



Hooke's Law

Pre-Lab Discussion: For springs, the amount of force used to stretch a spring is directly proportional to the distance the spring is stretched. This relationship is known as Hooke's Law.

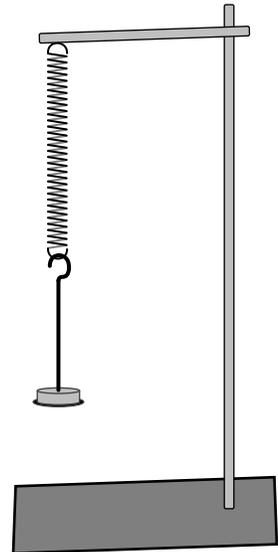
Purpose: To determine the relationship between force and distance a spring is stretched and to find the force constant (k) for a spring.

Materials: spring hook
various masses meter stick

Method:

1. Add a 50 g hook to the end of the spring. Measure from the table top to the bottom of the disk of the hook. Record this height as the rest position of the spring (let $x_0 = 0.0$ cm) and as if zero mass has been added.
2. Add the 50 g hook. Record the spring position and total mass as 50 g in the data table for Trial 1.
3. Repeat for three more trials by adding another 50 g to the total each time.

Lab #15



Data and Processing: Record data and results on the table below:

	Spring 1		Spring 2	
Trial	Spring Position (cm)	Mass (kg)	Spring Position (cm)	Mass (kg)
0		0.0000		0.0000
1				
2				
3				
4				

Calculations:

As example calculations, use the data for the first trial and show how to calculate:

x

F_g

k

Energy (J)

Conclusions:

1. Use a spreadsheet to calculate results and make a plot of force (N) vs distance (x). (Let $g = 9.81 \text{ m/s}^2$.)
2. On the spreadsheet graph, show the equation of the best fit line. Record the slope and the fit (R^2) below.

3. What are the units for the slope of the best fit line and what does it represent?

Write the slope equation and then solve it for force. Write the equation for force on the line below.

4. What are the units for the area under the best fit line and what does it represent?

Write the area equation. For the force, substitute the result from the slope equation in 3 above. Write the substituted equation for the area on the line below.

5. Make a plot of energy vs. x on your spreadsheet.
6. Write an equation relating the force, the spring stretch displacement, and the force constant (k) for the spring. This equation is Hooke's Law. State Hooke's Law in a sentence.

7. Use your reference table and write the equation for the potential energy stored in a stretched spring (PE_s). Compare the PE_s equation to the area equation you wrote for 4 above. Draw a conclusion.
