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

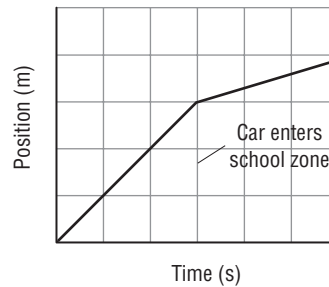**1. (a)** Graph should have a negative slope crossing the *x*-axis at 5 s.

   (b) 3 seconds

   (c) 100 m [E]

   (d) –12.5 m [W]
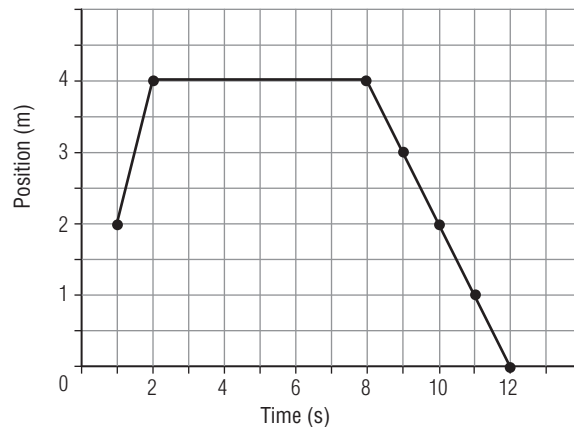
   (e) –25 m/s

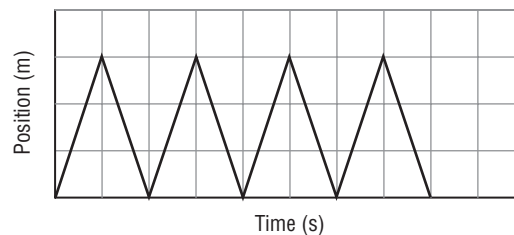   **(f)** The car is moving westward toward the origin with constant velocity.

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

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) $\Delta\vec{a} = \dfrac{\Delta v}{\Delta t}$

   (b) $\Delta v = a\Delta t$

   (c) $\Delta t = \dfrac{\Delta v}{a}$

2.

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

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

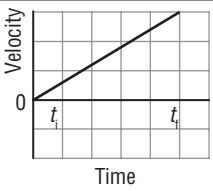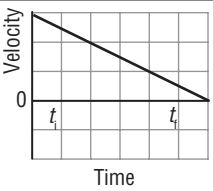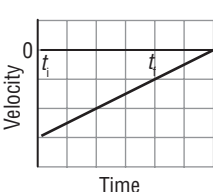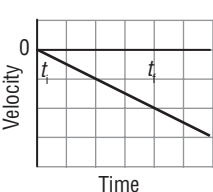**(d)** ball is at rest (it has stopped)

Illustrating Concepts
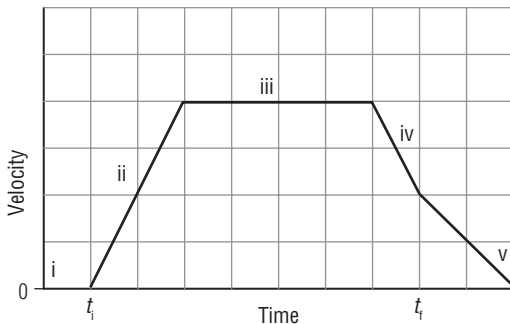**Sketching and interpreting velocity-time graphs**
Page 174

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.