Chapter 1 Answer Key

BC Science Physics 11

Page 4 – Quick Check

1. A law is a general statement of fact
2. Observation - Hypothesis - Experimentation – Statement of Theory
3a. Quantitative
3b. Qualitative
3c. Quantitative
3d. Qualitative
3e. Qualitative
3f. Quantitative
3g. Quantitative

Page 6 – Quick Check

1. 0.5
2. 19^0
3. 1156
4. 800 or 8.00×10^2
5. 2.64159265358979 – a good point to discuss sig figs

Page 12 – Quick Check

1. 1 and 3 - low precision, points are spread apart; 2 and 4 - high precision, points are close together within a close range.
2. 1 and 2 – low accuracy; 3 and 4 high accuracy
3. 1 and 2
4. 3 and 4

Page 14 – Practice Problems 1.3.1

1. 12.93 mm
2. 48.1 m^3
3. 12.01 ml
4. 0.9 mm
5. 12.5 g
6. 16.767 kg

Page 16 – Practice Problems 1.3.2

1. 0.31 m^2
2. 5.2 cm^2
3. 6.7 cm
4. 76.8 g
5. 4.1×10^2 g/ml

Page 17 – Quick Check

1. (a) 0.00572 kg = 5.72×10^{-3} kg

(b) 520 000 000 000 km = 5.2 x 10^{11} km
(c) 300 000 000 m/s = 3.0 x 10^{8} m/s
(d) 0.00000000000000000016 C = 1.6x10^{-19}C
(e) 118.70004 g = 1.1870004 x 10^{2} g
2. (a) $10^{3+7+12} = 10^{22}$
(b) $10^{23-5} = 10^{18}$
(c) $10^{12+(-13)} = 10^{-1}$
(d) $10^{-8+(-12)} = 10^{-20}$
(e) $10^{5-(-7)} = 10^{12}$
(f) $10^{-2-(-9)} = 10^{7}$
3. (a) 2.5 x 10^{-10}
(b) 6.2 x 10^{9}
(c) 4.69 x 10^{7}
(d) 4.501 x 10^{-3}
4. 358 m^3 = 3.58 x 10^{2} m^3
5. 11 g/ml

Page 23 - Practice Problems 1.4.1
1. 1.6 x 10^{-2} ks
2. 75 L
3. 4.57 x 10^{8} m/s
4. 5600 dm

Page 24 – Practice Problems 1.4.2
1. 2.67 kg/L
2. 8.9994 x 10^{-7} kg/L
3. 16 m/s

Page 25 – Practice Problems 1.4.3
1. 34 000 g Hg
2. 1.47 L Pb
3. 1.5 x 10^{8} km

Page 26 – Practice Problems 1.4.4
1. 4300 cm^3
2. 1030 g/cm^2
3. 0.51 lb/ft^3

Page 29 – Practice Problems 1.4.5
1a. Exponential
1b. Inverse
1c. Linear
2a. Linear
2b. 4 ^{0}C/min
2c. 42 ^{0}C
2d. Temp = (4 ^{0}C/min)t + 22 ^{0}C/min
2e. 14.5 min
2f. Temperature of water in beaker at
2g. Uneven heating

Chapter 2 Answer Key

BC Science Physics 11

Page 39 Practice Problems 2.1.1

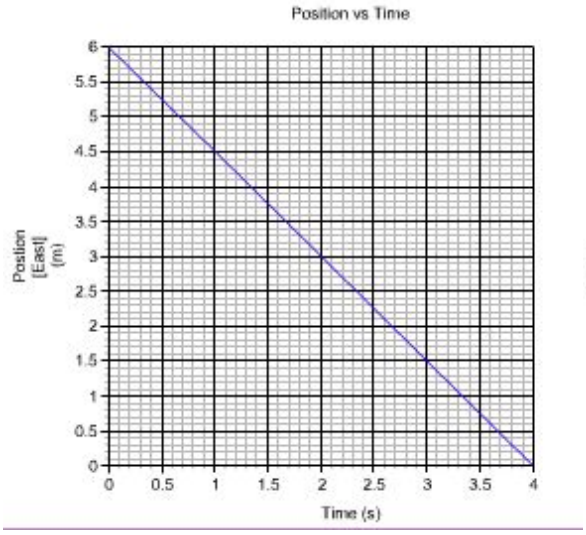
1a. 1100 m
1b. 500 m 36^{o} S of W
2a. 503 m
2b. 209 m
3. Total Distance = 19 m.
Displacement = 5.0 m 53^{o} E of N

Page 41 Quick Check

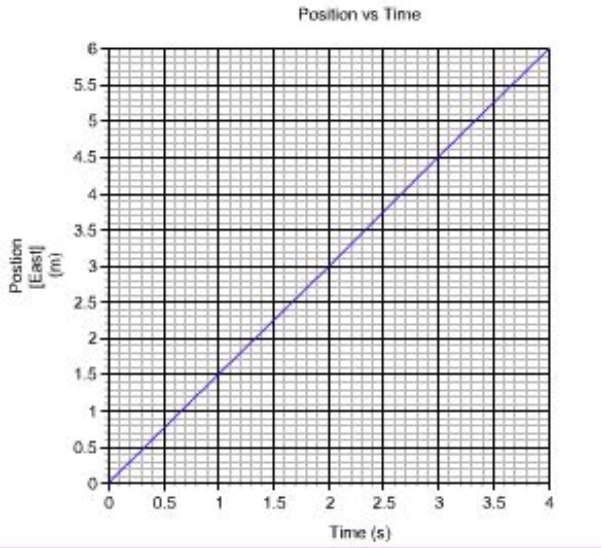
1a. Average speed is total distance over total time. Instantaneous speed is speed at a give point in time.
1b. When an object is moving at a constant speed.
2. 89 km/h
3. 0.76 hr or 46 min
4. 460 km

Page 44 Practice Problems 2.1.3

1a. Object at rest.
1b. Object moving away from origin at constant velocity.
1c. Object moving towards origin at a constant velocity.
2a.



2b.



2c. Person moving with ball so graph line horizontal
3a.

Time (s)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Distance (m)	8.3	16.6	24.9	33.2	41.5	49.8	58.1	66.4	74.7

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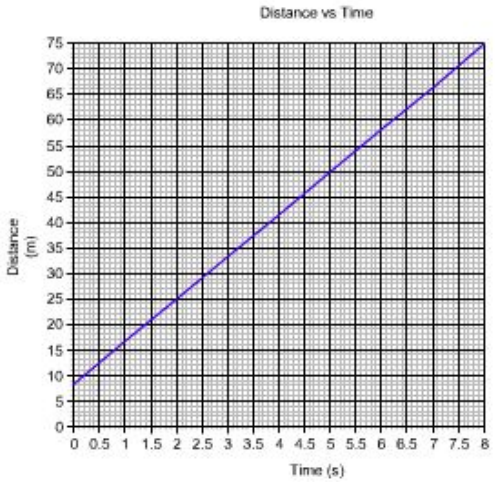
3b.



Page 46 2.1 Review Questions

1. Yes, when the direction is different
2. Right and left. Compass directions – north, south, east, west
3. 0.64 km
4. 2.3 hr

5a. 1.3×10^2 s

5b. 2.2 min

6. 114 km/hr

7a. 95 km

7b. 86 km/hr

8a. 0.50 sec

8b. 28 m/s

Page 49 Practice Problems 2.2.1

1a. 20km/h/s

1b. 3 m/s^2

2. 2.00 km/h/s
3. 15 km/h/s

Page 52 2.2 Review Questions

1a. 16.7 m/s

1b. 25.6 m/s; 92.1 km/h

2. 3.0 s

3a. $v_f = 20\text{m/s} + 14.0\text{m/s}^2 t$

3b. 14.0 $m/s^2 t$

3c. 14.0 m/s^2

3d. 14.0 m/s^2

3e. Observers were at different locations. The aircraft was already moving when observer (a) recorded data.

4. 5.0 m/s

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5. 8.5 m/s^2
6. Graph to come
7a. 10 m/s^2
7b. 0
7c. -7.5 m/s^2

Page 56 Practice Problems 2.3.1
1a. 15.0 m/s
1b. 4.00 m/s^2
1c. acceleration
1d. $v_f = 15\text{m/s} + (4.00\text{m/s}^2)t$
2a. 5.0 m/s
2b. 9.8 m/s^2
2c. 17 m/s

Page 58 Quick Check
1. 10 m/s [E]
2. 64.0 m
3. 41.6 m

Page 62 2.3 Review Questions
1a. 5.5 m/s
1b. -7.9 m/s^2
1c. $v_f = 5.5\text{m/s} - (7.90\text{m/s}^2)t$
2a.6.6 m/s
2b. -2.2 m/s^2
2c. 3.0 s
3. -1.23 m/s^2
4a. 4.0 m/s
4b. 10 m
5a. 3.00 m/s^2
5b. 45.0 m/s
5c. 3.38 x 10^2 m
6.167 m or 1.7 x 10^2 m
7. 1.0 x 10^1 s
8. 9.0 x 10^{15} m/s^2

Page 65 Practice Problems 2.4.1
1a. 1.0 x 10^2 m/s
1b. air resistance slows the ball down
2. 62.6 m
3a. 18.6 m/s
3b. 17.6 m
4. 2.4 x 10^2 m

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Page 67 Quick Check
1a. 9.8 m/s^2
1b. -9.8 m/s^2
1c. 9.8 m/s^2
2. (1.2, 0); at time 1.2 s, the ball reaches the highest point of its motion and comes to rest before falling back down.
3. 4.9 m

Page 68 2.4 Review Questions
1. 0.40 m/s^2
2a. 196 m/s^2
2b. -9.8 m/s^2
2c. 196 m/s
2d. At B, because v_y=0 at peak of flight
2e. As soon as the ball leaves the pitcher's hand, the only force is gravity, which means a = g = -9.8 m/s^2
2f. Direction is as important, as well as speed
2g. 82.3 m
2h. 82.3
2i. 0 – ball returns to original place
3a. 4.9 m
3b. 14.7 m

Page 69 Chapter 2 Review Questions
1. Velocity is speed and direction
2. 79 km/h
3a. 20.8
3b. 55.13
3c. 0.2 m/s
4. 2.56 s
5. When acceleration constant
6. 70 m/s or 252 km/h or 2.5 x 10^2 km/h
7a. 8.00 m/s^2
7b. 40.0 m/s^2
7c. 2.00 x 10^2 m
7d. $v_f = 20.0\text{m/s} + (8.0\text{m/s}^2)t$
8. 4.0 m/s
9. 77.3 s
10. 66 m/s
11. 49 m
12a. 16 m/s
12b. 6.8 s
12c. 6.4 s
13. 0.10 s to pass window
14a. 4.00 m/s^2
14b. 9.00 s

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15. 7.67 m/s
16a. 3.1 m/s
16b. 0.64 s
17a. Graph of *d vs t* is a parabola
17b. Graph of *d vs* t^2 is a straight line

17c. A slope of 2.5 cm/s^2. So d = kt^2. Since $d = \frac{1}{2}at^2$, the slope must equal $\frac{1}{2}a$.

Therefore, $a = 2k = 5.0\text{cm/s}^2$

Page 73 Chapter 2 Extra Practice
1a. 60 s
1b. 3600 s
1c. 86400 s
1d. 3.15 x 10^7 s
2. 622 km/h or 6.2 x 10^2 km/h
3. 1.0 x 10^{-2} mm/s
4. 3.84 x 10^5 km
5. 5.3 x 10^2 km
6a. 15.0 m/s
6b. 4.00 m/s^2
6c. $v_f = 15.0\text{m/s} + (4.00\text{m/s}^2)t$
7a. 37.5 m/s
7b. 47 m
7c. 120 m
8a. 46.6 m – moose is saved
8b. 59.2 m – moose needs to move!
9. 10.4 s
10a. 24.6 m/s
10b. 88.5 km/h
11. -20.0 m/s^2
12. 8.2 s
13a. 3.50 m/s
13b. -0.25 m/s^2
13c. 24.5 m
13d. $v = 3.5\text{m/s} - (0.25\text{m/s}^2)t$
15. 6.3 m/s^2

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Chapter 3 Answer Key

BC Science Physics 11

Page 77 Quick Check

1. 8.8 x 10^2 N
2. 64.9 kg
3. 1.7 N/kg

Page 80 Quick Check

1a. $\frac{1}{4}F_g$

1b. $\frac{1}{9}F_g$

1c. $4F_g$

1d. $9F_g$

2a. 9.80 x 10^2 N

2b. 1.62 x 10^2 N

2c. 1.4 x 10^{-11} N

Page 83 3.1 Review Questions

1. 600 N
2. $F \alpha$ m
   $\therefore$ 3m = 3F

3a. 7.8 x 10^2 N

3b. 1.4 x 10^2 N

4. 80.5 kg
5. 3.61 m/s^2; 37%
6. 143.9 N

7a. $2F_g$

7b. $2F_g$

7c. $4F_g$

7d. F_g

8. 6.86 x 10^2 N and F = mg gives 6.86 x 10^2 N

9a. 7.5 x 10^{-8} N

9b. 3.00 x 10^{-7} N

10. 2.5 x 10^2 N

11. 1.72 x 10^3 N

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Page 88 Practice Problems 3.2.1
1. 30 N
2a. 29.4 N
2b. 24.5 N
3. 0.801

Page 92 3.2 Review Questions
1a. Steering, axles, chain, sprocket, lubricant
1b. Brakes, tires/road
2a. $\mu = \frac{F_{fr}}{F_N}$
2b. The units cancel
3. 0.480
4. 2.45×10^3 N
5. Friction force is independent of surface area of contact. The force remains the same.
6. 0.88

Page 94 Quick Check
1. 0.64 N
2. 1.33 N/cm
3. 20 cm

Page 97 3.3 Review Questions

1. Units cancel
2. Note: question refers to Figure 3.3.1.
$F = 1.33x$
3a. 2.7 cm
3b. 0.03 N
4. k is constant, 1.50
5a. k = 20 N/cm
5b. F_g = (20 N/cm) x
5c. 4.0 cm
5d. 60 N

Page 98 Chapter 3 Review Questions
1. 6.86×10^2 N and F = mg gives 6.86×10^2 N
2. 160 N
3. G is the same everywhere in the universe.
4a. Moon = 0.16g
Mercury = 0.34g
Ganymede = 0.15g
Sun = 27.9g

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4b. Mercury

5. 1.13×10^2 N

6. 1.8×10^2 N

7. 0.105

8a. If F_N (which is equal to F_g) is doubled, then the F_{fr} will double

8b. If stacks side by side, F_{fr} will stay the say as friction force is independent of surface area of contact.

9. 5.0×10^1 N

10a. Slope = 4.15 N/cm

F_g = (4.15 N/cm)x

10b. F_g = 6.23 N

10c. x = 1.57 cm

Page 100 Chapter 3 Extra Practice

1.

2a.

2b.

3.

4.

5a.

5b.

5c.

6.

7.

8.

9.

10.

11.

12.

13a.

13b.

14.

15.

16.

17.

18a.

18b.

18c.

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Chapter 4 Answer Key

BC Science Physics 11

Page 103 Quick Check
2. ISS astronaut has same inertial mass both on the station and on earth.

Page 104 Quick Check
2. As bus quickly stops all unsecured objects move forward (or in the direction of the motion) rather than backwards. Suitcase could not have moved backwards.

Page 108 4.1 Review Questions
2. Twice as much apples have twice the inertia
4. If the forces are balanced, the pen could be in uniform motion.
6. Headrest prevents head from snapping back over seat during rapid accelerations.
8. You feel your body moving forward. If you were wearing a seatbelt, you would feel your body pressing against seatbelt.

Page 110 Quick Check
2. 12 500 kg

Page 112 Practice Problems 4.2.1
2. 450 N each
4a. 20 N
4b. 0.41

Page 114 4.2 Review Questions
2a. 2.5 m/s^2
2b. 5.1×10^3 m/s
4. 6.0×10^1 kg
6. 0.11

Page 117 Quick Check
2. Reaction force is ground pushing back on feet.

Page 120 4.3 Review Questions

2. The club hitting the ball is the action force
4. Each exert the same force
6. -2000 N

Page 122 Quick Check
2. 1.98×10^4 kg

Page 125 – Practice Problems 4.4.1.

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2. 1.5 kgm/s

Page 126 – 4.4 Review Questions

2. 5.5×10^{-2} Ns
4. 0.88 m/s
6. 18 m/s

Page 127 Chapter 4 Review Questions

2. In an inertial frame of reference (sum of forces equal zero), if there are no unbalanced forces acting on a mass, it will not accelerate. It will continue moving at the same speed and in the same direction. If F = 0, then a = 0.

4. 2.0×10^{-2} m/s^2
6. 2.0 m/s^2
8. Answers will vary, but example should clearly identify both action and reaction force.

10a. Momentum is a measure of the product of an objects mass and velocity

10b. Momentum in a closed system is conserved. This is an important property when studying motion.

12. The reaction force on the rifle accelerates it into one's shoulder.
14. 3.4 m/s

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Chapter 5 Answer Key

BC Science Physics 11

Page 133 Practice Problems 5.1.1

1. 1.1×10^2 J
2. 1.72×10^4 J, or 17.2 kJ
3. $W = F \times 0 = 0$

Page 134 Practice Problems 5.1.2

1. 73 W
2. 5.4×10^5 J/h
3. Useable work: 2.7×10^{11} J; Heat: 8.1×10^{11} J

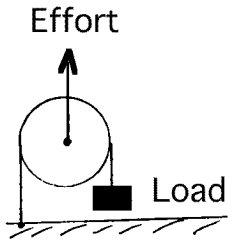
Page 139 5.1 Review Questions

1. 4.9×10^2 J
2. 1.30×10^3 J

3a. 1.2×10^2 J

3b. 0

4. 8.6×10^4 J
5. 375 J
6. Effort force (b) will only be $1/8^{th}$ of the load
7. With the following pulley arrangement, mechanical advantage is ½. The load is ½ the effort. So, the effort is twice the load.



8. 4.9×10^3 W

9a. 6.9×10^3 W

9b. 9.3 HP

10. 4.32×10^6 J

Page 143 Quick Check

1. Doubling mass will double kinetic energy, but doubling speed will *quadruple* kinetic energy.
2. 4.19×10^4 J
3. 7.2×10^{-2} J

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Page 144 Quick Check
1. Potential energy doubles
2. 25.3 kg
3. 6.12 m

Page 147 Practice Problems 5.2.1

1. 7.67 m/s
2. 31.9 m
3. 5.10 m

Page 148 5.2 Review Questions
1. 3.14×10^4 J
2a. 4.4×10^5 J
2b. 750 m
3. 1.63 m/s^2
4a. -5.2 m/s 4b. 7.41 m/s
5a. 2.0×10^2 J
5b. 0.31 m
6a. 20% lost
6b. Heat, sound, friction energy loses account for energy lost
7. 3.8×10^3 J
8a. 5.2 J
8b. Force is not constant as spring compresses. Average force identifies the assumption of constant force is being used.

Page 151 Quick Check
1a. Temperature is the average translational kinetic energy of all molecules in a material. Thermal energy is the total energy of all molecules in an amount of material. Heat is the amount of thermal energy transferred between one material to another.
1b. Heat refers to transfer of thermal energy. A body contains thermal energy.
2a. 293 K
2b. 586 K; 313^{o}C
3a. water
3b. nail
3c. nail loses heat to water
3d. water; neither

Page 154 Quick Check
1. convection
2a. breeze toward shore
2b. breeze away from shore
2c. early morning breeze goes out to sea
3. Vacuum stops conduction, convection. Silvered walls reflect radiant heat back into the bottle. Rubber or plastic stopper slows heat transfer by all three methods.
4. Dirty snow absorbs more radiant heat.

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Page 159 5.3 Review Questions

1. translational, rotational and vibrational
2. 303 K
3. radiation
4. from 2 to 1, and from 3 to 4
5. body heat is reflected back to the body. Hypothermia victims require warming from the outside, and the suit prevents this.
6. radiation
7. convection
8. metal blades conduct thermal energy away faster.

Page 161 Practice Problems 5.4.1

1. 2.3×10^{7} J
2. 39 ^{o}C
3. 4.0×10^{6} J
4. Water has a very high specific heat capacity
5. $c = 3.9\times10^{2}$ J/kg/C

Page 163 Practice Problems 5.4.2

1. 90%
2. 960 W
3. 3.0 W
4. 12% efficient. Examples of waste are heat, sound and friction

Page 165 5.4 Review Questions

1. 5.0×10^{4} J
2. 1.5×10^{5} J
3. 1.47×10^{5} J
4. 14.7 MJ
5. 200 J/kg/C

6a. 0.04 C/s
6b. 84 W
6c. 100 W

7. Higher specific heat capacity of water means ocean water helps moderates temperature
8. Three times as much light is emitted by the fluorescent light bulb
9. 90%

Page 167 Chapter 5 Review Questions

1a. 9.86 J
1b. 0
2. 126 J
3. Same amount of work both ways

4a. 4

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4b. 60 N
4c. 11.2
4d. 4.2×10^2 W
5a. 12
5b. 2.40 m
5c. 168 J
5d. 168 J
6. 3.6×10^6 J/s
7. 20 kJ
8. $3E_k$
9. 17 cm
10. 20 cm
11. 9.9 m/s
12. 523 K
13. 323 ^oC
14. Metal a good conductor of thermal energy
15a. convection
15b. conduction
15c. radiation/conduction
16. convection. Warm water is less dense than cold water
17. Water gives off 10 times as much heat.
18. approximate 36 ^oC
19. 720 kJ
20. 93%

Page 171 Chapter 5 Extra Practice
1.
2a.
2b.
3.
4.
5.
6a.
6b.
6c.
6d.
6e.
7a.
7b.
8a.
8b.
9.
10.
11.
12.
13.

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14a.
14b.
14c.
14d.
14e.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24

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Chapter 6 Answer Key

BC Science Physics 11

Page 176 Quick Check

1a. 1.25 Hz
1b. 0.800 s
2a. 256 Hz
2b. 3.91×10^{-3}s
3. 0.25 Hz

Page 178 Practice Problems 6.1.1

1a. If f doubles, λ is halved
1b. If f halves, λ is doubles
2. 200 Hz
3. 1.5 m

Page 181 6.1 Review Questions

1. energy
2. pulse
3. 107 300 000 Hz
4. 0.04 s
5. 0.5 Hz
6. 4 m as captain is looking at whole wave from the trough
7. 1/60 Hz
8. 1/43200 Hz
9. 1/3 T
10. 10 Hz
11. 1.0×10^{-2}m
12. 2 m/s

Page 194 6.2 Review Questions

1. reflection
2. diffraction
3. diffraction
4a. refraction
4b. Wavelength shortens, direction changes and frequency is constant
5. Images ‘c’ and ‘f’ will produce a flat rope when the two wave meet in the middle.
6. sound, light, water
7. sound
8. Yes, it will occur because you are moving relative to the source; same as vice versa
9. The plane is going faster than the speed of sound
11. A sonic boom occurs when something moves faster than the speed of sound which is also called the sound barrier.

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Page 196 Chapter 6 Review Questions

1. A pulse in a non-repeating wave. A periodic wave is repeating waves
2. See page 175 in work text
3. Hertz is the measure of frequency and refers to how many times per second.
4. Frequency and period are reciprocals of each other.

5a. 2.5 Hz

5b. 0.40 s

6. Transverse waves are produced by a vibration or disturbance that is at right angles to the motion. Longitudinal waves travel in the direction of the pulse.
7. Wave speed is the product of wave frequency and wavelength
8. $5.0 \times 10^{6}\,\text{m}$
9. 0.645 m
11. Refraction is the bending of a wave like when a water wave enters a shallower body of water. Diffraction is when a wave spreads out as it passes through narrow openings, around corners or small obstacles. For example, the rainbow you observe when you move a DVD disc in the light.

12a. decrease

12b. frequency stays the same

12c. Change if wave enters at an angle

12d. No change if wave does not enter at an angle

13a. Constructive interference is when waves add together when they meet

13b. Destructive interference is when wave cancel each other when they meet

14. Nodal lines are destructive interference and maximum is constructive interference
15. Circular waves, originating at the focus, reflect from the first mirror as straight, parallel waves that travel to the second mirror, reflect as circular waves with a center at the focus of the second mirror, where the match is.
16. $4.5 \times 10^{3}\,\text{m}$

Page 198 Chapter 6 Extra Practice

1.
2a.
2b.
3.
4.
5a.
5b.
5c.
6.
7.
8.
9.
10.
11.
12.

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13a.
13b.
14.
15.
16.
17.
18a.
18b.
18c.

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Chapter 7 Answer Key

BC Science Physics 11

Page 205 Quick Check

1. 1 m
2. The dark outside allows you to see reflection from glass

3a. Same distance, but image in the mirror
3b. behind
3c. Less of your image is viewable

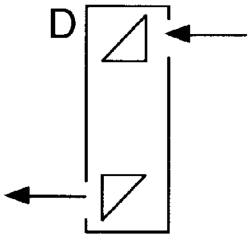
Page 210 7.1 Review Questions

2. Radiation that is detected by the human eye. 10^{15} Hz
4. Ultraviolet light, X-rays and gamma rays
6. Answers will vary, but placing a mirror at an angle to the corner in such a way the normal line is pointing directly at the corner will cause the incident ray to reach the mirror and the reflecting ray to reach your eye as stated in the law of reflection.
8. No light reaches the location of the image

9a. 5
9b. 7
9c. 23
9d. 35
9e. 359

10. You need a mirror half your height (90 cm)
11.

12. Image on screen was inverted, real and smaller
13.



Page 215 Quick Check

1a. real, inverted, smaller between C and F
1b. real, inverted, same size, at C
1c. Image is found beyond C

Page 218 Practice Problems 7.2.1

1. 100 cm
2. D = 2*f*

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3. 13.3 cm
4. d_i = -30.0 cm The image is virtual and appears behind the mirror

Page 223 7.2 Review Questions
4a. Concave
4b. Convex
4c. Plane
5. E, A, F,B, D, C
6a. Far away: Inverted, real, smaller, between C and F
6b. Outside C: Inverted, real, smaller, between C and F
6c. At C: Inverted, real, same size and at C
6d. Between C and F: Inverted, real, larger, beyond C
6e. At focal point: No image formed
6f. Between focal point and vertex: Upright, virtual, larger, behind mirror
7a. See worked solution video
8a. concave
8b. convex
8c. convex
8d. concave
9. Image to come, image will be upright, virtual, smaller and behind the mirror.
10a. No, all convex mirror images are virtual
10b. No, an image gets larger as an object gets closer to the mirror, but the image is never larger.

Challenge
1. Image to come

Page 228 Quick Check
1. 1.53
2. $\angle r = 4.11°$
3a. $\angle r = 19.5°$
3b. Light enters the glass at 30^o from the normal, then refracts within the glass at 20^o from the normal. When it leaves the glass it goes back into air, it will be at 30^o from the normal again.
4. Prism, Violet refracts most.

Page 230 Quick Check
1. $i_c = 24.4°$
2. $i_c = 41.8°$
3. n = 1.27

Page 237 7.3 Review Questions

1. Incident angle is 70o, which is greater than the critical angle, so this particular ray will reflect back into the water. Some rays will refract out at other angle and reach the fisher's eyes.

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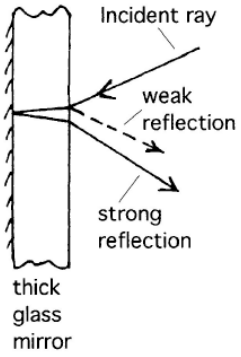
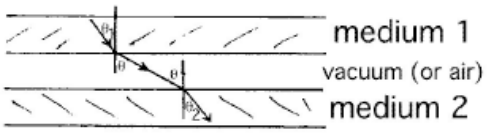
2a. Below
2b. Aim at what you see. The laser refracts light too.



3.
4. 39.3°
5. 600 nm
6. 1.24 x 10^8 m/s
7.



Snell's Law: For the situation above, where light travels from medium1 into a vacuum and then into medium 2,

$$\frac{\sin\theta}{\sin\theta_1} = n_1 \text{ and } \frac{\sin\theta}{\sin\theta_2} = n_2$$

$$\frac{n_1}{n_2} = \frac{\sin\theta}{\sin\theta_1} \times \frac{\sin\theta_2}{\sin\theta} = \frac{\sin\theta_2}{\sin\theta_1}$$

or, $n_1\sin\theta_1 = n_2\sin\theta_2$

8. Water is pure, light is coming from a vacuum or air, and the frequency is for 'average' visible light.
9a. refraction, dispersion and total internal reflection
9b. Sun behind you and rainclouds in front of you
9c. red, orange, yellow, green, blue, indigo, violet.
10. All the same speed in a vacuum. Red is fastest in glass.
11. 2.0×10^8 m/s
12. 1.54
13a. 489 nm
13b. blue
13c. Frequency determines colour

Page 242 Quick Check
1. See QR code below for summary.
2. The images formed by a diverging lens is always virtual, erect and smaller than the object. This QR code provides a visual summary.

Page 244 Quick Check

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1. 50.5 mm
2. 100 mm or 10.0 cm
3. 20 mm

Page 252 7.4 Review

2a. -50.0 cm
2b. a virtual image
3. To come
4. 1.90 cm
5. H_i = 1.7 cm
6. Magnification is 2.00, The image is real because $D_o > f$
7. To come
8.

$$\frac{1}{D_i} = \frac{1}{f} - \frac{1}{D_o} = \frac{1}{-6.0\text{cm}} - \frac{1}{10.0\text{cm}} = \frac{-16}{60.0\text{cm}}$$

D_i = -60.0 cm/16 = -3.75 cm (virtual image)

$$\frac{H_i}{H_o} = \frac{D_i}{D_o} = \frac{3.75\text{cm}}{10.00\text{cm}} = 0.375$$

(Image is diminished.)

H_i = 0.375 x H_o = 0.375 x 5.0 cm = 1.9 cm.

Image is on the same side of the lens as object.

9. Red eye is the flash reflecting off the retina. Most cameras flash twice. The first flash causes the pupil to contract and the second flash takes the picture. The smaller pupil reduces 'red eye'.

Page 254 Chapter 7 Review Questions

4. 0.8 mm
5. 7
6. To get a wide angle view
7. Place the filament between *f* and 2*f*
8. Between the focus and the mirror
9. 1.7 m (real image)
10. 2.0 m
11. $\angle r = 21°$
    The beam will lave the glass at 35°
12. $\angle i_c = 41.1°$
13. n=1/sin45°=1.41
14. To come
15. The shorter the wavelength (violet) the more the ray bends
16. 1.5×10^8 m/s

17a. The graph is a straight line through 0,0
17b. Slope is 1.50 (n=1.50)
17c. 41.8^o
18. Wrong lens to focus light
19a. D_o is greater than 2*f*

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19b. D_o is between f and $2f$
19c. $D_o = 2f$
19d. D_o is much less than f
20. Inverted, smaller, real image forms between C and F
21. E
22. 22.5 cm
23. Inverted, enlarged, real image forms beyond C
24. 12 mm
25. 6.5 cm
26. -55.9 cm

Page 258
Chapter 7 Extra Practice
1.
2a.
2b.
3.
4.
5a.
5b.
5c.
6.
7.
8.
9.
10.
11.
12.
13a.
13b.
14.
15.
16.
17.
18a.
18b.
18c.

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Chapter 8 Answer Key

BC Science Physics 11

Page 261 Quick Check

1a. 10 km/h
1b. 15 km/h
2a. 25 km/h
2b. 0 km/h
2c. 5 km/h
3. 0 km/h
4. 10 km/h
5. Assigning a positive value to velocities to the right in the figure.
Wind: +20 km/h
Bird: -5km/h
Boat: -15 km/h
Earth: 0 km/h
River: -5km/h

Page 263 Quick Check

1. zero, which is constant!
2. Same as Figure 8.1.4, but the parabola is elongated

Page 270 Practice Problems 8.1.1

1. 6.6 s
2. 10 s
3. 50 s
4. 1.1×10^2 s

Page 268 Practice Problems 8.1.2

1. 78 m
2. 50 m
3. 4.5 m

Page 272 Quick Check

1a. 0.10 *mc*
1b. 0.50 *mc*
1c. 0.87 *mc*
1d. 0.9999 *mc*
1e. *mc*
2a. approximately 0.10 *mc*
2b. 0.58 *mc*
2c. 1.8 *mc*
2d. 71 *mc*
2e. p approaches infinity

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3. $F = \Delta p / \Delta t$
$F \to \infty$ since $\Delta p \to \infty$

Page 274 8.1 Review Questions

2. Speed = c
3a. 13 a
3b. 38.0 m
4. $1.15t_o$
5. $v = 0.87c$
6. $0.866c$ or approximately $0.9c$
7. c, light from a star takes time to reach our eyes on earth.
8. $v = 0.995c$
9. 9×10^{10} J
10a. 4.1×10^{15} J
10b. 2.0×10^{5} years!

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Chapter 9 Answer Key

BC Science Physics 11
Numerical Answers

Page 290 Quick Check

4a. ${}^{4}_{2}\mathrm{He}$

4b. ${}^{0}_{-1}e$

4c. ${}^{214}_{82}\mathrm{Pb}$

4d. ${}^{210}_{84}\mathrm{Po}$

Page 292 Practice Problems 9.1.1

1. 62 atoms
2. 5.2 years. 1/32 is five half-lives.

Page 292 Quick Check

1. ${}^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$
2. ${}^{214}_{82}\mathrm{Pb} \rightarrow {}^{214}_{83}\mathrm{Bi} + {}^{0}_{-1}e$
3. 8 elements and 15 isotopes

Page 295 9.1 Review Questions

6a. ${}^{14}_{5}\mathrm{N}$

6b.

6c. ${}^{225}_{89}\mathrm{Ac}$

6d. ${}^{209}_{82}\mathrm{X}$ and ${}^{0}_{-1}\mathrm{x}$

7. 125 g

Page 303 Review Questions

9. 1.9×10^{3} atoms

11a. ${}^{226}_{88}\mathrm{Ra}$

11b. ${}^{0}_{-1}e$

11c. ${}^{14}_{7}\mathrm{N}$

11d. ${}^{4}_{2}\mathrm{He}$

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