**Chapter 10**

1. A wheel starts from rest and rotates with constant angular acceleration to reach an angular speed of 12.0 rad/s in 3.00 s. Find (a) the magnitude of the angular acceleration of the wheel and (b) the angle in radians through which it rotates in this time interval.

Solution:

2. A wheel 2.00 m in diameter lies in a vertical plane and rotates about its central axis with a constant angular acceleration of 4.00 rad/s2. The wheel starts at rest at *t* = 0, and the radius vector of a certain point *P* on the rim makes an angle of 57.38 with the horizontal at this time. At *t* = 2.00 s, find (a) the angular speed of the wheel and, for point *P*, (b) the tangential speed, (c) the total acceleration, and (d) the angular position.

Solution:

3. Find the net torque on the wheel in Figure P10.27 about the axle through *O*, taking *a* = 10.0 cm and *b* = 25.0 cm.



Solution:

**Chapter 11**



1. A cat usually lands on its feet regardless of the position from which it is dropped. A slow-motion film of a cat falling shows that the upper half of its body twists in one direction while the lower half twists in the oppo- site direction. (See Fig. CQ11.10.) Why does this type of rotation occur?

Solution:

2. A light, rigid rod of length , l = 1.00 m joins two particles, with masses *m*1 = 4.00 kg and *m*2 = 3.00 kg, at its ends. The combination rotates in the *xy* plane about a pivot through the center of the rod (Fig. P11.11). Determine the angular momentum of the system about the origin when the speed of each particle is 5 m/s.

Solution:

**Solutions for Chapter 10**

1. A wheel starts from rest and rotates with constant angular acceleration to reach an angular speed of 12.0 rad/s in 3.00 s. Find (a) the magnitude of the angular acceleration of the wheel and (b) the angle in radians through which it rotates in this time interval.

Solution:

(a) We start with ωf = ωi + αt and solve for the angular acceleration α:



(b) The angular position of a rigid object under constant angular acceleration is given by Equation 10.7:



2. A wheel 2.00 m in diameter lies in a vertical plane and rotates about its central axis with a constant angular acceleration of 4.00 rad/s2. The wheel starts at rest at *t* = 0, and the radius vector of a certain point *P* on the rim makes an angle of 57.38 with the horizontal at this time. At *t* = 2.00 s, find (a) the angular speed of the wheel and, for point *P*, (b) the tangential speed, (c) the total acceleration, and (d) the angular position.

Solution:

Given *r*=1.00 m, α=4.00 rad/s2, *ωi*=0, and *θi*=57.3º = 1.00 rad:

(a) *ωf*=*ωi*+*αt*=0+*αt*

At t=2.00 s, *ωf*=4.00 rad/s2 (2.00 s) = 8.00 rad/s

(b) *υ* = *rω*=(1.00 m)(8.00 rad/s) = 8.00 m/s

(c) 



The magnitude of the total acceleration is



The direction the total acceleration vector makes with respect to the radius to point P is



(d) 

3. Find the net torque on the wheel in Figure P10.27 about the axle through *O*, taking *a* = 10.0 cm and *b* = 25.0 cm.



Solution:

To find the net torque, we add the individual torques, remembering to apply the convention that a torque producing clockwise rotation is negative and a counterclockwise rotation is positive.





**ANS. FIG. P10.27**

The thirty-degree angle is unnecessary information.

**Solutions for Chapter 11**

1. A cat usually lands on its feet regardless of the position from which it is dropped. A slow-motion film of a cat falling shows that the upper half of its body twists in one direction while the lower half twists in the oppo- site direction. (See Fig. CQ11.10.) Why does this type of rotation occur?

Solution:

As the cat falls, angular momentum must be conserved. Thus, if the upper half of the body twists in one direction, something must get an equal angular momentum in the opposite direction. Rotating the lower half of the body in the opposite direction satisfies the law of conservation of angular momentum.

2. A light, rigid rod of length , l = 1.00 m joins two particles, with masses *m*1 = 4.00 kg and *m*2 = 3.00 kg, at its ends. The combination rotates in the *xy* plane about a pivot through the center of the rod (Fig. P11.11). Determine the angular momentum of the system about the origin when the speed of each particle is 5 m/s.

Solution:

Taking the geometric center of the compound object to be the pivot, the angular speed and the moment of inertia are

*ω* = *υ/r* = (5.00 m/s)/0.500 m = 10.0 rad/s

and

*I =***Σ***mr*2 = (4.00 kg)(0.500 m)2 + (3.00 kg)(0.500 m)2

= 1.75 kg · m2

By the right-hand rule, we find that the angular velocity is directed out of the plane. So the object’s angular momentum, with magnitude

*L* = *Iω* = (1.75 kg m2)(10.0 rad/s)

is the vector



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**ANS. FIG. P11.11**