

Lesson 5

Water Underground

How do surface water and ground water interact?
What happens if a pollutant enters the surface water?
From where does drinking water come?

GOAL To understand that surface water and ground water should be monitored and protected from contamination.

OBJECTIVES Students will:

- ✓ create a model that demonstrates the interaction between surface and ground water
- ✓ determine how surface water and ground water interact
- ✓ simulate “pollution” in their models

MATERIALS plastic 2-liter bottle, gravel (two cups), two paper cups, sand (two cups), food coloring, piece of nylon, a pump from lotion or soap dispenser, rubber band, paper to record observations, pencil

CORE CURRICULUM CONTENT STANDARDS

- Science 1(1,6), 3(4), 7(5), 8(2-4,6)
- Social Studies 10(1,3,6) 11(1,5), 12(3), 13(4)

VOCABULARY run-off, (im)permeable, percolate, aquifer, water table, effluent, penetrate

PROCEDURES

1. Begin by asking students where does water flow to when it rains. Some of the water may evaporate, flow over land as runoff into the waterways, or soak into the soil and become ground water. As rain water soaks into the ground it slowly *percolates* down into the soil through layers of soil and rock. The *permeability* of the soil affects how quickly or slowly the water is able to pass, or soak through the soil. Examples of permeable soil include sand and gravel because there are pore spaces in the soil. Clay is an example of an impermeable surface because it can effectively block water from flowing through it. Water percolates downward until it reaches an impermeable layer. Then, the water begins to accumulate, or fill up. The underground pockets of water held in the rocks are called *aquifers*. Aquifers are important sources of fresh water and many provide the supply of drinking water to many households. Wells are drilled to pump water from aquifers. Protecting this resource is extremely important as pollutants may contaminate water supplies. The interaction between surface water (rain water, lakes, wetlands, rivers) and groundwater (aquifers) is important because the water quality of one may affect the other

2. Break students up into groups and have them conduct the following exercise so as to illustrate the interaction between ground water and surface water: Distribute materials and have student groups assemble ground water models as a class.
 - a. Have students cut the 2-liter bottle in half. Then, place a thin layer of clay on the bottom of the bottle to represent the impermeable layer.
 - b. Have students fill one-third with gravel or rocks.
 - c. Afterwards, have groups secure a piece of nylon over the bottom end of the pump sprayer with a rubber band.
 - d. Place pump sprayer into rocks and fill container with sand two inches from the top.
 - e. To demonstrate how groundwater accumulates, have students add water into container, observing how the water affects the water table. Water can be poured into cup (with holes in bottom) while holding it over the 2-liter bottle so that it percolates through the soil. Have students continue pouring water until it accumulates to just past the top of the gravel (*water table*)
 - f. Instruct groups to make a depression in the sand by scooping it from one side of the model and piling it on the other side. Have students dig the depression down to the gravel. This represents a reservoir.
 - g. Discuss with students how surface water (reservoir) can interact with ground water. Have students simulate pollution into their models. Have each group follow different scenarios or instructions:
 - i. A sewage plant is working to its capacity. The plant requires new equipment and upgrades so as to keep up with technology. It was revealed that the effluent, or discharge from the plant is not meeting the appropriate standards. Have students pour two drops of food coloring into reservoir. Have it “rain” from the cup. Repeat four times. Have students pump water out of the ground using the lotion pump. Record their observations.
 - ii. An underground oil tank was removed from a property recently sold. After careful inspection, oil leakage was found in areas of the surrounding soil. Have students dig a hole in the sandy portion of the model. Place two drops of food coloring to simulate oil in the soil. Re-cover the hole. Have it “rain” from the cup with holes in the bottom. Repeat four times. Have students pump water out of the ground using the lotion pump. Record their observations.
 - iii. A new housing development was situated on a hill overlooking the reservoir and surrounding terrain. Many trees were cut down and a road was built reducing the amount of pervious surfaces. Sediment and run-off were spilling into the waterways. Place two drops of food coloring on the surface of the sandy portion of the model. Have it “rain” from the cup with holes in the bottom. Repeat four times. Have students record observations.
3. Conclude the lesson by having each group present their scenarios. Have them address where they placed the pollution and the effect it had on the surface water and ground water.

EXTENSIONS

1. Have students research the geological formations, such as stratified drift and bedrock that help in the storage of underground water reserves.
2. Have students try different types of soil in the cup to test percolation of the various types of soil.

RESOURCES

Etgen, John, *Healthy Water, Healthy People, Water Quality Educators Guide*, The Watercourse 2003, Bozeman, Montana 59717 - 0575

Haskin, Kathleen M., *The Ways of the Watersheds: An Educators Guide to the Environmental and Cultural Dynamics of New York City's Water Supplies*, 1995, Claryville, NY: The Frost Valley YMCA

GLOSSARY

aquifer - an underground layer of earth, gravel, or porous stone that yields water

effluent - an outflow from a sewer or sewage system

impermeable - preventing especially liquids to pass or diffuse through

penetrate - to enter into and permeate

percolate - to cause (liquid, for example) to pass through a porous substance or small holes; filter

permeable - that which can be permeated or penetrated, especially by liquids or gases:

permeable membranes; rock that is permeable by water

run-off - rainfall not absorbed by water

water table - the level below which the ground is completely saturated with water; also called the water level