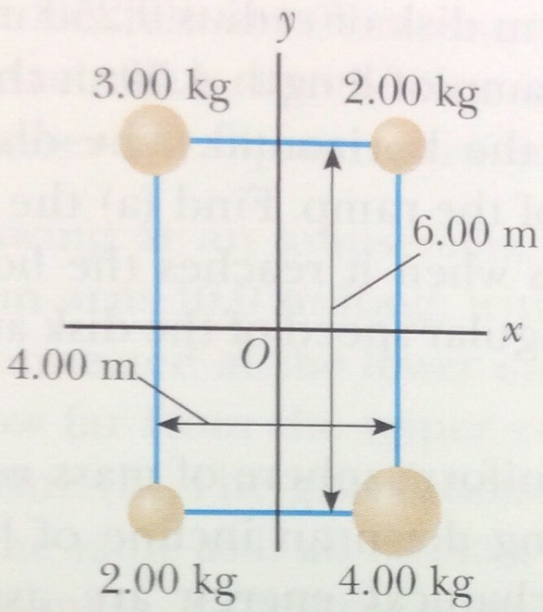

FIGURE P8.31 (Problems 31 and 32)

32. If the system shown in Figure P8.31 is set in rotation about each of the axes mentioned in Problem 30, find the torque that will produce an angular acceleration of 1.50 rad/s^2 in each case.

33. A large grinding wheel in the shape of a solid cylinder of radius 0.330 m is free to rotate on a frictionless, vertical axle. A constant tangential force of 250 N applied to its edge causes the wheel to have an angular acceleration of 0.940 rad/s^2. (a) What is the moment of inertia of the wheel? (b) What is the mass of the wheel? (c) If the wheel starts from rest, what is its angular velocity after 5.00 s have elapsed, assuming the force is acting during that time?

34. GP An oversized yo-yo is made from two identical solid disks each of mass $M = 2.00$ kg and radius $R = 10.0$ cm. The two disks are joined by a solid cylinder of radius $r = 4.00$ cm and mass $m = 1.00$ kg as in Figure P8.34.

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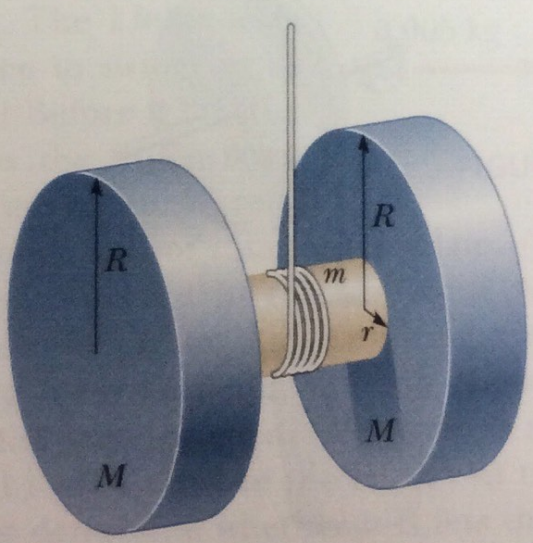

FIGURE P8.34

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numeric value for the system's acceleration? (i) What is the tension in the string? (j) How long does it take the system to drop 1.00 m from rest?

35. ecp A rope of negligible mass is wrapped around a 225-kg solid cylinder of radius 0.400 m. The cylinder is suspended several meters off the ground with its axis oriented horizontally, and turns on that axis without friction. (a) If a 75.0-kg man takes hold of the free end of the rope and falls under the force of gravity, what is his acceleration? (b) What is the angular acceleration of the cylinder? (c) If the mass of the rope were not neglected, what would happen to the angular acceleration of the cylinder as the man falls?

36. A potter's wheel having a radius of 0.50 m and a moment of inertia of 12 $kg \cdot m^2$ is rotating freely at 50 rev/min. The potter can stop the wheel in 6.0 s by pressing a wet rag against the rim and exerting a radially inward force of 70 N. Find the effective coefficient of kinetic friction between the wheel and the wet rag.

37. A model airplane with mass 0.750 kg is tethered by a wire so that it flies in a circle 30.0 m in radius. The airplane engine provides a net thrust of 0.800 N perpendicular to the tethering wire. (a) Find the torque the net thrust produces about the center of the circle. (b) Find the angular acceleration of the airplane when it is in level flight. (c) Find the linear acceleration of the airplane tangent to its flight path.

38. A bicycle wheel has a diameter of 64.0 cm and a mass of 1.80 kg. Assume that the wheel is a hoop with all the mass concentrated on the outside radius. The bicycle is placed on a stationary stand, and a resistive force of

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38. A bicycle wheel has a diameter of 64.0 cm and a mass of 1.80 kg. Assume that the wheel is a hoop with all the mass concentrated on the outside radius. The bicycle is placed on a stationary stand, and a resistive force of 120 N is applied tangent to the rim of the tire. (a) What force must be applied by a chain passing over a 9.00-cm-diameter sprocket in order to give the wheel an acceleration of 4.50 rad/s^2? (b) What force is required if you shift to a 5.60-cm-diameter sprocket?

39. A 150-kg merry-go-round in the shape of a uniform, solid, horizontal disk of radius 1.50 m is set in motion by wrapping a rope about the rim of the disk and pulling on the rope. What constant force must be exerted on the rope to bring the merry-go-round from rest to an angular speed of 0.500 rev/s in 2.00 s?

40. ecp An Atwood's machine consists of blocks of masses $m_1 = 10.0$ kg and $m_2 = 20.0$ kg attached by a cord running over a pulley as in Figure P8.40. The pulley is a solid cylinder with mass $M = 8.00$ kg and radius $r = 0.200$ m. The block of mass m_2 is allowed to drop, and the cord

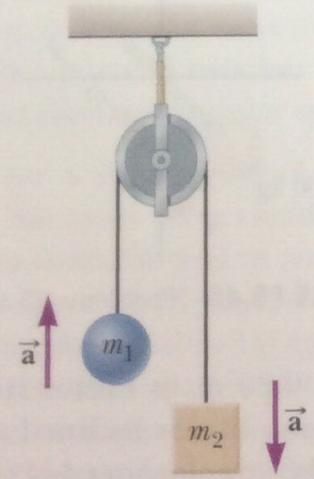

FIGURE P8.40

turns the pulley without slipping. (a) Why must the tension T_2 be greater than the tension T_1? (b) What is the acceleration of the system, assuming the pulley axis is frictionless? (c) Find the tensions T_1 and T_2.

41. An airliner lands with a speed of 50.0 m/s. Each wheel of the plane has a radius of 1.25 m and a moment of inertia of 110 kg·m^2. At touchdown, the wheels begin to spin under the action of friction. Each wheel supports a weight of 1.40×10^4 N, and the wheels attain their angular speed in 0.480 s while rolling without slipping. What is the coefficient of kinetic friction between the wheels and the runway? Assume that the speed of the plane is constant.

SECTION 8.6 ROTATIONAL KINETIC ENERGY

42. A car is designed to get its energy from a rotating flywheel with a radius of 2.00 m and a mass of 500 kg. Before a trip, the flywheel is attached to an electric motor, which brings the flywheel's rotational speed up to 5 000 rev/min. (a) Find the kinetic energy stored in the flywheel. (b) If the flywheel is to supply energy to the car as a 10.0-hp motor would, find the length of time the car could run before the flywheel would have to be brought back up to speed