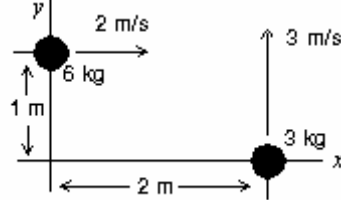


## Chapter 12 (Rolling, Torque & Angular Momentum)

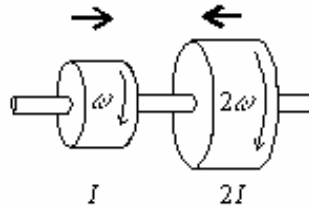
1- A 2.0-kg block is located on the x-axis 3.0 m from the origin and is acted upon by a force  $F = 8.0i$  N. Find the net torque acting on the block relative to the origin. (A: 0.0 N.m)

2- Force  $F = (2.0i - 3.0j)$  N, acts on a mass located at  $r = (0.50i + 2.0j)$  m. Find the resulting torque (in N.m) about the origin. (A: - 5.5 k)

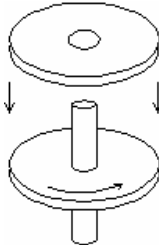
3- Two objects are moving in the x,y plane as shown. The magnitude of their total angular momentum (about the origin O) is (in  $\text{kg}\times\text{m}^2/\text{s}$ ): (A:  $6 \text{ kg}\times\text{m}^2/\text{s}$ )



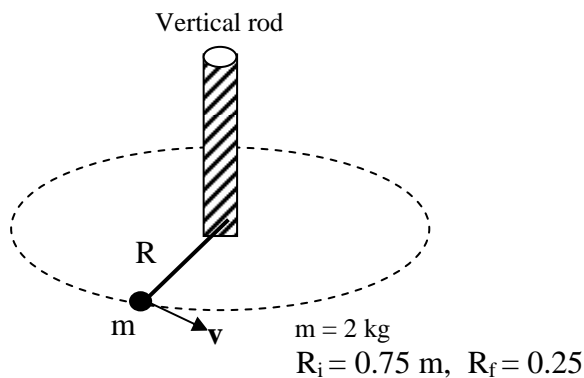
4- Two disks are mounted on low-friction bearings on a common shaft. The first disc has rotational inertia  $I$  and is spinning with angular velocity  $\omega$ . The second disc has rotational inertia  $2I$  and is spinning in the same direction as the first disc with angular velocity  $2\omega$  as shown. The two disks are slowly forced toward each other along the shaft until they couple and have a final common angular velocity of: (A:  $5\omega/3$ )



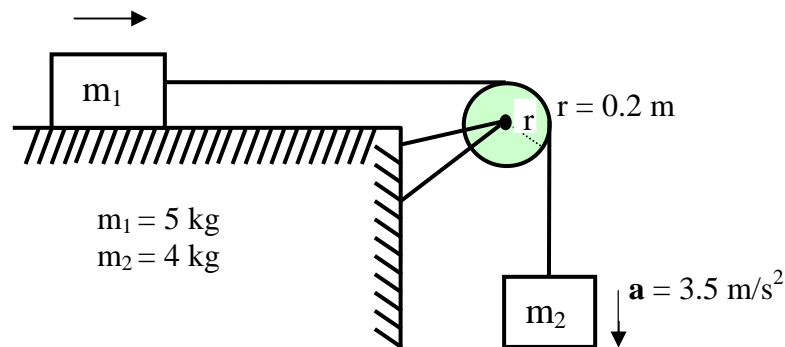
5- A wheel, mounted on a vertical shaft of negligible rotational inertia, is rotating at 500 rpm. Another identical (but not rotating) wheel is suddenly dropped onto the same shaft as shown. The resultant combination of the two wheels and shaft will rotate at: (A: 250 rpm)



6. A 2.0 kg mass is attached to a string and fixed to a vertical rod (Fig 6). The mass is initially orbiting with a speed of 5.0 m/s in a circle of radius 0.75 m. The string is then slowly winding around the vertical rod. What is the speed of the mass at the moment the string reaches a length of 0.25 m? (A: 15 m/s)



7. A mass ( $m_1 = 5.0 \text{ kg}$ ) which slides on a frictionless surface is connected by a light cord to a mass ( $m_2 = 4.0 \text{ kg}$ ), as shown in Fig 7. The pulley (radius =  $0.20 \text{ m}$ ) rotates about a frictionless axle. The acceleration of  $m_2$  is  $3.5 \text{ m/s}^2$ . What is the rotational inertia of the pulley? (A:  $0.088 \text{ kg}\cdot\text{m}^2$ )



8. A solid ball, whose radius  $R$  is  $10 \text{ cm}$  and whose mass  $M$  is  $8.5 \text{ kg}$ , rolls smoothly from rest down a  $25^\circ$  inclined plane whose length  $L$  is  $5.0 \text{ m}$ . What is the speed of the center of mass of the ball when it reaches the bottom of the inclined plane? (A:  $5.4 \text{ m/s}$ )

9. A  $2.5 \text{ kg}$  block travels around a  $0.50 \text{ m}$  radius circle with an angular velocity of  $12 \text{ rad/s}$ . Find the magnitude of the angular momentum of the block about the center of the circle. (A:  $7.5 \text{ kg}\cdot\text{m}^2/\text{s}$ )

10. An object of mass  $m = 100 \text{ g}$  and velocity  $=V_0$  is fired onto one end of a uniform thin rod ( $L = 0.4 \text{ m}$ ,  $M = 1.0 \text{ kg}$ ) initially at rest. The rod can rotate freely about an axis through its center ( $O$ ). The object sticks to the rod after collision. The angular velocity of the system (rod + object) is  $10 \text{ rad/s}$  immediately after the collision. Calculate  $V_0$ . (A:  $8.7 \text{ m/s}$ )