

# Do Rocks Have Holes?

## Where do our underground natural resources like water, oil and gas reside?

Water, oil and gas are trapped inside the rocks beneath our feet. Porous rocks, or "rocks with holes" are good reservoirs for oil, gas and water. Non-porous layers of rock act as caps or seals to trap the resources.

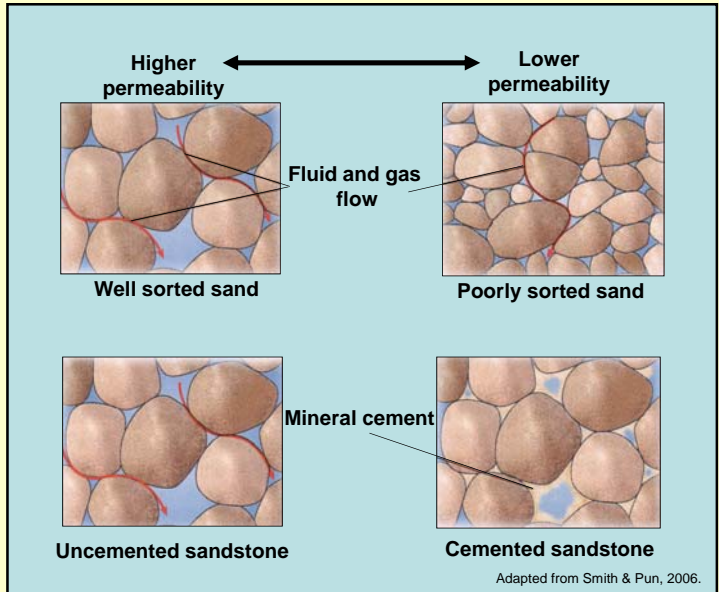
### What is porosity?

Porosity is the ratio of the amount of empty space to the amount of solid space in a material. Many materials, including rocks, have empty space inside them.

### What is permeability?

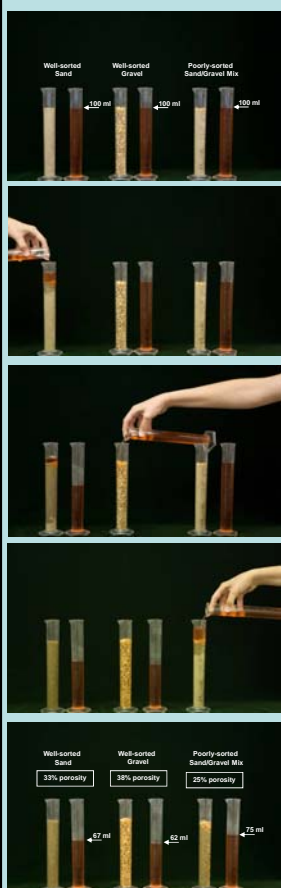
#### Are all porous rocks permeable?

Permeability is a measure of the ability of a liquid or gas to flow through a material. A material can be highly porous, but if the pore spaces are not connected together, liquid and gas will not flow through due to the low permeability.



### Determining % Porosity of Sediments

We can measure the amount of pore space between sediment grains by determining how much fluid it takes to completely soak 100 ml of sediment.



Begin with 100 ml each of several different sediments and 100 ml of water for each sediment sample.

**Observe and Think**  
 Is the entire 100 ml in the sediment sample made up of sediment? Or is there space between the grains?

Slowly add water from the graduated cylinder next to each sediment sample. Continue until the water level just reaches the top of the sediment.

When all sediments are saturated, record the volume of water that is left in each cylinder.

**Calculate volume of space between grains or "pore space":**  
 $100 - \text{volume poured} = \text{volume of pore space}$

**Calculate % porosity:**  
 $(\text{Pore space/total volume}) \times 100 = \% \text{ porosity}$   
 $(\text{Volume poured}/100 \text{ ml total}) \times 100 = \text{???}$

**In the experiment pictured:**  
 Well sorted sand =  $100 - 67 = 33$  and  $33/100 \times 100 = 33\% \text{ porosity}$   
 Well sorted gravel =  $100 - 62 = 38$  and  $38/100 \times 100 = 38\% \text{ porosity}$   
 Poorly sorted sand and gravel =  $100 - 75 = 25$  and  $25/100 \times 100 = 25\% \text{ porosity}$

**QUESTIONS**

- How does the sorting of grains affect the porosity?
- What are sedimentary rocks made up of?
- Can sedimentary rocks have porosity too?
- Why might knowing about the porosity of sedimentary rocks be important to us?

### Porosity Ranges for Different Earth Materials

Material	Typical Porosity Range
<i>Unconsolidated sediment</i>	
Well-sorted sand and gravel	25-50%
Mixed sand and gravel	20-35%
Silt and clay	30-60%
<i>Rock</i>	
Shale	0-10%
Sandstone	3-30%
Limestone and dolostone	1-30%
Plutonic and metamorphic rocks	0-5%
Volcanic rocks	1-50%

from Smith and Pun, 2006