Laboratory #3

# The pendulum

Arrange yourselves in groups of about four students. Think and talk about what you are doing before you actually do it.

Examine the relationship between the period of a pendulum and its length and mass. We have not done this in class, but Galileo worked out a relationship between $g$ and the length and period of a pendulum which we can check and get a second measurement of the value of $g$.

To measure the period use one of the stop watches to time ten full swings (back and forth is one swing); then take the time and divide by ten to find the period. It is best to start and stop the watch when the pendulum bob goes through its lowest point—this is easier to time than when the pendulum is at one of its extremes. It is best to keep the amplitude of the swing small; when it gets too big then Galileo's relationship between $l$ and $T$ is no longer accurate.

First focus on the relationship between the length, $l$, and the period, $T$, of the pendulum. Measure the period a few times for each length putting the data in a table; then add an extra column to the table for $T^2$. Measure the period for about four different values of $l$, and also note that if $l$ were 0.0m then $T$ would be 0.0s, so you can include that as part of your data too.

Galileo thought that $l = (g/4\pi^2)T^2$ So if you make a graph of $l$ (on the vertical axis) versus $T^2$(on the horizontal axis) then the slope of your graph should be $g/4\pi^2$ where, you will recall, $g$ is the acceleration due to gravity measured last week. Make your graph plenty *big*. Find the slope of your graph and then estimate $g$ using

$$g = 4\pi^2 \times \text{slope}.$$

How well did you do? How does your value for $g$ this week compare to what you obtained last week?