



## WATER CYCLE IN THE CLOUD FOREST

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**Grade Level:** 6-8<sup>th</sup>

**Introduction:** Students will collect data to reinforce the concept that most of the earth is covered in water. The cycle of that water, and the other phases that it exists in, will be studied using *Canopy In The Clouds* media and small modeling demonstrations. Students will label different diagrams with the steps of the water cycle and identify the steps as they occur around them in their daily lives.

**Major Themes:** Water Cycle

**Connections to the National Science Standards:** Structure of the Earth System

**Time:** 50 minutes (10 min for opening globe activity, 10 min for student observations and media viewing, 20 min for water cycle models, 5 min for additional media, 5 min for closing)

**Materials:** inflatable globe, one computer with internet access and LCD projector, *Canopy In The Clouds* water cycle video in *Media*. Student handouts included.

*Demo 1:* large glass mason jar or bottle, black construction paper, tape, warm water, bag of ice cubes, match

*Demo 2:* water, water kettle, two dinner plates or pie tins

**Objectives:** Students will be able to 1) define the steps of the water cycle 2) locate steps of the water cycle within the cloud forest and 3) compare the water cycle of the cloud forest to local environment.

**Potential Misconceptions:** Students may have the following misconceptions:

- 1) When learning the water cycle, some students develop the misconception that the same water goes around the water cycle again and again, forever. Water molecules are actually split apart and reformed during several different processes, including photosynthesis. If necessary, show students the chemical formula for photosynthesis ( $6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ ). Notice that water is a reactant in photosynthesis but not a product – it has been split apart to help form sugar and oxygen. The burning of fossil fuels is an opposite process. Fossil fuels contain carbon and hydrogen and when burned, the C and H combine with  $\text{O}_2$  in the air to form carbon dioxide and water. New water molecules are formed here.
- 2) Many students believe that water disappears when it evaporates. Remind students that water is the only substance that can exist as all three phases of matter: solid, liquid, and gas. Evaporation is a change of state, not a change in the water molecule. Use an example of steam to help students understand that water still remains water when it is in the gas state, and may only be visible in certain situations.



- 3) Younger students may believe that clouds contain water that leaks out as rain or that too much evaporation leads to clouds filling up and needing to release rain. Again, emphasize that water can exist in different phases of matter. Explain that clouds do not “hold” water to be released later. Instead, teach students that when the air temperature reaches a certain point, water vapor in the atmosphere will change phase into liquid water that we experience as rain. What we see as clouds is an accumulation of condensation.

## PROCEDURE

**Opening:** Create a t-chart on the board and label one side “water” and the other “land”. Ask a volunteer to act as the data recorder, placing tally marks on the appropriate side of the chart when announced by classmates. Throw the inflatable globe to students and ask them to catch it with two hands. They are to report whether their right thumb is covering land or water. If their thumb is covering both, clarify that students should choose the one that is represented more. Students should pass the globe amongst themselves, reporting data to the recorder. Continue 20-30 times or until sufficient data is present to show a clear trend.

Engage students in a conversation involving the following questions:

- What conclusion can be drawn about water on Earth from the data collected?
- Is water in the oceans the only water present on Earth?
- Where else/how else is water present on Earth?

Tell students that they will be learning more about the different phases and steps that water cycles through on Earth, using examples of water present in the tropical montane cloud forests of Monteverde, Costa Rica.

**Development:** Ask students to write down their answers to the question “Where do I see or experience water around me?” in the left hand column on page 1 of the student handouts: *Student Observations*. Perform a Think-Pair-Share, in which students will first think about and record their own answers, then exchange ideas with a partner, and finally share with the class. Create a list of the different contributions on the board. Answers may include: snow, rivers, hail, sweat, humidity, etc.

Display the *Canopy In the Clouds* water cycle video for students to watch. Students should make observations on the water being described by the scientist on the left side of the chart. On the right side, students should record the name given to that process of water by the scientist and briefly explain it. Replay the video if necessary, and write vocabulary words on the board to help with spelling. Using the news terms described by the scientist, students should label each step on water cycle diagram on p.2 of the student worksheets, *Water Cycle Diagram*, with the correct term. Clarify any confusion regarding the steps:

*Precipitation:* Any form of water that falls from the atmosphere: rain, snow, hail, sleet.

*Evaporation:* Sun heats water and turns it into water vapor which rises into the air.



*Condensation:* Water vapor in the air cools into tiny water droplets that we see as clouds.

*Transpiration:* Water absorbed through the roots of plants is evaporated from the leaves.

*Run-off:* Water that is not absorbed into the ground stays on earth's surface and flows into bodies of water.

*Collection:* Area of water with large volume (ocean, lake) where run-off accumulates and evaporation occurs.

*Sun:* Although not a formal step in the water cycle, the sun's energy is the driving force that keeps the cycle moving.

Students will now create a model of the water cycle and identify the steps. If sufficient supplies are not available for multiple groups the teacher may demonstrate and have students observe.

*Demo Option #1:* Cover the back half of a mason jar with black construction paper. This will make it easier for students to see the movement of water vapor. Fill the bottom, about  $\frac{1}{4}$  full, with warm water. Light a match and drop in into the jar and then quickly cover the jar with a bag of ice cubes. The match represents the 'sun', which drives the entire process. The water on the bottom of the jar is 'collection', water vapor or steam will be seen rising as 'evaporation' and an accumulation will begin to form near the bag of ice on top which is 'condensation'. Occasionally droplets of water will form on the inside of the jar, which represents 'precipitation'.

*Demo Option #2:* This demonstration is simpler and involves fewer materials, but also does not represent as many steps in the water cycle. Bring the water in the kettle to a boil. Elevate one of the plates at an angle above the steam that emerges as 'evaporation'. 'Condensation' will form on the underside of the plate. Position the other plate beneath the angled plate so that it catches drips of 'precipitation' as they form. The accumulation of 'precipitation' in the bottom plate is 'collection' (although it will be a small amount).

Students should draw the demonstration they utilize, and label where each step of the water cycle is represented.

Show students additional *Canopy In The Clouds* media and ask them to identify steps of the water cycle, independently on paper or as a class discussion. Muting the sound is recommended when watching media to ensure that students are focused on locating evidence of the water cycle, not listening to information presented by the scientist.

Suggested media: Panorama #3, Canopy Hotspot #1 ~ Microclimate & Plants  
Panorama #3, Canopy Hotspot #2 ~ Soil in the Air  
Panorama #4, Hotspot #3 ~ The Canopy's Close!  
Panorama #4, Hotspot #6 ~ A View from the Top

**Closing:** Refer back to the water list created during the Think-Pair-Share. Have students label each contribution with a step from the water cycle. Ask students to answer the following questions to turn-in as they leave the classroom:



- What provides the energy to keep the water cycle occurring?
- What steps of the water cycle do you see on a daily basis? Name and explain the steps.
- What steps of the water cycle are hard to see on a daily basis? Name and explain the steps.
- Draw your own water cycle and label each step.

**Suggested Student Assessment:** Students can complete p. 3 of the student handouts: *Student Assessment: Steps of the Water Cycle*. As an alternative, or an addition, ask students to write a story in which they are a molecule of water traveling through the water cycle and explain their journey. Please refer back to misconception #1 and set-up the writing assignment so that students may incorporate this knowledge into their story if desired.

**Extending the Lesson:** Allow students to go outside and experience the water cycle in their school yard or local neighborhood. Obtain or create a map of the area and identify how rainfall travels to collection locations, using different colors to represent each part of the water cycle on the map. This might include creeks and streams, or locating storm drains and researching their path below. Students may even identify that certain sidewalks in their neighborhood are always flooded when it rains and study the direction of the water flow. Incorporate transpiration into the study and include on the map areas with vegetation that contribute to the water cycle.

**Vocabulary:** evaporation, condensation, transpiration, precipitation, run-off