Name: _____ Date: _____ Course: _____ Professor: _____

M23b Prelab: Rotational Dynamics and Determining the Moment of Inertia

Read the lab instructions and the appropriate sections from your textbook before answering the questions.

In M23b experiment, you are going to observe Newton's Second Law for rotational motion, experimentally determine moment of inertia of a platform and of a hollow cylinder ("hoop"), and compare your experimental values with theoretical/calculated values.

It is possible that a number of students will be conducting this experiment before the material will be covered in a lecture course. Since many concepts could be new for you, it is important to read your text, the lab handout, and get familiar with the concepts related to the experiment and calculations you will be expected to do in the lab. You can also ask your lecture instructor for help, if needed.

Once you are fully prepared, answer the following questions:

1. Write down Newton's Second Law for rotational motion.

2. Describe what is torque and how the torque can be calculated if the magnitude of a force and the distance from the axis of rotation to the point where the force is applied are given.

3. Write down the definition of the angular acceleration, α.

4. The rotation of the system happens because a hanging mass moving with a linear acceleration, **a,** is attached to a pulley with radius, **r.** Write down the equation that you will use to calculate the linear acceleration using the measured radius and angular acceleration.

5. Describe what is moment of inertia.

6. Which parameters you will need to measure/determine to be able to calculate the theoretical moment of inertia of the hoop? Write the equation you are going to use to for this calculation.

7. Which parameters you will need to measure/determine to be able to calculate the theoretical moment of inertia of the disk? Write the equation you are going to use to for this calculation.

8. Draw a free-body diagram for the hanging mass. Apply Newton's Second Law for the hanging mass and derive the equation which will allow you to calculate tension in the string using the linear acceleration, **a**, mass, **m**, and free-fall acceleration **g**.

9. What is(are) the force(s) exerting the torque on the disk in the experiment?

10. Based on Newton's Second law for rotational motion, which shape (trendline) do you expect for the graph of angular acceleration as a function of the net torque?

11. If you know the slope of the graph mentioned above, how would you determine the experimental moment of inertia? Explain why!