# 8. THE SIMPLE PENDULUM

**Equipment List:**

- A long string
- One mass to act as the "bob" of the pendulum
- Stop watch timer
- A two meter stick
- One long rod and one short rod (with threads at one end) and one "right-angle" clamp

**Introduction:**

In this lab the relation between the length of a simple pendulum and the period of its swing is investigated.

**Theory:**

Derive the famous simple pendulum equation that relates the period of its oscillation to its length.

**Procedure:**

1. Construct the apparatus as shown in the picture that is not here yet!

2. Using only one mass for the whole experiment (choose a mass of at least twenty or even fifty grams and tie the string to it), measure the length of the pendulum string with the two meter stick and the period of its swing for ten different lengths. Use a big range of different lengths; make one length as long as possible (at least one or one and a half meters) and another rather short (about ten centermeters). To make it easy to change different string lengths, you need only wrap the string around the threads of the upper pole a few times; that way, you don't have to keep tying and un-tying a knot on the pole. For each length, measure the total time for ten periods. To calculate the actual period, of course, you will divide the total time by ten (what type of error does this help to minimize?).

**Analysis:**

Have the computer draw two graphs:

1. The first graph will be Period versus Length. This graph should yield a square root, non-linear curve. Have the trendline analysis of Excel use a power fit and see how close the power is to 0.5. Also, check the coefficient of the length and see how close it is to the theoretical expected value. Have a correlation coefficient printed on this graph as well. You should expect an excellent fit.

2. For the second graph choose different axis for the same data. You will choose those axis that give a straight line whose slope is equal to g. Use the linear trendline analysis and see how close the slope is to the gravity field, g. Have the correlation coefficient printed on your graph too.

3. Compare the value of *g* from your graph to the accepted value, 9.81 $m/s^2$ , with a discrepancy test. You should expect two percent or less. More than five percent and you are probably making a mistake.

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**More:**

1. Investigate the dependence of the period of the pendulum on the amplitude of the swing.
2. Investigate the dependence of the period of the pendulum on the mass of the bob.