

## Lab A13: *Kinetic and Potential Energy of a Pendulum*

12/2/02

**Goal:** To see if the total mechanical energy (kinetic + gravitational) of a swinging pendulum is conserved, by comparing the energy at each different location during its swing.

**Reading:** Walker, Sections 8.1-8.3

### Procedure:

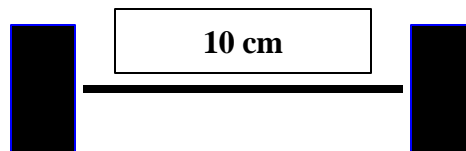
In this lab, you will use Videopoint and Graphical Analysis to analyze the motion of a swinging pendulum. You are expected to decide how you will use the software tools to meet the goal of this lab. Using all the points along the pendulum's path, you should determine the pendulum's kinetic, gravitational and total energies at all those points. Since you have already used Videopoint and Graphical Analysis in several labs, detailed instructions on how to use them will not be given here. Videopoint help can be accessed at <http://courses.ncssm.edu/bennett/vphelp2.htm>

The video clip of the pendulum can be downloaded via Internet Explorer at <http://courses.ncssm.edu/clips/physics/pendulum>. If that doesn't work, try: <http://projects.ncssm.edu/clips/physics>.

Use one of the following clips:

pend1c.avi  
pend2c.avi  
pend3c.avi  
pend4c.avi

Note: The mass of the ball is 25 grams. Remember to make endpoints so that



Right click on the video file and use the Save Target As option to save the file to your M: drive (you could also save the file to the computer's Desktop, but in that case be sure to delete the video file once you have finished analyzing it, in order to conserve disk space).

Then open Videopoint and select the Open Movie option to analyze your movie clip.

### Analysis:

In addition to the usual components (goals, conclusions, etc.) of your lab report, you should include a detailed description of whatever procedure you used to determine the kinetic and gravitational energies. Be sure to include diagrams that clearly show which points correspond to high potential energy and which correspond to high kinetic energy. You should also explain WHY the total energy of the pendulum should be conserved in this experiment.

Please include, and show your instructor or TA, a printed graph of Kinetic, Potential and Total Mechanical energy as a function of time. You should plot all three types of energy on the same axes. Use this graph to justify your conclusions and estimate the error. (e.g. "The total energy of the pendulum is conserved to within \_\_%.") Make sure that your instructor checks this graph, either on the screen or on paper, before you finish the lab.

Note: Videopoint will give you the “X” and “Y” position of the pendulum bob as a function of time. Make sure that the origin is located in an intelligent place; verify this with your instructor or TA. In order to find the energies, you will need to make new calculated columns of data in graphical analysis. You will also need to use the “derivative” function to find the slope of the X vs. time and Y vs. Time graphs. For help in the error analysis, you can use the “statistics” option under Analysis. Be sure graders are called as you progress through the lab.

Naturally write a good concise conclusion.