

Water Models



■ Grade Level:

Upper Elementary, Middle School

■ Subject Areas:

Earth Science, Ecology, Geology, Physical Science

■ Duration:

Preparation time: 30 minutes
Activity time: two 50-minute periods

■ Setting:

Classroom

■ Skills:

Gathering information (observing, researching); Analyzing; Applying (making models); Presenting

■ Charting the Course

"Piece It Together" and "Wet Vacation" help students understand more about climates and ecosystems. Other water cycle activities include "The Incredible Journey," and "Imagine!" Further investigations of climate and culture are found in "The Rainstick" and "Raining Cats and Dogs."

■ Vocabulary

climate, condensation, ecosystem, evaporation, precipitation, transpiration, water cycle

Does water move through the water cycle in a desert as it would in a rain forest?

▼ Summary

Students construct models of the water cycle to illustrate its major components and processes, and adapt their models to show how they think water would cycle in various ecosystems.

Objectives

Students will:

- recognize the roles of condensation and evaporation in the water cycle.
- relate the water cycle to different climates and ecosystems around the world.

Materials

- Heat source
- Frying or cooking pans
- Ice
- Duct tape
- Large plastic or glass jars with tops (Students can bring empty pickle or peanut butter jars from home.)
- Water
- Sand
- Rocks
- Items that represent components of different climates or ecosystems (collected by students)
- Heat-resistant gloves (or oven mitts)
- Copies of *Water Cycle in a Jar*
- Copies of *Observation Sheet*

Making Connections

When it rains and when water flows down a river, students see evidence of water moving through the water cycle. But some components of the water cycle are not visible to the eye and may be overlooked. Constructing water cycle models can help students better appreci-

ate how evaporation and condensation help move water through the environment and around the world.

Background

Earth's water supply is finite, and this same water has been moving over, on, and under Earth's surface for thousands of years. The continual movement of water—often called the water cycle—collects, purifies, and distributes water around the world. The pull of gravity, electromagnetic forces, and the sun's energy keep water in continual motion.

Solar energy heats water on Earth's surface and in oceans, streams, lakes, soil, and vegetation and causes it to evaporate into the atmosphere. Heat from the sun also causes snow and ice to melt and then evaporate. Sometimes snow and ice can evaporate directly rather than going to the liquid state first; this process is called sublimation. Winds and air masses, also energized by the sun, flow around the globe, carrying water vapor with them. Falling temperatures cause water vapor to condense into tiny droplets that form clouds or fog. Water then leaves the atmosphere as precipitation (rain, snow, hail, etc.). Water often leaves the atmosphere many miles from where it originated. About 77 percent of the precipitation over the surface of Earth falls into the oceans. Water that falls on the ground seeps downward through soil and permeable rock formations, flows over the surface, or evaporates again.

There are three major climates (polar, temperate, and tropical). At the poles the air is cold and dry. The Arctic and the Antarctic are covered with snow throughout most of the year. Limited sunlight and cold temperatures allow very few plants to exist. Examples of plants that live in the tundra of the Arctic include mosses, lichens, and other plants

that grow close to the ground. Although water at the poles stays frozen for a long time, sometimes it does evaporate. The water vapor eventually condenses and falls back to Earth as snow or it may be carried by global wind currents to other parts of the planet. At lower latitudes, the snow may melt and be absorbed by plants or flow for a while over the surface.

Tropical climates are hot and humid. The tropics, especially the rain forests, are densely populated by a great diversity of plants. Very tall trees, whose tops form a dense canopy, cover much of the land area. Some plants growing beneath this crown cover have large leaves to catch sunlight that filters through the canopy, while others (epiphytes) grow far above the ground on the branches of taller trees. The ground is moist throughout most of the year, so plants do not need to grow deep roots to find water. Rain forests create their own weather systems. Water evaporates from the ground or from plants (through transpiration) and rises to the top level of the trees, where it condenses and then falls back to the ground. The water may flow over the surface, be absorbed by plants, or filter to the ground. Some water vapor does eventually escape to the atmosphere, where global winds carry it to other places.

While weather at the poles and in the tropics is fairly consistent throughout the year, the temperate climates (Earth's mid-latitude regions) experience seasons. A variety of plants live in this climate, such as deciduous trees, flowering plants, mosses, and grasses. Their life cycles and growing patterns must comply with the changing seasons. In this climate, water flows over the surface, seeps underground, freezes, and evaporates. Water moves through the atmosphere as vapor, eventually

falling back to Earth—sometimes many miles away or in a different climate.

Geographic qualities, such as nearness to the ocean, elevation, and extent of land mass, create a variety of ecosystems within the temperate climate. For example, deserts are hot and dry. To live in these conditions, some plants, such as mesquite, have extremely deep root systems. Other plants, such as cacti, have fleshy tissue and very few pores, so they can retain large quantities of water instead of losing it through transpiration.

The processes of evaporation and condensation within all these climates help water move around Earth's surface. In this way, water is used and reused, with all parts of Earth eventually sharing the same water.

Procedure

▼ Warm Up

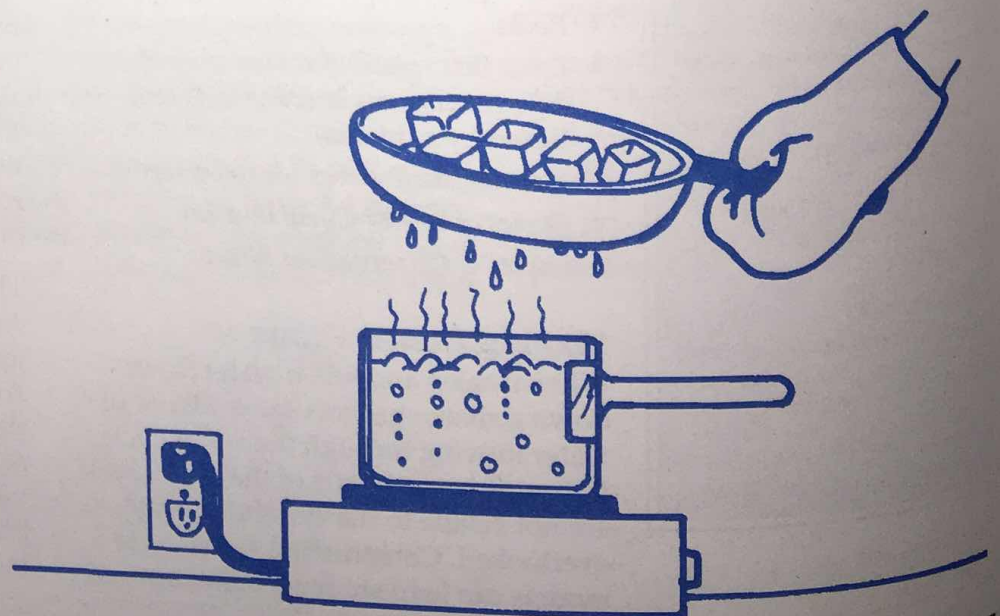
Set up the following teacher demonstration:

- Place a hot plate or other heat source on a table at the front of the room.
- Place a pot of water over the heat source.

- Once the water is hot, hold a pan of ice above the rising water vapor. (Wear heat resistant gloves for protection.)
 - Drops of water vapor should condense on the bottom of the pan of ice.
 - The drops of liquid water will fall and return to the pan of hot water.
- Have the students make a list of observations and explain each. Ask students to list the processes that are occurring and how these might be exhibited in nature.

▼ The Activity

1. Provide groups of students with a copy of *Water Cycle in a Jar* and have them construct their model and record observations on the *Observation Sheet*.
2. Have students summarize their observations, identifying and explaining the processes of evaporation and condensation. Help students understand the role of solar energy in these processes. Runoff, filtration through sand, and other aspects of the water cycle can also be discussed.
3. Discuss the role of plants in the water cycle. Have students research different climates (polar, temperate,



tropical) and/or ecosystems around the world (rain forest, desert, tundra, etc.). They should focus their search on learning how water moves in the area. Would water evaporate quickly? Would there be much standing water? Does water remain frozen? Students could further their investigations by finding out what plants live in the area. How do they manage to live in these different climates?

4. **Challenge students to adapt their jar model to represent the climate or ecosystem they are studying.** For example, if the model represents a desert, they could put in tiny cacti, sand, and a little water, and place it in the sunlight.

▼ **Wrap Up**

Have students present their models to the class and describe how water moves within the model and within the climate or ecosystem represented by the model.

After the presentations are complete, draw a large circle on the floor that represents Earth. Bisect the circle with a line to indicate the equator. Have students arrange their models comparable to where they are located on Earth. (An alternative is to lay a world map on the ground.) Students should extrapolate how evaporation and condensation and other processes of the water cycle help water travel from one part of the world to another. Have students summarize how the world shares water.

Assessment

Have students:

- construct a simple model of the water cycle and identify the processes of evaporation and condensation (steps 1 and 2).
- create a model simulating the water cycle of different climates or ecosystems throughout the world (step 4).

- use the model to explain how the world shares water (*Wrap Up*).

Notes ▼

Extensions

Involve students in the following activities to further explore condensation and evaporation. Hand out paper towels soaked with equal amounts of water to groups of students. Charge them with finding the fastest way to dry the towels using only things they find in the room. Students should discover that motion, heat, and increasing the exposed surface help the water evaporate more quickly. Discuss where the evaporated water goes. Challenge students to retrieve water from the air. Discuss the process of condensation. Provide helpful hints by having metal or glass containers and ice water available.

Resources

Alexander, Gretchen. 1989. *Water Cycle Teacher's Guide*. Hudson, N. H.: Delta Education, Inc.

Biological Science Curriculum Study. 1987. *Biological Science: An Ecological Approach*. Dubuque, Iowa.: Kendall/Hunt Publishing Company.

🍏 Cast, Vance C. 1992. *Where Does Water Come From?* Hauppauge, N.Y.: Barron's Educational Series, Inc.

Hurd, Dean et al. 1988. *Physical Science*. Englewood Cliffs, N.J.: Prentice Hall.

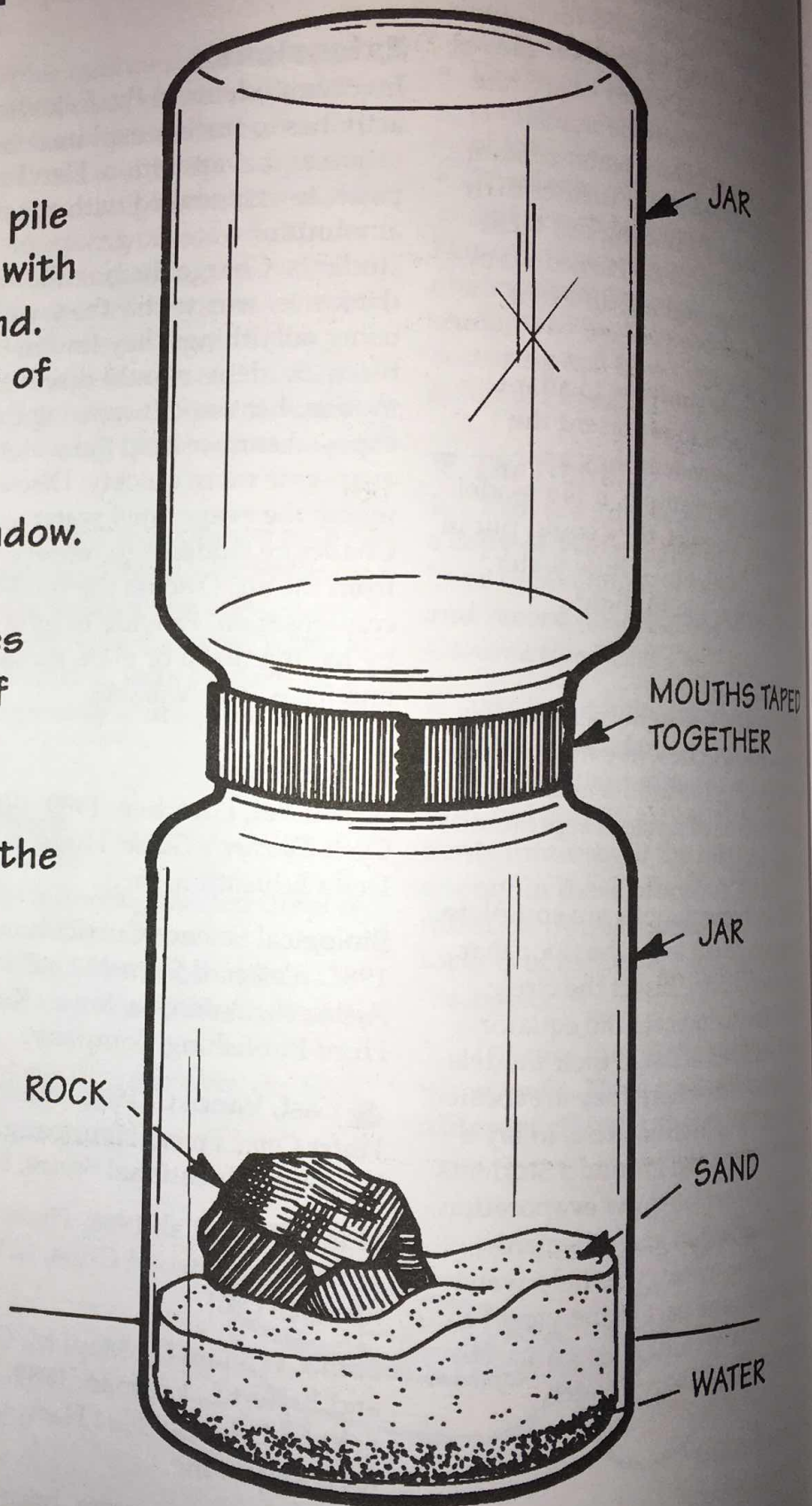
Lamb, William G., Mapi M. Cuevas, and Robert L. Lehman. 1989. *Physical Science*. Orlando, Fla.: Harcourt Brace Jovanovich, Inc.

🍏 Mayes, Susan. 1989. *What Makes It Rain?* London, England: Usborne Publications.

🍏 Schmid, Elenore. 1990. *The Water's Journey*. New York, N.Y.: North-South Books.

Water Cycle in a Jar

1. Take two identical jars; put a pile of sand in one and saturate with water. Place a rock in the sand. Tape together the open ends of the two jars. (See diagram.)
2. Put the jars near a sunny window.
3. Observe the jars several times during the day for a period of at least a week.
4. Record your observations on the observation sheet.



Observation Sheet

Water Cycle Model

Team Members: _____ Date: _____

	Day 1	Day 2	Day 3	Day 4	Day 5
Solar Energy Record: Good/Fair/Poor	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:
Evaporation Record: Good/Fair/Poor	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:
Condensation Record: Good/Fair/Poor	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:
Water Level (measure in inches or centimeters)	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:	obs. 1: obs. 2: obs. 3:

What time of day does condensation usually appear? _____

What processes are occurring to make these changes? _____

What is the role of sunlight and temperature? _____

Conclusions: _____

