Newton's Second Law: The Atwood Machine

Lab #1

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Newton's Second

Objective

The objective of the lab is to measu
varying total masses and forces, while

Introduction

The main theory used within the lab

such that within an Atwood machine,
of gravity, $F_g = mg$, works in opposite
total acceleration of the system is con
we must also subtract the force of fric
air), and add the mass of the pulley t

Thus, $F_{net} = (m_1 + m_2 + m_{pulley})$
This can then be rewritten as

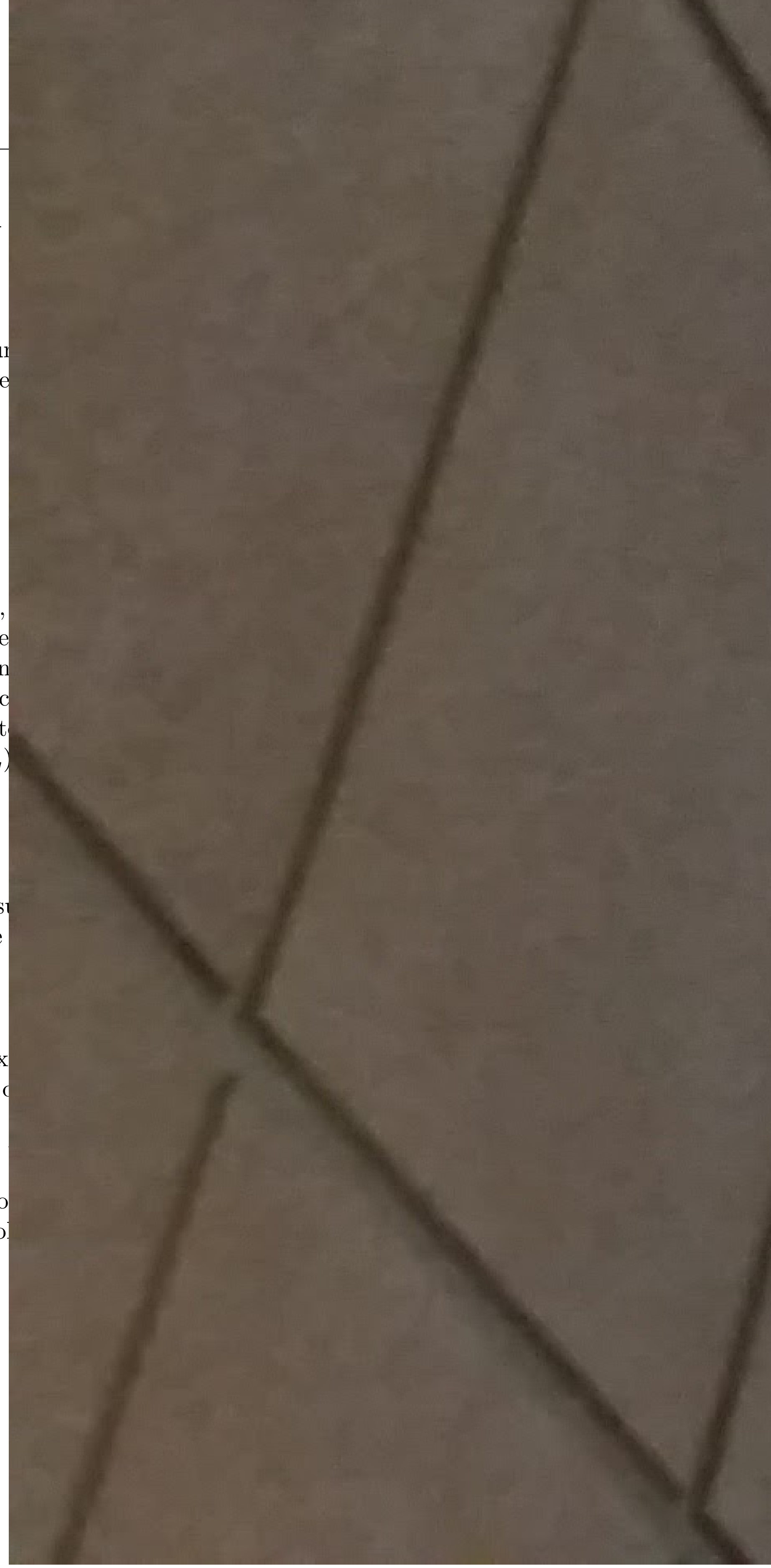
$$a =$$

This can then be taken when a = 0, s
the gravitational constant to find the

$$a =$$

The acceleration of the actual ex
time the mass takes to fall a specific c

can be used to find the acceleration o
modified due to starting from rest, so



Procedures and Results

First, the entire Atwood machine setup must be built, with equal masses on both sides, adding mass to one side until a = 0, such that the added mass is m_f, the mass needed to compensate for friction, then we added mass to the descending side, and measuring the amount of time it took to fall a specific distance. After, we tested using different masses on both, but preserving the relative mass, creating different frictional masses/forces on each, measuring the resultant acceleration.

Next,

$$m_{eq} = 31.6g$$

Trial	1	2	3	4
Descending Mass, m_2 (kg)	0.06636	0.165		
Ascending Mass, m_1 (kg)	0.055	0.150		
Distance of Travel, y (m)	0.8984	0.855		
Time of Travel, Run 1, t_1 (s)	1.47	2.1		
Time of Travel, Run 2, t_2 (s)	1.21	2.27		
Time of Travel, Run 3, t_3 (s)	1.31	2.18		
Average Time, t_{avg} (s)	1.33	2.183		
Measured Acceleration, a_m (kgm/s^2)	1.015			
Total Mass, m_t (kg)	0.1529			
Frictional Mass, m_f (kg)	0.00136	0.005		
Net Force, F_{net} (N)				
Theoretical Acceleration, a_t $(kg * m/s^2)$				
Percent Acceleration Error				

Discussion

Calculations for the data for the first tests on differing frictional force are as shown:

$$t_{avg} = \frac{t_1 + t_2 + t_3}{3} = \frac{1.47 + 1.21 + 1.31}{3} = 1.33$$

$$a = \frac{2y}{t^2} = \frac{2 * 0.8984}{1.33^2} = 1.015$$

$$m_t = m_1 + m_2 + m_{pulley} = 0.06636 + 0.055 + 0.0316 = 0.1529$$

Conclusion