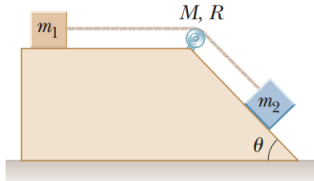


## Problems

- 32. Review.** A block of mass  $m_1 = 2.00$  kg and a block of mass  $m_2 = 6.00$  kg are connected by a massless string over a pulley in the shape of a solid disk having radius  $R = 0.250$  m and mass  $M = 10.0$  kg. The fixed, wedge-shaped ramp makes an angle of  $\theta = 30.0^\circ$  as shown in Figure P10.32. The coefficient of kinetic friction is 0.360 for both blocks. (a) Draw force diagrams of both blocks and of the pulley. Determine (b) the acceleration of the two blocks and (c) the tensions in the string on both sides of the pulley.



- 50.** Consider two objects with  $m_1 > m_2$  connected by a light string that passes over a pulley having a moment of inertia of  $I$  about its axis of rotation as shown in Figure P10.50. The string does not slip on the pulley or stretch. The pulley turns without friction. The two objects are released from rest separated by a vertical distance  $2h$ . (a) Use the principle of conservation of energy to find the translational speeds of the objects as they pass each other. (b) Find the angular speed of the pulley at this time.

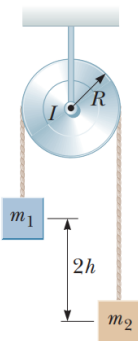


Figure P10.50

- 51.** The top in Figure P10.51 has a moment of inertia of  $4.00 \times 10^{-4}$  kg  $\cdot$  m<sup>2</sup> and is initially at rest. It is free to rotate about the stationary axis  $AA'$ . A string, wrapped around a peg along the axis of the top, is pulled in such a manner as to maintain a constant tension of 5.57 N. If the string does not slip while it is unwound from the peg, what is the angular speed of the top after 80.0 cm of string has been pulled off the peg?

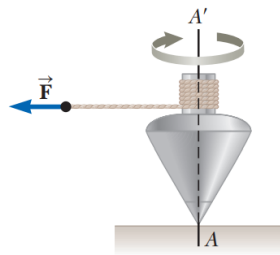


Figure P10.51

- 54. Review.** A thin, cylindrical rod  $\ell = 24.0$  cm long with mass  $m = 1.20$  kg has a ball of diameter  $d = 8.00$  cm and mass  $M = 2.00$  kg attached to one end. The arrangement is originally vertical and stationary, with the ball at the top as shown in Figure P10.54. The combination is free to pivot about the bottom end of the rod after being given a slight nudge. (a) After the combination rotates through 90 degrees, what is its rotational kinetic energy? (b) What is the angular speed of the rod and ball? (c) What is the linear speed of the center of mass of the ball? (d) How does it compare with the speed had the ball fallen freely through the same distance of 28 cm?

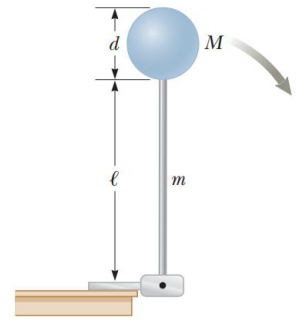


Figure P10.54

- 55. Review.** An object with a mass of  $m = 5.10$  kg is attached to the free end of a light string wrapped around a reel of radius  $R = 0.250$  m and mass  $M = 3.00$  kg. The reel is a solid disk, free to rotate in a vertical plane about the horizontal axis passing through its center as shown in Figure P10.55. The suspended object is released from rest 6.00 m above the floor. Determine (a) the tension in the string, (b) the acceleration of the object, and (c) the speed with which the object hits the floor. (d) Verify your answer to part (c) by using the isolated system (energy) model.

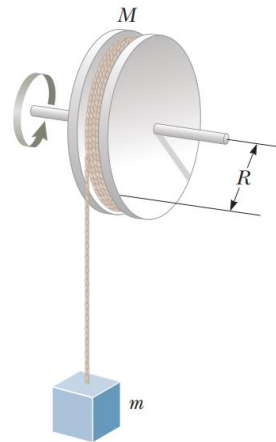


Figure P10.55

- 73.** A long, uniform rod of length  $L$  and mass  $M$  is pivoted about a frictionless, horizontal pin through one end. The rod is nudged from rest in a vertical position as shown in Figure P10.73. At the instant the rod is horizontal, find (a) its angular speed, (b) the magnitude of its angular acceleration, (c) the  $x$  and  $y$  components of the acceleration of its center of mass, and (d) the components of the reaction force at the pivot.

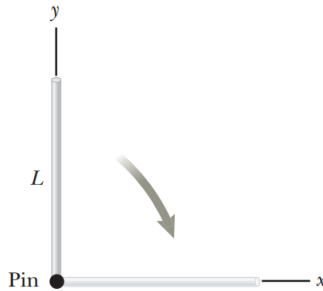


Figure P10.73

- 78. Review.** A string is wound around a uniform disk of radius  $R$  and mass  $M$ . The disk is released from rest with the string vertical and its top end tied to a fixed bar (Fig. P10.78). Show that (a) the tension in the string is one third of the weight of the disk, (b) the magnitude of the acceleration of the center of mass is  $2g/3$ , and (c) the speed of the center of mass is  $(4gh/3)^{1/2}$  after the disk has descended through distance  $h$ . (d) Verify your answer to part (c) using the energy approach.

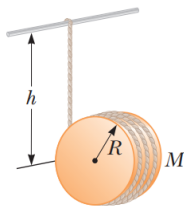


Figure P10.78