

## RETENTION – Activity 3

### INTRODUCTION

The ability of various soils and rocks to hold water, or to retain it, can be important for agricultural and other purposes. Retention depends upon multiple factors, such as porosity and permeability. In this investigation, you will investigate the permeability of earth materials.

**OBJECTIVES** - - Upon completion of this activity, the student should be able to . . .

1. Define retention (in a geologic sense)
2. Measure the retention of different types of earth materials
3. Explain how retention affects fluid movements in the earth's crust
4. Explain how porosity, permeability, retention, and capillarity are interrelated (after completing the four activities in this set of activities)

### STATE STANDARDS ADDRESSED

- 12.E.2a -- Identify and explain natural cycles of the earth's land, water and atmospheric systems
- 12.E.2b -- Describe and explain short term and long term interactions of the earth's components
- 12.E.3a -- Analyze and explain large-scale dynamic forces, events and processes that affect the earth's land, water, and atmospheric systems.

### MATERIALS NEEDED

1 plastic column (with drain tube and pinch clamp)	100 mL of pea gravel*
1 ring stand	100 mL of sand
2 burette clamps	1 graduated cylinder (100 mL)
1 500 mL beaker	water supply

\* Aquarium gravel can be easily substituted for pea gravel

### PROCEDURES

- A. Attach the two burette clamps to the ring stand. Place one clamp near the middle of the ring stand, and place the other clamp near its top. Open both clamps as wide as they will widen.
- B. Place the plastic column in the burette clamps, and tighten the clamps. Be sure the tube-end of the plastic column is down. Also, be sure the drain tube is clamped closed (using the pinch-clamp). The bottom of the plastic column should be high enough above the base of the ring stand that you can easily move the 500 mL beaker beneath it (to catch water coming out of the plastic column). See Figure 1 on the next page.
- C. Using the 100 mL graduated cylinder, measure out 100 mL of pea gravel.
- D. Carefully pour the pea gravel into the plastic column.
- E. Measure and pour 300 mL of water into the plastic column with the pea gravel inside.
- F. Next, drain the water from the plastic column. Be sure measure the amount of water that actually drains out of the plastic column. Subtract this volume of water from the original 300 mL you put into the plastic cylinder. This remainder is equal to the amount of water the pea gravel retained. Record this time in the Data Table on the next page.
- G. Next, repeat Procedures A-G, but this time use sand rather than pea gravel. Be sure to record the measured time in the Data Table on the next page. This volume of water is a measure of the retention of the sand.

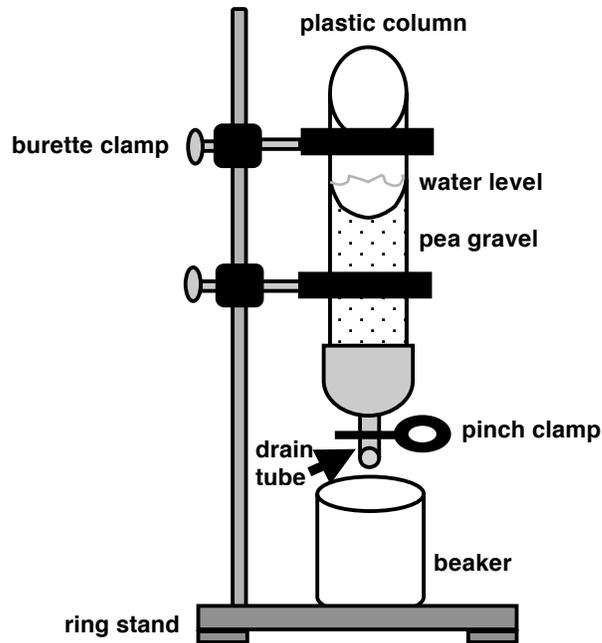


Figure 1

Data Table for Retention

Earth Material Size	Retention (volume of water held in material)
Pea Gravel (12 mm diameter)	
Sand (7 mm diameter)	

**QUESTIONS**

1. Compare the water retention of pea gravel and that of sand. Which size of particle retains the most water?
2. Which earth material would you select if you wanted much water retention: one with particles having a larger diameter or those having a smaller diameter? Explain your answer.
3. Which type of rock do you think would retain the most water: sandstone, limestone, or granite? Explain your answer.
4. If you wanted to plant a crop that needed water, but you could not add water frequently, would you use a soil that retained water well or one that did not? Explain your answer.

**RESOURCE:**

American Geologic Institute. (1967). *Investigating the earth*. Boston: Houghton Mifflin Company.