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Physics, Appendix C

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Appendix C

Answers to Odd-Numbered
Problems

Chapter 1

1-1. No answer.
1-3. (a) $(5, 53°)$; (b) $(7.1, 315°)$; (c) $(13.4, 153°25')$.
1-5. $(2.5 \text{ m}, 4.3 \text{ m})$.
1-7. $R = 10.7 \text{ m}$; $(x, R) = 73°45'$; $(y, R) = 62°15'$; $(z, R) = 32°55'$.
1-9. $\mathbf{A} + \mathbf{B}: (7.07, 171°50')$; $\mathbf{A} - \mathbf{B}: (9.06, 276°20')$.
1-11. (a) $(4.51, 145°45')$; (b) $(24.1, 357°5')$.
1-13. No answer.
1-15. $5.04, 79°35'$.

Chapter 2

2-1. (a) 40 mi/hr; (b) 58.7 ft/sec.
2-3. (a) 7.75 mi/hr; (b) 3.9 min.
2-5. 253 mi/hr, $9°5'$ E of N.
2-7. 4.9 ft/sec^2.
2-9. 4.28 ft/sec^2.
2-11. (a) 5.71 ft/sec^2; (b) 20.5 sec.
2-13. (a) 71.6 ft/sec; (b) 75.5 ft/sec.
2-15. (a) 4 sec; (b) 120 ft from base; (c) 132 ft/sec, $\theta = -76°50'$.
2-17. 402 cm/sec, 598 cm/sec.
2-19. (a) 7.95 km; (b) 30,000 cm/sec, $\theta = -30°$.
2-21. (a) 0.24 ft/sec^2; (b) 4,950 ft.
2-23. (a) 6.67 m/sec; (b) 5.2 m/sec; (c) 1.38 m.
2-25. (a) 5.76 ft; (b) 57.6 ft/sec, $\theta = 19°30'$.
2-27. No answer.
2-29. (a) 38 m/sec, $\theta = 71°35'$; (b) 12 m/sec^2 (y-direction).
2-31. (a) 1.63 sec; (b) 56.4 ft; (c) 143.5 ft.
2-33. (a) -32 ft/sec; (b) 0.
2-35. No answer.
2-37. No answer.
2-39. No answer.

Chapter 3

3-1. 15 lb.
3-3. (a) 69.3 lb; (b) 138.5 lb.
3-5. (a) 230 lb; (b) 230 lb.
3-7. (a) 575 lb; (b) 1,150 lb.
3-9. 175 lb.
3-11. (a) 90 lb; (b) 150 lb.
3-13. (a) 49 lb; (b) 130 lb; (c) 88 lb; (d) 62 lb.
3-15. (a) 8 lb; (b) 0.061; (c) 65.9 lb.

Chapter 4

4–1. 6 lb ft.
4–3. (a) 1,225 lb; (b) 285 lb; (c) 980 lb.
4–5. 2.5 ft from 60 lb wt.   **4–7.** (a) 1,200 lb; (b) 2,000 lb.
4–9. (a) 115 lb; (b) 693 lb.   **4–11.** 0.56.
4–13. 0.67a, 0.29a.   **4–15.** 30.5 lb, 75°20' with horizontal.
4–17. 2.94 in.   **4–19.** No answer.
4–21. (a) 4 ft; (b) 120 lb.   **4–23.** No answer.

Chapter 5

5–1. 6,000 dynes.   **5–3.** 428 lb.
5–5. 50,000 dynes.   **5–7.** 84,500 lb.
5–9. (a) 281 lb; (b) 2,081 lb.
5–11. (a) 30,000 dynes; (b) 275,000 dynes.
5–13. (a) 8 ft/sec^2; (b) 18 lb.   **5–15.** (a) 1.96 m/sec^2; (b) 23.5 nt.
5–17. (a) 150 lb; (b) 46.3 ft/sec.   **5–19.** 0.43.
5–21. 10 ft.   **5–23.** No answer.
5–25. 2.6 × 10^5 dynes.   **5–27.** 161 nt.
5–29. 15.8 sec.   **5–31.** (a) 20 lb; (b) 40 lb.
5–33. (a) 6.4 ft/sec^2; (b) 6.4 ft/sec^2; (c) 7.2 ft/sec^2.
5–35. 38.4 ft/sec.

Chapter 6

6–1. (a) 6π rad/sec; (b) 37.7 ft/sec; (c) 10,800°.
6–3. π rad/sec^2; (b) 1,100 rev.
6–5. No answer.   **6–7.** No answer.
6–9. (a) 3,125 dynes; (b) 20.8 cm/sec^2.
6–11. 2.7 × 10^{-3} m/sec; (b) 5.83 × 10^{24} kg.
6–13. (a) 6°; (b) 0.13.
6–15. (a) 4.95 rad/sec; (b) 1.22 × 10^5 dynes.
6–17. (a) 4,033 ft; (b) 1,260 lb.
6–19. (a) 2.97 × 10^4 m/sec; (b) 5.91 × 10^{-3} m/sec^2; (c) 3.53 × 10^{22} nt.
6–21. (a) 20 mi; (b) 2 mi   **6–23.** 1.97 × 10^{30} kg.
6–25. No answer.   **6–27.** 800 lb.

Chapter 7

7–1. (a) 600 ft lb; (b) 0.33.   **7–3.** (a) 1,120 ft lb; (b) 1,120 ft lb.
7–5. (a) 1,800 ft lb; (b) 1,200 ft lb; (c) 600 ft lb.
7–7. (a) 1,800 ft lb; (b) 960 ft lb; (c) 840 ft lb; (d) 0.4.
7–9. (a) 8.82 × 10^6 ergs; (b) 198 cm/sec; (c) 190 cm/sec.
7–11. 11,900 ft lb/sec.
7–13. (a) 1,875 lb; (b) 400 ft/sec; (c) 1,100 ft/sec.
7–15. No answer.   **7–17.** 6.7 lb.
7–19. 9 × 10^{16} ergs.
7–21. (a) −24; (b) 18, −z-direction; (c) 18, +z-direction.
7–23. 37.5 mi/hr.
7–25. (a) 0; (b) 30.25 ft lb; (c) no answer.

Chapter 8

8–1.   (a) 15.6 slugs/ft^3;   (b) 1.56 slugs/ft^3;   (c) 0.8.
8–3.   (a) 0.5 ft;   (b) 17,500 lb;   (c) 20,000 lb;   (d) flat.
8–5.   (a) 1.65 cm;   (b) 1.55 cm.   **8–7.**   37.8 cm.
8–9.   (a) 4.53 $\times$ 10^4 lb/ft^2;   (b) 1.94 $\times$ 10^{10} lb.
8–11.   (a) 10.4 lb/ft^2;   (b) 2,130 lb/ft^2.
8–13. 76 cm.   **8–15.**   (a) 4,830 tons;   (b) 15,000 ft^3.
8–17.   (a) 1,670 dynes; (b) 2,500 dynes; (c) 1,670 dynes; (d) 1,250 dynes.

Chapter 9

9–1.   (a) 5.43 ft/sec;   (b) 3.06 ft/sec.   **9–3.**   (a) 27 ft/sec;   (b) 141 ft^3/min.
9–5.   1.44 $\times$ 10^4 sec.   **9–7.**   (a) 26.8 ft/sec;   (b) 2.33 ft^3/sec.
9–9.   5,180 lb.
9–11.   (a) 22.6 ft/sec;   (b) 0.471 ft^3/sec;   (c) 10 lb/in^2.
9–13.   (a) 9.9 m/sec;   (b) 14.1 m;   (c) 17.1 m/sec, $\theta = -54°35'$.
9–15. 1.96 $\times$ 10^{-3} slug/ft sec.
9–17.   (a) 0.436 ft^3/sec;   (b) 10.3 lb/in^2.

Chapter 10

10–1.   (a) 395 slug ft/sec;   (b) 395 lb sec;   (c) 20,000 lb;   (d) 0.0198 sec.
10–3.   (a) 150,000 dynes;   (b) 0.96.
10–5.   (a) $V_1 = 54$ cm/sec, $V_2 = 144$ cm/sec;   (b) 0.64.
10–7.   31.2 ft/sec.   **10–9.**   (a) 9,760 lb sec;   (b) 9,760 lb sec.
10–11. No answer.   **10–13.**   (a) 0.1 ft;   (b) 0.001 ft.
10–15. 10e^2;   (b) 10e^4, only if $e = 1$.
10–17. 69 lb.   **10–19.**   (a) 650 lb sec;   (b) 156 lb sec.
10–21.   (a) 500 nt;   (b) 625 joules;   (c) 50 nt sec.

Chapter 11

11–1.   7 $\times$ 10^4 ft lb.
11–3.   (a) 37.5 rad/sec^2;   (b) 375 rad/sec.
11–5.   No answer.
11–7.   (a) 1.33 rad/sec^2;   (b) 1.09 $\times$ 10^6 gm cm^2.
11–9.   (a) 768 ft lb;   (b) 768 ft lb;   (c) 22.6 rad/sec.
11–11.   (a) 7.68 $\times$ 10^4 gm cm^2;   (b) 30.6 rad/sec^2;   (c) 14.7 $\times$ 10^4 dynes;
          (d) 212 cm/sec.
11–13. 3.9 ft/sec.   **11–15.** 181 rad/sec.
11–17. 0.38 rad/sec.   **11–19.** Left.
11–21. Stops after second reversal.   **11–23.** No answer.
11–25.   (a) 40 rad/sec^2;   (b) 200 rad/sec;   (c) 6 $\times$ 10^{14} m/sec^2;   (d) 0.0195 kg m^2.
11–27.   (a) 0;   (b) 4.93 $\times$ 10^6 dyne cm;   (c) 4.93 $\times$ 10^6 dyne cm.

Chapter 12

12–1.   (a) 0.314 sec;   (b) 1.2 $\times$ 10^6 dynes;   (c) 2.4 $\times$ 10^3 cm/sec^2.
12–3.   (a) 1.176 $\times$ 10^4 dynes/cm;   (b) 0.448 sec.
12–5.   2.25 kg.

12–7. (a) 4.27×10^4 dynes;   (b) 1.71 rad/sec^2;   (c) 0.546 rad/sec;
(d) 2.46×10^5 dynes;   (e) 47.4 cm/sec, 85 cm/sec^2.
12–9. 977.3 cm/sec^2.
12–11. (a) 0.25 sec^{-1};   (b) −1.5 rad/sec;   (c) 1.48 rad/sec^2;   (d) 0.60 sec.
12–13. $\frac{1}{8}$ sec.   **12–15.** 1.58 sec.
12–17. 9.14 cm.   **12–19.** $2\pi (h\rho/\rho_0)^{1/2}$.

Chapter 13

13–1.   (a) 10^8 dynes/cm^2;   (b) 8×10^{-5}.
13–3.   (a) 2.39×10^3 lb/in^2;   (b) 1.82×10^{-4};   (c) 5.46×10^{-4} ft.
13–5. 7.13×10^{11} dynes/cm^2.   **13–7.**   1.9%.
13–9.   (a) 3.6×10^6 dynes/cm^2;   (b) 8.5×10^{-6};   (c) 8.5×10^{-6} rad.
13–11.   (a) 1.27×10^4 lb/in^2.   (b) 9.7×10^{-4} (brass), 7.3×10^{-4} (copper).
13–13.   (a) 0°;   (b) 45°.   **13–15.**   −0.87 cm, −0.58 cm, −0.44 cm.
13–17.   (a) 104 dynes;   (b) 520 ergs.   **13–19.**   4,730 dynes/cm^2.
13–21.   1.5 cm.   **13–23.**   No answer.

Chapter 14

14–1.   160°C.   **14–3.**   80.026 ft.
14–5. 4.43×10^9 dynes/cm^2.   **14–7.**   547.8 mm of Hg.
14–9.   (a) 3.66×10^{-3} per °C;   (b) 66.9°C.
14–11. No answer.   **14–13.**   (a) 864 atmos;   (b) 793 atmos.
14–15. 10.015 lb.   **14–17.**   1,740 lb/in^2.
14–19.   (a) 3.7×10^{-4} per °C;   (b) 6×10^{-4} per°C.

Chapter 15

15–1.   31.8°C.   **15–3.**   20.6°C.
15–5.   0.21°F.   **15–7.** $\Delta t = 6.5$°C.
15–9.   436 gm.   **15–11.**   0°C, 268 gm.
15–13.   1,760 watts.   **15–15.**   (a) 89%; (b) 6,000 joules; (c) 1.43°C.

Chapter 16

16–1.   95.1 cm of Hg.   **16–3.**   No answer.
16–5.   27 lb/in^2.
16–7.   (a) 5.65×10^{-14} erg;   (b) 7.72×10^{-14} erg.
16–9. 2.41×10^{19} molecules/cm^3.
16–11.   (a) 348 cal;   (b) 249 cal;   (c) 22.4 liters.
16–13.   (a) 362 cm^3;   (b) 37°C.   **16–15.** 1.57×10^{10} ergs.
16–17.   103 cm^3.   **16–19.**   8.41 joules/kg °C.
16–21.   2 joules.   **16–23.**   No answer.

Chapter 17

17–1.   (a) 40 cal;   (b) 500 cal;   (c) 0.93.
17–3.   (a) 1.013×10^6 dynes/cm^2;   (b) 1.049×10^6 dynes/cm^2.
17–5.   No answer.   **17–7.**   (a) 46.9%;   (b) 12.3%.

Chapter 18

18–1. 0.208 cal/cm sec °C.

18–3. 144,300 cal.

18–5. 15,100 Btu/hr.

18–7. 19.9 watts.

18–9. 49.93 watts.

18–11. (a) 72.7 °C;   (b) 1.30 cal/sec.

18–13. (a) 15°F/in;   (b) 180 Btu/hr ft^2;   (c) 100°F.

18–15. 5,700°Abs.

Chapter 19

19–1. (a) 26.8%;   (b) 268 cal;   (c) 732 cal.

19–3. 46.9%.

19–5. (a) 750 cal;   (b) 3,750 cal.

19–7. 33.3%.

19–9. 102°C.

19–11. 20%.

19–13. (a) −2.68 cal/°K;   (b) +2.68 cal/°K;   (c) 0;   (d) 0.

19–15. (a) +10^{-3} joule/°K;   (b) 0;   (c) −10^{-3} joule/°K;   (d) 0;   (e) 0.

Chapter 20

20–1. 2,000 cm/sec.

20–3. (a) 16 cm;   (b) 16,000 cm/sec;   (c) 1.02 × 10^7 dynes.

20–5. 0.17 sec.

20–7. No answer.

20–9. (a) $y = 5 \cos \dfrac{2\pi x}{100} \sin \dfrac{2\pi t}{0.01}$;   (b) 9.5 cm.

20–11. 2°35′ N of E.

20–13. (a) 5 cm;   (b) 1.54 cm.

20–15. 0.

Chapter 21

21–1. (a) 880 vib/sec;   (b) 1.25 ft.

21–3. 22.9 vib/sec.

21–5. (a) 1,064 vib/sec;   (b) 944 vib/sec.

21–7. (a) 997.3 vib/sec;   (b) 1,002.7 vib/sec;   (c) 5.4 beats/sec.

21–9. 4 beats/sec.

21–11. (a) 1.25 ft;   (b) 880 vib/sec, 1,320 vib/sec.

21–13. (a) 2.16 × 10^8 dynes;   (b) 1,040 vib/sec, 1,560 vib/sec.

21–15. (a) 2.46;   (b) 24°.

21–17. 55 ft to 0.055 ft.

Chapter 22

22–1. 1.12 × 10^4 dynes.

22–3. 8.19 × 10^{-8} nt.

22–5. 0.304 dyne, $\theta = 205°15′$.

22–7. 9.0 gm.

22–9. 4.4 × 10^{-40}.

Chapter 23

23–1. 4 × 1_r dynes/stcoul.

23–3. 0.352 dyne/stcoul.

23–5. $\mathbf{E} = (13.3\ \mathbf{1}_x + (0)\ \mathbf{1}_y)$ dynes/stcoul.

23–7. $\mathbf{E} = (1.48 \times 10^7\ \mathbf{1}_x - 2.04 \times 10^7\ \mathbf{1}_y)$ nt/coul.

23–9. 98 nt/coul, upward.

23–11. (a) 3.60 × 10^5 $\mathbf{1}_n$ nt/coul;   (b) 0.

23–13. (a) 0;   (b) 0;   (c) 2.25 × 10^9 $\mathbf{1}_r$ nt/coul.

Chapter 24

24–1. (a) 6×10^4 dynes, in direction of $\mathbf{E}$; (b) 2.4×10^5 ergs; (c) -2×10^4 stvolts.
24–3. 1.5×10^{-4} joules. **24–5.** 33.3 stvolts.
24–7. (a) 6,600 volts; (b) 9,000 volts; (c) 0.012 joule.

24–9. $V_{r0} = \dfrac{\rho}{6\epsilon_0}(3a^2 - r_0^2)$. **24–11.** 1 erg $= 6.25 \times 10^{11}$ ev.

24–13. 5.2×10^{-19} cal. **24–15.** 1.02×10^7 m/sec.

Chapter 25

25–1. (a) 1.67×10^{-4} μfd; (b) 2.50×10^{-4} μfd.
25–3. No answer.
25–5. (a) 240 μcoul; (b) 1.44×10^{-2} joule.
25–7. (a) 159 stfd; (b) 1.99×10^4 stcoul; (c) 1.24×10^6 ergs.

25–9. $C = 4\pi\epsilon_0 \dfrac{r_1 r_2}{r_2 - r_1}$.

25–11. (a) 300 μcoul, 500 μcoul; (b) 8 μfd; (c) 0.04 joule.
25–13. (a) 17.1 μcoul, 12.9 μcoul; (b) 4.29 volts.
25–15. (a) 2.93 μfd; (b) 41.7 volts; (c) 166.7 μcoul.
25–17. 10 stcoul cm.
25–19. 0.334 dyne/stcoul, $\theta = 4°45'$.
25–21. $\mathscr{W}_V = \frac{1}{2}\kappa_e\epsilon_0 E^2 = \frac{1}{2}DE$.

Chapter 26

26–1. 3 amp.
26–3. 2.4×10^4 amp/m^2, $-x$-direction.
26–5. (a) 0.33 amp; (b) 360 ohms.
26–7. (a) 5.47×10^{-3} ohm; (b) 0.318 ohm.
26–9. 60.8°C. **26–11.** 0.042 mho/m.
26–13. 6×10^6 ohms. **26–15.** 1.46×10^7 ohms.

Chapter 27

27–1. (a) 18 ohms; (b) 4 amp, 2.67 amp.
27–3. (a) 1.33 amp; (b) 20 volts, 33.3 volts, 66.7 volts; (c) 160 watts.
27–5. 1 watt, 2 watts, 3 watts. **27–7.** (a) 112 volts; (b) 70 ohms.
27–9. (a) 720 ohms; (b) 20 watts. **27–11.** (a) 120 volts; (b) 0.2 ohm.
27–13. (a) 99 volts; (b) 297 watts; (c) 94%; (d) 82.5%.
27–15. 0.505 ohm, 0.051 ohm, 0.005 ohm; 950 ohms, 9,950 ohms, 99,950 ohms.
27–17. 1×10^{-4} amp. **27–19.** R ohms.
27–21. (a) 0.635 amp; (b) -2.18 volts. **27–23.** 2.56 ohms.

Chapter 28

28–1. 2.02 gm. **28–3.** (a) 0.380 amp; (b) 1.52 volts.
28–5. (a) 0.207 amp; (b) 2.07 volts.
28–7. (a) $a = 0$, $b = 595 \times 10^{-3}$, $c = 1.45 \times 10^{-5}$, $\mathscr{E}$ in mv; (b) 158°C.

Chapter 29

29–1. (a) 36.5 dynes, $\theta = 218°15'$; (b) 44.4 dynes, $\theta = 0°$; (c) 794 dynes, $\theta = 104°45'$.
29–3. 1,640 dynes, repulsion.   **29–5.** 0.84 oersted, $\theta = 0°$.
29–7. (a) 8.75 nt/weber, $\theta = 90°$; (b) 4.30 nt/weber, $\theta = 236°50'$;
     (c) 321 nt/weber, $\theta = 104°35'$.
29–9. 760 cgs pole cm.   **29–11.** 900 nt/weber.

29–13. $H = \dfrac{p}{\kappa_m r^2} 1_r$; $H = \dfrac{p}{4\pi\mu_0 \kappa_m r^2} 1_r$.

Chapter 30

30–1. (a) 125 amp/m; (b) 1.57 oersteds.
30–3. $25°15'$.
30–5. (a) 0.114 oersted; (b) 8.54 amp.
30–7. 40 dynes.   **30–9.** No answer.
30–11. 637 amp/m.   **30–13.** 105 dyne cm.

Chapter 31

31–1. 4.8×10^{-9} dyne.   **31–3.** 1.8×10^{-17} gm cm/sec.
31–5. $F_x = 6 \times 10^{-5}$ nt, $F_y = -4.5 \times 10^{-5}$ nt, $F_z = 1.6 \times 10^{-5}$ nt.
31–7. $F_x = 2.5$ nt, $F_y = 0$, $F_z = -1.5$ nt.
31–9. (a) 0.045 cm; (b) 3.52×10^3 turns/m.
31–11. 0.38 amp.   **31–13.** 9.6×10^{-10} nt m.
31–15. (a) 2.310×10^{-20} nt (repulsion); (b) 2.53×10^{-23} nt (attraction);
     (c) 2.307×10^{-20} nt (repulsion).
31–17. $R = W/BI$.

Chapter 32

32–1. 0.004 volt.   **32–3.** 1,770 volts.
32–5. 7.5 volts.   **32–7.** 2.26 volts.
32–9. 39.8 amp/m.   **32–11.** 0.05 henry.
32–13. 7.9×10^{-4} henry.
32–15. (a) 0.946 amp; (b) 2.396 amp; (c) 2.400 amp; (d) 0.002 sec.
32–17. No answer.
32–19. (a) 1.26×10^{-2} joule; (b) 251 joules/m³.

Chapter 33

33–1. (a) 0.63 henry; (b) 0.34 henry; (c) 0.18 henry.
33–3. (a) 5.45×10^{-4} weber/m²; (b) 12.6 cm.
33–5. (a) 8,000 amp/m; (b) 8.05 weber/m²; (c) 8.04 weber/m².
33–7. 0.072 amp.   **33–9.** (a) $H = 0$; (b) $H = I/2\pi a$.

Chapter 34

34–1. (a) 12.1 ohms; (b) 49.5 ohms; (c) 2.22 amp; (d) 3.14 amp; (e) $14°10'$;
     (f) 106.6 volts; (g) 26.8 volts; (h) 237 watts.
34–3. No answer.

34–5. (a) $X_L = 678.6$ ohms, $X_C = 265$ ohms, $Z = 415.3$ ohms;   (b) 0.265 amp;
   (c) $V_R = 10.6$ volts, $V_C = 70.2$ volts, $V_L = 180$ volts.
34–7. No answer.   **34–9.** (a) 55 to 1; (b) 0.273 amp.
34–11. 2.2×10^{-3} fd.
34–13. (a) 2.0 amp; (b) 0.2 henry; (c) 123.7 ohms.
34–15. (a) 1.5 amp; (b) 0.894; (c) 100 ohms.

Chapter 35

35–1. 50 ma.   **35–3.** (a) 215 ma; (b) 108 volts.
35–5. 5.25 ma.   **35–7.** No answer.
35–9. 300 m.

Chapter 36

36–1. 1.26×10^{-5} steradian.
36–3. (a) 3.38×10^{-12} erg; (b) 2.96×10^{17} quanta/sec.
36–5. (a) 260 lumens; (b) 1.53%; (c) 20.7 candelas; (d) 2,630 candelas/m^2.
36–7. (a) 0.92 watt; (b) 0.2 lumen/watt.
36–9. 195 candelas.
36–11. (a) 18.1 lumens/ft^2; (b) 7.35 lumens/ft^2; (c) 19.6 lumens/ft^2.
36–13. (a) 58 cents; (b) 13 cents.

Chapter 37

37–1. (a) 2.254×10^{10} cm/sec; (b) 2.245×10^{10} cm/sec.
37–3. (a) 1.68 cm; (b) 1.71 cm.
37–5. (a) 32°30′; (b) 44°45′; (c) 39°45′.
37–7. 3.0 cm^{-1}.   **37–9.** 1.5.
37–11. 3°15′.   **37–13.** No answer.

Chapter 38

38–1. 30 cm; real, inverted, enlarged.
38–3. (a) −6 cm; (b) 1.5; (c) upright, virtual, enlarged.
38–5. (a) −16.7 cm; (b) 25 cm^2.
38–7. (a) 53.3 cm; (b) 3.33 cm; (c) real, inverted, enlarged.
38–9. 1.7%   **38–11.** (a) 37.5 cm; (b) 35.2 cm.
38–13. (a) $s_1' = 20$ cm; (b) $s_2' = 3.33$ cm; (c) −0.67; (d) real, inverted, diminished.
38–15. (a) $s_2' = 6.78$ cm; (b) −0.261.
38–17. (a) 5 cm from arc; (b) 4.76×10^{-2} lumens/cm^2.

Chapter 39

39–1. 1 ft.   **39–3.** 3 diopters.
39–5. 50 cm.   **39–7.** (a) −66.7 cm; (b) 66.7 cm.
39–9. 0.23 in.   **39–11.** 6.15 cm, 73.85 cm.
39–13. 4.5 cm.

Chapter 40

40–1. (a) 0.103 cm; (b) 0.103 cm.   **40–3.** 66.3%.
40–5. No answer.

40–7. (a) 5.61×10^{-3} cm; (b) 20.8 lines/cm.
40–9. 0.118 cm.   **40–11.** (a) $15°20'$; (b) $31°50'$.
40–13. 5,556 lines.

Chapter 41

41–1. (a) $58°45'$; (b) $51°5'$.   **41–3.** $\sin \theta_C = \cot \theta_P$.
41–5. (a) N_0; (b) $1 : 0.64$.
41–7. (a) 1.64×10^{-3} cm; (b) 3.28×10^{-3} cm; (c) retarded.
41–9. (a) 0.9; (b) 0.1; (c) 0.5.   **41–11.** 9.38%.

Chapter 42

42–1. (a) 3.03×10^{-12} erg; (b) 1.89 ev.
42–3. 1.9 ev.   **42–5.** 1.63×10^4 °K.

42–7. $\mathcal{E} = -\dfrac{2\pi^2 m e^4 Z^2}{n^2 h^2}$.

42–9. (a) $\lambda = h^2 n / 2\pi e^2 m$; (b) $n\lambda = 2\pi r_n$; (c) yes, they are equivalent statements of the same hypothesis.
42–11. 1.53×10^{-32} cm, particle-like behavior.
42–13. 5.46×10^{-13} cm.

Chapter 43

43–1. (a) $4°46'$; (b) $9°32'$; (c) 2.2%.   **43–3.** 0.558 A.
43–5. K_α-0.574 A, K_β-0.485, K_γ-0.460 A, K_δ-0.449 A.
43–7. (a) Yes; (b) 0.124 A; (c) 9.92 Kev; (d) plate; (e) plate.
43–9. (a) 3.97×10^{-8} erg; (b) 1.92×10^{-9} erg; (c) 1.92×10^{-9} erg.
43–11. (a) 0.307 A; (b) $3°8'$.
43–13. (a) 1.99×10^{-18} gm cm/sec; (b) 0.332 A.
43–15. (a) 0; (b) 2.4×10^{-61} cm; (c) 8.9×10^{-24} cm; (d) 8.9×10^{24} cm.

Chapter 44

44–1. $0.00785 = 7.31$ Mev.   **44–3.** 8.81 cm, 9.52 cm.
44–5. (a) 308 gausses; (b) 320 cm, 322 cm.
44–7. 190 Mev.
44–9. (a) 1.53×10^{11} cal; (b) 6.1×10^4 lb of coal.

Chapter 45

45–1. (a) 4.87×10^{-18} sec^{-1}; (b) 1.23×10^4 alpha particles/sec.
45–3. 3.32×10^{-7} curie.   **45–5.** 6.96×10^{-4} curie.
45–7. (a) 0.00524 amu; (b) 0.08 Mev.

Chapter 46

46–1. $0.66L_0$.   **46–3.** $0.995\,c$.
46–5. (a) 2.62×10^{10} cm/sec; (b) 0.545 Mev; (c) 0.661 Mev.
46–7. No answer.
46–9. (a) 19.7 Mev; (b) 39.4 Mev; (c) 78.8 Mev.
46–11. (a) $_{92}\mathrm{U}^{238} + _0\mathrm{n}^1 \to (_{92}\mathrm{U}^{239}) \to _{56}\mathrm{Ba}^{143} + _{36}\mathrm{Kr}^{94} + 2_0\mathrm{n}^1$;   (b) 0.233 amu; (c) 217 Mev; (d) 217 Mev.