

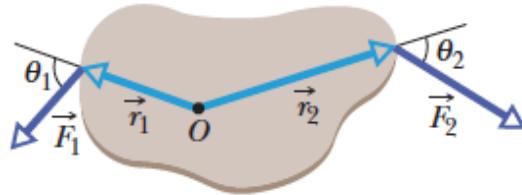
Warm-up problems to be done BEFORE recitation #8  
Physics 271, October 26 and 27, 2017

ROTATIONAL KINETIC ENERGY AND MOMENT OF INERTIA

- 35 **SSM** Two uniform solid cylinders, each rotating about its central (longitudinal) axis at 235 rad/s, have the same mass of 1.25 kg but differ in radius. What is the rotational kinetic energy of (a) the smaller cylinder, of radius 0.25 m, and (b) the larger cylinder, of radius 0.75 m?

TORQUE

- 45 **SSM ILW** The body in Fig. 10-36 is pivoted at  $O$ , and two forces act on it as shown. If  $r_1 = 1.30$  m,  $r_2 = 2.15$  m,  $F_1 = 4.20$  N,  $F_2 = 4.90$  N,  $\theta_1 = 75.0^\circ$ , and  $\theta_2 = 60.0^\circ$ , what is the net torque about the pivot?



WORK DONE BY TORQUE

- 59 An automobile crankshaft transfers energy from the engine to the axle at the rate of 100 hp ( $= 74.6$  kW) when rotating at a speed of 1800 rev/min. What torque (in newton-meters) does the crankshaft deliver?

CONSERVATION OF ANGULAR MOMENTUM I

- 47 **SSM** A track is mounted on a large wheel that is free to turn with negligible friction about a vertical axis (Fig. 11-48). A toy train of mass  $m$  is placed on the track and, with the system initially at rest, the train's electrical power is turned on. The train reaches speed 0.15 m/s with respect to the track. What is the angular speed of the wheel if its mass is  $1.1m$  and its radius is 0.43 m? (Treat the wheel as a hoop, and neglect the mass of the spokes and hub.)



Fig. 11-48 Problem 47.

## CONSERVATION OF ANGULAR MOMENTUM II

**••53 GO** A uniform thin rod of length 0.500 m and mass 4.00 kg can rotate in a horizontal plane about a vertical axis through its center. The rod is at rest when a 3.00 g bullet traveling in the rotation plane is fired into one end of the rod. As viewed from above, the bullet's path makes angle  $\theta = 60.0^\circ$  with the rod (Fig. 11-50). If the bullet lodges in the rod and the angular velocity of the rod is 10 rad/s immediately after the collision, what is the bullet's speed just before impact?



**Fig. 11-50** Problem 53.

## EQUILIBRIUM

**•7** A 75 kg window cleaner uses a 10 kg ladder that is 5.0 m long. He places one end on the ground 2.5 m from a wall, rests the upper end against a cracked window, and climbs the ladder. He is 3.0 m up along the ladder when the window breaks. Neglect friction between the ladder and window and assume that the base of the ladder does not slip. When the window is on the verge of breaking, what are (a) the magnitude of the force on the window from the ladder, (b) the magnitude of the force on the ladder from the ground, and (c) the angle (relative to the horizontal) of that force on the ladder?