**Physics 231: General Physics I** **Names:**_____
**Lab 8 – April 2, 2004**

# Rotational Dynamics

## A. Theory – Pre-lab

1. Draw free-body diagrams for the falling object and the rotating disk. For the disk, be sure to draw the forces where they act on it.

2. Write Newton's second law for each object in symbolic form. For the disk, use I for the moment of inertia and also include a frictional torque ($\tau_f$) which opposes the rotation.

3. How are the acceleration of the falling object and the angular acceleration of the disk related?

4. Solve for the acceleration (a) of the falling object.

**B. Measurements**

1. Measure the radius at which the string is wrapped.

$$R = \_\_\_\_\_$$

2. Draw a diagram of your rotating disk. Include all measurements made.

3. Given the dimensions and mass of the rotating disk, calculate its moment of inertia in units of $kg \bullet m^2$ (Hint: Each part is a cylinder rotating around its axis.).

$$I = \_\_\_\_\_$$

4. Determine the frictional torque by finding the time it takes the disk to stop rotating from a given speed. The rotational acceleration of the disk is due to the frictional torque. Describe your method and do your calculation below.

$\tau_f$ = _____

5. Record the size of the falling mass and how far it will fall.

m = _____ h = _____

6. Measure the time required for the mass to hit the ground. Record the average for the class.

t = _____

7. Using the measurements, calculate the acceleration of the falling mass (Hint: The acceleration is constant). Show your work.

a = _____

**C.** C**omparison**

1. Use the equation from part A to make a prediction of what the acceleration should have been

2. Determine the percentage difference between the predicted and measured accelerations.