

SIMPLE PENDULUM

OBJECTIVE

To understand the relationship between the period and the length of a simple pendulum.

EQUIPMENT

Balance, 1-meter string, 2-pendulum bobs, lab post, pendulum apparatus, timer w/ gate.

PROCEDURE

1. Measure and record the mass of each pendulum bob. Insert the lab post into the table and clamp the pendulum apparatus to this post. Attach the pendulum apparatus to the lab post and suspend the pendulum bob. There is a clamp with a thumbscrew you can use to suspend the bob. This will allow the pendulum to oscillate about a single point. Align the pendulum bob at each of your lengths of thread so that the bob passes through the photogate to permit a period measurement.
2. Set the apparatus so that the length of the pendulum is between 5 and 80 cm. Accurately measure and record the length you use. For these measurements, you should keep the amplitude of oscillation small, less than about 10° (estimated by eye). Select measurement for Time, set the mode to pendulum. Start the bob swinging, in an arc of about 10 degrees. At the extreme of the swing press start. The meter will display the time for one complete cycle. Note, one cycle is defined as the motion that returns the bob to its original position and velocity.
3. Measure and record the time required for the bob to complete a cycle (the period) at least 10 times. It is best if you start the bob swinging, make sure it is smooth, and then start recording. Starting the swing can introduce other oscillations, which may affect your readings. Thus, it is best to measure your data with only one release.
4. Measure the period of the pendulum using a variety of different pendulum lengths ranging from 5 cm to 80 cm. Choose as least 7 different lengths in this range. Your choices should span the entire range.
5. Repeat the entire experiment for the second pendulum bob.

GRAPHS AND DIAGRAMS

1. Plot the pendulum length versus the square of the period
2. Make a free body diagram showing all the forces acting on the pendulum bob when the pendulum is at the maximum in swing.

QUESTIONS

1. What is the expected relationship between the length of a simple pendulum and its period? Does your data follow the expected trend?
2. From graph 1, determine g , the acceleration of gravity. Is this a good way to determine g ? What limits your precision? Does your value of g agree with the expected value?
3. Did the mass of the bob have an effect?
4. Instead of using the timer to measure the period of many individual oscillations, how would you find the period with good accuracy using a stopwatch?