water (2). Our bodies can't store water, so we need to constantly be replacing water every day.

Approximately 4 trillion gallons of water fall to Earth every day in the form of precipitation (rain, snow, hail, sleet, etc.). We need this water to grow trees, flowers, and much of the food we eat, including grains, fruits, and vegetables. Plants don't use all of the water they receive; some of it infiltrates into the ground, some runs into streams, and most of it is evaporated back into the sky.

Beyond food, another commonly-grown crop is in your clothes: cotton! It takes approximately 1,500 gallons of water to grow the cotton for just one pair of jeans, and even more water to actually make the jeans (3). For example, from the cotton field, to the factory, to the washing machine, it takes around 3,000 total gallons of water to make and maintain a single pair of Levi's jeans (4).

TEACHER PREPARATION

Read up on local water quality issues. Here are a few recommended resources:

- http://www.iowadnr.gov/Environment/WaterQuality.aspx
- http://www.epa.gov/climatechange/impacts-adaptation/midwest.html
- http://www.iowadnr.gov/Portals/idnr/uploads/aware/suggestedreadinglist_2013.pdf
- http://www.igsb.uiowa.edu/wqm/data/wqi/WqiMonthly.htm

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INSTRUCTIONS

1. Ask students to brainstorm all the places where water can be found. A map or globe can be used to illustrate where water is found globally. Prompt students to dig deeper than just oceans, rivers, and lakes... think about water being held in glaciers, underground aquifers, and in people, plants and other living organisms!

2. Distribute paper and drawing materials to each student.

3. Ask each student to create their own illustration of the water cycle. Students can use pictures, arrows, and text to illustrate water movement throughout the water cycle. Optional: Provide students with a list of water cycle processes (precipitation, infiltration, runoff, evaporation, transpiration, condensation) to integrate into their illustrations.

4. Once students have completed their illustrations, explain that while the Earth is covered in water (332.5 million cubic miles of water), 96% percent of this is salt water. It's very hard to make salt water drinkable! So that leaves only 4% as freshwater. Of this freshwater, most of it is still frozen in glaciers. A lot of it is also in the ground; there can be water in the ground under your feet when you play outside. There will never be any new water, so protecting the water resources we do have is very important. The water cycle is working hard, day in and day out, to clean and purify our water. As the song says, it's the earth's way of recycling, and the earth rocks when the water is clean! Discuss these concepts with students and brainstorm ways to keep our water clean.

DEFINITIONS

Evaporation - The process of water molecules transitioning from liquid phase to vapor phase, escaping the surface of the Earth and entering the atmosphere. Evaporation takes place as molecules of water escape from a collective body of water. This can be as small as a puddle or as large as the ocean.

Transpiration - The process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores. Transpiration is often grouped with evaporation, referred to collectively as evapotranspiration (ET).

Nonpoint source pollution - Pollution that comes from a widespread area and can't be pinpointed to one individual source. It has a cumulative effect from several different places, such as agricultural fields, fertilized lawns, or the oil that cars leak onto the road. Much of this pollution makes its way into water bodies via surface runoff.

Precipitation - Several different forms of water which fall to the ground, e.g. snow, sleet, rain, hail, etc.

Infiltration - The process of passing through. In this case we are referring to water and how it passes through, or infiltrates, soil.

Groundwater - Water found under the Earth's surface, in spaces between soil particles and rock formations. Large deposits of groundwater are referred to as aquifers. Groundwater is frequently accessed via wells to be used for such purposes as drinking water or irrigation.

Runoff - When the ground is either impermeable or saturated, runoff is the water flowing overland and all that it is carrying as it moves downhill, eventually ending up in nearby streams and rivers.

Condensation - The process of water transitioning from vapor phase to liquid phase.

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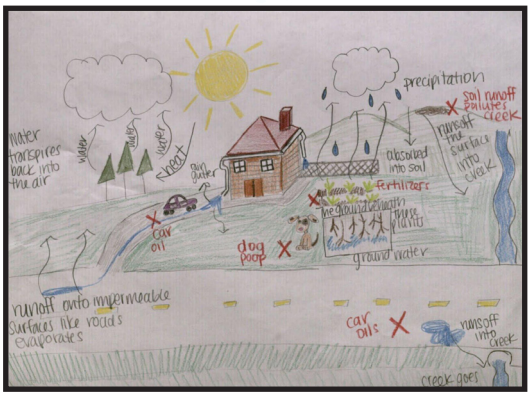
OPTIONAL EXPANSION ACTIVITY

1. Divide the class into groups of 3-4 students. Ask each group to discuss and answer the following questions:
   - What is pollution?
   - How does it happen?
   - What types of things can pollute our water here in Iowa?
   - (For Grades 6-8) What is point source pollution? What is nonpoint source pollution? How do they differ?

2. Reconvene as a class and discuss the students' responses to the questions.

3. Ask students to revisit their water cycle illustrations, thinking about possible sources of pollution. With a red crayon, colored pencil, or marker, have students mark red Xs in places where there could be pollution. A few examples include fertilizers, pet waste, oil, and loose soil being eroded.

4. Discuss as a class what can be done to prevent pollution and/or minimize its impacts.



ADDITIONAL RESOURCES

http://ga.water.usgs.gov/edu/watercycle-kids-placemat.html (USGS water cycle diagram)
http://whyfiles.org/wp-content/uploads/2010/04/hydrologic_cycle.jpg (NOAA water cycle diagram)
http://nd.water.usgs.gov/index/quiz.html (Good quiz for middle school students from USGS)
http://kids.nationalgeographic.com/kids/games/puzzlesquizzes/water-wiz/ (Kid-friendly quiz by National Geographic about personal water usage in all aspects of life, using common things like a liter bottle of pop to quantify how much water is used)
http://www.learner.org/interactives/weather/watercycle.html (Explains the water cycle as it pertains to weather in easy terms)

MATERIALS REFERENCED IN TEXT

(1) http://environment.nationalgeographic.com/environment/freshwater/change-the-course/water-footprint-calculator/
(2) http://www.livestrong.com/article/494958-how-long-can-the-average-human-go-without-water
(3) http://myhydros.org/more-about-water/how-much-water-for-stuff/
(4) http://www.levistrauss.com/sustainability/planet/water

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