Name _____   Date _____

Infiltration of H₂O

Objective: The purpose of this experiment is to observe how different sediment particle sizes affect the rate of infiltration of water into the ground.

Hypothesis: _____

_____

Materials:

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Plastic tubes (3)	4mm beads	colored water
Tube clamp and stand (3)	7mm beads	stopwatch
plastic beakers (2)	12mm beads	meter stick

Procedure:

_____ 1. Before pouring any water, test the stopwatch. Make sure that it is functioning and that every group member can start, stop, and reset it.

_____ 2. Get a tube with the 4mm-beads (smallest particles) and place it on a flat surface. Place an empty beaker under the red nozzle at the bottom of the tube.
 (Note: You don't have to start with the smallest beads, use whichever size is available to start, just make sure you record your findings in the correct place on the data chart.)

_____ 3. Using a meter stick, measure the distance from the top of the bead column where there is a line marked "A" to the very end of the thin red nozzle at the bottom of the tube. Record this distance in the "distance water traveled" row on the data chart to the nearest whole centimeter. You will need to use this distance later when calculating infiltration rate.

_____ 4. Pour 200mL of water into the other beaker (it doesn't have to be exact). Add a little food coloring to make the water more visible.

_____ 5. Steadily pour the entire 200mL of colored water into the tube. Start timing the infiltration of water when the water <u>hits the top of the beads</u>. Stop timing when there is <u>a steady flow of water out of the red nozzle</u> at the bottom of the tube.

_____ 6. Record the infiltration time in the appropriate place in the data chart.
 (Since our timers are accurate to hundredth of a second, record your answer as such.)

_____ 7. Repeat steps 4-6 two more times for the tube with the smallest sediments.
 (Note: Since some water is retained in the bead column, you may have to add more water to the beaker between trials)

_____ 8. Calculate the average infiltration time and record your answer on the data chart to the nearest hundredth of a second.

_____ 9. Calculate the average infiltration rate (speed) by using the following formula:
   Just to keep practicing our rounding rules, this time record your answer to the nearest tenth.

$$\text{average rate of infiltration} = \frac{\text{distance water traveled}}{\text{average infiltration time}}$$

_____ 10. Repeat steps 2-9 for the tubes with the 7mm (medium-sized) and 12mm (large) sediments. Record all data in the appropriate places in the data chart.

_____ 11. Construct a line graph showing the relationship between **particle size** (x-axis) and **average infiltration rate** (y-axis). Be sure to follow all graphing rules and completely label the graph axes.

In this column, put the correct units on the blank lines that follow each measurement or calculation that you make.
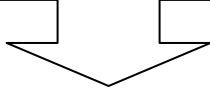
Data Chart

	4mm particles	7mm particles	12 mm particles
Distance Water Traveled _____			
Infiltration Time 1 _____			
Infiltration Time 2 _____			
Infiltration Time 3 _____			
Average Infiltration Time _____			
Average Infiltration Rate _____			

Infiltration of Water through Different Sized Particles
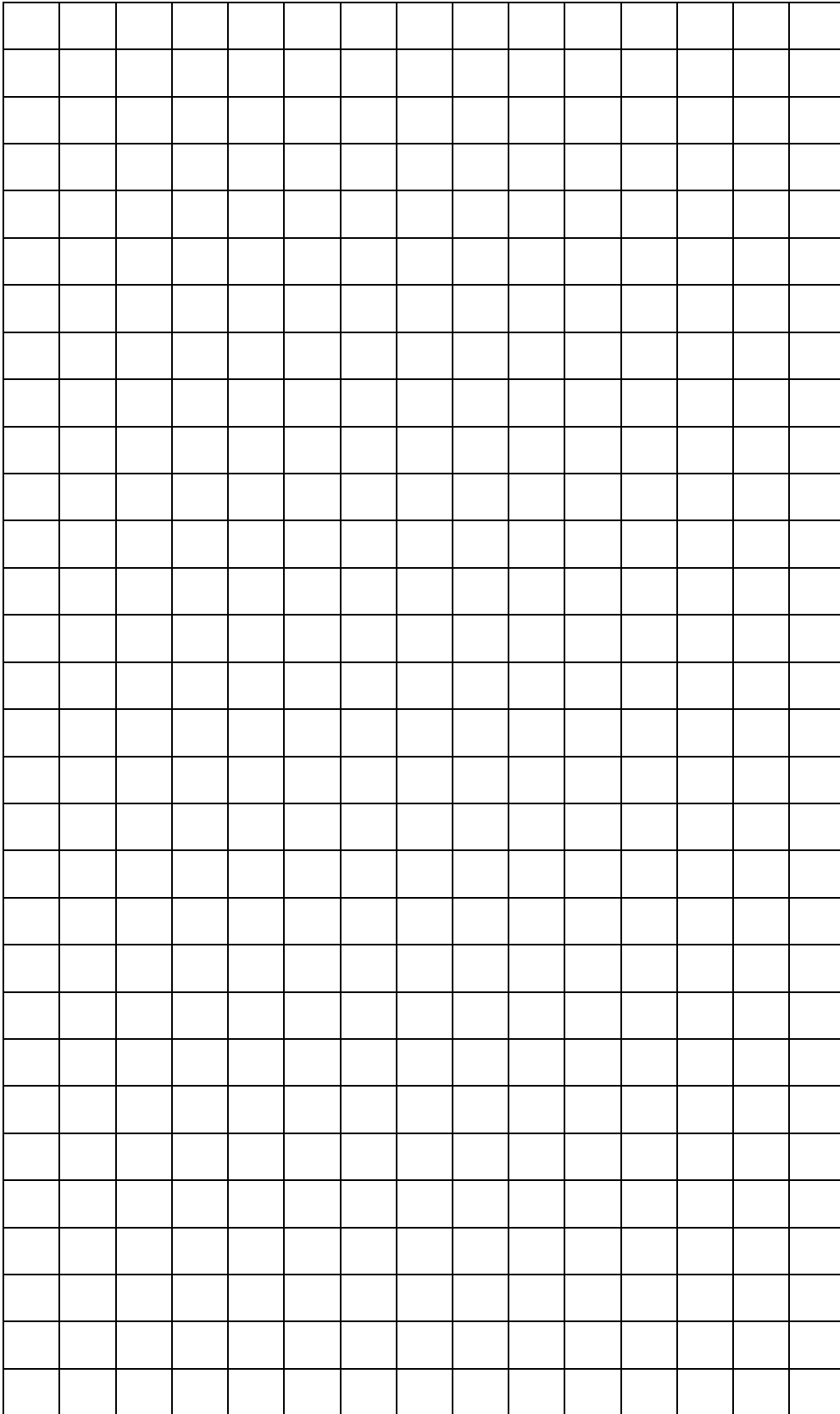
Summary Questions
(Answer in Complete Sentences or Else!)

1. Was the original hypothesis proven correct or incorrect? Based on the collected data and calculations made, what is the relationship between particle size and water infiltration rate? Make sure to use <u>numerical data</u> to support your conclusion.

2. Clay-sized particles are the smallest sediment sizes. What do you think would happen if you conducted the same experiment with a tube filled with clay-sized particles?

3. The permeability of a soil is defined as the rate at which water passes downward through the pore spaces in a soil sample.   Sketch a line graph that shows the relationship between grain size and permeability. Explain the relationship the graph illustrates.

4. Since a soil must be porous to be permeable, explain one factor that would <u>reduce the porosity</u> of a sample and therefore reduce its permeability and why it does so.

5. There is some room for error in the measurement of infiltration times during the procedure portion of this lab. You performed 3 trials for each particle size, but you might notice a slight variation in infiltration times for a specific particle size (or maybe even a large variation).   State one reason why there might be variations in infiltration times for a given particle size. (Calculation errors on your part do not count.)