Chapter 6

Problems & Exercises

1.

723 km

3.

5×10^7 rotations

5.

117 rad/s

7.

76.2 rad/s

728 rpm

8.

(a) 33.3 rad/s

(b) 500 N

(c) 40.8 m

10.

12.9 rev/min

12.

4×10^{21} m

14.

a) 3.47×10^4 m/s^2, 3.55×10^3 g

b) 51.1 m/s

16.

a) 31.4 rad/s

b) 118 m/s

c) 384 m/s

d)The centripetal acceleration felt by Olympic skaters is 12 times larger than the acceleration due to gravity. That's quite a lot of acceleration in itself. The centripetal acceleration felt by Button's nose was 39.2 times larger than the acceleration due to gravity. It is no wonder that he ruptured small blood vessels in his spins.

18.

a) 0.524 km/s

b) 29.7 km/s

20.

(a) 1.35×10^3 rpm

(b) 8.47×10^3 m/s^2

(c) 8.47×10^{-12} N

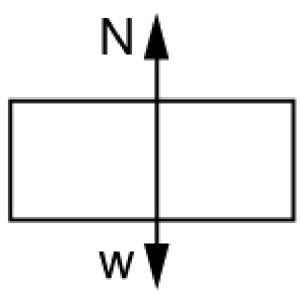
(d) 865

21.

(a) 16.6 m/s

(b) 19.6 m/s^2

(c)



(d) 1.76×10^3 N or 3.00 w , that is, the normal force (upward) is three times her weight.

(e) This answer seems reasonable, since she feels like she's being forced into the chair MUCH stronger than just by gravity.

22.

a) 40.5 m/s^2

b) 905 N

c) The force in part (b) is very large. The acceleration in part (a) is too much, about 4 g.

d) The speed of the swing is too large. At the given velocity at the bottom of the swing, there is enough kinetic energy to send the child all the way over the top, ignoring friction.

23.

a) 483 N

b) 17.4 N

c) 2.24 times her weight, 0.0807 times her weight

25.

4.14º

27.

a) 24.6 m

b) 36.6 m/s^2

c) $a_\mathrm{c} = 3.73\ g$. This does not seem too large, but it is clear that bobsledders feel a lot of force on them going through sharply banked turns.

29.

a) 2.56 rad/s

b) 5.71

30.

a) 16.2 m/s

b) 0.234

32.

a) 1.84

b) A coefficient of friction this much greater than 1 is unreasonable .

c) The assumed speed is too great for the tight curve.

33.

a) 5.979×10^{24} kg

b) This is identical to the best value to three significant figures.

35.

a) 1.62 $\mathrm{m/s}^2$

b) 3.75 $\mathrm{m/s}^2$

37.

a) 3.42×10^{-5} $\mathrm{m/s}^2$

b) 3.34×10^{-5} $\mathrm{m/s}^2$

The values are nearly identical. One would expect the gravitational force to be the same as the centripetal force at the core of the system.

39.

a) 7.01×10^{-7} N

b) 1.35×10^{-6} N, 0.521

41.

a) 1.66×10^{-10} m/s^2

b) 2.17×10^5 m/s

42.

a) 2.937×10^{17} kg

b) 4.91×10^{-8}

of the Earth's mass.

c) The mass of the mountain and its fraction of the Earth's mass are too great.

d) The gravitational force assumed to be exerted by the mountain is too great.

44.

1.98×10^{30} kg

46.

$\frac{M_J}{M_E} = 316$

48.

a) 2.11×10^4 m/s

b) 1.05×10^4 m/s

c) 2.86×10^{-7} s

d) 1.83×10^8 N

e) 2.22×10^5 J

49.

a) 5.08×10^3 km

b) This radius is unreasonable because it is less than the radius of earth.

c) The premise of a one-hour orbit is inconsistent with the known radius of the earth.

51.

(a) The normal force is greatest at point B. At point A, the normal force and the weight are the net force; at point B, only the normal force points in the same direction as the net force.

(b) i. This is not consistent because a larger radius should decease the net force and tension, not increase it. ii. This does not make sense because $F_c = mv^2/r$.

(c)