Earth Science Name: ______________________________

LAB #16: INFILTRATION Date: ______________________

Infiltration Lab #16

Discussion: If you dig a hole far enough into the ground, water will start to fill the bottom. You now have a well. You have dug a hole deep enough that the bottom is below the water table. This can be a real problem if you build a house where the basement floor is below the water table every time it rains. After a rain, why do some areas drain rapidly and other areas have puddles that last a long time? What factors allow (or do not allow) water to infiltrate the soil quickly?

Define the following terms:

1. Porosity – ____

   ____
2. Permeability – ____

   ____
3. Soil water retention – ____

   ____
4. Capillarity – ____

   ____
5. Runoff – ____

   ____
6. Flooding – ____

   ____

Objectives: Measure the porosity, permeability, water retention, and capillarity of three soil samples. Describe the relationship between porosity, permeability, capillarity, and particle size. Describe the relationship between infiltration, runoff, and flooding.

Purpose: Determine that factors that allow water to move through a given sample of soil.

Hypothesis: There is a relationship between particle size, permeability, capillarity, and water retention.

Theory: Some soil factors increase infiltration such as permeability and porosity. Other factors, such as capillarity, water retention, and saturation will decrease infiltration.

Materials:

beads	water	infiltration column
beaker	timer	graduated cylinder
pinch clamp	ring stand	utility clamp

Method:

1. Set up three columns as shown in the illustration.
2. Record the size of the beads (particle size).
3. Pour the large beads into a large, graduated cylinder (500. mL) and record the total volume (beads plus air space) of the beads.
4. Transfer the beads to a column (1 = large beads, 2 = medium beads, and 3 = small beads)
5. Repeat steps 2 through 4 adding medium beads into column 2, and small beads into column 3.
6. Pour 100 mL of water from a graduated cylinder into column 1 recording the time it takes for the water to reach the bottom of the column. Record this wetting front time for the column.
7. Keeping track of the total volume of water added (remember that you have already added 100 mL of water), add water to column 1 until the level just covers the beads. Record this pore volume of water (the porosity of the beads).
8. Now add water to the column until you have added a total of 350 mL.
9. Open the clamp at the bottom of the tube being sure to capture and measure both the amount of water to measure the time required for the water to drain out. Record both the volume of the recovered water and drainage time for this column.
10. Repeat steps 2-9 for columns 2 and 3.

Data Collection and Processing:

DATA and RESULTS TABLE			
	Column 1	**Column 2**	**Column 3**
Particle size (mm)			
Total volume (beads + air in mL)			
Wetting front time (sec) – 100 mL			
Pore volume (mL)			
Recovered water volume (mL)			
Drainage time (sec) – 350 mL			

Results:

1. Calculate the porosity (percentage of pore space) for each bead size.

$$Porosity = \frac{Pore\ volume}{Total\ volume} \times 100$$

Column 1 Column 2 Column 3

2. Calculate the permeability (inverse of the wetting front time) for each bead size.

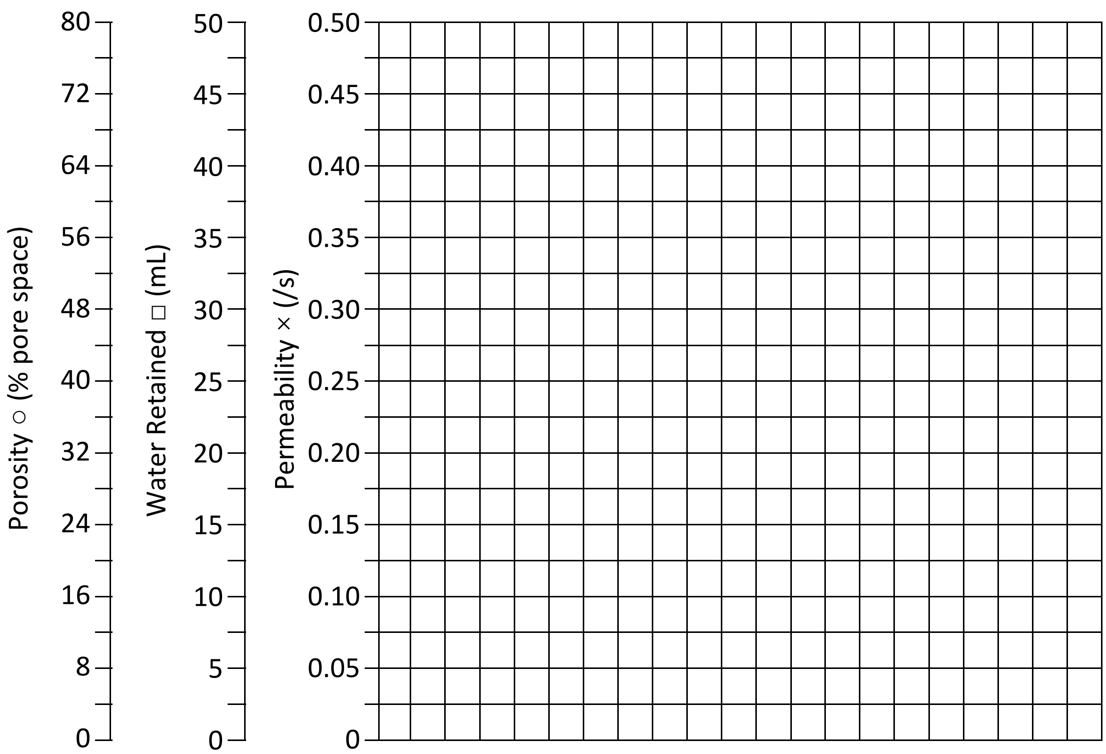
Column 1	Column 2	Column 3

3. Calculate the amount of water retained for each bead size.

Column 1	Column 2	Column 3

Analysis:

1. The graph below shows porosity (as % pore space, use ○), retained water (in mL, use □), and permeability (in per seconds or 1/s, use ×). These three y-axis scales have been provided for you on the graph. Add the scale and label for the Particle Size on the x-axis.



Conclusions:

1. What is the relationship between particle size and pore space?

    ____

    ____

2. What is the relationship between particle size and the amount of water retained?

    ____

    ____

3. What causes water retention?

    ____

    ____

4. What is the relationship between water retention and capillarity?

    ____

    ____

5. Explain how soil particle size would affect infiltration, runoff, and flooding during a rainstorm.

    ____

    ____

6. List two ways to decrease the porosity.

    ____

    ____

7. Explain how a soil layer could have a significant amount of porosity and still be impermeable.

    ____

    ____

    ____

    ____