

Porosity

Introduction

Ground water is the source from which we obtain much of our water that we use at home, school or work. This water is stored in spaces between particles of sand and gravel, and in cracks or spaces in rock. The ability to hold water in these spaces is called porosity. The layer of sand, gravel or rock that holds the water is called an aquifer.

Objectives

The students will:

1. Define porosity as the spaces between particles of sand and gravel, and in cracks and other spaces in rock under the land surface where ground water is stored.
2. Determine how the number and size of these spaces are related to the amount of water that can be stored.
3. Define an aquifer as the sand, gravel or rock that can store water below ground level.
4. Discover that ground water provides much of the water used in our homes, schools and work places.

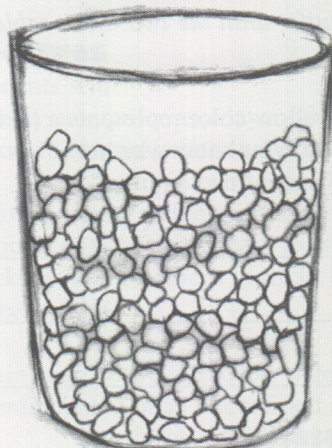
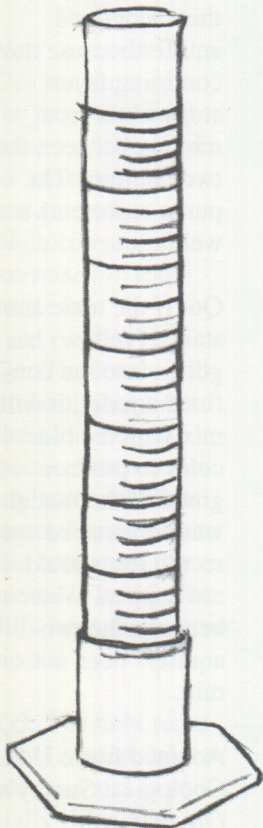
Materials (for each group)

- one 100 ml graduated cylinder
- two clear plastic 9 oz. cups
- pea-sized gravel
- mixture of sand and pea-sized gravel
- water

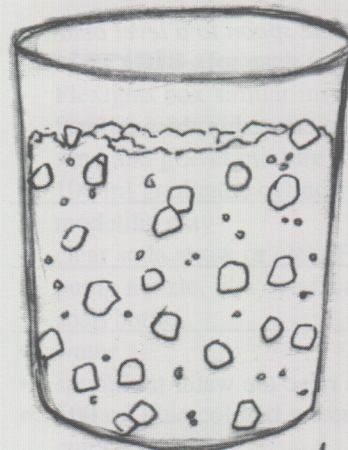
Student Directions

1. Fill one cup with pea-sized gravel and the other cup with the mixture of gravel and sand.

Q1 Which cup do you predict will hold the most water? Why?



pea-size
gravel



gravel + sand

2. Fill 100 ml graduated cylinder to the 100 ml mark with water.

3. Pour water slowly into the cup of gravel until the water reaches the top of the gravel. Record the amount here (100 ml minus the amount remaining in cylinder equals the amount poured):

4. Repeat the process into the cup of gravel and sand. Record the amount here:

5. Calculate the % porosity of the materials. One 9 oz. cup contains approximately 266 ml.

$\% \text{ porosity} = \text{measured volume of water in ml divided by } 266$

$\% \text{ porosity of gravel} =$ _____

$\% \text{ porosity of gravel and sand} =$ _____

Q2 Which substance has the highest % porosity? How can you explain this?

Q3 Examine chart below. Would an aquifer composed of uniform sand or sand mixed with gravel be able to hold more water? Explain your answer.

Representative Porosity Ranges for Sedimentary Materials

(Source: *Handbook of Applied Hydrology*: Chow)

Material	Porosity %
soil	50-60
clay	45-55
silt	40-50
medium to coarse mixed sand	35-40
uniform sand	30-40
fine to medium mixed sand	30-35
gravel	30-40
gravel and sand	20-35
sandstone	10-20
shale	1-10
limestone	1-10
