

**PHYS 1401
General Physics I**

**EXPERIMENT 10
ARCHIMEDES' PRINCIPLE**

I. INTRODUCTION

The objective of this experiment is to study Archimedes' principle by measuring the weights of various objects in air and in water and measuring the weight of the displaced water to see if the data are in agreement with this principle. Archimedes' principle states that "an object wholly or partially submerged in a fluid experiences a buoyant force upward equal to the weight of the displaced fluid". Algebraically

$$F_B = \rho_{fl} V_{sub} g \quad (1)$$

II. APPARATUS

Triple beam balance, beakers, various objects, supply of water.

III. EXPERIMENTAL PROCEDURE

1. Place the digital balance on a lab jack. Make sure the balance reads zero.
2. Raise the lab jack and hang one of the objects from a hook connected to the bottom of the balance and read the mass of the object and calculate its weight. This is the weight in air. The real weight.
3. Place the beaker with the spout under the object. Fill the beaker with water until the water runs out of the spout. Have a container ready to catch the water.
4. Lower the object into the water while catching the displaced water with a graduated cylinder. This should be done very carefully so as not to spill or splash any water outside. Continue lowering until the object is completely submerged.
5. Take the reading of the digital balance and calculate the (apparent) weight of the object. This is the weight of the object submerged in water.
6. Using the digital scale, measure the mass of the displaced fluid and calculate its weight. Don't forget to subtract the mass of the graduated cylinder.
7. Repeat the above process for the other three objects. Each time dry off the inside of the graduated cylinder.

IV. ANALYSIS

1. Calculate the buoyant force by subtracting the weight of the object under water from the weight of the object in air. Draw a force diagram for the object in air and in water and show that the buoyant force is the difference between the two weights.
2. Calculate the weight of the displaced fluid.
3. Compare these two items by calculating the percent difference.
4. Write a conclusion summarizing your results. Comment on the success of this experiment. Explain any percent differences which are larger than 10%. Is your result consistent with Archimedes' principle? What do you think are the two most important sources of error?

Experiment (10) Data Table				
Object	Mass m (kg)	Weight in Air $W_1 = mg$ (N)	Apparent Mass (kg)	Weight under Water $W_2 = mg$ (N)
Steel				
Brass				
Aluminum				
Lead				

Object	Buoyant Force $F_B = W_1 - W_2$ (N)	Weight of Displace Water (N)	Percent Difference
Steel			
Brass			
Aluminum			
Lead			