VII. Discussion Questions

Remember that $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

4. What would be the effect on *k* if you used two loops of the same length instead of one? Find the numeric ratio of the *k* value with two loops compared to the *k* value using one loop.

   See the explanation at:

   Wikipedia Hooke's Law, Multiple Springs,
   http://en.wikipedia.org/wiki/Hooke%27s_law#Multiple_springs

   k would change to *2k*: $k_{old} = k$, $k_{new} = 2k$

5. What would be the effect on *f* if you used two loops of the same length instead of one? Find the numeric ratio of the *f* value with two loops compared to the *f* value using one loop.

$$f_{old} = \frac{1}{2\pi}\sqrt{\frac{k_{old}}{m}}$$

$$f_{new} = \frac{1}{2\pi}\sqrt{\frac{k_{new}}{m}} = \frac{1}{2\pi}\sqrt{\frac{2k_{old}}{m}}$$

$$\frac{f_{new}}{f_{old}} = \frac{\frac{1}{2\pi}\sqrt{\frac{2k_{old}}{m}}}{\frac{1}{2\pi}\sqrt{\frac{k_{old}}{m}}}$$

$$\frac{f_{new}}{f_{old}} = \frac{\sqrt{\frac{2k_{old}}{m}}}{\sqrt{\frac{k_{old}}{m}}}$$

$$\frac{f_{new}}{f_{old}} = \sqrt{\frac{2k_{old}}{k_{old}}}$$

$$\frac{f_{new}}{f_{old}} = \sqrt{2} \approx 1.41$$

$$f_{new} \approx 1.41 f_{old}$$

6. What would be the effect on k if you folded the single loop to make two loops of half the original length? Find the numeric ratio of the k value with the folded loop compared to the k value using the single, unfolded loop.

   k would change to $4k$. Halving the spring or rubber band doubles the spring constant. Because there are two loops in parallel with a spring constant of $2k$ the spring constant for the two loops together is $4k$.

   Using the same reasoning as above,

   k would change to $4k$: $k_{old} = k$, $k_{new} = 4k$

7. What would be the effect on f if you folded the single loop to make two loops of half the original length? Find the numeric ratio of the f value with the folded loop compared to the k value using the single, unfolded loop.

$$f_{old} = \frac{1}{2\pi}\sqrt{\frac{k_{old}}{m}}$$

$$f_{new} = \frac{1}{2\pi}\sqrt{\frac{k_{new}}{m}} = \frac{1}{2\pi}\sqrt{\frac{4k_{old}}{m}}$$

$$\frac{f_{new}}{f_{old}} = \frac{\frac{1}{2\pi}\sqrt{\frac{4k_{old}}{m}}}{\frac{1}{2\pi}\sqrt{\frac{k_{old}}{m}}}$$

$$\frac{f_{new}}{f_{old}} = \frac{\sqrt{\frac{4k_{old}}{m}}}{\sqrt{\frac{k_{old}}{m}}}$$

$$\frac{f_{new}}{f_{old}} = \sqrt{\frac{4k_{old}}{k_{old}}}$$

$$\frac{f_{new}}{f_{old}} = 2$$

$$f_{new} = 2f_{old}$$