Chapter 10

Problems & Exercises

1.

$\omega = 0.737$ rev/s

3.

(a) -0.26 rad/s^2

(b) 27 rev

5.

(a) 80 rad/s^2

(b) 1.0 rev

7.

(a) 45.7 s

(b) 116 rev

9.

a) 600 rad/s^2

b) 450 rad/s

c) 21.0 m/s

10.

(a) 0.338 s

(b) 0.0403 rev

(c) 0.313 s

12.

0.50 kg $\cdot$ m^2

14.

(a) 50.4 $N \cdot$ m

(b) 17.1 rad/s^2

(c) 17.0 rad/s^2

16.

3.96×10^{18} s

or 1.26×10^{11} y

18.

$$I_{end} = I_{center} + m\left(\tfrac{l}{2}\right)^2$$

$$\text{Thus, } I_{center} = I_{end} - \tfrac{1}{4}ml^2 = \tfrac{1}{3}ml^2 - \tfrac{1}{4}ml^2 = \tfrac{1}{12}ml^2$$

19.

(a) 2.0 ms

(b) The time interval is too short.

(c) The moment of inertia is much too small, by one to two orders of magnitude. A torque of 500 N $\cdot$ m is reasonable.

20.

(a) 17,500 rpm

(b) This angular velocity is very high for a disk of this size and mass. The radial acceleration at the edge of the disk is $>$ 50,000 gs.

(c) Flywheel mass and radius should both be much greater, allowing for a lower spin rate (angular velocity).

21.

(a) 185 J

(b) 0.0785 rev

(c) $W = 9.81$ N

23.

(a) 2.57×10^{29} J

(b) $\text{KE}_{\text{rot}} = 2.65 \times 10^{33}$ J

25.

$\text{KE}_{\text{rot}} = 434$ J

27.

(a) 128 rad/s

(b) 19.9 m

29.

(a) 10.4 rad/s^2

(b) net $W = 6.11$ J

34.

(a) 1.49 kJ

(b) 2.52×10^4 N

36.

(a) 2.66×10^{40} kg $\cdot$ m^2/s

(b) 7.07×10^{33} kg $\cdot$ m^2/s

The angular momentum of the Earth in its orbit around the Sun is 3.77×10^6 times larger than the angular momentum of the Earth around its axis.

38.

22.5 kg $\cdot$ m^2/s

40.

25.3 rpm

43.

(a) 0.156 rad/s

(b) 1.17×10^{-2} J

(c) 0.188 kg $\cdot$ m/s

45.

(a) 3.13 rad/s

(b) Initial KE = 438 J, final KE = 438 J

47.

(a) 1.70 rad/s

(b) Initial KE = 22.5 J, final KE = 2.04 J

(c) 1.50 kg $\cdot$ m/s

48.

(a) 5.64×10^{33} kg $\cdot$ m^2/s

(b) 1.39×10^{22} N $\cdot$ m

(c) 2.17×10^{15} N