Chapter 6 Answers to Problems

1. 75 J **2.** 3.1 kJ **3.** no work is done **4.** 13 kJ **5.** 210 kJ **6.** (a) 47 kJ (b) −47 kJ (c) 47 kJ **7.** (a) zero (b) 8.8 J **8.** 153 J **9.** 1.3 m **10.** 720 kJ **11.** 15.6 J **12.** 27.2 kJ, 163 kJ **13.** (a) 0.70 J (b) 0.37 m/s **14.** 0.12 N **15.** 0 **16.** −550 J **17.** −4.17 kJ **18.** (a) 50 MJ (b) 600 kN opposite the plane's direction of motion **19.** 5.8 MJ, 0.46 MJ, The meteoroid has more than 12 times the kinetic energy of the car. **20.** 54.8 kJ **21.** (a) zero (b) 3.4 kJ (c) dissipated as heat **22.** (a) 12 MJ (b) 3.1 MJ **23.** (a) 0 (b) −2.9 J **24.** (a) 4.43 m/s (b) 4.03 m/s **25.** (a) 2 (b) 1.88 kJ (c) 1.88 kJ (d) 8.00 m **26.** 2.5 kJ **27.** (a) 14.3 m/s (b) yes; the cart will reach position 4 **28.** 25 m/s, 18 m/s, 21 m/s **29.** 8.42 m/s **30.** 1.9 m **31.** −52 kJ **32.** 25 m **33.** (a) $\sqrt{(v^2+2gh)}$ (b) the final speed is independent of the angle **34.** 2.9 m/s **35.** (a) 0.286 N/cm (b) 11.0 cm **36.** (a) 6.09 kJ, 0 J (b) 6.09 kJ, 0 J, −2.34 kJ, 73.0 N opposite the direction of motion, 0.103 **37.** 2.37 km/s **38.** 60.0 km/s **39.** 13.0 km/s **40.** 22.4 km/s **41.** 2 **42.** 11.2 km/s **43.** 10.0 km/s **44.** 55 km/s **45.** 1.6 km/ s **46.** 10,500 m/s **47.** 8 J **48.** 1.6 J **49.** 5.2 J **50.** (a) 3200 N/cm (b) 4.0 J **51.** (a) 4.9 cm (b) 1.4 N/cm (c) 88 mJ **52.** (a) 6.0×10^{10} N/m (b) 8.0 nm (c) 1.9 μJ **53.** (a) 1.9 N/cm (b) 0.49 J (c) 2.4 kg **54.** (a) 1.5 J (b) 1.1 J **55.** Zero **56.** 0.5 J **57.** 0.35 m **58.** $4h$ **59.** 13 m **60.** (a) $d\sqrt{(k/m)}$ (b) d **61.** 8.7 cm **62.** 115 N/m **63.** (a) 2.2 m/s (b) 0.21 m (c) 0.50 m **64.** 13.0 s **66.** 4.08 min **67.** 22 W **68.** 150 W **69.** (a) 20 N (b) 6.7 m/s **70.** (a) 80.0 kW (b) 0.079 L **71.** 60 kW **72.** (a) 510 W (b) no **73.** 6.2 g, The other 90% of the energy is dissipated as heat **74.** (a) 8.8 kW (b) 6.4 kW **75.** 930 kW **76.** (a) −500 J (b) 3 GW (c) 300,000 households **77.** 4.8 m/s **78.** 6.1 m **79.** 16 m/s **80.** 200 ft **82.** 6.0 m/s **83.** (a) $k/2$ (b) $2k$ **84.** (a) 19.8 m/s (b) 29.0 kN (c) 25.0 m **85.** 27 N **86.** (a) 25 N/m (b) 25 m/s **87.** 0.33 m **88.** (a) 3.45 kJ (b) 4.96 kJ (c) −1.52 kJ (d) 187 N **89.** 1.6 m/s **90.** (a) 94 W (b) 2.0 MJ (c) 490 Calories **91.** (a) 10 kW (b) 5.8º **92.** 20.0 J **93.** (a) 2.62 kW (b) 7.85 kW **94.** (a) 124 J (b) 10,300 fastballs **95.** (a) 2200 kcal/day (b) more than 0.51 lb **96.** 5.8 m/s **97.** (b) 4.9 m/s (c) 1.24 m **98.** 43.5 km/s **99.** $2R/3$ **100.** (a) $k_1k_2/(k_1+k_2)$ (b) 0.15 J **101.** (a) $k = k_1+k_2$ (b) 0.16 J **102.** (a) $\sqrt{(5g(L-d))}$ (b) $\cos^{-1}(5d/2L-3/2)$ **103.** 1.3 cm, 32 J **104.** (a) 0.5 J (b) zero (c) some of the energy is dissipated as heat **105.** (a) 26 cm (b) 34 cm **106.** (a) 500 m^3 (b) 600 kg (c) 30 kJ (d) 12 kW (e) 1/8, The power production of wind turbines is inconsistent, since modest changes in wind speed produce large changes in power output. **108.** $v\propto1/L$ **109.** kinetic energy cannot be negative, no, it must remain in the region $x < 3$ cm **110.** 100 J, Since the final kinetic energy is positive, the answer is yes