

## Lab Report—Rock Density

### Introduction

One way to determine the rock's volume is to measure it with graph paper and a ruler. The other method is to use water displacement in a graduated cylinder. The goal of the experiment is to determine if one method is better than the other.

### Group Members

Alex Average, Project Manager  
Ronnie Best, Materials Manager  
Patty Prettygood, Quality Control Manager

### Materials Used

Graduated cylinder, water, rock, graph paper, balance, goggles, metric ruler

### Procedure

1. The rock was placed on graph paper and its outline was drawn. The boxes inside the outline were counted to determine the area of the base of the rock.
2. The metric ruler was used to determine the height of the rock. Then the area was multiplied by the height to calculate the rock's volume.
3. A graduated cylinder was partially filled with water and the initial volume was recorded.
4. The rock was placed in the cylinder and the new volume was recorded. The volume of the rock was found by subtracting the beginning volume from the final volume.
5. The triple beam balance was used to determine the mass of the rock.
6. The formula  $\text{density} = \text{mass}/\text{volume}$  was used to calculate the density of the rock by the two methods.

### Data

Volume Measurement using graph paper-metric ruler method

Area of base of rock	10 cm <sup>2</sup>
Height of rock	2 cm
Calculated volume of rock	20 cm <sup>3</sup>

(note: 1 mL = 1 cm<sup>3</sup>)

Volume Measurement using water displacement method

Initial volume	150 mL
Final volume	160 mL
Volume of rock	10 mL

Mass of rock: 3.5 g

Rock Density Calculations  $D = M/V$

Using graph paper-ruler method	$= 3.5\text{g}/20\text{ mL} = 0.175\text{ g/mL}$
Using water displacement	$= 3.5\text{g}/10\text{ mL} = 0.35\text{ g/mL}$

### Analyze and Apply Questions

1. How did you measure the volume of the rock in each of the two methods?  
In the first method, we calculated the volume of the rock by multiplying its base surface area by its height. In the second method, we used displacement of water by the rock to measure its volume.
2. How did you measure the mass of your rock?  
We measured the mass of the rock by using the triple beam balance.

3. Compare the density figures you got using your two different methods.  
Because the two methods for measuring volume gave us two different volumes, we got two different density results. The graph-paper method gave a larger volume and thus a lower density than we got from using water displacement.
4. Which method do you think was more accurate of the methods you tried? Why?  
I think the displacement method was more accurate, because it's hard to directly measure the volume of irregularly shaped objects like rocks. Direct measurement is best for regularly shaped solids.
5. Compare your methods with those used by other groups.  
The other groups used the same methods, too.

Conclusion:

We enjoyed this lab because it allowed us to develop our measuring skills and work in cooperative groups to accomplish our task. We learned that the best way to measure the density of irregularly shaped objects is to use displacement to find the volume and a balance to find the mass. By dividing mass by volume, density is calculated. This method results in fewer errors in measurement. One possible source of error is that each measurement was only carried out once; if we were to repeat this lab, we would make each measurement at least three times and average the results for greater accuracy. We could also pay better attention to significant figures in our measurements.