



Density and Percent Error

Lab #2

Discussion: Sometimes people say that lead is heavier than water. What they probably mean by that is that lead has a higher density than water. It is certainly true that here on Earth a gallon of water is much heavier than a lead BB. For a pure substance, density is a characteristic property. That means you can identify a substance by its density and it also means that the density should be the same regardless of the size and shape of the object.

Purpose: To gain expertise in calculating density and percent error. We will also get some practice using formulas. Always record the proper units.

Hypothesis: Mass can be measured on a scale or balance. The unit for mass is the _____

For regular objects, the volume can be measured and calculated using volume formulas.

Formula for volume of a cube: $V =$ _____

Formula for volume of an orthorhombic solid: $V =$ _____

Formula for volume of a cylinder: $V =$ _____ $\pi =$ _____

Since we will measure length in cm, our volumes will have the units _____

For irregular objects, volume is found by using _____

When using a graduated cylinder, always read the _____ of the meniscus.

Theory: Density is defined as the _____ per unit _____.

The formula for density is:

$$D = \frac{\text{mass}}{\text{volume}} = \frac{m}{V}$$

The units for density will be _____

Materials: aluminum cube	plastic cube	aluminum cylinder	brass cylinder
copper cylinder	mineral A	mineral B	graduated cylinder
water	balance	metric rule	

Method:

1. Use a balance to determine the mass of an object. Record your data in the correct space in the Data Table on the next page.
2. For regular solids, measure the data you need to calculate. For irregular solids, use a graduated cylinder to measure the volume. Record the data or the volume on your Data Table.
3. Repeat steps 1 and 2 until you have data for all seven objects.

Data Collection and Processing:

Object	Mass (g)	Measurements	Calculated Volume (cm ³)	Calculated Density (g/cm ³)	Accepted Density (g/cm ³)	Percent Error [(m-a)/a]×100
aluminum cube		h = w = l =				
Lucite cube		h = w = l =				
aluminum cylinder		h = d =				
brass cylinder		h = d =				
copper cylinder		h = d =				
mineral A (gray)		V _f = V _i =				
mineral B (red)		V _f = V _i =				

Data Collection and Processing: (continued)

Calculations:

1. Use the collected data to calculate the volume of each object. Use special care with the formula for cylinders. Square the radius first, then multiply by π and h . Show the formula, setup, and final answer in the space provided in the data and results table. Do not forget to show your units.
2. Use the collected data to calculate the density of each object. Show the setup and the answer in the spaces provided on the data and results table. Do not forget to show your units.
3. Research the accepted values for the density of the objects and enter this data in your data and results table. Do not forget the units.
4. Calculate the percent error for each of the objects. Show the formula, setup, and final answer in the space provided in the data and results table. Do not forget to show your units.

Analysis and Conclusions:

1. In which shape (cylinder or cube) does aluminum have the greatest density? Explain.

2. Silver has a density of 10.5 g/cm^3 . Suppose a bar of silver is cut in half? What is the density of one of the halves? Explain.

3. What are some possible reasons why the measured density of the objects was different from the accepted values?

4. How is it possible for a 4000 kg redwood log to float in water while a penny with a mass of 2.5 g sinks in water?
