Name _____

Angular Momentum: $L = I\omega$, units $kg * m^2/s$

Linear Motion	Rotational Motion
m (mass)	I (Moment of Inertia)
v (velocity)	ω (angular velocity)
$p = mv$ (momentum)	$L = I\omega$ (angular momentum)
$F_{net} = \frac{\Delta p}{\Delta t}$ (Newton's 2nd Law with momentum)	$\tau_{net} = \frac{\Delta L}{\Delta t}$ (Newon's 2nd Law with angular momentum)
$p_{0tot} = p_{ftot}$ (If $F_{net} = 0$, momentum is conserved)	$L_{0tot} = L_{ftot}$ (If $\tau_{net} = 0$, angular momentum is conserved)

1. What is the angular momentum of a spinning solid disk that has a mass of $5kg$, a radius of $0.2m$ and an angular speed of $10rad/s$?

   If a torque of $12Nm$ acts on an object for $5s$, and the object started from rest, what will be the angular momentum of the object at $5s$?

2. What keeps the Earth spinning once per day? What keeps it orbiting the sun?

3. If I stand on a spinning platform with my arms folded and then I extend my arms...
   Will my angular speed **A**: increase, **B**: decrease, or **C**: stay the same?
   What happens to my angular momentum? **A**: increase, **B**: decrease, or **C**: stay the same?
   What happens to my moment of inertia?**A**: increase, **B**: decrease, or **C**:stay the same?

4. With global temperatures rising, scientists predict the polar ice caps could melt. This will make ocean levels rise and have the effect of increasing the radius of the Earth. What would happen to the length of the day? **A**: Increase, **B**: decrease **C**: Stay same

5. You can distinguish a hard boiled egg from a raw egg by spinning it on your countertop. Explain why this works.

   If you spin a raw egg and stop it briefly but then let it go, it will continue spinning. Explain why this happens.

6. A solid disk with mass $m = 10kg$ and radius $r = 0.4m$ is rotating with angular speed $\omega = 3rad/s$ about its center. A ring with mass $m = 2kg$ and radius $r = 0.3m$ is dropped onto the spinning disk such that its center coincides with the center of the disk.
   What is the moment of inertia of the disk?

   What is the moment of inertia of the ring?

   What is the new angular speed of the disk and ring spinning together?

7. A girl ($m = 28kg$) is standing at the center of a merry-go round, which has a moment of inertia of $120kg\ m^2$. The merry go round is initially spinning at $1rad/s$. The girl gets some courage to move outward and moves to the outer edge of the merry-go round, which has a radius of $0.8m$.

   (a) What is the girl's moment of inertia at the center?

   (b) What is the girl's moment of inertia at the outer edge? (Hint: Treat the girl like a particle, which has moment of inertia $I = mr^2$)

   (c) What is the angular speed of the merry-go-round when the girl is at the outer edge?