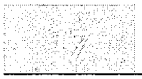
Name _____ Section _____ Date _____



LABORATORY 17 *Moment of Inertia and Rotational Motion*

PRE-LABORATORY ASSIGNMENT

1. What equation is the rotational equivalent of Newton's second law? Give the meaning of each symbol and state which rotational quantities are analogous to which linear quantities.

2. What equation defines moment of inertia? Define the terms used in the equation.

3. What is the moment of inertia of a solid cylinder of radius $R = 0.0950$ m, thickness $t = 0.015$ m, and total mass $M = 3.565$ kg? Show your work.

4. A mass hung on a string that is wrapped around an axle on a wheel produces a tension in the string of 5.65 N. The axle has a radius of 0.045 m. The wheel has a mass of 4.000 kg and a radius of 0.125 m. What is the torque produced by the tension on the axle? Show your work.

5. The mass in Question 4 has an acceleration of 0.655 m/s^2. What is the angular acceleration α of the system? Show your work.

6. In the experimental procedure, why is a path length longer than 1 m suggested for the motion of the mass on the string?

7. The following data were taken with a system like the one described in this laboratory. The path length of the falling mass was $x = 1.434$ m, and the radius of the hub around which the string was wrapped was $r = 0.040$ m. For the values of mass m on the string listed, the times to accelerate the distance x are given in the table. Use these data to calculate the values for the acceleration a, the tension T, the torque τ, and the angular acceleration α. Perform a linear least squares fit with τ as the vertical axis and α as the horizontal axis. Record the slope as I the moment of inertia, the intercept as τ_f the frictional torque, and the correlation coefficient r.

m (kg)	t (s)	a (m/s^2)	T (N)	τ (N–m)	α (rad/s^2)
0.050	10.60				
0.100	7.40				
0.150	6.10				
0.200	5.20				
0.250	4.60				
0.300	4.20				

$I =$ _____ kg–m^2

$\tau_f =$ _____ N–m

$r =$ _____