Moment of Inertia

Purpose:

To determine the moment of Inertia of a pulley on a modified Atwood's machine apparatus using conservation of energy.

Procedure:

1. Using the Vernier caliper measure the diameter of the **second** smallest axle and the bow caliper to measure the diameter of the biggest axel precisely.
2. Setup the apparatus as seen at the front of the room. **Set the pulley about 2 meters above the floor.**
3. Wind a length of string around the **second smallest** 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**. This is you frictional mass. The frictional mass value will be between **1 gram and 2 grams.**
5. Record the value of this mass. Call it m_{fr} (frictional mass).You will keep this mass tape to the string during the entire experiment.
6. Attach a 5 gram hanger and 10 gram in masses to the string for a total of 15 grams. This is your hanging mass m.
7. Set the bottom of the mass hanger to a height of **1.50 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. Calculate the average time for all **ten values**.

Calculations:

1. Calculate the experimental value for the moment of Inertia by using the following information:
   a. m_{fr} = frictional mass (do not include in your calculations).
   b. m = the hanging mass = **0.015 kg** (10 grams + 5 grams (hanger))
   c. r = second smallest axel radius in meters.
   d. y_o = falling height in meters (**1.50 meters**)

$$I = (m*r^2)[(g*t^2_{aveg.}/(2*y_o)) -1] \ [kgm^2]$$

2. Calculate the value of the moment of inertia again by modeling the pulley as a solid disk **($I = ½ MR^2$)**. Mass the pulley without the axel.. **Use the radius of the big wheel for R.**
3. Compare the two values of I by calculating a percent difference. For this lab you are allowed up to 25% difference.