# Experimental Determination of the Period of a Pendulum

Names_____

A pendulum is simply described as a weight on the end of a string that swings back and forth. Before electronic clocks, pendulums were used widely as time keeping devices. They move due to gravity, accelerate until the weight reaches the bottom of the arc, and then are slowed down (also due to gravity) as they swing the opposite direction.

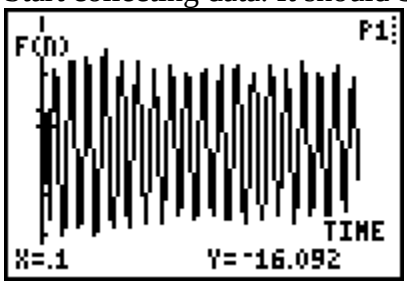
The period of a pendulum is the amount of time it takes for the weight to swing back and forth once. What do you think affects the period of the pendulum? There are only three factors that could involve the period of a pendulum: the mass of the weight at the end of the string, the length of the string and the amount of swing imposed on the pendulum.

Setup your LabPro apparatus. For Part A of this experiment, use a Low-g accelerometer probe. This probe measures differences in velocity. In Part B we will use a stop watch to manually measure the period of a pendulum. You can do either part A or Part B first (based on probe availability).

**Part A:** Plug in the Low-g accelerometer probe into channel 1 of the LabPro. You may have to manually set this probe up in the LoggerPro software. In the Data Collection Menu (of LoggerPro), enter the number of samples to 100samples per second. Set the experiment length to 15 seconds.

Measure the length of the accelerometer from the pivot point to the middle of the mass of the sensor. It should be .50 meters. Carefully cause the probe to swing back and forth. It is very important that the pivot point remain stationary!!!

Start collecting data. It should be a wavy line that looks something like this:




The period of the pendulum is equal to time interval between TWO peaks. You can use this graph to find the time value for every other peak. Find the periods of five (it will require 10 peaks to do this) and record that data in your data table.

## DATA TABLE Part A

| Length(m) | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_{Avg}$ | $T_{calculated}$ | $P_{error}$ |
|---|---|---|---|---|---|---|---|---|
| .50m | | | | | | | | |
| 1.0m | | | | | | | | |
| 1.5m | | | | | | | | |
| 2.0m | | | | | | | | |

Calculate the average period by adding the five periods and dividing by five.

Next, calculate using the formula below what the period of the pendulum should be at the length specified. Record this data in your table under **Calculated value**. Calculate your percentage error (**$P_{error}$**) by using the formula below:

**Period of a Pendulum (calculated):**

$$T = 2\pi\sqrt{\frac{L}{g}}$$

**Percentage Error Formula:**

$$P_{error} = \frac{(T_{calcualted} - T_{measured})}{T_{calculated}} x100$$

Print out each graph (make sure your names are on it!).

If you haven't done Part B, do so now.

# Part B

Outside Experimentation

As you have probably figured out by now, the longer your pendulum is, the more precise it is.

Take your bolt pendulum outside and find a place where you can dangle your pendulum to a distance of 4.0 meters. If you are over a walkway, make sure someone is down below so your pendulum swinging doesn't kill somebody.

Using a stop watch, count 10 periods of your pendulum, and divide by 10 to get the average period. Enter that period in the box below:

Now, using the formula from the previous section, calculate what the actual period should be (for 4 meters) and write it in the box:

Turn the data sheet, your four printouts, and this sheet for credit. Staple it all together!