

Global Precipitation Measurement Mission

The Water Cycle Teacher Guide

Lesson Overview:

This activity was developed to give participants an understanding of Earth's water cycle. In this one-hour long activity, students participate in a webquest to learn about the water cycle, and then build a mini model of the water cycle to observe how water moves through Earth's four systems.

Learning Objectives:

- Describe the processes that a droplet of water goes through as it moves through Earth's four systems
- Identify the four Earth systems on a diagram of the water cycle

National Standards:

- *Core Idea ESS2.C: The Roles of Water in Earth's Surface Processes*
Water continuously cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, and crystallization, and precipitation, as well as downhill flows on land.
 - MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic 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.]

Background Information:

Water is fundamental to life on Earth. Knowing where and how much rain or snow falls globally is vital to understanding how weather and climate impact both our environment and Earth's water and energy cycles, including effects on agriculture, fresh water availability and responses to natural disasters. The Global Precipitation Measurement (GPM) mission, launching in 2014, will help scientist to better understand how much rain and snow falls around the world.

Precipitation is a vital component of how water moves through Earth's water cycle. The water cycle connects all four of Earth's spheres: the hydrosphere, geosphere, atmosphere and biosphere. Water evaporates from the surface of land and oceans, rises and cools, condenses into rain or snow, and falls again to the surface as precipitation. The water falling on land collects in rivers and lakes as well as soil, and much of it flows back into the oceans. Water also transpires from plants into the atmosphere. All living things need water to survive.

This lesson is adapted from GPM's "Water Cycle Webquest" and from the Monroe County (NY) Water Authority.

<http://pmm.nasa.gov/education/interactive/water-cycle-webquest>

<http://www.mcwa.com/MyWater/KidsWaterFun.aspx#cycle>

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Materials:

Computers with internet access
Copies of [“The Water Cycle” student capture sheet](#)
Large metal or plastic bowl
Bucket of water
Plastic wrap
Dry coffee mug
Long piece of string or large rubber band

Engage:

Show [“The Water Cycle” presentation](#) and ask students where the water that they drink comes from and generate a discussion about how we get the water that we use in our daily lives. (Slide 2) Inquire about how water resources are used in our daily lives (i.e. drinking, watering crops, generating power, etc.) At this point, don't worry about giving the students the answers, but rather generate curiosity and get a feel for their pre-existing background knowledge.

Explore:

Make a model of the water cycle (Slide 3)

First, set up the water cycle model by following the instructions on [“The Water Cycle” student capture sheet](#). Move on to the next sections of the lesson while the water droplets form on the plastic wrap. Then, return to the model to make observations.

Adapted from <http://www.mcwa.com/MyWater/KidsWaterFun.aspx#cycle>

Explain:

Webquest (Slides 4 and 5)

(adapted from <http://pmm.nasa.gov/education/interactive/water-cycle-webquest>)

Tell the students that they will complete a webquest using different websites and data sets to give them some background about the water cycle. They will record their answers on a student capture sheet.

As a result of interacting with the material in this webquest, students will learn how much water on Earth is actually freshwater, how water moves through Earth's water cycle, the importance of the oceans to our water cycle, the interactions of Earth's systems as water changes state and moves through them, how the average person in the U.S. uses freshwater resources, how clouds form, and why understanding the water cycle is vital to knowing about weather, climate and natural resources.

Explain:

Return to the water cycle models. Students should record their observations and answer the questions on the capture sheet. (Slide 6)

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Water from the "ocean" of water in the bowl evaporated. It condensed to form misty "clouds" on the plastic wrap. When the droplets grow large enough and become too heavy to stay up, it "rained" into the mug!

Evaluate:

Ask students to use what they've learned to draw a picture of the water cycle – it can have words, pictures, arrows, etc. (Slide 7)

Elaborate/Extend:

Ask students to add four vocabulary words to their diagram: hydrosphere, atmosphere, geosphere, biosphere.. Discuss the words, roots, and definitions if desired.

Use Slide 8 in "[The Water Cycle](#)" presentation and ask them if they can identify the parts of the water cycle labeled with letters. <http://ga.water.usgs.gov/edu/watercycleguess.html> Students can also build a more "real" model of the watershed with rocks, plants, etc. Use the steps from Learning Activity 2 from the following site. This can be taken home for more long-term observations. http://www.thirteen.org/h2o/educators_lesson2b.html Complete the entire [water cycle webquest](#).

Teacher Notes:

The webquest can be completed on individual computers, as groups on computers, or as a class using the PowerPoint.

The [water cycle webquest](#) used to develop this lesson has many more sections to it. There are also many useful websites with more information about the water cycle.

It is recommended to try the mini water cycle model before doing it with students. This will help determine how much time it will take for the different water phases to occur.

Additional Resources:

- Helpful information, background, and resources about the GPM mission and Precipitation Education <http://pmm.nasa.gov/education/>
- Water Cycle article: <http://earthobservatory.nasa.gov/Features/Water/>
- EPA water cycle animation http://www.epa.gov/safewater/kids/flash/flash_watercycle.html
- Water cycle lesson plans:
 - http://www.thirteen.org/h2o/educators_lesson2b.html
 - <http://learn.fi.edu/guide/hongell/lessonplans.html>
- USGS Water Cycle article with diagram to label at the bottom <http://ga.water.usgs.gov/edu/watercycleprecipitation.html>