Objective: The objective of this activity is to correctly predict the distance a spring will stretch when a known mass is attached to it and dropped.

1. What spring are you using? Spring # 14.
2. What mathematical model explains the relationship between the force applied to your spring and its stretch?

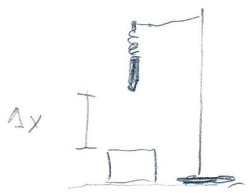
$$F = k\Delta x + F_0$$

3. What mathematical model explains the relationship between the stretch of this spring and its elastic potential energy? How is this related to the applied force versus stretch graph?

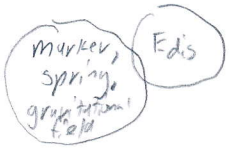
$U_{el} = \frac{k}{2}(\Delta x)^2 + F_0\Delta x$. The elastic potential energy is the area under the force versus stretch graph.

4. Draw an energy flow diagram using boxes to represent relative amounts of energy. After you have done this, write out an energy flow equation using generic mathematical expressions for the energy that is present.

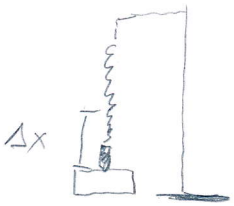
Before Diagram



System



After Diagram



$K_i + U_{gi} + U_{el} + W + E_{dis} = K_f + U_{gf} + U_{elf}$

$U_{gi} = U_{elf}$

$mgh = \frac{k}{2}(\Delta x)^2 + F_0\Delta x$

5. What variable/s represent spring stretch? Algebraically solve the *generic* energy flow equation for spring stretch.

Spring stretch $\Delta x = \Delta h$

$mg\Delta x = \frac{k}{2}(\Delta x)^2 + F_0\Delta x$

$\frac{2}{k}(mg - F_0) = \Delta x$

6. Write a simplified equation that predicts ~~how much~~ your *particular* spring will stretch when a known mass is attached to it and dropped.

$k = 3.226\ N/m$, $F_0 = 0.188N$ $\quad \Delta x = \frac{2}{3.226\frac{N}{m}}(mg - 0.188N) = \left(6.07\frac{m}{kg}\right)m - 0.116m$

7. Test the accuracy of your calculations and model by doing several trial runs on your own.

8. Once you are confident in your results, you are ready for the graded test.
   - 1st try – 5 points
   - 2nd try – 3 points
   - 3rd try – 1 point
   - 3 bonus points will be awarded to the first group to succeed