THE INCREDIBLE JOURNEY

LAB ETHS 1

RELATED TOPICS

Water Cycle
States of matter
Watersheds
Data analysis and interpretation
Writing

STANDARDS ADDRESSED

Science and Technology	Environment and Ecology
3.4.4, 3.4.7	4.1.4, 4.1.7
3.5.4, 3.5.7	4.2.4
	4.3.4
	4.6.4, 4.6.7

This activity is designed for students in upper-elementary or middle school. It can be performed in a large room or on a playing field during two 50-minute periods.

PURPOSE

The purpose of this activity is to allow students to simulate the movement of water within the water cycle and to understand the states of water as it moves through the water cycle.

EQUIPMENT/MATERIALS

8 pieces of paper (8 ½ " × 11 ") – 1 each of brown, green, black, white, dark blue, light blue, tan, red, clear
1 overhead transparency
Copies of "Water Cycle Table"
Long pipe cleaners – 1/students
9 small clear cups to hold beads
Beads that fit on pipe cleaners – colors needed: brown, green, black, white, dark blue, light blue, tan, red, clear
Bell, whistle, buzzer, or some sound maker
Marking pens
9 boxes of equal sides, or dice

PREPARATION

Boxes are used to make dice for the game. Gift boxes used for coffee mugs are a good size. A possible source of boxes is a mailing outlet. Each station requires one die, but the pace of the game will increase if more dice are used, especially at the clouds and ocean stations. The labels that should be made for each of the dice are noted in the Water Cycle Table. These labels represent the pathway options that water can follow. Explanations for the labels are provided. Pictures can be used for younger students. It is helpful to have the die colored to match the color of the paper and the bead for that station. As alternatives to dice made of boxes, spinners can be designed and used at each station or regular dice can be used.

Reference:
Project Wet, Water Education for Teachers. http://www.montana.edu.wwwwet/journey.html (accessed May 2003).

BACKGROUND

The water cycle is often thought of as a circle, with water flowing from a stream to an ocean, evaporating to the clouds, raining down on a mountaintop, and flowing back into a stream. While water does circulate from one point of state to another in the water cycle, the many possible paths make the water cycle much more complex than it is often considered.

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 to pools that 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 in its gaseous phase. Water is constantly evaporating, changing from a liquid to a gas. As a vapor, it can travel through the atmosphere over the Earth's surface. In fact, water vapor surrounds us all the time. Where it condenses and returns to Earth depends upon the loss of heat energy, gravity, and the structure of 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 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 it is removed form food during digestion. Water is excreted as a liquid or leaves as a gas, usually through respiration. When water is present of the sin of an animal (as perspiration, for example), evaporation may occur.

Among living organisms, the greatest movers of water 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 the 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 the Earth.

PROCEDURE

Before Beginning

Ask students to identify the different places water can go as is moves through and around the 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, Ground Water, Soil, and Glaciers. Write these names on large pieces of papers 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 the 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 lists, have each group share their work. The die for each station can be handed to that group and they can check to se if they covered all the places water can go. The Water Cycle Table provides an explanation of water movements from each station.
4. Students should discuss the form in which water moves from one location to another. Most of the movement 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 clouds (condenses), the students will grab a partner and move to the next location.
6. In this game, a roll of the die determines where water will go. Students line up behind the die at their station and add a bead from the station to their pipe cleaner. (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 add a bead from the station to their pipe cleaner. Next, 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 or notepad 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.

   Each student should also be given a pipe cleaner to hold the beads collected at each station visited. This also provides a record of their travels.

8. Tell students the game will begin and end with the sound of a bell (or buzzer or whistle). Begin the game!

The Wrap Up

1. 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.
2. Discuss any cycling that took place (that is, if any students returned to the same station).
3. 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.
4. Have older students teach "The Incredible Journey" to younger students.

ASSESSMENT

Have students:

- role-play water as it moves through the water cycle.
- identify the states water is in while moving through the water cycle.
- write a story describing the movement of water.

EXTENSIONS

1. 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.
2. Have students investigate how water becomes polluted and is cleaned as it moves through the water cycle. For instance, water might pick up contaminants as it travels through the soil. These contaminates are then left behind as the water evaporates at the surface. Challenge students to modify "The Incredible Journey" to include these processes. For example, rolled-up pieces of masking tape can represent pollutants while 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; because when water evaporates it leaves pollutants behind.

RESOURCES

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.

McKinney, Barbara Shaw. 1998. *A Drop Around the World.* Nevada City, CA: Dawn Publications. (Teacher Guide also Available)

Kerley, Barbara. 2002. *A Cool Drink of Water.* National Geographic.

The Incredible Journey Water Cycle Table

Station	Die Side Labels	Explanation
Soil	One side *plant*	Water is absorbed by plant roots.
	One side *river*	The soil is saturated, so water runs off into a river.
	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	Two sides *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	One side *stay*	Water remains on the surface (perhaps in a puddle, or adhering to a soil particle).
Plant	Four sides *clouds*	Water leaves the plant through the process of transpiration.
	Two sides *stay*	Water is used by the plant and stays in the cells.
River	One side *lake*	Water flows into lake.
	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	One side *ocean*	Water flows into the ocean.
	One side *animal*	An animal drinks water.
	One side *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	One side *stay*	Water remains in the current of the river.
Clouds (white)	One side *soil*	Water condenses and falls on soil.
	One side *glacier*	Water condenses and falls as snow on glacier.
	One side *lake*	Water condenses and falls into a lake.
	Two sides *ocean*	Water condenses and falls into the ocean.
	One side *stay*	Water remains as a water droplet clinging to a dust particle.
Ocean	Two sides *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	Four sides *stay*	Water remains in the ocean.

Station	Die Side Labels	Explanation
Lake	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	One side *animal*	An animal drinks water.
	One side *river*	Water flows into a river.
	One side *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	Two sides *stay*	Water remains within the lake or estuary.
Animal	Two sides *soil*	Water is excreted through feces and urine.
	Three sides *clouds*	Water is respired or evaporated from the body.
	One side *stay*	Water is incorporated into the body.
Ground Water	One side *river*	Water filters into a river.
	Two sides *lake*	Water filters into a lake.
	Three sides *stay*	Water stays underground.
Glacier (clear)	One side *ground water*	Ice melts and water filters into the ground.
	One side *clouds*	Ice evaporates and water goes to the clouds (sublimation).
	One side *river*	Ice melts and water flows into a river.
	Three sides *stay*	Ice stays frozen in the glacier.