ATWOOD'S MACHINE

OBJECTIVE:
To verify the equations relating to constant acceleration and Newton's second law of motion as applied to Atwood's Machine.

APPARATUS:

Spoke, ball-bearing pulley with support rod
Meter stick fixed vertically
2- 50g mass holders
Assorted masses
Stopwatch
String

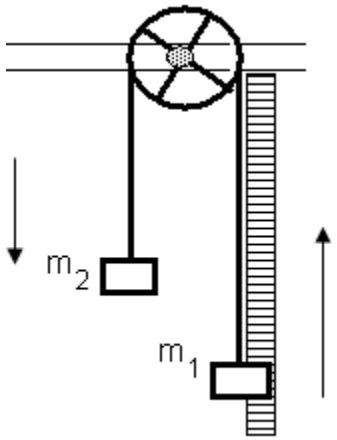

Figure 1

INTRODUCTION:

The Atwood's Machine is simply a pulley of negligible inertia and friction over which are suspended two masses. When the masses are unequal, the system will accelerate in the direction of the heavier mass. In this experiment, you will measure the acceleration and compare it to that predicted by Newton's second law.
For the purposes of this experiment, we shall assume that the acceleration is constant. Therefore, if the system begins at rest, y is the distance traveled and t is the time it takes to go a distance of y. You will measure y and t to calculate the acceleration, using the constant acceleration equations located in your textbook.

PROCEDURE:

1. Use a length of string such that when one mass holder is on the table, the other is about 50 cm above (Does not have to be 50 cm). Make sure that one mass holder is directly in front of the vertical meter stick as in Figure 1.

2. Place 500g on each mass holder and move the system so that both masses are at the same level. No motion should occur.

3. While holding the system(gently place your finger under the mass holder) , add 1 gram of mass to the side in front of the meter stick, then let go to see if the system moves. If not, see if it will move after a slight push to the larger mass. If it still doesn't move, try a 2 g mass; continue adding masses until the mass moves. Record the additional mass required on the data sheet.

4. With 550g total on each side, add a 10g mass to the side in front of the meter stick. This 560g will be m_2.

5. Pull the light side down to the table and hold it. Read the distance of the heavy side above the table by sighting across the bottom of the mass holder to the meter stick. Record this distance as ***y*** on the data sheet.

6. Time the fall by starting the stopwatch as you release the lighter mass from the table, and stopping it when the heavier mass hits the table. Take five time readings and record them in a data table.

7. Repeat steps 5 and 6 using masses of 565g and 570g for m_2. This gives you 3 sets of data. Now complete the back page.

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ATWOOD'S MACHINE LAB SHEET 1

DATA TABLE: INCLUDE UNITS

TRIAL	*y*	TIME 1	TIME 2	TIME 3	TIME 4	TIME 5	Step 3Mass
1							
2							
3							

CALCULATIONS: **SHOW ALL WORK INCLUDE ANSWERS ON RESULTS TABLE**

1. Average the 5 times for each trial.

2. Using the equations for constant acceleration calculate the acceleration of the system in each of the three trials. Assume that the initial velocity is zero and use the data measured for the average vertical distance, ***y***, and average time.

3. Using Newton's second law of motion, $\sum F = ma$, applied to the Atwood's machine, calculate the acceleration of the system, in each of the three trials. Hint: The magnitudes of the acceleration of both blocks are the same.

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ATWOOD'S MACHINE LAB SHEET 2

4. Calculate the percent error of the results for each of the accelerations calculated in the two previous steps. Use the value calculated in question 2 as the experimental value and the value calculated in question 3 as the actual value.

5. Calculate the affect of friction on the experimental value of acceleration. To do this use the value recorded from procedure step 3 and divide by the mass difference for each of the runs. Convert this number into a percentage.

RESULTS TABLE: INCLUDE UNITS

TRIAL	Average Time	Experimental Value of Acceleration	Actual Value of Acceleration	Percent Error	Percent Error Due to Friction
1					
2					
3					

CONCLUSION:

LIST OF ATTACHMENTS:

NONE

TURN IN:

ATWOOD'S MACHINE LAB SHEET 1 AND 2