Physics 12
M. Lam   <u>Factors Affecting the Period of a Simple Pendulum</u> Block:

Introduction

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.

Experimental Method

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

While you are free to explore further, suggested ranges are:
- L: 10 cm – 100 cm (L is the distance from the pivot point to the bob's centre of mass)
- M: 50 g – 500 g
- θ_0: 10° – 30° (keep θ_0 below 30°)

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

Describe how you collected your data and comment on how experimental uncertainty was reduced. Include a labelled apparatus diagram.

Data
Complete the following data tables. It may not be necessary to fill in all rows.

Table 1: Period as length varies

$M =$ _____ $\theta_0 =$ _____

Length, L (m)	Period, T (s)

Table 2: Period as mass varies

$L =$ _____ $\theta_0 =$ _____

Mass, M (g)	Period, T (s)

Table 3: Period as amplitude varies

$L =$ _____ $M =$ _____

Amplitude, θ_0 (m)	Period, T (s)

Analysis and Discussion

1. Which factor affects the period of the pendulum?

2. For the factor identified above, plot the period vs. that factor. Start each axis at zero. Include a best fit curve. The curve should resemble one of the common relationships discussed in class.
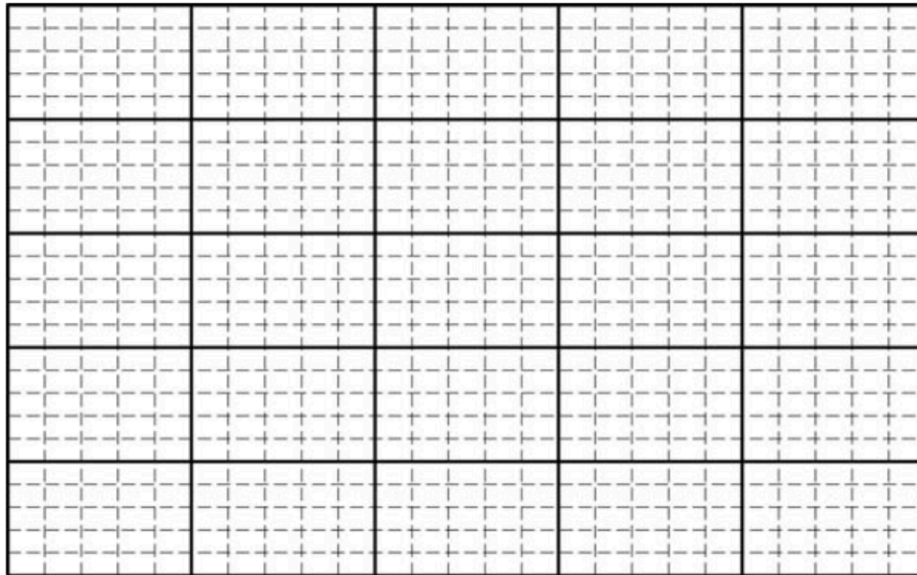
3. Construct a linear plot of the data. Show the plotted values in the table.
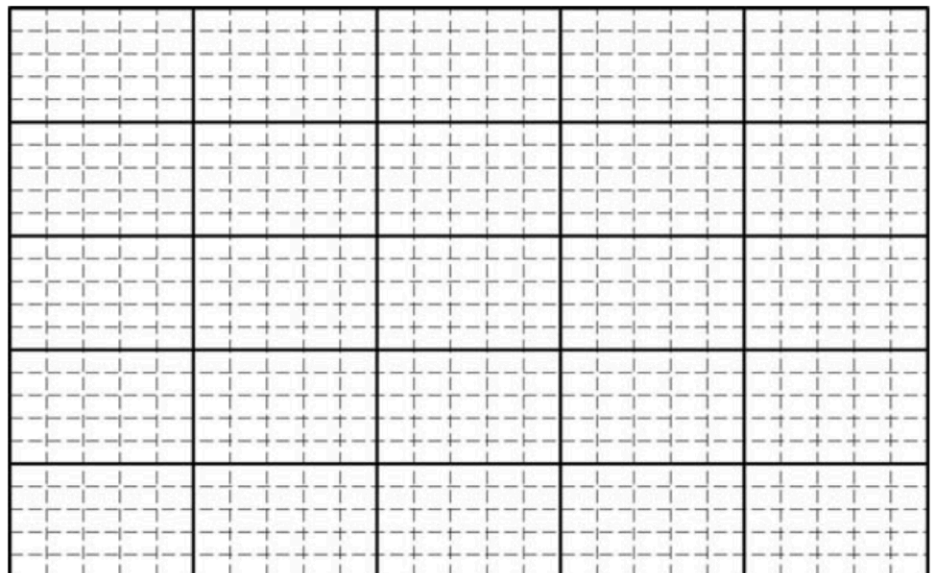
4. Complete the sentence describing the relationship shown in your linearized plot.

_____ is _____ proportional to _____.
directly/inversely

5. What is the equation of your best fit line? Write the equation using correct variables. What is the slope? Clearly mark the points on the line used to calculate the slope (e.g. with an ×). Be sure to include units.

6. What is the equation for the period of a simple pendulum? You can look this up. Use the slope of your graph to determine the experimental value of g. Compare this to the theoretical value by determining percent error.