Possible Pre Lab 5

1. A spring is hanging from a post with total length $L\_{0}$ as shown. When a mass $m\_{1}$ is added to the spring the spring stretches to a new length $L\_{1}$. How would you calculate the force and the stretch of this spring?

$$L\_{1}$$

$$L\_{0}$$

1. The force and the stretch of a spring has been measured for six different masses. Plot the data below and using a scatter plot with a linear trendline through your points find the *best fit value* for the spring constant $k$ of the spring.

|  |  |
| --- | --- |
| Force (N) | stretch (cm) |
| 2 | 4 |
| 3 | 9.2 |
| 4 | 14.3 |
| 5 | 18.7 |
| 6 | 24 |

1. A mass is bouncing up and down on a spring and a position vs time graph has been generated.

Use this graph to determine the **period** of the bounces, the amount of time it takes a mass to complete one full bounce.

Lab 5: PHY 211

Springs

Safety Goggles (provided by the instructor) and closed-toe shoes are absolutely required for this Lab

Equipment:

Goggles for each lab member: Points will be deducted for group members who are not wearing goggles at any time after the experiments have started.

1 stand to hold the spring

1 box of springs (make sure that you return your box to the drawer properly, we will need this labs results for next lab.)

1 hook (Don’t forget that this has mass)

1 mass rack. When placing multiple masses on the hook, please turn the slots on the masses in opposite directions to prevent the masses from falling off.

1 triple beam balance

1 computer with Logger Pro



1 motion detector-CBR2-with a cable to connect directly to a USB port on the computer.

The CBR2 sends small clicks out from the speaker and listens for the echo off of nearby objects. It then sends the distance measurements directly to logger pro. Therefore we are able to trust the distance and velocity measurements that are plotted for us, or we can transfer the Time, Distance, and Velocity numbers directly to excel and generate our own graphs.

 One problem with the CBR2 is that sometime it gives very noisy data. Some things that you can do to help include making sure that the speaker is aligned directly at the object you are measuring, and making sure that the CBR2 is looking for a “small object” by adjusting the slider on the inside it to “car.”

**Any reasonable requests for additional equipment will be honored.**

Procedure:

 This lab has two parts:

1. First you need to use the setup described in the Possible Prelab Questions 1 and 2 to measure the k value of the three of springs in your box {Red, green, and your choice}. The Researcher should include a description of how force and stretch were determined as they are not directly measured. You need to measure at least 5 different weights for each spring.
	1. The DA should include the entire **Force vs Stretch table for at least one spring** as well as a scatter plot **showing the data for all three springs** (with trend lines and equations for all three springs). If you can’t achieve clarity with careful labelling, you can have multiple scatter plots.
	2. Should the mass be moving while you measure the spring’s distance? The
	Researcher should record the groups reasoning for their answer in the procedure.
	3. How does the fact that the spring’s coils touch each other alter the normal formula for springs, usually called Hook’s Law, $\vec{F}=-k\vec{Δx}$? The PI should include a discussion of the meaning of the y intercept found on the Force vs distance graph generated by the DA. Also, please report the measured k value for all the springs.
2. Pick **one mass, 550 g or less,** that is large enough that it can bounce up and down several times on all the measured springs. If the spring snaps together and bangs while bouncing, your mass is too small or you are stretching it too far. Place the motion detector on the floor aimed up at the mass to quickly create position vs time graphs.
	1. Use a few position vs time graphs to determine if the **period** of the oscillations depends on the **amplitude** of the bounce. Amplitude equals HALF the distance from the top of the bounce to the bottom of the bounce.
		1. The Researcher should include one of the position vs time graphs in the Procedure section to explain how to measure period and amplitude.
		2. The DA should provide a table of Amplitude vs period for one spring. If the Period depends on the amplitude, create a scatter plot to determine if the relationship between period and amplitude is linear or not.
		3. The PI should report the final answer by interpreting the data.
	2. Use a few position vs time graphs to determine if the period of the oscillations depends on the k value of the springs. The DA should provide a table of k value vs period. The PI should report the final answer by interpreting the data.