Pendulum lab

Phys 256 at Olympic College

# Background

The period of a pendulum is the time it takes the pendulum bob to make one complete cycle of motion. For example, if you hold a pendulum up and release it from rest, the period would be the elapsed time from when it leaves your hand to when it returns to your hand.

A *simple* pendulum is one where we can consider the pendulum bob to be a point particle suspended from massless string which does not stretch. The parameters that may affect the period of a pendulum are amplitude, length, and mass. For small amplitude oscillations, the period of a simple pendulum is given by the expression:

where *l* is the length of the pendulum bob, and *g* is the local strength of Earth’s gravitational field.

# Tools

For this lab, you’ll use materials you should be able to find around your home by constructing a simple pendulum out of some relatively compact object and string. For measurements, you can use a ruler/tape measure and a stopwatch.

Here are some suggestions for what to use as pendulum bobs:

* Washers or Nuts
* Coins (attaching them to a string my be tricky, but I’m sure you can figure something out)
* Tabs from aluminum cans (you’ll need to consider how the mass of the pendulum bob compares to the mass of the string)
* Sliverware (you’ll need to consider how the length of the pendulum bob compares to the length of the string)
* Wrenches (again, consider the length of the object)
* Roll of tape
* Younger sibling or family pet (don’t do this)
* Anything else relatively compact that can be attached to a string

# Task

You have three objectives:

1. Determine if the period of a simple pendulum depends on the length of the pendulum, to within your experimental uncertainties.
2. Determine if the period of a simple pendulum depends on the mass of the pendulum bob, to within your experimental uncertainties.
3. Determine if the period of a simple pendulum depends on the amplitude of the pendulum, to within your experimental uncertainties.

# Notes & tips

* Pay close attention to assumptions you are making when you set up your experiments. Document them for your reference when writing your report.
* Graphical analysis can be a robust tool; you should not be relying on a handful of calculations.
  + This is where error bars are useful in making comparisons between data points.
* You’ll probably need to use some amount of judgement when deciding on an experimental uncertainty for the period of your pendulum. Things to consider are your reaction time with the stopwatch, and how the amplitude may decay over the course of many cycles.
* There are three variables you’re controlling: mass, length, and amplitude. When investigating one, be careful that the other two aren’t also changing.