# Physics 20 Lab: Pendulums

**Part A** – What is the value of ***g*** as determined from the swing of a pendulum?

**Part B** – What are the effects of differing masses on the period of a pendulum?

## Background Information

The pendulum has been used to measure time since Galileo first observed its properties late in the 16th century. A simple pendulum consists of a mass, called the bob, suspended by a thin string from a fixed support.

## Prediction

**Part A** – Manipulate the period equation for pendulum and solve for ***g***

**Part B** – Predict the effects of different masses on the period of a pendulum

## Experimental Design

In the experiments involving the pendulum, students are to set up a pendulum apparatus of various lengths, and time the periods of the pendulum at these lengths. A graphical relationship is then established, and the value for gravitational acceleration is determined. Students will then use different masses on the pendulum to determine the effects of these masses on the period of the pendulum.

## Materials

Different masses

Timer

String

Pendulum clamp

Pendulum stand

## Procedure

**Part A**

1. Set up a pendulum apparatus. Note the initial length of the pendulum.
2. From a small and consistent angle from equilibrium, release the pendulum and record the time it takes for the pendulum to repeat 10 oscillations. Record this time in your table of evidence, and determine the period of the pendulum.
3. Repeat step 2 with six more successive lengths, and record all data in your table of evidence.

**Part B**

1. Set up a pendulum apparatus at any arbitrary length. Hang an initial mass on the end of the string.
2. From a small angle from equilibrium, release the pendulum and record the amount of time it takes for 10 oscillations. Record this time in your table of evidence, and determine the period of the pendulum.
3. Repeat step 2 with two other masses, and record these times in your table of evidence. Compare the average periods of the pendulum in all three cases.

**Part A**

|  |  |  |  |
| --- | --- | --- | --- |
| ***Length (m)*** | ***Time for 10 oscillations (s)*** | ***Period (s)*** | ***Period T2 (s2)*** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |

**Part B**

|  |  |  |
| --- | --- | --- |
| ***Length (m)*** | | |
| ***Mass (kg)*** | ***Time for 10 oscillations (s)*** | ***Period (s)*** |
|  |  |  |
|  |  |  |
|  |  |  |

## Analysis

**Part A**

1. Derive the proportional relationship between period and length using 
2. Using the proportional relationship, plot a graph of the two variables. Include a title, label the axes and include appropriate units.

X: [ , , ]

Y: [ , , ]

*a* =

*b* =

1. State the value of the slope, including units.
2. Derive an expression for ***g*** using .
3. Using the slope and the previous expression, determine the value of ***g*** from the above graph. Include appropriate units.
4. Determine the accuracy of ***g*** as compared to the actual value of ***g*** on Earth using percent error.

**Part B**

1. Describe the effects of varying masses on the period of a pendulum from the data you have gathered.