Atwood Machine Lab
online version

Purpose:
To determine the mathematical relationship between acceleration (**a** in m/s^2) and the total mass of a system ($\mathbf{m_{TOT}}$ in kg) and acceleration (a in m/s^2)and the net force($\mathbf{F_{NET}}$ in N which is a kgm/s^2) by using an Atwood machine.

Some instructions and pointers:

1. Do the Prelab worksheet on the next page and make hypotheses before beginning the lab and collecting data.

2. Work by yourself. Use the simulation on the following website to get your data (at least six points per graph).

Atwood Machine
http://physics.bu.edu/~duffy/HTML5/Atwoods_machine.html

3. Write your procedure section detailing the steps you used on these simulations. Refer back to to the prelab worksheet for help on what you need to do to gather the data. Include a picture of the Atwood machine.

4. In your data section, include freebody diagrams (see prelab) and anything held constant within the experiment as well as your data points.

5. For your data analysis, you may have to do some calculations with your data before you are ready to graph it. Show one of each type of calculation; the rest may be recorded in a table.

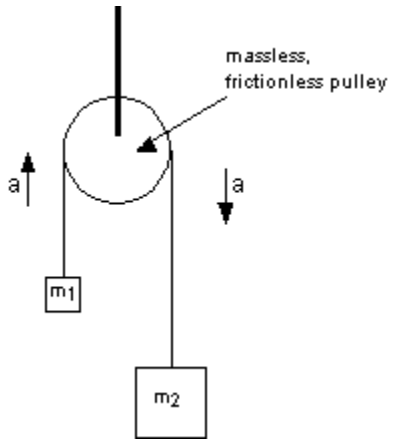
6. You will have 2 graphs. To help with slope units, note that a N is the same as a kgm/s^2.

7. In the conclusion, show how the slopes compare to the quantities you held constant. Also show how the models for **a vs** $\mathbf{F_{NET}}$ and **a vs** $\mathbf{m_{TOT}}$ can be combined into one equation.

Atwood Machines Unit V Prelab
Worksheet

Purpose:
To determine mathematical models for the relationship between net force (total force or $\mathbf{F_{net}}$) and acceleration (**a**) of a system and between total mass ($\mathbf{m_{tot}}$) and the acceleration (**a**) of a system.

Atwood Machine



a and F_{net} are both vectors acting in the same direction.

m_{tot} is a scalar.

$m_2 > m_1$

If you are doing this experiment with actual equipment instead of a simulation, you can use cups to hold masses or hooks with slotted masses for m_2 and m_1. Acceleration can be measured with a photogate and a smart pulley

1. Draw a freebody diagram for $\mathbf{m_1}$ and $\mathbf{m_2}$.

$\mathbf{m_1}$ $\mathbf{m_2}$

2. On the two freebody diagrams above, rank the forces from largest to smallest.

3. If you know the mass, how do you calculate the weights of $\mathbf{m_1}$ and $\mathbf{m_2}$? (formula?)

4. All a pulley does is change the direction of the force (not its magnitude). What is the net force (total force) acting on the whole system ($\mathbf{m_1}$ and $\mathbf{m_2}$ together) that causes the acceleration? Explain. Think of $\mathbf{m_1}$ and $\mathbf{m_2}$ as having a tug-of-war.

5. What would be the acceleration of the system if $\mathbf{m_1} = \mathbf{m_2}$? Describe the possible motions of the system.

6. Write an equation for the net force ($\mathbf{F_{net}}$) on the whole system in terms of $\mathbf{m_1}$, $\mathbf{m_2}$ and $\mathbf{g}$ (9.8 N/kg).

7. If $\mathbf{m_{tot}} = \mathbf{m_1} + \mathbf{m_2}$, how can you hold the total mass constant, but change $\mathbf{F_{net}}$?

8. How can you hold $\mathbf{F_{net}}$ constant but change $\mathbf{m_{tot}}$?