

The spring. A massless spring is the focal point of this lab. By default there is no damping, but dampening can be turned on using the check box in the lower right corner of the screen.

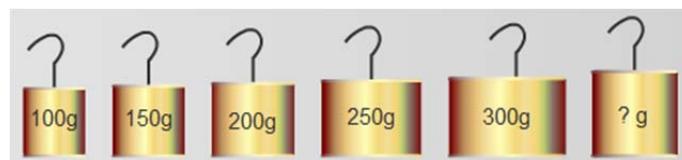


Damp Spring

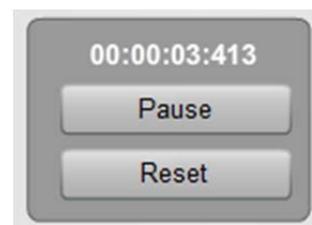
The masses. Masses from 100g to 300g plus one unknown (?g) mass are found toward the bottom of the screen. Click and drag one to the bottom of the spring and it will attach itself. If a mass is already on the hook, it will replace it.

Once on the spring, continue to drag the mass to extend or compress the spring, and then release the mouse to set the spring in motion.

The mass and spring system will automatically release once it reaches its maximum position. To remove a mass from the spring, just click and drag it away from the spring and drop it anywhere else on the screen.

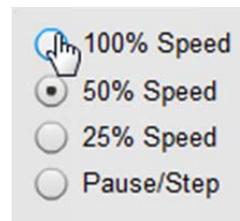


The stopwatch. Located just left of the masses, the stopwatch is an invaluable tool for this lab. By default, the “Auto-Stopwatch” setting is on, which starts the watch from zero every time the spring is set in motion. The stopwatch can be paused, restarted, and reset using the accompanying buttons. Checkboxes to the bottom right of the screen can turn the “Auto-Stopwatch” setting off, or hide the stopwatch altogether.

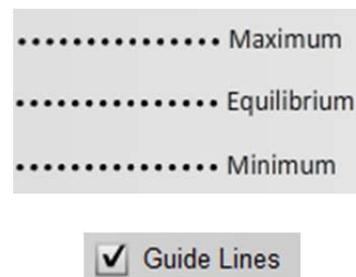


Stopwatch
 Auto-Stopwatch

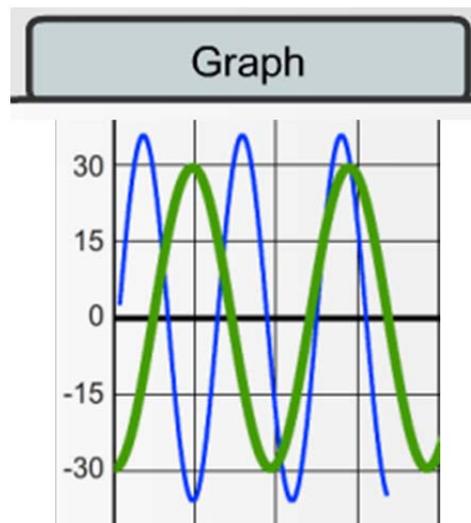
The speed controls. By default, the spring system moves in real time, or in other words, at 100% Speed. The virtual lab system allows for the speed to be slowed or even paused, without disrupting the motion. Directly below the stopwatch are 4 speed settings that allow the lab to be at 100% Speed, 50% Speed, 25% Speed, or Paused. The spring system, the stop watch, the position graph, the reference circle, and the energy graphs are all updated at the selected speed. When the "Pause/Step" option is selected, the system is paused, but continued mouse clicks on the "Pause/Step" option will advance the motion ahead one small bit of time.



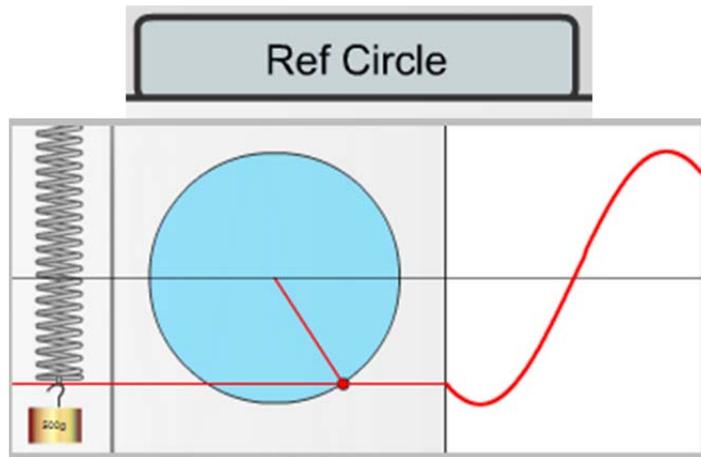
The Guide Lines. Guide lines are available to better read the Maximum, Minimum, and Equilibrium positions of the spring on the meter stick. With the "Guide Lines" option turned on in the lower right of the screen, these three guide lines will appear near the spring. These can be clicked and dragged as needed to help measure the distances that the spring travels.



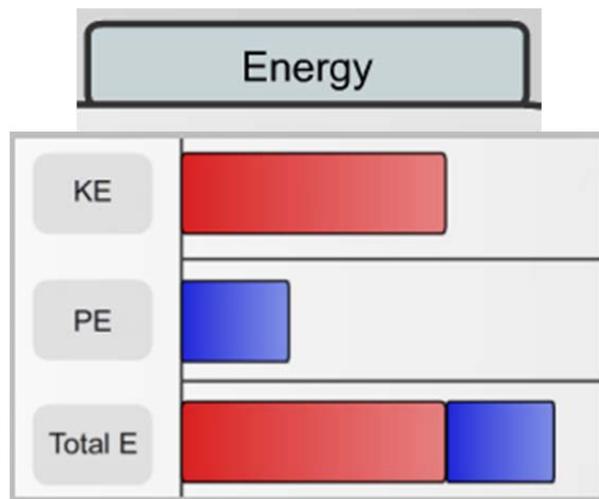
The (Position) Graph tab. By default, the Position Graph tab is the first tab the user sees. As the spring is set in motion with a mass, the graph updates the spring's position relative to its equilibrium point. There is a checkbox on the bottom of the graph called "Auto Clear," which when checked will clear any data and start a new graph whenever the spring is set into motion. If this is unchecked, new data of a different color will be plotted on the graph along with any previous data. To clear all data, click the "Clear All" button. The bottom right corner of the graph contains a button labeled "Copy Data to Clipboard." When this button is clicked, the highlighted data will be copied to the clipboard in a format that allows for pasting into Excel or other data spreadsheet programs. The data most recently plotted is already highlighted, but any other set of data can be highlighted by clicking on the set in the graph. Highlighted data sets show a bolder or thicker curve line than the rest.



The Reference Circle tab. To switch to the Reference Circle diagram, click the “Ref Circle” tab at the top of the screen. This view shows a miniature version of the spring and mass, next to a reference circle, and a different position graph. The circle is the size of the maximum amplitude of the spring, and changes accordingly even in the case of a dampening spring. A red reference point travels around the circumference of the circle, keeping pace with the bottom of the spring. This red reference point’s position is plotted on the graph to the right. This is a visual representation of the connection between simple harmonic motion, sinusoidal motion, and circular geometry.



The Energy tab. To switch to the Energy diagram, click the “Energy” tab at the top of the screen. This view shows the Kinetic Energy, the Potential Energy, and the Total Energy of the spring system in real-time. Slow the speed of the experiment down to really see where KE and PE are at their maximum and minimum magnitudes.



Snapshot. As with most of our labs, you can take a screenshot of any portion of the screen by clicking on the Snapshot icon and then clicking and dragging a box around what you want to capture. A dialog will then appear asking you what you want to call the image and where you want to save it. In most labs, a timestamp will be added to the image to keep track of it better.

