Survey of Physics

Lab 1: Measurements

Theory:

Measurements are at the heart of all science. In your daily life, measurements are often taken quickly and casually. In scientific experiments we must measure and record the values carefully.

The following units are used in this lab:

10 mm = 1 cm
1000 mm^3 = 1 cm^3
1 cm^3 = 1 mL

The following symbols and equations are used in this lab:

d	= *diameter*	$V = \ell w h$	for a rectangular box
h	= *height*		
ℓ	= *length*	$V = \pi r^2 h$	for a cylinder
m	= *mass*	$V = \frac{4}{3}\pi r^3$	for a sphere
r	= *radius*	$r = \frac{1}{2}d$	
V	= *volume*		
w	= *width*	$D = \frac{m}{V}$	
D	= *density*		

Equipment:

Welch measurement set, digital micrometer and calipers, graduated cylinder, top loading mass balance (on back counters)

Procedure:

Part 1: *Raw Data*

Measure the following dimensions and record the raw data in the lab report. These numbers are ***raw data***. If the instrument is graduated in cm, the raw data must be recorded in cm.

All numbers must have units.

1. dimensions (length, width and height) of the metal rectangular block

   l = _____

   w = _____

   h = _____

2. diameter of the metal sphere

   d = _____

3a. diameter and height of the exterior of the metal cylinder (the one with the cavity)

   d = _____ h = _____

3b. diameter and height of the interior cavity of the same metal cylinder

   d = _____ h = _____

4. thickness of a sheet of paper using the micrometer

   t = _____

5. mass of the metal rectangular block (from digital mass balance)

   m = _____

6. volume of large metal cylinder measured by fluid displacement

   V_1 (water only) = _____

   V_2 (water and metal) = _____

Part 2: *Derived Data*

Compute the following data and record your answers in the lab report.

1. Volume of the metal rectangular block

   in units of mm^3

   V = _____

   in units of cm^3

   V = _____

2. Volume of the metal sphere.

   V = _____

   in units of cm^3

   V = _____

3. Volume of the **outside** of the metal cylinder (in units of mm^3)

   V = _____

   Volume of the **inside** of the metal cylinder (in units of mm^3)

   V = _____

   Volume of metal of the cylinder (outside volume – inside volume)

   V = _____

4. Compute the thickness of a stack of 100 sheets of this paper, in cm.

   t = _____

5. Density (mass/volume) of the metal rectangular block (use your value from step 1 and the mass from the raw data step 5). Give your answer in units of g/cm^3.

   D = _____

6. Determine the volume of the metal cylinder by subtracting your measurements from step 6 (raw data). Convert units to mm^3, then compare your result to the volume you computed in step 3 (derived data).

   V = _____

   If this volume is not similar to the answer in step 3, determine why and fix your answers.