Lab 15-1 : **Springs**

Purpose: 1. To determine the relationship between force and stretch in a spring.
2. To determine the relationship between mass and period for an oscillating mass on a spring.

Materials: 1 Spring 1 Hanger 1 Mass Set 1 Stopwatch

Procedure:

1. Record the mass of the hanger. Then attach the hanger to the spring and suspend it from a stand and clamp.
2. You will need to measure how much the spring stretches as you add more and more mass to the hanger. As best you can, note the position of the bottom of the hanger while you are still holding it so that you can measure (and record) how much the spring stretches when it is holding up the hanger.
3. Lift the hanger slightly and let it go to get it oscillating up and down. Record the time for 10 oscillations.
4. Repeat steps 3 for several more trials, each time changing the hanging mass by adding some mass to the hanger. Also record how mutch the hanger has stretched from its initial position. Try and add as much as you can without overstretching the spring. (Different springs behave differently, so you will have to judge your range of masses.)

Analysis:

1. Calculate the force in the spring for each trial when the system was at rest. *(Hint: when the hanger is at rest, what are the two forces acting on the hanger and what is the net force?)*
2. Calculate the period of oscillation for each trial when the system was not at rest.
3. Make two graphs: Force vs. Stretch and Period vs. Mass.
4. Even though both graphs will look linear at first glance, only one of them actually is linear. (Hint: make sure you see the origin of the graph.) After linearizing the non-straight graph, put regression lines through the two resulting graphs.
5. Copy and paste clear and legible copies of your graphs into this lab. (Don't forget labels, units and titles.)

Data:

Mass of Hanger: _____ kg

Total Mass of Hanger (kg)	Stretch (m)	Time 10 Cycles (s)	Force (N)	Period (s)

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Graphs:

Copy and paste the two linear graphs here.

Conclusion:

1. What was the equation that related the force in the spring to the amount of stretch in the spring?

2. What is the physical significance of the slope of the F vs x graph?

3. What was the equation that related the period of oscillation to the mass hanging?

4. Compare the units of the two slopes of the two equations above. What do you notice? (You will have to simplify one of the slopes.)

5. In general, how should the slope of the second graph depend on the slope of the first graph? *(Note: you can only answer this question after you know the official equation for the period of a mass on a spring.)*

6. Imagine you have a mass oscillating on a spring. What would happen to the period of oscillation if
   a. the mass were doubled?

   b. the spring constant were doubled?

   c. the amplitude were doubled?