(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

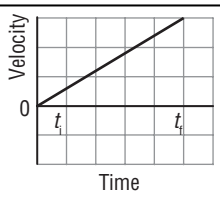
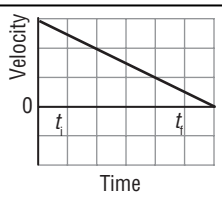
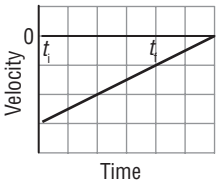
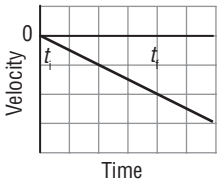
Sketching and interpreting velocity-time graphs

Page 174

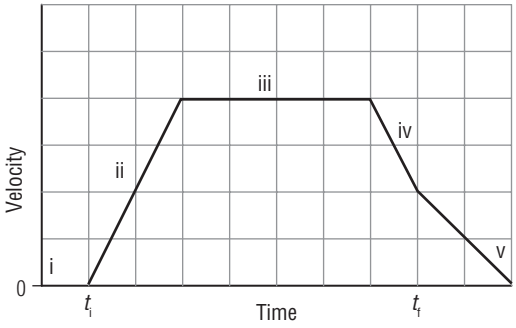
1.

	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.

4. As the temperature of an object rises, the amount of thermal energy rises.
5. As the kinetic energy of a group of molecules increases, the molecules move faster.
6. As the potential energy of a group of molecules increases, the molecules move farther apart.
7. Heat is the amount of thermal energy that transfers from an area or object of high temperature to an area or object of low temperature.
8. Answers may vary. Concept should show initial thermal energy having high levels then transferring this energy to an area or object with low thermal energy. End result of the transfer of energy would be increase in molecules moving and temperature then rising.
9. Thermal energy is transferred by conduction, convection, and radiation.

Applying Knowledge

Thermal energy transfer

Page 182

1.

Type of thermal energy transfer	What is happening in the diagram
conduction	Thermal energy from stove is transferred to pot. Stove has higher temperature and greater kinetic energy.
convection	Thermal energy is transferred within a fluid and a current is created moving the fluid from one place to another.
radiation	Any material with a temperature greater that absolute zero radiates some thermal energy

2. Metals are good thermal conductors.
3. Air, snow, wood, and Styrofoam are materials that do not transfer thermal energy easily and are called insulators.
4. Heating the liquid causes the particles to move faster. The warmer liquid moves to the top of the lamp because it is less dense than the surrounding liquid. At the top of the lamp, the liquid cools, contracts, and sinks only to be reheated and recirculated. The lava lamp operates by a convection current.
5. Radiant energy is the energy carried by electromagnetic waves.

Assessment

Temperature, thermal energy, and heat

Page 183

1. D **2.** A **3.** C **4.** G **5.** H **6.** B **7.** F **8.** E **9.** A **10.** B **11.** A **12.** C **13.** D

Section 10.2 Energy Transfer in the Atmosphere

Applying Knowledge

The Earth's atmosphere

Page 188

1. Air is a combination of gases in the lower atmosphere.
2. Nitrogen and oxygen make up 99 percent of dry air.
3. The Earth's rotation, the effects of day and night, and the Sun are some of the factors that cause the atmosphere to constantly change.
4.

Layer	Altitude above sea level	Average temperature	Factors affecting composition
troposphere	10 km	Drops 6.5°C per 1 km increase	• water vapour • solar radiation • thermal energy • particulate matter
stratosphere	10–50 km	– 55°C	• clear dry air • warmer at top • winds • ozone layer
mesosphere	50–80 km	– 100°C	• dust • meteors crashing
thermosphere	80–500 km	1500°C–3000°C	• solar radiation
exosphere	Over 500 km	Not defined	• merges with outer space

Comprehension

What is weather?

Page 189

1. Weather is the condition of the atmosphere in a specific place and at a specific time.
2. Convection moves air and thermal energy throughout the troposphere.
3. An aneroid barometer contains a small capsule made of flexible metal. As atmospheric pressure changes, the capsule expands or contracts.
4. The SI unit for atmospheric pressure is the kilopascal (kPA). The kPA represents the vertical forces per unit area.
5. As the altitude increases, the density of the air decreases. Your ears try to balance the higher atmospheric pressure within your middle ear with lower external pressure.
6. **(a)** molecules spread out, resulting in lower atmospheric pressure
   (b) atmospheric pressure drops
   (c) atmospheric pressure increases

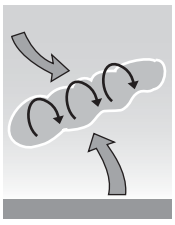
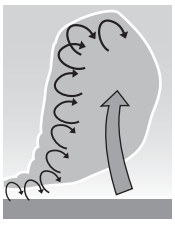
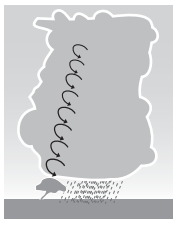
7. Wind is the movement of air from an area of higher pressure to lower pressure while an air mass is a parcel of air with similar temperature and humidity throughout.
8. When a high pressure system forms, the air mass cools, particles in the air lose kinetic energy, and the air becomes more dense. Wind is created. Clear skies often occur.
9. When a low pressure system forms, the air mass warms, it expands and rises, making the layer of air thicker. As the air rises, it cools. The water vapour may condense, producing clouds or precipitation.

Interpreting Illustrations

Weather patterns

Page 190

1. **(a)** cool temperatures, forming rain or snow, depending on elevation
   (b) strong, dry, warm winds called Chinooks form
2. Arrows should deflect to the right in the northern hemisphere and to the left in the southern hemisphere.
3. **(a)** polar easterlies
   (b) prevailing westerlies
   (c) northeast trade winds
   (d) southeast trade winds
   (e) prevailing westerlies
   (f) polar easterlies
4. **(a)** Warm air replaces cold air, therefore precipitation will result.
   (b) Cold air replaces warm air, therefore cooler, drier weather will occur.
5.

(a) funnel cloud develops	**(b)** funnel cloud becomes vertical and touches ground	**(c)** tornado moves along ground
		

6. Warm ocean water and winds lift moist air high into the atmosphere. The water vapour condenses, producing clouds and rain. The rising air produces a low pressure area at the ocean's surface. Warm air rushes down towards the low pressure area. The Coriolis effect forces the air to rotate, causing a massive, spinning storm.

Assessment

Energy transfer in the atmosphere

Page 192

1. C **2.** D **3.** B **4.** G **5.** H **6.** F **7.** A **8.** E **9.** C **10.** D **11.** B **12.** C

Chapter 11 Climate change occurs through natural processes and human activities.

Section 11.1 Natural Causes of Climate Change

Cloze Activity

Natural causes of climate change

Page 196

1. climate
2. paleoclimatologists
3. natural greenhouse effect
4. tilt; wobble; shape
5. water vapour
6. convection currents
7. Coriolis effect
8. El Niño-Southern Oscillation
9. carbon sink
10. weathering
11. catastrophic events

Comprehension

Factors that affect climate

Page 197

1. A decrease in the amount of greenhouse gases would lower the temperature on Earth.
2. An increase in the tilt of Earth would result in extreme seasonal changes. In the northern hemisphere, winters would be colder and summers would be warmer.
3. A change in Earth's wobble will affect the angle of incidence of the Sun's rays.
4. When Earth's orbit is elliptical, Earth's orbit takes it farther from the Sun, and less solar radiation reaches Earth's surface.
5. As yearly temperatures increase, the atmosphere holds more water vapour and traps more thermal energy. The resulting increase in temperature causes more water to evaporate.