

## The Water Cycle

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<b>Strand</b>	Matter
<b>Topic</b>	Changes in the state of matter
<b>Primary SOL</b>	2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include c) changes in phases of matter with the addition or removal of energy.
<b>Related SOL</b>	2.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) observations and predictions are made and questions are formed; b) observations are differentiated from personal interpretation; d) two or more characteristics or properties are used to classify items; e) length, volume, mass, and temperature are measured in metric units and standard English units using the proper tools; g) conditions that influence a change are identified and inferences are made; l) simple physical models are designed and constructed to clarify explanations and show relationships. 2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include b) measurement of the mass and volume of solids and liquids.

### Background Information

Thermal energy causes water to evaporate (changing from a liquid to a gas). The resulting water vapor rises in warm air and eventually meets a cooler air mass. As the gaseous water cools, it loses energy and condenses into a liquid (gas to a liquid is condensation). These droplets fall as precipitation. This process is called the *water cycle* or the *hydraulic cycle*.

In this activity, the environment in the plastic container simulates the water cycle on the Earth. The sun heats the water in the cup. The water in the cup, which represents the ocean, evaporates (liquid to a gas) and then condenses (gas to a liquid) when it hits the cup of ice, which represents the cooler air masses in the upper atmosphere. After some time, the condensed water vapor falls to the rock, which represents the Earth, and eventually makes its way back to the “ocean.” Once the water cycle has begun to flow, the water level should remain about the same in the cup. The water in the Earth’s environment is constantly recycled. This activity may be done as a class demonstration, in small groups, or as individuals.

### Materials

- For each student:
  - two clear 9-oz beverage cups
  - a 3 ¼ oz plastic condiment cup, small
  - rock that fits in the bottom of the 9-oz cup
  - ice

- water
- permanent marker
- masking tape
- metric ruler
- student activity sheet

### **Vocabulary**

*evaporation, condensation, precipitation, water cycle*

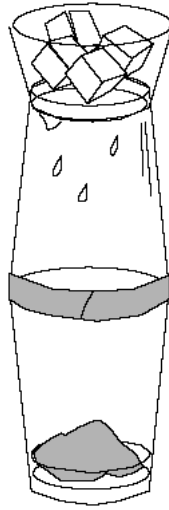
### **Student/Teacher Actions (what students and teachers should be doing to facilitate learning)**

#### *Introduction*

1. Ask students what they think will happen if you put a wet paper towel on the windowsill in the sun. (If you do not have a sunny window or if it is cloudy, you can use a lamp with an incandescent bulb as a light source.) Make sure the students understand that water will evaporate in a room without sunlight. The warmer and dryer the air, the faster the water will evaporate. Have them explain what they think will happen.
2. Put the paper towel on the windowsill.
3. When you are ready to begin the activity, return to the paper towel that was wet. It should be dry or much drier than it was in the beginning. Ask students what they think happened to the water.

#### *Procedure*

1. Distribute a 9-oz clear cup and a rock to each student. Direct students to carefully place the rock in the bottom of their cup.
2. Ask students to pour water into their cup until the rock is half covered. Direct them to use the ruler to measure how many centimeters of water are in the cup.
3. Guide students to place an upside down 9-oz clear cup on top of the cup with the rock and water it in, making a dome.
4. Direct students to work together and use masking tape to seal the two cups together tightly at the seam. Explain that their containers represent a closed water cycle model.
5. Place ice in each 3 ¼-oz cup and distribute to students. Ask them to place the cups on top of their models.



6. Have students place the models in a sunny location. Ask them to watch closely to see what will happen.
7. Distribute a copy of the recording sheet and guide students to complete it.

### Assessment

- **Questions**
  - What happened in the model? What role did the sun play? The ice? The rock?
  - What causes the water droplets to form? How do they get there?
  - Was any water lost during this activity? How could we test to see if any water was lost?
  - What causes evaporation in the water cycle? What causes condensation?
- **Journal/writing prompts**
  - Imagine you have an ice cold soda on your desk. What would happen to it after five minutes? 30 minutes? An hour?
  - What do you think happens to puddles after the rain?
- **Other**
  - Collect and grade the student recording sheets.
  - Ask students to draw a model of the water cycle and explain the terms- evaporation, condensation, and precipitation.

### Extensions and Connections (for all students)

- Go out on the school grounds and make predictions of where water may puddle when it rains. Mark these locations. Either wait for a rainy day or with a garden hose and rotating sprinkler simulate a rain storm. After the “rain” measure the puddles and discuss what happens to the water. Some may suggest the water is absorbed into the ground, others that it will evaporate. What happens if the ground cannot absorb the water? After the puddle has dried out, line it with plastic and simulate another rain event. Predict how long it will take for the water to evaporate.

- Water also falls as snow. Bring snow inside and watch it melt. Put a measured amount of snow in a plastic container outside and watch it. Does it melt before it evaporates?
- Display the song sheet on the overhead (or copy it on chart paper), and sing it with the class. Keep it on display to sing at various times during the study of this topic.
- Make a larger version of the water-cycle model, using a large, clear plastic container. A container from a salad bar works well. Measure the depth of the water before sealing. Then set up a second large version of the water cycle in which a small section of the lid has been cut away. Make sure that the water in the second model is exactly the same depth as that in the first. Leave the models in place for about a week. Have the students measure the two water levels daily. How do the results compare?

### **Strategies for Differentiation**

- Have a volunteer assist students with building the water cycle model.
- Pair a student with another student to complete the recording sheet.
- Assist each student with measuring the amount of water in his/her model.

# Changes in Phases of Matter

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Use a word from the word bank to complete each sentence.

evaporation	solid	freezing	condensation
precipitation	liquid	gas	melt

Adding the sun’s energy to a puddle causes \_\_\_\_\_.

Ice is water in a \_\_\_\_\_ form.

\_\_\_\_\_ is when water vapor collects in a cloud.

If the energy of the sun is removed from a liquid, \_\_\_\_\_ occurs.

Rain is water in a \_\_\_\_\_ form.

\_\_\_\_\_ happens when clouds become too full of water.

Steam is water in a \_\_\_\_\_ form.

If the energy of the sun is added to an ice cube, it will \_\_\_\_\_.

## Water Cycle Experiment

How much water did you put in your cup for your experiment? \_\_\_\_\_ cm

If you were to measure your water now, do you think you would have the same amount? \_\_\_\_\_

Take your water cycle model apart and measure the amount of water. How much water is in your model? \_\_\_\_\_ cm

What happened to the water in the model? \_\_\_\_\_

\_\_\_\_\_

# The Water Cycle Song

*(Sung to the tune of “Oh My Darlin’ Clementine”)*



Evaporation,

Condensation,

Precipitation all the time...

This is called the *water cycle*,

And it happens all the time.