Graphing Your Motion and the Experimental Calculation of g Name_____

Graphs made using a motion detector can be used to study motion. A motion detector measures the distance to the nearest object in front of it by emitting and receiving pulses of ultrasound. This data is routed directly into your Lab PC via the LabPro unit, and is graphed in real time.

Your group will be presented with a number of graphs that you will try to match as closely as possible. Your grade is determined by the accuracy (how well you match the graphs) of graphs you complete.

Start by setting up your apparatus. The Sonic range finder probe should be set-up so that it is level with your abdomen, with about 4 meters of clear walking space from the probe.

Turn on your PC and start the Logger Pro program. Plug the Sonic probe into the Sonic (Digital In) port on your LabPro, and then connect the LabPro USB cable to the PC. If Logger Pro does not automatically detect the probe, you will have to set it up manually.

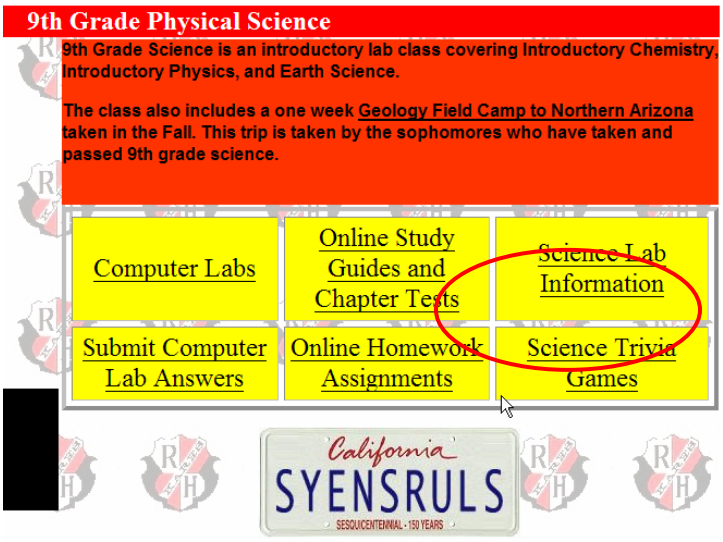
Take a while to familiarize yourself with the probe. When collecting, the small LED light is on and the unit makes a soft clicking sound.

It is important to note that each data collection experiment is exactly 6.0 seconds long. You may have to enter this (under Experiment, Data Collection) on each run you perform.

When you are familiar with how the probe works, move on to the next page.

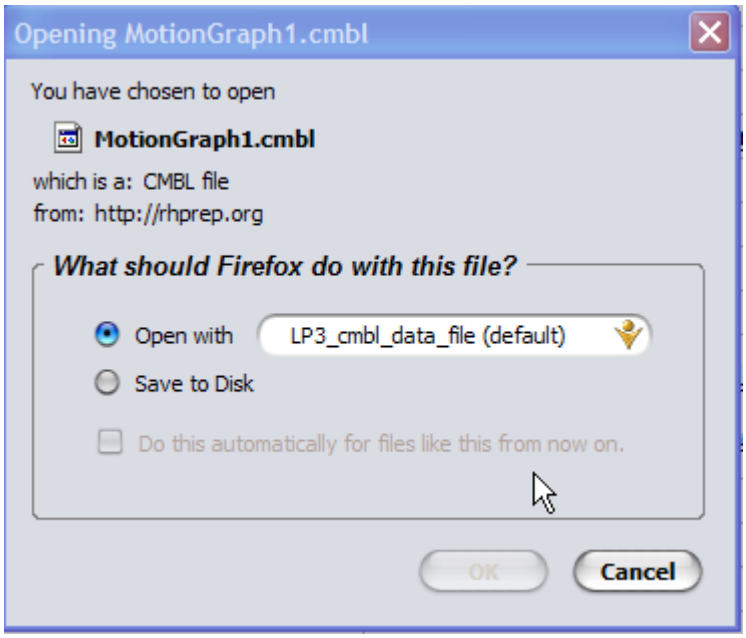
Distance vs. Time Graphs

Start this experiment by navigating to the Physical Science Web Page, and clicking on the Science Lab information link.

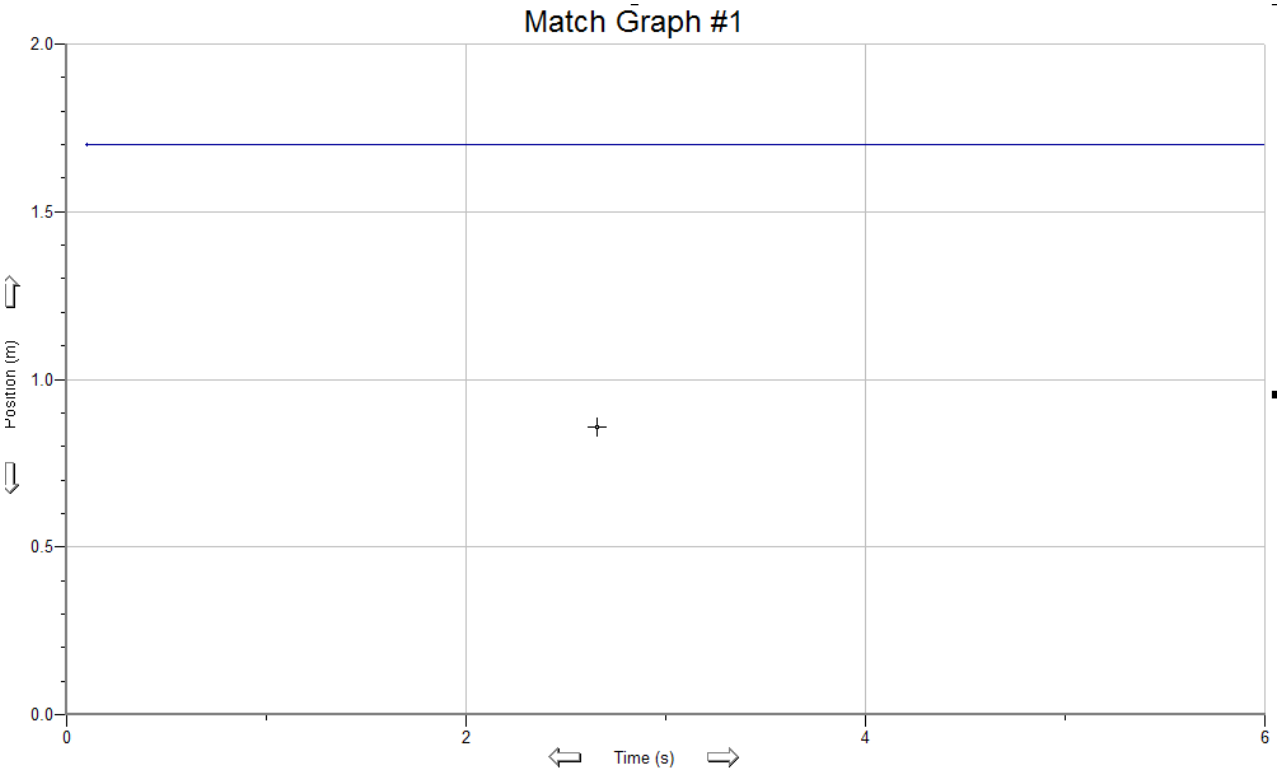


Find the "Graphing Your Motion" lab, and under the associated links, click on **Graph1**.

You may get a window that looks like the one below. If you do, click on OK to run the Logger Pro Software.



Distance/Time graphs show the distance away from the probe per unit of time. If you look at the graph on your screen, you will notice that the graph line is horizontal. This means that the object is stationery, 1.7m from the probe. Try to match this graph. When you have done so, print out the graph (**in landscape mode!**) and move to the next one (make sure your name is on the printout (Pull down the File menu, choose Print Options and type your names in the Footer section – type the graph number in the comment section).

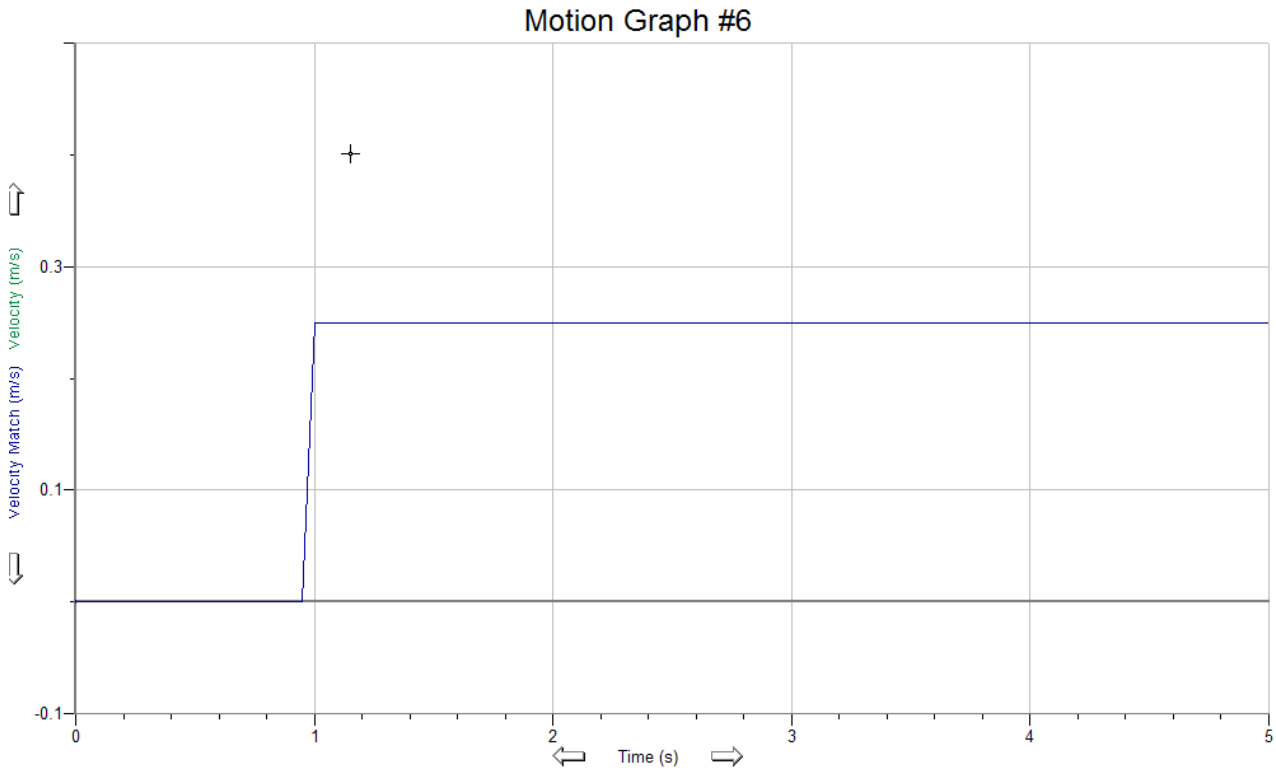


Do the same for the graphs #2, #3, #4 and #5.

Turn the page when you get to Graph #6.

Graph #6 is the hardest of them all. This is a Speed vs. Time graph. The data points are the speed of the object at any given time (m/s). A line that slopes up means the speed is increasing (as is acceleration), a line that is horizontal means the speed is constant (no acceleration is taking place).

It will be next to impossible to match your velocity to the graph, but try to get as close as possible. Good luck!



Make sure all the printouts are complete with your names printed on each graph. We are now going to determine the value of 'g' (acceleration due to gravity) using experimentation.

Set-up your probe (using the clamp or other secure method) so that it is facing downward towards the floor from the lab bench. Get your dropping object (a basketball, non-valuable book or other object). In Logger Pro, click on New. In the Data Collection option, set the probe to collect data for 5 seconds.

Place the dropping object about .5m from the probe. Once data collection has begun, let the dropping object free fall to the ground (if it is valuable, you may want to catch it before it hits the ground).

If you are satisfied with the results, calculate the acceleration due to gravity (using the velocity data) by entering the data into the following formula:

$$a = g = \frac{v_f - v_i}{t}$$

You should be able to use any two data points for your calculations. V_f = to the final velocity; V_i = the initial velocity. **Put all your calculations below and turn this sheet in with your answer.** If you need help, see the instructor.