Factors Affecting the Period of a Simple Pendulum

Objective

A simple pendulum consists of a bob suspended from a string whose weight is insignificant compared to the bob. When swinging in a plane, the motion of the pendulum is nearly periodic. The purpose of this lab is to investigate the variables that affect the period of a pendulum.

There are three possible variables that might impact period. But only one of them does. Is it the angle, the length, or the mass?

Experimental Notes

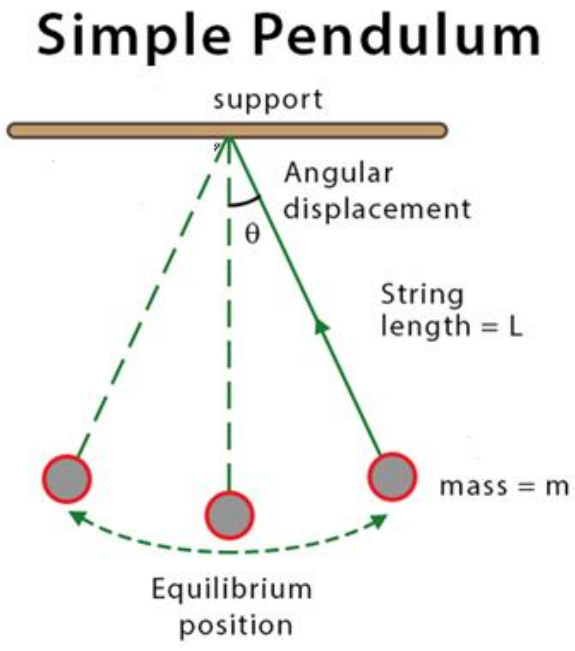
1. The period T of the pendulum might depend upon three of the most readily apparent physical parameters:
   - the mass attached to the string, M
   - the amplitude (how large the swing is), θ_0
   - the length of the pendulum string, L

2. While you are free to explore further, suggested ranges are:
   - *mass*: 50 g – 500 g
   - θ_0: 10° – 80° (keep θ_0 below 90°)
   - *Length*: 10 cm to 100 cm (L is the distance from the pivot point to the centre of mass)

3. Human reaction time is one of the main sources of uncertainty in this experiment. Consider ways in which this uncertainty can be minimized.

4. Consider how you collect your data and how experimental uncertainty might be reduced.

5. Include a labelled apparatus diagram in your lab report.



Mass, M (g)

1. Record the length of the pendulum to the center of the mass. L = _____
2. Use the **protractor** to record the angle. At what angle is it being dropped? θ_0 = _____
3. Change the Mass, M attached to the string, record the time it takes the pendulum to swing back and forth, ten times, then calculate the Period, T (s)
4. Record **5 trials** using different masses.

	Mass, M (g)	Time to Swing Back and Forth, Ten Times	Period, T (s) $\frac{seconds}{cycle}$
Trial #			

5. **Create a line graph for the Period vs. Mass.**

Angle, θ_0 (degrees)

1. Record the length of the pendulum to the center of the mass. L = _____
2. Record the mass attached to the string. M = _____
3. Record the angle and record the time it takes the pendulum to swing back and forth, ten times, then calculate the Period, T.
4. Record **5 trials** using different angles.

	Angle it is being dropped. θ_0	Time to Swing Back and Forth, Ten Times	Period, T (s) $\frac{seconds}{cycle}$
Trial #1			

5. **Create a line graph for the Period vs. Angle, θ_0 (degrees).**

Length, L

1. Record the mass attached to the string. M = _____
2. Use the **angle meter** app to record the angle. At what angle is it being dropped? θ_0 = _____
3. Change the Length, L (m) of the string, record the time it takes the pendulum to swing back and forth, ten times, then calculate the Period, T (s)
4. Record **5 trials** using different lengths.

	Length, L (m)	Time to Swing Back and Forth, Ten Times	Period, T (s) $\frac{seconds}{cycle}$
Trial #1			

5. **Create a line graph for the Period vs. Length.**

Analysis

1. Which factor affects the period of the pendulum?
2. For the period vs length graph. What is the slope of your best fit line?
3. For the period vs length graph. What is the y-intercept of your best fit line?
4. For the period vs length graph. What is the equation of your best fit line $y = mx + b$?
5. What is the equation for the period of a simple pendulum? You can look this up.