**Spring Force Lab**

*By Derek Willingham*

**Purpose**

* To analyze spring displacement and develop a

mathematical model describing the relationship

between spring force and the distance stretched.

* Calculate the force constant of the spring
* Apply the mathematical model to determine an

expression for the potential energy of the spring.

**Materials**

* Spring - an [elastic](http://en.wikipedia.org/wiki/Elasticity_(physics)) object used to store mechanical [energy](http://en.wikipedia.org/wiki/Energy). 
* Weighted Masses – increments of 20g, 10g, and 5g with a 50g base. 
* Meter Stick

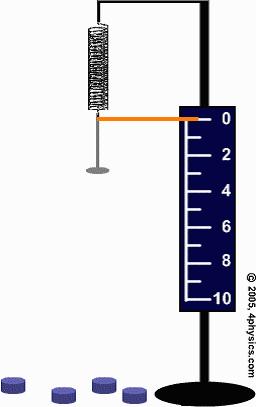


* Ring stand and mounting clamp



**Procedure**

1. Set up lab equipment as follows.

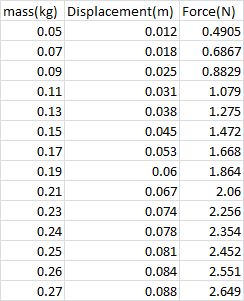


1. Record the starting point of the bottom of the spring.
2. Place a starting mass of 50g on the bottom of the spring and record the new displacement of the spring.
3. Increase mass by increments of 20g for the next 9 trials and record the new displacement each time.
4. Increase the mass by 10g for the next 4 trials and record displacement.
5. Using F=mg calculate the FG on the spring for all trials.

**Data**

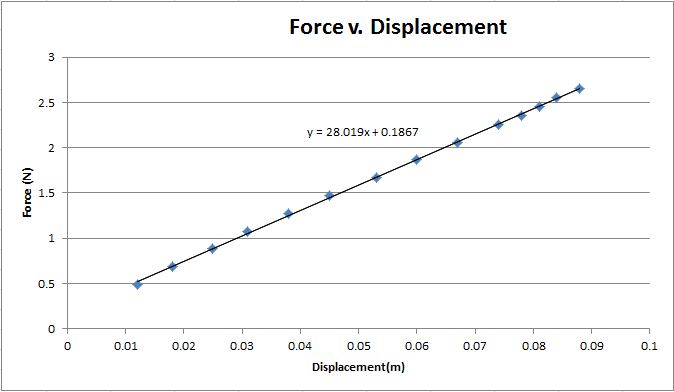
Table- to derive force the mass was multiplied by gravity (9.81m/s2)

.05kg x 9.81m/s2 = .4905N



**Data Analysis**

Graph-



This graph presents a linear relationship between force and displacement of the spring. The slope is the force constant of the spring.

Calculations:

From the graph :

Furthermore, :

Using this equation we can solve for :

Then Integrate. :

Solve for

**Conclusion**

The expression for the potential energy of the spring was . This was derived from the expression. The potential energy of the spring that was used in this experiment can be modeled by the equation. “k” was found by observing the rate of change between the force on the spring and the spring’s displacement and is 28.019 N/m. As the force increased the spring’s displacement also increased in a linear relationship. This spring was an ideal spring and followed a linear pattern. While there may have been sources of error they did not skew the data in a unreasonable way and did not affect the overall outcome of the experiment. When deriving the equation for potential energy of the spring the y-intercept of the equation of the line of best fit was dropped because it was one, small and not extremely significant to our equation, and two, because the integration of the equation with the y-intercept included would create an equation that was not equivalent to the U of the spring.