Name_____ Class Period_____ Date _____

LAB INVESTIGATION 1-2 MEASURING MASS, VOLUME & DENSITY

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Objectives: The student will be able to:

1. measure mass and volume (linear and displaced volume)
2. calculate density and percent error
3. explain the relationships between mass, volume and density of a specific substance.

Materials:

density kit	metric ruler	balance	graduated cylinder
overflow can	ESRT	lined paper	metric graph paper

Tips for the Student:

1. Use the correct units for all values.
2. Find the mass of objects **before** finding the volume.
3. Round your answers to the nearest tenth.
4. Mathematical information:
   1 milliliter = 1 cm^3 volume of a cylinder = $\pi r^2 h$
   volume of a sphere = $4/3\ \pi r^3$ ($\pi = 3.14$ or $22/7$)
5. The % error should not be >10%
6. **READ THE ENTIRE LAB BEFORE YOU BEGIN.**

Procedure:

1. **Finding the mass:**
   a. Zero the balance.
   b. Find the mass of each object.
   c. Record your findings on the data table.

2. **Finding the volume:**
   a. Use the water displacement method to determine the volume of the objects.
   b. Record your findings on the data table.
   c. Use the ruler and formulas for finding the linear volume of your objects
   d. Record your findings on the data table.

3. **Working with the data:**
   a. Using scrap paper, compute your average volumes. Record your answers on the data table provided.
   b. Using your average volume, calculate your density. Record this on *Report Sheet #1*. Organize and show all of your work, including the formulas.
   c. Obtain from your teacher the Accepted Value Density and record this on your data table.

d. Compute your % error. Record this on *Report Sheet #2*. Organize and show all of your work, including formulas.
e. Also record your % error on the data table.

4. Graphing Data:

Plot the line graph of the data of mass and volume of different samples of basalt on separate graph paper.
Label the x-axis "volume in ml" and the y-axis "mass in grams".
Remember to title your graph.

5. Showing what you learned:

Answer the following Conclusion Questions on a separate piece of white lined paper.
Write out each question, highlight it or underline it or use a separate color. On the next line, write out your answer in complete sentences. Skip a line between questions.

1. Why were the values for density different than those of your classmates and the accepted values?

2. How could your measurements have been made more accurate?

3. What effect does the shape of objects of the same material have on their density? Explain your answer. (Hint: Think about the two different pieces of aluminum.)

4. How would the density of a specific material change if you doubled or halved its size? Explain your answer. (Hint: Check back to the graph on basalt.)

5. Compare the densities of the three states of matter for most substances (not water).

6. How does temperature affect density?

7. How does pressure affect density?

8. How does density relate to the flotation of objects in each other? (Hint: Think of oil in water, ice in liquid water, granite in mercury.)

9. On the graph, what value do the plotted points represent?

10. What type of graphing relationship does the slope of the data represent?

11. Would the graph line of higher density rock samples be above or below the graph line showing the density of basalt?

DATA TABLE

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OBJECT	MASS	DISPLACED VOLUME	LINEAR VOLUME	AVERAGE VOLUME	CALCULATED DENSITY	ACCEPTED DENSITY	% ERROR
COPPER CYLINDER							
BRASS CYLINDER							
IRON CYLINDER							
ALUMINUM CYLINDER							
ALUMINUM CUBE							
ALUMINUM BAR							

Show work for Linear Volume:

REPORT SHEET #1 - DENSITY

Name_____ Class Period_____ Date _____

REPORT SHEET #2 - % ERROR

Name_____ Class Period_____ Date _____

GRAPH OF THE DENSITY OF BASALT

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Graph the following data on the mass and volume of some ideal samples of basalt, broken off from a larger piece:

VOLUME IN MILLILITERS	MASS IN GRAMS
5	15
10	30
15	45
20	60
25	75
30	90
35	105
40	120
45	135
50	150
55	165
60	180
65	195
70	210
75	225
80	240
85	255
90	270
95	285
100	300

Filename: Density Lab
Directory: C:\Documents and Settings\Administrator\Local Settings\Temporary Internet Files\OLK17
Template: C:\Documents and Settings\Administrator\Application Data\Microsoft\Templates\Normal.dot
Title: Regents Earth Science Unit 5 Vocabulary
Subject:
Author: Sheila Ornstein
Keywords:
Comments:
Creation Date: 10/9/2005 10:54:00 AM
Change Number: 2
Last Saved On: 10/9/2005 10:54:00 AM
Last Saved By: Michael Passow
Total Editing Time: 3 Minutes
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As of Last Complete Printing
Number of Pages: 6
Number of Words: 914 (approx.)
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