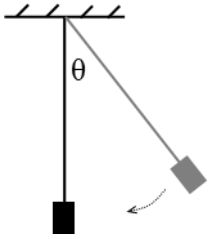
Enter group members' names: [ ]
Enter the name of the member who will submit the group report in the Google Classroom: [ ]

Physics Lab: Pendulum

In this lab, you will release a simple pendulum from various angles and measure the speeds of the pendulum bob at the lowest point of the swing. You will analyze the relationship between the release angles and the speeds and use this relationship to find an experimental value for g, the acceleration due to gravity. (You may wish to get a cell phone angle inclination app for angle measurement. There are also protractors for you to use.)



- Derive an expression for the speed of the pendulum bob at the lowest point of the swing in terms of the release angle θ to the vertical, the length L of the pendulum, and physical constants, as appropriate. Assume air resistance is negligible. Show your work here:

Lab procedures:

1. Set up a pendulum so it will hang vertically and can swing freely in a vertical plane.

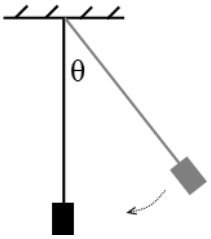
2. Position the photogate timer (set it to "gate" and set memory to "ON") so that its beam will be interrupted by an appropriate part of the pendulum bob when the pendulum is in the vertical position. Please also be careful so the swinging pendulum bob does not hit the timer.
   Which part of the pendulum bob should be aligned with the photogate timer beam? [ ]

3. Pull the pendulum aside so the pendulum makes an angle θ = 60° with the vertical. Have one person hold the support steady. Reset the timer. Release the pendulum and allow it to swing down smoothly through the timer beam. You may wish to catch the pendulum bob carefully after it moves out of the beam. Record the time and repeat the process for two more trials.

4. Repeat procedure 3 for each of these different starting angles: 50°, 40°, 30°, and 20°.

Data:

Diameter of the cylindrical pendulum bob: [m]
The length L of the pendulum: [m] On the diagram provided below, clearly label from where to where the measurement is made.



θ	x-axis of graph: [ ]	trial #1: t (s)	trial #2: t (s)	trial #3: t (s)	average t (s)	v at lowest pt (unit:)	y-axis of graph: [ ]
60º							
50º							
40º							

30º							
20º							

Plot a linear graph to relate θ and v that can be used to determine an experimental value for g. Use a computer software or graph paper to plot the graph. Your graph should include all data points and the line of best-fit. Include the graph here:

Find the linear regression equation (equation of the line of best-fit) for your graph. Write the equation here: [ ].

- What is the slope of your linear regression line? [ ] Using the slope of the linear regression, find an experimental value for g. Show your work here:

  Compare the g_{exp} you find using the slope to the commonly accepted value of $g_{accepted}$ at your location ($g_{accepted}$ = [ ]). The % error between the two is [ ]. Show your work here:

- What is the y-intercept (or x-intercept, depending on the graph you plot) of your linear regression line? [ ] Using this intercept of the linear regression, find an experimental value for g. Show your work here:

  Compare the g_{exp} you find using the intercept to the commonly accepted value of $g_{accepted}$ at your location ($g_{accepted}$ = [ ]). The % error between the two is [ ]. Show your work here:

Do error analysis and discuss sources of error here: