Rotational Kinetic Energy and Angular Momentum Name _____
Mastery Assignment SOLUTIONS

You are to show all steps. Numerical answers alone are not enough to get any credit. You may get help from anyone. When you have finished, show your work to the teacher and then check your answers. The teacher will not check your work beyond seeing that you have completed it. Show all of your work on a separate sheet or sheets of paper. Not this paper!

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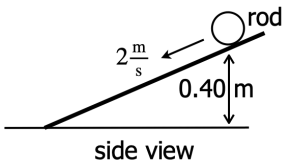
1. A figure skater is spinning with her arms outstretched. Her initial moment of inertia is 2.4 kgm^2 and she is spinning at 2π $^{rad}/_{s}$. She then pulls her arms in, decreasing her moment of inertia to 0.8 kgm^2. What is her new angular velocity?

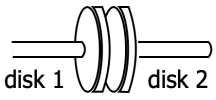
2. A solid metal disk (Disk A) with a moment of inertia of 4.0 kgm^2 is rotating at 12 $^{rad}/_{s}$ on a frictionless vertical axle. A second non-rotating disk (Disk B) with a moment of inertia of 2.0 kgm^2 is dropped onto the first disk. Due to friction, they quickly start spinning together. What is the final angular velocity of the two-disk system?

3. A 40 kg child stands on the edge of a 100 kg solid disk-shaped merry-go-round ($I_{disk} = ½mr^2$) with a radius of 2 m. The system is spinning at 1.5 $^{rad}/_{s}$. The child then walks to the very center. Calculate the new angular velocity of the system.

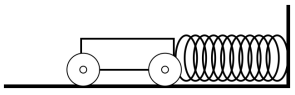
4. A solid ½ kg rod with a radius of 0.50 m and a length of 0.3 m is traveling 2 $^{m}/_{s}$ down a ramp. When the rod is traveling at 2 $^{m}/_{s}$ it is 0.40 m above the floor on the ramp. Assuming the rod does not slip as it rolls, what will be its translational velocity at the bottom of the ramp?



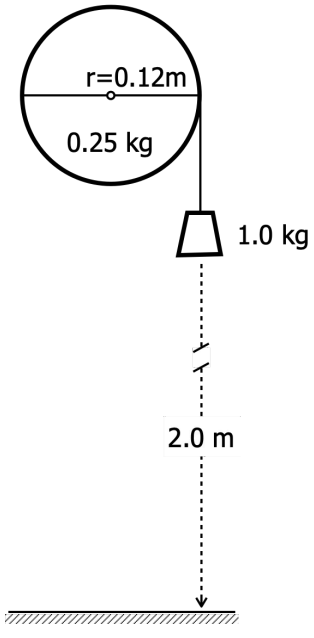
5. Two disks are used in a machinery clutch system. Disk 1 has a moment of inertia of 1.5 kgm^2 and is spinning clockwise at 20 $^{rad}/_{s}$. Disk 2 has a moment of inertia of 3.5 kgm^2 and is spinning **counter-clockwise** at 10 $^{rad}/_{s}$. The two disks are pushed together until they spin as one unit. What is their final angular velocity **AND** direction?



6. A 2 kg lab cart has four wheels. Each wheel is a 0.2 kg small solid disk and a radius of 0.05 m. The cart is pushed against a spring (k = 500 $^{N}/_{m}$), compressing it by 0.10 m, and then released from rest. The set up is placed on a horizontal table top. What is the **velocity** of the cart after it leaves the spring, (at the spring's equilibrium position?)



7. A string is wrapped many times around a solid disk that can spin without friction. The 0.25 kg disk has a radius of 0.12m. On the other end of the string is attached a 1 kg mass. If the mass is released from rest, when it hits the ground 2.0 m below, what will be the angular velocity of the disk?



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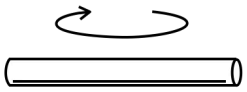
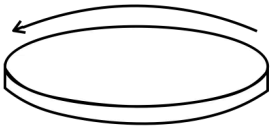
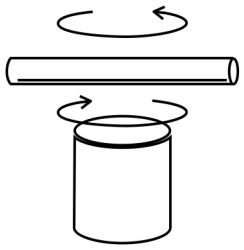
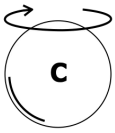
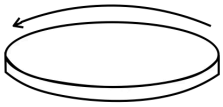
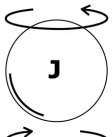
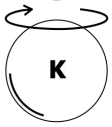
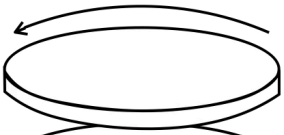
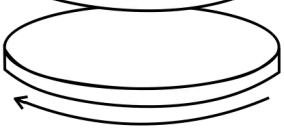
650. The two pictured objects are colliding. The top object is being dropped onto the bottom object. After colliding the two objects will stick together and spin as one object. Your task is to determine if they will spin in the same direction as the top object or the bottom object when they are stuck together <u>by circling or writing the letter of the object.</u>

$I=10\ kgm^2, \omega=5\frac{rad}{s}$  **A** $I=3\ kgm^2, \omega=15\frac{rad}{s}$  **B**	$I=4\ kgm^2, \omega=5\frac{rad}{s}$  **G** $I=2\ kgm^2, \omega=15\frac{rad}{s}$ **H**
$I=2\ kgm^2, \omega=3\frac{rad}{s}$  **C** $I=4\ kgm^2, \omega=5\frac{rad}{s}$  **D**	$I=4\ kgm^2, \omega=5\frac{rad}{s}$  **J** $I=3\ kgm^2, \omega=7\frac{rad}{s}$  **K**
$I=3\ kgm^2, \omega=8\frac{rad}{s}$  **E** $I=6\ kgm^2, \omega=3\frac{rad}{s}$  **F**	

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660. For the problems below you are given the rotational directions and all of the angular velocities. The signs have been randomly given to each pair of objects. After looking at "after the collision" information, determine which object will spin in the same direction as the object pair when they are stuck together <u>by circling or writing the letter of the object.</u>