# PHYS 102 Lab #4 Newton’s Second law Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Purpose: Verify Newton’s second law using Atwood’s Machine.

Apparatus: PC, interface, photogate sensor (head, rod, cable, and pulley), two mass sets, string, and lab stand.

Pasco Capstone display menu descriptions:



1. Maximize graph (Scale axes to show all active data)
2. Automatically scale axes during data collection.
3. Select visible runs.
4. Select ranges of data.
5. Statistics.
6. Display area under active data
7. Curve fitting.
8. Show coordinates tool.
9. Determining slope.
10. Annotation.
11. Add new Y-axis.
12. Add new plot area.
13. Remove data.

Theory: Newton’s second law is: Net Force = Mass X Acceleration.

Procedure:

a) Go online and search for “Atwood’s machine”, “Newton’s second law and Atwood’s machine”, collect info about it, and describe it below.

b) Experimental Set-Up:

1)               Assemble the photogate with the pulley (Atwood's machine), plug it in to digital input 1 on the Interface, and attach the rod to a lab stand so that the head is horizontal.



2)               Cut a piece of string approximately a meter long. Place the string into the groove of the pulley.

3)               Tie the two mass sets (m1 and m2) to the ends of the string, as shown below.



4) Setting up the Interface:   
a. Make sure that the power for the interface is turned on.  
b. Open **PASCO Capstone** software from the desktop.   
c. Click **File** (top-left corner), click **Open Experiment**, click the drop-down menu for **Files of type**, and choose **DataStudio 1.9 files**, open **P10\_Atwood’s.ds** from desktop, and OK **USB 850 interface.**d. Open the Velocity VS. Time graph, by clicking on the velocity graph tab.

5)               Now, pull the m1 mass up and hold it there to keep it from moving down.

6)           Click "Recordt" and release the M1 mass. Stop recording data after M1 reaches the table.

7)           Determine the experimental acceleration by finding the slope for the linear portion of the Velocity VS Time graph.

8)           Repeat steps 5-8 for the following two cases.

c) Data Collection & Analysis

Case I: Keeping the total mass = M = m1+ m2 constant, measure the acceleration as you change the net force. Collect 8 sets of data, tabulate your data, and plot an appropriate graph to verify Newton’s second law.

Case II: Keeping the net force constant, measure the acceleration as you change the total mass. Collect 8 sets of data, tabulate your data, and plot an appropriate graph to verify Newton’s second law.

d) Write a conclusion.