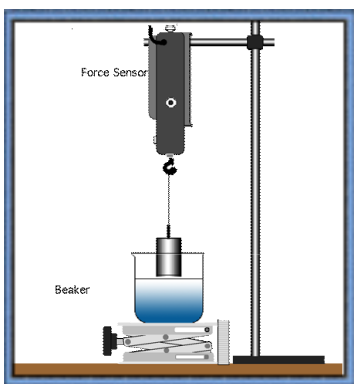
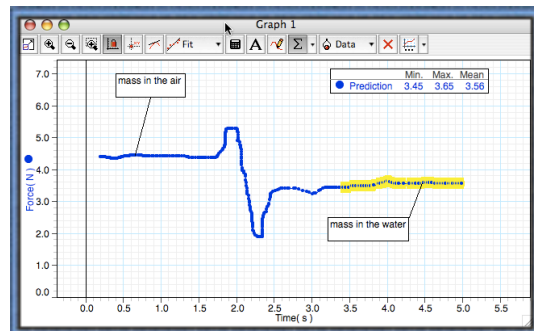


Step 1. Calibrate the force sensor.

Double click the icon of the force sensor on the set-up screen. The third tab is for calibration. In this lab, using units of grams will make your calculations easier, so use a low value of 0.0 g and 150.0 g for the high value. Even if DataStudio thinks it is measuring Newtons of force, you will have grams for your answers.

Step 2. Create a graph.

A good graph will be the best way to get your values for this lab. You might expect to create a graph such as the one shown here. The mean (average) value of just the right part of a force/time graph will get you both masses without stopping the trial.



Step 3. Take your measurements.

Make sure the metal sample is not swinging, and allow around 10 seconds to show a nice straight line for the mass in the air. Place the metal in the water, either by lowering the metal or raising the water. Don't worry if the graph spikes, you can ignore the parts of the graph that are irrelevant. Again, allow around 10 seconds for a good sample size.

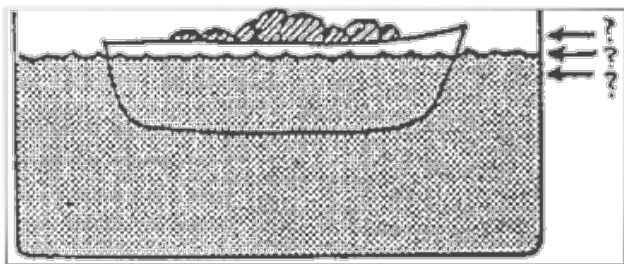
Data and Calculations:

$\rho_{\text{water}} = \underline{\hspace{2cm}}$

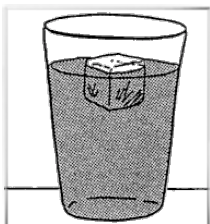
$$\rho_{unk} = \frac{m_{out} \rho_w}{m_{out} - m_{in}}$$

	Material?	Mass out of water	Mass in the water	ρ_{unknown}	ρ_{accepted}	% Error
1						
2						
3						
4						

Questions:



Consider a boat loaded with scrap iron in a swimming pool. If the iron is thrown overboard into the pool, will the water level at the edge of the pool rise, fall, or remain unchanged?



As the ice melts, what happens to the level of the water? Will it rise, fall or remain unchanged?

In part one of the lab you made direct measurements of the unknown metals. How did your accuracy compare in part 2?

What are some objects that would be easier to measure using the methods in this section?

MATERIAL	Density (g/ml)
Aluminum, cast-hammered	2.55 - 2.80
Brass, cast-rolled	8.4 - 8.7
Carbon	2.26
Copper, cast-rolled	8.85
Diamond	2.26
Gold, pure	19.32
Iron, gray cast	7.03 - 7.13
Lead	11.34
Mercury	13.534
Nickel	8.9
Silver, pure	10.4 - 10.6
Steel, machine	7.80
Tin, 100% Pure	7.29
Water, fresh	1.0
Zinc, cast-rolled	7.2