Acceleration Due to Gravity

Purpose - to measure and verify the acceleration due to gravity.

Background - a pendulum swings with a Period (time for a complete swing left to right and back to left) proportional to its length L, in meters, and $\vec{g}$ as shown $T = 2\pi\sqrt{\frac{L}{\vec{g}}}$

T is period in sec, L is length in meters, $\vec{g}$ is acceleration due to gravity. Solved for $\vec{g}$ this appears as: $\vec{g} = 4\pi^2 \frac{L}{T^2}$

Percent error - is the difference between what you measured and what was expected as a fraction of what is expected. It is found using the equation: $\%\ error = \frac{meaured-expected}{expected} \times 100\%$

Procedure -

1.) Obtain a 0 – 5 N and 0 – 20 N spring scale.

2.) Hang masses of 50, 100, 200, 500, and 800 grams from the scales and complete the table below.

Mass (kg)	Force (N)

3.) Graph the data from table 1 as a plot of force vs. mass.

4.) Calculate the slope of the graph and include a unit calculation.

5.) Obtain a small object and stop watch.

6.) With your partner's help drop the object from the heights listed below and complete table 2.

Height (m)	Time (s)	Time^2 (s^2)
0.50		
1.0		
1.5		
2.0		
2.5		

7.) Plot a height vs. time^2 graph.

8.) Calculate the slope of the graph and include a unit calculation. Expect values near $+5.0\,\frac{m}{s^2}$.

9.) Set up a pendulum similar to the one at the front of the class, carefully measure the length to the top of the weight.

10.) Time the period of the pendulum and record it.

11.) Repeat procedure 10 from a different height.

12.) Repeat procedure 10 from a different height.

13.) Find the average period, record it and use it to find g as shown in the equation above.

Discussion -

1.) Compare the slope of the line calculated in procedure 4 and the accepted value for the acceleration due to gravity as given in your notes by calculating percent error.

2.) Relate the calculation in procedure 8 to one of the kinematic equations.

3.) Most people will get a value for slope equal to about $\frac{1}{2}$ g in procedure 8. Why is this perfectly acceptable for this part of the lab (**hint**: look carefully at the equation you used)?

4.) Compare the value calculated for g in procedure 13 and the accepted value by calculating the % error.

5.) Cite possible error sources in each part of the lab.

Conclusion - Provide a meaningful conclusion to this lab, include a statement explaining any difference between the calculated value of g and its accepted value.