

Lesson Three: WATER CYCLE

This lesson provides students with an opportunity to examine precipitation, evaporation, condensation, and transpiration as phases of the water cycle.

Part I. LESSON OVERVIEW

A. Learning Objectives

Upon completion of this lesson students will be able to:

- Describe characteristics of the water cycle by recording observations of the phases of the water cycle—condensation, evaporation, precipitation, and transpiration in their journals.
- Discuss how phases of the water cycle function as a whole.
- Illustrate the direction of flow in the water cycle.

B. Correlation to State and National Standards and Guidelines

[See chart](#)

C. Textbook Compatibility

[See chart](#)

D. Materials

- 2 or 3 Clear plastic bottles (filled with ice and water)
- Clipboards-1 per student
- Hot pot
- Ice
- Laminated cards labeled station 1, station 2, station 3, and station 4
- Potted plant (inside large plastic bag)
- Plastic bag
- Relief map of specific region
- Spray bottle (filled with water)
- Student journals
- Water cycle poster

E. Advance Preparation

In this lesson, clear plastic bottles filled with ice and water allows students to directly explore the phenomenon of condensation. Shortly before facilitating this lesson several water bottles need to be filled with ice and water. A plant in a large plastic bag allows student to directly explore transpiration. It

is best if the plant is placed in the bag the night before teaching the lesson.

The facilitator may want to arrive several minutes early to the classroom in order to set up the four different stations for this lesson. To avoid confusion, it is best if the stations are set up in a way that allows student to circulate through the different stations either clockwise or counterclockwise. Station 4, evaporation, requires an electrical outlet for the hot pot. It is easier to see steam rising from the boiling water if the hot pot is placed against a dark colored wall or other dark background.

F. Key Vocabulary

EVAPORATION	WATER CHANGING FROM A LIQUID TO A GAS.
CONDENSATION	WATER CHANGING FROM A GAS TO A LIQUID.
PRECIPITATION	WATER FALLING TO THE EARTH'S SURFACE FROM THE CLOUDS.
TRANSPIRATION	WATER CARRIED THROUGH PLANTS. WATER TRAVELS FROM A PLANT'S ROOTS TO ITS LEAVES WHERE IT CHANGES TO VAPOR AND IS RELEASED INTO THE ATMOSPHERE.
WATER CYCLE	THE CONSTANT MOVEMENT OF WATER FROM THE EARTH'S SURFACE, INTO THE ATMOSPHERE AND BACK TO THE EARTH'S SURFACE.

G. References

Brewer, Richard. *The Science of Ecology*, 2nd ed. Ft. Worth: Saunders College Publishing/Harcourt Brace College Publishers 1994, 362-365.

Campbell, Neil A. *Biology*, 4th ed. Menlo Park, CA: The Benjamin/Cummings Publishing Company, Inc., 1996, 1154.

Miller, G. Tyler. *Living in the Environment*, 10th ed. Belmont, CA: Wadsworth Publishing Company, 1998, 119-121, 184.

PHASE II: LEARNING CYCLE APPLICATION

Phase One: Exploration (E)

1. Introduce the lesson to the class. Explain the exploration activity:

The class will be divided into four groups. Each group will move through the different stations. At each station, you will explore as instructed and then record your observations in your journals. I will briefly demonstrate and explain what you are expected to do at each station, please open your journals and follow along as I rotate through the stations.

Station 1: CONDENSATION

Observe the water bottles. Observe carefully. Do the bottles feel dry or wet? Do the bottles feel colder or warmer than the room? Record these observations in your journals.

Station 2: PRECIPITATION

Hold the spray bottle high above the relief map. Spray the bottle two times. Carefully observe water as it leaves the spray bottle. Which way does water move? Record these observations in your journals.

Station 3: TRANSPIRATION

Observe the potted plant in the plastic bag. Observe carefully. Do you feel or see water on the outside of the plastic bag? Do you see water on the inside of the bag? Record these observations in your journals.

Station 4: EVAPORATION

It is very important to be careful at this station. In order to safely observe what is going on, please remain a safe distance from the pot of boiling water. Do not lean on the surface where the hot pot is sitting, even when recording your observations. This is why you have clipboards. Observe carefully. Record these observations in your journals.

2. Hand out clipboards.
3. Divide the class into four student groups.
4. Explain to the students that they may not start at Station 1, so care should be taken to record their observations in the appropriate space in their journals.
5. Before allowing the class to move to their first station, make sure a facilitator is on duty at station 4.
6. Instruct the groups to move to their first station.
7. After 3-5 minutes instruct the groups to move to their next station.
8. Repeat until all stations are visited.

Phase Two: Concept Introduction (CI)

1. Discuss the students' observations as recorded on the journal sheets. Ask students to share their observations.
2. Define key vocabulary. Write the terms on the board. Refer to the exploration activity and elicit observations from the students as you introduce each term. Use the water cycle poster to aid you.
NOTE: The phases of the water cycle are too advanced to read or speak for most third graders. When you ask questions about the terms make sure the answer is not the term itself. For example: What is precipitation? Have you ever seen condensation happen?
3. Define CONDENSATION. *Condensation is water changing from a gas to a liquid.* Ask the students where they have observed condensation. Examples are water on the outside of a cold glass or

can, a cloud, and breath on a cold window.

4. Define PRECIPITATION. *Precipitation is moisture that falls to the Earth's surface from the clouds.* Ask the students to give examples of precipitation that they have experienced in their own lives. Examples are rain, snow, sleet, and hail.
5. Define TRANSPIRATION. *Transpiration is moisture carried through plants.* Water travels from a plant's roots to its leaves where it changes to water and is released back into the atmosphere. Ask the students if they know of any examples of transpiration. This is a difficult concept for third-graders. In western North Carolina, the mist hanging over the trees in the early morning or after it rains are examples of transpiration. You can explain to the students how the Smoky Mountains received their name because of this phenomenon. (Use a relevant example for your region.)
6. Define EVAPORATION. *Evaporation is water changing from a liquid to a gas.* Ask the students where they have observed evaporation. Examples are puddles on pavement disappearing after rain, wet laundry drying on a clothesline.
7. Define the WATER CYCLE. *The water cycle is the constant movement of water from the Earth's surface, into the atmosphere and back.* Explain that precipitation, condensation, transpiration and evaporation are all parts of the water cycle. Use the poster to aid you in defining the water cycle.
8. Teach the "Water Cycle Boogie". The Water Cycle Boogie is sung to the melody of "The Wheels on the Bus". This activity works well either inside or outside.
9. Demonstrate the motions to the "Water Cycle Boogie". Ask students to repeat the following words and motions after you.

The Water Cycle Boogie

The Water Cycle Boogie goes up and down.

(Point up and down with your index fingers.)

The Water Cycle Boogie goes round and round.

(Continue to point up and down while turning in circles.)

We've got...

CONDENSATION

(Spread your arms over head in a Y-shape. Then, cup hands together.)

PRECIPITATION

(Start with your arms over your head. Lower your hands to your sides with your fingertips facing upwards. Wiggle your fingers downward until you're in a crouching position.)

TRANSPIRATION

(Stand up and spread arms to the sides like tree branches. Slowly lift your arms over your head and wiggle your fingers upward.)

EVAPORATION

(Wiggle fingers and lift hands over head.)

Repeat.

10. After you've had fun with the Water Cycle Boogie, ask the class to open to the water cycle diagram in their journals.
11. Instruct the students to study the diagram and write the phases of the water cycle in the correct place.
12. Have the students color label the diagram in their journals, illustrating the flow of the water cycle.
13. Circulate through the classroom to answer questions or help guide the activity if necessary.

Phase Three: Concept Application (CA)

EcoTeam Application Lesson and Roots & Shoots Service-Learning Project, please see corresponding sections of website.

PART III. BACKGROUND INFORMATION FOR FACILITATOR

A. General

The WATER CYCLE (or HYDROLOGIC CYCLE) is the continuous journey of water through Earth's systems. Water falls to the earth in the form of PRECIPITATION and returns to the atmosphere through EVAPORATION. Precipitation may INFILTRATE the soil and accumulate as GROUNDWATER or RUN-OFF into streams, lakes, or ponds. Plants remove large amounts of water from the soil through the process of TRANSPIRATION. The process of transpiration combined with evaporation is sometimes referred to as EVAPOTRANSPIRATION. CONDENSATION of water occurs in the atmosphere until it falls in the form of precipitation again, continuing the endless cycle of water. As water moves through this cycle it may pass through all three STATES OF MATTER, SOLID (ice), LIQUID (clouds, oceans, ponds, and streams), and GAS (invisible water vapor).

Precipitation

Precipitation is a convenient place to begin investigating the water cycle. Water vapor condenses to form clouds (thus transforming from a gas to a liquid), and as water droplets become larger they gain sufficient weight to fall to the Earth's surface. Precipitation may fall to the earth in many forms (hail, rain, sleet, or snow). When rain hits the Earth's surface, it begins to move laterally outward and vertically downward. Lateral movement of water is called run-off. Run-off accumulates into puddles, lakes, rivers, and streams where it collects. A glacier or an icecap is also a form of water storage. Vertical movement of water through soil or porous rock is called infiltration. Through infiltration, water seeps into the earth and recharges groundwater supplies.

Evaporation

Evaporation is the process by which water changes from a liquid state to a gaseous state. This is promoted by low pressure in the atmosphere, high temperatures, and low humidity. Evaporation from the oceans is a major component of the climatic system of our planet.

Transpiration

Transpiration is the process by which water travels up the *xylem* of a plant and exits from its leaves. This occurs through capillary action, and it occurs when there is an excess of water in the plant compared to the atmosphere. In the Southern Appalachian mountains of our region, transpiration usually occurs at night. In the Smoky Mountains of North Carolina and Tennessee this water evaporates and then condenses. Thus, the name!

Condensation

Condensation occurs when warm moist air contacts something cool. It then changes from a water vapor (a gas) to a solid.

B. Humans and the Water Cycle

The water cycle is one of the many cycles of nature, also seen in BIOGEOCHEMICAL CYCLING of carbon, nitrogen, and other basic elements. Disruptions to these cycles may create harmful consequences such as a depletion of available liquid water for plants and animals, an increase in CO₂ in the atmosphere leading to GLOBAL WARMING, or a toxic concentration of ammonia in aquatic ecosystems. The water cycle also acts to clean impurities and pollutants from water in an endless process of purification.

Humans negatively modify the water cycle in numerous ways such as building dams and impermeable surfaces, diverting water for irrigation, contributing to water pollution via fertilizer or pesticide runoff, and poor construction practices or agricultural techniques leading to erosion and siltation.

C. Environmental Citizenship

Humans have choices with respect to how we treat and use water, many of which are applicable even in the lives of elementary school students. For example, we can practice water conservation. Of all the water on Earth, less than 0.01% is available as liquid water for plants and animals. Conserving water slows the depletion of groundwater supplies. We can do our part to share this universally essential resource.

We can also be mindful of what we add to the water cycle. NON-POINT sources of pollution, such as run-off from private residences contribute greatly to the oils, pesticides, and other pollutants in our waterways. Many people are unaware that dumping gasoline, oils, paints, and pesticides on the ground or down storm drains is illegal and environmentally damaging.

Today, safe alternatives to toxic products, such as phosphate free and biodegradable cleaning detergents and fluids are becoming more and more available. These “green” alternatives can help us curb our impact on the Earth’s precious water supply.