Science Lab

SEED

The Absorbency of Rock

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When you think of [oil] reservoirs, you [may] think of the giant reservoir that you're not allowed to drive motorboats in, or the reservoir you're not allowed to swim in. You think of a giant lake. That's not what it is. A reservoir occurs in a rock that looks on the surface like any other. This rock, which to you and me looks like a solid, has tiny little pore spaces, and that's where the oil and gas pool. And it's out of rocks like this that we have to get the oil and gas that we use every day.

Rocks can hold liquid! To demonstrate this concept, we will use water instead of oil for several reasons:

- It's not as messy
- After the experiment it's easy to let the rock dry so you can use it again.
- There's a neat relationship between the weight of water and its volume: 1 gram = 1 cc = 1 ml

Core samples of reservoir rock taken during process of drilling an oil well

Tools & Materials

To perform this experiment, you will need:

- A porous rock. Pumice is a good choice and is available in the foot care section of many pharmacies. Chalk is also excellent for this experiment.
- A scale or balance that can weigh in units of one gram or less.
- A container of water that is big enough to hold the stone submerged in water.

The Experiment

1. Weigh the dry rock and record your result on a printout of the form below or in your own notebook.
2. Put the rock in water and leave it there for at least an hour.
3. Take the rock out and shake off the excess water. Weigh it again and record your result.
4. Weigh and record several more times at one-hour intervals.
5. Leave the rock in water overnight. Weigh and record again.

What do your results show?

Student/Group	
Time	Weight of Rock
Day 1	
Dry weight of rock	Grams
Time	Grams
Time	Grams
Time	Grams
Time	Grams
Time	Grams
Day 2	
Time	Grams

Follow-up Discussion

The rock should increase in weight. It may take a day or more to reach its maximum.

When we tried it the dry rock weighed 34 grams. After a day it had increased to 37 grams. After two days it was still at 37 grams. This means that there were three grams, or 3 cubic centimeters, of water in the stone. Is this a lot or very little? How much liquid can rock hold? We can determine this by measuring the **volume** of the rock and comparing it to the volume of the water it can hold.

We can measure the volume of the rock using the **displacement** method. Just like **Archimedes** in his bathtub, we can determine an object's volume by measuring how much water is displaced when it is submerged. We measured the volume of our rock by filling a mesuring cup to the 150 ml mark and submerging the stone. The water level rose to 175 ml, so we know that the volume of the stone is 25 ml, or 25 cc. Since the stone absorbed a total of 3 cc, we can calculate that the stone was able to hold water equivalent to 12% of it's volume. This can be expressed with the following formula:

$$\frac{\text{Volume of Water Absorbed}}{\text{Volume of Stone}} = \frac{3\text{ cc}}{25\text{ cc}} = \frac{x}{100} = 12\%$$

This experiment could be repeated with different stones and with oil instead of water. Keep in mind that since oil is lighter than water 1 gram of oil occupies more than 1 cc of space. The exact amount depends upon the kind of oil.

We also did the experiment using a piece of chalk. It weighed 10 grams when dry. After soaking in water for 5 minutes the weight had increased to 11g. After 10 minutes it was 12g. It didn't increase any more than that, but after 30 minutes it had become soft and was starting to fall apart.

The piece of chalk held 2g, or 2 cc of water. To calculate the volume of the chalk we could have used the displacement method, but we did it differently. Since the piece of chalk was a cylinder we decided to measure it and use the formula for the volume of a cylinder. It's length was exactly 8 cm and the diameter of the face on each end was 1cm. So

$$\begin{aligned} \text{Volume} &= \pi r^2 (L) \\ &= 3.14\ (.5)^2\ (8) \\ &= 3.14\ (.25)\ (8) \\ &= 3.14\ (2) \\ &= 6.28\ \text{cc} \end{aligned}$$

Then we calculated how much water the chalk could contain as a percentage of its total volume:

$$\frac{\text{Volume of Water Absorbed}}{\text{Volume of Chalk}} = \frac{2\ \text{cc}}{6.28\ \text{cc}} = .3184 = 32\%$$

Try this yourself with different kinds of stone.

Share Your Results

Send us your results. We'll periodically post new information in the Exhibit Hall along with the reports from other people who have done these experiments.