05-04 Buoyancy Lab *Name: _____*

Objective

- Explore the apparent weight of an object when it is submerged.

Materials

- 4 Large washers
- Paperclip
- Force Sensor
- Beaker (or cup) of water
- Caliper
- Known mass (to calibrate the force sensor)

Procedure

1. Calibrate the force sensor.
2. Hang the 4 washers from the force sensor using a bent paperclip. Measure the weight of the washers.
   W_{air} = _____ N
3. Carefully submerge the washers in water without touching the sides or bottom. What does the force sensor read now?
   $W_{submerged}$ = _____ N
4. Since this weight is less, the water must be pushing the washers up. What is the difference in weights (this is called **buoyant force**)? B = _____ N
5. Find the volume of the washers.
   a. Outer diameter, d_{out}=_____ cm; r_{out} = _____ cm
   b. Inner diameter, d_{in} = _____ cm; r_{in} = _____ cm
   c. Height of stack of washers, h = _____ cm
   d. $V = \pi h(r_{out}^2 - r_{in}^2)$, V = _____ cm^3
6. When the washers were put in the water, how much water was displaced? _____ cm^3
7. Using density, find the mass of water of the same volume (ρ_{water} = 1 g/cm^3). m_{water} = _____ g
8. Find the weight of that much water. W = _____ N
9. Compare steps 4 and 8 and find the percent difference. $\%\ diff = \frac{|value1 - value2|}{\left(\frac{value1 + value2}{2}\right)} \times 100\%$ _____
10. Talk to neighboring groups and make a conclusion about the buoyant force and the weight of water displaced.

Dry the washers before putting them away.