Using a Pendulum to Measure $g$

Your task today is to use a pendulum to measure the magnitude of the local acceleration due to gravity.

A pendulum is an object that swings back and forth under the influence of gravity. The period $T$ of a pendulum is the time it takes to complete one back-and-forth cycle. If friction is negligible and the object is suspended by a massless string, then the period of a pendulum depends only on the amplitude of swing, the length of the pendulum, and the local acceleration due to gravity, $g$. If the amplitude of the swing is small (if the maximum $\theta$ is about 10° or less) then the period depends mostly on $L$ and $g$, and you can show that

$$T = 2\pi \sqrt{\frac{L}{g}}.$$ \hspace{1cm} [1]

Take up to 25 minutes to measure the period $T$ in seconds of pendulums of varying lengths $L$. Try to use lengths as short as 0.1 m and as long as 2 m or longer. Discuss within your group other techniques you could use to ensure your results are as accurate as possible. On a separate sheet of paper record a data table of your measurements.

If you square both sides of equation [1], the result is

$$T^2 = \frac{4\pi^2}{g} \cdot L.$$ \hspace{1cm} [2]

According to equation [2], a graph of $T^2$ versus $L$ should be a straight line with a slope of $4\pi^2/g$ and an intercept of zero. Use the graph paper provided to plot $T^2$ versus $L$. Draw a line of “best fit” for these points. Calculate the slope and intercept of your line and record the results here:

slope: ____________________________
intercept: ____________________________

Then calculate your experimentally-determined value for $g$, and record the result here: __________.

The percent error of your measured result is the difference between the measured value and the actual value. The actual value of $g$ near the S&T Physics building is posted on the bulletin board across from rooms 214 and 215.

$$\% \text{ error} = \left| \frac{\text{actual } g - \text{ your value for } g}{\text{actual } g} \right| \times 100\%$$

Record your percent error in this box: \hspace{1cm} % error = ________.

Hand this sheet, with your printed names on it and your data table and calculations stapled to it.

Your names. (Print your names legibly. That means so we can read them!)

___________________________________
___________________________________
___________________________________

Did you remember to print your names legibly (please check one)? \hspace{1cm} ☐ yes ☐ no.