Amazon Water Cycle Role-play

GRADE LEVEL 4th - 8th
SUBJECTS Life Sciences; Earth and Space Sciences
DURATION Prep time: 15 minutes; Activity time: 45 minutes
SETTING Large open space

OBJECTIVES

Students will be able to:
1. describe the various processes of the water cycle.
2. understand that water changes forms throughout the water cycle, and that this cycle runs continuously with different processes happening at the same time.

MATERIALS

- ☐ cards for each role (one per student)
- ☐ 2 bags labeled "cloud"
- ☐ 2 bags labeled "ocean"
- ☐ 1 large bag of cotton balls (representing rain drops)
- ☐ if desired, leaves cut from construction paper

SCIENTIFIC TERMS FOR STUDENTS

» **Condensation:** the change of a gas or vapor to a liquid, either by cooling or by being subjected to increased pressure. When water vapor cools in the atmosphere, for example, it condenses into tiny drops of water, which form clouds.

» **Precipitation:** a form of water, such as rain, snow, or sleet, that condenses from the atmosphere, becomes too heavy to remain suspended, and falls to the Earth's surface

» **Transpiration:** the process of giving off vapor containing water and waste products, especially through the stomata on leaves

» **Uptake:** the process of the roots of a plant taking up water from the soil

BACKGROUND FOR EDUCATORS

The Amazon River basin of South America is considered the largest rainforest on Earth, traversing the countries of Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, and French Guiana. The Amazon River flows east, beginning in the high elevations of the Andes Mountains and traveling 6,400 km (4,000 miles) to the Atlantic Ocean off the coast of Brazil. Although second to the Nile River in length, the Amazon is the largest of the world's rivers by volume, holding 20% of Earth's available fresh water. This volume is created by an impressive system of over 15,000 tributaries (smaller rivers and streams) feeding its flow. At its mouth, the Amazon River pours an average of 200,000 cubic meters (50,000 gallons) of river water into the Atlantic Ocean each second!

With water prevalent, rainforest plants rarely lack this essential resource; instead, plants regularly expel excess water. By transpiring water from the underside of their broad leaves during the warm daytime, trees draw water up the stem so that soil nutrients dissolved in the water may spread throughout their tissues. This transpiration, in turn, contributes to constant rainfall by providing water vapor to the atmosphere. The vapor will eventually form clouds that provide rain for the rainforest habitat. The Amazon Rainforest is particularly efficient with recycling water in this way, recycling at least 50% of the local water in the form of precipitation. Estimates for the volume of water moved via the combined processes of evaporation and transpiration average 9 x 1012 m3/yr, which means the Amazon Basin contributes 6.5 trillion gallons (6,500,000,000,000 gallons) of water to the atmosphere each day!

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TEACHER PREP

1. Print a role card for each student. See the "Table of Student Roles" at the end of this lesson to determine how many of each card to print.
2. Gather materials.
3. If desired, cut leaves from green construction paper to act as props for the "Leaves" actors.
4. Select an open area to use as the "stage" for the role play.

INTRODUCTION

» Introduce the activity by showing students a large map of South America, indicating the Amazon River and the surrounding rainforest (a land area larger than the 48 contiguous United States!) as the class setting for today's activity.

» Ask students to describe the environment of the Amazon rainforest: what does the air feel like? (hot, humid); what do you see, smell, and hear? (plants and vines all around, dappled sunlight, damp dirt, bird and insect calls, the river rushing).

» Explain that the Amazon rainforest is different than the wooded forests in California because of its location near the equator. With steady sunlight all year long, the rainforest does not experience cooler winter months, and instead is continually warm and humid. Trees in the tropical forest, while dependent on the falling rain for growth, also play an important role in maintaining this rainy weather. As a class, students will learn how water is recycled in the Amazon habitat by performing a skit in which each student plays a part in the water cycle.

PROCEDURE

1. Introduce or review the water cycle. The water cycle helps us understand how water moves around in the environment – in the air as vapor, on land as bodies of water, and in living things.
2. Remind students that water can exist in the form of a solid, liquid, or a gas. You won't find much ice in the warm tropics, but in the Amazon, you'll find plenty of water in the form of liquid (in bodies of water, plants, and animals!) or gas (held by air as water vapor). Have students identify points in the water cycle where water changes from one form to another.
3. Break the class into teams of actors who will play each role. Distribute role cards and props to the actors and give students time to read about their roles, recite their lines, and practice any gestures (these are all described on the role cards, and also explained at the end of this lesson plan).
4. Position students on the "stage." The river actors should be seated on the floor in a line, with the ocean actors at one end of the river. Tree actors can be situated on either side of the river, with the root actors seated on the floor and leaves actors standing above them. Cloud and air actors should roam freely around the stage.
5. Distribute cotton balls randomly around the stage, describing how, at any one time, different water droplets are involved in the various water cycle processes. In our rainforest, water is in the river, is flowing up tree trunks, and is hanging out in the air, making it quite humid.
6. Dress rehearsal: begin a 1-minute practice round of the role-play after confirming students understand their responsibilities. As a rule, actors must stick to the script, only passing water drops to and from specific actors as designated on the role cards. Allow for a degree of mistake, practice, and adjustment!
7. Performance: begin the skit once more; this time, instruct actors that this act will be considered "Take 1", so they should be careful to distribute drops correctly, use props appropriately, and follow the script. If problems arise, feel free to "cut" and begin a new "take."
8. Freeze the cycle after 1 - 2 minutes of proper role-play. Have students look around to see where the water drops are located at this point in time.

Teacher Tip: *Be prepared for a degree of noise and chaos (and fun!) as the cotton balls start travelling and your whole class calls out their lines at the same time. Set some clear expectations for student behavior ahead of time to keep things manageable, and establish a signal that will tell students when to stop the role-play.*

9. Continue the action and freeze again after a few minutes. Look around again and see what has changed. Review the multiple paths water can take in the cycle, and how air, heat, gravity, and plants contribute to its movement.

WRAP-UP

Discuss the following questions:

- Where were the raindrops when the role-play was stopped at different time? Was this always the same?
- Did water drops always move through the cycle in the same order? At the same pace? *(Textbook diagrams often make the water cycle seem like a steady, organized, step-by-step process. In reality, water can move between states in any order, sometimes quickly and sometimes slowly, all depending on the conditions and circumstances.)*

EXTENSIONS

- Introduce a water drop that is a different color than the rest, and follow it's path through the water cycle. Make note of where this drop is each time you pause the action, and talk about how it got there. If desired, diagram the progress of this water drop, highlighting the points where it changed from liquid to vapor or vice versa.
- Explore cause and effect by introducing changes to the environment, such as "cutting down" all the trees (removing those actors from the stage) or damming the river (preventing the river actors from passing along their drops. Have students observe what happens to the water in these situations and compare it to what happened in the original scenario.

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Student Roles

ROLE	# OF ACTORS	SCRIPT LINES	STAGE POSITION	PROPS or MOVEMENTS
CLOUDS (precipitation)	2 - 4	It's cold up here! Pre-ci-pi-tate	Walks in a slow circle around the trees	High-fives Air when condensing Drops rain throughout habitat
AIR (condensation, with clouds)	2 - 4	I'll carry up that water. Condense!	Free to travel anywhere on stage to collect water vapor	Adds drops to "cloud bag" and high-fives to condense
ROOTS of the KAPOK TREE (uptake)	3 - 6	My tree is thirsty! Aaah, water. Up you go!	Seated at the feet of a Leaves actor, knees up to resemble roots	Pulls water from the soil and stretches the drops up to the leaves
LEAVES of the KAPOK TREE (transpiration)	3 - 6	I need water and carbon dioxide to grow tall! Transpiiiire	Standing behind Roots with arms outstretched high	Takes water from the roots and transfers drops to Air passing by
AMAZON RIVER (runoff)	6 - 20	Flow, flow, downhill	Seated in a row between the trees	Rocks back and forth, waves arms to mimic flow; Stretches to collect fallen drops, and pass down the line.
ATLANTIC OCEAN (accumulation and evaporation)	2 - 4	Movement won't stop – I'll give a bit off the top! Evaporate!	Sitting cross-legged facing the Amazon River	Stores drops in "ocean bag"; May occasionally hold a few out for Air to collect

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Parts of the Water Cycle

PRECIPITATION: Precipitation is a big word for "water that falls from the sky." Can you think of examples? Rain is the only type of water that will precipitate down to the Amazon rainforest.

From where will rain precipitate? *(clouds!)* But where does the water in the **Clouds** come from? *(comes into the air from plants, animals, and bodies of water)*

CONDENSATION: The humid air of the rainforest is holding almost as much water as it can take. This water—not a liquid, but a gas—is called water vapor. Can you see water vapor? *(Not often, but you can feel it in the form of humidity, notice steam on the bathroom mirror, spot fog and clouds outside)* California air is "dry" because it is not often full of water vapor, but Amazon air is "wet" like the air in the bathroom after you shower.

So, our habitat near the Amazon River is very humid. But when you climb up a mountain, the air gets chillier, right? The **Air**, when moving around, brings water vapor high up into the sky where it is quite cold. The **Clouds** will remind us by occasionally shivering, and complaining of the chill.

You can make liquid water so cold that it turns to ice (freezing). Likewise, you can make water vapor so cold that it turns into liquid water (condensation). This is what occurs in the cloud layer. Water vapor condenses into liquid water.

UPTAKE: A raindrop's fate will depend on where it lands. Some water might fall near the **Roots** of the great kapok trees that line the Amazon River. The roots uptake the drops for use by the plant. **Roots** are responsible for collecting drops that fall on the soil within their reach, and transporting them up the stem and to the leaves. Ever seen water flow up a paper towel, even when you only dip the corner in a spill?

TRANSPIRATION: Just as water spreads on a paper towel, water is pulled up to the leaves, where it is used in photosynthesis to make food using the energy from sunlight. The leaves also need carbon dioxide from the air. Plants take in carbon dioxide through small holes on the underside of their leaves.

In the rainforest, it also gets mighty warm sitting in the sun all day. What happens when we sit outside, and our body gets warm? *(Our skin sweats water out of its pores, which evaporates to become water vapor).* Likewise, plants lose water through small holes on the underside of their leaves. When plants need carbon dioxide from the air, they accidentally transpire, or lose water from these holes! The warm air outside captures this water in the form of vapor. Kapok Tree **Leaves** may fan their leaves as they capture air and lose water simultaneously.

RUNOFF: Although plants will catch a lot of the falling rain, some drops may land direct in the Amazon River, or fall on soil already soaked to the brim.

The **Amazon River** collects rain that falls nearby. This action will simulate runoff, the flow of rain over land to a river or stream. After collecting the drops, the water will flow until it reaches the **Atlantic Ocean.** This river flow starts in the high elevations of the Andes Mountains and ends at sea-level, so movement of water is always downhill.

ACCUMULATION AND EVAPORATION: The water that runs down the river eventually reaches the **Atlantic Ocean**. Large bodies of water accumulate, or store up, water that will be recycled at a slower rate than that given off by transpiration.

Only water at the surface can be turned into water vapor, so the **Atlantic Ocean** may only evaporate sporadically using water drops at the water's surface.

STANDARDS ADDRESSED

Next Generation Science Standards

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and using models **3-5:** Develop and/or use models to describe and/or predict phenomena. **3-5:** Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed systems. [Extensions] **6-8:** Develop and/or use a model to predict and/or describe phenomena.	**MS-ESS2.C:** **The Roles of Water in Earth's Surface Processes** Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.	**Cause and effect** **6-8:** Cause and effect relationships may be used to predict phenomena in natural or designed systems. [Extensions]

Related Performance Expectations

Remember, performance expectations are not a set of instructional or assessment tasks. They are statements of what students should be able to do after instruction. This activity or unit is just one of many that could help prepare your students to perform the following hypothetical tasks that demonstrate their understanding:

MS-ESS2-4: Develop a model to describe the cycling of water through the Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways in which water changes its state as it moves through the multiple pathways of the hydrological cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]