

DENSITY OF SOLIDS

Reminder – Goggles must be worn at all times in the lab!

PRE-LAB DISCUSSION:

Density is an important property of matter. By itself, or in conjunction with other properties, density can be used to identify substances. Density is defined as the quantity of matter in a given unit of volume. This relationship, expressed mathematically, is:

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \quad \text{or} \quad D = \frac{M}{V}$$

Volumes of regularly shaped geometric solids can be calculated from direct measurements of their dimensions. For example, the volume of a rectangular solid is calculated by multiplying its length, width, and height ($V = \ell \cdot w \cdot h$). Volumes of solids are usually expressed in cubic centimeters (cm^3). Many solids do not lend themselves to direct measurement of their dimensions. These include irregularly shaped objects, such as rocks, and regular solids that are too small to be measured with any degree of accuracy. Volumes of such solids can be measured by water displacement. If a solid is immersed in a liquid such as water, the solid will push aside, or DISPLACE, a volume of water equal to its own volume. Thus, each milliliter of water that is displaced by a solid represents one cubic centimeter of solid volume.

PURPOSE:

The purpose of the lab is to combine methods of determination of both mass and volume to calculate the density of several solids.

PROCEDURE:

1. Obtain one of the three solids from the back table. Record the identity of the solid.
2. Weigh the solid using the four-beam balance and record its mass to three places past the decimal.
3. Fill a 100 mL graduated cylinder to the 50.0 mL mark. Record this as the initial volume.
4. Submerge the solid in the graduated cylinder. Read and record the NEW water level.
5. Remove the solid and dry it off. Return it to the back counter.
6. Repeat this process with the other two solids.

RESULTS:

Observations and Data

	Mass	<u>Mass and Water Displacement</u>	
		Original H ₂ O Level	Final H ₂ O Level
1. Glass rod	_____g	_____mL	_____mL
2. Zinc	_____g	_____mL	_____mL
3. Copper	_____g	_____mL	_____mL

Calculations

1. Complete the calculation of the density of each substance. Remember, $D = \frac{M}{V}$. List the masses of these substances arrived at from your. Calculate the volume by subtraction:
Volume = Final H₂O Level – Original H₂O Level
2. Calculate the densities from the mass and volume data.
3. Remember that 1 mL = 1 cm³, so g/mL and g/cm³ are equivalent.

<u>Identity of the Solid</u>	<u>Mass</u> (g)	<u>Volume</u> (ml)	<u>Density</u> g/cm ³