

Names: _____

Period and Length of a Pendulum

SPH4U

Purpose: To determine the value of g , given that the period T of a pendulum of length l is

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Materials: string or fishing line, 200 g mass, retort stand, c-clamp (if necessary), protractor, stopwatch, metre stick

Procedure:

1. Tie one end of the string or fishing line to the mass and the other end to the retort stand, creating a simple pendulum. The mass should be approximately 100 cm below the pivot point.
2. Measure the length of the pendulum from the pivot point to the centre of the mass. Record this length and your estimate of the error in the length in Table 1 below.
3. Pull the mass aside by 10° and release it. Using a stopwatch, determine the time required (in seconds) for the pendulum to complete 10 cycles. Divide this time by 10 to determine the period of the pendulum and record the period in Table 1 below.
4. Repeat Step 3 four times, calculating the mean of your measurements, and determine the error in your measurements by calculating the standard deviation in your measurements.
5. Decrease the length of the pendulum in steps of approximately 20 cm, to a final length of approximately 20 cm, repeating Steps 2 – 4 for each length.

Table 1: _____

Length (m)	Error in the length (m)	Period (s)						Standard deviation in the period (s)
		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Mean	

Show your completed table to your teacher and ask your teacher to initial here: _____

Analysis:

1. Graph your data. Note that length should be on the horizontal axis and period on the vertical. Your error should be represented by error bars. Sketch your curve of best fit through the points.

Show your completed graph to your teacher and ask your teacher to initial here: _____

What kind of relationship does the graph suggest for period and length?

2. Re-plot the data in a form that results in a straight-line graph. This will require calculations of both the new values and their errors, the results of which should be shown in Table 2 below.

Table 2: _____

	Error		Error

Show your completed table and graph to your teacher and ask your teacher to initial here: _____

3. Draw your maximum and minimum lines of best fit and calculate their slopes. Mark the points used to determine the slopes on your graph and show your calculations in the space below:

Maximum slope:

Minimum slope:

Central value and deviation: _____

Show your slope calculation to your teacher and ask your teacher to initial here: _____

4. Given your slope and the equation $T = 2\pi\sqrt{\frac{l}{g}}$, determine g , including an estimate of the error in your measurement:

Show your g calculation to your teacher and ask your teacher to initial here: _____