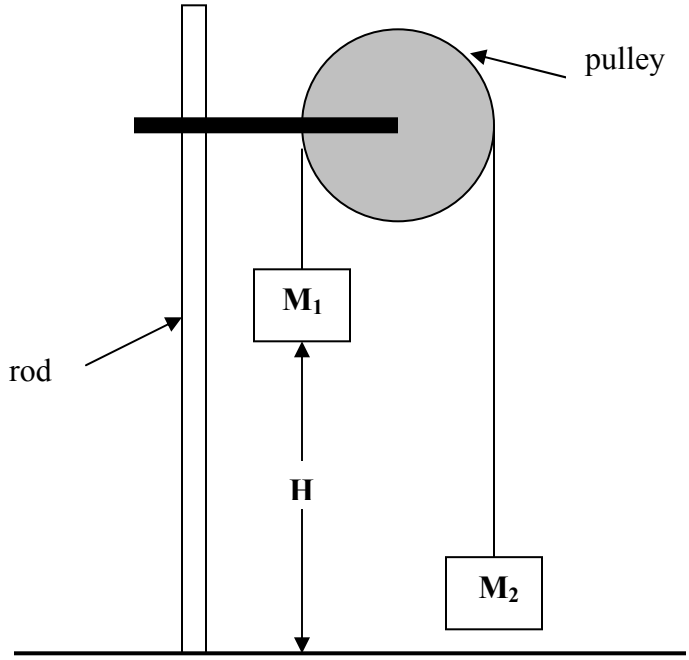
ATWOOD'S MACHINE

OBJECTIVE

To calculate the acceleration of the Atwood's Machine experimentally by using the kinematic equations of motion and to compare to the expected value obtained from applying Newton's 2nd Law to the Atwood's Machine.

EQUIPMENT

1. pulley
2. rod
3. stop watch
4. pan balance
5. masses
6. 2-meter stick



THEORY

Using Newton's 2nd Law

1. Draw a free-body diagram of mass M_1 and mass M_2.
2. Select an appropriate coordinate system for each mass.
3. Apply Newton's 2nd Law to each mass by using the corresponding coordinate system.
4. Obtain an expression for the acceleration of the blocks in terms of M_1, M_2, and g. That is a = a (M_1, M_2, g). This expression will give the theoretical (expected) value for the acceleration.

Using the Kinematic Equations of Motion

1. Using one of the kinematic equations derive and expression for the acceleration of the blocks when they have moved a distance H starting from rest in a time *t*. Your expression will be in terms of H and *t*. That is a = a(H, *t*). This expression will give the experimental acceleration. The

PROCEDURE

1. Setup apparatus as shown on equipment section.
2. Choose M_1 = 180g and M_2 =150g.
3. Adjust M_1 and M_2 so that M_1 falls through a height H ≈ 130 cm.
4. Release M_1 from rest and measure the time of fall *t* for a total of 5 runs.
5. Repeat steps (2) and (3) for M_1 = 230g and M_2 =200g.
6. Calculate a_{exp} and a_{theo} for each set of data.
7. Construct a data table like the following:

H(cm)	M_1	M_2	t_1	a_1	t_2	a_2	t_3	a_3	t_4	a_4	t_5	a_5	a_{ave}	a_{theo}	%error
130															
130															