



# CHILDREN'S CLEAN WATER FESTIVAL

Where Youth Are Making Waves!

## The Water Cycle

### Background:

Water is perhaps the ultimate example of recycling. Water is constantly renewing its purity by cycling itself from a liquid (or solid) into a vapor and back again. The cycle begins when heat from the sun causes ocean water to evaporate and become water vapor. The atmosphere holds the water vapor while the vapor gradually cools and forms clouds. The water eventually falls as rain or snow and flows in rivers and streams back into the ocean where the cycle is completed.

### The Water Cycle: The Incredible Journey

CIM CORRELATION: Science

- Common Curriculum Goal: Understanding structure and properties of matter: distinguish among solids liquids and gases
- Common Curriculum Goal: Understand chemical and physical changes: recognize that heating and cooling causes changes in states of matter
- Common Curriculum Goal: Understanding energy, its transformation, and interaction with matter: identify examples of energy transfer in the environment.

### The Incredible Journey

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- **Grade Level:** Upper Elementary, Middle School
- **Subject Areas:** Earth Science
- **Duration:** Preparation time 50 minutes, Activity time two 50-minute periods
- **Setting:** A large room or playing field
- **Skills:** Organizing (mapping); Analyzing (identifying components and relationships); Interpreting (describing)
- **Vocabulary:** condensation, evaporation, electromagnetic forces

## Summary

Where will the water you drink this morning be tomorrow? With a roll of the die, students simulate the movement of water within the water cycle.

## Materials

- 9 large pieces of paper
- Copies of **Water Cycle Table** (optional)
- Marking pens
- A bell, whistle, buzzer, or some sound
- 9 boxes, about 6 inches (15 cm) on a side

*(Boxes are used to make dice for the game. Gift boxes used for coffee mugs are a good size or inquire at your local mailing outlet. There will be one die [or box] per station of the water cycle. [To increase the pace of the game, use more boxes at each station, especially at the clouds and ocean stations.] The labels for the sides of the die are located in the Water Cycle Table. These labels represent the options for pathways that water can follow. Explanations for the labels are provided. For younger students, use pictures.)*

## Objectives

Students will:

- Describe the movement of water within the water cycle
- Identify the state of water as it moves through the cycle

## Making Connections

When children think of the water cycle, they often imagine a circle of water, flowing from a stream to an ocean, evaporating to the clouds, raining down on a mountaintop, and flowing back into a stream. Role-playing a water molecule helps students to conceptualize the water cycle as more than a predictable two dimensional path.

## Background

While water does circulate from one point or state to another in the water cycle, the paths it can take vary.

Heat energy directly influences the rate of motion of water molecules. When the motion of the molecule increases because of an increase in heat energy, water will change from solid to liquid to gas. With each change in state, physical movement from one location to another usually follows. Glaciers melt into pools, which overflow to streams, where water may evaporate into the atmosphere.

Gravity further influences the ability of water to travel over, under, and above Earth's surface. Water as a solid, liquid, or gas has mass and is subject to gravitational force. Snow on mountaintops melts and descends through watersheds to the oceans of the world.

One of the most visible states in which water moves is the liquid form. Water is seen flowing in streams and rivers and tumbling in ocean waves. Water travels slowly underground, seeping and filtering through particles of soil and pores within rocks.

Although unseen, water's most dramatic movements take place during its gaseous phase. Water is constantly evaporating, changing from a liquid to a gas. As a vapor, it can travel through the atmosphere over Earth's surface. In fact, water vapor surrounds us all the time. Where it condenses and returns to Earth depends upon loss of heat energy, gravity, and the structure of the Earth's surface.

Water condensation can be seen as dew on plants or water droplets on the outside of a glass of cold water. In clouds, water molecules collect on tiny dust particles. Eventually, the water droplets become too heavy and gravity pulls the water to the Earth.

Living organisms also help move water. Humans and other animals carry water within their bodies, transporting it from one location to another. Water is either directly consumed by animals or is removed from food during digestion. Water is excreted as a liquid or leaves as a gas, usually through respiration. When water is present on the skin of an animal (for example, as perspiration), evaporation may occur.

The greatest movers of water among living organisms are plants. The roots of plants absorb water. Some of this water is used within the body of the plant, but most of it travels up through the plant to the leaf surface.

When water reaches the leaves, it is exposed to the air and the sun's energy and is easily evaporated. This process is called transpiration.

All of these processes work together to move water around, through, and over Earth.

## Procedure

**Warm Up** - Ask students to identify the different places water can go as it moves through and around Earth. Write their responses on the board.

### **The Activity**

- 1. Tell students that they are going to become water molecules moving through the water cycle.**
- 2. Categorize the places water can move through into nine stations: Clouds, Plants, Animals, Rivers, Oceans, Lakes, Groundwater, Soil, and Glaciers. Write these names on large pieces of paper and put them in locations around the room or yard.** (Students may illustrate station labels.)
- 3. Assign an even number of students to each station. (The cloud station can have an uneven number.) Have students identify the different places water can go from their station in the water cycle. Discuss the conditions that cause water to move.** Explain that water movement depends on energy from the sun, electromagnetic energy, and gravity. Sometimes water will not go anywhere. After students have come up with their list, have each group share their work. The die for each station can be handed to that group and they can check to see if they covered all the places that water can go. The *Water Cycle Table* provides an explanation of water movement from each station.
- 4. Students should discuss the form in which water moves from one location to another.** Most of the movement of water from one station to another will take place when water is in its liquid form. However, any time water moves to the clouds, it is in the form of water vapor, with molecules moving rapidly and apart from each other.
- 5. Tell students they will be demonstrating water's movement from one location to another.** When they move as liquid water, they will move in pairs, representing many water molecules together in a water drop. When they move to the clouds (evaporate), they will separate from their partners and move alone as individual water molecules. When water rains from the cloud (condensation), the students will grab a partner and move to the next location.
- 6. In this game, a roll of the dice determines where water will go.** Students line up behind the die at their station. (At the cloud station they will line up in single file; at the rest of the stations they should line up in pairs.) Students roll the die and go to the location indicated by the label facing up. If they roll **stay**, they move to the back of the line.

When students arrive at the next station, they get in line. When they reach the front of the line, they roll the die and move to the next station (or proceed to the back of the line if they roll *stay*).

In the clouds, students roll the die individually, but if they leave the clouds they grab a partner (the person immediately behind them) and move to the next station; the partner does not roll the die.

- 7. Students should keep track of their movements.** This can be done by having them keep a journal, notepad or beads to record each move they make, including *stays*. Students may record their journeys by leaving behind personal stickers at each station. Another approach has half the class play the game while the other half watches. Onlookers can be assigned to track the movements of their classmates. In the next round the onlookers will play the game, and the other half of the class can record their movements.
- 8. Tell students the game will begin and end with the sound of a bell (or buzzer or whistle). Begin the game!**

**Wrap Up and Action** Have students use their travel records to write stories about the places water has been. They should include a description of what conditions were necessary for water to move to each location and the state water was in as it moved. Discuss any *cycling* that took place (that is, if any students returned to the same station).

Provide students with a location (e.g., parking lot, stream, glacier, or one from the human body-bladder) and have them identify ways water can move to and from that site. Have them identify the states of the water.

Have older students teach "The Incredible Journey" to younger students.

## Assessment

Have students:

- role-play water as it moves through the water cycle (step 8).
- identify the states water is in while moving through the water cycle (step 4 and *Wrap Up*).
- write a story describing the movement of water (*Wrap Up*).

## Extensions

Have students compare the movement of water during different seasons and at different locations around the globe. They can adapt the game (change the faces of the die, add alternative stations, etc.) to represent these different conditions or locations.

Have students investigate how water becomes polluted and is cleaned as it moves through the water cycle. For instance, it might pick up contaminants as it travels through the soil and then leave them behind as water evaporates at the surface. Challenge students to adapt "The Incredible Journey" to include these processes. For example, rolled-up pieces of masking tape can represent pollutants and be stuck to students as they travel to the soil station. Some materials will be filtered out as the water moves to the lake. Show this by having students rub their arms to slough off some tape. If they roll *clouds*, they remove all the tape; when water evaporates it leaves pollutants behind.

## Water Cycle Table

STATION	DIE SIDE LABELS	EXPLANATION
Soil	one side <i>plant</i>	Water is absorbed by plant roots.
	one side <i>river</i>	The soil is saturated, so water runs off into a river.
	one side <i>ground water</i>	Water is pulled by gravity; it filters into the soil.
	two sides <i>clouds</i>	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	one side <i>stay</i>	Water remains on the surface (perhaps in a puddle, or adhering to a soil particle).
Plant	four sides <i>clouds</i>	Water leaves the plant through the process of transpiration.
	two sides <i>stay</i>	Water is used by the plant and stays in the cells.
River	one side <i>lake</i>	Water flows into a lake.
	one side <i>ground water</i>	Water is pulled by gravity; it filters into the soil.
	one side <i>ocean</i>	Water flows into the ocean.
	one side <i>animal</i>	An animal drinks water.
	one side <i>clouds</i>	Heat energy is added to the water, so the water evaporates and goes to the clouds.
one side <i>stay</i>	Water remains in the current of the river.	
Clouds	one side <i>soil</i>	Water condenses and falls on soil.
	one side <i>glacier</i>	Water condenses and falls as snow onto a glacier.
	one side <i>lake</i>	Water condenses and falls into a lake.
	two sides <i>ocean</i>	Water condenses and falls into the ocean.
	one side <i>stay</i>	Water remains as a water droplet clinging to a dust particle.

<b>Ocean</b>	two sides <i>clouds</i>	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	four sides <i>stay</i>	Water remains in the ocean.
<b>Lake</b>	one side <i>ground water</i>	Water is pulled by gravity; it filters into the soil.
	one side <i>animal</i>	An animal drinks water.
	one side <i>river</i>	Water flows into a river.
	one side <i>clouds</i>	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	two sides <i>stay</i>	Water remains within the lake or estuary.
<b>Animal</b>	two sides <i>soil</i>	Water is excreted through feces and urine.
	three sides <i>clouds</i>	Water is respired or evaporated from the body.
	one side <i>stay</i>	Water is incorporated into the body.
<b>Ground Water</b>	one side <i>river</i>	Water filters into a river.
	two sides <i>lake</i>	Water filters into a lake.
	three sides <i>stay</i>	Water stays underground.
<b>Glacier</b>	one side <i>ground water</i>	Ice melts and water filters into the ground.
	one side <i>clouds</i>	Ice evaporates and water goes to the clouds (sublimation).
	one side <i>river</i>	Ice melts and water flows into a river.
	three sides <i>stay</i>	Ice stays frozen in the glacier.

## Additional Resources:

### Books

- Alexander, Gretchen. 1989. *Water Cycle Teacher's Guide*. Hudson, NH: Delta Education, Inc.
- Mayes, Susan. 1989. *What Makes It Rain?* London, England: Usborne Publications.
- Schmid, Eleonore. 1990. *The Water's Journey*. New York, NY: North-South Books.

### Websites

- Day in the Life of a Water Drop: <http://cordle.estigers.k12.mo.us/studentwebpage/dayaswater/teacher.htm>
- Live From Mars a website developed by K-12 teachers, NASA's IITA Program & University of Washington: [http://www-k12.atmos.washington.edu/k12/pilot/water\\_cycle/teacherpage.html](http://www-k12.atmos.washington.edu/k12/pilot/water_cycle/teacherpage.html)
- USGS – Water Science for Schools: <http://ga.water.usgs.gov/edu/followdrip.html>
- Hydrologic/Water Cycle: <http://www.und.nodak.edu/instruct/eng/fkarner/pages/cycle.htm>
- Water Cycle Relay Activity: <http://www.bigsiouxwaterfestival.org/t57.html>

### Water Cycle Games:

- <http://kids.earth.nasa.gov/droplet.html>
- <http://kids.earth.nasa.gov/droplet.html>
- [http://www.conserve2o.org/water\\_cycle.html](http://www.conserve2o.org/water_cycle.html)

### Local Contacts or Possible Field Trips:

The Lower Columbia River Estuary Partnership  
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