10–42 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 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 acceleration of the yo-yo and the tension in the string.

10–36 A large 15.0-kg roll of wrapping paper of radius $R = 12.0$ cm rests against the wall and is held in place by a bracket

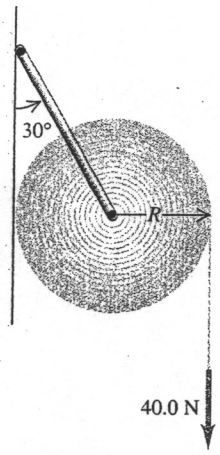


FIGURE 10–38

attached to a rod through the center of the roll (Fig. 10–38). The rod turns without friction in the bracket, and the moment of inertia of the paper and rod about the axis is $0.120\ \text{kg}\cdot\text{m}^2$. The coefficient of kinetic friction between the paper and the wall is $\mu_k = 0.20$. A constant vertical force $F = 40.0$ N is applied to the paper, and the paper unrolls. a) What is the magnitude of the force that the rod exerts on the paper as it unrolls? b) What is the angular acceleration of the roll?

10–39 A block with mass $m = 5.00$ kg slides down a surface inclined 37.0° to the horizontal (Fig. 10–40). The coefficient of kinetic friction is 0.20. A string attached to the block is wrapped around a flywheel on a fixed axis at O. The flywheel has a mass $M = 20.0$ kg, an outer radius $R = 0.200$ m, and a moment of inertia with respect to the axis of $0.300\ \text{kg}\cdot\text{m}^2$. a) What is the acceleration of the block down the plane? b) What is the tension in the string?

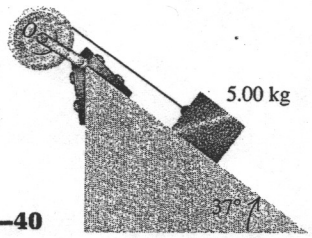


FIGURE 10–40

10–40 Atwood's Machine. Figure 10–41 represents an Atwood's machine. Find the linear accelerations of blocks A and B, the angular acceleration of the wheel C, and the tension in each side of the cord if there is no slipping between the cord and the surface of the wheel. Let the masses of blocks A and B be 5.00 kg and 2.00 kg, respectively, the moment of inertia of the wheel about its axis be $0.200\ \text{kg}\cdot\text{m}^2$, and the radius of the wheel be 0.100 m.

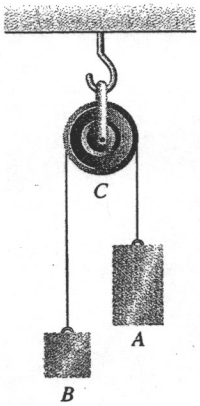
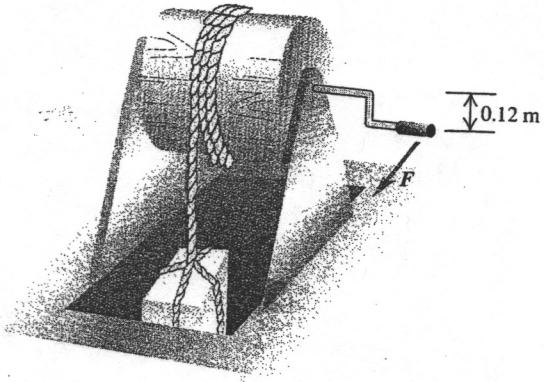


FIGURE 10–41



10–37 The mechanism shown in Fig. 10–39 is used to raise a crate of supplies from a ship's hold. The crate has a total mass of 50.0 kg. A rope is wrapped around a wooden cylinder that turns on a metal axle. The cylinder has radius 0.250 m and moment of inertia $I = 0.920\ \text{kg}\cdot\text{m}^2$ about the axle. The crate is suspended from the free end of the rope. One end of the axle is pivoted on frictionless bearings; a crank handle is attached to the other end. When the crank is turned, the end of the handle rotates about the axle in a vertical circle of radius 0.12 m, the cylinder turns, and the crate is raised. What magnitude of the force $\boldsymbol{F}$ applied tangentially to the rotating crank is required to raise the crate with an acceleration of $1.20\ \text{m/s}^2$? (The moment of inertia of the axle and of the crank and the mass of the rope can be neglected.)