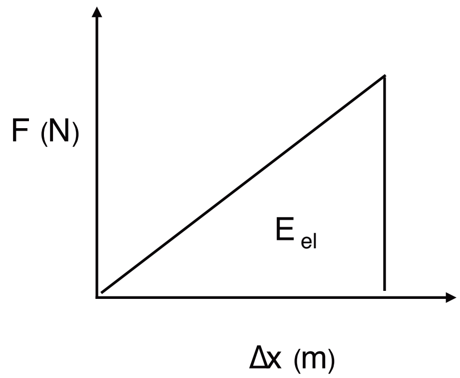
spring post lab notes

Graph of applied force (F) vs the change in length (x) of a "loose" spring:



Var	Given value	Units	Description
F		N	force applied to spring
k		$\frac{N}{m}$	spring constant (slope)
Δx		m	change in length of spring
E_{el}		j	elastic potential energy (area under curve)
F_o		N	initial force required before spring will begin to stretch (y–intercept)

The equation for this line is:

$$F = k\Delta x$$

The area under the curve is equal to the elastic potential energy (E_{el}) now stored in the spring.

$$\text{area of triangle} = \frac{1}{2} b\, h$$

spring post lab notes (continued)

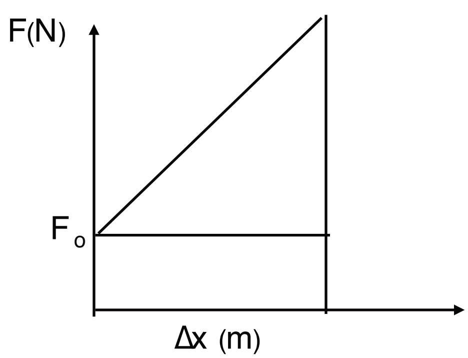
$$E_{el} = \frac{1}{2}\Delta x F$$

Substitute in for F using the equation of the line:

$$E_{el} = \frac{1}{2}(\Delta x)(k\Delta x)$$

$$E_{el} = \frac{1}{2}k\Delta x^2$$

For a stiffer spring, the graph of F vs Δx may have a y–intercept equal to the initial force (F_o) which must be applied to the spring before it even begins to stretch. In this case, you need to add the area of the rectangle to the equation for elastic potential energy.



$$\textit{area of rectangle} = b\,h = F_o\Delta x$$

$$E_{el} = \frac{1}{2}k\Delta x^2 + F_o\Delta x$$