Name: _____
Period:_____
Date:_____

Density of a Mineral Lab

Purpose: The purpose of this lab is to apply the relationship between mass, volume, and density to determine the density of a mineral sample as compared to the known density. All matter takes up space and has mass. The ratio of an object's mass to its volume is an important physical property called density. This important physical property is commonly measured in grams per milliliter or $\frac{g}{mL}$. The relationship between the density, mass, and volume is expressed in the formula:

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (mL)}} \quad \text{or} \quad d = \frac{m}{V}$$

It is important to realize that density is an intensive property. An intensive property does not depend upon the quantity of matter present. This means that even if we possessed twice as much of a given material, the density would still be the same. Properties that do depend on the amount of material, such as mass and volume, are called extensive properties. It is interesting that while density relates two extensive properties (mass and volume), density itself is an intensive property.

Hypothesis (4 points):

What is your mineral and what do you expect the density of your mineral to be? Describe below what your hypothesis of this lab is and provide an explanation for your reasoning.

Materials:

1 flask
1 stopper
A sample mineral
Tweezers
Tongs
Quad-beam balance
Water, water, and more water
Density of water at different temperatures

Procedure:

1. Always wear your safety glasses.
2. Zero your balance.
3. Wash and dry the flask—do your best to dry the flask as much as possible, inside and out. Once you have washed and dried the flask, avoid touching it with your hands by handling it with tongs.
4. Measure the mass of the flask and stopper (Mass $_{flask+stopper}$).
5. Fill the flask with water up to the very top and put the stopper on. Some water will spill over the sides. If you consistently fill the flask to the top and put the stopper on, there should be no need for measuring the volume of the water. You can assume the volume of water is a "full flask" and you can work with mass only. Minimize error by using the same pressure to place the stopper on the flask.
6. Measure the mass of the flask, stopper, and water (Mass $_{flask+stopper+water}$).
7. Measure the mass of the mineral (Mass $_{mineral}$).
8. Empty and dry the flask and stopper. Add the mineral to the flask without water.
9. Measure the mass of the flask, stopper, and mineral (Mass $_{flask+stopper+mineral}$).
10. Add water to the top of the flask again and put the stopper on, again, allowing the excess water to spill out.
11. Dry off the flask.
12. Measure the mass of the flask, stopper, water, and mineral (Mass $_{flask+stopper+water+mineral}$).
13. Calculate a.) the mass of the water *before* adding the mineral (Mass $_{H2O\ before}$) and b.) the mass of the water *after* adding the mineral (Mass $_{H2O\ after}$).
14. Calculate the mass of the displaced water (M $_{displaced\ H20}$).
15. Find the volume of the displaced water (V $_{displaced\ H2O}$) using the mass you calculated in the step above and the density of the water (for a given temperature—D $_{water}$).
16. The volume of water displaced will be equal to the volume of the mineral (V $_{displaced\ H2O}$ = V $_{mineral}$).
17. Calculate the density of the mineral (D $_{mineral}$) based on its previously determined mass and volume.
18. Calculate percentage (%) error for each of your trials and find the average.
19. **DO THREE (3) TRIALS FOR EACH MEASUREMENT AND CALCULATE AN AVERAGE!!**

Data Table (42 points) – Use the appropriate UNITS.

Measurement	Trial 1	Trial 2	Trial 3	Average
Mass $_{\text{flask+stopper}}$				
Mass $_{\text{flask+stopper+water}}$				
Mass $_{\text{mineral}}$				
Mass $_{\text{flask+stopper+mineral}}$				
Mass $_{\text{flask+stopper+water+mineral}}$				
Mass $_{\text{H2O before}}$				
Mass $_{\text{H2O after}}$				
Mass $_{\text{displaced H20}}$				
Temperature of H_2O				
Density $_{\text{water}}$				
V $_{\text{displaced H2O}}$				
V $_{\text{mineral}}$				
D $_{\text{mineral}}$				
% Error				

Sample Calculations: Provide example calculation (i.e. *from one of your trials*) here for each of your calculations in the data table above, including percent (%) error (8 points).

Error: Discuss possible sources of your above calculated error. Be specific (4 points).

Conclusion (6 points):