

Warm-up problems to be done BEFORE recitation #9  
Physics 271, November 2 and 3, 2017

ROLLING WITHOUT SLIPPING

- 2 An automobile traveling at 80.0 km/h has tires of 75.0 cm diameter. (a) What is the angular speed of the tires about their axles? (b) If the car is brought to a stop uniformly in 30.0 complete turns of the tires (without skidding), what is the magnitude of the angular acceleration of the wheels? (c) How far does the car move during the braking?

KINETIC ENERGY OF A ROLLING OBJECT

- 3 **SSM** A 140 kg hoop rolls along a horizontal floor so that the hoop's center of mass has a speed of 0.150 m/s. How much work must be done on the hoop to stop it?

FORCES ON A ROLLING WHEEL

- 11 In Fig. 11-34, a constant horizontal force  $\vec{F}_{\text{app}}$  of magnitude 10 N is applied to a wheel of mass 10 kg and radius 0.30 m. The wheel rolls smoothly on the horizontal surface, and the acceleration of its center of mass has magnitude  $0.60 \text{ m/s}^2$ . (a) In unit-vector notation, what is the frictional force on the wheel? (b) What is the rotational inertia of the wheel about the rotation axis through its center of mass?

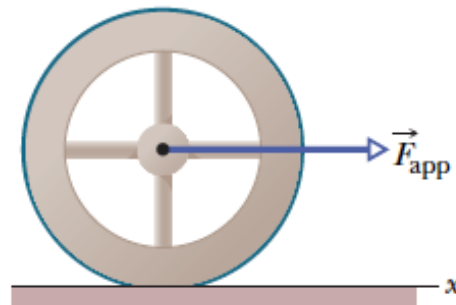



Fig. 11-34 Problem 11.

**NOTE THREE MORE PROBLEMS ON NEXT PAGE**

### THE YO-YO

- 18**  In 1980, over San Francisco Bay, a large yo-yo was released from a crane. The 116 kg yo-yo consisted of two uniform disks of radius 32 cm connected by an axle of radius 3.2 cm. What was the magnitude of the acceleration of the yo-yo during (a) its fall and (b) its rise? (c) What was the tension in the cord on which it rolled? (d) Was that tension near the cord's limit of 52 kN?

### CONSERVATION OF ANGULAR MOMENTUM

- 51** **SSM** **ILW** A wheel is rotating freely at angular speed 800 rev/min on a shaft whose rotational inertia is negligible. A second wheel, initially at rest and with twice the rotational inertia of the first, is suddenly coupled to the same shaft. (a) What is the angular speed of the resultant combination of the shaft and two wheels? (b) What fraction of the original rotational kinetic energy is lost?

### CONSERVATION OF ENERGY

- 83** A solid sphere of weight 36.0 N rolls up an incline at an angle of  $30.0^\circ$ . At the bottom of the incline the center of mass of the sphere has a translational speed of 4.90 m/s. (a) What is the kinetic energy of the sphere at the bottom of the incline? (b) How far does the sphere travel up along the incline? (c) Does the answer to (b) depend on the sphere's mass?