



Floods

3–5

Flood Science

LESSON PLAN 1

The Hydrologic Cycle

It is important for children to understand the hydrologic cycle in preparation for learning the science behind floods and flash floods.

Key Terms and Concepts

condensation	infiltration	transpiration
evaporation	precipitation	watershed
hydrologic cycle	runoff	

Purposes

To give the students an understanding of the hydrologic cycle through demonstration and illustration

To have students illustrate how the hydrologic cycle and geography relate to floods

Objectives

The students will—

- Follow *You're the Scientist: Making Rain* and *You're the Scientist: Transpiration* to demonstrate steps in the hydrologic cycle.
- Understand how the demonstrations illustrate the hydrologic cycle.
- Discuss what might happen if any part of the hydrologic system stopped functioning.
- Write “what if...” science-fiction scenarios about the hydrologic system. (Linking Across the Curriculum)
- Label the parts of a plant with the aid of *You're the Scientist: Transpiration*, to illustrate how transpiration occurs and track the time of transpiration. (Linking Across the Curriculum)
- Define the word “watershed.”
- Use a map to find watersheds across the state.
- Create illustrations of the watersheds and draw and label the hydrologic cycle that occurs within them.
- Research and discuss the role the watersheds play in the hydrologic cycle.
- Find watersheds in which members of their family have lived. (Home Connection)
- Research to learn how the water from their homes and school returns to the hydrologic cycle. (Linking Across the Curriculum)



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Activities

“The Hydrologic Cycle”

“Water and Geography”

TEACHING NOTE To understand the science behind floods and flash floods, it is important for the students to learn the hydrologic cycle. If your class has already been introduced to the concept, use this lesson plan as reinforcement or skip the lesson.



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Materials

- *You're the Scientist: Making Rain*, 1 copy per student
- *You're the Scientist: Transpiration*, 1 copy per student

For each group:

- Large and small pots
- Very hot water and cold water
- Ice
- Flashlight
- White flowers (carnations, Queen Anne's lace) or a stalk of celery (faster demonstration)
- Red, blue or green food coloring
- Water
- Vase
- Colored pencils or crayons



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"The Hydrologic Cycle"

SET UP 40 minutes CONDUCT two 30-minute classes

Science: Earth Science and Physical Science

1.  To introduce the hydrologic cycle, write the following words on the chalkboard and have the students copy the terms into their science journals:

condensation
evaporation

precipitation
transpiration

2. Distribute *You're the Scientist: Making Rain* and *You're the Scientist: Transpiration* to teams of students.

TEACHING NOTE Depending on the time available and the abilities of your students, half the groups could work with the rain demonstration and the other half with transpiration. Completing the demonstrations as a whole class is another option.



Wrap-Up

After completing the demonstrations, have the students discuss their observations and apply the terms of the hydrologic cycle in nature (Condensation: clouds; precipitation: rain, sleet, snow and hail; evaporation: rivers, oceans and lakes; transpiration: trees and other plants)



Discuss with the class how the terms represent a cyclical system and explain how the amount of water in the cycle remains the same at all times.

TEACHING NOTE For all discussion questions, answers will vary, but might include ideas within the parentheses.

Discuss—

- What would happen if one part of the hydrologic system stopped functioning? Explain for each part of the cycle. (If water no longer evaporated, the groundwater would continue to rise, rivers would flood their banks, and oceans would rise above the shoreline. If there were no precipitation, the atmosphere would stay moist, but eventually the waters on the earth could evaporate and not be replenished. If ice did not melt, rivers and oceans would shrink, some rivers would dry up, new snow and ice would accumulate (not melt) throughout the years, and we could have another ice age.)



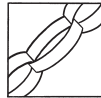
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- What would happen if more water were suddenly added to the system? Could the hydrologic cycle keep the system stable? What would need to occur? (If more water were added to the system, floods would occur and oceans would rise unless the evaporation and transpiration part of the cycle also increased in efficiency and the atmosphere could hold more water longer.)
- What would happen if water suddenly disappeared from the system? What would be the long-term effect? (If water disappeared, there could be short- and then long-term drought—not enough precipitation and a lowered water table. Worldwide drought could cause a global food shortage, could devastate rain forests and eventually could eliminate living things on the earth.)



Linking Across the Curriculum

Language Arts: Writing; Science: Earth Science

Have the students turn their discussion of “What would happen if...” into science fiction stories based on scientific, hydrologic facts. Critique the stories for scientific accuracy as well as creativity.

Science: Life Science; Language Arts: Vocabulary

If necessary, distribute another copy of *You're the Scientist: Transpiration* to each student. Ask the students to explain the diagrams of their transpiration experiment and label the anatomy of the plant to illustrate how transpiration occurs.



Use the following terms: *stoma*, *phloem* and *transpiration*. Have the students cut cross sections of the stems to show the phloem and to gauge the time of transpiration.



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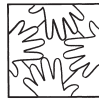
The Hydrologic Cycle

Materials

- Large state map, showing rivers, streams, ponds, lakes and other bodies of water
- Construction paper and markers



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"Water and Geography"

SET UP 5 minutes CONDUCT 30-45 minutes

Science: Earth Science; Social Studies: Geography

1.  Talk with the students about places where they find water in their area: rivers, streams, ponds, lakes or the ocean. Ask them to define "watershed." (A watershed is an area of land from which all of the water that is under it, or that drains from it, flows to the same place—a river, a lake or even the ocean.) Ask the students: Do we live in a watershed? (Yes, everyone does.) Do all of us live in the same watershed? (Answers will vary, depending on where students' homes are located.)
2. Using a large state map, guide the students to find the watersheds. Working in small groups, have the students choose a section from the map and create a large landscape illustration of the watershed. Within their illustrations students will depict the parts of the hydrologic cycle: clouds indicate condensation; raindrops equal precipitation; bodies of water show evaporation; and trees and other plants depict transpiration.

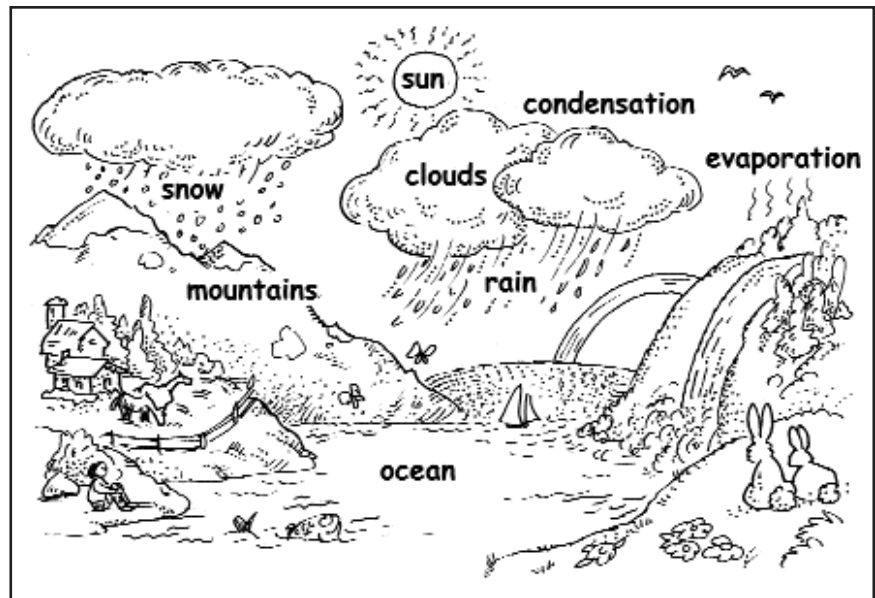


Wrap-Up

Students will present their illustrations to the class, using arrows within their pictures to illustrate the cyclical motion of the hydrologic system.



Ask the students to discuss the role their watersheds play in the cycle. For example:





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TEACHING NOTE The Environmental Protection Agency (EPA) has an excellent map of watersheds in the United States with information about problems and successes in supporting these areas: Surf Your Watershed at <http://cfpub.epa.gov/surf/locate/map2.cfm>



Home Connection

Many students or their families have lived in other places. Direct them to the Web site entitled Surf Your Watershed at <http://cfpub.epa.gov/surf/locate/>

map2.cfm to discover the watersheds they have lived in. Have the students talk with their families to find out about the watersheds in which they have lived. Which watersheds are in trouble? How? Ask them to share their information in class.



Linking Across the Curriculum

Science: Earth Science; Social Studies: Government

Challenge the students to find out how the water from their homes and school returns to the water cycle. Invite a representative from your local government to come and talk with the students about waterlines and water treatment, or take a field trip to a water treatment plant in your area or a museum with civil engineering exhibits.



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You're the Scientist: Making Rain

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Name _____

Directions: Follow the steps below to demonstrate three major processes in the hydrologic cycle: evaporation, condensation and precipitation.

What you need:

- Adult supervision
- 1 large and 1 small pot
- Very hot water and cold water
- Ice
- Flashlight



What you do:

1. Fill the large pot with very hot water.
2. Fill the smaller pot with cold water and ice. Hold the pot of cold water over the pot of hot water.
3. Draw your experiment.
4. Turn off the lights and shine a flashlight under the pot of cold water.





You're the Scientist: Making Rain

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5. Draw what you observe. Label each part of your observation: evaporation, condensation or precipitation.

6. Explain how each term relates to the hydrologic cycle.





You're the Scientist: Transpiration

Page 1 of 3

Name _____

Directions: Plants have a role in the hydrologic cycle. Follow the steps below to demonstrate the process of transpiration.

What you need:

- White flower (carnation, Queen Anne's lace)
- Red, blue, or green food coloring
- Water
- Vase
- Colored pencils or crayons



What you do:

1. Fill the vase with water and put several drops of the food coloring into it.
2. Remove leaves from the flower stem and place the flower in the vase.
3. Draw the setup of your experiment to illustrate the color of the water.





You're the Scientist: Transpiration

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4. Make your observations every 2 hours, and draw and color what you observe.

Hour 2

Hour 4

Hour 6

Hour 8





You're the Scientist: Transpiration

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- What happened to the water in the vase?
 - What happened to the water that flowed up the stem of the flower?
5. Explain the term *transpiration* based on your experiment. How does it relate to the hydrologic cycle?

