

Name(s): \_\_\_\_\_

Date: \_\_\_\_\_

## How Full is Full? Activity – Porosity and Permeability Worksheet

### Purpose

To study the characteristics of different kinds of soil by measuring *pore space* and *permeability*.

### Background

The **porosity** of a material is a measurement of how much of its volume is open space (also called pore space). Porosity is usually expressed as a percentage of the material's total volume. The **permeability** is a measurement of how easily liquid flows through a material (or soil). Both porosity and permeability are important to environmental engineers and other people who work with ground water.

### Materials

2 paper cups (1 with a hole and 1 without a hole in the bottom)  
Graduated cylinder  
Large jar or beaker  
Soil samples  
Spoon/scrapper  
Stopwatch or other timing device

### Procedure

#### A. Measuring Porosity of Samples

1. Pour 100 mL of water into your cup and draw a line where the water comes up to. **Write 100 mL in the total volume column on your data sheet. Dump out the water.**
2. Fill the cup with the first soil sample up to the line you drew.
3. Using your graduated cylinder, slowly and carefully pour water into the cup until the water reaches the top of your sample. **Write the volume of water remaining in the graduated cylinder on your data sheet.**
4. Subtract the volume remaining from the total volume. This is the amount of water you added to your sample. **Write the volume of water added to the sample on your data sheet** – this is the pore space.
5. To determine the porosity of the sample, divide the pore space volume by the total volume and multiply the result by 100. **Write the porosity on your data sheet.** (Note: % pore space = pore space / total volume x 100)

#### B. Measuring Permeability of Samples

1. Hold the empty cup with a hole in it over a jar or an empty cup/container. Carefully pour your sample into the cup with the hole, allowing the water to drain into the jar.

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2. Pour 100 mL of water into the cup with your sample. Time how long it takes from when you begin pouring until when the water drains out of the sample. **Write this time down on your data sheet.**

**C. Repeat Parts A and B for all other soil samples.**

**Prediction**

Which soil sample do you think will have the greatest porosity? How about the greatest permeability?

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**Data Table**

Sample Number	Description of Sample	Total Volume	Volume Remaining in Cylinder	Pore Space	Porosity (% pore space)	Time for water to pass through (seconds)
Example	Coarse Gravel	100 mL	70 mL	100-70= 30 mL	30/100 * 100 = 30%	5

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1. Which sample had the greatest porosity?

\_\_\_\_\_

2. Which sample did the water pass through most quickly? That is, which had the highest permeability?

\_\_\_\_\_

### Conclusions

1. As an environmental engineer, where would you recommend locating a drinking water well? Why?

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. As an environmental engineer, which soil sample had the greatest risk of transferring harmful chemicals into a drinking water aquifer? Why?

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. What factors would you consider when locating your drinking water well?

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\_\_\_\_\_  
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