

Spring Energy Lab

Teacher's Guide

Topic:

Work, Energy and Power

The following information is provided to the student:

Question:

What is the total amount of mechanical energy for a mass on a spring at four different locations along its trajectory? How do the results compare to the expected results?

Purpose:

To compare the total amount of mechanical energy of a mass on a spring at four different positions along its trajectory and to compare the results to the expected results.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion and a Discussion of Results. The data section should provide a graphic labeling the four locations in the trajectory of the mass which were analyzed. It should include two tables of data - one for collected data and one for calculated data. The tables should have a row and column format; column headings should be clearly stated; units should be provided; work should be clearly shown for all calculated data. The Conclusion/Discussion should include a comparison of the total energy at four positions and a generalization about the principle which the data support. An error analysis should be conducted in which the expectations are discussed; the degree to which the data align with the expectations should be described. Averaging and percent differences can be used.

Materials Required:

Spring; hooked mass; computer interfaced motion detector; lab poles; clamps.

Description of Procedure:

A spring is secured to a clamp and elevated above the floor. A hooked mass is attached to the end of the spring so that it can freely oscillate up and down. A motion detector is placed upon the floor underneath the bob. With the bob allowed to rest freely in its equilibrium position, the motion detector is zeroed. With the motion detector ready to collect data, the bob is then pulled down below its equilibrium position and released. After a few periods of oscillation, the motion detector is stopped. The resulting plot on the computer is used to determine the speed of the bob, the stretch of the spring, and the height of the bob. Calculations of potential energy (elastic and gravitational) and kinetic energy are performed as part of the analysis.

Alternative Materials and Procedure:

A photogate system and meter sticks could be used in place of the motion detector in order to determine the speed of the bob, the stretch of the spring and the height of the bob.

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

The Laboratory

Suggestions, Precautions, Notes:

1. The detector is more able to detect the motion of the bob if a note card is taped to the bottom of it.
2. If the motion detector is zeroed for position when the bob is at equilibrium, then the resulting position read from the graph is the height and the absolute value of this position is the stretch distance.

Auxiliary Materials:

None

Scoring Rubric:

E9. Spring Energy Lab	Score
<p>___ Included, labeled and organized all parts of the lab report.</p> <p>___ Data section includes a graphic clearly labeling the four locations along the trajectory which were analyzed. Included two tables of data - one for measured data and one for calculated data; column headings and units are clearly provided. Calculations are clearly shown and accurately performed. Measurements are reasonably accurate.</p> <p>___ Conclusion/Discussion describes the energy at the four positions. Discussed expectations regarding the energy values and discussed the degree to which expectations matched the results. Averaged all TME values and calculated percent differences for each trial based on the average; work is clearly shown and labeled for one of the trials. Discussion reveals understanding.</p>	___/___

Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/energy/u5l2bb.cfm>

<http://www.physicsclassroom.com/Class/energy/u5l2bc.cfm>

Connections to Minds on Physics Internet Modules:

Sublevels 7 and 8 of the Work and Energy module are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>