Hooke's Law Lab

PSI Physics Name:_____

Date:_____ Period:_____

Purpose

Hooke's Law explains the relationship between the force exerted on a spring, the stretch of the spring, and the spring constant of the spring. Springs are very special because they have a restoring force, which means that when a force is applied on them, they exert an opposing force to restore their original shape.

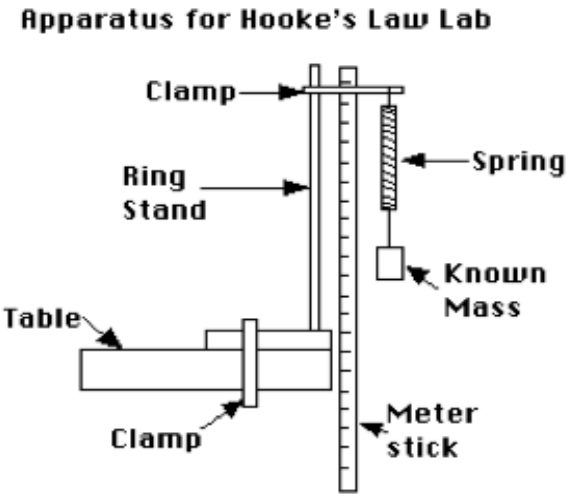
Hooke's Law is given by: **F = - kx**

During this lab, you will find the value for the spring constant, k, for two springs.

Materials

- Ring Stand
- Clamps
- Ruler
- Springs
- Set of masses

For reference, see http://njc.tl/17g



Procedure

Repeat the procedure twice, once for each spring.

1. Set up the apparatus by attaching the spring to the ring stand and having one of your group members hold or clamp the ruler so the zero mark is next to the end of the spring (usually the end of the spring has a hook or a loop attached).

2. Attach a mass to the end of the spring and record the mass in the table. Convert the mass to weight in Newtons and record on the table.

3. Measure the stretch of the spring by looking at the **change in length or elongation**, and record this measurement in the table. Make sure to convert this distance to meters.

4. Repeat steps 2-3 for four additional masses.

   (Note: too much weight on a spring can permanently damage it. Only add a little weight at a time!)

Data

Spring 1

Mass, m (kg)	Weight or Force, F (N)	Distance, x (m)

Spring 2

Mass, m (kg)	Weight or Force, F (N)	Distance, x (m)

Analysis

Repeat for each spring:

1. The equation for the force of spring is: $F = -kx$. This means that if we plot the force on the y-axis and the distance stretched on the x-axis, the slope of the line created would represent the spring constant, k. Additionally, the line should go through the origin because there is no y-intercept in the equation. The negative sign refers to the fact that when the mass pulls down on the spring, the spring pulls back up. We will ignore the negative sign for the rest of the lab.

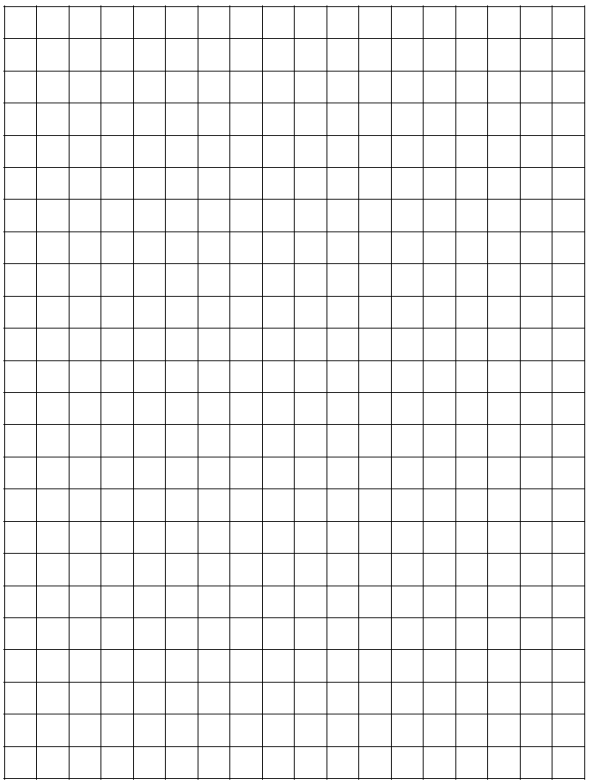
2. Graph Force (y-axis) vs. Distance (x-axis) for the two springs. Connect the points with a straight line through the origin. **Make sure your graph has a title and that the axes are properly labeled with units.**

3. Inspect the points on the graph. Try to draw a best-fit line for each of your plots. Be sure to include (0,0).

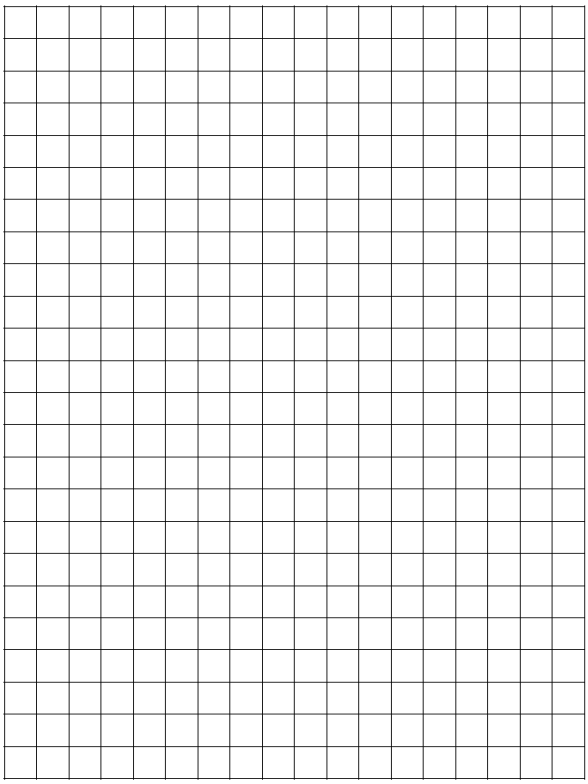
4. Do these best-fit lines approximate your data well? Yes or No
   (If so, then you've established Hooke's Law F = kx)

5. Whether your data agrees with Hooke's Law or not, find the slope of your graph. This represents the spring constant, k.

   Slope for Spring 1:



   Slope for Spring 2:



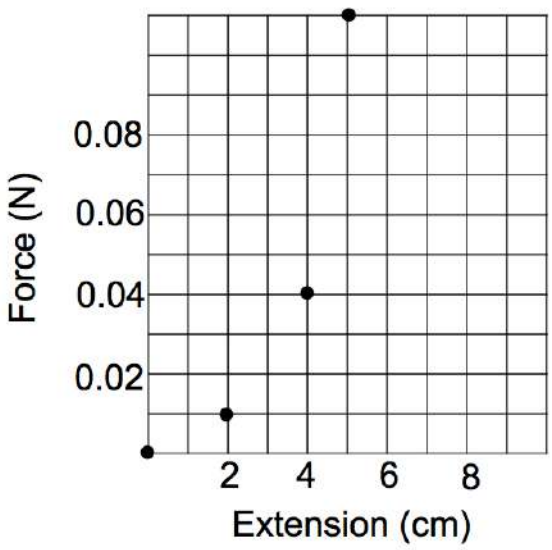
Conclusion

1. Did your data approximate Hooke's law well?

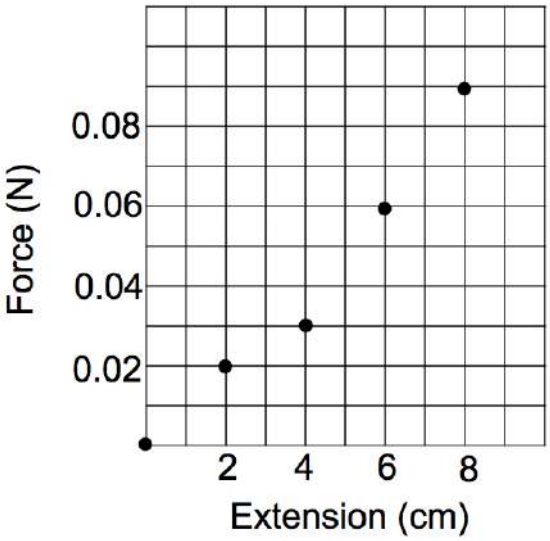
2. Explain why all of your points may have not fallen perfectly on your line of best fit.

3. Two groups of students measured the force on two different springs and the extension of those springs then plotted the graphs on the next page. Explain whether or not each spring obeys Hooke's Law.

Spring 1:



Spring 2:



Application:

1. The end of a spring stretches 0.02 m when a 100 g mass is added to it. How much will the spring stretch when a 500 g mass is placed on it?

2. A spring has a spring constant of 100 N/m. What would be the stretch of the spring a force of 4 N is applied to it?