A RAINDROP ROADTRIP (1.5-2 Hours)

Addresses NGSS
Level of Difficulty: 2
Grade Range: 3-5

OVERVIEW
In this activity, students will “become” water droplets and travel among the different storages of water. Students will roll a die to determine which station in the classroom they will go to: the atmosphere, ocean, forest, or glaciers. They must answer a question correctly to roll the die again and continue to another storage in the water cycle. As students journey around the water cycle, they will keep track of their travels and also name the process that allows them to travel from one water storage to another.

Topic: Water Cycle

Real-World Science Topics
• Modeling of a major Earth system.
• An exploration of the storage and flows in the water cycle.

Objective
After completing this activity, students will be able to describe the storages and flows of the water cycle.

NGSS Three-Dimensions

Science and Engineering Practices
 Developing and Using Models
• Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions.

Disciplinary Core Ideas
 ESS2.A: Earth Materials and Systems
• Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)

Crosscutting Concepts
 Systems and System Models
• A system can be described in terms of its components and their interactions.
Background Information

What is the water cycle?
The water cycle is a biogeochemical cycle that collects, purifies, and distributes water. The amount of water on Earth stays the same but it moves and changes state between solid, liquid and gas. The water cycle is also called the hydrologic cycle.

How much of the Earth’s water is in each storage of the water cycle?
The vast majority of the Earth’s water is in bodies of water such as oceans, lakes, and rivers. This accounts for 96.5% of water. 1.7% of the Earth’s water is frozen as a glacier, ice, or snow. Another 1.7% is contained in the pores of soil and underground aquifers. An aquifer is an underground layer of porous rock that is saturated with water. The atmosphere contains water, not only in the clouds, but also as invisible water vapor in the air around us. Atmospheric water only accounts for 0.001% of the Earth’s water.

How long does water stay in each storage?
The amount of time a molecule of water stays in a particular storage is called residence time. It can vary greatly. The following residence times are typical time frames.

- atmosphere ............... less than two weeks
- rivers .................... 2 weeks
- soil ........................ months to years
- lakes ........................ 10 years
- oceans ...................... decades to 4,000 years
- groundwater aquifer ...... decades to 10,000 years
- glaciers/ice ................ decades to 10,000 years

What are some other cycles of the Earth’s system?
Other important cycles of the Earth’s system are carbon, oxygen, nitrogen, phosphorus, and sulfur.

What do the Earth’s cycles have in common?
All of these cycles are considered biogeochemical cycles. That means each cycle involves living organisms, the earth, and chemicals. Each cycle is powered directly or indirectly by solar energy. The atoms and molecules involved in these cycles are necessary for organisms to live, grow, and reproduce.
Key Vocabulary

**Water Cycle** – the storages and pathways of the earth’s water supply  
**Evaporation** – the process of a liquid turning into a gas  
**Precipitation** – water that falls from the atmosphere in the form of rain, sleet, hail or snow  
**Transpiration** – the process of water being absorbed by a plant and eventually evaporating into the atmosphere  
**Condensation** – the process of a gas turning into a liquid  
**Groundwater Aquifer** – a water bearing, underground layer of rock  
**Run-off** – the flow of water along the surface of the earth  
**Infiltration or Percolation** – refers to water moving into and downward through the soil  
**Sublimation** – the process of a solid turning into a gas

Materials Needed for Activity

- Dice (one die per group)
- Signs for each station
- Water cycle questions at each station
- Copies of *A Raindrop Roadtrip Handout* and pencils

Teacher Preparation

- Designate an area in the room for each storage of the water cycle: atmosphere, rivers/oceans/lakes, glaciers/ice, groundwater/soil. Plants/trees can be added for grades 5 and 6, if desired. Make a sign for each station.
- Display questions about the water cycle at each station. Use the questions in Appendix A, or create your own.
- Gather all the materials.
1. **Warm-up Activity:** As a class, brainstorm where all of Earth’s water is located: oceans/rivers/lakes, glaciers/ice/snow, atmosphere, groundwater/soil. Tell the class that a place that holds water is called a “storage” in the water cycle.

Have each student make a prediction: Put the storages in order from “contains the most water” to “contains the least water.”

Share the correct order: oceans/rivers/lakes (96.5% of water)  
glaciers/ice/snow (1.7%)  
groundwater/soil (1.7%)  
atmosphere (0.001%)

Water doesn’t stay in one storage forever. It can move from one storage to another. Display the following matching on a smart board to review the processes of flow in the water cycle.

- evaporation
- condensation
- freezing
- melting
- precipitation
- run-off
- rain, sleet, snow, hail
- gas changing into a liquid
- water flowing along the ground
- liquid changing into a gas
- solid changing into a liquid
- liquid changing into a solid

**Grades 5 and 6:** You may choose to add some/all of the following terms: transpiration, infiltration or percolation, plant uptake, groundwater flow, sublimation

2. Divide students into groups of 2 or 3. Show the class that there is a station in the room for each storage of the water cycle. Today they will become raindrops that are travelling among the storages of the water cycle. Each group will roll a die to determine the first stop on their “raindrop roadtrip.”

Roll 1 = atmosphere  
Roll 2 = rivers/oceans/lakes  
Roll 3 = glaciers/ice  
Roll 4 = groundwater/soil  
Roll 5 = roll again  
Roll 6 = roll again

**Grades 5 and 6:** Add another storage: plants/trees. When students roll a five, they will go to the plants/trees station. Also, the term “groundwater aquifer” can be used in place of “groundwater.”

3. Students will record their first stop on the *Raindrop Roadtrip Handout* and choose one question to answer at that station. Instruct students to write their answer on the handout.

**Grades 5 and 6:** You can require students to answer 2 or 3 questions.

4. Each group will then roll a die to determine the next stop on their raindrop roadtrip. (If they roll the number for their current location, simply roll again.) On the *Raindrop Roadtrip Handout*, have students record the name of the process that carries water from their first storage to their second storage.
5. Repeat steps 3 and 4 until students have made four stops on their raindrop roadtrip.
   
   **Grades 5 and 6:** The activity can be lengthened to include more stops.

6. Students will diagram their trip around the water cycle on the *Raindrop Roadtrip Handout*.

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**Extension Activity**

Now students know that the Earth’s water gets used again, and again, and again. We never get more! So it is super important to use our water resources wisely. Students can research ways to conserve water and create pamphlets or posters to share with family and friends.

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**Sources**

http://water.usgs.gov/edu/

http://www.unep.org/dewa/vitalwater/
A RAINDROP ROADTRIP
STUDENT HANDOUT

Name: 
Date: 

Roll the die to determine your first stop in the water cycle. Your first stop is: 

Choose a question. Write a sentence, in the space below, to answer your question. 

Name the process that takes water from your first stop to your second stop: 

Roll the die to determine your second stop in the water cycle. Your second stop is: 

Choose a question. Write a sentence, in the space below, to answer your question.
A RAINDROP ROADTRIP
STUDENT HANDOUT

Roll the die to determine your third stop in the water cycle.
Your third stop is:

Choose a question.
Write a sentence, in the space below, to answer your question.

Name the process that takes water from your second stop to your third stop:

Roll the die to determine your fourth stop in the water cycle.
Your fourth stop is:

Choose a question.
Write a sentence, in the space below, to answer your question.

Name the process that takes water from your third stop to your fourth stop:
On the diagram below, use arrows to show your journey in the water cycle. Label each arrow with the name of the process that is happening.
**Atmosphere**

- What are two types of precipitation?
- What does it mean if air is humid?
- Name a type of cloud.
- What are clouds made of?
- What do you call a cloud that is at ground level?

**Rivers/lakes/oceans**

- Is water in the ocean fresh or salty?
- Name a fish that lives in the ocean.
- Name three oceans.
- Heat can cause water in the ocean to evaporate and become water vapor in the atmosphere. Where does that heat come from?
- Name an animal that lives in the ocean that is not a fish.
- How many oceans are there?

**Glaciers/ice**

- Name a place on Earth where you might find a glacier.
- Heat can cause a glacier to melt and become run-off. Where does that heat come from?
- At what temperature does water become ice?
- What is it called when a liquid becomes a solid?
- Does water usually remain in a glacier for a short or long amount of time?

**Groundwater/soil**

- How do people get groundwater out of the ground?
- When soil is heated, some of the water evaporates out of the soil.
- Where does the heat come from?
- Explain one way water is added to soil.
- Name a type of land that is very dry.
- If soil is completely full of water and can’t hold any more, it is called ____________.