The Simple Pendulum

Objectives:

1) To determine if/how mass, length, and angular displacement affect the period of a simple pendulum

2) Use a simple pendulum to determine the acceleration of gravity

Materials: light string, meter stick, stopwatch, various masses

- Your simple pendulum will consist of a **mass** suspended by light thread from a point about which it can freely swing.
- The **displacement** of the pendulum will be the angle at which it is pulled back before release to swing.
- The **length** is the distance from the point of suspension to the **center of gravity of the mass**.
- You will measure the **period** (the time it takes for the pendulum bob to swing from one side to the other and back again) while individually varying the mass, length, and angular displacement of the pendulum.

I. DOES MASS AFFECT THE PERIOD OF A PENDULUM?

A. Use a length of string between 0.60 m and 1.20 m. Tie a mass to the string. Pull the pendulum bob back about 30° and record the time it takes for the pendulum to make 10 complete cycles. Divide this time by 10 to get the period of the pendulum.
B. Record this information in DATA TABLE I.
C. Now perform the same procedure, but use a different mass. Be sure to keep all other variables EXACTLY the same as before.
D. Repeat these steps for the other masses. Record all information in the data table.

II. DOES LENGTH AFFECT THE PERIOD OF A PENDULUM?

A. Find the period of the pendulum as you did above, but use the **same mass** and **amplitude** in each trial, while varying only the pendulum's **length**.
B. Do this according to DATA TABLE II.

III. DOES AMPLITUDE AFFECT THE PERIOD OF A PENDULUM?

A. This time use a **constant length** and **mass**, but vary the **amplitude** (angle) through which the pendulum swings.
B. Find the period of the pendulum with initial amplitudes given in DATA TABLE III.
C. Record all information in the data table.

Find the formula for the pendulum **in your book** and use your results to **calculate** the **acceleration of gravity** for each trial.

DATA TABLE I – Variable Mass

Mass, g	Length, m	Amplitude, deg	Time, s 10 cycles	Period, s	g, m/s^2
20					
50					
100					
200					
500					

DATA TABLE II – Variable Length

Mass, g	Length, m	Amplitude, deg	Time, s 10 cycles	Period, s	g, m/s^2
	0.20 m				
	0.35 m				
	0.50 m				
	0.65 m				
	0.80 m				
	0.95 m				
	1.10 m				
	1.25 m				
	1.40 m				

DATA TABLE III – Variable Amplitude

Mass, g	Length, m	Amplitude, deg	Time, s 10 cycles	Period, s	g, m/s^2
		10			
		20			
		30			
		40			
		50			

Results:

Make a graph of "Period vs Mass" using the results of Data Table I.
Make a graph of "Period vs Length" using the results from Data Table II.
Make a graph of "Period vs Amplitude" using the results of Data Table III.

On each graph, write a statement commenting on the relationship between the period and the manipulated variable that is indicated by the shapes of the graphs. For example, you may find relationships that are *directly proportional*, *inversely proportional*, *quadratic*, *square root*, *sinusoidal*, or you may find *no relationship* at all.

Write a summary paragraph describing what you learned about pendulums from this activity.