Chapter 14 Even Answers

2. (a) 2.50×10^{-5} N (b) between the masses and 0.245 m from the 500 kg mass

4. 2.00 kg and 3.00 kg

6. $\rho_M/\rho_E = 2/3$

8. (a) 1.02×10^3 m/s (b) 1.35 mm

10. 2.67×10^{-7} m/s^2

12. (a) 3.46×10^8 m (b) 3.34×10^{-3} m/s^2 toward the Earth

14. (a) 4.23×10^7 m (b) 0.285 s

16. $M = 2v^3T/\pi G$

18. 35.2 A.U.

20. Planet Y has gone through 1.30 revolutions

22. 1.63×10^4 rad/s

24. (a) 1.31×10^{17} N (b) 2.62×10^{12} N/kg

26. $GMr(a^2 + r^2)^{-3/2}$ toward center of ring

28. 4.17×10^{10} J

30. 2.52×10^7 m

32. 2.82×10^9 J

34. (a) 42.1 km/s (b) 2.20×10^{11} m (1.47 A.U.)

36. (a) $2\pi\sqrt{\dfrac{(R_E + h)^3}{GM_E}}$ (b) $\sqrt{\dfrac{GM_E}{R_E + h}}$ (c) $GM_Em\left[\dfrac{R_E + 2h}{2R_E(R_E + h)}\right] - \dfrac{2\pi^2R_E^2\,m}{(86400\ \text{s})^2}$

38. 469 MJ

40. (a) 10.0 m/s^2 (b) 21.8 km/s

42. 11.8 km/s

46. (b) 1.81 h (c) the moon's core is not molten

48. (a) $\dfrac{Gmm_1a}{R_1^3}$ toward the center (b) $\dfrac{Gmm_1}{b^2}$ toward the center

(c) $\dfrac{Gm(m_1 + m_2)}{c^2}$ toward the center

50. $\dfrac{2}{3}\sqrt{\dfrac{GM}{R}}$ for M, $\dfrac{1}{3}\sqrt{\dfrac{GM}{R}}$ for $2M$

52. (c) 1.85×10^{-5} m/s^2

54. $v = 492$ m/s

56. $\omega = 0.0572$ rad/s (or 1 rev in 110 s)

58. (a) $G^{1/2}c^{-3/2}h^{1/2}$ (b) $\sim 10^{-34}$ m

60. (a) $\dfrac{dg}{dr} = 4\pi G\left[\rho(r) - \dfrac{2}{3}\rho_{av}(r)\right]$

(b) the value of g increases as one descends into the Earth

62. (a) 2.93×10^4 m/s (b) $K = 2.74 \times 10^{33}$ J, $U = -5.40 \times 10^{33}$ J

(c) $K = 2.57 \times 10^{33}$ J, $U = -5.22 \times 10^{33}$ J

64. (a) 850 MJ (b) 2.71×10^9 J

66. (a) 2.26×10^8 yr (b) $\sim 10^{11}$ solar masses, $\sim 10^{11}$ stars

68. $v = \sqrt{2MG\left(\dfrac{1}{R} + \dfrac{1}{r}\right)} = \sqrt{2R^2g\left(\dfrac{1}{R} + \dfrac{1}{r}\right)}$

70. (a) 2.77 m/s^2 (b) 3.70 m/s^2