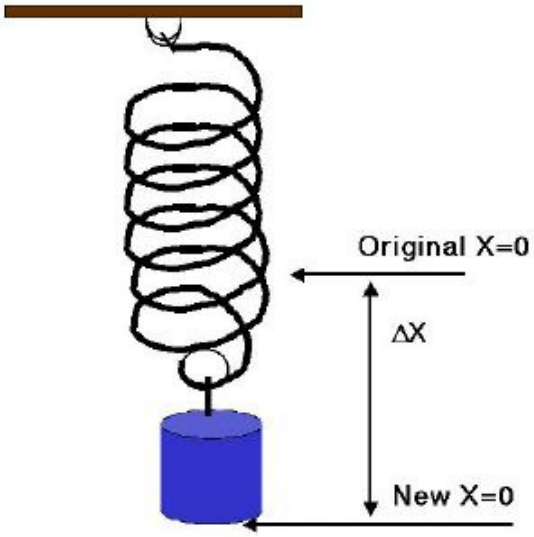
Hooks Law Lab

In this lab you will find the spring constant for three different springs, then use this to find the mass of some objects of unknown mass.

Pre-lab:
From the description of the way a spring stretches when you hang a mass from it described below, predict what the graph would look like of Force (mass x gravity) as a function of stretch (Δx), and draw it in the space below the picture.



Part A: Finding the k of three different springs:
Equipment: Ruler and pole arrangement; three different springs; set of masses from few tens of grams to 200 grams or so (be careful not to overstretch the springs!!).

Procedure:
1. First hang a spring on the pole, and measure the height of the bottom of the spring without anything hanging from it.
2. Next, hang a small mass, say 10 grams (.01 kg) from the bottom of the spring, and note the DELTA x – i.e., the amount that the spring stretched.
3. Add mass in constant increments, say 10 grams at a time, or 20 grams at a time. For a stiffer spring you may go up in larger increments. Record the amount of stretch relative to the initial position. Record all your data in a table like so (included on a separate sheet):

Mass (kg)	Weight Newtons (m * g)	X (meters)	$\Delta x = x - x_i$
0	0		0

4. Graph Force (mass x gravity) as a function of stretch (Δx). You can graph in Excel, or by hand.
5. Repeat for two more springs.

Conclusion of Part A:
You now have THREE graphs for THREE different springs. CALCULATE the spring constant for each spring from the slope of the graph.
SHOW ALL YOUR MATHEMATICAL REASONING: On the y-axis you have Force, which is (mass x gravity). On the x-axis you have stretch, which is Δx. Calculate the slope,

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

k_1 =_____ k_2 = _____ k_3 =_____

Part B: Finding the mass of three unknown objects from your graph.
Select three objects the weight of which you don't know, such as someone's keys, maybe a candy bar, a toy animal, a glove, etc. Hang each object, one at a time, from one of your springs and record the amount of stretch.

Plot this stretch on the graph for that spring on the x-axis, and using the graph, find the weight of the object by reading up from the x-axis to the line (mass x gravity) = kx, and then reading across to the weight.

Weigh your object on one of the electronic balances, and compare this measurement with the weight you derived from your graph. How close were you?

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You should have all three graphs in your lab notebook, as well as the three data tables, and the masses of your unknowns from your graphs and the comparison with the weight from the electronic balance.