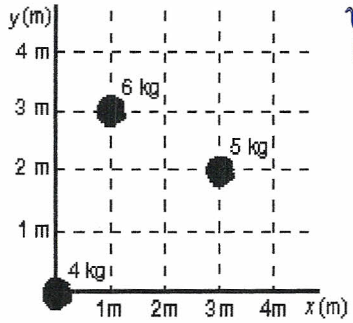
Sample Exam 3 KEY

1. The x,y coordinates, in meters, of the center of mass of the three-particle system shown below are:

$$X_{cm} = \frac{M_1 x_1 + M_2 x_2 + M_3 x_3}{M_1 + M_2 + M_3} = \frac{6(1) + 5(3) + 4(0)}{(6) + (5) + (4)} = 1.4\ m$$



$$y_{cm} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3}{m_1 + m_2 + m_3} = \frac{6(3) + 5(2) + 4(0)}{6 + 5 + 4} = 1.9\ m$$

A) 0, 0
B) 1.3 m, 1.7 m
C) 1.4 m, 1.9 m
D) 1.9 m, 2.5 m
E) 1.4 m, 2.5 m

2. The center of mass of a uniform disk of radius R is located:
A) on the rim
B) a distance $R/2$ from the center
C) a distance $R/3$ from the center
D) a distance $2R/3$ from the center
E) at the center

3. The center of mass of a system of particles remains at the same place if:
A) it is initially at rest and the external forces sum to zero
B) it is initially at rest and the internal forces sum to zero
C) the sum of the external forces is less than the maximum force of static friction
D) no friction acts internally
E) none of the above

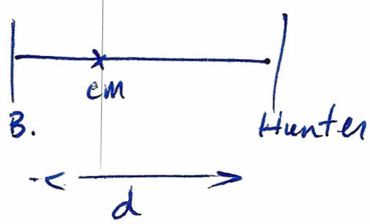
$\Sigma \vec{F}_{ext.} = M\vec{a} = 0$ if not moving
$\therefore \Sigma F_{ext.} = 0$

4. A 640-N hunter gets a rope around a 3200-N polar bear. They are stationary, 20 m apart, on frictionless level ice. When the hunter pulls the polar bear to him, the polar bear will move:
A) 1.0 m
B) 3.3 m
C) 10 m
D) 12 m
E) 17 m

$$X_{cm} = \frac{m_{P.B.}(0) + M_{Hunter}(d)}{M_{PB} + M_{Hunter}}$$

$$= \frac{(3200N)/g\ (0) + (640N/g)(20m)}{(3200 + 640)/g}$$

$$= 3.3 m$$



Choose toward wall as +

5. A 1.0 kg-ball moving at 2.0 m/s perpendicular to a wall rebounds from the wall at 1.5 m/s. The change in the momentum of the ball is:
   A) zero
   B) 0.5 kg · m /s away from wall
   C) 0.5 kg · m /s toward wall
   D) 3.5 kg · m /s away from wall
   E) 3.5 kg · m /s toward wall

$$\Delta\vec{p} = \vec{p}_f - \vec{p}_i = m(\vec{v}_f - \vec{v}_i)$$
$$= (1\,kg)(-1.5 - 2)\,m/s$$
$$= -3.5\ kg\cdot m/s$$

away from wall

6. A 64-kg woman stands on frictionless level ice. She kicks a 0.10-kg stone backwards with her foot so that the stone acquires a velocity of 1.1 m/s. The velocity (in m/s) acquired by the woman is:
   A) 1.1 forward
   B) 0.0017 backward
   C) 0.0017 forward
   D) 1.1 backward
   E) none of these

$$\Delta\vec{p} = 0 \Rightarrow p_f = p_i$$
frictionless
$$m_1 v_{1i} \stackrel{0}{=} m_1 v_{1f} - m_2 v_{2f}$$
$$v_{1f} = m_2 v_{2f}/m_1 = \frac{(0.10\,kg)(1.1\,m/s)}{64\,kg} \Rightarrow 1.7\times10^{-3}\,m/s$$

7. A man is marooned at rest on level frictionless ice. In desperation, he hurls his shoe to the right at 15 m/s. If the man weighs 720 N and the shoe weighs 4.0 N, the man moves to the left at approximately:
   A) 0
   B) 2.1×10^{-2} m/s
   C) 8.3×10^{-2} m/s
   D) 15 m/s
   E) 2.7×10^{-3} m/s

$$\Delta\vec{p} = 0 \Rightarrow p_f = p_i$$
frictionless
$$m_1 v_{1i} \stackrel{0}{=} m_1 v_{1f} - m_2 v_{2f}$$
$$v_{1f} = m_2 v_{2f}/m_1 = (4\,N/g)(15\,m/s)/(720\,N/g) = 0.08\bar{3}\,m/s$$

8. A 3.00-g bullet traveling horizontally at 400 m/s hits a 3.00-kg wooden block, which is initially at rest on a smooth horizontal table. The bullet buries itself in the block without passing through. The speed of the block/bullet after the collision is:
   A) 1.33 m/s
   B) 0.40 m/s
   C) 12.0 m/s
   D) 40.0 m/s
   E) 160 m/s

$$\Delta\vec{p} = 0 \Rightarrow \vec{p}_i = \vec{p}_f$$
$$m_1 v_{1i} = (m_1 + m_2)V$$
$$V = \frac{m_1 v_{1i}}{m_1 + m_2} = \frac{(0.003\,kg)(400\,m/s)}{(0.003 + 3)\,kg} = 0.399\,m/s$$

9. Bullets from two revolvers are fired with the same velocity. The bullet from gun #1 is twice as heavy as the bullet from gun #2. Gun #1 weighs three times as much as gun #2. The ratio of the momentum imparted to gun #1 to that imparted to gun #2 is:
   A) 2:3
   B) 3:2
   C) 2:1
   D) 3:1
   E) 6:1

$$m_1 = 2m_2,\quad M_{g1} = 3M_{g2}$$
Momentum: $m_1 v_{1i} \Rightarrow m_1 v_1 \Rightarrow \boxed{2m_2 v_1 = M_{g1} v_{g1f} = P_1}$

$m_2 v_{2i} \Rightarrow m_2 v_1 \Rightarrow \boxed{m_2 v_1 = \frac{1}{3}M_{g2} v_{g2f} = P_2}$

$$\frac{P_1}{P_2} = \frac{2m_2 v_1}{m_2 v_1} = \frac{2}{1}$$

1st energy for swing: $\Delta K + \Delta U = 0$

$\cancel{K_f} - K_i + U_f - \cancel{U_i} = 0$

$\frac{1}{2}(m_1+m_2)V^2 = (m_1+m_2)gh$

$V = \sqrt{2gh} = \sqrt{2(9.8)(\frac{3}{1000}m)}$

10. A 3-gram bullet is fired horizontally into a 10-kg block of wood suspended by a rope from the ceiling. The block swings in an arc, rising 3 mm above its lowest position. The velocity of the bullet was:
   A) 0.24 m/s
   B) 8.0×10^2 m/s
   C) 24.0 m/s
   D) 8.0 m/s
   E) 2.4×10^4 m/s

$V = 0.2425$ m/s

2nd collision:

$\Delta \vec{p} = 0$

$m_1 v_{1i} = (m_1+m_2)V$

$\rightarrow v_i = \frac{(m_1+m_2)}{m_1}(V)$

$= \frac{(10 + 0.003)kg}{0.003kg}(0.2425 m/s)$

$= 808$ m/s

11. Blocks A and B are moving toward each other. Block A has a mass of 2.0 kg and a velocity of 50 m/s, while B has a mass of 4.0 kg and a velocity of –25 m/s. They suffer a completely inelastic collision. The kinetic energy dissipated during the collision is:
   A) 0
   B) 1250 J
   C) 3750 J
   D) 5000 J
   E) 5600 J

stick together

$m_1 v_{1i} + m_2 v_{2i} = (m_1+m_2)V$

$\frac{(2)50 - (4)(25)}{(2+4)} = V = 0$

$\therefore \Delta K = \frac{1}{2}(m_1+m_2)V^2 - (\frac{1}{2}m_1 v_{1i}^2 + \frac{1}{2}m_2 v_{2i}^2)$

$\rightarrow \Delta K = -\frac{1}{2}((2)(50)^2 + 4(25)^2)$

$= -3750$ J

12. Two spacemen are floating together with zero speed in a gravity-free region of space. The mass of spaceman A is 120 kg and that of spaceman B is 90 kg. Spaceman A pushes B away from him with B attaining a final speed of 0.5 m/s. The final recoil speed of Spaceman A is:
   A) zero
   B) 0.38 m/s
   C) 0.50 m/s
   D) 0.67 m/s
   E) 1.0 m/s

Same as #7 $\Delta \vec{p} = 0$

$0 = m_A v_{Af} - m_B v_{Bf}$

$v_{Af} = \frac{m_B v_{Bf}}{m_A} = \frac{(90 kg)(0.5 m/s)}{120 kg} = 0.375$ m/s

13. Block A, with a mass of 2.0 kg, moves along the x axis with a velocity of 5.0 m/s in the positive x direction. It suffers an elastic collision with block B, which initially has a velocity of –2.0 m/s (in the negative x direction). The blocks leave the collision along the x axis. If B is much more massive than A, the velocity of A after the collision is:
   A) 0
   B) –3.0 m/s
   C) –5.0 m/s
   D) –7.0 m/s
   E) –9.0 m/s

$v_{Af} = \frac{m_A - m_B}{m_A + m_B} v_{Ai} + \frac{2m_B}{m_A+m_B} v_{Bi}$

$m_B >> m_A$

$\cong -v_{Ai} + 2v_{Bi}$

$= -5 m/s + 2(-2 m/s)$

$= -9$ m/s

14. A 5.0-g ball is moving downward at 100 cm/s. It undergoes an elastic collision with a heavy horizontal plate, which is fixed to the Earth. The change in momentum of the ball due to this collision is:
   A) 500 g · cm/s, up
   B) 1000 g · cm/s, up
   C) zero
   D) 500 g · cm/s, down
   E) 1000 g · cm/s, down

$\Delta \vec{p} = m_{ball}(\vec{v_f} - v_i)$ Earth doesn't move

$= (5\ g)(100\ cm/s\ \text{up} - 100\ cm/s\ \text{down})$

$= (5g)(-100\ \text{down} - 100\ \text{down}) = -1000\ g \cdot \frac{cm}{s}$ down

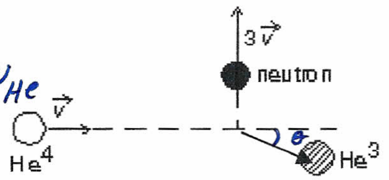
or $1000\ g \cdot cm/s$ up

15. A He[4] nucleus (atomic weight 4) moving with speed v breaks up into a neutron (atomic weight 1) and a He[3] nucleus (atomic weight 3). The neutron moves off at right angles to the original He[4] as shown. If the neutron speed is $3v$, the final speed of the He[3] nucleus is:

$x: (4)v = (3)\cos\theta\, v_{He}$

$y: 0 = (1)(3v) - (3)\sin\theta\, v_{He}$

dividing y by x:



   A) zero
   B) v
   C) $4v/3$
   D) $5v/3$
   E) none of these

$\tan\theta = 3/4$ i.e. $\sin\theta = 3/5$, $\cos\theta = 4/5$

then $v_{He} = \underset{y:}{\frac{v}{\sin\theta}} = \underset{x:}{\frac{4v}{3\cos\theta}}$ sub for $\sin\theta \Rightarrow$

$v_{He} = \frac{v}{\sin\theta} = \frac{v}{3/5} = \frac{5}{3}v$

16. The angular speed in rad/s of the second hand of a watch is:
   A) $\pi/1800$
   B) $\pi/60$
   C) $\pi/30$
   D) 2π
   E) 60

$\omega = \frac{2\pi\ rad}{60\ s} = \frac{\pi}{30}\ rad/s$

17. A phonograph turntable, rotating at 0.75 rev/s, slows down and stops in 30 s. The magnitude of its angular acceleration in rad/s^2 for this process is:
   A) 1.5
   B) 1.5π
   C) $\pi/40$
   D) $\pi/20$
   E) 0.75

$\underset{0}{\omega_f} = \omega_0 + \alpha t$

$\alpha = \frac{-\omega_0}{t} = -\frac{(0.75\ rev/s)(2\pi\ rad / 1\ rev)}{30\ s}$

$= 0.157\ rad/s^2 = \frac{\pi}{20}\ rad/s^2$

18. A wheel initially has an angular velocity of 18 rad/s but it is slowing at a rate of 2.0 rad/s^2. By the time it stops it will have turned through:

A) 13 rev
B) 26 rev
C) 39 rev
D) 52 rev
E) 65 rev

$\theta_f - \theta_i = \omega_o t + \frac{1}{2}\alpha t^2$ OR $\omega_f^2 = \omega_o^2 + 2\alpha(\theta_f - \theta_i)$

$\theta_f - \theta_i = \frac{\cancel{\omega_f^2} - \omega_o^2}{2\alpha} = \frac{-(18\ rad/s)^2}{2(-2\ rad/s^2)} = 81\ rad\left(\frac{1\ rev}{2\pi\ rad}\right)$

$= 12.89$ rev

19. A wheel starts from rest and has an angular acceleration of 4.0 rad/s^2. When it has made 10 rev its angular velocity is:

A) 16 rad/s
B) 22 rad/s
C) 32 rad/s
D) 250 rad/s
E) 500 rad/s

$\theta_f - \theta_i = \omega_o t + \frac{1}{2}\alpha t^2$ OR $\omega_f^2 = \omega_o^2 + 2\alpha(\theta_f - \theta_i)$

$\omega_f = \sqrt{\cancel{\omega_o^2} + 2\alpha(\theta_f - \theta_i)} = \sqrt{2(4\ rad/s^2)(10\ rev)\left(\frac{2\pi\ rad}{1\ rev}\right)}$

$= 22.4$ rad/s

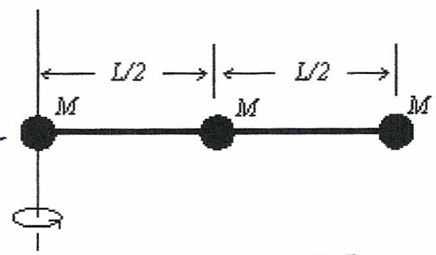
20. Three identical objects, each of mass M, are fastened to a massless rod of length L as shown. The rotational inertia about one end of the rod of this array is:

For pt. masses:

$I = \sum_i m_i r_i^2$

$= M(0)^2 + M(L/2)^2 + ML^2$

$= \frac{5}{4} ML^2$



Since rod is massless $I_{rod,end} = 0$

But can you do this problem if rod has Mass?
(Check your homework)

A) $ML^2/2$
B) ML^2
C) $3ML^2/2$
D) $5ML^2/4$
E) $3ML^2$

21. The rotational inertia of a solid uniform sphere about a diameter is $(2/5)MR^2$, where M is its mass and R is its radius. If the sphere is pivoted about an axis that is tangent to its surface, its rotational inertia is:

i.e. a distance R from CM

A) MR^2
B) $(2/5)MR^2$
C) $(3/5)MR^2$
D) $(5/2)MR^2$
E) $(7/5)MR^2$

$I_{new} = I_{cm} + Mh^2 = \frac{2}{5}MR^2 + MR^2$

$= \frac{7}{5}MR^2$

22. A solid uniform sphere of radius R and mass M has a rotational inertia about a diameter that is given by $(2/5)MR^2$. A light string of length $2R$ is attached to the surface and used to suspend the sphere from the ceiling. Its rotational inertia about the point of attachment at the ceiling is:

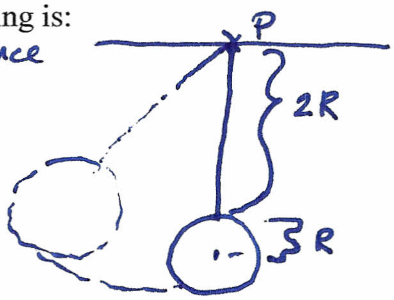
A) $(2/5)MR^2$
B) $4MR^2$
C) $(7/5)MR^2$
D) $(22/5)MR^2$
E) $(47/5)MR^2$

$I_p = I_{cm} + Mh^2$ where h = distance from CM to P

$I_p = \frac{2}{5}MR^2 + M(2R+R)^2$

$= \left(\frac{2}{5} + 9\right)MR^2 = 9\tfrac{2}{5}\,MR^2$

$= 47/5\ MR^2$



23. A thin circular hoop of mass 1.0 kg and radius 2.0 m is rotating about an axis through its center and perpendicular to its plane. It is slowing down at the rate of 7.0 rad/s^2. The net torque acting on it is:

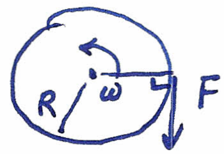
A) 7.0 N · m
B) 14.0 N · m
C) 28.0 N · m
D) 44.0 N · m
E) none of these

$\vec{\tau} = \vec{r} \times \vec{F} \Rightarrow |\vec{\tau}| = rF\sin 90° \Rightarrow RF$

also $\tau = I\alpha = (I_{Hoop})(\alpha)$

$|\tau| = (MR^2)(7\ rad/s^2) =$

$= (1kg)(2m)^2(7\ rad/s^2) = 28\ N \cdot m$



24. A certain wheel has a rotational inertia of 12 kg · m^2. As it turns through 5.0 rev its angular velocity increases from 5.0 rad/s to 6.0 rad/s. If the net torque is constant, its value is:

A) 0.016 N · m
B) 0.18 N · m
C) 0.57 N · m
D) 2.1 N · m
E) 3.6 N · m

$\omega_f^2 = \omega_0^2 + 2\alpha(\theta_f - \theta_i) \Rightarrow \alpha = \frac{\omega_f^2 - \omega_0^2}{2(\theta_f - \theta_i)} = \frac{(6)^2 - (5)^2}{2(5)(2\pi)}$

$\alpha = 0.175\ rad/s^2$

$\tau = I\alpha = 12\,kg \cdot m^2\,(0.175)\ rad/s^2 = 2.1\ N \cdot m$

25. A 16 kg block is attached to a cord that is wrapped around the rim of a flywheel of diameter 0.40 m and hangs vertically, as shown. The rotational inertia of the flywheel is 0.50 kg · m^2. When the block is released and the cord unwinds, the acceleration of the block is:

radius = 0.2 m

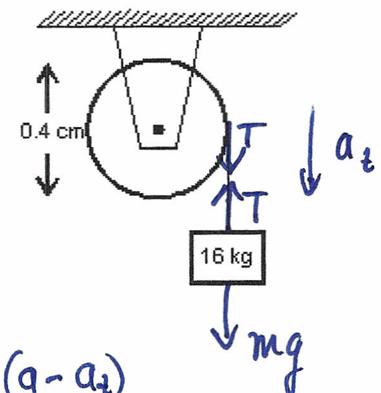
① $\Sigma F = m a_t = mg - T$

$\Rightarrow T = m(g - a_t)$

② $\Sigma \tau = I\alpha = I\,a_t/r$

also $\tau = rT$

combine $\Rightarrow T = \frac{\tau}{r} = \frac{I a_t}{r^2}$



A) 0.15 g
B) 0.56 g
C) 0.84 g
D) g
E) 1.3 g

and $\frac{I a_t}{r^2} = m(g - a_t)$

$\Rightarrow a_t = \frac{mg}{(I/r^2 + m)} = \frac{(16kg)\,g}{(0.5/(0.2)^2 + 16)\,kg} = 0.56\,g$

MR^2 High — $\frac{1}{2}MR^2$ med — $\frac{2}{5}MR^2$ Low

26. A hoop, a uniform disk, and a uniform sphere, all with the same mass and outer radius, start with the same speed and roll without slipping up identical inclines. Rank the objects according to how high they go, least to greatest.
A) hoop, disk, sphere
B) disk, hoop, sphere
C) sphere, hoop, disk
D) sphere, disk, hoop
E) hoop, sphere, disk

$K_{rot_i} + K_{trans_i} = U_f$

$\frac{1}{2}I\omega_i^2 + \frac{1}{2}mv_i^2 = mgh$

$\frac{1}{2}I\omega^2 + \frac{1}{2}m(\omega r)^2 = mgh$

$(\frac{1}{2}I + \frac{1}{2}mr^2)\omega^2 = mgh$

$h = (I + mr^2)\omega^2 / 2mg$

All have same m and same r. Only difference is I which is due to shape.
High I ⇒ High h
Low I ⇒ Low h

27. A sphere rolls without slipping along level ground at 5 m/s. Its mass is 0.20 kg and its radius is 0.25 cm. The sphere encounters an incline. How high up the incline does the center of mass of the sphere rise?
A) 0.36 m
B) 0.50 m
C) 1.3 m
D) 1.8 m
E) 5 m

Same as # 26

$h = \frac{(I + mr^2)\omega^2}{2mg}$ OR $\frac{(I+mr^2)}{2mg}\left(\frac{v}{r}\right)^2$

$= \frac{(\frac{2}{5}mr^2 + mr^2)(v/r)^2}{2mg} = \frac{(2/5+1)v^2}{2g} = \frac{7}{10}(5\ m/s)^2 / 9.8\ m/s^2$

cancel m's and r^2's $= 1.8\ m$

28. Two identical disks, with rotational inertia I (= 1/2 MR^2), roll without slipping across a horizontal floor and then up inclines. Disk A rolls up its incline without slipping. On the other hand, disk B rolls up a frictionless incline. Otherwise the inclines are identical. Disk A reaches a height 12 cm above the floor before rolling down again. Disk B reaches a height above the floor of:
A) 24 cm
B) 18 cm
C) 12 cm
D) 8 cm
E) 6 cm

DISK A: from # 26

$\frac{1}{2}I\omega^2 + \frac{1}{2}mv^2 = mgh$

$\frac{1}{2}I(v/R)^2 + \frac{1}{2}mv^2 = \frac{1}{2}(\frac{1}{2}mR^2)(v/R)^2 + \frac{1}{2}mv^2$

$(\frac{1}{4} + \frac{1}{2})mv^2 = mgh$

$h_A = \frac{3v^2}{4g}$ OR $v^2 = \frac{4gh_A}{3}$

DISK B: doesn't roll on incline

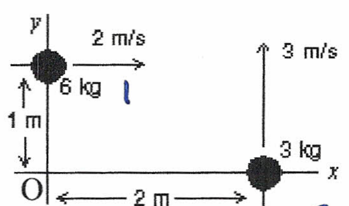
$\frac{1}{2}mv^2 = mgh$

$h_B = \frac{v^2}{2g}$

Same v ∴

$h_B = \frac{1}{2g}\left(\frac{4gh_A}{3}\right) = \frac{2}{3}h_A = 8\ cm$

29. Two objects are moving in the x,y plane as shown. The magnitude of their total angular momentum about the origin O is:



$\vec{l}_1 = \vec{r}_1 \times \vec{p}_1$

$= \vec{r}_1 \times m_1\vec{v}_1$

$= \begin{vmatrix} i & j & k \\ 0 & 1 & 0 \\ 2 & 0 & 0 \end{vmatrix}(6kg)$

$= -2\hat{k}(6kg)$

$= -12\hat{k}\ kg\cdot m^2/s$

$\vec{l}_2 = \vec{r}_2 \times \vec{p}_2$

$= \vec{r}_1 \times m_2\vec{v}_2$

$= \begin{vmatrix} i & j & k \\ 2 & 0 & 0 \\ 0 & 3 & 0 \end{vmatrix}(3kg)$

$= +6\hat{k}(3kg)$

$= 18\hat{k}\ kg\cdot m^2/s$

A) zero
B) 6 kg·m²/s
C) 12 kg·m²/s
D) 30 kg·m²/s
E) 78 kg·m²/s

$\vec{l}_1 + \vec{l}_2 = 6\hat{k}\ kg\cdot m^2/s$

paper clip's

30. A 15-g paper clip is attached to the rim of a phonograph record with a radius of 30 cm, spinning at 3.5 rad/s. The magnitude of its angular momentum is:
A) 1.4×10^{-3} kg · m²/s
B) 4.7×10^{-3} kg · m²/s
C) 1.6×10^{-2} kg · m²/s
D) 3.2×10^{-1} kg · m²/s
E) 1.1 kg · m²/s

$\vec{l} = \vec{r} \times \vec{p}$ OR $\underline{\vec{L} = I\vec{\omega}}$

$L = mr^2\omega = (0.015)\text{kg}(0.3\,\text{m})^2(3.5\,\text{rad/s})$

$= 4.7 \times 10^{-3}\ \text{kg}\cdot\text{m}^2/\text{s}$

31. A man, with his arms at his sides, is spinning on a light frictionless turntable. When he extends his arms:
A) his angular velocity increases
B) his angular velocity remains the same
C) his rotational inertia decreases
D) his rotational kinetic energy increases
E) his angular momentum remains the same

why? Frictionless means no external torques. ∴

$\Sigma\tau = 0 = \frac{d\vec{L}}{dt}$ and $\vec{L}$ = constant

32. A uniform sphere of radius R rotates about a diameter with angular momentum L. Under the action of internal forces the sphere collapses to a uniform sphere of radius $R/2$. Its new angular momentum is:
A) $L/4$
B) $L/2$
C) L
D) $2L$
E) $4L$

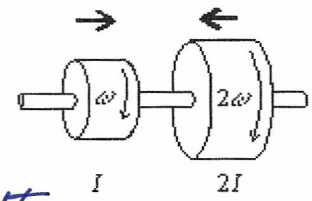
$\boxed{L_f = L_i}$ same!

for ω? $I_i\omega_i = I_f\omega_f$

$\frac{2}{5}MR^2\omega_i = \frac{2}{5}M\left(\frac{R}{2}\right)^2\omega_f$

$\rightarrow \omega_f = 4\omega_i$

33. 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 ω. The second disc has rotational inertia $2I$ and is spinning in the same direction as the first disc with angular velocity 2ω 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) $5\omega/3$
B) $\omega\sqrt{3}$
C) $\omega\sqrt{7/3}$
D) ω
E) 3ω

before = after

$L_i = I\omega + (2I)(2\omega) = (I+2I)\omega_f = L_f$

$\omega_f = \frac{I + 4I\omega}{I + 2I} = \frac{5I\omega}{3I} = \frac{5}{3}\omega$

34. A playground merry-go-round has a radius of 3.0 m and a rotational inertia of 600 kg · m^2. It is initially spinning at 0.80 rad/s when a 20-kg child crawls from the center to the rim. When the child reaches the rim the angular velocity of the merry-go-round is:

A) 0.62 rad/s
B) 0.73 rad/s
C) 0.80 rad/s
D) 0.89 rad/s
E) 1.1 rad/s

$$L_i = L_f$$

$$(m(0)^2 + I_{merry})\omega_i = (m(r)^2 + I_{merry})\omega_f$$

0

$$\omega_f = \frac{I_{merry}\,\omega_i}{mr^2 + I_{merry}} = \frac{(600\ kg\cdot m^2)(0.8\ rad/s)}{(20 kg)(3m)^2 + (600\ kg\cdot m^2)}$$

$$= 0.615\ rad/s$$

Answer Key -- Sample Exam #3 Spring 08

1. C
2. E
3. A
4. B
5. D
6. C
7. C
8. B
9. C
10. B
11. C
12. B
13. E
14. B
15. D
16. C
17. D
18. A
19. B
20. D
21. E
22. E
23. C
24. D
25. B
26. D
27. D
28. D
29. B
30. B
31. E
32. C
33. A
34. A