Physics 200   Name _____

Exam 3 – Rotation   November 22, 2005

This is a closed book examination. You may print and use the concept/equation sheet available on-line. Please work the problems on separate sheets of paper. Multiple-choice answers are worth 5 points – 1 point for the answer and 4 points for the reason. Show your work!

Reminder the GOAL of problem solving:

Gather Information: What do you know? What do you want? Draw coordinate frame. Draw a picture with labels.

Organize: Type of problem (Kinematics, Energy Conservation, Momentum Conservation, Rotation), Pick approach.

Analyze: List mathematical relationships, Simplify and solve, Plug in numbers.

Learn: Check your answer – Is it reasonable? Are units correct?

	Ring (thin)	$I = mr^2$
	Disk (solid)	$I = \frac{1}{2}mr^2$
	Sphere (solid)	$I = \frac{2}{3}mr^2$
	Sphere (hollow)	$I = \frac{2}{5}mr^2$
	Rod	$I = \frac{1}{12}ml^2$

1) [5 pts] Given a solid disk and a ring that are the same diameter, can they have the same moment of inertia?
   a) Yes
   b) No

2) [5 pts] Given a disk and a solid sphere that are the same mass, can they have the same moment of inertia?
   a) No
   b) Yes

3) [10 pts] Two solid disks are released to roll down an incline at the same time. Both disks have the same mass but one has a diameter twice the other. Which disk reaches the bottom of the ramp first? Assume both disks roll without slipping. Show your answer is correct by solving the physics for each situation.
   a) The smaller disk
   b) The larger disk
   c) They reach the bottom at the same time

4) [20 pts] How to win when playing "Wheel of Fortune". You are spinning a solid disk (r = 1m and m = 50 kg) that is free to rotate horizontally. The disk has a frictional torque of 50 Nm.
   a) How fast does the disk need to be rotating initially to make 2.25 rotations?
   b) How much energy does the disk have initially?

Draw angular velocity, angular acceleration, torque and angular momentum vectors for the following objects. Clearly label location and direction of each vector (you may need to draw two views).

5) [5 pts] A merry-go-round that is rotating in the counter clockwise direction (as viewed from above) and has a frictional torque about its rotation axis.

6) [5 pts] A top spinning in the clockwise direction (as viewed from above) on a frictionless surface.

7) [5 pts] A record (analog CD) placed on a record player that is initially stationary but then starts to revolve.