1. *Chapter 11, Problem 10*

A hollow sphere of radius 0.180 m, with rotational inertia \( I = 0.0350 \text{ kg} \cdot \text{m}^2 \) about a line through its center of mass, rolls without slipping up a surface inclined at 33.3° to the horizontal. At a certain initial position, the sphere's total kinetic energy is 19.0 J. (a) How much of this initial kinetic energy is rotational? (b) What is the speed of the center of mass of the sphere at the initial position? When the sphere has moved 1.10 m up the incline from its initial position, what are (c) its total kinetic energy and (d) the speed of its center of mass?

(a) Number 7.6 Units J
(b) Number 3.751114120212 Units m/s
(c) Number 9.409893091172 Units J
(d) Number 2.639844151244 Units m/s

2. *Chapter 11, Problem 12*

In the figure here, a solid brass ball of mass 0.117 g will roll smoothly along a loop-the-loop track when released from rest along the straight section. The circular loop has radius \( R = 0.1 \text{ m} \), and the ball has radius \( r \ll R \).

(a) What is \( h \) if the ball is on the verge of leaving the track when it reaches the top of the loop?
(b) If the ball is released at height \( h = 6R \), what is the magnitude of the horizontal force component acting on the ball at point \( Q \)?

(a) \( h = 0.270000000000 \) m
(b) \( F = 0.008198357143 \) N

3. Test Bank, Question 8

The coefficient of static friction between a certain cylinder and a horizontal floor is 0.40. If the rotational inertia of the cylinder about its symmetry axis is given by \( I = (1/2)MR^2 \), then the maximum acceleration the cylinder can have without sliding is:

- \( 0.1 \text{ g} \)
- \( 0.2 \text{ g} \)
- \( 0.4 \text{ g} \)
- \( 0.8 \text{ g} \)
- \( g \)
4. *Chapter 11, Problem 15

**Flying Circus of Physics**

A bowler throws a bowling ball of radius $R = 11$ cm along a lane. The ball (Fig. 11-38) slides on the lane with initial speed $v_{com,0} = 8.8$ m/s and initial angular speed $\omega_0 = 0$. The coefficient of kinetic friction between the ball and the lane is 0.33. The kinetic frictional force $f_k$ acting on the ball causes a linear acceleration of the ball while producing a torque that causes an angular acceleration of the ball. When speed $v_{com}$ has decreased enough and angular speed $\varphi$ has increased enough, the ball stops sliding and then rolls smoothly. During the sliding, what are the ball's (a) linear acceleration and (b) angular acceleration? (c) How long does the ball slide? (d) How far does the ball slide? (e) What is the linear speed of the ball when smooth rolling begins? Note that the clockwise direction is taken as negative.

\[ \text{Fig. 11-38} \]

Problem 15.

(a) Number $-3.234$ Units m/s$^2$
(b) Number $-73.5$ Units rad/s$^2$
(c) Number $0.777453838678$ Units s
(d) Number $5.864223240317$ Units m
(e) Number $6.285714285714$ Units m/s

5. *Chapter 11, Problem 71

In figure 11-60, a constant horizontal force $\vec{F}_{app}$ of magnitude 78.9 N is applied to a uniform solid cylinder by fishing line wrapped around the cylinder. The mass of the cylinder is 20.5 kg, its radius is 0.449 m, and the cylinder rolls smoothly on the horizontal surface. (a) What is the magnitude of the acceleration of the center of mass of the cylinder? (b) What is the magnitude of the angular acceleration of the cylinder about the center of mass? In unit-vector notation, what is the frictional force acting on the cylinder ((c), (d) and (e) for $\vec{i}$, $\vec{j}$ and $\vec{k}$ components respectively)?

\[ \text{Fig. 11-60} \]

Problem 71.

(a) Number $5.131707317073$ Units m/s$^2$
(b) Number $11.429192242925$ Units rad/s$^2$
(c) Number $26.3$ Units N
(d) Number $0$ Units N
(e) Number $0$ Units N
6. Test Bank, Question 17

A yo-yo, arranged as shown, rests on a frictionless surface. When a force $\vec{F}$ is applied to the string as shown, the yo-yo:

- moves to the left and rotates counterclockwise
- moves to the right and rotates counterclockwise
- moves to the left and rotates clockwise
- moves to the right and rotates clockwise
- moves to the right and does not rotate

7. *Chapter 11, Problem 84

Flying Circus of Physics

A yo-yo has a rotational inertia of 951 g·cm² and a mass of 147 g. Its axle radius is 1.77 mm, and its string is 132 cm long. Suppose that this yo-yo is thrown so that its initial speed down the string is 1.4 m/s. (a) How long does the yo-yo take to reach the end of the string? As it reaches the end of the string, what are its (b) total kinetic energy, (c) linear speed, (d) translational kinetic energy, (e) angular speed, and (f) rotational kinetic energy?

(a) Number 0.934794645178 Units s
(b) Number 31.368302106488 Units J
(c) Number 1.434149682091 Units m/s
(d) Number 0.151173720332 Units J
(e) Number 810.254057678419 Units rad/s
(f) Number 31.217128386155 Units J

8. Test Bank, Question 24

The angular momentum vector of Earth, due to its daily rotation, is directed:

- tangent to the equator toward the east
- tangent to the equator toward the west
- north
- south
9. *Chapter 11, Problem 31

In figure 11-42, a 0.400 kg ball is shot directly upward at initial speed 22.9 m/s. What is the magnitude of its angular momentum about $P$, 6.89 m horizontally from the launch point, when the ball is (a) at maximum height and (b) halfway back to the ground? What is the magnitude of the torque on the ball about $P$ due to the gravitational force when the ball is (c) at maximum height and (d) halfway back to the ground?

(a) Number 0 Units kg·m^2/s
(b) Number 44.627206016958 Units kg·m^2/s
(c) Number 27.03636 Units N·m
(d) Number 27.03636 Units N·m

10. *Chapter 11, Problem 73

A 4.68 kg toy car moves along an $x$ axis with a velocity given by $\vec{v} = -8.14t^3 \hat{i}$ m/s, with $t$ in seconds. For $t > 0$, what are (a) the angular momentum $\vec{L}$ of the car and (b) the torque $\vec{\tau}$ on the car, both calculated about the origin? What are (c) $\vec{L}$ and (d) $\vec{\tau}$ about the point (7.37 m, 5.33 m, 0)? What are (e) $\vec{L}$ and (f) $\vec{\tau}$ about the point (7.37 m, -5.33 m, 0)?

(a) $\vec{L} = (0 \text{ kg·m}^2/\text{s}) \hat{i} + (0 \text{ kg·m}^2/\text{s}) \hat{j} + (0 \text{ kg·m}^2/\text{s}) \hat{k}$
(b) $\vec{\tau} = (0 \text{ N·m}) \hat{i} + (0 \text{ N·m}) \hat{j} + (609.142248 \text{ N·m}) \hat{k}$
(c) $\vec{L} = (0 \text{ kg·m}^2/\text{s}) \hat{i} + (0 \text{ kg·m}^2/\text{s}) \hat{j} + (-203.047416 \text{ kg·m}^2/\text{s}) \hat{k}$
(d) $\vec{\tau} = (0 \text{ N·m}) \hat{i} + (0 \text{ N·m}) \hat{j} + (609.142248 \text{ N·m}) \hat{k}$
(e) $\vec{L} = (0 \text{ kg·m}^2/\text{s}) \hat{i} + (0 \text{ kg·m}^2/\text{s}) \hat{j} + (203.047416 \text{ kg·m}^2/\text{s}) \hat{k}$
(f) $\vec{\tau} = (0 \text{ N·m}) \hat{i} + (0 \text{ N·m}) \hat{j} + (609.142248 \text{ N·m}) \hat{k}$

11. Test Bank, Question 33

http://edugen.wileyplus.com/edugen/shared/assignment/test/agprint.uni?numberQuest=true&title... 2011/11/21
A uniform disk, a thin hoop, and a uniform sphere, all with the same mass and same outer radius, are each free to rotate about a fixed axis through its center. Assume the hoop is connected to the rotation axis by light spokes. With the objects starting from rest, identical forces are simultaneously applied to the rims, as shown. Rank the objects according to their angular momenta after a given time $t$, least to greatest.

- hoop, sphere, disk
- disk, hoop, sphere
- hoop, disk, sphere
- all tie

12. Test Bank, Question 40

A pulley with radius $R$ and rotational inertia $I$ is free to rotate on a horizontal fixed axis through its center. A string passes over the pulley. A block of mass $m_1$ is attached to one end and a block of mass $m_2$ is attached to the other. At one time the block with mass $m_1$ is moving downward with speed $v$. If the string does not slip on the pulley, the magnitude of the total angular momentum, about the pulley center, of the blocks and pulley, considered as a system, is given by:

- $(m_1 - m_2)vR + \frac{Iv}{R}$
- $(m_1 + m_2)vR + \frac{Iv}{R}$
- $(m_1 - m_2)vR - \frac{Iv}{R}$
- $(m_1 + m_2)vR - \frac{Iv}{R}$
- none of the above

13. *Chapter 11, Problem 41

Figure 11-45 shows a rigid structure consisting of a circular hoop of radius $R$ and mass $m$, and a square made of four thin bars, each of length $R$ and mass $m$. The rigid structure rotates at a constant speed about a vertical axis, with a period of rotation of 1.3 s. If $R = 1.7$ m and $m = 3.6$ kg, calculate the angular momentum about that axis.

Number 159.235248561799 Units kg·m$^2$/s

Significant digits are disabled; the tolerance is +/-2%
14. Test Bank, Question 45

When a man on a frictionless rotating stool extends his arms horizontally, his rotational kinetic energy:

- must increase
- must decrease
- must remain the same
- may increase or decrease depending on his initial angular velocity
- may increase or decrease depending on his angular acceleration

15. *Chapter 11, Problem 52

A cockroach of mass \( m \) lies on the rim of a uniform disk of mass \( 9m \) that can rotate freely about its center like a merry-go-round. Initially the cockroach and disk rotate together with an angular velocity of 0.319 rad/s. Then the cockroach walks halfway to the center of the disk.

(a) What then is the angular velocity of the cockroach-disk system?
(b) What is the ratio \( K/K_0 \) of the new kinetic energy of the system to its initial kinetic energy?

(a) \( \omega = 0.369368421053 \) rad/s
(b) \( K/K_0 = 1.157894736842 \)

16. *Chapter 11, Problem 66

In Fig. 11-58, a small 0.337 kg block slides down a frictionless surface through height \( h = 0.712 \) m and then sticks to a uniform vertical rod of mass \( M = 0.380 \) kg and length \( d = 1.84 \) m. The rod pivots about point \( O \) through angle \( \theta \) before momentarily stopping. Find \( \theta \).

![Fig. 11-58](Fig. 11-58
Problem 66)

Number 34.899982148606 Units ° (degrees)

Significant digits are disabled; the tolerance is +/-2%
17. *Chapter 11, Problem 63

In the figure here, a 31 kg child stands on the edge of a stationary merry-go-round of radius 2.2 m. The rotational inertia of the merry-go-round about its rotation axis is 100 kg·m². The child catches a ball of mass 1.1 kg thrown by a friend. Just before the ball is caught, it has a horizontal velocity of magnitude 10 m/s, at angle $\phi = 27^\circ$ with a line tangent to the outer edge of the merry-go-round, as shown. What is the angular speed of the merry-go-round just after the ball is caught?

$$\omega = 0.084437735489 \text{ rad/s}$$

*Significant digits are disabled; the tolerance is +/-2%*

18. *Chapter 11, Problem 65

Two 2.30 kg balls are attached to the ends of a thin rod of length 72.0 cm and negligible mass. The rod is free to rotate in a vertical plane without friction about a horizontal axis through its center. With the rod initially horizontal (Fig. 11-57), a 40.0 g wad of wet putty drops onto one of the balls, hitting it with a speed of 3.31 m/s and then sticking to it. (a) What is the angular speed of the system just after the putty wad hits? (b) What is the ratio of the kinetic energy of the system after the collision to that of the putty wad just before? (c) Through what angle (deg) will the system rotate before it momentarily stops?

(a) Number 0.079262452107 Units rad/s
(b) 0.008620689655
(c) Number 180.766964086974 Units ° (degrees)