Ground-Water Movement

Introduction

Ground water must be able to move through underground materials at rates fast enough to supply useful amounts of water to wells or springs in order for those materials to be classified as an aquifer. For water to move in an aquifer, some of the pores and fractures must be connected to each other. Water moves through different materials at different rates, faster through gravel, slower through sand, and even slower through clay. Gravels and sands are possible aquifers; clays usually are not aquifers. The following activity demonstrates how different sizes of rock materials that make up an aquifer affect water movement.

Objectives--Students will:

1. Identify several sources of rock materials that make up an aquifer.
2. Discuss how water moves through gravel, sand, and clay.

Materials

1. At least 10 students.
2. Large area to conduct activity.

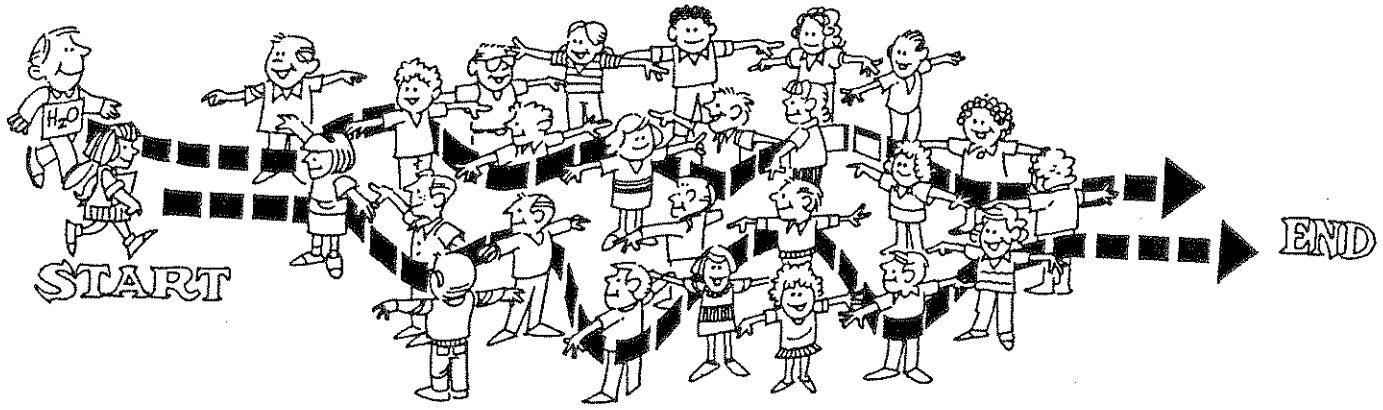
Teacher Preparation

This activity can be conducted in the classroom, gymnasium, or outside the school building. If conducted in the classroom, move all furniture to allow for sufficient room for the movement of students. This is a three-part demonstration that may create some excitement.

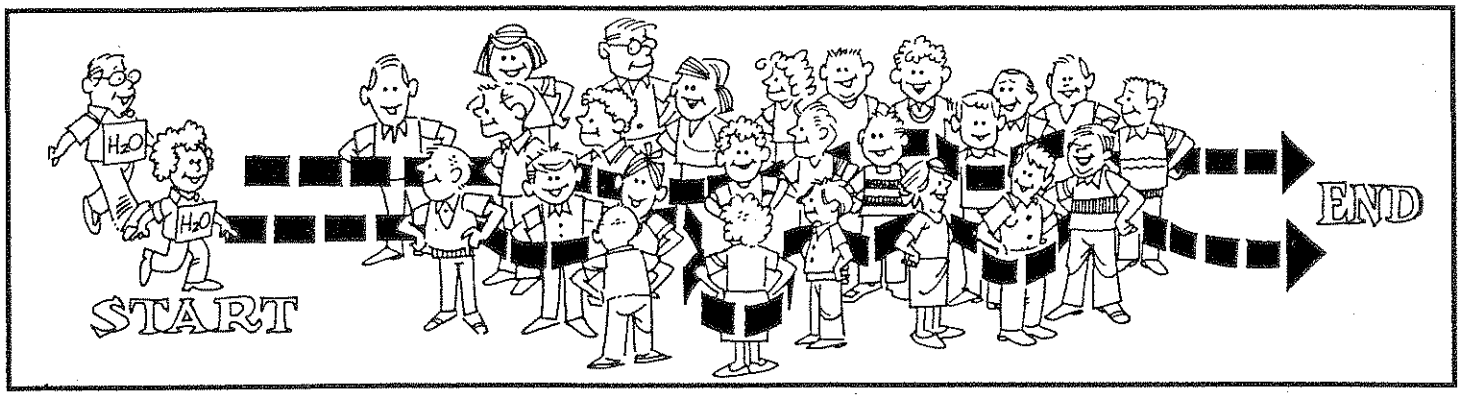
Procedures

Select two or three students to be molecules of water. The remaining students will be rock materials.

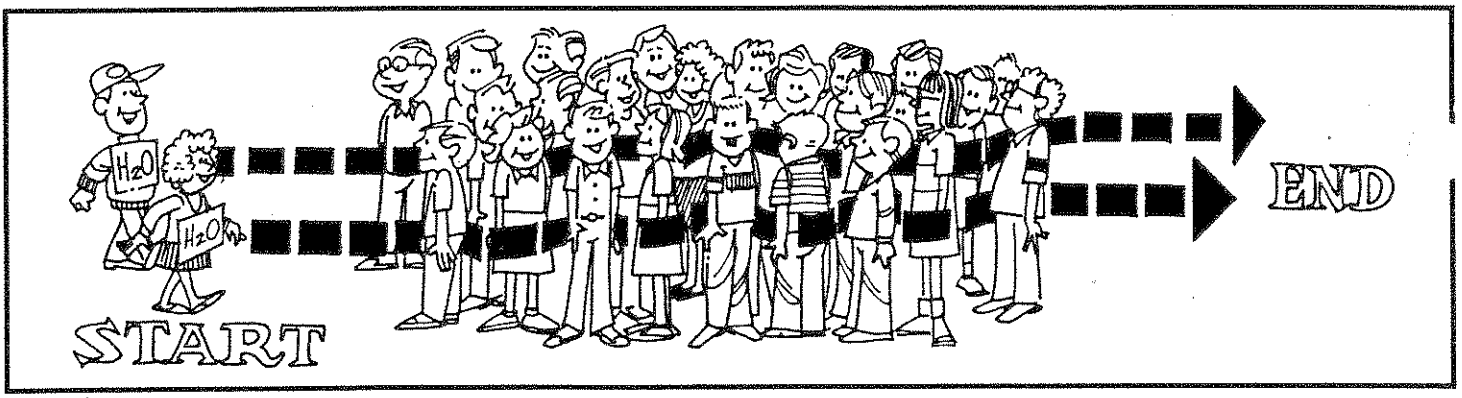
1. **Activity One:** Water movement through gravel. The students represent gravel by holding arms outstretched, leaving a 15- to 30- centimeter (cm) space between their outstretched arms. Locate these students in the center of the activity area. The students representing water molecules are to start on one side of their "gravel" classmates and move through them, exiting on the other side. The water molecules will move easily through the gravel.



2. **Activity Two:** Water movement through sand. The students represent sand by extending arms, bending them at the elbows and touching their waists with their fingers. Locate these students in the center of the activity area, spacing them approximately 15 cm apart. Once again, have the water molecules slowly make their way through their "sand" classmates. The water molecules will experience some difficulty, but should still reach the oth side.



3. **Activity Three:** Water movement through clay. Students become clay particles by placing their arms straight down the sides of their bodies and standing approximately 10 cm apart. Locate these students in the center of the activity area. It will be a formidable task for water molecules to move through the clay. Without being rough, the water molecules should slowly make their way through the clay. The water molecules may not be able to move through the clay at all.



Interpretive Questions

1. Which one of the materials — gravel, sand, or clay — was the easiest for the water molecules to move through? (Answer: Gravel, then sand, then clay.) Why? (Answer: Because there are larger spaces between the gravel particles.)
2. If there were three rock units, one of gravel, one of sand, and one of clay, all containing the same quantity of water, in which would you drill a well? (Answer: Gravel. Water moves easier through gravel than sand or clay.)

Extension

Obtain 250 milliliters (mL) of sand, 250 mL of pea-size gravel, 250 mL of clay, and three large funnels (top diameter approximately 12 cm). Force a piece of cheesecloth into the top of the spout of each funnel. This will prevent material from going through the funnel spout. Put each funnel into separate clear containers so that the spout of the funnel is at least 5 cm above the bottom of the container. Pour the sand into the first funnel, pea-size gravel into the second funnel, and the clay into the third funnel. Pour equal amounts of water (approximately 200 mL) onto the materials contained in the funnels. Select three students to pour the water, creating a permeab race. Time how long it takes the water to flow through the materials. Record on a data sheet. Which material did the water flow through the fastest? Why?

This activity was adapted from "Get the Ground Water Picture," National Project WET.