

The Water Cycle

Purpose

To help students understand the continuous cycle that water undergoes as it changes form.

Context

In this lesson, students build upon their previous investigations of water—and its different forms—by learning about the water cycle and its continuous flow around us. Students begin by reviewing what they already know about water and how it can freeze into ice or turn into a gas depending on how low or high temperatures become. They then learn about the water cycle and its key processes that affect our lands, oceans, and atmosphere. The ongoing need for fresh-water conservation is also highlighted.

In general, students at this level should already have an understanding of the following benchmark ideas: some events in nature have a repeating pattern—such as daily weather patterns or changes in temperature and the appearance of rain and snow at different times of the year; water can be a liquid or a solid and can go back and forth from one form to the other; and water left in an open container disappears, but water in a closed container does not disappear. Understanding of these concepts grows slowly as students mature and encounter them in different contexts.

This lesson furthers what students know about the connection between liquid and solid forms of water, in addition to helping them recognize that water can also be a gas, which is much more difficult at this level. For example, students will be asked to think about where water in an open container goes when it disappears. This is neither self-evident nor easy to detect. But the water cycle is of such profound importance to life on earth that students at this level should certainly have experiences that will in time contribute to their understanding of evaporation, condensation, and the conservation of matter. (*Benchmarks for Science Literacy*, [pp. 67–68](#).) This lesson introduces these formal concepts.

While teaching, be aware that research shows that students' ideas about the conservation of matter, phase changes, clouds, and rain are interrelated and contribute to understanding the water cycle. Students seem to go through a series of stages to understand evaporation. Before they understand that water is converted to an invisible form, they may initially believe that when water evaporates it ceases to exist, or that it changes location but remains a liquid, or that it is transformed into some other perceptible form (fog, steam, droplets, etc.). With special instruction, some students in the 5th grade can identify the air as the final location of evaporating water, but they must first accept air as a permanent substance. This appears to be a challenging concept for upper elementary students. Students can understand rainfall in terms of gravity in middle school but not the mechanism of condensation, which is not understood until early high school. (*Benchmarks for Science Literacy*, [p. 336](#).)

To learn more about the water cycle in the context of the earth's climates, read this [excerpt](#) from *Science for All Americans*.

Planning Ahead

This lesson is appropriate for older students in the 3-5 grade level. As a prerequisite, students should have had experiences with water in liquid and solid forms, as well as with water "disappearing" from a cup. These concepts are reviewed in the Motivation section of this lesson. There are three Science NetLinks lessons at the K-2 level that deal with the three states, or forms, of water:

- [Water 1: Water and Ice](#)
- [Water 2: Disappearing Water](#)
- [Water 3: Melting and Freezing](#)

Materials:

- [Round and Round It Goes!](#) student sheet
- [Model Water Cycle](#) student sheet
- [Water Cycle](#) student E-Sheet
- Water
- Two dishes
- An ice cube
- A clear glass
- Poster paper
- Crayons/markers
- Large glass, metal, or plastic bowls
- Dry ceramic mugs (like coffee mugs)
- Long pieces of string or large rubber bands
- A pitcher or bucket
- A sheet of clear plastic wrap

Motivation

In order for students to understand how the water cycle works, it is important for them to review what they have already learned about water itself, and the different states it can assume (solid, liquid, or gas) in our ever-changing environment. This can be done by showing the class three items—a half-filled glass of water, a dish with an ice cube, and a dish with a wet paper towel.

Begin by drawing attention to the glass of water. Ask questions such as:

- What is in this glass?
- What is water? What does it look or feel like?
- Is water a solid, a liquid, or a gas?
- Where can you find water? Where does it come from?

Guide the class in establishing that water is a liquid that both falls from the sky in the form of rain and can be found in abundance in oceans, lakes, streams, and underground. Next, pick up the dish with the ice cube and show it to the class. Ask questions such as these:

- What is in this dish?
- Describe ice. What does it look or feel like?
- Is ice a solid, a liquid, or a gas?
- What is ice made of? How is it made?
- If I left the ice in the room for a few hours, what would happen to it?

Help the class to see that ice is water that has been frozen into a solid because it has been exposed to very low temperatures. Make sure they understand that when ice is allowed to warm up, it returns to liquid water.

Next, present the dish with the wet paper towel, asking questions like these:

- What is this?
- What would happen if I left it out for a few hours?
- Why would it dry out?
- Besides paper towels, what are some other examples of wet things that dry out over time? (Examples could include wet clothes, watered plants, glasses of water, and puddles.)
- What if I put this wet paper towel outside during the winter? What might happen to it? Why?

At this point, students should understand that when water is exposed to warm temperatures, it disappears or evaporates, becoming a gas, while under colder conditions it can freeze into ice, becoming a solid. It is important to emphasize that the three water samples they've seen represent the three states, or forms, that water takes on as temperature and other conditions change.

Development

To help students better understand the constant circulation and transformation of water in the outside world—the water cycle—have them think about and discuss questions such as these:

- Where does water go when it disappears or evaporates?
- What role does the sun play in the evaporation process?
- Where does water come from when it rains?
- How are clouds formed?
- When rain (snow/sleet) falls to the ground, what usually happens to it?

(Accept all reasonable answers. Encourage students to elaborate on their responses.)

Using their [Water Cycle](#) student E-Sheets, students should visit [Round & Round It Goes! The Water Cycle](#) to learn more about how the water cycle works. Students will be directed to click on and read each process of the water cycle as shown on the graphic—starting with precipitation and ending with water vapor—and answer questions and take notes using their [Round and Round It Goes!](#) student sheets. When finished, discuss with them what they have learned and be sure to emphasize key benchmark concepts involving both the transformative (liquid/solid/gas) and the continuous, cyclical aspects of the global water cycle process.

Next, divide the class into groups, depending on the availability of your resources. To better apply and reinforce what they have learned, have each group complete the hands-on activity on the [Model Water Cycle](#) student sheet. Each group will be asked to create a model of a water cycle in class. Among other things, they will be able to observe how water condenses and then precipitates. Once the models are completed and the changes within them start taking place, include in your discussion questions such as these:

- Describe what is happening in your miniature water cycle.
- What effect is the sun having on your water cycle? The shade?
- What caused the water to evaporate in the mug or "ocean"?
- Where did the water go?
- How can you explain what is taking place on the plastic wrap?
- How can you explain the dripping that is taking place?
- Explain the processes involved in the water cycle that took place inside your models.

Assessment

Divide the class into seven groups with each one representing one of the key processes in the water cycle—precipitation, infiltration, ground water, water table, evaporation, transpiration, and water vapor. Hand out poster paper and crayons or markers, and have each group draw a picture showing how their process works within the water cycle. Instruct them to use their notes and previous websites as resources. When they have finished, have the teams arrange their posters on the wall in the correct order, starting with precipitation. Ask each team to explain how their process works. After their presentations, encourage a class discussion, supported by their water cycle models or real-world examples.

For further enjoyment and a greater challenge, assign a new water cycle process to the same groups and have them do the water cycle presentations all over again—this time without use of their notes.

Optional Activity

The [Water Cycle Boogie](#) is a sing-a-long about the water cycle which features key terms and processes that students have already learned in the lesson. It may be sung for fun and further reinforcement.

Extensions

Students can further apply what they have learned by doing the [My Life As A Drip](#) activity, where they imagine that they are a drop of water, and write a short story about where they think they came from (in the context of the water cycle).

Students of all grade levels can learn much more about the ways the water cycle affects the environment at the EPA's [Water Sourcebook Series](#) website. This resource features activities, fact sheets, reference materials, and more.

Franklin Institute's [Water in the City](#) website can help to broaden students' understanding of water and the continuous, global water cycle. This resource covers the "Water Basics" and science of water and also presents an analysis of Philadelphia's water system and case studies on waterways throughout the world.