Modified Atwood's Machine Experiment

Purpose:

To determine the moment of Inertia of a pulley on a modified Atwood's machine apparatus experimentally and theoretically.

Procedure:

1. Setup the apparatus as seen at the front of the room. **Set the pulley about 2 meters above the floor.**
2. Using the vernier caliper measure the diameter of the **second smallest axle** precisely.
3. Wind a length of string around the axel several times and then cut the other end at the floor level **(we want the string to reach the floor before it unwinds from the axle)**. Use the small hole on the pulley to secure the string.
4. Hang small masses from the string using a small piece of tape. Increase the mass until the system moves with constant speed when given a small push. Using this mass value calculate the frictional torque.
5. **Remove the masses from step 4.**
6. Attach a 5 gram hanger and 10 gram in masses to the string.
7. Set the bottom of the mass hanger to a height of **1.5 m**. Keep this height constant during the entire experiment.
8. Release the system from rest and time the descent. Cushion the impact with a foam rubber pad.
9. One person should release the mass and work the timer at the same time.
10. Repeat the timing 4 more times. Make sure that your time values are close to each other.
11. Have your lab partner do 5 trials also. Use the same height (1.5 m) for all measurements.
12. Compare your times to see if they are consistent. **If the time are not consistent then figure out why and arrive at a mutually acceptable time.**
13. Calculate the average time for all **ten values**.

Calculations:

1. Calculate the frictional torque by using the value of the frictional mass and the radius of the second smallest axel.
2. Calculate the linear acceleration **a** (m/s^2) by using kinematic equations and the average value of the 10 times.
3. Calculate the Tension (**T**) and the value of the Torque due to this tension force. Again use the radius of the second smallest axel.
4. Calculate the experimental value of the Moment of Inertia using the experimental formula on the board.
5. Calculate the value of the moment of inertia again by modeling the pulley as a solid disk **($I = \frac{1}{2} MR^2$)**. The mass of the pulley **(M) is giving in this table**. **Use the radius of the big wheel for R.**
6. Compare the two values of I by calculating a percent difference.