The Water Cycle

Week 1 – Day 3

Lesson Overview

The purpose of this lesson is to teach students about the water cycle and highlight the role of plants in the water cycle. This lesson explores more deeply the role of water as a component that plants need for growth introduced in the previous lessons.

Lesson Vocabulary

water cycle, transpiration, evaporation, condensation, precipitation, plants, roots, xylem, and stomata

Standards and Learning Targets for Lesson
Learning Targets • I can describe the major components of the water cycle. • I can explain the role of plants in the water cycle.
Next Generation Science Standards • 5-ESS2 -1 – Earth's Systems - Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
Idaho Science Standards • 5.S.4.1.1 – Earth and Space Systems - Describe the interactions among the solid earth, oceans, and atmosphere. • 5.S.1.6.4 – Understand Scientific Inquiry and Develop Critical Thinking Skills - Use evidence to analyze descriptions, explanations, predictions, and models.
Common Core ELA Standards • W.5.7 – Writing - Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

Materials

- Jar of water (You can use the same jar from Day 1 of this week.)
- Water Cycle Game supplies:
  - Signs (Print one copy, cut out the signs, and hang one at each of nine stations.)
  - Station cards (Print, cut out, and place at each station. Tip: print two or three copies. It will be easier for students to read and move quickly with multiple copies at each station.)
  - Dice: two or three dice at each of nine stations
  - Blank paper: one sheet for each student to draw their journey through the water cycle

- U.S. Geological Survey (USGS) water cycle diagram: regular and kid versions as PDFs (See websites in Resources section below for other downloadable and online interactive versions.)
- Computer and projector for showing water cycle diagram
- Transpiration demonstration: set up on Day 1 of this week
- Xylem demonstration: set up on Day 2 of this week

Lesson Duration

Approximately 2 hours

Lesson Description

Engage (10 minutes)

- Hold up a jar of water in front of the class. Tell them that you just filled it from the sink this morning (or two days ago) and ask the students, *How old is this water?*
  - Have students write their answers in their science notebooks and explain their answers. Once they have finished writing their responses, let them know that we will revisit their responses at the end of today's lesson.
- Have students work in groups to make a list of all the places in the world where water exists. Ask for a few examples to get them started (i.e., lake, rain, ocean, etc.).
  - Ask a few students to share an example of where water exists, and let them know that today we are going to learn about the water cycle on Earth.
  - Tell them that there are nine main places where water can be found in the water cycle. Have them compare their lists to the nine stations in the game.
  - As you go through this with the students, hang the Water Cycle Game station signs at each station and place the station cards and dice at each station.
- Unpack the learning targets: (1) *I can describe the major components of the water cycle*; and (2) *I can explain the role of plants in the water cycle*. Write the learning targets on the board or on chart paper. Discuss the meaning of key words. Discuss the purpose of the lesson in terms of what students will be able to do by the end of the lesson.

Explore (30 minutes)

- Introduce the Water Cycle Game. Let the students know that they will each be a drop of water traveling through the Earth's water cycle. As they travel through the water cycle, they will create a picture of their journey that shows all the places they traveled to and how they got to each place.
- Place this statement about the water cycle on the board (from the USGS website https://water.usgs.gov/edu/watercycle.html) and briefly discuss it before and after playing the game: "Earth's water is always in movement, and the natural water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth. Water is always changing states between liquid, vapor (gas), and ice (solid), with these processes happening in the blink of an eye and over millions of years."

- Explain the instructions clearly:
  - You will start at one of the nine stations, and I will tell you which one before we get started.
  - At each station, you will read about where you are and add to your drawing.
  - When you hear the bell ring, each student will roll the dice and read the key on the card at your station to tell you where to go next based on the number you rolled. (Teachers can model this for the students as an example to show them how the key works.)
  - Before you move to the next station, you will draw an arrow to show where you are now and where you are traveling to. You will also carefully read about what is happening to get you from one place to another and write down key words or phrases on your diagram. (Teachers can also model an example of reading and drawing on the board.)
  - I will ring the bell again to tell you when to move to your next station. When you get to your next station, you will read the text about your new location and record major vocabulary words and processes on your diagram.
- The process will continue for several rounds until students have mapped out most or all of the water cycle on their drawings.
- Remind students that there are nine stations, so they should think about this when they start using the space on their paper. They might need to use the back or a second paper along the way.
- Distribute blank pieces of paper to each student to draw their journey as a drop of water.
- Evenly distribute the students at all the stations and start the game.
- You might let students move through the game at their own pace, or you might find it best to ring a bell (or make another noise) when it is time for each group to roll the dice AND when it is time to move to their next station.
- Monitor how much time is needed for students to draw most of the water cycle on their diagrams. It is okay if students do not get to hit every station and get every part of the water cycle, as they can fill in what they are missing during the Explain phase of the lesson.

Explain (30 minutes)

- Have students circle up and have each share one thing that they learned by playing this game.
- Give a mini-lesson on the water cycle using the USGS water cycle diagram. Review the major parts of the water cycle—sublimation, evaporation, condensation, precipitation, and transpiration. Highlight the role of plants in transpiration, and how plants take up water from the soil through their roots.
- Keep the USGS diagram projected and have students compare their own diagrams to the USGS diagram. Instruct students to make any corrections or adjustments on their diagrams. Make sure they have correctly labeled the key pieces that were just covered in the mini-lesson.
- Revisit the USGS quotation from the beginning of the lesson and ask students to reflect on how their thinking has changed through the lesson.
- The Resources section below includes a link to the USGS website with an online interactive version of the USGS water cycle diagram and a link to the online Project WET water cycle

game. One extension or alternative option for this lesson is to have students use those online interactive versions to further their understanding and improve their hand-drawn diagrams.

Elaborate (30 minutes)

- Have students look at the transpiration demonstration that was set up on Day 1 of this week and the xylem demonstration that was set up on Day 2. You may choose to have two different stations and divide the class in half, with one group at each station.
- At each station have students record their observations in their science notebooks. Instruct them to use what they know about plants, photosynthesis, and the water cycle to write explanations for their observations.
- **For the transpiration demonstration:**
  - First have the students make a data chart in their science notebooks. The chart should have cells to record eight observations of the number of water droplets in the bags, four of sun plants and four of shade plants (see example below).
  - Have students make observations of all eight plants and record their observations in their science notebooks.
  - You can make a class data chart on the wall (see example below) and have each student record their eight observations on the class chart. Students can then take averages (with the level of support that teachers decide is appropriate).

Example Data Chart for Transpiration Demonstration (individual student science notebooks)

Location	Plant #1	Plant #2	Plant #3	Plant #4
Sun				
Shade				

Example Class Data Chart for Transpiration Demonstration

Location	Plant #1	Plant #2	Plant #3	Plant #4
Sun	For each cell, all students record #s in cell, with + signs in between. Then, teacher shows how to calculate average by taking sum and dividing by number of observations.			
Shade				

- Conduct a class discussion based on the class data analysis. Ask students what was similar and what was different between the plants in the sun and the shade. Ask students to think about where the water droplets in the plastic bag could have come from. Ask them to consider what they know about leaves and water. Ask them how the amount of light influenced the amount of water, and why they think this is the case. Also, ask the students how their observations compare to the predictions they made when they set up the demonstration.

- **For the xylem demonstration*:***
  - Have the students (or help them) cut the celery into cross sections so they can observe the colored dots the whole way up the celery stalk.
  - Prompt students to think about what they know about photosynthesis and water (i.e., plants need water for the reaction). Then ask them to consider where plants get water (i.e., from the soil via their roots).
  - Ask them to think about what they can observe in the celery about how plants take water from the soil and get it to the leaves for use in photosynthesis.
- With the whole class, review the major conclusions from the two demonstrations. Through this discussion give a mini-lesson to clarify the concepts of transpiration and xylem. Make sure to reinforce key vocabulary words on the board with class definitions of transpiration, stomata, roots, and xylem. Leave time between explanations for students to record the main points of each demonstration in their science notebooks.
  - For transpiration: ask students to share their thinking on how plants transpire water. Clarify that plants lose water through their stomata (when they open for taking in carbon dioxide and giving off oxygen in photosynthesis). Ask students to consider what factors

might influence how much water a plant loses through its stomata (Hint: *What happens to you when you get hot? What escapes the pores of your skin?*).

- For xylem: ask students to share their thinking on how plants take up water from the soil and get it to the chloroplasts in the leaves for use in photosynthesis. Ask students to consider what factors might influence how much water a plant can take up from the soil (Hints: *What would happen if it rained less? What would happen if soil were dry and not moist? What would happen to plants without water?*).

Evaluate (20 minutes)

- Without using their notes, have students work individually to draw a diagram of a plant in the water cycle. Provide the following vocabulary words for students to include in their diagrams: accumulation, evaporation, transpiration, condensation, precipitation, xylem, roots, leaves, and stomata.
- In the last five minutes of class revisit the question about the jar of water: *How old is this water?* Have students go back to their initial answers in their notebooks and decide if their thinking has changed. Ask them, *Based on what you know about the water cycle now, how old do you think this water is?*
- Ask students to share their thinking. Clarify that the Earth is over 4 billion years old and the molecules of water in this jar have been moving through the water cycle for at least 4 billion years!

Resources Used in Lesson Development

U.S. Geological Survey (USGS) water cycle website. http://water.usgs.gov/edu/watercycle.html. This website has a section specifically for educators, including a kid-friendly version of the water cycle diagram and an interactive diagram (http://water.usgs.gov/edu/watercycle-kids-adv.html) that kids can click on to read more. Water cycle diagrams and summaries are also available in many different languages.

Project WET Foundation, 2011. http://www.discoverwater.org/blue-traveler/ The water cycle game in this lesson is designed similarly to this web-based game. Students can also utilize this website as an additional exercise to supplement this lesson.

Fifth Grade Curriculum:
Wheat Farming and Climate Change in the Inland Pacific Northwest

Water Cycle Game—Station Signs

Plant	**River**	**Glacier**
Animal	**Lake**	**Groundwater**
Soil	**Cloud**	**Ocean**

Water Cycle Game—Station Cards

OCEAN

An ocean is a body of salt water. Oceans cover about three-fourths of the Earth's surface and about 96% of all the water on Earth is in the oceans.

If you rolled a …	You now travel to the …
1 or 2	**Ocean**—You stayed in the ocean!
3, 4, 5, or 6	**Cloud**—You experienced **evaporation** and **condensation**! Due to the sun's heat on the ocean surface, you **evaporated**, or changed from a liquid to a gas called water vapor. Then as invisible water vapor, you floated up into the sky, cooled, and **condensed**, or turned into tiny liquid water drops called a cloud.

CLOUD

Clouds are formed when tiny invisible droplets of water vapor rise into the atmosphere, cool, and condense into a liquid or solid form of water.

If you rolled a …	You now travel to the …
1 or 2	**Ocean**—You experienced **precipitation** and fell as rain into the ocean! As water vapor continued to condense and your cloud became heavier, it could no longer float in the air, so it started to rain. Rain is a form of **precipitation**.
3	**Cloud**—You stayed in a cloud!
4	**Glacier**—You experienced **precipitation** and fell as snow onto a glacier! As water vapor continued to condense and your cloud became heavier, it could no longer float in the air, so it started to snow. Snow is a form of **precipitation**.
5	**Soil**—You experienced **precipitation** and fell as rain onto soil! As water vapor continued to condense and your cloud became heavier, it could no longer float in the air, so it started to rain. Rain is a form of **precipitation**.
6	**Lake**—You experienced **precipitation** and fell as rain into a lake! As water vapor continued to condense and your cloud became heavier, it could no longer float in the air, so it started to rain. Rain is a form of **precipitation**.

SOIL

Water is stored in soil and used by plants for making food to grow.

If you rolled a …	You now travel to the …
1 or 2	**Cloud**—You experienced **evaporation** and **condensation**! Due to the sun's heat on the soil surface, you **evaporated**, or changed from a liquid to a gas called water vapor. Then as invisible water vapor, you floated up into the sky, cooled and **condensed**, or turned into tiny liquid water drops called a cloud.
3	**Soil**—You stayed in the soil!
4	**Groundwater**—With the help of gravity, you soaked into the underground space between rocks and soil.
5	**River**—Because the soil was saturated (fully soaked, or already holding as much water as it could hold), you ran along the soil surface and into a river.
6	**Plant**—You were absorbed through the roots of a plant.

RIVER

Rivers are large streams of water that flow into a lake, ocean, or another river. Rivers carry water from one place to another on the Earth's surface.

If you rolled a …	You now travel to the …
1	**Lake**—You flowed down the river into a lake.
2	**Ocean**—You flowed down the river into an ocean.
3	**Groundwater**—With the help of gravity, you soaked into the underground space between rocks and soil.
4	**Animal**—An animal (human or non-human) consumed you as they drank water from the river.
5	**Cloud**—You experienced **evaporation** and **condensation**! Due to the sun's heat on the river's surface, you **evaporated**, or changed from a liquid to a gas called water vapor. Then as invisible water vapor, you floated up into the sky, cooled, and **condensed**, or turned into tiny liquid water drops called a cloud.
6	**River**—You kept on flowing down the river!

LAKE

A lake is a body of water surrounded by land.

If you rolled a …	You now travel to the …
1	**Groundwater**—With the help of gravity, you soaked into the underground space between rocks and soil.
2	**River**—You flowed out of the lake and into a river.
3	**Cloud**—You experienced **evaporation** and **condensation**! Due to the sun's heat on the lake surface, you **evaporated**, or changed from a liquid to a gas called water vapor. Then as invisible water vapor, you floated up into the sky, cooled, and **condensed**, or turned into tiny liquid water drops called a cloud.
4	**Animal**—An animal (human or non-human) consumed you as they drank water from the lake.
5 or 6	**Lake**—You stayed in the lake!

GROUNDWATER

Groundwater is the water found underground in the spaces or cracks between rocks and soil.

If you rolled a …	You now travel to the …
1 or 2	**Lake**—You filtered through several layers of rock and soil under the Earth's surface and into a lake.
3	**River**—You filtered through several layers of rock and soil under the Earth's surface and into a flowing river.
4, 5, or 6	**Groundwater**—You stayed underground.

GLACIER

Glaciers are large bodies of dense ice. Glaciers form when snow accumulates in one location and over many years compresses into large, thick ice masses.

If you rolled a …	You now travel to the …
1	**Cloud**—You experienced **sublimation**! With the sun's heat on the glacier surface, you transformed from ice (solid form of water) to water vapor (gas form of water). Then as invisible water vapor, you floated up into the sky, cooled, and **condensed**, or turned into tiny liquid water drops called a cloud.
2	**Groundwater**—As you melted, gravity helped you soak into the underground space between rocks and soil.
3, 4, or 5	**Glacier**—You stayed frozen in the glacier.
6	**River**—You melted and flowed into a river.

PLANT

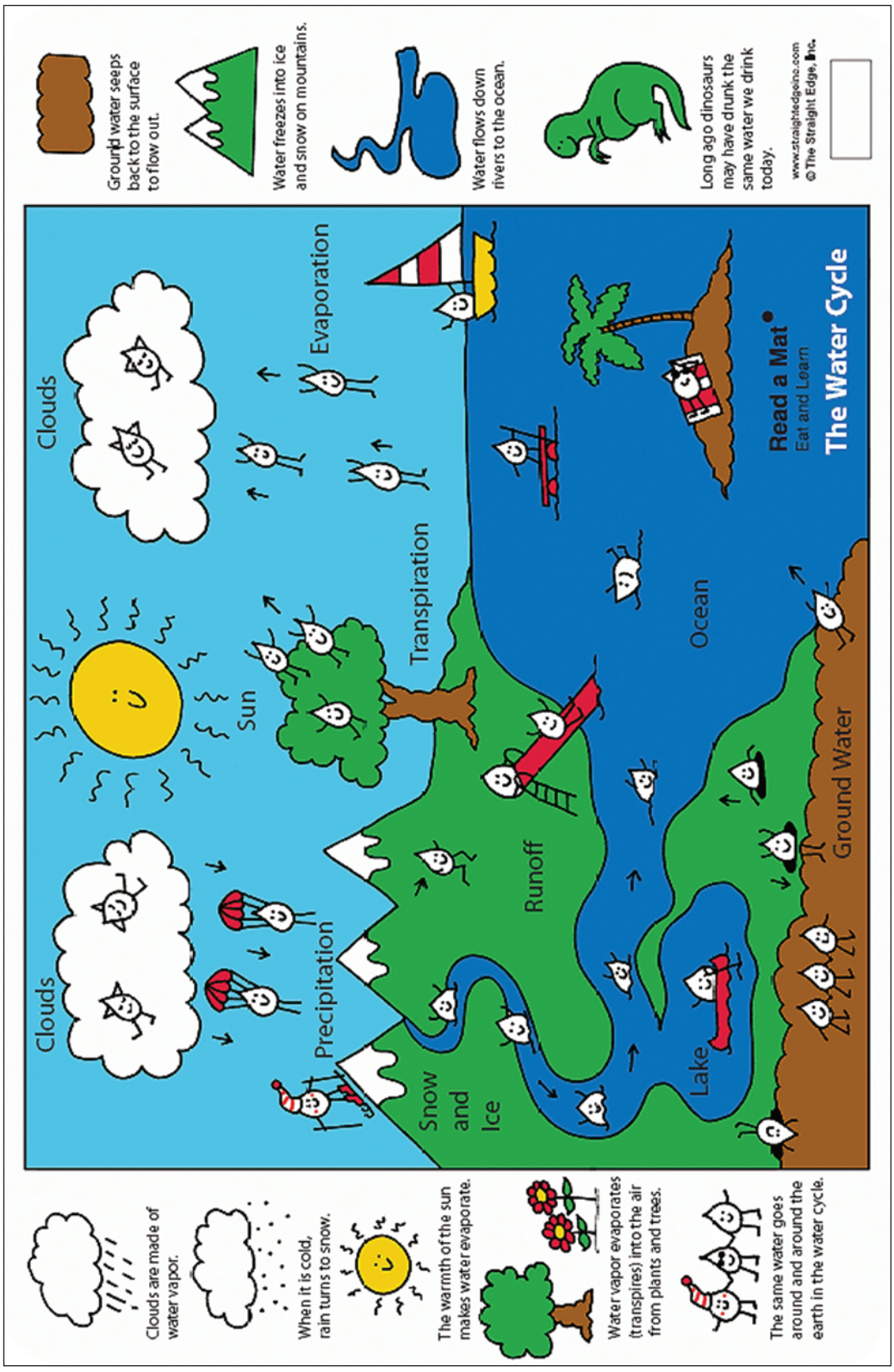
Plants get water and nutrients from the soil through their roots. Water travels up the stem to the leaves where it is used for making food in a process called photosynthesis. Some water vapor escapes through small leaf pores called stomata and is released into the air. This process, called **transpiration,** is an important part of the water cycle.

If you rolled a …	You now travel to the …
1, 2, 3, or 4	**Cloud**—You experienced **transpiration** and **condensation**! In the process of transpiration you exited the plant through an open stoma on the leaf and transformed from a liquid to a gas called water vapor. Then as invisible water vapor you floated up into the sky, cooled, and **condensed**, or turned into tiny liquid water drops called a cloud.
5 or 6	**Plant**—You stayed in the plant!

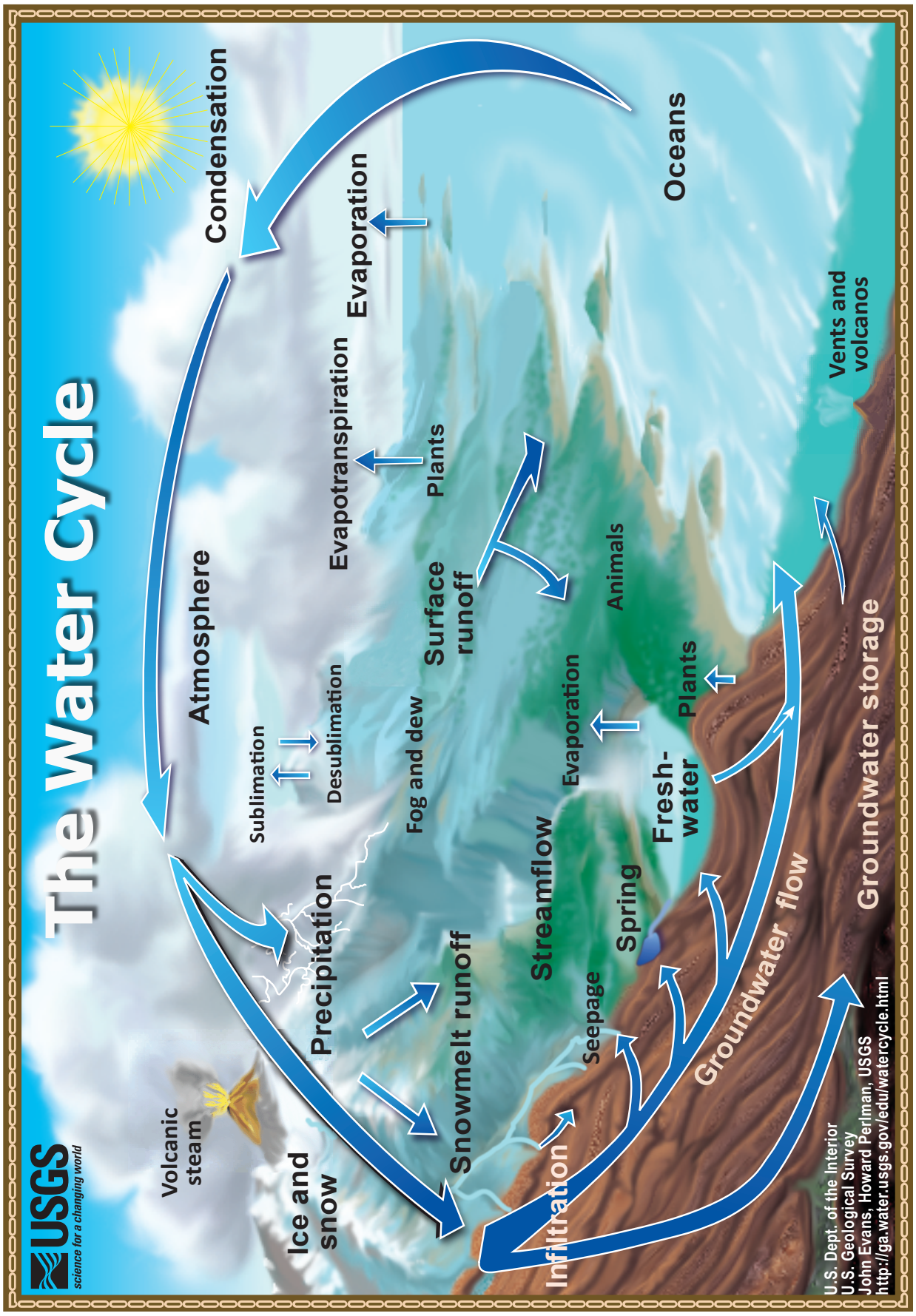
ANIMAL

All animals, including you, play a role in the water cycle.

If you rolled a …	You now travel to the …
1	**Animal**—You were incorporated into the body of an animal. Did you know that more than 60% of your body is water, and you can survive only for about three days without water? So be sure to drink plenty of water and stay hydrated!
2, 3, or 4	**Cloud**—You were released from the animal's body through sweat or breathing (also called respiration).
5 or 6	**Soil**—You were excreted from the animal's body as either feces or urine. You might think yuck! BUT did you know that animal feces actually acts as fertilizer, adding essential nutrients back into the soil?



Color images available for download at **reacchpna.org/education/elementary-curriculum**



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