# Contents

14) A motorist travels for 3.0 h at 80 km/h and 2.0 h at 100 km/h. What is her average speed for the trip?

A) 85 km/h

B) 88 km/h

C) 90 km/h

D) 92 km/h

Answer: B
*Diff: 2* *Page Ref: Sec. 2.2–2.3*

15) An airplane travels at 300 mi/h south for 2.00 h and then at 250 mi/h north for 750 miles. What is the average speed for the trip?

A) 260 mi/h

B) 270 mi/h

C) 275 mi/h

D) 280 mi/h

Answer: B
*Diff: 2* *Page Ref: Sec. 2.2–2.3*

16) In a 400–m relay race the anchorman (the person who runs the last 100 m) for team A can run 100 m in 9.8 s. His rival, the anchorman for team B, can cover 100 m in 10.1 s. What is the largest lead the team B runner can have when the team A runner starts the final leg of the race, in order that the team A runner not lose the race?

A) 2.0 m

B) 3.0 m

C) 4.0 m

D) 5.0 m

Answer: B
*Diff: 3* *Page Ref: Sec. 2.2–2.3*

17) A car decelerates uniformly and comes to a stop after 10 s. The car's average velocity during deceleration was 50 km/h. What was the car's deceleration while slowing down?

A) 10 km/h–s

B) 8.0 km/h–s

C) 5.0 km/h–s

D) 4.0 km/h–s

Answer: A
*Diff: 1* *Page Ref: Sec. 2.4*

12) A person of weight 480 N stands on a scale in an elevator. What will the scale be reading when the elevator is accelerating downward at 4.00 $m/s^2$?

A) 196 N

B) 284 N

C) 676 N

D) 480 N

Answer: B
*Diff: 2* *Page Ref: Sec. 4.4–4.6*

13) A person on a scale rides in an elevator. If the mass of the person is 60.0 kg and the elevator accelerates downward with an acceleration of 4.90 $m/s^2$, what is the reading on the scale?

A) 147 N

B) 294 N

C) 588 N

D) 882 N

Answer: B
*Diff: 2* *Page Ref: Sec. 4.4–4.6*

14) A person on a scale rides in an elevator. If the mass of the person is 60.0 kg and the elevator accelerates upward with an acceleration of 4.90 $m/s^2$, what is the reading on the scale?

A) 147 N

B) 294 N

C) 588 N

D) 882 N

Answer: D
*Diff: 2* *Page Ref: Sec. 4.4–4.6*

15) Two horizontal forces act on a 5.0–kg mass. One force has a magnitude of 8.0 N and is directed due north. The second force toward the east has a magnitude of 6.0 N. What is the acceleration of the mass?

A) 1.6 $m/s^2$ due north

B) 1.2 $m/s^2$ due east

C) 2.0 $m/s^2$ at 53° N of E

D) 2.0 $m/s^2$ at 53 m E of N

Answer: C
*Diff: 1* *Page Ref: Sec. 4.7*

# Chapter 7 Linear Momentum

## Conceptual Questions

1) What is the SI unit of momentum?

A) N•m

B) N/s

C) N•s

D) N/m

Answer: C
*Diff: 1* *Page Ref: Sec. 7.1–7.2*

2) When a cannon fires a cannonball, the cannon will recoil backward because the

A) energy of the cannonball and cannon is conserved.

B) momentum of the cannonball and cannon is conserved.

C) energy of the cannon is greater than the energy of the cannonball.

D) momentum of the cannon is greater than the energy of the cannonball.

Answer: B
*Diff: 1* *Page Ref: Sec. 7.1–7.2*

3) A freight car moves along a frictionless level railroad track at constant speed. The car is open on top. A large load of coal is suddenly dumped into the car. What happens to the velocity of the car?

A) It increases.

B) It remains the same.

C) It decreases.

D) cannot be determined from the information given

Answer: C
*Diff: 1* *Page Ref: Sec. 7.1–7.2*

4) A child falls sideways off a sled while sledding on frictionless ice. What happens to the velocity of the sled?

A) It increases.

B) It remains the same.

C) It decreases.

D) cannot be determined from the information given

Answer: B
*Diff: 1* *Page Ref: Sec. 7.1–7.2*

4) Two children sit on opposite ends of a uniform seesaw which pivots in the center. Child A has mass 60 kg and sits 2.0 m from the center. Child B has mass 40 kg. How far from the center must child B sit for the seesaw to balance?

A) 1.3 m

B) 2.5 m

C) 3.0 m

D) cannot be determined without knowing the seesaw's mass

Answer: C
*Diff: 1* *Page Ref: Sec. 9.1–9.2*

5) A uniform board of weight 40 N supports two children weighing 500 N and 350 N, respectively. If the support is at the center of the board and the 500–N child is 1.5 m from the center, what is the position of the 350–N child?

A) 1.1 m

B) 1.5 m

C) 2.1 m

D) 2.7 m

Answer: C
*Diff: 1* *Page Ref: Sec. 9.1–9.2*

6) A 10–m uniform beam of weight 100 N is supported by two ropes at the ends. If a 400–N person sits at 2.0 m from the left end of the beam, what is the tension in the left rope?

A) 130 N

B) 250 N

C) 370 N

D) 500 N

Answer: C
*Diff: 2* *Page Ref: Sec. 9.1–9.2*

7) A 10–m uniform beam of weight 100 N is supported by two ropes at the ends. If a 400–N person sits at 2.0 m from the left end of the beam, what is the tension in the right rope?

A) 130 N

B) 250 N

C) 370 N

D) 500 N

Answer: A
*Diff: 2* *Page Ref: Sec. 9.1–9.2*

26) A mass attached to the free end of a spring executes simple harmonic motion according to the equation y = (0.50 m) sin (18π t) where y is in meters and t is seconds. What is the period of vibration?

A) 9.0 s

B) 18 s

C) 1/9 s

D) 1/18 s

Answer: C
*Diff: 2* *Page Ref: Sec. 11.1–11.3*

27) A 1.5–kg mass attached to spring with a force constant of 20.0 N/m oscillates on a horizontal, frictionless track. At t= 0, the mass is released from rest at x= 10.0 cm. (That is, the spring is stretched by 10.00 cm.)
(a) Determine the frequency of the oscillations.
(b) Determine the maximum speed of the mass. Where does the maximum speed occur?
(c) Determine the maximum acceleration of the mass. Where does the maximum acceleration occur?
(d) Determine the total energy of the oscillating system.
(e) Express the displacement as a function of time.

Answer: (a) 0.58 Hz
(b) 0.37 m/s, at the equilibrium position
(c) 1.3 m/s$^2$, at maximum displacement
(d) 0.10 J
(e) $x$ = (0.10 m) cos (3.7$t$)
*Diff: 2* *Page Ref: Sec. 11.1–11.3*

28) A pendulum makes 12 complete swings in 8.0 s. (a) What are its frequency and period on Earth?

A) 1.5 Hz, 0.67 s

B) 0.67 Hz, 1.5 s

C) 0.24 Hz, 4.2 s

D) 4.2 Hz, 0.24 s

Answer: A
*Diff: 1* *Page Ref: Sec. 11.4*

29) A 3.00–kg pendulum is 28.84 m long. What is its period on Earth?

A) 10.78 s

B) 7.891 s

C) 4.897 s

D) 0.09278 s

Answer: A
*Diff: 1* *Page Ref: Sec. 11.4*

# Chapter 14 Heat

## Conceptual Questions

1) Which of the following is the smallest unit of heat energy?

A) Calorie

B) Kilocalorie

C) Btu

D) Joule

Answer: D
*Diff: 1* *Page Ref: Sec. 14.1*

2) The amount of heat necessary to raise the temperature of 1 gram of water by 1°C is referred to as the

A) calorie.

B) kilocalorie.

C) British thermal unit.

D) joule.

Answer: A
*Diff: 1* *Page Ref: Sec. 14.1*

3) The measure of the average kinetic energy of individual molecules is referred to as

A) internal energy.

B) thermal energy.

C) temperature.

D) heat.

Answer: C
*Diff: 1* *Page Ref: Sec. 14.2*

4) A cup of water is scooped up from a swimming pool of water. Compare the temperature T and the internal energy U of the water, in both the cup and the swimming pool.

A) $T_{Pool}$ is greater than $T_{Cup}$, and the U is the same.

B) $T_{Pool}$ is less than $T_{Cup}$, and the U is the same.

C) $T_{Pool}$ is equal to $T_{Cup}$, and $U_{Pool}$ is greater than $U_{Cup}$.

D) $T_{Pool}$ is equal to $T_{Cup}$, and $U_{Pool}$ is less than $U_{Cup}$.

Answer: C
*Diff: 1* *Page Ref: Sec. 14.2*

25) What are the magnitude and direction of the electric field at a distance of 1.50 m from a 50.0–nC charge?

A) 20 N/C away from the charge

B) 20 N/C toward the charge

C) 200 N/C away from the charge

D) 200 N/C toward the charge

Answer: C
*Diff: 1* *Page Ref: Sec. 16.7–16.8*

26) A 5.0–C charge is 10 m from a small test charge. What is the magnitude of the electric field at the location of the test charge?

A) $4.5 \times 10^6$ N/C

B) $4.5 \times 10^7$ N/C

C) $4.5 \times 10^8$ N/C

D) $4.5 \times 10^9$ N/C

Answer: C
*Diff: 1* *Page Ref: Sec. 16.7–16.8*

27) A 5.0–C charge is 10 m from a small test charge. What is the direction of the electric field?

A) toward the 5.0 C

B) away from the 5.0 C

C) perpendicular to a line joining the charges

D) none of the given answers

Answer: B
*Diff: 2* *Page Ref: Sec. 16.7–16.8*

28) A 5.0–C charge is 10 m from a small test charge. What is the magnitude of the force experienced by a 1.0 nC charge placed at the location of the test charge?

A) 0.045 N

B) 0.45 N

C) 4.5 N

D) 45 N

Answer: B
*Diff: 2* *Page Ref: Sec. 16.7–16.8*

18) Kirchhoff's loop rule is an example of

A) conservation of energy.

B) conservation of charge.

C) conservation of momentum.

D) none of the given answers

Answer: A
*Diff: 1* *Page Ref: Sec. 19.3*

19) Kirchhoff's junction rule is an example of

A) conservation of energy.

B) conservation of charge.

C) conservation of momentum.

D) none of the given answers

Answer: B
*Diff: 1* *Page Ref: Sec. 19.3*

20) Which of the equations here is valid for the circuit shown?

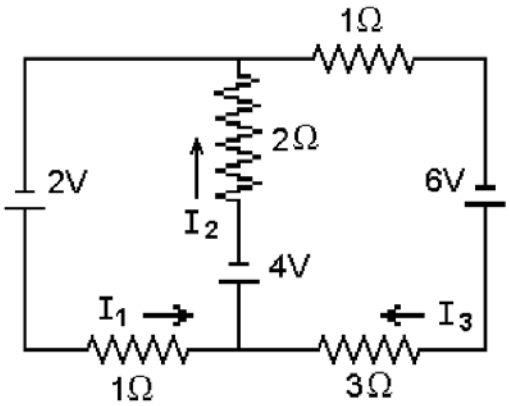


**FIGURE 19–1**

A) $2 - I_1 - 2I_2 = 0$

B) $2 - 2I_1 - 2I_2 - 4I_3 = 0$

C) $4 - I_1 + 4I_3 = 0$

D) $-2 - I_1 - 2I_2 = 0$

E) $6 - I_1 - 2I_2 = 0$

Answer: D
*Diff: 2* *Page Ref: Sec. 19.3*

32) A circular loop of wire of radius 0.50 m is in a uniform magnetic field of 0.30 T. The current in the loop is 2.0 A. What is the magnetic torque when the plane of the loop is parallel to the magnetic field?

A) zero

B) 0.41 m•N

C) 0.47 m•N

D) 0.52 m•N

Answer: C
*Diff: 2* *Page Ref: Sec. 20.9–20.10*

33) A circular loop of wire of radius 0.50 m is in a uniform magnetic field of 0.30 T. The current in the loop is 2.0 A. What is the magnetic torque when the plane of the loop is parallel to the magnetic field?

A) zero

B) 0.41 m•N

C) 0.47 m•N

D) 0.52 m•N

Answer: C
*Diff: 2* *Page Ref: Sec. 20.9–20.10*

34) A circular wire loop of area 0.25 $m^2$ carries a current of 5.0 A. The coil lies in a horizontal plane with the current flowing in the counterclockwise direction when viewed from above. At this point, the Earth's magnetic field is $1.2 \times 10^{-4}$ T directed 60° below the horizontal. What is the magnitude of the torque which acts on the loop?

A) $2.5 \times 10^{-5}$ m•N

B) $5.0 \times 10^{-5}$ m•N

C) $7.5 \times 10^{-5}$ m•N

D) $1.0 \times 10^{-4}$ m•N

Answer: C
*Diff: 2* *Page Ref: Sec. 20.9–20.10*

35) In a mass spectrometer, a single-charged particle (charge e) has a speed of $1.0 \times 10^6$ m/s and enters a uniform magnetic field of 0.20 T. The radius of the circular orbit is 0.020 m. What is the mass of the particle?

A) $3.2 \times 10^{-28}$ kg

B) $6.4 \times 10^{-28}$ kg

C) $1.7 \times 10^{-27}$ kg

D) $3.1 \times 10^{-31}$ kg

Answer: B
*Diff: 2* *Page Ref: Sec. 20.11*

40) An index of refraction less than one for a medium would imply
A) that the speed of light in the medium is the same as the speed of light in vacuum.
B) that the speed of light in the medium is greater than the speed of light in vacuum.
C) refraction is not possible.
D) reflection is not possible.

Answer: B
*Diff: 1* *Page Ref: Sec. 23.4*

41) The index of refraction of diamond is 2.42. This means that a given frequency of light travels
A) 2.42 times faster in air than it does in diamond.
B) 2.42 times faster in diamond than it does in air.
C) 2.42 times faster in vacuum than it does in diamond.
D) 2.42 times faster in diamond than it does in vacuum.

Answer: C
*Diff: 1* *Page Ref: Sec. 24.4*

42) The angle of incidence
A) must equal the angle of refraction.
B) is always less than the angle of refraction.
C) is always greater than the angle of refraction.
D) may be greater than, less than, or equal to the angle of refraction.

Answer: D
*Diff: 1* *Page Ref: Sec. 23.5*

43) Light traveling at an angle into a denser medium is refracted
A) toward the normal.
B) away from the normal.
C) parallel to the normal.
D) equally.

Answer: A
*Diff: 1* *Page Ref: Sec. 23.5*

44) Light enters air from water. The angle of refraction will be
A) greater than the angle of incidence.
B) equal to the angle of incidence.
C) less than the angle of incidence.

Answer: A
*Diff: 2* *Page Ref: Sec. 23.5*

15) Farsightedness can usually be corrected with
A) cylindrical lenses.
B) achromatic lenses.
C) diverging lenses.
D) converging lenses.

Answer: D
*Diff: 1* *Page Ref: Sec. 25.2*

16) If the human eyeball is too short from front to back, this gives rise to a vision defect that can be corrected by using
A) convex meniscus eyeglasses.
B) concave meniscus eyeglasses.
C) cylindrical eyeglasses.
D) contact lenses, but no ordinary lenses.
E) shaded glasses (i.e., something that will cause the iris to dilate more).

Answer: A
*Diff: 2* *Page Ref: Sec. 25.2*

17) What type of lens is a magnifying glass?
A) converging
B) diverging
C) spherical
D) cylindrical

Answer: A
*Diff: 1* *Page Ref: Sec. 25.3*

18) An important reason for using a very large diameter objective in an astronomical telescope is
A) to increase the magnification.
B) to increase the resolution.
C) to form a virtual image, which is easier to look at.
D) to increase the width of the field of view.
E) to increase the depth of the field of view.

Answer: B
*Diff: 1* *Page Ref: Sec. 25.4*

5) If the accuracy in measuring the velocity of a particle increases, the accuracy in measuring its position will

A) increase.

B) decrease.

C) remain the same.

D) be uncertain.

Answer: B
*Diff: 2* *Page Ref: Sec. 28.3*

6) The quantity "h–bar" has a value of

A) $1.055 \times 10^{-34}$ J•s.

B) $6.626 \times 10^{-34}$ J•s.

C) $8.85 \times 10^{-12}$ J•s.

D) $8.988 \times 10^{9}$ J•s.

Answer: A
*Diff: 1* *Page Ref: Sec. 28.3*

7) The principal quantum number can have any integer value ranging from

A) $-\infty$ to $+\infty$.

B) 0 to $\infty$.

C) 1 to $\infty$.

D) 1 to 100.

Answer: C
*Diff: 1* *Page Ref: Sec. 28.6*

8) The orbital quantum number can have any integer value ranging from

A) 0 to n.

B) 0 to (n–1).

C) 1 to n.

D) 1 to (n+1).

Answer: B
*Diff: 1* *Page Ref: Sec. 28.6*

9) The magnetic quantum number can have any integer value ranging from

A) –n to +n.

B) $-l$ to $+l$.

C) 0 to n.

D) 0 to $l$.

Answer: B
*Diff: 1* *Page Ref: Sec. 28.6*

4) A proton strikes an oxygen-18 nucleus producing fluorine-18 and another particle. What other particle is produced by this nuclear reaction?
   A) a neutron
   B) an alpha particle
   C) an $\beta^-$ particle
   D) an $\beta^+$ particle

   Answer: A
   *Diff: 1* *Page Ref: Sec. 31.1–31.3*

5) A nuclear reaction is said to be exothermic if the total kinetic energy is
   A) less after the reaction than before.
   B) equal both before and after the reaction.
   C) greater after the reaction than before.
   D) zero after the reaction.

   Answer: C
   *Diff: 2* *Page Ref: Sec. 31.1–31.3*

6) A nuclear reaction is said to be endothermic if the total kinetic energy is
   A) less after the reaction than before.
   B) equal both before and after the reaction.
   C) greater after the reaction than before.
   D) zero after the reaction.

   Answer: A
   *Diff: 2* *Page Ref: Sec. 31.1–31.3*

7) The process during which a heavy nucleus such as uranium splits into two intermediate-sized nuclei after being struck by a neutron is referred to as
   A) nuclear fission.
   B) nuclear fusion.

   Answer: A
   *Diff: 1* *Page Ref: Sec. 31.1–31.3*

8) The process during which small nuclei combine to form larger ones is referred to as
   A) nuclear fission.
   B) nuclear fusion.

   Answer: B
   *Diff: 1* *Page Ref: Sec. 31.1–31.3*

5) What is the parallax angle for Proxima Centauri, which is Earth's nearest star at 4.3 ly?

A) $1.2 \times 10^{-14}$ degrees

B) $2.1 \times 10^{-4}$ degrees

C) $1.2 \times 10^{-7}$ degrees

D) $2.1 \times 10^{-7}$ degrees

Answer: B
*Diff: 2* *Page Ref: Sec. 33.1–33.3*

6) The apparent brightness of a star is $1.0 \times 10^{-12}$ W/m$^2$ and the peak wavelength is 600 nm. Estimate its distance from us.

A) 0.90 pc

B) 9.0 pc

C) 90 pc

D) 900 pc

Answer: C
*Diff: 3* *Page Ref: Sec. 33.1–33.3*

7) It can be shown that the approximate age of the universe is 1/H, where H is the Hubble constant. Taking H = 20 km/s/Mly, estimate the age of the universe, in years.

A) 15 thousand years

B) 15 million years

C) 15 billion years

D) 15 trillion years

Answer: C
*Diff: 2* *Page Ref: Sec.33.5*

8) If a galaxy is moving away from us at 1.0% of the speed of light, how far away is it from us?

A) 200 ly

B) 200 thousand ly

C) 200 million ly

D) 200 billion ly

Answer: C
*Diff: 2* *Page Ref: Sec. 33.5*

9) Estimate the speed of a galaxy that is 10 billion light–years away.

A) 0.1c

B) 0.3c

C) 0.5c

D) 0.7c

Answer: C
*Diff: 2* *Page Ref: Sec. 33.5*