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*Problem set 8*

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- The moment of inertia

Calculate the moment of inertia of a uniform solid cone about an axis through its center (Fig. 8.1). The cone has mass  $M$  and altitude  $h$ . The radius of its circular base is  $R$ .

- Torque

A square metal plate 0.180 m on each side is pivoted about an axis through point  $O$  at its center and perpendicular to the plate (Fig. 8.2). Calculate the net torque about this axis due to the three forces shown in the figure if the magnitudes of the forces are  $F_1 = 18.0$  N,  $F_2 = 26.0$  N, and  $F_3 = 14.0$  N. The plate and all forces are in the plane of the page.

- Torque and Angular Acceleration for a Rigid Body

A 12.0-kg box resting on a horizontal, frictionless surface is attached to a 5.00-kg weight by a thin, light wire that passes over a frictionless pulley (Fig. 8.3). The pulley has the shape of a uniform solid disk of mass 2.00 kg and diameter 0.500 m. After the system is released, find (a)

- a) the tension in the wire on both sides of the pulley,
- b) the acceleration of the box, and
- c) the horizontal and vertical components of the force that the axle exerts on the pulley.

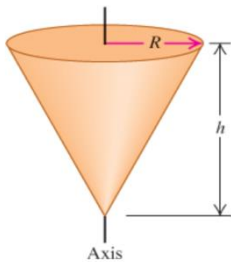


Figure 8.1

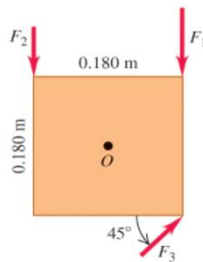


Figure 8.2

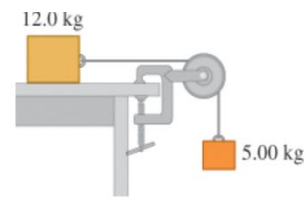


Figure 8.3

- The Yo-Yo

A yo-yo is made from two uniform disks, each with mass  $m$  and radius  $R$ , connected by a light axle of radius  $b$ . A light, thin string is wound several times around the axle and then held stationary while the yo-yo is released from rest, dropping as the string unwinds. Find the linear acceleration and angular acceleration of the yo-yo and the tension in the string.

- Asteroid Collision

In an upcoming disaster movie, an asteroid hits the earth and makes a day 25 hours long. Suppose the asteroid traveling straight toward the center of the earth were to collide with our planet at the equator and bury itself just below the surface. What would have to be the mass of this asteroid? Assume that the asteroid is very small compared to the earth and that the earth is uniform throughout. You can google the earth's mass.