**Hydrologic Cycle:**

**How the Water Cycle Is Affected by a Warmer Climate**

**PURPOSE**

The purpose of this lesson is to demonstrate how water is exchanged between the ocean, atmosphere and land, and how the hydrologic or water cycle is influenced by climate change and a warming atmosphere.

**ENGAGEMENT**

Put the following processes involved in the water cycle in order.

 \_1\_\_The sun heats the water in the ocean.

 \_\_\_\_Rivers and streams flow to the ocean.

 \_\_\_\_Water vapor cools and condenses on tiny dust particles in the air to form clouds.

 \_\_\_\_Excessive rain or melting snow causes runoff.

 \_\_\_\_Precipitation comes from clouds in solid or liquid forms.

 \_\_\_\_Some precipitation infiltrates the soil.

 \_\_\_\_Water vapor may also be evaporated from plants’ leaves, known as transpiration.

 \_\_\_\_Water drops combine and become heavy.

 \_\_\_\_Water molecules evaporate and form water vapor.

**EXPLORATION**

Read the procedure and make a prediction about what will happen.

*Prediction:*

**Procedure**

1. Prepare 100 mL of warm saltwater by adding 1 tablespoon of sodium chloride to warm water.
2. Add a few drops of blue food coloring to the warm saltwater and pour into the clear plastic cup.
3. Place the small paper cup on the water so it is floating inside the clear plastic cup
4. Place aluminum foil over the top of the plastic cup.
5. Carefully place the colored ice cubes on the aluminum foil.
6. Place the cup near a heat source and leave for approximately 20 minutes.
7. Predict what will happen.
8. Record observations after 20 minutes.

**THE SCIENTISTS’ EXPLANATION**

The sun provides the energy to drive the water or hydrological cycle on Earth. As water is heated, the molecules begin to move faster and further apart. Evaporation occurs when liquid water changes into a gas or water vapor. Evaporation occurs at the surface of all bodies of water, soil, and living organisms. Water is evaporated from the leaves of plants through the process of transpiration. Approximately 80% of evaporation on Earth takes place over the oceans and 20% over the land. Once in the atmosphere, water vapor can be moved by winds. Water vapor is in the atmosphere for a short period of time. Because the water vapor is warm, it rises into the atmosphere, which is colder at higher altitudes. Colder air cannot hold as much water vapor as warmer air, so the water vapor condenses. Condensation is the process in which water vapor changes into liquid water. These droplets of water condense on tiny particles of dust, pollen or ice to form clouds. When water droplets combine and become heavy enough, they fall as solid (snow) or liquid (rain) precipitation.

Most of the water vapor will eventually fall back into the ocean as precipitation, but approximately 10% will be transported over land and fall as precipitation over land. When precipitation falls onto land, some of the water evaporates and some drains downward through the soil. If the surface cannot absorb all the water, the excess will flow off the land as runoff, making its way into streams and rivers, and eventually back to the oceans.

The demonstration provides a model of heat warming the seawater. Water evaporates and the water vapor rises. As the water vapor rises to the top of the cup, the cooler air near the ice cannot hold as much water vapor, so condensation occurs on the bottom of the aluminum foil. As the water droplets combine and become heavy enough, they fall as precipitation into the cup.

**EVALUATION**

1. If water was in your paper cup, how do you think it got there? What color was the water? What does the color show?
2. How does your water cycle model represent the water cycle on Earth?
3. How is your water cycle model different from the water cycle on Earth?
4. Based on your model, how could you obtain freshwater from saltwater?

## 5. Using the Internet, describe some ways that the water cycle and people’s lives may be affected if Earth’s global climate were warmer. Describe five or more recent extreme events related to water cycle and a warmer atmosphere. These sites will help you get started:

 Climate Central - <http://www.climatecentral.org/>

 Current Climate News - <http://www.huffingtonpost.com/news/climate-change>

##

**EXTENSION**

* EPA Water Cycle Animation - <http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html>
* Readers’ Theater Script: Water Cycle Adventure - <http://www.enchantedlearning.com/rt/weather/watercycle.shtml>
* NASA Precipitation Education - <http://pmm.nasa.gov/education/water-cycle>