The Water Cycle

Where does water come from, and where does it go?

GRADE LEVEL

- 3-6

SUBJECT AREAS

- Earth Science, Physical Science, Life Science

SKILLS

- Organize, Analyze, Interpret, Apply, Evaluate, Technology

VOCABULARY

Absorption, condensation consumption, excretion, evaporation, deposition, flow, freezing, gravity, hydrogen, liquid, melting, molecule, oxygen, percolation, precipitation, respiration, solar energy, solid, state, sublimation, transpiration, vapor

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MEASURABLE OBJECTIVES

The learner will:

- Recognize solar energy as the main driver for the movement of water on Earth.
- Describe the movement of water within the water cycle.
- Identify the three states of water and how water transitions between them.

BACKGROUND AND TEXT OVERVIEW

INTRODUCTION

The Water Cycle is the endless movement of water around the planet. Earth's natural systems are constantly moving and using water. As a liquid, gas or solid, powered by the sun and the force of gravity, water travels over, under and above the surface of the Earth in an incredible journey called the water cycle.

OLD WATER

Did you know the world has the same amount of water today as when the Earth formed long ago? According to Geologists, Earth was formed about 4.5 billion years ago. Volcanic eruptions released various gases and created a primitive atmosphere—water vapor was one of these gases. As the earth cooled the vapor condensed into liquid and water rained down onto the Earth's surface creating the ocean and seas. No significant amounts of new water have formed since long ago, and the water formed then has not disappeared. The Earth's existing water moves around the planet through a complex water cycle. The water cycle is the endless movement of water around the planet. Water changes from liquid, to solid and vapor form as it moves from place to place on the Earth's surface, in the atmosphere and under ground.

H_2O

Water is made of millions of tiny molecules—just like a cookie appears to be one solid piece, but when crumbled, it is made up of many tiny pieces. Each water molecule (smallest unit of water) contains two hydrogen (H) atoms and one atom of oxygen. These molecules constantly move. Heat makes the molecules move faster and cold makes the molecules move slower. The motion of molecules determines the state of water. In the vapor state, the molecules have a large amount of heat energy, move rapidly and are spread apart. The molecules in liquid water move more slowly and are closer together. As a solid (ice), the molecules contain the least amount of energy, so they move very slowly.

WHAT DRIVES THE WATER CYCLE?

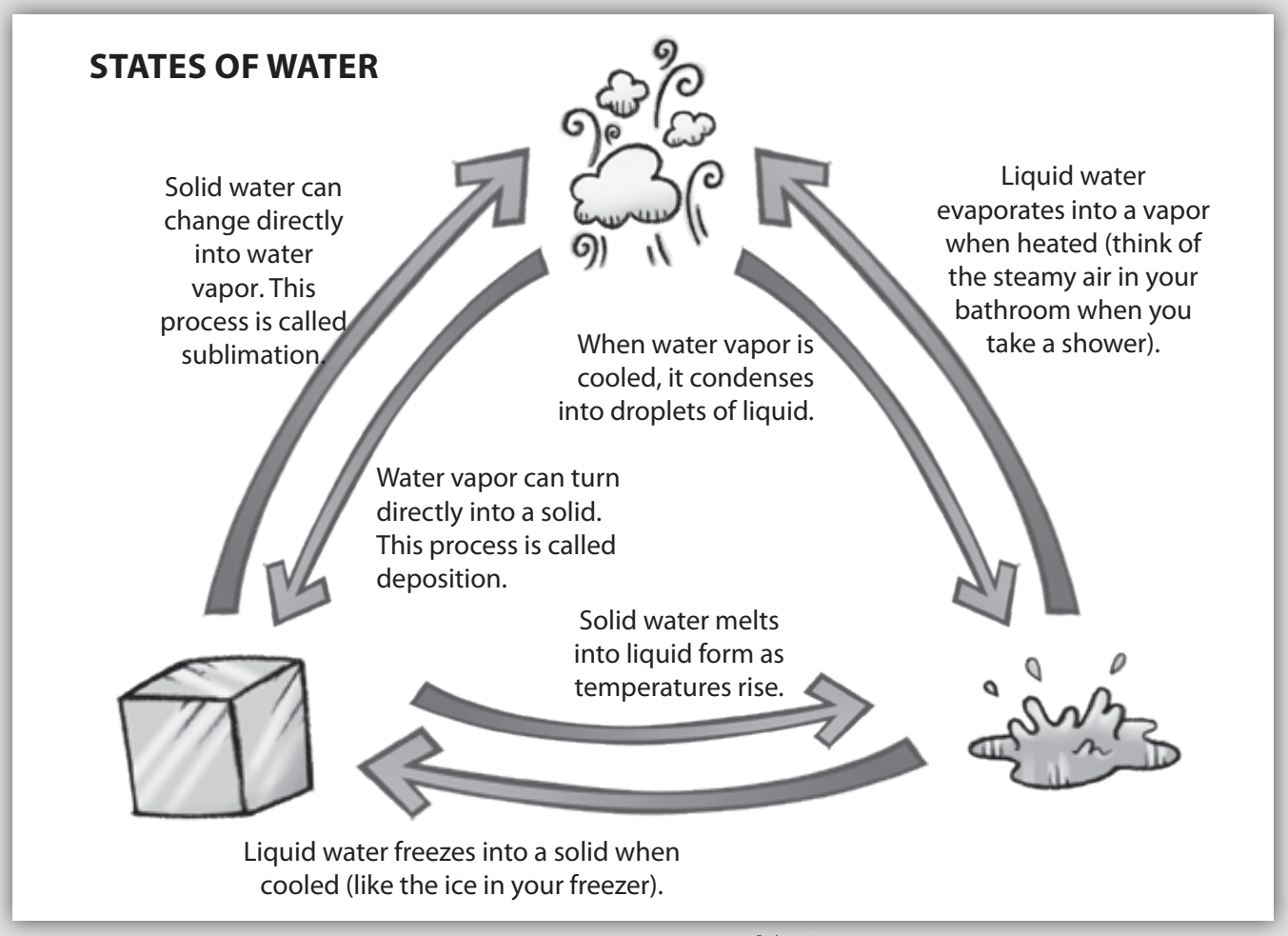
The sun provides the heat energy necessary to cause water on earth to change states and move through the water cycle. As temperatures increase ice melts and liquid water evaporates. When temperatures decrease water vapor condenses to liquid form and liquid water freezes to solid.

Another reason water moves along the Earth's surface is gravity. Water flows downhill, from higher to lower elevations due to the force of gravity. Gravity causes rivers to flow and water to seep into the ground. Earth's natural systems are constantly moving and using water. As a liquid, gas or solid, powered by the sun and the force of gravity, water travels over, under and above the surface of the Earth in an incredible journey called the water cycle.

STATES OF WATER

Water exists in three forms at the Earth's surface: liquid, solid and vapor. Liquid is the state of water with which we are most familiar. This is the form of water we drink, and in which we swim and bathe. Water vapor is the gaseous state of water. Water vapor is all around us, even though we can't see it most of the time. Water in solid form is called ice. Water changes from one state to another when heat energy is added or lost.

We all live underwater—just not necessarily under liquid water. There is water vapor in the air surrounding us all the time.



ACTIVITIES

THE WATER CYCLE ACTIVITY

Please see *The Water Cycle* student copy page.

ANSWER KEY

Please see student/teacher copy page.

TAKE ACTION!

POSTER ITEMS

1. I will wash the family's car on grass so soap doesn't enter the storm drain.

2. I will offer to water my family's plants or pets for a month.

ACTIVITIES

- Host a water festival in your community and ask students to help teach *The Incredible Journey* to festival attendees.
- Visit the local water authority to find out more about water in the community. Where does municipal water come from? (Ground water, wells, etc.) What are the local issues associated with the water supply? How would the issues affect the water cycle?
- Create a photo-documentary of the local watershed that represents each aspect of the water cycle to print in the local newspaper or post online to a blog or video site.

ASSESSMENTS

PRETEST/POSTTEST

Before students visit The Water Cycle Unit of the *Discover Water* website, have them take the following quiz to see what they already know about how water moves around our planet. Have students take the same quiz again as a posttest to measure learning.

Please see *The Water Cycle Pretest/Posttest* student copy page.

PRETEST/POSTTEST ANSWER KEY

1. True
2. True
3. True
4. True
5. False
6. The sun
7. True

CRITICAL THINKING QUESTIONS

LEVEL 1

How does water move?

Depending on grade level and expectations, answers could include discussion of flow, soaking in, percolation, consumption, excretion, transpiration, evaporation, precipitation and possibly deposition and sublimation.

LEVEL 2

Where does water come from, and where does it go?

Answers should discuss the idea that all water on earth is recycled endlessly from place to place and state to state through the water cycle.

LEVEL 3

How does the sun, which is over 92 million miles away, drive the water cycle on Earth?

Answers should include discussion of how solar energy heats water on Earth, causing it to change states from liquid to vapor.

WHAT DID I LEARN? ONLINE QUIZ ANSWER KEY

Q. Water is never used up, but cycles around the planet continuously.

A. True

Q. Water exists in which of the following states:

A. Liquid, solid and vapor

Q. When water moves from liquid form in a lake to vapor form in the air, it:

A. Evaporates

Q. The biggest force driving the water cycle is solar energy from the sun.

A. True

Q. Gravity causes water to flow over the earth's surface and into the ground.

A. True

EXTENSIONS

Ideas for ways to support and expand lesson plans about this topic or provide additional activities for advanced learners.

- Visit a local water feature (pond, lake, creek, beach—even puddle) and have students write a story about a water droplet in that location, discussing how it got there and where it might go next.
- Have students place their own dish of water inside or outside in the sun and discuss or write about where it goes when it evaporates.
- Use a ground water model to demonstrate how the water cycle continues underground.

RESOURCES

PROJECT WET RESOURCES

Project WET KIDS (Kids in Discovery Series) Booklets

- *Discover Ground Water and Springs*
- *Discover the Hudson River*
- *Discover the Waters of Nevada*
- *The Water Story*
- *Water, Every Drop Counts*

Project WET Activities

- *Adventures in Density*
- *Blue Planet*
- *Blue River*
- *Get the Ground Water Picture*
- *Just Passing Through*
- *Snow and Tell*
- *pringing Into Action*
- *Storm Water*
- *The Incredible Journey*
- *The Thunderstorm*
- *Urban Waters*
- *Your Hydrologic Bank Account*

ADDITIONAL STUDENT RESOURCES

Cassino, Mark, and Jon Nelson. 2009. *The Story of Snow*. San Francisco, CA: Chronicle Books.

Hooper, Meredith. 2008. *A Drop in My Drink: A Story of Water on Our Planet*. London, UK: Francis Lincoln Children's Books.

Locker, Thomas. 2002. *Water Dance*. San Diego, CA: Voyager Books/Harcourt.

Rice, William B. 2010. *Inside the Water Cycle*. Minneapolis, MN: Compass Point Books.

Waldman, Neil. 2003. *The Snowflake: A Water Cycle Story*. Minneapolis, MN: Millbrook Press.

ADDITIONAL EDUCATOR RESOURCES

Hrennikoff, Margo. 2006. "Implementing an Imaginative Unit: Wonders of the Water Cycle." *Educational Perspectives*, 39 (2), 27-33.

McDuffie, Thomas. 2007. "Precipitation Matters." *Science and Children*, 44 (9), 38-42.

Robertson, William C. 2005. *Air, Water, and Weather: Stop Faking It! Finally Understanding Science So You Can Teach It*. Arlington, VA: National Science Teacher Association.

Shepardson, Daniel P., Bryan Wee, Michelle Priddy, Lauren Schellenberger, and John Harbor. 2009. "Water Transformation and Storage in the Mountains and at the Coast: Midwest Students' Disconnected Conceptions of the Hydrologic Cycle." *International Journal of Science Education*, 31 (11), 1447-1471.

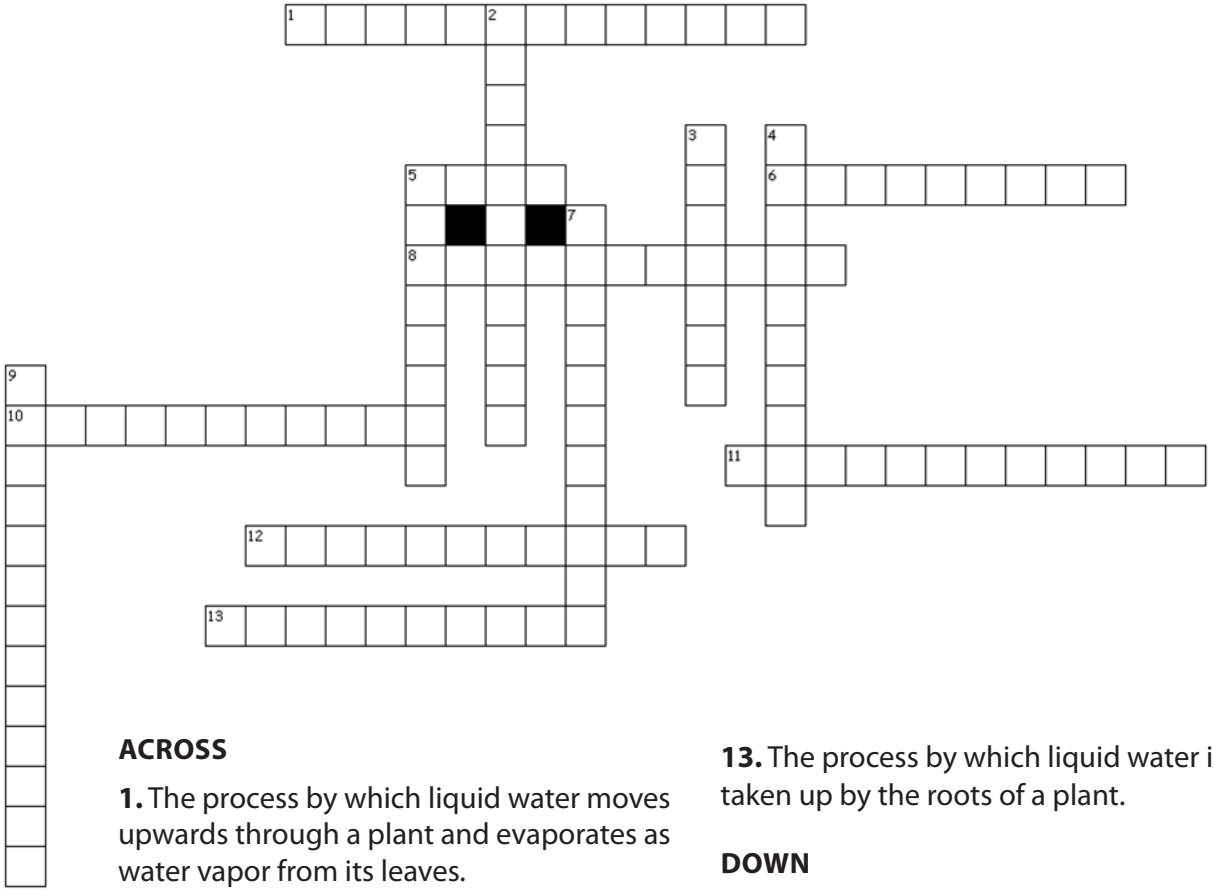
Toft, Joanne and Kathy Scoggin. 2007. "The Ripple Effect." *Science and Children*, 45 (3), 21-23.

Vowell, Julie and Marianne Phillips. 2007. "A Drop through Time." *Science and Children*, 44 (9), 30-34.

THE WATER CYCLE ACTIVITY

Use the words below to complete the crossword puzzle.

Evaporation	Sublimation	Transpiration
Condensation	Deposition	Respiration
Precipitation	Percolation	Consumption
Melting	Flow	Excretion
Freezing	Absorption	



ACROSS

1. The process by which liquid water moves upwards through a plant and evaporates as water vapor from its leaves.

5. The movement of liquid water from higher to lower elevation due to gravity.

6. The process by which water leaves an animal through waste removal.

8. The process by which liquid water changes to water vapor.

10. The process by which water vapor is exhaled and inhaled an animal breathes.

11. The process by which water vapor changes to liquid water.

12. The process by which solid water (ice) changes directly to water vapor.

13. The process by which liquid water is taken up by the roots of a plant.

DOWN

2. The movement of liquid water through pore spaces under ground.

3. The process by which solid water (ice) changes to liquid water.

4. The process by which water vapor changes directly to solid water (ice).

5. The process by which liquid water changes to solid water (ice).

7. The process by which water enters an animal through eating and drinking.

9. Water falling as rain or snow from the atmosphere to Earth.

THE WATER CYCLE ACTIVITY (Answer Key)

Use the words below to complete the crossword puzzle.

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Condensation	Deposition	Respiration
Precipitation	Percolation	Consumption
Melting	Flow	Excretion
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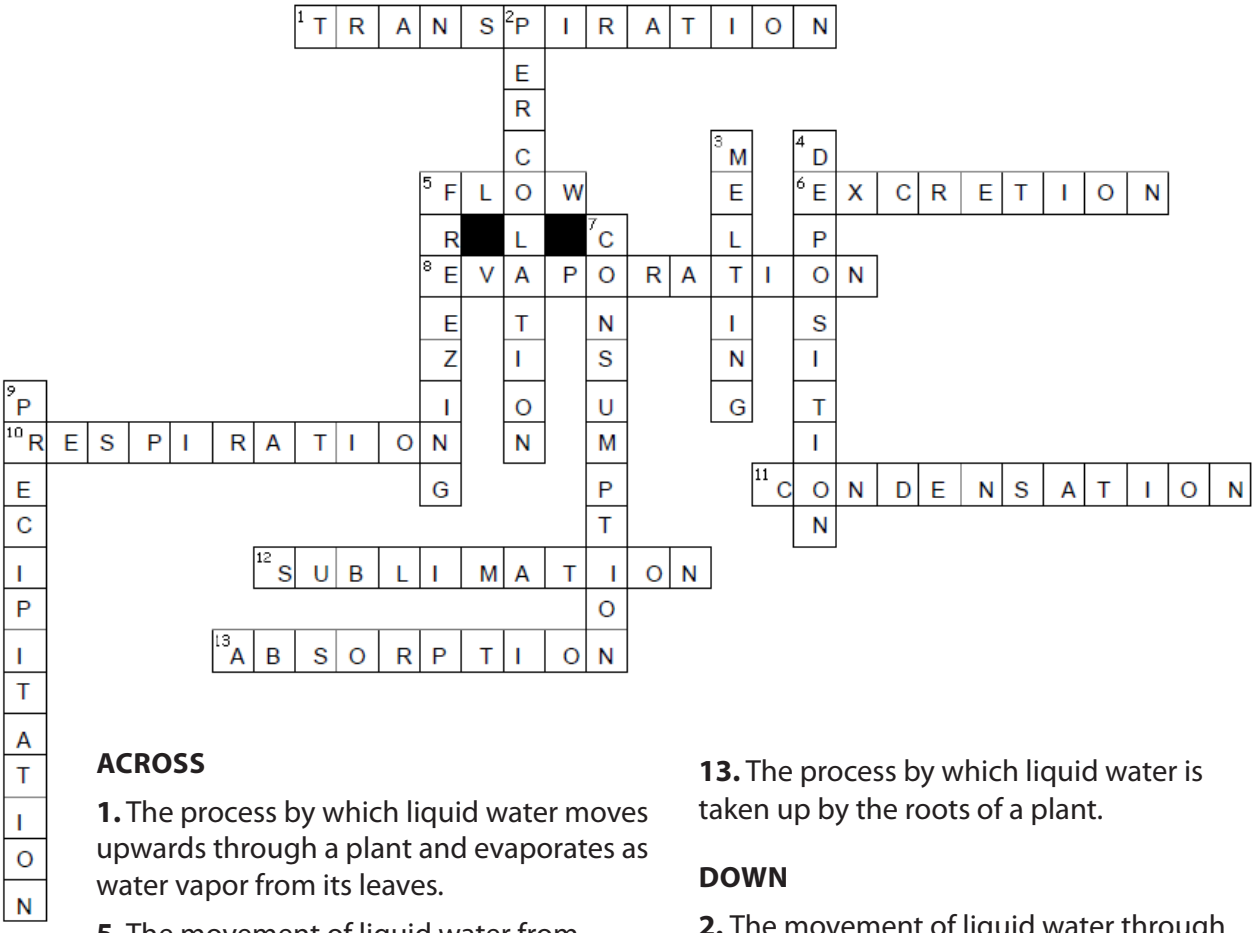

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The Water Cycle Unit Pretest/Posttest

1. True or false, no significant amounts of new water have formed on earth for millions of years.

2. True or false, water is constantly moving from place to place around the planet.

3. True or false, each water molecule is made up of two Hydrogen atoms and one Oxygen atom.

4. True or false, molecules in water vapor move fast.

5. True or false, molecules in solid water (ice) move fast.

6. The main source of energy driving the water cycle is
   a. The moon
   b. Gravity
   c. The sun
   d. Wind

7. True or false, water can change directly from its solid state to vapor.

Score: ___/7