Chapter 11 Answers to Problems

1. 52 W/m^2 **2.** (a) 260 m (b) 1.5×10^{-10} W/m^2 **3.** 170 mW/m^2 **4.** 31 kW **5.** 4.0×10^{26} W **6.** (a) 1.5 m/s (b) 21 cm/s **7.** (a) 6.0 m (b) 1.7 s **8.** 3.8 g/m **9.** 168 m/s **10.** The pulse moves faster on the second string. 6.9 ms **11.** 16 ms **12.** 250 m/s **13.** 0.375 m **14.** 400 Hz **15.** (a) 340 Hz (b) 3.0×10^8 Hz **16.** 4.3×10^{14} Hz to 7.5×10^{14} Hz **17.** 0.33 Hz **18.** 4.8 m **19.** 0.83 cm/s **20.** (a) 3.5 cm (b) 6.0 cm **21.** (a) 4.0 mm (b) 1.0 m (c) 0.010 s (d) 100 m/s (e) in the +x-direction (to the right) **22.** (a) 2.9 m/s (b) 370 m/s^2 (c) 8.7 m/s (d) The motion of the particles on the string is not the same as the motion of the wave along the string. **23.** $y(x,t)$ = (0.120 m)sin[(134 s^{-1})t + (20.9 m^{-1})x] **24.** $y(x,t)$ = (2.50 cm)sin[(8.00 rad/m)x – (2.90 rad/s)t] **25.** (a) 2.6 cm (b) 14 m (c) 20 m/s (d) 1.4 Hz (e) 0.70 s **26.** (a) 4.0 cm 0.020 cm 1.2 cm/s (b) $\pi/189$ s = 16.6 ms **27.** 0.063 m/s 0.79 m/s^2 **29.** (c) $y(x,t)$ = (0.80 mm)sin($kx - \omega t$) represents a wave traveling in the +x-direction. $y(x,t)$ = (0.50 mm)sin($kx + \omega t$) represents a wave traveling in the –x-direction. **30.** (a) to the left (b) 2.0 mm 1600 rad/s 160 rad/m (c) 1.0 ms, 5.0 ms, 9.0 ms **33.** (a) 6.9 cm (b) 5.7 cm **34.** 120º **35.** 96.0º **36.** 375 nm **37.** 1.7 s **38.** 5.3 s **39.** (a) 0º 8.0 cm (b) 180º 2.0 cm (c) 4:1 **40.** (a) 0º 9.0 cm (b) 180º 3.0 cm (c) 9:1 **41.** 79 mW/m^2 **42.** 80 μW/m^2 **43.** (a) 0.25 W/m^2 (b) 0.010 W/m^2 (c) 0.130 W/m^2 **44.** 106 Hz and 137 Hz **45.** 7.8% **46.** The frequency increases by 7%. **47.** 0.016 m **48.** (a) 1350 m/s (b) 45.6 N (c) 0.76 m and 450.0 Hz **49.** (a) 33 Hz (b) 300 N **50.** 616 Hz **51.** 4.5×10^{-4} kg/m **52.** 10 Hz **53.** (a) 260 Hz (b) 2.8 g **54.** 1.0/n^2 N, where n = 1, 2, 3, … **55.** 0.050 kg **57.** 190 m **58.** 1.9 cm/s 3.0 cm/s^2 **59.** 3.3 m **60.** (a) A given particle will oscillate sinusoidally in the ±y-direction about its equilibrium position with an amplitude of 5.0 cm and a period of 1/8 s. (b) The particles would oscillate along a direction perpendicular to the y-axis. **61.** 80 km **62.** 2.4 km **63.** 3.64 cm 7.07 cm 10.32 cm **65.** 470 Hz **66.** (a) $y(x,t)$ = (0.020 m) sin[(1.6 rad/s)t + (0.0016 rad/m)x] (b) 0.031 m/s (c) 1.0 km/s **67.** (a) Hooke's law: $T = k(x-x_0) \approx kx$ for $x>>x_0$ (b) 4.00 s **68.** $v \propto \sqrt{(\lambda g)}$ **69.** $v \propto \sqrt{(\gamma/\lambda\rho)}$ dispersive **70.** (a) left (b) 7.00 cm (c) 10.0 Hz (d) 0.333 cm (e) 3.33 cm/s (f) Oscillates sinusoidally along the y-axis about y = 0 with an amplitude of 7.00 cm. (g) transverse **71.** (a) upward (b) downward (c) A **73.** 12 **74.** (b) standing wave