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AP Physics

8-21-14

Inquiry Lab 1

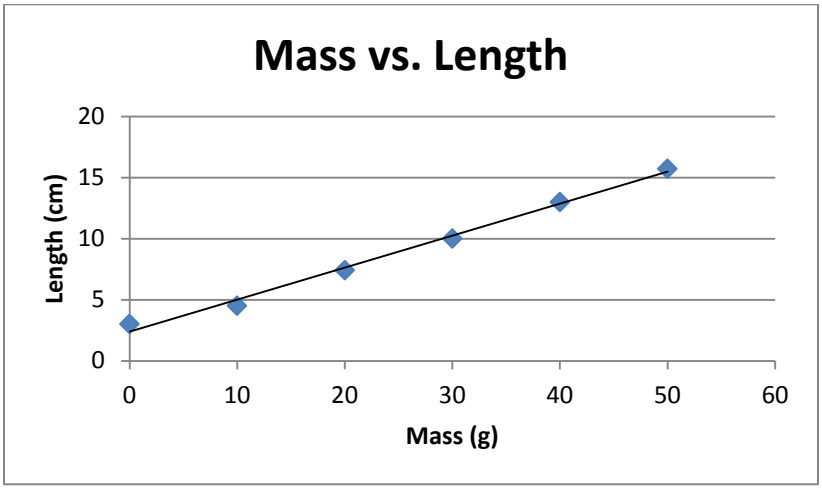
Purpose: Analyze the relationship between a hanging mass and the length of a spring.

Procedure: Hang the spring vertically from a stand. Measure the initial length of the spring. Add 10g of mass to the end of the spring and measure the new length of the spring. Repeat this process in mass increments of 10g until 50g of mass is attached.

Data:

Mass (g)	Length of spring (cm)
0	3.0
10	4.5
20	7.4
30	10
40	13
50	15.7

Analysis:



The graph shows a linear relationship between the hanging mass and the length of the spring.

$$length \propto mass$$

The line is best described as a linear-regression: $y = mx + b$. This indicates that the independent variable (mass), is directly proportional to the dependent variable (length) hence the linear slope.

The y-intercept (b) is the initial length of the spring sans mass. The slope of this line $\left(\frac{y_f - y_i}{x_f - x_i}\right)$, is represented as the constant (m). Dimensionally this constant has the unit of cm/g. As shown:

$$y = mx + b$$

$$length(cm) = [slope \times mass(g)] + intial\ length(cm)$$

$$length(cm) - intial\ length\ (cm) = slope \times mass(g)$$

$$\frac{length(cm)}{mass(g)} = slope$$

$$slope = \frac{cm}{g}$$

Using the values of the data the function is given as: $y = 0.2617x + 2.3905$

The slope does not seem represent a physical proportion I have used in physics yet.

Conclusion: It is shown that the relationship between a hanging mass and the length of a spring is that of a direct proportion. The plotted data showed that a linear-regression slope best fit the data displayed.

$$length \propto mass$$

It should be noted that length and mass are by no means equal to each other. The two quantities are simply proportional ($\propto$); in that if the amount of mass hanging is increased then the length of the spring will increase by a proportional amount.

Sources of Uncertainty: Going into this lab I was certain in the overall outcome. The more mass you add to the spring the more it will stretch. I knew this because as you increase the weight the spring will experience a greater pulling force due to Earth's gravity. I can't tell you exactly why there is a force of gravity or what causes it. I just know it has something to do with mass.

*Ozzy has not learned about force and gravity since middle school!