Chapter 9

2. 6.93 μm
4. 1180 N
6. 1.32 mm
8. 80 people
10. 2.1 x 10^7 Pa
12. 6.28 x 10^4 N
    (1.41 x 10^4 lb)
14. 1.95 cm
16. aluminum,
    ρ = 2.7 x 10^3 kg/m^3
18. 6.28 N
20. 3,58 x 10^6 Pa
22. 1.13 atm
24. 9,86 x 10^4 Pa
26. 10.2 m
28. 2.04 N•m
30. a. 1.28 x 10^5 Pa
    b. 2.67 x 10^4 Pa
32. a. 1960 N
    b. the same
34. 5.60 N
36. 5.10 cm
38. 9.41 x 10^3 N
40. 77.7 kg
42. 1.25 cm
44. .0732 N/m
46. 2.27 cm
48. 5.56 x 10^{-2} N/m
50. 29.8 cm
52. 140°
54. 2.04 x 10^6 Pa
56. 1.03 x 10^4 Pa
58. 150 cm^2
60. a. .0146 m^3
    b. 2100 kg/m^3
62. a. 3570 kg/m^3
    b. 643 kg/m^3
64. 4140 m^3
66. a. 1.16 x 10^5 Pa
    b. 52.0 Pa
68. 833 kg/m^3
70. 15 m
72. 1.71 cm
74. .0107 N
76. ?

Chapter 10

2. 12.7 min
4. a. 11.1 m/s
    b. 50.9 s
6. 8.85 m/s
8. 4.35 x 10^{-2} Pa
10. a. 585 Pa
    b. 1.02 x 10^5 N, up
12. a. 7860 Pa
    b. 2.64 x 10^4 Pa
14. a. 80 g/s
    b. .0267 cm/s
16. 9 cm
18. a. 2.65 m/s
    b. 2.31 x 10^4 Pa
20. a. 17.7 m/s
    b. 1.73 mm
22. a. larger pipe
    b. 296 cm^3/s
24. .0792 N•s/m^2
26. 20.7 atm
28. a. .273 cm^3/s
    b. 30.6 min
30. .412 mm
32. 8 cm/s
34. .6 m/s
36. RN=2890,
    Unstable flow, but not necessarily turbulent
38. .10 kg/m^4
40. 4 x 10^{-13} kg
42. 1.43 x 10^4 s
    or 3.99 h
44. 1.41 x 10^{-5} N•s/m^2
46. 2.82 microns
48. a. 16 m/s
    b. 1.73 x 10^5 Pa
50. 1.08 x 10^4 W
    (14.4 hp)
52. 3 cm/s
54. a. .318 m
    b. 1.34 x 10^5 Pa

Chapter 15

2. .0173 to 17.3 m
4. .196 s
6. 5 x 10^{-7} m
8. 1.04 x 10^9 Pa
10. a. 10^{-8} W/m^2,
    10^{-2} W/m^2
12. 10 machines
14. 64 dB
16. 2 (I_A to I_B)
    5 (I_A to I_C)
18. 3.14 x 10^{-3} W
20. a. 94 dB
    b. 90.5 dB
    c. 88 dB
22. a. 1095 Hz
    b 920 Hz
24. 480 Hz
26. .391 m/s
28. The velocity of the medium has no effect.
30. 41,8°
32. 690 Hz
34. 5.17 m
36. 800 m
38. 824 N
40. 845, 1690, 2535 Hz
42. a. Nodes at 0, 2.67, 5.33, and 8 m
    Antinodes at 1.33, 4, 6.67 m
44. 378 Hz
46. 3450 Hz
48. 349 m/s
50. Resonance occurs at frequencies given by f_n = n (28.8 Hz) where n is an odd integer between 1 and 694.
52. a. .4 m
    b. 1080 Hz
54. a. 5.72mm to 21.4 m
    b. 8.58 mm to 32.1 m
56. a. .655 m
    b. 11.7°C
58. 2.94 cm
60. 21.5 Hz
62. 3.79 m/s, toward
    3.88 m/s away
64. a. 120 cm
    b. 30 Hz
66. 3.01 dB
68. 10 mosquitoes
70. 1f00 dB
72. 4 Hz
74. 1.34 x 10^4 N
76. 1.93 m/s
78. 6.5

Chapter 24

2. 1.98 x 10^{11} m
4. a. 536 rev/s
    b. 1070 rev/s
6. 75°
8. 5 relections
10. a. 1.81 x 10^8 m/s
    b. 2.25 x 10^8 m/s
    c. 1.56 x 10^8 m/s
12. a. 327 nm
    b. 287 nm
14. 16.5°
16. 43.4°
18. 110.6°
20. .387 cm

Chapter 24 (continued)

22. 1.06×10^{-10} s
24. 30.4°, 23.3°
26. 106 m
28. 6.39 ns
30. 2.37 cm
32. .39°
44. ≥ 1.89
46. a. 40,8°
    b. 60.6°
48. 67.2°
50. 22°
52. $.707n_{prism}$
54. 77.5°
56. ?
58. ?
60. a. 90°
    b. 30,3°
    c. Not possible since the beam is initially traveling in a medum of lower index of refraction.
62. ?

Chapter 25

2. a. 3 ft
    b. doesn't matter
4. parallel
6. a. 13.3 cm in front, real, and upside-down, with M = -.333
    b. 20 cm in front, real, and upside-down, with M = -1
    c. no image
8. a. 8 cm behind, virtual, upright, with M = 1/5
    b. 6.67 cm behind, virtual, upright, with M = 1/3
    c. 5 cm behind, virtual, upright, with M = 1/2
10. 26.7 cm behind, upright, M = .027
12. 30 cm in front
14. 20 cm in front
16. 1 m
18. 8.05 cm
20. 20 cm
22. 5 cm
24. a. R is infinite
    b. ? c. ?
26. 38.2 cm below the top surface
28. n = 2
30. 3.75 mm
32. a. -32.7 cm
    b. -10.3 cm
    c. -4.8 cm
    d. -2.32 cm
34. a. -17.1 cm
    b. -8 cm
    c. -4.24 cm
    d. -2.18 cm
36. n = 1.47
38. a. 12 cm
    b. 12 cm
    c. 18 cm
    d. no image
    e. -12 cm
40. a. 12.8 cm behind, virtual, upright, with M = .490
    b. 12.2 cm behind, virtual, upright, with M = .510
42. a. -12 cm
    b. -12 cm
    c. -9 cm
    d. -6 cm
    e. -4 cm
44. a. 9.63 cm or 3.27 cm
    b. 2.1 cm
46. a. -30 cm
    b. diverging
48. 120 cm in front, M = .25
50. 3.4, upright
52. -2f
54. a. 6 cm in front of the 2nd lens, M = -.6
    b. at the position of the 2nd lens, M = -1
56. 119 cm beyond the 2nd lens, M = -1.25
58. 7.74 cm left of the 2nd lens, 1.07 cm tall, upright and virtual
60. 160 cm left, inverted and M = -.8
62. a. 60 cm
    b. 42.9 cm in front, real, inverted, .429 times
    c. 15 cm behind , upright and virtual, 1.5 times
64. 10 cm
66. real, inverted, 5.71 cm in front of the mirror
68. -25 cm
70. 8 cm
72. a. -11.1 cm
    b. 2.5
    c. virtual, upright
74. 2.67 cm left of the 2nd surface (virtual)

Chapter 26

2. 3 cm
4. a. 1.72 cm
    b. 2.47 cm
    c. 1.72 cm
    d. 2.47 cm
6. 2.02 μm
8. 1.5 mm
10. 515 nm
12. 75 m
14. 1.62 km
16. 4 lines
18. 184 nm
20. 51nm
22. 150 m
24. 4750 nm
26. 233 nm
28. 193 nm
30. 550 nm
32. 625 nm
34. 1640 nm
36. 20×10^{-6} °C
38. 91.2 cm
40. a. 2.25 mm
    b. 4.5 mm
42. .32°
44. 1.2 mm, 1.2 mm
46. n = 2.2
48. ?
50. 36.9°
52. 1.4°
54. ?
56. 210 nm or any interal multiple of 210 nm
58. 127 m
60. .156 mm
62. a. ?
    b. 54.7°
64. 41.8°

66. a. 1.93 μm
b. $\delta = 3\lambda$
c. maximum
68. ?
70. 1.49 x 10^{-4} m

Chapter 27

2. 30 cm beyond the lens, M = -1/5
4. 3, 1.5, .75 cm
6. f/8
8. f/1.4
10. 90.9 cm
12. right eye: P = -11.8 diopters
left eye: P = -8.2 diopters
14. a. -5 diopters
b. 37.1 cm
16. a. -.67 diopters
b. .67 diopters
18. 1.27 m
20. a. 4.17 cm in front of the eye
b. M = 6
22. a. 5.77 cm
b. M = 4.33
24. a. M = 4
b. M = 3
26. M = -115
28. a. .4 cm
b. 1.25 cm
c. M = -1000
30. a. f/9.84
b. M = 50
32. 18.8
34. 18 times larger
36. a. M = 1.5
b. M = 1.90
38. a. A, 5.76 x 10^{-6} rad
B, 9.61 x 10^{-6} rad
b. M_A = 66.7, M_B = ?
40. 492 km
42. 5.65 x 10^{7} mi or 9.09 x 10^{7} km
44. 5.31 x 10^{11} mi or 3.3 x 10^{11} km
46. 5.4 mm
48. 28.5 μ radians
50. 50.4 μm
52. 1 + (30λ/5 cm)
54. 404 nm
56. a. 13 orders
b. 1 order
58. 625 nm
60. 700 to 800 nm
62. 44.5 cm
64. a. 3646 slits
b. 1823 slits
66. a. 2.67 diopters
b. .16 diopters too low
68. -1.33 diopters
70. a. 982 lines
b. 327 lines
72. 22,800 slits
74. 19.4°
76. 3.14 diopters

Chapter 28

2. a. 1,87 x 10^{-15} s
b. 1.02 fringes
4. .958c
6. 5 s
8. a. 1.31 x 10^{-7} s
b. 38.5 m
c. 7.64 m
10. a. rectangular box
b. sides perpendicular to velocity are 2 m long vs 1.11 m sides parallel to velocity
12. ≤ .745c
14. 4.64 x 10^{-10} s

16. a. 17.4 m
b. 3.3°
18. a. 4.8 yr
b. 2.65 yr
20. 9.38 x 10^{-15} m
22. a. 5 x 10^{-21} kg•m/s
b. 2.9 x 10^{-19} kg•m/s
c. 1.03 x 10^{-18} kg•m/s
24. 3.38 x 10^{5} m/s
26. .995c
28. .866c, result is independent of mass
30. 2.22 x 10^{-27} kg
32. a. .999999995c
b. 35 cm
34. -c
36. .238c to the right
38. -.94c
40. .998c
42. .866c
44. 9.39 x 10^{8} eV
46. a. 4.5 x 10^{16} J
b. 1.43 x 10^{7} y
48. 4.39 x 10^{18} electrons
50. 1.52 x 10^{-18} kg•m/s, 2070 MeV
52. faster: 2.52 x 10^{-28} kg slower: 8.83 x 10^{-28} kg
54. a. 1.67 x 10^{-27} kg
3.2 x 10^{5} m/s
b. 2.56 x 10^{-27} kg, .758c
56. 6.28 x 10^{7} kg
58. a. .183 MeF
b. 2.45 MeV
62. ?

Chapter 29

2. a. 2.49 x 10^{-5} eV
b. 2.49 eV
c. 124 eV
4. 5180 K, no
6. 9660 K
8. 3.7 x 10^{19} photons
10. a. 2.34 x 10^{31}
b. 4.28 x 10^{-32}
12. 8.71 x 10^{12} electrons
14. a. 2.24 eV
b. 555 nm
c. 5.41 x 10^{14} Hz
16. 5.43 eV
18. 4.77 x 10^{14} Hz, 2.03 eV
20. .784 eV
22. 4.14 x 10^{4} V
24. 124 V to 1.24 x 10^{7} V
26. 18.2°
28. .078 nm
30. .281 nm
32. ?
34. 59.6°
36. a. 1.18 eV
b. 6.45 x 10^{5} m/s
38. 70°
40. a. 1880 MeV
b. a6.6 x 10^{-16} m
42. a. 3.52 MeV
b. 8.5 x 10^{20} Hz
44. a. 1460 m/s
b. 7.28 x 10^{-11}m
46. a. 3.97 x 10^{-11} m
b. 3.97 x 10^{-14} m
48. a. 14.8 keV vs 15.1 keV
b. 124 keV
50. 9.05 x 10^{-15} m
52. ?
54. 3.57 x 10^{-13} m
56. 2.1 x 10^{-32} m/s
58. 10^{5} m/s order of magnitude

60. 1.64 x 10^{-14} s
62. 4.05 eV
64. a. 4.22 x 10^{35}
b. 3.32 x 10^{-34} J
66. a. .0249 nm
b. .285 nm
68. 2.41 nm (e)
.056 nm (p)
70. a. 7.77 x 10^{-12} m
b. 93.8°
c. 35.4°

Chapter 30

2. 656, 486, 434 nm
visible range
4. 4.57 x 10^{14},
6.17 x 10f^{14},
6.91 x 10^{14} Hz
6. a. 91.13 nm
Lyman
364.5 nm
Balmer
820.1 nm
Paschen
1458 nm
Brackett
b. 13.6 eV
Lyman
3.41 eV
Balmer
1.51 eV
Paschen
.85 eV
Brackett
8. ?
10. a. six
b. 1880 nm
12. a. 13.6 eV
b. 1.51 eV
14. ?
16. .053, .212, .476 nm
18. a. .212 nm
b. 10^{-24} kg•m/s
c. 2.1 x 10^{-34} J•s
d. 3.39 eV
e. -6.78 eV
f. -3.39 eV
20. 8.23 x 10^{-8} N
22. a. .97 eV
b. .27 eV
24. 91.4 nm
26. a. 2.89x10^{-34} kg•m/s
b. n = 2.74 x 10^{-34} J•s
and 7.3 x 10^{-69}
28. ?
30. ?
32. 30.4, 22.8 nm
34. a. ? b. ?
c. 72 electrons
36. ?
38. ?
40. a. 2
b. 8
c. 18
d. 32
e. 50
42. .155 nm, 8.03 kV
44. 1.03 x 10^{-2} nm
46. 97.3, 103, 657,
1217, 1881 nm
48. a. 10.2 eV
b. 7.88 x 10^{4} K
50. 1.25 x 10^{-4} J
b. 3.98 x 10^{14} photons
52. a. .0529 nm
b. 1.99 x 10^{-24} kg•m/s
c. 1.05 x 10^{-34} kg•m^2/s
d. 13.6 eV
e. -27.2 eV
f. -13.6 eV
54. ?
56. a. 124 MeV
b. no
58. ?
60. ?

Chapter 32

2. A = 48
4. A = 2,
r = 1.51 x 10^{-15} m
A = 60
r = 4.7 x 10^{-15} m
A = 197
r = 6.98 x 10^{-15} m
6. 368 m
8. 6.11 x 10^{13} N
10. a. 1.85 x 10^{7} m/s
b. 7.11 MeV
12. 2.8 x 10^{7} m/s
14. 161 MeV
16. 8.66 MeV/nucleon
18. 8.26 MeV/nucleon
and 8.7 MeV/nucleon
for Rb
20. .764 MeV
22. 7.93 MeV
24. 576 MeV
26. 465 days
28. .465 curies
30. a. 9.98 x 10^{-7} s^{-1}
b. 1.85 x 10^{10} nuclei
32. a. .0558 h^{-1}, 12 h
b. 2.30 x 10^{13} nuclei
c. 1.88 mCi
34. 21.6 mCi
36. $_{208}X_{81}$, $_{95}Rb_{37}$, $_{144}Nd_{60}$
38. 5.41 MeV
40. yes, ?
42. ?
44. 4220 ?
46. 570 MeV ?
48. a. -3.14 MeV
b. -2.77 MeV
50. $_4He_2$ and $_4He_2$
52. a. $_{30}Po_{15}$
b. -2.64 MeV
54. 192 MeV
56. a. $_{13}C_6$
b. $_{10}B_5$
58. a. $_1n_0$
b. 18.000953 u
60. 24 decays/min
62. 46.5 days
64. X > 0, no
threshold energy
is required
66. a. 2.52 x 10^{24}
nuclei
b. 2.306 x 10^{12} Bq
c. 1.07 x 10^{6} y
68. .35%
70. 18.3 counts/min
b. The observed
count rate is slightly
less than the
average background
and would be diffi-
cult to measure
accurately using
reasonable counting
times.
72. 4.45 x 10^{-8} kg/h