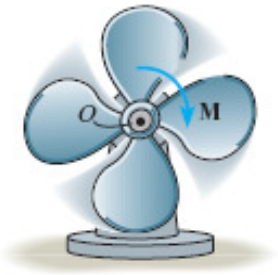
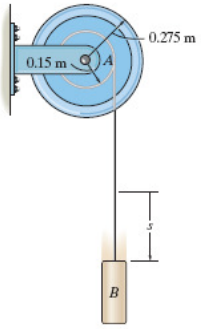
Exercise 9: Impulse and Momentum

1. [Prob. 17-55 and 19-5] Determine the angular velocity of the fan blades at *t=4sec*. Given that it is at rest at *t=0* and is subjected to a moment of $M = 3\left(1 - e^{-0.2t}\right)$. The blades have a total mass of *2 kg* and the moment of inertia about the centre is $I_O = 0.18\,\text{kg m}^2$.
   (a) using equations of motion
   (b) using principle of angular impulse and momentum

2. [Prob. 17-80 and 19-8] A 0.5 kg block B is suspended from the cord and released from rest. The cord is wrapped around the inner core of the *18 kg* spool. Determine the spool (disc) angular velocity at *t=3sec*. Given that the radius of gyration of the spool about axle *A* is $k_A = 0.125\,\text{m}$. You may neglect the mass of the cord.
   (a) using equations of motion
   (b) using principle of angular impulse and momentum



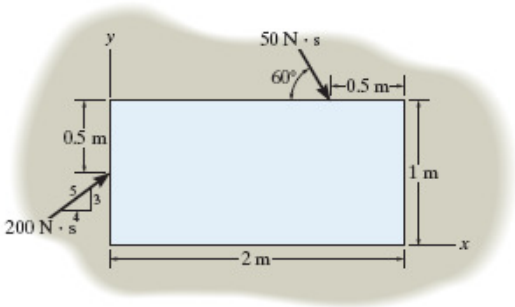
Prob. 17–55



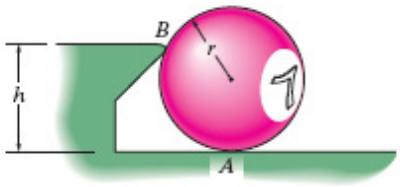
Prob. 17–80

3. [Prob. 19-25] The *10 kg* rectangular plate is at rest on a smooth horizontal floor. If it is given the horizontal impulses shown, determine its angular velocity and the velocity of the mass centre.

4. [Prob. 19-31] Determine the height of the bumper of the pool table, so that when the pool ball of mass *m* strikes it, no frictional fore will be developed between the ball and the table at *A*. assume the bumper exerts only a horizontal force on the ball.



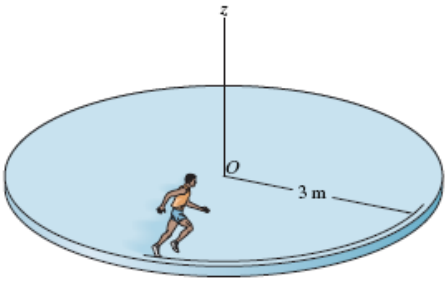
Prob. 19–25



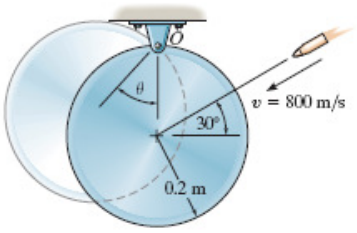
Prob. 19–31

5. [Prob. 19-46] A horizontal circular platform has a weight of *150 kg* and a radius of gyration $k_z = 2.4\ m$ about the z axis passing through its centre O. The platform is free to rotate about the z axis and is initially at rest. A *75 kg* man begins to run along the edge in a circular path of radius *3 m*. If he ha a speed of *1.2 m/s* and maintains this speed relative to the platform, determine the angular velocity of the platform. Neglect friction.

6. [Prob. 19-49] A *7 gram* bullet having a velocity of *800 m/s* is fired into the edge of the *5 kg* disc as shown. Determine the angular velocity of the disc just after the bullet becomes embedded in it. Also, calculate how far θ the disc will swing until it stops. The disc is initially at rest.



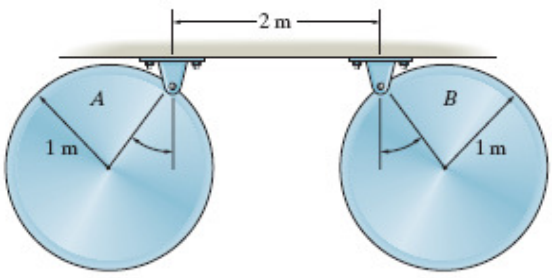
Prob. 19–46



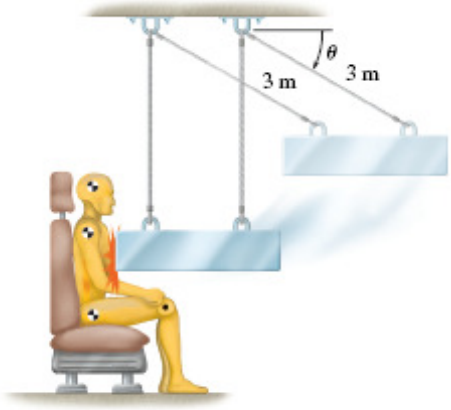
Prob. 19–49

7. [Prob. 19-50] The two disks each weigh *1000 kg*. If they are released from rest when $\theta=30^o$, determine θ after they collide and rebound from each other. The coefficient of restitution is $e=0.75$. when $\theta=0^o$, the disks hang so that they just touch one another.

8. [Prob. 19-54] Tests of impact on the fixed crash dummy are conducted using the *150 kg* ram that is released from rest at $\theta=30^o$, and allowed to fall and strike the dummy at $\theta=90^o$. If the coefficient of restitution between the dummy and the ram is $e=0.40$, determine the angle θ to which the ram will rebound before momentarily coming to rest.



Prob. 19–50



Prob. 19–54