SMS-204: Integrative marine sciences.

Lab 3, Buoyancy lab.

Station 1: Archimedes ball (**Note: data you collect will be used in homework**).

a. Measure the diameter ____(cm) of the ball. Estimate the uncertainty in diameter by measuring at several places and/or looking at the precision of the caliper ____(cm).
b. Measure the mass of the ball with cork in place but hose removed, ____(g). Determine the uncertainty based on precision of scale and likely effect of fluid that was not completely removed, ____(g).
c. Compute the ball's volume, _____(cm^3) with crock in place and its uncertainty, ____(cm^3).
d. Compute the empty ball's density, _____ (g cm^{-3}) and its uncertainty, _____ (g cm^{-3}).

Station 2: A hydrometer is a device to obtain the densities of fluids relative to a standard.

a. Speculate on how it works.
b. Suppose you add ice or salt to water. Will it float higher or lower? Why? Try it.
c. Why does the scale mention temperature?
d. Hydrometers are used in the beer industry. Can you speculate why?

Station 3: Cartesian diver

a. Squeeze the bottle. Why is the half-closed pipe inside the bottle sinking?
b. How is it related to Archimedes's principle and to last week Pascal's press?

Station 4: Weight in and outside water (**Note: data will be used in homework**).

a. Measure the box's length ____(cm), width ____(cm) and height ____(cm). Note that the box is marked with lines 1cm apart.
b. Compute the cross section area of the both (length x width) _____(cm^2) and volume (length x width x height)_____(cm^3).
c. Using the spring scale measure the weight of the empty box in air, then lower the box into the water until it floats and record the weight showing on the spring scale.

d. Remove the box from the scale and note the depth to which the box is immersed while floating. Record the answers in the table.

e. Add 25g of weight to the box, and use the spring scale to measure: a. the box weight outside the water. b. The box weight in water, and c. the depth to which the box is immersed in water (each mark on the box is 1cm). Repeat 4 times.

Weight added to box	Weight in air	Weight in water	Immersion depth
0g			
25g			
50g			
75g			
100g			

f. What is the difference between the final box weight inside and outside water, and what is the formula which you could get the difference?

<u>Station 5:</u> Rocking boat.

You have a large rock on a boat floating in a pond. When you throw the rock overboard and it sinks, will the level of the pond rise, drop, or remain the same? What about an object that floats in water (e.g. a life jacket)?

1. Reach a consensus in your group based on what you know about buoyancy.
2. Find an instructor and tell her/him your conclusion.
3. Test your prediction with the setup provided.

<u>Station 6:</u> Can a can float?

1. Examine the two cans. List similarities and differences between them.
2. What do you think the floating/sinking behavior of each canwill be when placed in room-temperature tap water? Discuss the reasoning for your prediction.
3. Place the two cans in the tank. Be sure no bubbles cling to the cans. Does your observation agree with your prediction? How would you explain this observation?
4. Why might there be a difference in density between the cans?