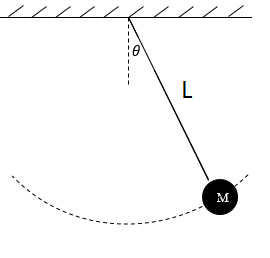
# What Affects the Period of a Pendulum?

## Prelab 1: Making Accurate Measurements

This prelab is the first part of the formal lab for PHYS 250. The end product will be a formal lab report describing your work. You will be graded on the quality of your experimental design, data analysis, and the writing in the report. Expectations for the report itself will be outlined separately.

In this lab you will examine the motion of a simple pendulum. A simple pendulum is defined as a point particle that swings back and forth under the influence of gravity while tied to a string of negligible mass. In practical terms, no macroscopic mass is a point particle, so in effect we are referring to swinging object where the size is much less than the length of the string. (A swinging object that has non-negligible size in relation to the string length is referred to as a “physical pendulum”).

A few terms and variables are used to describe the motion of a simple pendulum. The swinging object (mass m) is referred to as the “pendulum bob”. The maximum angle in a pendulum’s swing, , is referred to as the amplitude. The length of the string is usually described with the variable L. The period, T, is the amount of time it takes for the pendulum to complete a full swing (over and back).

The goal of this lab is to determine what how the length and amplitude affect the period a simple pendulum, and to characterize those effects mathematically. If you already know something about pendulums, please try to forget it: the goal here is to let the experiments tell us what is going on. You may be surprised by the results!

### Experimental Design

Your task in this prelab is to use objects around the house to set up a pendulum and develop measurement techniques you can use to measure the length, amplitude, and period of oscillation of a pendulum.

1. Set up a pendulum in your house that is as close to as possible to a simple pendulum: that is, the mass should be as close to as possible to a point mass, and friction and drag should be as negligible as possible. Note, as you choose the object to use as a pendulum bob, that there will be some tradeoff between minimizing these two factors! Also note that you will need to be able to adjust the length and amplitude of the pendulum’s swing when you do the experiment, so your design should allow for this. You will also want to consider the need to make the measurements described below as you do your setup. Be creative! Lots of objects can be used as the pendulum bob, string, and attachment points.
2. Take photos documenting your pendulum setup. Include
   1. An overview photo of the setup
   2. A close-up of the way you will attach the string to the bob
   3. A close-up of the way you will attach the string to whatever you are using to hold the string in place at the top.

1. Once you have a good setup, consider how you will measure the following variables:
   1. Amplitude (maximum swing angle, as measured from the vertical)
   2. String length
   3. Period

Your job is to develop techniques to measure all three variables as accurately as possible. Consider carefully any potential sources of error! **In order to do this well, you must actually conduct some sample measurements: you cannot just “imagine” how the measurements will work.** One last rule: you CANNOT use videos to measure time: instead you must use a stopwatch. (Smart phones have stopwatches, or you can find a stopwatch on the internet).

1. Describe, in detail, exactly how you will measure the amplitude of the swinging of your pendulum. Use photos to document the process. There should be enough detail that a classmate could read your description and repeat your measurement exactly as you did it.
2. Describe, in detail, exactly how you will measure the length of your pendulum. Use photos to document the process. Note that you should clearly describe exactly where the length measurement will start and stop. There should be enough detail that a classmate could read your description and repeat your measurement exactly as you did it.
3. Describe, in detail, exactly how you will measure the period of the swinging of your pendulum. (Photos are not needed here). You CANNOT use a video recording, and must use a stopwatch. Note that you should clearly describe exactly where when the stopwatch will be started and stopped. There should be enough detail that a classmate could read your description and repeat your measurement exactly as you did it.