Name _____ Period _____ Date _____

Stretchy Lab 3.1

Purpose

To verify Hooke's law and determine the spring constants for a spring and a rubber ban

Required Equipment

- Hooke's Law setup
- two springs with different spring constants
- rubber band
- Masses

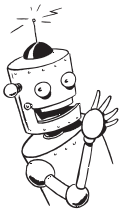
Discussion

When a force is applied, an object may be stretched, compressed, bent, or twisted. The internal forces between atoms in the object resist these changes. These forces become greater as the atoms are moved farther from their original positions. When the outside force is removed, these forces return the object to its original shape. Too large a force may over- come these resisting forces and cause the object to deform permanently. The minimum amount of stretch, compression, or torsion needed to do this is called the elastic limit.

Hooke's law applies to changes below the elastic limit. It states that the amount of stretch or compression is directly proportional to the applied force. The proportionality constant is called the spring constant, k. Hooke's law is written F = kx, where x is the displacement (stretch or compression). A stiff spring has a high spring constant and a weak spring has a small spring constant.

Procedure

1. Setup the Hooke's law spring apparatus as directed by your instructor.
2. Obtain from your instructor two springs and a rubber band.
3. Attach different masses to the end of the spring. With your eye level to the bottom of the spring or pointer, note its position each time mass is added. The stretch in each case is the difference between the rest position of the bottom of the spring (or pointer) and the load position when a mass is added to the spring. Be careful not to exceed the elastic limit of the spring. Record the mass and stretch of each trial in the Data Table.
4. Attach the second spring and repeat step 3.
5. Attach the rubber band and repeat step 3.



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	Mass (kg)	Displacement (m)	Force (N)	Spring Constant
Spring 1	0.045			
	0.085			
	0.125			
	0.165			
	0.205			
			Ave Spring Constant (N/m)	
Spring 2	0.025			
	0.045			
	0.065			
	0.085			
	0.105			
			Ave Spring Constant (N/m)	
Rubber Band				
			Ave Spring Constant (N/m)	

Complete the Data Table

6. Calculate the force acting on the spring for each trial.

$$W = mg \longrightarrow W = F \longrightarrow \boxed{F = mg}$$

Graph The Results

7. On the graph of force vs. distance, plot the force and displacement for each trial. Use colored pencils or label each data table.

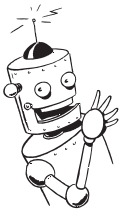
8. Draw a best line fit through the scattering of points that you have plotted for each set of data. Your line should start at zero.

9. The slope of your best fit line represents the spring constant, find the slope of your best fit line.

Slope of best fit line (spring 1): _____ N/m

Slope of best fit line (spring 2): _____ N/m

Slope of best fit line (rubber band): _____ N/m



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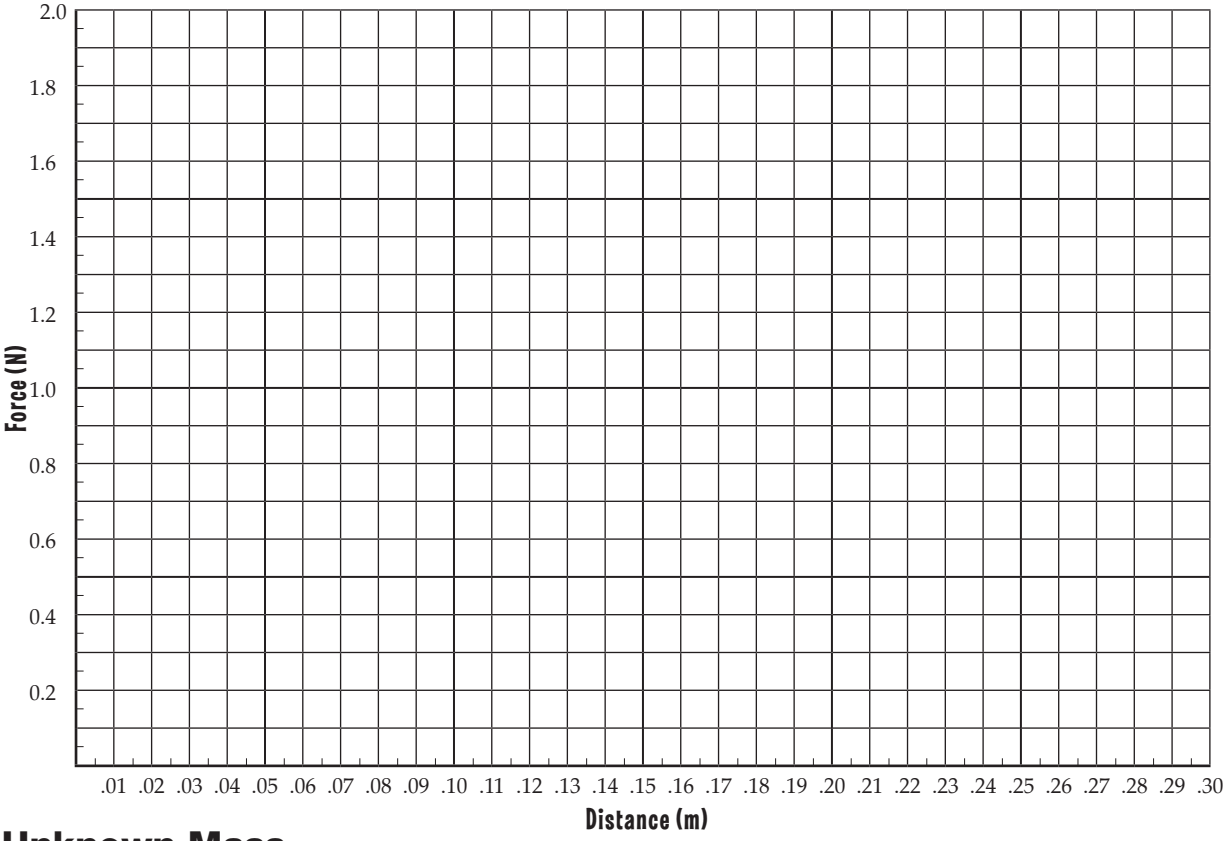
Force vs Distance



Unknown Mass

10. Obtain an unknown mass for your instructor.

11. Using one of the springs, test your unknown mass by placing on the spring and then use Hooke's law and the wight formula to calculate the mass.

$$F = k\Delta x \longrightarrow F = mg \longrightarrow mg = k\Delta x \longrightarrow \boxed{m = \frac{k\Delta x}{g}}$$

Show your work:

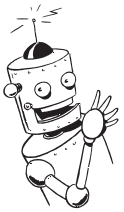
Calculated mass: _____ kg

Percent Error

12. Get the actual distance from your teacher and calculate the percent error using the percent error formula. Show all your work.

$$\%\ \text{error} = \left(\frac{\text{Calculated Mass} - \text{Actual Mass}}{\text{Actual Mass}} \right) \times 100$$

Show your work:



Percent Error: _____

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Stretchy

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