Time Interval	Distance Travelled	Displacement
0 min–1 min	180 m	**180 m [E]**
1 min–2 min	**140 m**	**140 [W]**
2 min–3 min	**100 m**	100 m [E]

(b) 420 m

(c) 140 m [E]

Comprehension

Positive, negative, and zero slopes

Page 150

1. Graph B

2. Graph A

3. Graph C

4. Graphs A, B and C

5. Graph B

6. Graph C

7. Graph A

Analyzing Information

Uniform motion

Page 151

1. (a) non-uniform motion

(b) uniform motion

(c) non-uniform motion

2.

Time Interval	Slope of Line	Description of Motion
0 s–10 s	positive	The object is moving to the right of the origin with uniform motion.
10 s–15 s	zero	The object is at rest.
15 s–30 s	negative	The object is moving back toward the origin with uniform motion.
30 s–40 s	negative	The object is moving to the left of the origin with uniform motion.
40 s–55 s	positive	The object is moving back toward the origin with uniform motion.

3. 10 s–15 s

4. 15 s–30 s

5. 0–2 s and 7–12 s

6. pacing backward away from the bus stop

7. pacing forward toward the bus stop

8. 2 m in front of the bus stop

9. –8m, that is 8 m backward

10. 20 m

11. 0 m

Assessment

The language of motion

Page 153

1. E **2.** D **3.** B **4.** G **5.** F **6.** A **7.** C **8.** A **9.** B **10.** D **11.** D

Section 8.2 Applying Knowledge

Applying Knowledge

Calculating average velocity

Page 156

1. (a) $U_{av} = \frac{\Delta \vec{d}}{\Delta t}$

(b) $\Delta \vec{d} = \vec{v}_{av} \Delta t$

(c) $\Delta t = \frac{\Delta \vec{d}}{\vec{v}_{av}}$

2.

Displacement	Time	Average Velocity	Formula Used and Calculation Shown
15.6 m	3 s	5.2 m/s	$\vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t} = \frac{15.6}{3} = 5.2$ m/s
357.5 km	6.5 h	**55 km/h**	$\vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t} = \frac{357.5}{6.5} = 55$ km/h
22.6 m	**4 s**	5.65 m/s	$\Delta t = \frac{\Delta \vec{d}}{\vec{v}_{av}} = \frac{22.6}{5.65} = 4$ s
243.75 km	3.25 h	75 km/h	$\Delta \vec{d} = \vec{v}_{av} \Delta t = 75 \times 3.25 =$ 243.75 km
12.6 m	3.15 s	**4 m/s**	$\vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t} = \frac{12.6}{3.15} = 4$ m/s
24 km	**0.75 h**	32 km/h	$\Delta t = \frac{\Delta \vec{d}}{\vec{v}_{av}} = \frac{24}{32} = 0.75$ h
480 m	8 s	60 m/s	$\Delta \vec{d} = \vec{v}_{av} \Delta t = 60 \times 8 = 480$ m

3. (a) 150 s

(b) 70 s

(c) 255 m [E]

(d) 14 s

(e) 0.375 km/min

(f) 800 000 a (years)

(g) 0.65 km, or 650 m

Applying Knowledge

Slopes of position-time graphs

Page 157

1. average velocity

2. uniform motion; constant velocity

3. Slope is the change in the vertical distance divided by the change in the horizontal distance.

4. slope = $\frac{\text{rise}}{\text{run}}$

5.

Line	Rise	Run	Slope Calculation	Slope
A	4	15	4 ÷ 15	0.27 m/s
B	0	20	0 ÷ 20	0 m/s
C	8	5	8 ÷ 5	1.6 m/s
D	–6	15	–6 ÷ 15	–0.4 m/s

© 2008 McGraw-Hill Ryerson Limited

Analyzing Information

Analyzing position-time graphs

Page 158

1. (a)

Time Interval	Displacement	Average Velocity
0 s–2 s	0 m	0 m/s
2 s–5 s	–3 m	–1 m/s
5 s–7s	+ 5 m	+ 2.5 m/s
7 s–12 s	0 m	0 m/s
12 s–14 s	–8 m	–4 m/s
14 s–16 s	+ 4 m	+ 2 m/s
16 s–18 s	0 m	0 m/s
18 s–19 s	+ 2 m	+ 2 m/s
19 s–20 s	0 m	0 m/s

(b) at 14 seconds

(c) 0 m

2. (a) C

(b) E

(c) B

(d) D

(e) F

(f) A

3. (a) The *y*-intercept represents the position at which the runner starts.

(b) No. Runner B starts out farther ahead than Runner A.

(c) Runner B is running faster at 2 s because Runner B has a steeper slope than Runner A.

(d) At 5 s, both runners are at the same position.

(e) Runner A is ahead at 10 s.

Extension Activity

Constructing and interpreting position-time graphs

Page 160

1. (a) Graph should have a negative slope crossing the *x*-axis at 5 s.

(b) 3 seconds

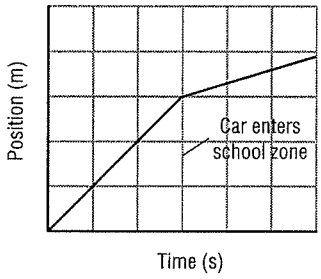
(c) 100 m [E]

(d) –12.5 m [W]

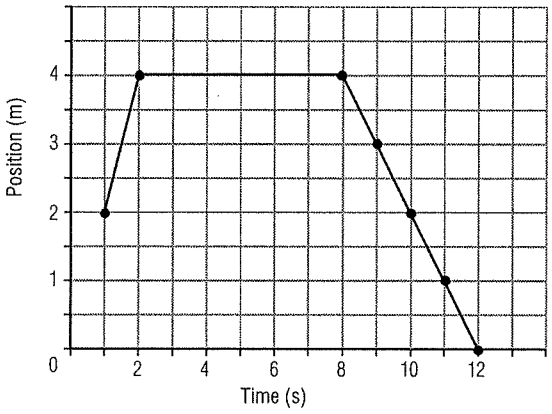
(e) –25 m/s

(f) The car is moving westward toward the origin with constant velocity.

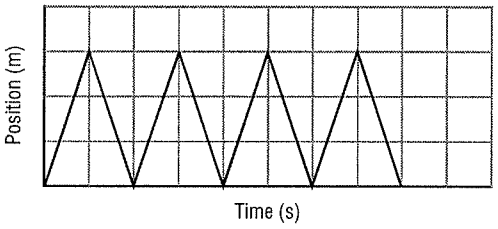
2. (a)



(b)



(c)



Assessment

Average velocity

Page 162

1. B **2.** C **3.** A **4.** D **5.** A **6.** A **7.** B **8.** D **9.** C **10.** B **11.** C **12.** C **13.** D **14.** A

Chapter 9 Acceleration is the rate of change in velocity.

Section 9.1 Describing Acceleration

Cloze Activity

Velocity and acceleration

Page 166

1. vector, speed

2. positive

3. negative

© 2008 McGraw-Hill Ryerson Limited

4. constant velocity
5. velocity
6. positive acceleration
7. negative acceleration
8. same direction
9. opposite direction
10. deceleration

Applying Knowledge

Calculating change in velocity

Page 167

1.

$\vec{v}_i$	$\vec{v}_f$	$\Delta\vec{v}$	Description of $\Delta\vec{v}$
+ 14 m/s	+ 5 m/s	–9 m/s	object is slowing down
+ 8 m/s	**+8 m/s**	0 m/s	object is in uniform motion
+13 m/s	+ 25 m/s	+ 12 m/s	object is speeding up
+ 20 m/s	–30 m/s	**–50 m/s**	object is slowing down
–38 m/s	**–48 m/s**	–10 m/s	object is slowing down
–16 m/s	–16 m/s	0 m/s	object is in uniform motion
–3 m/s	+ 22 m /s	**+ 25 m/s**	object is speeding up

2. **(a)** + 15 m/s
   (b) + 13 m/s
   (c) 0 m/s
   (d) – 6 m/s
   (e) – 10 m/s

Interpreting Illustrations

Positive, negative, and zero acceleration

Page 168

1. **(a)** positive acceleration
   (b) zero acceleration
   (c) negative acceleration
   (d) zero acceleration
2. **(a)** positive acceleration
   (b) negative acceleration
   (c) positive acceleration
   (d) negative acceleration
   (e) zero acceleration
   (f) positive acceleration

Assessment

Describing acceleration

Page 169

1. A 2. B 3. C 4. D 5. A 6. B 7. B 8. A 9. D

Section 9.2 Calculating Acceleration

Applying Knowledge

Calculating acceleration

Page 172

1. **(a)** $\Delta\vec{a} = \frac{\Delta v}{\Delta t}$
   (b) $\Delta v = a\Delta t$
   (c) $\Delta t = \frac{\Delta v}{a}$
2.

Change in Velocity	Time	Acceleration	Formula Used and Calculation Shown
140 m/s	8 s	17.5 m/s²	$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{140}{8} = 17.5$ m/s²
–60 km/h	4 h	**–15 km/h²**	$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{-60}{4} = -15$ km/h²
120 km/h	**2.5 h**	48 km/h²	$t = \frac{\vec{v}}{\vec{a}} = \frac{120}{48} = 2.5$ h
–52.5 m/s	15 s	–3.5 m/s²	$\vec{v} = \vec{a}\,t = (-3.5)(15) = -52.5$ m/s
12 m/s	2.5 s	**4.8 m/s²**	$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{12}{2.5} = 4.8$ m/s²
–25 m/s	**2 s**	–12.5 m/s²	$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{12}{2.5} = 4.8$ m/s²
48 km/h	9.6 h	5 km/h²	$\vec{v} = \vec{a}t = (5)(9.6) = 48$ km/h

3. **(a)** 7.8 m/s² [north]
   (b) 6 m/s [forward]
   (c) 1.52 s
   (d) +1700 m/s

Analyzing Information

Analyzing velocity-time graphs

Page 173

1. **(a)** acceleration
   (b) positive velocity
   (c) negative velocity
   (d) positive acceleration
   (e) negative acceleration
   (f) constant velocity; zero acceleration
   (g) zero velocity
2.

MOTION OF A BALL			
Time Interval	**Slope**	**Acceleration**	**Velocity**
0 s – 2 s	positive	positive	positive
2 s – 6 s	zero	zero	positive
6 s – 8 s	negative	negative	positive
8 s – 10 s	zero	zero	zero

3. **(a)** ball starts from rest and increases its velocity at a constant rate, heading to the right
   (b) ball travels right at a constant velocity and has zero acceleration

© 2008 McGraw-Hill Ryerson Limited

(c) ball slows down to a stop at a constant rate, while still travelling to the right

(d) ball is at rest (it has stopped)

Illustrating Concepts

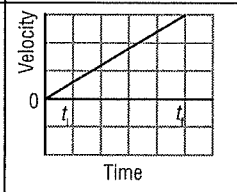
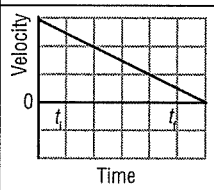
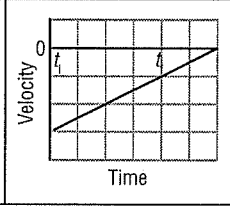
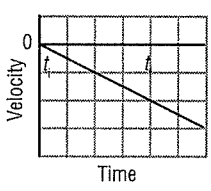
Sketching and interpreting velocity-time graphs

Page 174

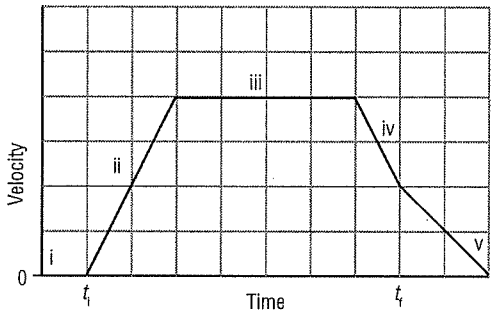
1.

	Graph A	Graph B	Graph C
Slope	zero	positive	negative
Acceleration	zero acceleration	positive acceleration	negative acceleration

2.

	Positive Acceleration	Negative Acceleration
Positive Velocity		
Negative Velocity		

3. (a)



(b) (i) zero slope

(ii) positive slope

(iii) zero slope

(iv) negative slope

(v) zero slope

(c) (i) zero acceleration

(ii) positive acceleration

(iii) zero acceleration

(iv) negative acceleration

(v) zero acceleration

Assessment

Calculating acceleration

Page 176

1. D 2. A 3. B 4. C 5. A 6. B 7. D 8. B

UNIT 4 Energy Transfer in Natural Systems

Chapter 10 The kinetic molecular theory explains the transfer of thermal energy.

Section 10.1 Temperature, Thermal Energy, and Heat

Illustrating concepts

Kinetic molecular theory and temperature

Page 180

1. Kinetic energy is the energy of a particle or object due to its motion.

2.

	Solid	Liquid	Gas
spaces between particles	very close	farther apart	even farther apart
movement of particles	vibrate slowly	move faster	move even faster
kinetic energy of particles	very little	increases	increases as collisions increase

3. Temperature is a measure of the average kinetic energy of all the particles in a sample of matter.

4. Hot water: Drawing should show long arrows (see textbook page 425, figure 10.2).

   Cold water: Drawing should show shorter arrows (see textbook page 425, figure 10.2).

5.

	Fahrenheit	Celsius	Kelvin
absolute zero	–459° F	–273°C	0 K
water freezes	32°F	0°C	273 K
water boils	212°F	100°C	373 K

Comprehension

Thermal energy, kinetic energy, potential energy

Page 181

1. Thermal energy is the total energy of all the particles in a solid, liquid, or gas.

2. Kinetic energy is the energy of a particle or an object due to its motion.

3. Potential energy is the stored energy of an object or particle, due to its position or state.

© 2008 McGraw-Hill Ryerson Limited