

Name: _____

Date: _____

Title: The Concept and Measurement of Density

Purpose: To gain an understanding of the physical property of density. To gain skill in measurement of mass and volume, using different methods for obtaining the volume of a solid.

Materials: Determine from reading the procedure

Equipment: Determine from reading the procedure

Procedure:

Part 1: Regular Solids

1. Select a cube and record its mass to the nearest 0.01g.
2. Record the dimensions of each side and record to the nearest 0.01 cm.
3. Repeat for a total of three cubes.

Part 2: Water Displacement – Irregular Solids

1. Obtain an irregular solid and record its mass to the nearest 0.01 g.
2. Obtain a dry graduate cylinder and fill it to approximately the 50.0 mL mark with tap water. Read the bottom of the meniscus to 0.1 mL and record as the initial volume.
3. Tilt the graduate to its side and slide the object into the water. Return the graduate to the upright position and record the final volume of the water to 0.1 mL.
4. Empty the contents of the graduate cylinder.
5. Repeat for a total of three solids.

Part 3: Water Displacement – Density of Pebbles

1. Fill the graduate cylinder to approximately the 50.0 mL mark with tap water. Read the bottom of the meniscus to 0.1 mL and record as the initial volume. For the first recording, 0 pebbles, it is also the final volume.
2. Find the mass of five pebbles selected from the container.
3. Tilt the graduate to its side and slide the pebbles into the water. Note the final volume of the water, V_{final} .
4. Find the mass of five more pebbles, and add them to the graduate cylinder.
5. Record the new final volume, and be sure to record the total mass of the pebbles in the graduate.
6. Repeat these steps until there are 20 pebbles in the graduate cylinder.

When finished with all three parts, return all materials to their proper places and set the balances back to zero. At home be sure to record your data in the computer. Click “Student”, login, and then find the title “Density” under the labs section.

Data:

Part 1:

<u>Regular Solid</u>	<u>Length (cm)</u>	<u>Width (cm)</u>	<u>Height (cm)</u>	<u>Mass (g)</u>

Part 2:

<u>Irregular Solid</u>	<u>V_{initial} (mL)</u>	<u>V_{final} (mL)</u>	<u>Mass (g)</u>

Part 3:

<u>Sample</u>	<u>V_{initial} (mL)</u>	<u>V_{final} (mL)</u>	<u>Tot V_{pebbles} (mL)</u>	<u>Mass (g)</u>	<u>Total Mass (g)</u>
Grad. + water + 0 pebbles					
Grad. + water + 5 pebbles					
Grad. + water + 10 pebbles					
Grad. + water + 15 pebbles					
Grad. + water + 20 pebbles					

Analysis:

- Blocks:
 - Show calculation for the volume of all blocks.
 - Show calculation for the density of all blocks.
- Irregular Solids:
 - Show the calculation for the volume of all solids.
 - Show the calculation for the density of all solids.
- Pebbles – Show for 5 pebbles, 10 pebbles, 15 pebbles, and 20 pebbles.
 - Show the calculation for the total mass of the pebbles.
 - Show the calculation for the total volume of the pebbles.
 - Show the calculation for the density of the pebbles.
- Determine the percent error for each regular solid.
- Construct a Mass vs. Volume graph for the Pebbles data. Use total mass of pebbles and total volume of pebbles for your data points.
- Draw the best-fit line and determine the slope and equation of the line.

Conclusion:

- What does the slope of the best-fit line in the Mass vs. Volume graph tell us about the object?
- If you measured the mass and volume of the regular solids to perfection, what would be the percent error values in analysis #4? Why?
- Provides reasons as to why the measurement of mass and volume may not be exact. Realize that miscalculation is NOT an error in collecting data, nor is rounding and significant digits. Do NOT consider the limitations of the tools used to gather the measurements, consider the limitations of the objects being measured.

Grading:

Input Data in Computer	5	Analysis Q6	4
Data (Units and correct digits)	5	Rounding/Units	3
Analysis Q1	6	Conclusion 1	2
Analysis Q2	6	Conclusion 2	3
Analysis Q3	12	Conclusion 3	8
Analysis Q4	3	Total	63
Analysis Q5	6		