Phys. Make-up lab

Name ______Section_____

Density and measurement in the metric system

Purpose: To develop a conceptual understanding of the term 'density', to learn how to calculate the volume of a cylinder and block, to introduce the idea of significant digits, and to become familiar with the use of a vernier caliper.

Equipment: Meter stick, vernier caliper, platform balance, metal blocks and metal cylinders.

(A) Measurement of length using a meter stick:

Let's look at a meter stick. Notice that it is divided into 100 cm and 1000 mm. See if you can find the place on the meter stick that represents 0.4563m. It is the same position on the meter stick that represents 45.63 cm and 456.3 mm. Notice that you have to guess at the position of the '3'. That estimate represents the last significant digit in your measurement, which is four significant digits long. You can only estimate (guess) one significant digit. Whenever you measure with a meter stick you should get the divisions on the stick as close as possible to the object being measured. Ask your lab instructor to show you how.

Let's take some measurements with the meter stick.

	meters
Length of your lab table	
width of your lab table	
surface area of your table	

(B) Measurement of distance using a vernier caliper: A Vernier caliper is used to measure small distances with more accuracy than can be achieved with a meter stick. Your instructor will demonstrate the use of a vernier caliper.

	(cm)
Thickness of a quarter	
Diameter of the quarter	

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(C) Measurement of mass using a platform balance: There are 1000 gm in a kilogram. The prefix 'kilo' means thousand.

How to use a platform balance. First, push all the sliding weights to the left and 'zero' the balance.

Next, place the object on the left pan and move the sliding weights until the pans are balanced. **Hint**-You may have to add some objects of known mass to the right hand balance. The object's mass equals the sum of the masses needed to balance the pans.

(gm) (kg)

Mass of the quarter

Let's use our measurement skills to determine the density of several objects.

Density: The density of an object is given by the formula $\rho \equiv \frac{M}{V}$. When mass is measured in grams and volume in cm³ density has the units of g/cm³.

You already know how to find the mass of an object by using a platform balance.

You can find the volume of an object by measuring the amount of water it displaces when it is submerged in water. We aren't going to use that method today. Instead, we will use the equations for the volume of a cylinder and for a block. A quarter is a cylinder whose thickness is L.



Area

 $V_{cylinder}$ =Length x area of one end. The formula for finding the area of one end is the same as finding the area of a circle ($A_{circle} = \pi r^2$), where 'r' is the radius of the circle (radius= 1/2 diameter).





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Make-up Lab preparation: Please complete the following exercise before coming to lab. Hand this page in, before the beginning of the lab.

What is the definition of density?

What is the equation for the area of a circle?

What is the equation for the volume of a cylinder?

What are the metric units of Volume?

What are the metric units of density?

Why is a bucket of water heavier than a bucket of feathers?

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(D) Density of metal blocks and cylinders: Fill in the chart and determine the density of the objects listed below.						
lead block	mass	volume	uchsity			
aluminum block						
brass block				-		
aluminum cylinder						
copper cylinder						
brass cylinder				-		
quarter				-		

Lead block calculations:

Aluminum cylinder calculations:

Is density affected by the shape of an object?

The density of the quarter is closest to which of the elements above _____