### Mr. Burtness Name \_\_\_\_\_\_\_\_\_\_\_\_

##### **LAB Energy in a Coil Spring**

**Goals:** 1. Experimentally determine **k**, the spring constant,

 2. Show that the energy stored in a spring ( ½kx2) = change in gravitational potential energy.

**Part I** Determine the spring constant, **k**, of your spring.

* Run the PhET simulation [Springs and Masses](https://phet.colorado.edu/en/simulation/masses-and-springs)

and select LAB, as highlighted (right)

* Turn **Damping** “ON” and use a ruler to measure the stretch of the spring for various known masses once the mass comes to equilibrium.
* Graph this data and determine the best-fit equation. **The slope of the line, F= -kx, is the spring constant. (Note: k** must be a positive value.)

Spring constant

**k=\_\_\_\_\_\_\_\_**

**Part II** Conservation of Energy

* Turn **Damping** “OFF”, **Displacement** “ON”,

**Mass Equilibrium”** “ON” and **Period Trace** “ON”.

* Pause the simulation and place a mass on the spring (somewhere just BELOW the zero stretch position)
* Use the ruler to record this position (initial stretch of the spring).
* Turn Pause “OFF” to release the mass.
* Pause the simulation after a full cycle is “traced” and record:
1. Highest position (=initial position) pos= \_\_\_\_\_\_\_\_\_
2. Change in height (=size of “trace”) h=\_\_\_\_\_\_\_\_\_\_
3. x1=initial position x1= \_\_\_\_\_\_\_\_\_\_
4. x2=initial pos. + change in height. x2= \_\_\_\_\_\_\_\_\_\_

Uinitial= 1/2 kx12 Ufinal = 1/2 kx22 Ugravity = mgh

**Part III** Energy Balance: Show that the work done in stretching a

spring = change in gravitational P.E.

* Draw a GOOD picture of test set-up, labeling each position.
* On your graph, show the top and bottom positions.
* Measure the area under the curve to determine the change in spring energy.
* For Calc students, ∫*Fdx=*Work. Carry out the integral and see if it works.
* Compare **Spring Energy** to **mgh**
* Present the energy balance clearly laid out, showing the names of each

type of energy, the terms used to represent each type of energy,

as well as the measured quantities used in each term.

**mgh = ½k (x2)2 - ½k (x1)2**

* Determine % error for this trial
* Repeat for a second trial.
* Comment on your findings.