DRAFT Equivalent Resistance for Springs in Parallel and Series

Individual Springs:

Discovery Learning –

1. "Play" with the springs provided and report on your findings.
2. Report your findings for the springs.

Interactive Demonstration –

1. Teacher asks how strings will stretch if various forces (*F*) are suspended.
2. Teacher asks how we can measure the stretch (to be called Δx)
3. Generate the principle, "The greater the force, the greater the stretch.)

Guided Inquiry Lab 1 – **Single Springs:**

1. Students vary F for a single spring and find Δx
2. Students graph F vs. Δx finding $F \propto \Delta x$ and $F = k\Delta x$
3. Student identify k as spring constant.

Guided Inquiry Lab 2 – **Identical Parallel Springs:**

1. Measure the spring constants of two identical springs to ensure $k_1 = k_2$
2. Arrange the two springs vertically and in parallel.
3. Measure the original length of each spring (x_1 and x_2).
4. Suspend a suitable weight (F) at the bottom of the spring set.
5. Remeasure the lengths of the individual springs (should be the same).
6. Determine the change in length for each spring (should be the same), Δx.
7. Note the following:
   a. $F = F_1 + F_2$
   b. $F = k_1\Delta x + k_2\Delta x = (k_1 + k_2)\Delta x$
   c. $F = k_{eq}\Delta x$
   d. $\therefore\ k_{eq} = k_1 + k_2$
8. Experimentally verify that $k_{eq} = k_1 + k_2$

Bounded Inquiry Lab 3 – **Different Series Springs:**

1. Measure the spring constants of two different springs (k_1 and k_2).
2. Arrange the two springs vertically in series (recall, $k_1 \neq k_2$).
3. Measure the original length of each spring (x_1 and x_2).
4. Suspend a suitable weight (F) at the bottom of the spring set.
5. Remeasure the lengths of the individual springs (x_1' and x_2').
6. Determine the change in length for each spring ($\Delta x_n = x_n^1 - x_n$).
7. Using an analysis similar to that above (*Lab 2*), find relationship between ks starting with:
   a. $\Delta x_1 = F/k_1$
   b. $\Delta x_2 = F/k_2$
   c. $\Delta x_1 + \Delta x_2 = F/k_{eq}$…
8. Experimentally verify your result.