

# PHYSICS LABORATORY: The Simple Pendulum

## BACKGROUND INFORMATION AND QUESTIONS

A simple pendulum consists of a mass attached to the end of a string. When the mass is pulled to the side away from its equilibrium position (from B to A), a force is applied to it, work is done on it, and it is given potential energy ( $PE_{\max}$  at A and C). If released, this potential energy will be transferred to kinetic energy ( $KE_{\max}$  at B) and back again in a periodic fashion. Because the mass on the end of the string is moving in a circular fashion, the mass must be accelerating towards the center of the circle (B) and hence there is a centripetal force pulling it towards the top of the pendulum (via tension in the string).

In this laboratory we will:

1. Investigate how the mass on the end of a pendulum affects its period (the time taken to get from one end to the other and back again).
2. Investigate how the length of a pendulum affects its period.
3. Determine an experimental value for  $g$  (the gravitational field) strength in our laboratory. The mathematical relationship between  $T$ ,  $l$ , and  $g$  is:

$$T = 2\pi \sqrt{\frac{l}{g}}$$

It is important to note that this equation holds for relatively *small swings* of the pendulum, for angles  $< 20^\circ$  from the vertical. Why would this be?

Remember to make a hypothesis for each investigation and justify your hypotheses as appropriate.

## DATA COLLECTION AND PROCESSING (DCP)

1. Think very carefully about how you are going to collect and process the data. Realize that you are really doing three investigations in this lab.
2. Think very carefully about your independent, dependent, and controlled variables.
3. A full error analysis with proper treatment of uncertainties is required.
4. Remember that you are responsible for collecting your own data, even if you are working with another person in the lab.

## CONCLUSION AND EVALUATION (CE)

1. Interpret your results.
2. Compare your experimental value of  $g$  to the accepted value at this location.

**Remember:**

1. Refer to the 'Physics Lab Report Guide' before submitting your report.
2. Attach the 'Physics Lab Report Rubric' as a cover page to your paper copy.

**You will be marked on Data Collection and Processing (DCP) and Conclusion and Evaluation (CE) for this lab.**

