



## “Hold My Water”

**Objective:** Demonstrate the movement of water through different sediment types.

**Grade Level**

4th

**Time Frame**

45 minutes

Learning Objectives	Vocabulary	Science TEKS	Materials
Students will: <ul style="list-style-type: none"> <li>Students will investigate the movement of water through different sediment types</li> <li>Students will discover that some sediments hold water better than other sediment types</li> </ul>	<ul style="list-style-type: none"> <li><i>Porosity</i></li> <li><i>Groundwater</i></li> <li><i>Recharge</i></li> <li><i>Aquifer</i></li> <li><i>Permafrost</i></li> </ul>	4.7(A),(B),4.8(B),4.9(A)	<ul style="list-style-type: none"> <li>Pea sized gravel</li> <li>Sand</li> <li>Clay</li> <li>Scissors</li> <li>Plastic bottles</li> <li>Cotton gauze</li> <li>Rubber bands</li> <li>Graduated cylinders</li> <li>Clear plastic cups</li> <li>Stop watch</li> <li>Water</li> </ul>

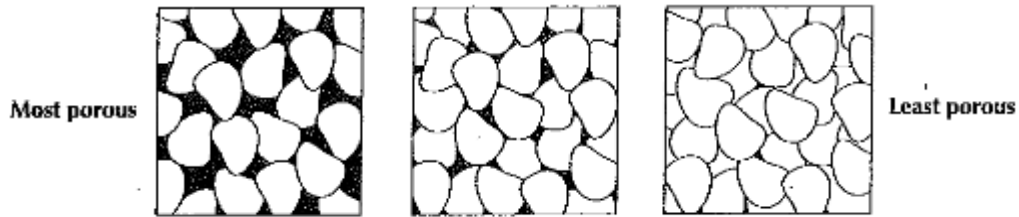
### Before the activity

Set up each student group workstation with the following materials:

- 3 plastic bottles
- Cotton gauze (enough to cover the top of each bottle)
- Rubber bands
- Scissors
- Graduated cylinder
- 3 plastic cups- one with gravel, one with sand, one with clay
- Stopwatch
- Gravel, sand, clay
- Water

## Background

The earth is made of different materials such as sand, gravel, rocks and clay. Water travels through these materials at different rates depending on the *porosity* of the material. Water can travel easily through particles of gravel and sand but has difficulty traveling through clay and rocks. Water has difficulty moving through clay because the clay particles are small, close together and the pore spaces are not interconnected well making it difficult for water to find its way through it. Rocks are an obstacle to moving water as well. Water must find a crack or hole in the rock, dissolve the rock or find a way around the rock to travel past it.



## Engage

Show students the three cups of gravel, sand and clay and ask them what they notice about the particle size of each. Ask students the following questions:

1. Which material has the largest particle size?
2. Which has the smallest particle size?
3. Which material do you think water will travel through the easiest and why?
4. Which material do you think water will travel through the slowest and why?

## Explore

Students will investigate how long it takes water to travel through the different materials. The procedure is as follows:

1. Cut off the bottoms of the water bottles
2. Remove the lid of the water bottle and cover the top of the bottle with a thin layer of cotton gauze, hold the gauze in place with a rubber band. You do not want the gravel, sand or clay to be able to pass through the gauze.
3. Fill  $\frac{1}{2}$  of one bottle with gravel
4. Fill  $\frac{1}{2}$  of one bottle with sand
5. Fill  $\frac{1}{2}$  of one bottle with clay
6. Measure 50 mL of water in the graduated cylinder
7. You will be using a stopwatch to time how long it takes for water to pass through each material:
  - a. Hold the bottle upside down; pour the water into the bottom of the bottle so that it travels through the material and out of the gauze. Use the plastic cups to catch the water that comes out of the bottles.
  - b. Time how long it takes the water to pass through the gravel, the sand and the clay.
8. Measure how much water exited the bottle using the graduated cylinder.
9. Record your results in your lab notebook

## Explain

Ask students to share their results with the class. Have them go back to the engaging questions and compare their results to what they thought would happen. Water travels through the gravel the fastest because it is the most porous material tested. This means that there are many spaces in between the pieces of gravel that are stacked on top of each other. On the other hand, water travels through clay the slowest because it is the least porous. This is important for several reasons:

1. *Groundwater recharge* depends on water traveling through earth material. The longer the water is held in the soil, the longer it takes to recharge our *aquifers*.
2. Plants depend on water in the soil to stay healthy
3. If water takes too long to travel through the material, it could cause erosion and runoff especially during heavy precipitation events.

## Elaborate

Soil type is an identifying characteristic of different ecosystems. This also accounts for the different type of plants that you find in different ecosystems. Hot and dry deserts like the Chihuahuan desert have rocky/gravelly soils while semiarid deserts have gravel and sand type soils. Savannas have porous soil and tundra biomes are mostly gravel and *permafrost*. The amount of groundwater found in the soil depends on how the different sediment types are stacked together. If the upper layer of soil is composed of clay, the water will not travel quickly through the soil layers. If the upper layer is composed of gravel, the water will travel through the soil layers quicker.

## Evaluate

Have students draw three different soil columns using gravel, sand and clay. One column should represent a soil stack where water would travel quickly through the upper layers (gravel, sand, clay). The second column should represent a soil stack where water would travel very slowly through the upper layers (clay, sand, gravel) and the third layer should represent a soil stack where water would travel at a medium speed through the upper layer (sand, gravel, clay).

## Vocabulary

- Porosity- the ratio of the volume of all the pores in a material to the volume of the whole.
- Groundwater- the water beneath the surface of the ground, consisting largely of surface water that has seeped down
- Recharge- the processes by which ground water is absorbed into the zone of saturation.
- Aquifer- any geological formation containing or conducting ground water, especially one that supplies the water for wells, springs, etc.
- Permafrost- frozen subsoil