

Appendix B Continued

Answers to Supplemental Problems

Chapter 1

No supplemental problems

Chapter 2

- $8.1 \times 10^5 \text{ g}$
 - $6.34 \times 10^{-4} \text{ g}$
 - $6 \times 10^7 \text{ g}$
 - $1.0 \times 10^{-6} \text{ g}$
- $5.8 \times 10^{-8} \text{ s}$
 - $4.6 \times 10^7 \text{ s}$
 - 9.27 s
 - $1.23 \times 10^4 \text{ s}$
- $6.32 \times 10^{-3} \text{ s}$
 - $8.36 \times 10^8 \text{ km}$
 - $1.69 \times 10^4 \text{ cm}^2$
 - $6.45 \times 10^{-13} \text{ m/s}$
- 4
 - 5
 - 3
 - 3
- 3
 - 5
 - 2
 - 4
- 90.0 g
 - 1.68 km
 - 128.6 kg
 - 47.9 s
- $2 \times 10^{16} \text{ m}^2$
 - $1.4 \times 10^{-7} \text{ km}^2$
 - 2.8 kg/m^3
 - $1.7 \times 10^{-3} \text{ m/s}$
- 22.2 m
 - 21 m^2
- $d = 5t^2$
- 0.30 m/s
 - $d = 0.30t$
- $m = \frac{Fr}{v^2}$
 - $r = \frac{mv^2}{F}$
 - $v = \sqrt{\frac{Fr}{m}}$

$$12. \quad d_o = \frac{d_i f}{d_i - f}$$

- 160 cm^2
 - 140 cm^2

Chapter 3

- 205 m
 - 45 m
 - 205 m
- 15 km/h; 0
- 330 m/s
- 20 m/s
- 0.450 s
 - 2592 km/h
- $3.3 \times 10^{-7} \text{ s}$
- 60 km/h
- 13.5 m, 5.5 s
- 10 m
 - 30 m
 - 0 m
 - 40 m
 - 80 m distance, but no displacement
- 2 m/s
 - 6 m/s
 - 0 m/s
 - 8 m/s
- 1 h
- $\approx 10 \text{ m/s}$
 - 0 m/s
 - $\approx -10 \text{ m/s}$
- 75 m/s
 - 300 m
- 3600 m
 - 9000 m
 - 0 m
- 25 km/h
 - 145 km/h

Chapter 4

- $-3.3 \times 10^3 \text{ m/s}^2$

- constant velocity = 10 m/s
 - slows to $v = 0 \text{ m/s}$
 - 0 m/s^2
 - -5 m/s^2
- $\approx 30 \text{ m/s}^2$
- 8.00 s
- 34 m/s
- 160 m
- -8.0 m/s^2
 - 480 m
- $4.9 \times 10^{-3} \text{ s}$
 - $3.3 \times 10^2 \text{ m/s}$
- 2.8 m/s^2
 - 35 m
- 26 m/s
- -81 m/s^2
- $35 \text{ m/s} = 130 \text{ km/h}$
- 0.23 m/s
 - 0.24 m/s^2
- 59 m/s
 - $1.8 \times 10^2 \text{ m}$
- 5.6 s
- 20 m

Chapter 5

- $2.36 \times 10^3 \text{ N}$ in direction of acceleration
- 750 kg
- 75 N
- 60 kg
- 3.3 m/s^2
- 3.6 m/s^2
 - $4.9 \times 10^2 \text{ N}$
- $1.6 \times 10^{-26} \text{ N}$
- 2 N
 - 0.02
- 7.4 N
- 0.60 m/s^2

11. $3.3 \times 10^3 \text{ N}$
 12. a. 490 N
 b. 490 N
 c. $3.8 \times 10^2 \text{ N}$
 d. $3.6 \times 10^2 \text{ N}$
 e. 490 N
 f. 0
 13. 3.3 m/s^2

Chapter 6

1. a. $\theta = 84.000^\circ$
 b. $\theta = 27.00^\circ$
 c. $\theta = 35.00^\circ$
 d. $\theta = 7.998^\circ$
 e. $\theta = 49.00^\circ$
 f. $\theta = 12.01^\circ$
 2. a. 0.53
 b. 1.0
 c. 1
 d. 1.6
 e. 0.64
 f. 0.33
 4. a. 140 N
 b. 20 N
 c. 100 N
 5. 38.5 min
 6. a. 90 N
 b. 87 N
 c. 84 N
 d. 79 N
 e. 67 N
 f. 30 N
 7. $R = 42 \text{ m}$, 315°
 8. $V = 112 \text{ m/s}$, 117°
 9. $F = 820 \text{ N}$, 232°
 10. $R = 48.1 \text{ m}$, 3.6° north of east
 11. $1.93 \times 10^2 \text{ km}$, north
 $2.30 \times 10^2 \text{ km}$, east
 12. 200 N
 13. $V_x = -50.0 \text{ km/h}$,
 $V_y = -86.6 \text{ km/h}$
 14. a. horizontal = 48 N;
 vertical = 82 N
 b. horizontal = 82 N;
 vertical = 48 N
 15. 0.71 m/s^2
 16. a. 30 N
 b. 29 N

- c. 21 N
 d. 15 N
 e. 0 N
 17. 580 km/h, 54° east of north
 18. 74 N, 253°
 19. 460 N
 20. 22 N
 21. a. 4.9 m/s^2
 b. 59 m
 c. 1 s

Chapter 7

1. a. 10.0 s
 b. $2.00 \times 10^3 \text{ m}$
 2. 0.966 m
 3. 132 m
 4. 1.7 m
 5. 1.7 m
 6. a. 3.46 s
 b. 58.8 m
 7. a. 55°
 b. 14 m
 8. a. 28 m/s
 b. 4.1 s
 c. 20 m
 9. a. 57.9 m
 b. 10.2 m
 10. 13 m/s
 11. $1.5 \times 10^3 \text{ m}$
 12. a. $2.1 \times 10^2 \text{ N}$
 b. $1.7 \times 10^2 \text{ N}$
 13. 972 N
 14. 2.0 m
 15. a. 2.01 s
 b. 4.86 s
 16. a. 0.10 kg
 b. 0.25 m
 c. shorten pendulum to 4.1 cm

Chapter 8

1. $2.7 \times 10^{12} \text{ m}$
 2. a. $2.21 \times 10^{15} \text{ m}^2/\text{s}$
 b. $2.0 \times 10^{11} \text{ m}^2/\text{s}$
 3. $4.2 \times 10^7 \text{ m}$

4. $1.0 \times 10^{-47} \text{ N}$
 5. $6.67 \times 10^{-11} \text{ N}$
 6. a. $1.6 \times 10^3 \text{ kg}$
 b. $1.3 \times 10^{-10} \text{ m/s}^2$
 7. $8.3 \times 10^{-9} \text{ N}$
 8. $7.2 \times 10^{22} \text{ kg}$
 9. a. $1.7 \times 10^{-10} \text{ N}$
 b. $1.7 \times 10^{-12} \text{ N}$
 10. $6.0 \times 10^{24} \text{ kg}$
 11. 235 N
 12. 79 days
 13. $V = 3.47 \times 10^3 \text{ m/s}$;
 $T = 6.45 \times 10^3 \text{ s}$ or 1.79 h
 14. 19.6 m/s^2 ; 2.45 m/s^2 ; 4.9 m/s^2
 15. 7.35 m/s^2
 16. 1.60 m/s^2

Chapter 9

1. 0.013 s
 2. a. $74 \text{ N} \cdot \text{s}$
 b. $1.0 \times 10^1 \text{ m/s}$
 3. a. $2.0 \times 10^4 \text{ kg} \cdot \text{m/s}$
 b. $1.3 \times 10^3 \text{ N}$
 4. $-1.2 \times 10^3 \text{ N}$
 5. $-6.0 \times 10^1 \text{ N}$
 6. a. $-14.5 \text{ kg} \cdot \text{m/s}$
 b. $-3.2 \times 10^4 \text{ N}$
 7. a. $1.32 \times 10^4 \text{ kg} \cdot \text{m/s}$
 b. $-1.32 \times 10^4 \text{ kg} \cdot \text{m/s}$
 c. $1.32 \times 10^4 \text{ kg} \cdot \text{m/s}$
 d. -19.4 m/s
 8. 9.6 km/h
 9. -4.94 m/s
 10. 0.30 m/s
 11. 0.35 m/s
 12. 1.1 m/s
 13. 1.26 in direction of riding
 14. 2.8 m/s
 15. b. 3.5 m/s; 67°

Chapter 10

- 988 J
- 2.75×10^4 N
- 8.87×10^7 J
- 3.44×10^3 J
- 4.4×10^3 J
- 3.4×10^3 J
- 8.0×10^4 J
- 36.2°
- 3.4×10^4 W
- 126 W
- 2.04×10^3 W
- 0.63 kW
- a. 3.5
b. 4.00
c. 88%
- 0.24 m
- 31.5 cm

Chapter 11

- 2.26×10^{-12} J
- 0.90 J
- a. 84 J
b. 84 J
c. 11 m/s
- 5.2 m
- a. 2.6×10^4 J
b. 66 m
c. 3.9×10^2 N
- 2.1 J
- 2.8×10^3 J
- 2.0 J
- 0.24 m
- 72°
- a. 1.17×10^3 J
b. 3.00×10^3 J
c. 3.00×10^3 J
d. 4.17×10^3 J
e. 23.6 m/s
- a. 2.4×10^5 J
b. 2.0×10^2 m
c. 1.2×10^3 N
d. 1.7×10^3 N

- a. 12.5 m/s
b. 781 J

- 19 m/s

- 2.8×10^2 m/s

Chapter 12

- 238.55 K
- -222.87°C
- 1.3×10^5 J removed
- 3.94×10^3 J
- 4.6 kg
- 0°C
- 132 J/kg · K
- a. 8.2×10^3 J
b. 1.3×10^2 J/kg · K
- 25.2°C
- $T_f = 16.2^\circ\text{C}$
- 1.18×10^5 J
- 3.6×10^5 J
- 30.0°C
- 0.29°C
- 47.8 g

Chapter 13

- 0.760 m
- 1.6×10^4 Pa
- 36.5 kg
- 4.0×10^3 Pa
- a. 1.61×10^3 Pa
b. 6.07×10^3 Pa
- a. 412 N
b. 4.20×10^{-2} m³
- 16.0
- 875 N
- 5.00×10^3 kg/m³
- 3.92×10^6 N
- -2.7×10^{-1} m
- 0.801 m³
- 5.3×10^3 cm³
- 4.5×10^{-2} cm

- 719°C

Chapter 14

- 5.00 m
- a. 0.250 s
b. 4.00 Hz
- a. 0.244 s
b. 4.10 Hz
- 1.50 m/s
- 0.330 m/s
- 0.600 m/s
- 8.00 m/s
- 1.6 m
- 3.00 m
- 12.0 Hz
- 24°

Chapter 15

- 8.6×10^2 m
- 150 m/s
- 800 m/s
- 1.60 m
- 0.635 m
- 1.07 s
- 7.87 s
- 1030 m
- 430 Hz
- 310 Hz
- 70 dB
- 110 dB
- 451 Hz
- 4 Hz
- 8 beats/s
- 435 Hz

Chapter 16

- 4.5×10^2 nm
- 4.50×10^5 m
- 3.8×10^{16} m

4. 2.7×10^2 s
5. 2.5 s
6. 3.37×10^{-7} s
7. 364 m
8. 60 MHz
9. 0.50 lx
10. 1.1×10^2 cd
11. 6.9 m

Chapter 17

1. 28°
2. 1.37
3. 15.9°
4. 48.4°
5. 85.23560°
7. 49.5°
8. apparent interception of rays at 9.0 cm below surface; apparent depth/ true depth = 0.75
9. 2.26×10^8 m/s
10. 1.28×10^8 m/s
11. 1.71
13. 1.56
14. 29.8°
17. 0.20
18. 2.0×10^6 m/s

Chapter 18

1. 75 cm behind mirror
2. 20.0 cm
3. 75.0 cm
4. 6.25 cm in front of mirror
5. 24.2 cm
6. 42.6 cm
7. a. 21.1 cm
b. -3.81 cm; inverted
8. -1.92 cm; inverted
9. 3.0
10. -0.15 m

11. -0.060 m
12. 39.3 cm
13. 10 cm
14. 1.1×10^2 cm
15. -1.5 cm; inverted
16. 6.7 cm
17. 0.19 mm
18. 15 cm
19. 25 cm; erect

Chapter 19

1. 4.00×10^2 nm
2. 5.0×10^2 nm
3. 5.40 mm
4. 0.750 m
5. 6.00 km
6. 1.3×10^{-6} m
7. 1.62 m
8. 3.7 m
9. 5.7°
10. 2.35×10^{-3} mm/line
11. 16.7°
12. 524 nm
13. 0.360 m
14. 2.18×10^{-5} m

Chapter 20

1. $F/4$
2. $4F$
3. 1.0×10^{-5} N
4. 8.0×10^{-5} N
5. 6.25×10^{18} electrons
6. $+9.0 \times 10^3$ N
7. -1.1×10^2 N; the force is attractive
8. +44N; away
9. -9.2×10^{-16} N
10. +2.5 N
11. $\pm 2.0 + 10^{-10}$ C

12. -9.7×10^{-6} C
13. 7.4 N to the left
14. 6.7 N at 7.2° to the left of vertical

Chapter 21

1. 1.00×10^3 N/C
2. 8.0 N/C
3. 6.9 N/C
4. 1.5 mC
5. -1.60×10^{-16} N
7. 2.00×10^3 V
8. 0.15 mJ
9. 9.00×10^{10} J
10. 11 V
11. 6.0×10^3 V
12. 1.8×10^8 V/m
13. 1.2×10^{-13} N
14. 40 μ F
15. 8.6×10^5 V
16. 3.6 mC

Chapter 22

1. 0.160 A
2. 1.00×10^2 C
3. 180 W
4. 83 W
5. a. 2.0 A
b. 12 kJ
6. 4.00 Ω
7. 20.0 Ω
8. 0.400 V
9. a. 10.4 A
10. a. 0.500 A
b. 0.522 A
11. 460 Ω
12. 133 Ω
13. a. 1.41 A
b. 0.447 A
14. 24 W

15. 62 cents/year
16. a. 16.7 A
b. 7.19 Ω
c. \$3.36

Chapter 23

1. a. 350 Ω
b. 0.143 A
c. 17.9 V
2. b. 60 Ω
c. 0.20 A
3. a. 680 Ω
b. 18 mA
c. 2.2 V
4. a. 0.10 A
b. 400 Ω
c. 40 Ω
5. 153 Ω
6. 7.2 Ω
7. 4.0 Ω
8. a. 36 Ω
b. 0.19 A
c. 0.14 A
9. a. 17 Ω
b. $I_1 = 1.0$ A; $I_2 = 0.64$ A;
 $I_3 = 0.41$ A
11. b. 6.0 Ω
c. 1.0 A
d. 0.75 A
e. 2.3 V
12. b. 20.0 Ω
c. 6.00 A
d. 3.00 A
e. 90.0 V
15. a. 6.0×10^3 Ω
b. 6×10^3 Ω
c. 1.8×10^4 Ω
d. 2.0×10^3 Ω

Chapter 24

6. 0.11 N
7. 0.060 N
8. 21 mN
9. 0.30 T
10. 4.2 A
11. 599 k Ω

14. 9.6×10^{-16} N into the page
15. 2.8×10^{-14} N
16. 1.9×10^{-12} N

Chapter 25

2. 0.20 mV
3. 5.0 mT
4. 20 m/s
5. 10 m/s
6. a. 6.4 V
b. 1.0 A
7. 41 mA
8. 170 V
9. 3.5 A
10. 406 V
11. 15.0 A
12. 69.4 Ω
14. 1 to 545
15. a. 50 turns
b. 0.40 A

Chapter 26

1. 7.6×10^5 m/s
2. 0.47 mT
4. 2.3 mT
5. 0.27 m
6. 2.8 cm
7. 1.25×10^7 C/kg
8. 2.7×10^{-26} kg
9. 16 u
10. 2.89 cm
11. 6.25 cm
12. 0.75 cm
13. 0.794 m

Chapter 27

2. 8.21×10^{14} Hz
3. 3.8 eV
4. 1.2×10^{-18} J

5. 5.0 V
6. 5.3×10^{-19} J
7. 5.3×10^{-19} J
8. 1.07×10^{-19} J
9. 1.66×10^{-27} kg \cdot m/s
10. 9.47×10^{-28} kg \cdot m/s
11. 0.24 nm
12. 2.4×10^6 m/s
13. a. 4.2×10^7 m/s
b. 0.017 nm

Chapter 28

1. 5.38×10^{14} Hz
2. E_3
3. 2.23 eV
4. 1.15 eV
5. 0.848 nm
6. $E_1 = -0.278$ eV
 $E_2 = -3.40$ eV
7. 3.12 eV
8. 7.53×10^{14} Hz

Chapter 29

1. 1.55 eV
2. 4.63×10^{22} e $^-$ /cm 3
3. 3.1 V
4. 20 Ω
5. 0

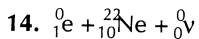
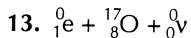
Chapter 30

1. 47 electrons, 47 protons, 62 neutrons
2. ${}_{20}^{40}\text{Ca}$
3. ${}_{30}^{64}\text{Zn}$
4. ${}_{84}^{210}\text{Bi} \rightarrow {}_2^4\text{He} + {}_{82}^{206}\text{Pb}$
5. ${}_{6}^{14}\text{C} \rightarrow {}_{-1}^0\text{e} + {}_7^{14}\text{N} + {}_0^0\bar{\nu}$
6. ${}_{89}^{225}\text{Ac} \rightarrow {}_2^4\text{He} + {}_{87}^{221}\text{Fr}$
7. ${}_{88}^{227}\text{Ra} \rightarrow {}_{-1}^0\text{e} + {}_{89}^{227}\text{Ac}$
8. ${}_{29}^{65}\text{Cu} + {}_0^1\text{n} \rightarrow {}_{29}^{66}\text{Cu} \rightarrow {}_1^1\text{p} + {}_{28}^{65}\text{Ni}$
9. ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{40}^{96}\text{Zr} + 3({}_0^1\text{n}) + {}_{52}^{137}\text{Te}$

10. a. 25% is left
 b. 12.5 % is left
 c. 6.3 % is left

11. 1/16 is left

12. 5 half-lives, or 515 years



15. +1

16. a. 0
 b. -1

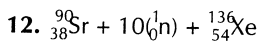
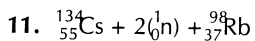
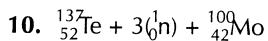
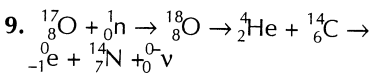
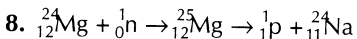
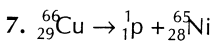
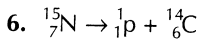
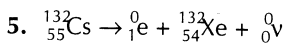
Chapter 31

1. a. 0.098 940 u
 b. 92.16 MeV

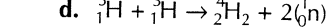
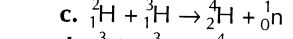
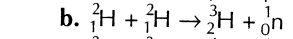
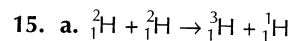
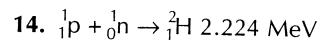
2. a. 0.291 77 u
 b. 271.8 MeV

3. a. 0.186 96 u
 b. 174.2 MeV
 c. 7.916 MeV/nucleon

4. 7.01600 U



13. a. 0.15096
 b. 140.6 MeV



Appendix B Continued

Numerical Answers to Text Questions

Chapter 1 _____

No numerical answers

Chapter 2 _____

Concept Review

p.19

1.1 1.574×10^8

p.26

2.3 Between 181.5 and 182.5 cm

p.31

3.2 Between 12 and 13 m/s

p.34

4.3 $S = 20T$

Applying Concepts

p.36

2a. Approx. 1 cm

2b. Approx. 0.1 mm

2c. Approx. 3 m

2d. Approx. 1 km

p.37

9. Zero

Chapter 3 _____

Concept Review

p.49

1.4b 171 numbers/min

Applying Concepts

p.58

9a. At 1.4 s and 8.2 s

9b. Car A

9c. At 4s

p.61

Using a Graphing Calculator

19.7 m/s

Chapter 4 _____

No numerical answers

Chapter 5 _____

Reviewing Concepts

p.104

5. 3.0 kg

Chapter 6 _____

Concept Review

p.113

1.3 700 N and 100 N

p.120

2.1 5 N

Applying Concepts

p.128

1. 10 mm

2. 15 N

3. Largest: 7 N; smallest: 1 N

9. Zero

p.129

12a. 45°

12b. 0°

12c. 90°

Chapter 7 _____

Applying Concepts

p.151

1. -20 m/s

4. 6.0 s

p.153

Using a Graphing Calculator

45 m above the ground

Chapter 8 _____

Concept Review

p.170

2.1 1.6 N/kg

Applying Concepts

p.171

2. Force becomes 1/4 as strong

4. Ratio is halved

9. $(1/4)g$

10. g would double

11. 3 times Earth's g

12. It will double

p.173

Using a Graphing Calculator

9.77 m/s²; 9.73 m/s²; 9.46 m/s²;
 9.18 m/s²

Chapter 9 _____

No numerical answers

Chapter 10 _____

Concept Review

p.211

2.3a 2 J

2.3b 2 J

Chapter 11 _____

Applying Concepts

p.237

11. 50 J

13. Speed is larger by a ratio of
1.414:1

Chapter 12 _____

Applying Concepts

p.262

2a. $-40^\circ\text{C} = -40^\circ\text{F}$

2b. $574\text{K} = 574^\circ\text{F}$

Chapter 13 _____

Concept Review

p.277

1.1b Force is 1.67 times more on the
larger box

Chapter 14 _____

No numerical answers

Chapter 15 _____

Concept Review

p.312

1.4 By a factor of 300

Applying Concepts

p.325

7. 100 times greater

8. 10

p.327

Using a Graphing Calculator

Amplitude = 1.41;

wavelength = 360

Chapter 16 _____

Concept Review

p.336

1.1 9 km

1.4 0.71 m

p.342

2.4 $\lambda/2$

Reviewing Concepts

p.343

2. 400 nm to 700 nm

Applying Concepts

p.344

3. 1/4 as bright

4. 1/4 as bright

Chapter 17 _____

Applying Concepts

p.363

5a. 19.2°

5b. 30.0°

Chapter 18 _____

p.389

Using a Graphing Calculator

At 5 cm, 7.5 cm; at 10 cm, 15.2 cm;

at 13 cm, 38 cm; at 17 cm, 37 cm;

at 20 cm, 14.4 cm; at 30 cm,

5.0 cm; at 50 cm, 2.1 cm

Chapter 19 _____

No numerical answers

Chapter 20 _____

Applying Concepts

p.422

12. 16 times the original force

Chapter 21 _____

No numerical answers

Chapter 22 _____

Reviewing Concepts

p.464

4. 6.25×10^{18}

Applying Concepts

p.465

8. With 1.5-V battery, $R = 3.3 \times 10^4 \Omega$; with 3.0-V battery, $R = 120 \Omega$

Chapter 23 _____

No numerical answers

Chapter 24 _____

No numerical answers

Chapter 25 _____

No numerical answers

Chapter 26 _____

Reviewing Concepts

p.552

1. Mass = 9.11×10^{-31} kg; charge = -1.60×10^{-19} C

Chapter 27 _____

Concept Review

p.569

2.4 Approx. 50 nm

Applying Concepts

p.570

1. Approx. 7-fold increase

7. Approx. 10^{33} -fold difference

Chapter 28 _____

Applying Concepts

p.592

6. Maximum energy = 13.6 eV

Chapter 29 _____

No numerical answers

Chapter 30 _____

Concept Review

p.624

1.3 113 days

Applying Concepts

p.636

2. Uranium-238, with 146 neutrons

p.637

Using a Graphing Calculator

850, 2400 and 4200 years old, respectively

Chapter 31 _____

No numerical answers