DENSITY LAB

Name:_____

Period_____ Date:_____

Part 1: Density of SOLIDS

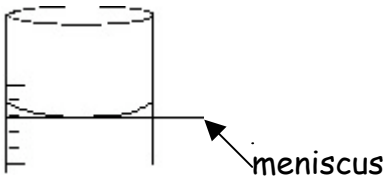
INTRODUCTION: Density is the ratio of an object's mass to its volume. Density is the term used to describe the relationship between the mass of an object and its volume. Under given conditions of temperature and pressure, the density of a material is constant. The density of any Earth material can be determined by measuring its mass and volume and using the formula for density as shown in the Earth Science Reference Tables:

$$D = M/V$$

OBJECTIVE: To be able to calculate the densities of different materials and recognize that density is one of the most important properties of matter. The masses will be determined using an electronic balance.

The volumes of the solids will be calculated either by linear measurement or by determining the amount of water displacement by submerging the object in water. Gold has a density of 19.0, the average rock has a density of 3.0, and water has a density of 1.0 g/mL. 1 g/mL means that 1 mL (or cm^3) of water has a mass of 1 gram or 1 liter of water has a mass of 1 kg.

Don't forget when reading the graduated cylinder to read the bottom of the meniscus as shown below.



VOCABULARLY:

Mass:

Weight:

Volume:

Displacement:

Pre-lab questions:

1. **Which is more dense, a marshmallow or hot chocolate? Answer:_____**

   a) It depends on how much you have

   b) The marshmallow because it floats

   c) The hot chocolate because it is a liquid

   d) The marshmallow because it weighs 25g and the chocolate powder only 17 g

2. Which is more dense, water or oil?

3. What mass does 3.0 mL of gold have?

Procedure: (solids)

1. Measure the mass of each object using a scale. Your answer will be in grams (g).
2. Find the volume of each object using the metric ruler and the equation: volume equals length x width x height (v = l x w x h) or by using the water displacement method. Your answer will be in cm^3
3. Calculate the density of each object by dividing the mass by the volume. (use the equation shown above)
4. Record these data on Report Sheet #1.
5. After completing Report Sheet #1 obtain the accepted densities for each item from your instructor.
6. Using your density values and the accepted values, calculate percent deviation from the accepted values for each of the items. Use the equation found in the Earth Science Reference Tables.
7. Record your calculation and answers on Report Sheet #2.

REPORT SHEET #1 (solids)

1. Aluminum Bar Mass = _____ L = _____ W = _____ H = _____ Volume = _____ Density = _____	2. Aluminum Cube Mass = _____ L = _____ W = _____ H = _____ Volume = _____ Density = _____	
3. Aluminum Sphere Mass = _____ Volume = _____ Density = _____	4. Plastic Sphere Mass = _____ Volume = _____ Density = _____	
5._____ Mass = _____ Volume = _____ Density = _____	6._____ Mass = _____ Volume = _____ Density = _____	7._____ Mass = _____ Volume = _____ Density = _____

REPORT SHEET #2 (solids)

1. Show all work.
2. Label with the correct units.

1. Aluminum Bar Your Value = _____ Accepted Value = _____ % Deviation _____	2. Aluminum Cube Your Value = _____ Accepted Value = _____ % Deviation _____
3. Aluminum Sphere Your Value = _____ Accepted Value = _____ % Deviation _____	4. Plastic Sphere Your Value = _____ Accepted Value = _____ % Deviation _____

5._____ Your Value = _____ Accepted Value = _____ % Deviation _____	6._____ Your Value = _____ Accepted Value = _____ % Deviation _____	7._____ Your Value = _____ Accepted Value = _____ % Deviation _____

QUESTIONS: Solids (construct your answers using complete sentences)

1. What is the effect of shape on the density of samples of the same material?

2. The aluminum bar is cut in half. What is the density of each half compared to the original density of the bar?

3. Of the three phases of matter, which phase has the greatest density for most substances?

4. Water is an unusual Earth material because it is densest in which phase?

5. There is water on the pan of the scale as you measure the mass of a mineral. If you were to ignore the water, what would be the effect on your density calculation?

CONCLUSION: Describe the procedure for determining the density of Earth materials.

Part 2: Density of LIQUIDS

INTRODUCTION: Just as solid objects less dense than water float, so too do liquids that are less dense, providing they do not mix. A light liquid will float on top of a heavy one. If you look at puddles on a busy main road, you will often see a thin layer of oil floating on the surface of the water. This is because of oil dropped on the road by vehicles is less dense than rainwater. Indeed, most oils are lighter than water. In the same way, changing the density of a liquid, either by changing its temperature or dissolving things in it, will affect how well solid objects float in it. Boats float higher on salty sea water than fresh water because it is denser.

Procedure: (liquids)

Place each of the empty graduated cylinders on the electronic balance and record their individual mass. Record your data to the nearest tenth in the data chart below. Repeat the same procedure for the same size graduated cylinders with unknown liquids #1, #2, and #3, and record below.

DATA CHART

Mass of empty graduated cylinders: #1_____g #2_____g #3_____g

Mass of graduated cylinder and unknown liquid #1: _____ g

Mass of graduated cylinder and unknown liquid #2: _____ g

Mass of graduated cylinder and unknown liquid #3: _____ g

***Subtract the difference between the empty graduated cylinders and the filled graduated cylinders to determine the mass of the unknown liquids, and record below:**

Calculated mass of unknown liquid #1: _____ g

Calculated mass of unknown liquid #2: _____ g

Calculated mass of unknown liquid #3: _____ g

***Calculate the density of liquid #1, liquid #2, and liquid #3. Be sure to include the appropriate units. Show your work.**

Liquid #1 Density = _____ Liquid #2 Density = _____ Liquid #3 Density = _____

IF ALL THREE LIQUIDS WERE PLACED TOGETHER IN THE SAME GRADUATED CYLINDER, WHICH LIQUID WOULD FLOAT ON THE TOP? Liquid #1, liquid #2, or liquid #3? Answer: _____ Why?_____

In the box provided, draw a diagram of a graduated cylinder

indicating each of the liquid layers by number in order of densities:

SOMETHING TO THINK ABOUT!….

Why do you have to shake salad dressing? How can you make an ice cube sink? How does temperature affect a liquid's density? How might pressure affect an object's density? When you make a root beer float, why does the ice cream rise to the top?

CONCLUSION: In determining density, explain how the density of a liquid would be affected by adding a substance to the liquid?