

# Physics Test Prep: Studying for the End-of-Course Exam

Glencoe Science

# PHYSICS

Principles and Problems

- Two pages of review questions for each chapter
- Multiple-choice format
- Physics content reinforcement
- Preparation for state physics exams and college entrance exams

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## CHAPTER

## 1

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. If the relationship between average velocity and distance of a moving object can be represented by a straight line with a positive slope, which describes the distance as velocity increases?

**A** becomes zero  
**B** decreases  
**C** increases  
**D** remains the same

Objective: 1.01

Thinking Skill: Analyzing

2. Ming estimated the average velocity of a vehicle to be  $26.82 \pm 0.20$  m/s. Four other students also estimated the average velocity of the vehicle. Their estimates are shown in the table.

Estimates of Average Velocity

| Student | Estimate (m/s)   |
|---------|------------------|
| 1       | $25.34 \pm 0.25$ |
| 2       | $26.42 \pm 11.5$ |
| 3       | $27.15 \pm 11.5$ |
| 4       | $27.22 \pm 11.5$ |

Which student's estimate is consistent with Ming's?

**A** student 1  
**B** student 2  
**C** student 3  
**D** student 4

Objective: 1.01

Thinking Skill: Organizing

3. Tino is designing an experiment to investigate how sound waves are affected by the type of medium through which they travel. Which is the independent variable?

**A** frequency of waves  
**B** speed of waves  
**C** type of medium  
**D** wavelength

Objective: 7.02

Thinking Skill: Analyzing

4. According to Ohm's law, the voltage,  $V$ , across a circuit is the product of the current through the circuit,  $I$ , and the circuit's resistance,  $R$ . Using these three variables, write an equation for voltage in a circuit, and then find the voltage in a circuit with 3.00 A of current and resistance of  $80.0 \Omega$ .

**A**  $V = IR, 2.40 \times 10^2 \text{ V}$

**B**  $V = \frac{R}{I}, 2.67 \times 10^1 \text{ V}$

**C**  $V = \frac{1}{R}, 1.25 \times 10^{-2} \text{ V}$

**D**  $V = \frac{I}{R}, 3.75 \times 10^{-2} \text{ V}$

Objective: 10.01

Thinking Skill: Integrating

**1** **Physics Test Prep***continued*

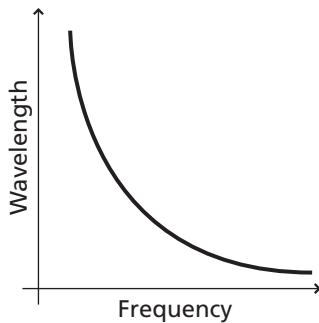
5. To calculate the weight of an object in newtons, N, Tamala multiplies its mass of 0.82 kg times the acceleration due to gravity ( $9.80 \text{ m/s}^2$ ). Which answer expresses the weight of the object with the correct degree of precision?

**A** 8 N  
**B** 8.0 N  
**C** 8.04 N  
**D** 8.036 N

Objective: 3.02

Thinking Skill: Organizing

6. The graph shows the relationship between the frequency and wavelength of light waves.



Which type of relationship do the two variables exhibit?

**A** inverse  
**B** linear  
**C** parabolic  
**D** quadratic

Objective: 7.01

Thinking Skill: Analyzing

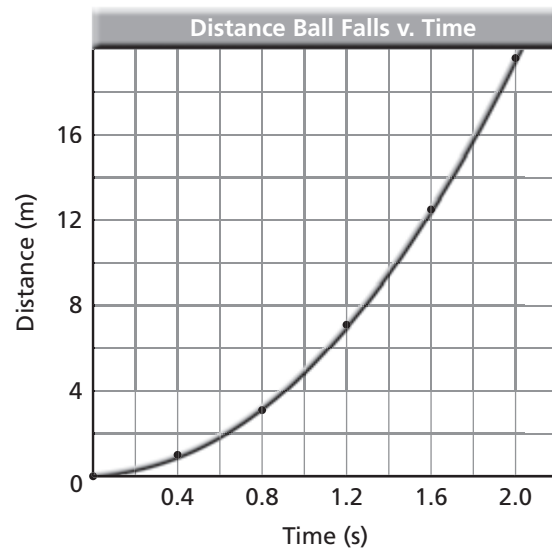
7. The speed of an ostrich is measured to be 63 km/h. Using correct significant figures, what is this speed in meters per second?

**A** 17 m/s  
**B** 17.5 m/s  
**C** 18 m/s  
**D** 18.5 m/s

Objective: 1.01

Thinking Skill: Evaluating

8.



The graph above shows a nonlinear relationship. Which equation below best represents the graph shown above?

**A**  $m = \frac{\Delta y}{\Delta x}$   
**B**  $y = \frac{x}{a}$   
**C**  $y = ax^2 + bx + c$   
**D**  $m = \frac{\Delta y^2}{\Delta x^2}$

Objective: 1.01

Thinking Skill: Analyzing

CHAPTER

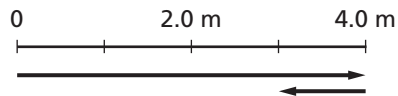
**2**

**Physics Test Prep**

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

Use the graph to answer problems 1 and 2.

The lines on the graph represent displacement vectors for the route along which a person moves.



1. What is the total distance traveled?

- A 3.0 m
- B 4.0 m
- C 5.0 m
- D 6.0 m

Objective: 2.02

Thinking Skill: Applying

2. What is the person's displacement for the trip?

- A 0.0 m
- B 3.0 m
- C 4.0 m
- D 5.0 m

Objective: 2.02

Thinking Skill: Applying

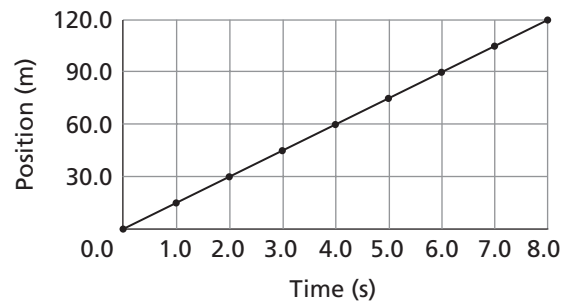
3. Which is a vector quantity?

- A distance
- B position
- C time
- D velocity

Objective: 1.02

Thinking Skill: Organizing

4. The position-time graph represents part of a car trip along a straight road.



What is the average velocity of the car for the first 8.0 s?

- A 20 m/s
- B 15 m/s
- C 12 m/s
- D 8 m/s

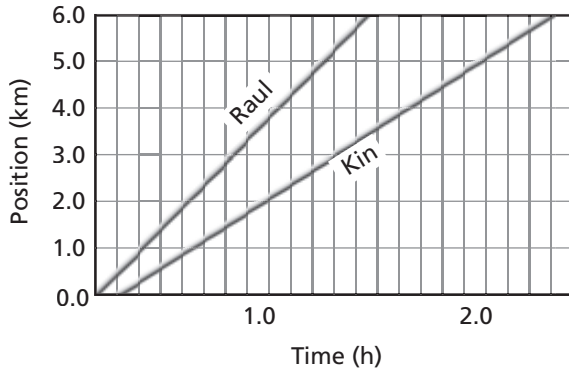
Objective: 1.03

Thinking Skill: Applying

**2** Physics Test Prep

continued

Use the following graph to answer problems 5 and 6.



5. The position-time graph represents two walkers. Which walker is the faster one? How do you know?
- A** Raul, because according to the graph, he started first.
- B** Kin, because his position-time graph looks longer.
- C** Raul, because the slope of his position-time is steeper, meaning he goes farther in a given time period.
- D** Kin, because the area under his graph is greater.
- Objective: 1.01  
Thinking Skill: Analyzing
6. Which equation below best represents the average velocity of the walker, Raul.
- A**  $v = \frac{4 \text{ km}}{1 \text{ h}}$
- B**  $v = \frac{1 \text{ h}}{4 \text{ km}}$
- C**  $v = \frac{5 \text{ km}}{2 \text{ h}}$
- D**  $v = \frac{1 \text{ km}}{2 \text{ h}}$

Objective: 1.01  
Thinking Skill: Generating

7. A bus leaves the terminal and travels for 120 s at an average velocity of 10.0 m/s before it stops at its first destination. How far from the terminal is the first destination?

- A** 10 m  
**B** 12 m  
**C** 120 m  
**D** 1200 m

Objective: 1.05  
Thinking Skill: Applying

8. A bicyclist maintains a constant velocity of 4.0 m/s for a distance of 480 m. How long does it take the bicyclist to travel this distance?

- A** 8 s  
**B** 120 s  
**C** 476 s  
**D** 1920 s

Objective: 1.05  
Thinking Skill: Applying

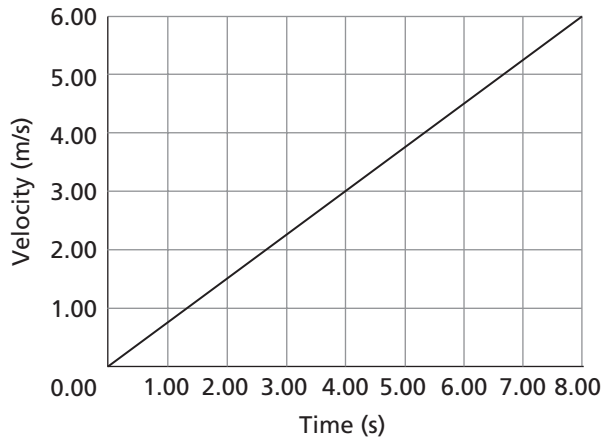
## CHAPTER

## 3

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. The graph shows the velocity of a bicycle as the rider moves away from a curb.



Based on the slope of the graph, what is the average acceleration of the bicycle?

- A 6.00 m/s<sup>2</sup>
- B 3.00 m/s<sup>2</sup>
- C 1.33 m/s<sup>2</sup>
- D 0.750 m/s<sup>2</sup>

Objective: 1.05

Thinking Skill: Applying

2. A car's velocity decreases from 22.0 m/s to 10.0 m/s over a period of 3.0 s. What is the car's average acceleration?

- A  $-4.0 \text{ m/s}^2$
- B  $-3.0 \text{ m/s}^2$
- C  $3.0 \text{ m/s}^2$
- D  $4.0 \text{ m/s}^2$

Objective: 1.04

Thinking Skill: Applying

3. If a sprinter accelerates from rest at a constant rate of  $2.0 \text{ m/s}^2$ , how fast will she be running after 4.0 s?

- A 8.0 m/s
- B 4.0 m/s
- C 2.0 m/s
- D 0.5 m/s

Objective: 1.04

Thinking Skill: Applying

4. A graph shows position as a function of time for an object moving with constant acceleration. What does the slope of the graph represent?

- A acceleration
- B displacement
- C time
- D velocity

Objective: 1.05

Thinking Skill: Analyzing

5. A pebble falls from a bridge into the river below. If the pebble falls for 1.20 s, what is its velocity when it hits the water?

- A  $-8.17 \text{ m/s}$
- B  $-8.40 \text{ m/s}$
- C  $-11.0 \text{ m/s}$
- D  $-11.8 \text{ m/s}$

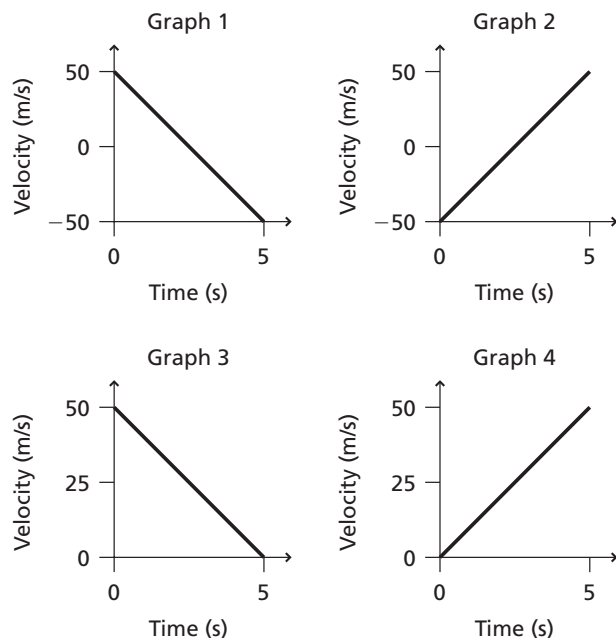
Objective: 1.05

Thinking Skill: Applying

**3** Physics Test Prep

continued

Use the graphs to answer questions 6 and 7.



6. Which graph might represent the acceleration of a jet plane moving down a runway from a rest position?

- A** Graph 1  
**B** Graph 2  
**C** Graph 3  
**D** Graph 4

Objective: 1.05

Thinking Skill: Analyzing

7. Which graph might show the velocity of a ball that is thrown straight up into the air and allowed to fall freely to the ground?

- A** Graph 1  
**B** Graph 2  
**C** Graph 3  
**D** Graph 4

Objective: 1.05

Thinking Skill: Analyzing

8. A car with an initial displacement of 10.0 m and an initial velocity of 16.0 m/s accelerates at an average rate of 0.50 m/s<sup>2</sup> for 4.0 s. What is the car's displacement after 4.0 s? *Hint:  $d_f = d_i + v_i t_f + \frac{1}{2} a t_f^2$*

- A** 68 m  
**B** 78 m  
**C** 82 m  
**D** 88 m

Objective: 1.05

Thinking Skill: Applying

9. A racing cyclist is traveling at 19.3 km/h when she speeds up with a constant acceleration of 0.67 m/s<sup>2</sup>. What is her velocity after 5.00 s?

- A** 3.4 m/s<sup>2</sup>  
**B** 31 km/h  
**C** 23 km/h  
**D** 140 m/s<sup>2</sup>

Objective: 1.04

Thinking Skill: Applying

## CHAPTER

## 4

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. Two horizontal forces, one 180.0 N and the other 200.0 N, are exerted in opposite directions on a boat on a lake. What is the net horizontal force on the boat?

**A** 380.0 N  
**B** 200.0 N  
**C** 180.0 N  
**D** 20.0 N

Objective: 4.01

Thinking Skill: Applying

2. Two dogs play tug-of-war with a rope toy that has a mass of 0.50 kg. If one dog pulls on the toy with a force of 140.0 N, and the other dog pulls in the opposite direction with a force of 138.0 N, what is the horizontal acceleration of the toy?

**A** 9.8 m/s<sup>2</sup>  
**B** 8.0 m/s<sup>2</sup>  
**C** 4.9 m/s<sup>2</sup>  
**D** 4.0 m/s<sup>2</sup>

Objective: 4.02

Thinking Skill: Applying

3. What is the force of gravity on a person who has a mass of 80.0 kg?

**A** 176 N  
**B** 686 N  
**C** 784 N  
**D** 801 N

Objective: 3.02

Thinking Skill: Applying

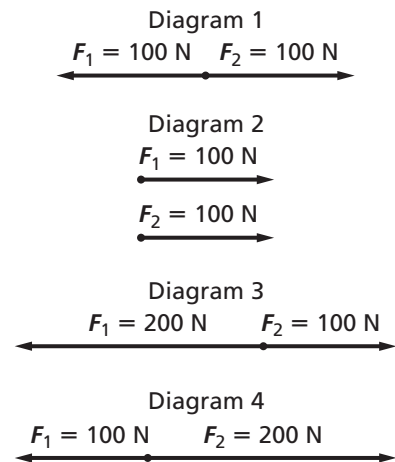
4. A 60.0-kg boy rides in an elevator that accelerates upward at 1.80 m/s<sup>2</sup>. What is the net force exerted on the boy?

**A** 9.8 N  
**B** 108 N  
**C** 480 N  
**D** 588 N

Objective: 4.02

Thinking Skill: Applying

5. The free-body diagrams below show four ways that two different forces could be exerted on an object.



In which diagram is the object in equilibrium?

**A** Diagram 1  
**B** Diagram 2  
**C** Diagram 3  
**D** Diagram 4

Objective: 3.01

Thinking Skill: Analyzing

**4** **Physics Test Prep***continued*

- 6.** Two teams, the Fifes and the Drums, are playing tug-of-war. Each team has 3 members. Both teams exert a force of 2002 N on the rope. The rope is not moving. What is the net force on the rope?
- A** 0 N  
**B** 333 N  
**C** 2002 N  
**D** 4004 N

Objective: 3.01

Thinking Skill: Inferring

- 7.** Two people are paddling together in a canoe. Each exerts a horizontal force of 238 N toward the back of the canoe. What is the net horizontal force on the canoe?
- A** 119 N  
**B** 238 N  
**C** 476 N  
**D** 952 N

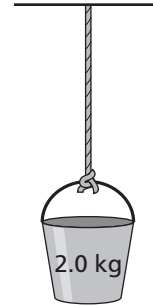
Objective: 1.05

Thinking Skill: Applying

- 8.** Refer to item 7 above. If the combined weight of the canoe and the two paddlers is 190 kg, what is the acceleration of the canoe?
- A**  $0.63 \text{ m/s}^2$   
**B**  $1.3 \text{ m/s}^2$   
**C**  $2.5 \text{ m/s}^2$   
**D**  $5.0 \text{ m/s}^2$

Objective: 1.04

Thinking Skill: Applying

*Use the diagram to answer problems 9 and 10.*

- 9.** The figure shows a bucket hanging motionless from a rope. Assume that the rope has no mass. What is the net force on the bucket?
- A** 0.0 N  
**B** 2.0 N  
**C** 9.8 N  
**D**  $2.0 \times 10^1 \text{ N}$

Objective: 3.01

Thinking Skill: Analyzing

- 10.** What is the tension on the rope?
- A** 9.8 N  
**B** 10 N  
**C** 14.2 N  
**D** 20 N

Objective: 4.02

Thinking Skill: Analyzing

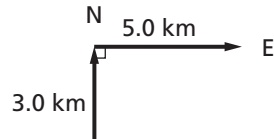
## CHAPTER

## 5

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. The figure shows the displacement vectors of a car.



What is the magnitude of the resultant vector?

- A** 2.0 km  
**B** 2.8 km  
**C** 4.0 km  
**D** 5.8 km

Objective: 2.02

Thinking Skill: Applying

2. If you exert 20.0 N of horizontal force while pushing a 10.2-kg box across the floor at a constant velocity, what is the coefficient of kinetic friction between the floor and the box?

- A** 1.20  
**B** 0.800  
**C** 0.400  
**D** 0.200

Objective: 3.03

Thinking Skill: Applying

3. The frictional force of a 2.0-kg block of wood on a wooden table is 3.8 N. If you push the block with a force of 11.8 N, what is its acceleration across the table?

- A** 1.8 m/s<sup>2</sup>  
**B** 2.0 m/s<sup>2</sup>  
**C** 3.1 m/s<sup>2</sup>  
**D** 4.0 m/s<sup>2</sup>

Objective: 3.03

Thinking Skill: Applying

4. A skier is at rest on a hill sloped at 40.0°. The coefficient of kinetic friction between the snow and the skis is 0.12. The skier starts skiing downhill. How fast is the skier going after 6.0 s?

- A** 7.2 m/s  
**B** 32 m/s  
**C** 38 m/s  
**D** 41 m/s

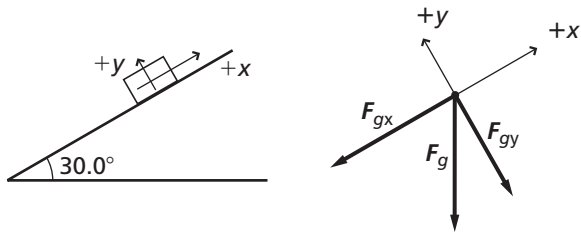
Objective: 3.03

Thinking Skill: Applying

**5** Physics Test Prep

continued

Use the diagram to answer problems 5 and 6.



5. The free-body diagram represents a 1.50-kg box resting on an inclined plane. What is the component of the weight parallel to the inclined plane?

**A**  $-3.27$  N  
**B**  $-7.35$  N  
**C**  $-7.50$  N  
**D**  $-12.7$  N

Objective: 3.02

Thinking Skill: Applying

6. What is the component of the weight perpendicular to the inclined plane?

**A**  $-3.27$  N  
**B**  $-5.66$  N  
**C**  $-7.35$  N  
**D**  $-12.7$  N

Objective: 3.02

Thinking Skill: Applying

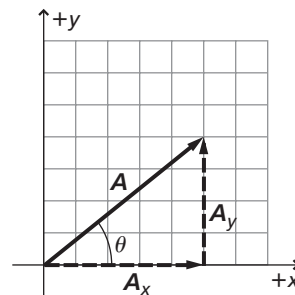
7. Two vectors with lengths 1.00 m and 2.00 m have an angle,  $\theta = 30.0^\circ$ , between them. What is the square of the length of the resultant vector?

**A**  $1.54$  m<sup>2</sup>  
**B**  $3.00$  m<sup>2</sup>  
**C**  $7.00$  m<sup>2</sup>  
**D**  $8.46$  m<sup>2</sup>

Objective: 2.02

Thinking Skill: Focusing

8. The coordinate system below shows the components of vector *A*.



How is the direction of a vector, *A*, measured?

**A** counterclockwise from the *y*-axis  
**B** counterclockwise from the *y*-axis  
**C** counterclockwise from the *x*-axis  
**D** clockwise from the *x*-axis

Objective: 2.02

Thinking Skill: Analyzing

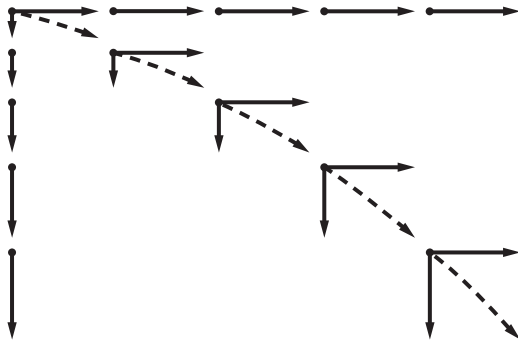
## CHAPTER

## 6

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

Use the figure below to answer problems 1 and 2.



1. The diagram shows the trajectory of a ball that is thrown horizontally from the top of a building. The ball's vertical and horizontal velocity vectors, along with the resultant vectors, are also indicated. If the ball takes 3.0 s to reach the ground, how fast is it moving by the time it reaches the ground?

- A** 9.8 m/s  
**B** 29 m/s  
**C** 58 m/s  
**D** 60 m/s

Objective: 2.03

Thinking Skill: Applying

2. If the ball's initial horizontal velocity is 1.9 m/s, how far from the building is the ball when it hits the ground?

- A** 5.7 m  
**B** 11.4 m  
**C** 32 m  
**D** 59 m

Objective: 2.03

Thinking Skill: Applying

3. In a penalty kick, a soccer player kicks the ball from ground level with an initial velocity of 25.0 m/s, 20.0° above the horizontal. Assume that air resistance is negligible. What is the maximum height,  $y_{\text{max}}$ , of the soccer ball?

- A** 0.510 m  
**B** 3.18 m  
**C** 3.73 m  
**D** 8.55 m

Objective: 2.03

Thinking Skill: Applying

4. What is the flight time of the soccer ball in the previous problem?

- A** 0.76 s  
**B** 0.87 s  
**C** 1.32 s  
**D** 1.75 s

Objective: 2.03

Thinking Skill: Applying

**6** **Physics Test Prep**

continued

5. The cars on an amusement-park ride travel at a constant velocity of 4.0 m/s on a circular track that has a radius of 4.0 m. What is the magnitude of each car's centripetal acceleration?

- A** 1.0 m/s<sup>2</sup>  
**B** 2.0 m/s<sup>2</sup>  
**C** 4.0 m/s<sup>2</sup>  
**D** 16 m/s<sup>2</sup>

Objective: 2.04

Thinking Skill: Applying

6. If each car in the previous problem has a mass of 130.0 kg, what is the net centripetal force acting on each car?

- A** 8.1 N  
**B** 33 N  
**C**  $3.9 \times 10^2$  N  
**D**  $5.2 \times 10^2$  N

Objective: 3.04

Thinking Skill: Applying

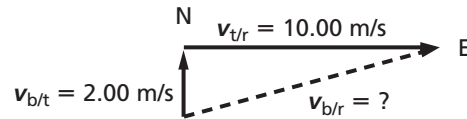
7. A clown in a circus act swings a 2.7-kg metal ball attached to a 72.0-cm nylon string in a horizontal circle above her head, making one revolution in 0.98 s. What is the tension force,  $F_{T_r}$ , exerted on the string by the ball?

- A** 3.8 N  
**B**  $3.0 \times 10^3$  N  
**C**  $8.0 \times 10^1$  N  
**D** 92 N

Objective: 2.04

Thinking Skill: Applying

Use the figure below to answer problems 8 and 9.



8. The diagram shows vectors representing the velocity of a truck relative to the road,  $v_{t/r}$ , and the velocity of a box sliding across the back of the truck relative to the truck,  $v_{b/t}$ . What is the speed of the box relative to the road?

- A** 8.00 m/s  
**B** 10.2 m/s  
**C** 12.0 m/s  
**D** 20.0 m/s

Objective: 2.02

Thinking Skill: Applying

9. What is the angle of the box's motion?

- A** 9.80° east of north  
**B** 10.3° east of north  
**C** 10.6° north of east  
**D** 11.3° north of east

Objective: 2.02

Thinking Skill: Applying

## CHAPTER

## 7

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

- Which of the following was correctly predicted by Einstein's theory of gravity?
  - the origin of mass
  - how mass curves space
  - the measure of  $G$
  - light deflected around large objects because of their gravity

Objective: 3.02

Thinking Skill: Evaluating

- Which property of two objects is directly proportional to the force of attraction between them?
  - distance
  - mass
  - radius
  - density

Objective: 4.03

Thinking Skill: Integrating

- Which object pulls on you with the greatest gravitational force?
  - 1.2-kg book at a distance of 0.2 m
  - 15-kg bicycle at a distance of 1 m
  - 20-kg rock at a distance of 2 m
  - 70-kg sofa at a distance of 10 m

Objective: 3.02

Thinking Skill: Focusing

Use the data in the table to answer problems 4 and 5.

| Planet | Mean Distance from Sun (AU) | Period of Orbit (Years) |
|--------|-----------------------------|-------------------------|
| A      | 0.39                        | ?                       |
| B      | 0.72                        | 0.62                    |
| C      | 1.00                        | 1.00                    |
| D      | ?                           | 1.88                    |
| E      | 5.20                        | 11.90                   |

- The table above provides information about the orbits of five planets. According to Kepler's third law, what is the period of planet A's orbit?
  - 0.25 y
  - 0.54 y
  - 1.52 y
  - 3.28 y

Objective: 2.04

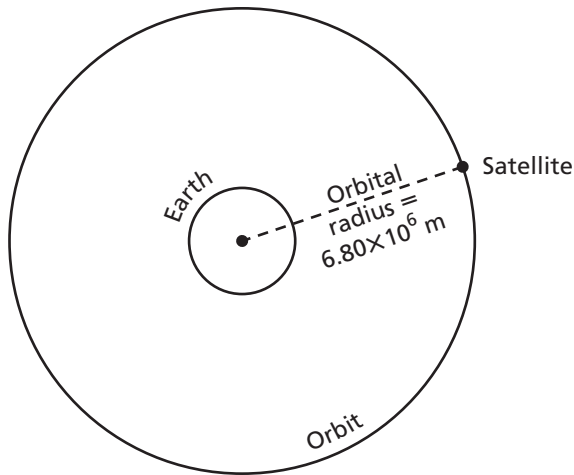
Thinking Skill: Generating

- What is planet D's mean distance from the Sun?
  - 1.2 AU
  - 1.4 AU
  - 1.5 AU
  - 2.8 AU

Objective: 2.04

Thinking Skill: Generating

Use the figure below to answer problems 6 and 7.



6. The diagram shows the orbit of a satellite around Earth. If Earth's mass is  $5.97 \times 10^{24}$  kg, what is the satellite's orbital speed?

$$(G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2)$$

- A**  $5.84 \times 10^7$  m/s  
**B**  $6.31 \times 10^4$  m/s  
**C**  $7.23 \times 10^3$  m/s  
**D**  $7.65 \times 10^3$  m/s

Objective: 4.02

Thinking Skill: Applying

7. How would the satellite's speed be affected if the orbital radius were increased by a factor of 4?

- A** multiplied by 2  
**B** divided by 2  
**C** multiplied by  $\sqrt{2}$   
**D** divided by  $\sqrt{2}$

Objective: 4.02

Thinking Skill: Analyzing

8. A planet has a mass of  $8.4 \times 10^{24}$  kg, which is about eight times the mass of its single moon. If the distance between the planet and the moon is about  $4.2 \times 10^5$  km, what is the gravitational pull of the planet on the moon?

- A**  $3.3 \times 10^{21}$  N  
**B**  $2.1 \times 10^{23}$  N  
**C**  $3.3 \times 10^{27}$  N  
**D**  $2.1 \times 10^{29}$  N

Objective: 4.03

Thinking Skill: Remembering

9. Which expression below best represents the period of a satellite orbiting Earth?

**A**  $\sqrt{\frac{2\pi r^3}{Gm_{\text{Sun}}}}$

**B**  $\sqrt{\frac{2\pi r^3}{Gm_{\text{Earth}}}}$

**C**  $\sqrt{\frac{Gm_{\text{Earth}}}{r}}$

**D**  $G \frac{m_1 m_2}{r^2}$

Objective: 3.02

Thinking Skill: Remembering

## CHAPTER

## 8

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. If a car has a linear acceleration of  $1.8 \text{ m/s}^2$  and the radius of its wheels is  $0.33 \text{ m}$ , what is the angular acceleration of the wheels?

**A**  $0.18 \text{ rad/s}$   
**B**  $0.59 \text{ rad/s}$   
**C**  $5.5 \text{ rad/s}$   
**D**  $9.8 \text{ rad/s}$

Objective: 2.01

Thinking Skill: Applying

2. Given the angular acceleration in the previous problem, how many revolutions does one of the car's wheels complete in  $10.0 \text{ s}$ ?

**A**  $0.88 \text{ rev}$   
**B**  $5.6 \text{ rev}$   
**C**  $8.8 \text{ rev}$   
**D**  $350 \text{ rev}$

Objective: 2.01

Thinking Skill: Applying

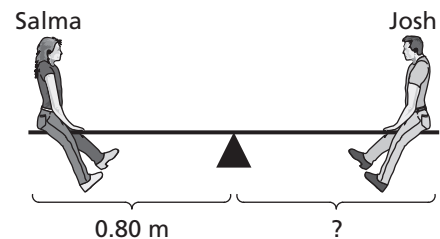
3. Jorge tightens a bolt on his bicycle with a wrench that is  $0.20 \text{ m}$  long. If he pulls perpendicularly on the end of the wrench with a force of  $140 \text{ N}$ , how much torque does he apply?

**A**  $2.8 \text{ N}\cdot\text{m}$   
**B**  $5.6 \text{ N}\cdot\text{m}$   
**C**  $14 \text{ N}\cdot\text{m}$   
**D**  $28 \text{ N}\cdot\text{m}$

Objective: 2.01

Thinking Skill: Applying

Use the figure below to answer problems 4 and 5.



4. Salma, who has a mass of  $42 \text{ kg}$ , and Josh, who has a mass of  $45 \text{ kg}$ , are trying to balance a seesaw. Salma's position is shown in the diagram. How far should Josh sit from the pivot point to balance Salma?

**A**  $0.86 \text{ m}$   
**B**  $0.80 \text{ m}$   
**C**  $0.75 \text{ m}$   
**D**  $0.72 \text{ m}$

Thinking Skill: Applying

5. Given Josh's distance from the pivot point in order to balance Salma, what must be his moment of inertia?

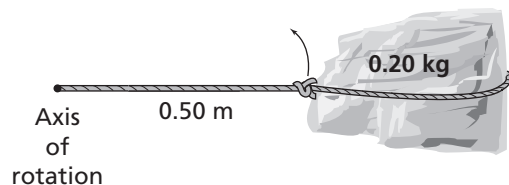
**A**  $25 \text{ kg}\cdot\text{m}^2$   
**B**  $27 \text{ kg}\cdot\text{m}^2$   
**C**  $29 \text{ kg}\cdot\text{m}^2$   
**D**  $110 \text{ kg}\cdot\text{m}^2$

Thinking Skill: Applying

## 8 Physics Test Prep

continued

6. A 0.50-m length of string with a 0.20-kg weight at one end is rotated around the other end, as shown in the diagram.



Assuming the mass of the string is zero and the weight is a point mass, what is the moment of inertia of the weight?

- A**  $0.020 \text{ kg}\cdot\text{m}^2$   
**B**  $0.050 \text{ kg}\cdot\text{m}^2$   
**C**  $0.10 \text{ kg}\cdot\text{m}^2$   
**D**  $0.50 \text{ kg}\cdot\text{m}^2$
- Objective: 2.04  
 Thinking Skill: Applying
7. An external torque is applied to an object with a narrow base. Which location for the center of mass would make the object less likely to tip over?
- A** just above the base  
**B** high above the base  
**C** just outside the base  
**D** far outside the base
- Objective: 3.01  
 Thinking Skill: Integrating

8. A solid sphere with a radius of 0.050 m and a mass of 3.0 kg has a rod through its center. A net torque of  $6.0 \times 10^{-4} \text{ kg}\cdot\text{m}^2$  is used to spin the sphere about the rod. What is the sphere's angular acceleration? *Hint: The moment of inertia for the sphere is  $\frac{2}{5}mr^2$ .*

- A**  $0.20 \text{ rad/s}^2$   
**B**  $0.21 \text{ rad/s}^2$   
**C**  $2.5 \text{ rad/s}^2$   
**D**  $5.0 \text{ rad/s}^2$

Objective: 2.04

Thinking Skill: Analyzing

9. Suppose you are standing on the edge of a merry-go-round that is rotating clockwise. At the twelve o'clock position, you toss a ball to someone standing at the edge of the merry-go-round, but not on it, at the six o'clock position. Which sentence below best describes the horizontal motion of the ball. *Hint: Consider the Coriolis "force" and ignore the vertical motion of the ball as it falls.*
- A** The ball travels in a straight line at constant speed toward the edge of the merry-go-round at the six o'clock position.  
**B** The ball travels in a curved path at constant speed toward the edge of the merry-go-round close to the four o'clock position.  
**C** The ball travels in a curved path at constant speed toward the edge of the merry-go-round at the six o'clock position.  
**D** The ball travels in a straight line toward the four o'clock position.

Objective: 2.04

Thinking Skill: Inferring

## CHAPTER

## 9

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. Two skaters, Elena and Tara, face each other on the ice. Elena has a mass of 57.4 kg, and Tara has a mass of 48.3 kg. Both are motionless until they push away with a force of 33 N. Then Elena has a velocity of 1.4 m/s. What is Tara's velocity?

- A** -1.7 m/s  
**B** -2.0 m/s  
**C** -2.4 m/s  
**D** -2.8 m/s

Objective: 6.05

Thinking Skill: Generating

2. The angular momentum of a spinning wheel decreases from  $8.4 \text{ kg} \cdot \text{m}^2/\text{s}$  to  $4.7 \text{ kg} \cdot \text{m}^2/\text{s}$  over a period of 2.1 s. What is the angular impulse that slowed the wheel?

- A**  $-0.57 \text{ kg} \cdot \text{m}^2/\text{s}$   
**B**  $-1.7 \text{ kg} \cdot \text{m}^2/\text{s}$   
**C**  $-3.7 \text{ kg} \cdot \text{m}^2/\text{s}$   
**D**  $-7.8 \text{ kg} \cdot \text{m}^2/\text{s}$

Objective: 6.03

Thinking Skill: Evaluating

3. A 0.068-kg ball strikes a wall with a velocity of 22.1 m/s. The wall stops the ball in 0.36 s. What force does the wall exert to stop the ball?

- A** 2.4 N  
**B** 4.2 N  
**C** 5.3 N  
**D** 12 N

Objective: 6.01

Thinking Skill: Information Gathering

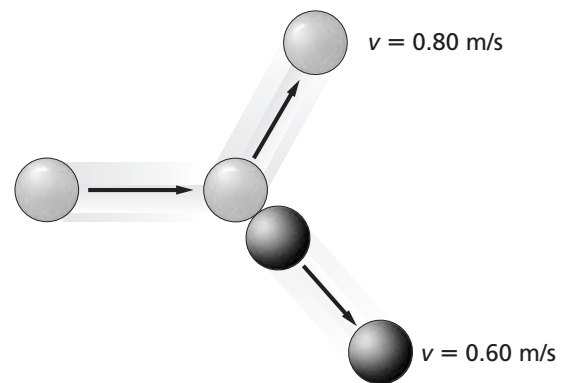
4. A 945-kg car is moving along a straight highway with a velocity of 98 km/h. The driver applies the brakes and reduces the car's speed to 36 km/h in 8.5 s. What is the impulse on the car?

- A**  $-1.9 \times 10^3 \text{ N} \cdot \text{s}$   
**B**  $-6.9 \times 10^3 \text{ N} \cdot \text{s}$   
**C**  $-1.6 \times 10^4 \text{ N} \cdot \text{s}$   
**D**  $-3.4 \times 10^4 \text{ N} \cdot \text{s}$

Objective: 6.02

Thinking Skill: Evaluating

5. The diagram shows two 0.17-kg billiard balls. The white ball strikes the stationary black ball and moves off at an angle  $60.0^\circ$  north of east. The black ball moves off at an angle  $48.2^\circ$  south of east.



What is the white ball's initial velocity?

- A** 0.78 m/s  
**B** 1.1 m/s  
**C** 1.3 m/s  
**D** 1.4 m/s

Objective: 6.03

Thinking Skill: Evaluating

6. A 2100-kg car is traveling at 25 m/s when it crashes into the rear end of a 1650-kg car traveling at 21 m/s in the same direction on ice. The two cars become stuck together and slide on the ice. How fast do the two cars move together immediately after the collision?

- A** 23 m/s  
**B** 22 m/s  
**C** 21 m/s  
**D** 18 m/s

Objective: 6.05

Thinking Skill: Applying

7. Two hockey players, Z and Q, are standing face-to-face and stationary on the ice. Skater Z has a mass of 72.5 kg. Skater Q has a mass of 65.3 kg. Skater Z shoves Skater Q. Which statement below best represents the skaters' momenta and motion after the shove?

- A** The momenta of the skaters after the shove are equal in magnitude but opposite in direction. Skater Z's motion is an example of recoil.  
**B** The momenta of the skaters after the shove are equal in magnitude and in direction.  
**C** The momenta of the skaters after the shove are equal in magnitude but opposite in direction. Skater Q's motion is an example of recoil.  
**D** The momenta of the skaters after the shove are of inverse proportion in magnitude and opposite in direction. The motion of both skaters are examples of recoil.

Objective: 6.04

Thinking Skill: Inferring

Use the following diagram for problems 8 and 9.

$$m_A = 1160 \text{ kg}$$

$$v_A = 16.3 \text{ m/s}$$



$$m_B = 1229 \text{ kg}$$

$$v_B = 20.7 \text{ m/s}$$

8. The diagram shows a car traveling north colliding with a car traveling east. After the collision, the cars stick together and move off in another direction. What is the magnitude of the cars' final momentum?

- A**  $5.96 \times 10^4 \text{ kg}\cdot\text{m/s}$   
**B**  $1.19 \times 10^4 \text{ kg}\cdot\text{m/s}$   
**C**  $3.13 \times 10^4 \text{ kg}\cdot\text{m/s}$   
**D**  $3.17 \times 10^4 \text{ kg}\cdot\text{m/s}$

Objective: 6.04

Thinking Skill: Applying

9. At what angle north of east is the cars' direction of motion after the collision?

- A**  $36.5^\circ$   
**B**  $38.2^\circ$   
**C**  $39.8^\circ$   
**D**  $53.4^\circ$

Objective: 6.04

Thinking Skill: Applying

## CHAPTER

## 10

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

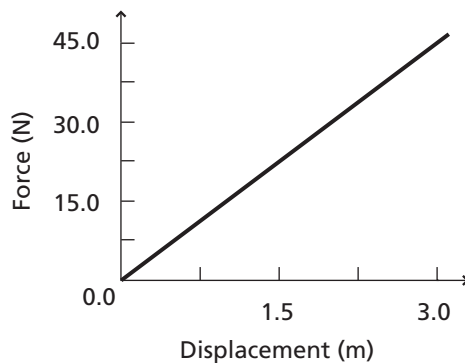
1. A child holds onto a string attached to a toy boat and exerts a force of 8.0 N to pull the boat a distance of 7.2 m along a straight shoreline. If the child holds the string at a  $15.0^\circ$  angle with the horizontal, how much work does she do on the toy boat?

**A** 14 J  
**B** 56 J  
**C** 58 J  
**D** 71 J

Objective: 5.04

Thinking Skill: Applying

Use the graph to answer problems 2 and 3.



2. The graph shows the force and displacement of an object that is being pushed. How much work is done to push the object 3.0 m?

**A** 140 J  
**B** 68 J  
**C** 15 J  
**D** 7.5 J

Objective: 5.04

Thinking Skill: Applying

3. How much power would be developed if the work were done in 2.5 s?

**A** 3.0 W  
**B** 6.0 W  
**C** 27 W  
**D** 54 W

Objective: 5.04

Thinking Skill: Applying

4. The weight of a bicyclist and a bicycle together is 53.0 kg. How much work has been done if the bicyclist slows the bicycle from a speed of 3.84 m/s to 1.27 m/s?

**A**  $-68.1$  J  
**B**  $-136$  J  
**C**  $-348$  J  
**D**  $-696$  J

Objective: 5.04

Thinking Skill: Applying

5. A bicycle has a front gear that is turned by a pedal and is connected by a chain to a rear gear, which turns the rear wheel. If the pedal radius is 18.0 cm, the front gear radius is 9.0 cm, the rear gear radius is 4.0 cm, and the rear wheel radius is 33.0 cm, what is the ideal mechanical advantage, *IMA*, of the bicycle?

**A** 0.24  
**B** 0.48  
**C** 0.55  
**D** 0.82

Objective: 5.04

Thinking Skill: Applying

**10** **Physics Test Prep***continued*

- 6.** A boy lifts a stack of six identical books from the floor to a 1.2-m-high shelf in 2.5 s. If lifting the books requires 50.8 W of power, what is the mass of each book?

**A** 0.88 kg  
**B** 1.1 kg  
**C** 1.8 kg  
**D** 2.9 kg

Objective: 5.02

Thinking Skill: Analyzing

- 7.** A worker uses a pulley system to lift a 21.7-kg box a distance of 12.4 m above the ground. The worker must exert a force of 97 N and pull 28.5 m of rope. What is the efficiency of the system?

**A** 44 percent  
**B** 46 percent  
**C** 95 percent  
**D** 97 percent

Objective: 5.04

Thinking Skill: Remembering

- 8.** When a person walks, the hip acts as a \_\_\_\_\_ and moves through the arc of a circle, centered on the foot.

**A** lever  
**B** piston  
**C** pulley  
**D** fulcrum

Objective: 5.04

Thinking Skill: Applying

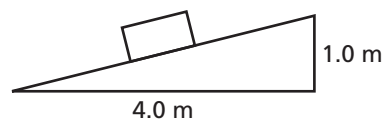
- 9.** Tall people can usually walk faster than short people. A taller person must apply \_\_\_\_\_ force to move the longer \_\_\_\_\_ that are their leg bones.

**A** less; levers  
**B** greater; levers  
**C** less; pistons  
**D** greater; pistons

Objective: 5.04

Thinking Skill: Applying

- 10.** The diagram below shows a box that is being pushed up a ramp. A force of 58 N is required to push the box up the ramp. If the ramp has an efficiency of 78 percent, what is the mass of the box?



**A** 18 kg  
**B** 19 kg  
**C** 20 kg  
**D** 21 kg

Objective: 5.04

Thinking Skill: Applying

CHAPTER

# 11 Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. What is the gravitational potential energy of a 0.15-kg ball resting at the edge of a roof that is 42 m above the ground?

- A 28 J
- B 36 J
- C 62 J
- D 63 J

Objective: 5.01

Thinking Skill: Applying

2. A 12.5-kg rock falls from a cliff at a height of 138 m to a cliff that is 79 m above the ground. How fast is the rock falling when it strikes the lower cliff?

- A 24 m/s
- B 34 m/s
- C 39 m/s
- D 52 m/s

Objective: 5.03

Thinking Skill: Evaluating

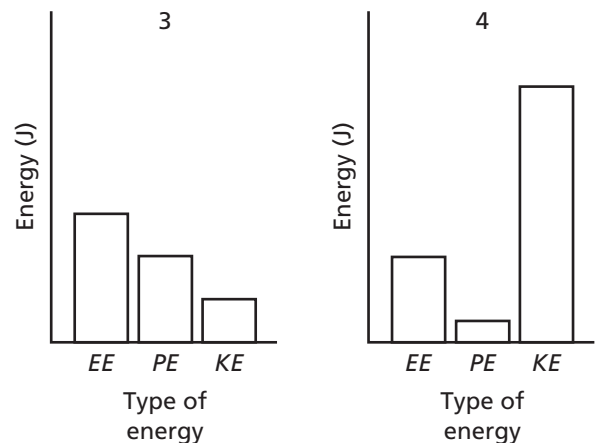
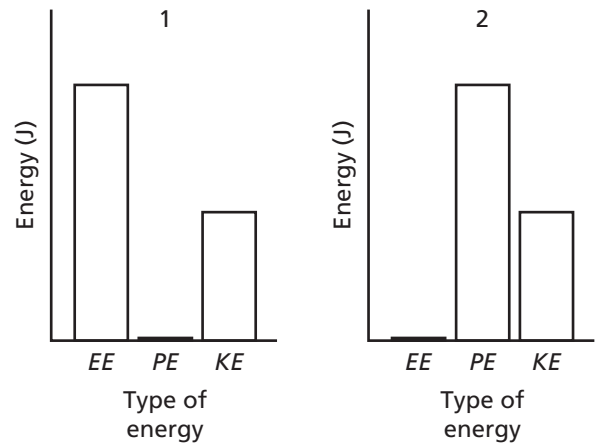
3. Which describes the conditions for an inelastic collision?

- A momentum conserved, kinetic energy conserved
- B momentum conserved, kinetic energy not conserved
- C momentum not conserved, kinetic energy conserved
- D momentum not conserved, kinetic energy not conserved

Objective: 5.03

Thinking Skill: Evaluating

4. The bar graphs represent the kinetic energy,  $KE$ , gravitational potential energy,  $PE$ , and elastic potential energy,  $EE$ , of a pole-vaulter.



Which graph might represent the pole-vaulter at the peak height of her vault?

- A 1
- B 2
- C 3
- D 4

Objective: 5.01

Thinking Skill: Analyzing

**11** **Physics Test Prep***continued*

5. A 52-kg snow skier is at the top of a 245-m-high hill. After she has gone down a vertical distance of 112 m, what is her mechanical energy?

**A**  $4.2 \times 10^4$  J  
**B**  $1.2 \times 10^5$  J  
**C**  $5.7 \times 10^5$  J  
**D**  $6.8 \times 10^5$  J

Objective: 5.03

Thinking Skill: Focusing

6. Considering the conservation of mechanical energy when designing a roller coaster, which statement below is true?

**A** No other hill on the roller coaster track can be higher than the first hill and the hills following the first hill must randomly vary in height—short, tall, tall, short, et cetera—in order to conserve the mechanical energy of the system.

**B** Only one other hill can be higher than the first hill and there must be a hill placed on the track between the first hill and this higher hill such that its slope is twice as steep as the slope of the higher hill.

**C** No other hill on the roller coaster track can be higher than the first hill because the energy required to climb such a hill would be greater than the total mechanical energy of the system.

**D** The only way to conserve the total mechanical energy of the system is to conserve the roller coaster's gravitational potential energy by making sure that the last vertical drop is the same as the first.

Objective: 5.03

Thinking Skill: Inferring

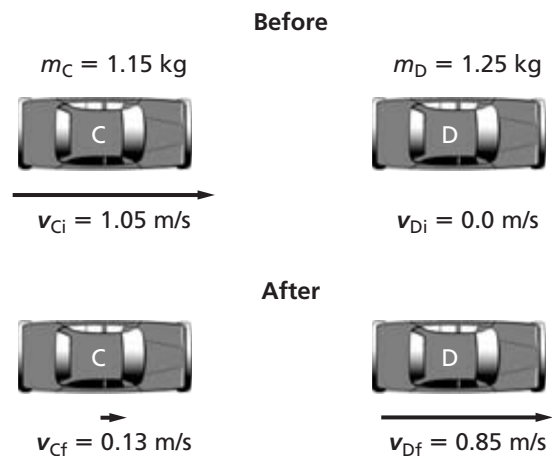
7. Suppose you are designing ramps for a skateboarding track. If you want to have a ramp that allows someone to fly high, what sort of ramp do you design?

**A** a ramp that has a really steep slope, the height does not matter  
**B** a ramp that is really high, the slope does not matter  
**C** a ramp that is both very high and very steep  
**D** a ramp with a steep slope that is placed at the end of the track, the height does not matter

Objective: 5.03

Thinking Skill: Applying

8. The diagram shows a system in which a collision occurs between two objects. What is the decrease in kinetic energy during the collision?



**A**  $-63$  J  
**B**  $-1.4$  J  
**C**  $-1.1$  J  
**D**  $-0.17$  J

Objective: 5.03

Thinking Skill: Applying

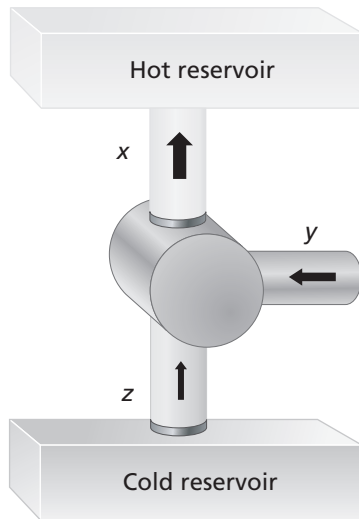
CHAPTER

12

Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. The diagram below represents the flow of energy in a heat engine. The letters  $x$ ,  $y$ , and  $z$  represent energy. Which equation expresses the change in thermal energy in the heat engine?



- A  $\gamma = x + z$
- B  $x = \gamma + z$
- C  $\gamma = z - x$
- D  $z = \gamma - x$

Objective: 8.02  
Thinking Skill: Analyzing

2. If a hot spoon is placed in a glass of cold water, what happens to the entropies of the molecules in the spoon and the water molecules?

- A spoon increase, water increase
- B spoon increase, water decrease
- C spoon decrease, water increase
- D spoon decrease, water decrease

Objective: 8.03  
Thinking Skill: Generating

Use the table below to answer problems 3 and 4.

| Material | Heat of Fusion $H_f$ (J/kg) | Heat of Vaporization $H_v$ (J/kg) |
|----------|-----------------------------|-----------------------------------|
| Gold     | $6.30 \times 10^4$          | $1.64 \times 10^6$                |
| Iron     | $2.66 \times 10^5$          | $6.29 \times 10^6$                |
| Lead     | $2.04 \times 10^4$          | $8.64 \times 10^5$                |
| Methanol | $1.09 \times 10^5$          | $8.78 \times 10^5$                |
| Silver   | $1.04 \times 10^5$          | $2.36 \times 10^6$                |

3. A 9.75-kg block of metal requires  $6.14 \times 10^2$  kJ of heat to change from a solid to a liquid at its melting point. What is the metal?
- A gold
  - B iron
  - C lead
  - D silver

Objective: 8.01  
Thinking Skill: Applying

**12 Physics Test Prep***continued*

4. How much heat is needed to convert a 2.0-kg sample of liquid methanol into a gas?

**A**  $5.5 \times 10^4$  J  
**B**  $2.2 \times 10^5$  J  
**C**  $4.4 \times 10^5$  J  
**D**  $1.8 \times 10^6$  J

Objective: 8.01

Thinking Skill: Applying

Use the table below to answer problems 5–7.

| Material | Specific Heat (J/kg·K) |
|----------|------------------------|
| Aluminum | 897                    |
| Brass    | 376                    |
| Copper   | 385                    |
| Iron     | 450                    |
| Lead     | 130                    |
| Water    | 4180                   |

5. A 0.38-kg block of iron initially has a temperature of 100.0°C. It is allowed to cool until its temperature is 22.0°C. How much heat did the iron transfer to its surroundings?

**A**  $9.2 \times 10^4$  J  
**B**  $6.6 \times 10^4$  J  
**C**  $2.2 \times 10^4$  J  
**D**  $1.3 \times 10^4$  J

Objective: 8.01

Thinking Skill: Integrating

6. Two 1-kg objects, C and D, increase in temperature by the same amount, but the heat transfer of object C is greater than the heat transfer of object D. If object C has a specific heat of 235 J/kg·K, which material might object D be made of?

**A** aluminum  
**B** brass  
**C** iron  
**D** lead

Objective: 8.01

Thinking Skill: Organizing

7. A calorimeter contains 0.750 kg of water at 19.0°C. A 0.0370-kg block of copper at 97.0°C is placed in the water. What is the final temperature of the system?

**A** 90.1°C  
**B** 91.5°C  
**C** 93.6°C  
**D** 94.2°C

Objective: 8.01

Thinking Skill: Applying

8. Entropy can be considered as a measure of the \_\_\_\_\_ of useful energy.

**A** decrease  
**B** unavailability  
**C** disorder  
**D** availability

Objective: 8.01

Thinking Skill: Generating

## CHAPTER

## 13

## Physics Test Prep

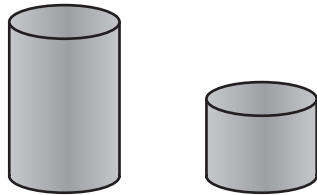
Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A box weighing 360 N rests on the ground. The bottom of the box measures 0.30 m by 0.20 m. How much pressure does the box exert on the ground?

**A**  $6.0 \times 10^3$  Pa  
**B**  $5.0 \times 10^3$  Pa  
**C**  $4.0 \times 10^3$  Pa  
**D**  $3.2 \times 10^3$  Pa

Thinking Skill: Applying

2. The figure below shows two canisters filled with different gases. Each container has the same number of gas particles. What is the temperature of the second gas?



|                   |                   |
|-------------------|-------------------|
| $V_1 = 20.0$ L    | $V_2 = 10.0$ L    |
| $P_1 = 100.0$ kPa | $P_2 = 160.0$ kPa |
| $T_1 = 282$ K     | $T_2 = ?$         |

**A** 176 K  
**B** 226 K  
**C** 353 K  
**D** 451 K

Thinking Skill: Integrating

3. Which factor best explains why dewdrops sitting on a leaf are nearly spherical?

**A** adhesive forces  
**B** surface tension  
**C** viscosity  
**D** capillary action

Thinking Skill: Analyzing

4. If the density of water is  $1.00 \times 10^3$  kg/m<sup>3</sup>, how much pressure is exerted on an object by a 50.0-m column of water?

**A**  $1.96 \times 10^5$  Pa  
**B**  $4.90 \times 10^5$  Pa  
**C**  $5.00 \times 10^4$  Pa  
**D**  $5.10 \times 10^4$  Pa

Thinking Skill: Applying

5. Which assumption is true of an ideal gas?

**A** The gas has volume because the particles take up space.  
**B** The particles experience no intermolecular attractive forces.  
**C** The particles undergo inelastic collisions with the surface of their container.  
**D** The ideal gas model is not accurate under most conditions.

Thinking Skill: Remembering

**13** **Physics Test Prep***continued*

6. The pistons of a hydraulic lift have diameters of 3.0 cm and 12.2 cm. A force exerted on the smaller piston lifts a maximum load of 475 N. What force is required to lift this load?

**A** 9.6 N  
**B** 21 N  
**C** 29 N  
**D** 39 N

Objective: 5.03

Thinking Skill: Remembering

7. An 8.3-kg object with a volume of  $0.86 \times 10^{-3} \text{ m}^3$  is submerged in water. What is the buoyant force on the object?

**A** 7.0 N  
**B** 7.1 N  
**C** 8.1 N  
**D** 8.4 N

Thinking Skill: Evaluating

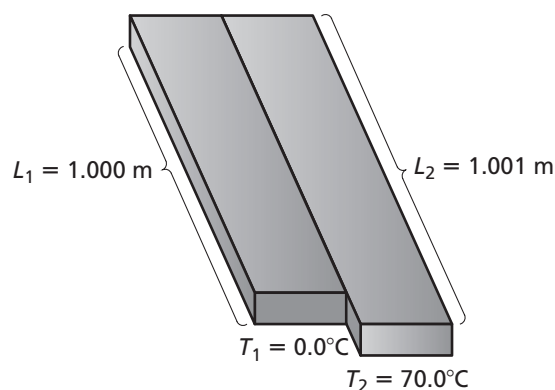
8. Which statement best explains why water rises in a capillary tube?
- A** All fluids at room temperature will rise through a narrow opening.
- B** The water outside the tube is under greater pressure than the air in the tube.
- C** The adhesive forces between the tube and the water molecules are stronger than the cohesive forces between the water molecules.
- D** Water is very viscous and resists flowing down the tube.

Thinking Skill: Generating

9. The thermal expansion of a solid is \_\_\_\_\_ the temperature change and the original length, and depends on the material.

**A** proportional to  
**B** inversely related to  
**C** a product of  
**D** always greater than

10. The figure below shows two identical metal bars at different temperatures.



Not drawn to scale

What is the coefficient of linear expansion for the metal from which the bars are made?

**A**  $16 \times 10^{-5} \text{ } ^\circ\text{C}^{-1}$   
**B**  $14 \times 10^{-5} \text{ } ^\circ\text{C}^{-1}$   
**C**  $12 \times 10^{-5} \text{ } ^\circ\text{C}^{-1}$   
**D**  $11 \times 10^{-5} \text{ } ^\circ\text{C}^{-1}$

Thinking Skill: Integrating

## CHAPTER

## 14

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A spring stretches 14 cm when an object weighing 28 N is hung from it. What is the spring constant?

**A**  $1.4 \times 10^2$  N/m  
**B**  $1.8 \times 10^2$  N/m  
**C**  $2.0 \times 10^2$  N/m  
**D**  $14 \times 10^2$  N/m

Objective: 7.01

Thinking Skill: Applying

2. If the period of a pendulum is 1.2 s, what is the length of the pendulum?

**A** 1.3 m  
**B** 1.0 m  
**C** 0.75 m  
**D** 0.36 m

Objective: 7.01

Thinking Skill: Applying

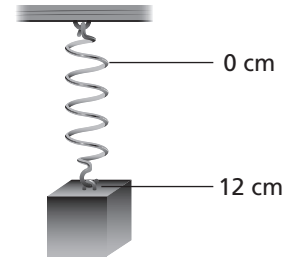
3. A longitudinal wave with a wavelength of 0.50 m has a period of 0.20 s. How far does the wave travel in 45 s?

**A**  $6.8 \times 10^1$  m  
**B**  $1.1 \times 10^2$  m  
**C**  $1.4 \times 10^2$  m  
**D**  $1.7 \times 10^2$  m

Objective: 7.01

Thinking Skill: Applying

Use the following illustration to answer problems 4 and 5.



4. The illustration shows a spring stretched by the weight of a block. If the block weighs 34 N, what potential energy is stored in the spring?

**A** 2.0 J  
**B** 2.8 J  
**C** 3.5 J  
**D** 4.1 J

Objective: 7.01

Thinking Skill: Generating

5. If the block were replaced with one that weighs 52 N, what would be the displacement?

**A** 17 cm  
**B** 19 cm  
**C** 21 cm  
**D** 23 cm

Objective: 7.01

Thinking Skill: Focusing

**14** **Physics Test Prep***continued*

6. A wave reflects off a wall. Which of the following is true of the reflected wave?
- A The reflected wave has about the same amplitude as the incident wave and is inverted.
  - B The reflected wave has a lesser amplitude than the incident wave and is inverted.
  - C The reflected wave has a greater amplitude than the incident wave and is upright.
  - D The reflected wave has about the same amplitude as the incident wave and is upright.

Objective: 7.03

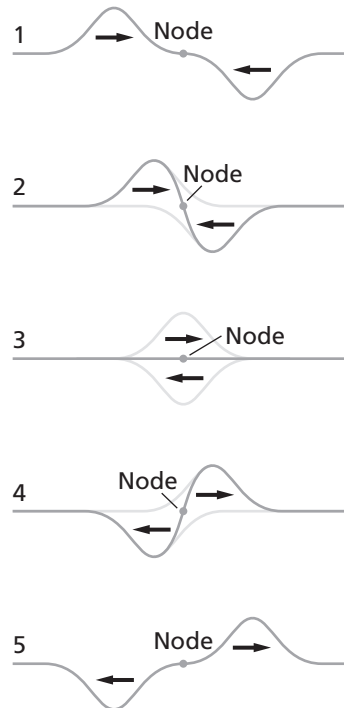
Thinking Skill: Remembering

7. \_\_\_\_\_ occurs when small forces are applied at regular intervals to a vibrating or oscillating object and the amplitude of the vibration increases.
- A a pendulum
  - B resonance
  - C larger displacement
  - D harmonic convergence
8. Echoes are caused by the \_\_\_\_\_ of sound waves off hard surfaces.
- A superposition
  - B resonance
  - C refraction
  - D reflection

Objective: 7.03

Thinking Skill: Remembering

9. The diagram shows the superposition of two waves.



Which of the following is true about the waves shown in the diagram?

- A equal amplitudes, constructive interference
- B equal amplitudes, destructive interference
- C different amplitudes, constructive interference
- D different amplitudes, destructive interference

Objective: 7.05

Thinking Skill: Evaluating

## CHAPTER

## 15

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

Use the table below to answer problems 1 and 2.

| Sound Waves |                    |                |
|-------------|--------------------|----------------|
| Wave        | Amplitude (Pa)     | Frequency (Hz) |
| 1           | $2 \times 10^{-5}$ | 20.0           |
| 2           | $2 \times 10^{-2}$ | 210            |
| 3           | $2 \times 10^2$    | 678            |
| 4           | $2 \times 10^3$    | 720            |

1. Which sound wave described in the table has a loudness of 60 dB?

**A** wave 1  
**B** wave 2  
**C** wave 3  
**D** wave 4

Objective: 7.01

Thinking Skill: Organizing

2. What is the wavelength of wave 4 in air? (The speed of sound in air is 343 m/s.)

**A** 0.48 m  
**B** 0.95 m  
**C** 2.1 m  
**D** 2.5 m

Objective: 7.01

Thinking Skill: Organizing

3. The velocity of sound is 343 m/s in air and 1493 m/s in water. For sound with a frequency of 440 Hz, what is the difference between the wavelength in air and in water?

**A** 1.0 m  
**B** 2.6 m  
**C** 4.2 m  
**D** 4.4 m

Objective: 7.05

Thinking Skill: Organizing

4. Two clarinet players are tuning their instruments. One plays a perfect G at 352 Hz. The other is slightly sharp and plays at 357 Hz. What is the beat frequency?

**A** 2.5 Hz  
**B** 5 Hz  
**C** 7.5 Hz  
**D** 10 Hz

Objective: 7.05

Thinking Skill: Generating

5. A 384-Hz tuning fork is held over a closed-pipe resonator. If the speed of the sound is 343 m/s, what is the spacing between the resonances?

**A** 0.223 m  
**B** 0.447 m  
**C** 0.670 m  
**D** 0.893 m

Objective: 7.05

Thinking Skill: Generating

- 6.** A car approaches a pedestrian standing on the side of the road. The car is traveling at 24.2 m/s. The horn of the car emits a sound wave with a frequency of 482 Hz. What frequency is heard by the pedestrian?
- A** 478 Hz  
**B** 490 Hz  
**C** 519 Hz  
**D** 522 Hz
- Objective: 7.06  
Thinking Skill: Focusing
- 7.** The loudness of sound as perceived by the ear and brain depends mainly on its \_\_\_\_\_.
- A** Doppler effect  
**B** amplitude  
**C** velocity  
**D** pitch
- Objective: 7.01  
Thinking Skill: Remembering
- 8.** Most sounds are \_\_\_\_\_ that comprise more than one frequency.
- A** vibrating objects  
**B** varying decibels  
**C** amplitudes  
**D** complex waves
- Objective: 7.02  
Thinking Skill: Remembering
- 9.** As a train speeds away from a station, its whistle sounds with a frequency of 624 Hz. For a listener standing on the platform of the station, sound waves from the whistle have a frequency of 580 Hz. What is the velocity of the train relative to the listener at the station?
- A** -23 m/s  
**B** -24 m/s  
**C** -25 m/s  
**D** -26 m/s
- Objective: 7.06  
Thinking Skill: Applying
- 10.** The fundamental frequency and harmonics can be described in terms of \_\_\_\_\_.
- A** resonance  
**B** the Doppler effect  
**C** beats  
**D** noise
- Objective: 7.05  
Thinking Skill: Generating

## CHAPTER

## 16

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

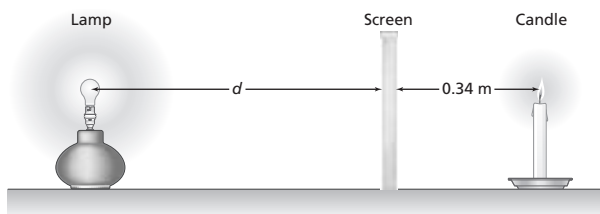
1. The wavelength of a beam of light passing through a vacuum is 420 nm. What is the frequency of the light beam?

**A**  $6.7 \times 10^{13}$  Hz  
**B**  $5.4 \times 10^{14}$  Hz  
**C**  $7.1 \times 10^{14}$  Hz  
**D**  $3.8 \times 10^{14}$  Hz

Objective: 7.01

Thinking Skill: Applying

2. The illustration shows a lamp and a candle illuminating a screen positioned between them. If the lamp is moved to a distance  $d = 1.02$  m, how much brighter must the lightbulb be than the candle to have the same illuminance on the screen?



**A** 1.5 times  
**B** 3 times  
**C** 4.5 times  
**D** 9 times

Objective: 7.03

Thinking Skill: Evaluating

3. Which describes the combination of two primary colors of light to produce a secondary color of light?
- A** Yellow light and blue light combine to produce green light.  
**B** Magenta light and cyan light combine to produce blue light.  
**C** Red light and green light combine to produce yellow light.  
**D** Green light and yellow light combine to produce white light.

Objective: 7.01

Thinking Skill: Remembering

4. If the luminous flux of a lightbulb is 1750 lm, what is the illuminance of a surface 2.0 m from the light source?

**A** 140 lx  
**B** 35 lx  
**C** 28 lx  
**D** 13 lx

Objective: 7.02

Thinking Skill: Applying

5. An architect is designing the lighting for a school. The illuminance in the classrooms must be at least 37 lx on students' desks. If the light shining on each desk has a luminous flux of 4200 lm, how far above the desks should the lights be placed?

**A** 1.0 m  
**B** 2.0 m  
**C** 3.0 m  
**D** 4.0 m

Objective: 7.02

Thinking Skill: Applying

6. Light from a distant galaxy has an apparent wavelength of 452 nm. If the galaxy is known to be moving away at a speed of  $\frac{1}{6}c$ , what is the actual wavelength of the light?

**A** 377 nm  
**B** 387 nm  
**C** 527 nm  
**D** 542 nm

Objective: 7.03

Thinking Skill: Generating

7. Which of the following statements is true?

**A** Ordinary light contains only those waves vibrating parallel to its direction of travel.  
**B** Ordinary light contains waves vibrating in every direction perpendicular to its direction of travel.  
**C** Ordinary light contains waves vibrating in one direction perpendicular to its direction of travel.  
**D** Ordinary light contains polarized waves.

Objective: 7.01

Thinking Skill: Generating

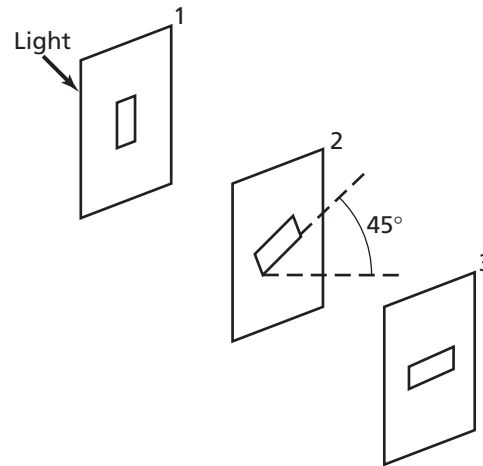
8. Polarized light consists of waves \_\_\_\_\_ in the same plane.

**A** reflected  
**B** displaced  
**C** oscillating  
**D** traveling

Objective: 7.01

Thinking Skill: Remembering

Use the illustration to answer problems 9 and 10.



9. The illustration above shows a beam of light moving through polarizing filters. What fraction of the initial light intensity,  $I$ , emerges from the third filter?

**A** 0  
**B**  $\frac{1}{4}I$   
**C**  $\frac{1}{2}I$   
**D**  $I$

Objective: 7.01

Thinking Skill: Organizing

10. If the order of the filters were changed to 2, 1, 3, what fraction of the initial light intensity would emerge from the last filter?

**A** 0  
**B**  $\frac{1}{4}I$   
**C**  $\frac{1}{2}I$   
**D**  $I$

Objective: 7.01

Thinking Skill: Applying

## CHAPTER

## 17

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. If a light ray reflects off a plane mirror at an angle of  $30^\circ$  to the normal, what is the angle of incidence of the ray?

**A**  $150^\circ$   
**B**  $60^\circ$   
**C**  $30^\circ$   
**D**  $15^\circ$

Objective: 7.03

Thinking Skill: Applying

2. What determines whether a surface produces a specular reflection or a diffuse reflection?

**A** the wavelength of the light  
**B** the index of refraction of the surface  
**C** how smooth the surface is  
**D** whether the surface is convex or concave

Objective: 7.03

Thinking Skill: Organizing

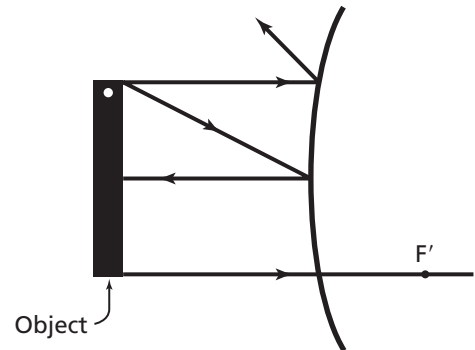
3. Which statement is true about the image produced by a plane mirror?

**A** It appears to be located on the same side of the mirror as the object.  
**B** It appears to be larger than the object.  
**C** It appears to be inverted relative to the object.  
**D** It appears to have reversed left and right, relative to the object.

Objective: 7.03

Thinking Skill: Evaluating

Use the diagram below to answer problems 4 and 5.



4. The diagram shows rays of light reflected from a convex mirror. Which describes the image size and orientation for this mirror?

**A** enlarged, inverted  
**B** enlarged, upright  
**C** reduced, inverted  
**D** reduced, upright

Objective: 7.03

Thinking Skill: Analyzing

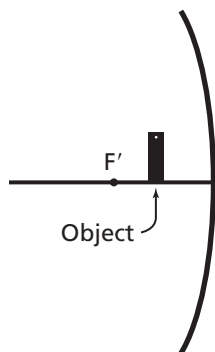
5. What is the value of the magnification,  $m$ , for this mirror?

**A**  $m = 1$   
**B**  $m < 0$   
**C**  $m > 1$   
**D**  $0 < m < 1$

Objective: 7.03

Thinking Skill: Remembering

6. The diagram below represents a concave mirror with an object located between the focal point,  $F$ , and the surface of the mirror. What type of image is produced when the object is in this position?



- A** inverted, enlarged, and real  
**B** upright, enlarged, and virtual  
**C** inverted, reduced, and virtual  
**D** upright, reduced, and real
- Objective: 7.03  
 Thinking Skill: Remembering
7. Which of the following explains the law of reflection?
- A** the specular model of light  
**B** the diffuse model of light  
**C** the wave model of light  
**D** the particle model of light
- Objective: 7.03  
 Thinking Skill: Remembering

8. What is the focal length of a concave mirror in which the image is located 10.0 cm in front of the mirror when the object is located 15.0 cm in front of the mirror?

- A** 6.00 cm  
**B** 12.0 cm  
**C** 15.0 cm  
**D** 30.0 cm

Objective: 5.03

Thinking Skill: Focusing

9. If a concave mirror has a focal length of 8.00 cm, how far from the mirror is the image of an object that is located 40.0 cm in front of the mirror?

- A** 10.0 cm  
**B** 6.67 cm  
**C** 5.00 cm  
**D** 1.50 cm

Objective: 7.03

Thinking Skill: Focusing

10. A candle is 30 cm from a spherical mirror. The mirror forms an image 15 cm from the mirror on the same side as the object. What is the magnification of the mirror?

- A** 2  
**B** 0.5  
**C** -2  
**D** -0.5

Objective: 7.03

Thinking Skill: Applying

## CHAPTER

## 18

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. If light passes from air into water at  $40.0^\circ$  to the normal, what is the angle of refraction? (The index of refraction for water is  $n = 1.33$ .)

**A**  $28.9^\circ$   
**B**  $31.3^\circ$   
**C**  $58.7^\circ$   
**D**  $61.1^\circ$

Objective: 7.03

Thinking Skill: Generating

2. Light passes from air into another medium at  $30.0^\circ$  to the normal. If the angle of refraction is  $18.0^\circ$ , what is the index of refraction of the new medium?

**A** 1.33  
**B** 1.52  
**C** 1.62  
**D** 2.42

Objective: 7.03

Thinking Skill: Generating

3. What happens when light enters a region with a higher index of refraction?

**A** The light slows down and bends toward the normal.  
**B** The light speeds up and bends toward the normal.  
**C** The light slows down and bends away from the normal.  
**D** The light speeds up and bends away from the normal.

Objective: 7.03

Thinking Skill: Remembering

4. A light beam passes from flint glass ( $n = 1.62$ ) into ethanol ( $n = 1.36$ ). What is the critical angle for total internal reflection of the light beam?

**A**  $15.1^\circ$   
**B**  $26.0^\circ$   
**C**  $57.1^\circ$   
**D**  $84.0^\circ$

Objective: 7.03

Thinking Skill: Remembering

5. An object is placed in front of a convex lens with a 7.00-cm focal length. If the object distance is 15.0 cm, what is the image distance?

**A** 2.75 cm  
**B** 4.77 cm  
**C** 8.00 cm  
**D** 13.1 cm

Objective: 7.03

Thinking Skill: Generating

6. Which of these describes how a rainbow forms?

**A** Light hitting a water droplet is refracted twice, then reflected.  
**B** Light hitting a water droplet is first refracted, then reflected, then refracted again.  
**C** Light hitting a prism is refracted twice, then reflected.  
**D** Light hitting a prism is first refracted, then reflected, then refracted again.

Objective: 7.03

Thinking Skill: Remembering

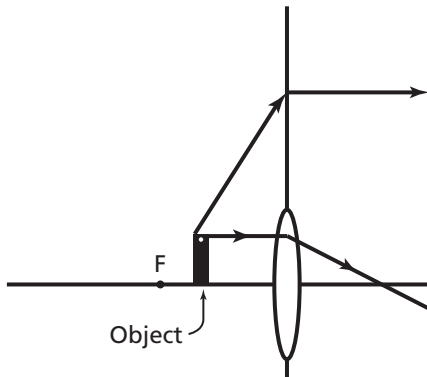
7. Which describes the image produced by a concave lens?

- A reduced and real
- B enlarged and real
- C reduced and virtual
- D enlarged and virtual

Objective: 7.03

Thinking Skill: Remembering

8. The diagram below shows rays of light from an object passing through a convex lens. Where will the image form?

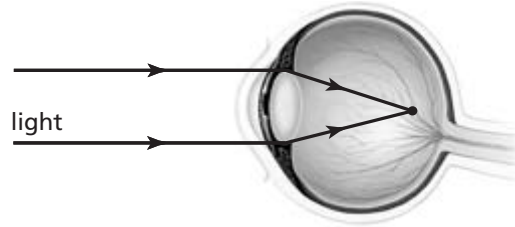


- A on the other side of the lens from the object
- B between the object and the focal point
- C between the object and the lens
- D beyond the object on the same side of the lens

Objective: 7.03

Thinking Skill: Analyzing

9. The diagram shows how light rays bend when they enter a human eye. Which statement is not true about the eye in the diagram?



- A It is farsighted.
- B Images focus in front of the retina.
- C The focal length is too short.
- D A concave lens can correct the vision problem.

Objective: 7.03

Thinking Skill: Evaluating

10. Mike holds a magnifying glass (convex lens) 5.00 cm above a sheet of paper. He looks at the writing on the page and notices that it is magnified by a factor of 3.00. What is the focal length of the lens he is using?

- A 7.50 cm
- B 3.75 cm
- C 4.00 cm
- D 2.00 cm

Objective: 7.03

Thinking Skill: Analyzing

## CHAPTER

## 19

## Physics Test Prep

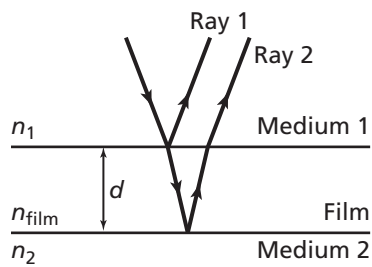
Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

- Which statement is true about coherent light?
  - It consists of light from just one source.
  - It has smooth wave fronts.
  - It has unsynchronized wave fronts.
  - It is the same as monochromatic light.Objective: 7.05  
Thinking Skill: Evaluating
- In a double-slit experiment, the slits are 0.025 mm apart and a screen is placed 0.75 m away. The first order bright band is found to be 1.35 cm from the central bright band. What is the wavelength of the light?
  - 250 nm
  - 410 nm
  - 450 nm
  - 720 nmObjective: 7.05  
Thinking Skill: Remembering
- Light viewed through a grating spectroscope produces a line spectrum with an angle of  $30.0^\circ$  between the central bright line and the first line. The light is found to have a wavelength of 668 nm. What slit separation was used to view the light?
  - 334 nm
  - 668 nm
  - 1230 nm
  - 1340 nmObjective: 7.05  
Thinking Skill: Generating
- A telescope is used to view two stars that are about 9.36 light-years away and emit light with an average wavelength of 570 nm. If the aperture of the telescope has a diameter of 1.8 m, what is the minimum separation of the stars so that they can be distinguished as two separate objects?
  - $1.2 \times 10^{-9}$  ly
  - $3.6 \times 10^{-6}$  ly
  - $1.2 \times 10^4$  ly
  - $3.6 \times 10^7$  lyObjective: 7.05  
Thinking Skill: Focusing
- When Young shone light from a single coherent source through two slits, the light formed interference fringes. What did this experiment show about the nature of light?
  - Light is monochromatic.
  - Light is coherent.
  - Light has particle properties.
  - Light has wave properties.Objective: 7.05  
Thinking Skill: Focusing
- Light with a wavelength of 600 nm strikes a thin film. What are the first three film thicknesses at which the light will be strongly reflected?
  - 150 nm, 300 nm, 450 nm
  - 150 nm, 450 nm, 750 nm
  - 600 nm, 1800 nm, 3000 nm
  - 2400 nm, 7200 nm, 12,000 nmObjective: 7.05  
Thinking Skill: Applying

# 19 Physics Test Prep

continued

Use the figure below to answer problems 7 and 8.



7. The diagram above shows reflection of light from a thin film. Under which conditions will both reflected rays be inverted?

- A**  $n_1 < n_{\text{film}} < n_2$   
**B**  $n_1 = n_{\text{film}} = n_2$   
**C**  $n_1 > n_{\text{film}} > n_2$   
**D**  $n_1 < n_{\text{film}} > n_2$

Objective: 7.05

Thinking Skill: Remembering

8. Suppose light with wavelength of 532 nm strikes the film with index of refraction  $n_{\text{film}} = 1.45$ . What is the minimum thickness of the film for constructive interference with both rays inverted?

- A** 45.9 nm  
**B** 91.7 nm  
**C** 183 nm  
**D** 367 nm

Objective: 7.05

Thinking Skill: Remembering

9. Light with a wavelength of 680 nm passes through a single slit of width 0.075 mm onto a screen that is 1.0 m away. What is the distance from the central bright band to the first dark band produced on the screen?

- A** 1.1 mm  
**B** 2.3 mm  
**C** 4.5 mm  
**D** 9.1 mm

Objective: 7.05

Thinking Skill: Applying

10. What type of pattern is produced by single-slit diffraction of coherent light?

- A** a series of bands nearly equally spaced apart  
**B** a wide central band with narrower bands on either side  
**C** a narrow central band with wider bands on either side  
**D** a mixture of patterns

Objective: 7.05

Thinking Skill: Remembering

11. Why are there limits to the resolving power of a telescope?

- A** The aperture is a double slit.  
**B** The aperture is a slit with two edges.  
**C** The aperture through which the light passes limits the amount of light that forms the image.  
**D** The aperture through which the light passes diffracts the light and blurs the image.

Objective: 7.05

Thinking Skill: Remembering

## CHAPTER

## 20

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. Why does a plastic comb rubbed with wool attract small bits of paper?
- A The comb is negatively charged. The paper is positively charged.
  - B The comb is negatively charged. The paper has no net charge.
  - C The comb is positively charged. The paper is negatively charged.
  - D The comb is positively charged. The paper has no net charge.

Objective: 9.02

Thinking Skill: Generating

2. An electroscope has an excess of  $3.9 \times 10^8$  electrons. What is the charge on the electroscope?
- A  $1.6 \times 10^{-11}$  C
  - B  $2.4 \times 10^{-11}$  C
  - C  $4.1 \times 10^{-11}$  C
  - D  $6.2 \times 10^{-11}$  C

Objective: 9.02

Thinking Skill: Evaluating

3. How can acquiring charge be described at a microscopic level?
- A It is a process of balancing the charge on an atom.
  - B It is a process of removing electrons from the nucleus.
  - C It is a process of transferring electrons.
  - D It is a process of creating charge.

Objective: 9.02

Thinking Skill: Remembering

4. If a positive rod is brought near the knob of a neutral electroscope, but does not touch it, what will occur?

- A The knob will become negatively charged, and the leaves will repel each other.
- B The knob will become negatively charged, and the leaves will remain closed.
- C The knob will become positively charged, and the leaves will repel each other.
- D The knob will become positively charged, and the leaves will remain closed.

Objective: 9.02

Thinking Skill: Generating

5. A lightning bolt transfers a charge of 17 C. How many electrons does the lightning bolt transfer if it strikes the ground?

- A  $1.1 \times 10^{18}$  electrons
- B  $2.7 \times 10^{18}$  electrons
- C  $1.1 \times 10^{20}$  electrons
- D  $2.7 \times 10^{20}$  electrons

Objective: 9.01

Thinking Skill: Integrating

6. Which of the following summarizes Coulomb's results?

- A  $F \propto \frac{1}{r^2}$
- B  $F \propto \frac{q_A q_B}{r^2}$
- C  $F \propto q_A q_B$
- D  $F \propto r^2$

Objective: 9.01

Thinking Skill: Integrating

7. A charge,  $q_A$ , experiences an attractive force of  $1.5 \times 10^2$  N as a result of a charge,  $q_B$ , located 2.4 cm away. If  $q_B$  has a charge of  $+5.2 \times 10^{-6}$  C, what is the charge of  $q_A$ ? ( $K = 9.0 \times 10^9$  N·m<sup>2</sup>/C<sup>2</sup>)

- A**  $-1.3 \times 10^{-6}$  C  
**B**  $-1.8 \times 10^{-6}$  C  
**C**  $-3.1 \times 10^{-6}$  C  
**D**  $-7.7 \times 10^{-6}$  C

Objective: 9.02

Thinking Skill: Evaluating

8. Spheres A and B are located  $4.0 \times 10^{-2}$  m apart. If sphere A has a charge of  $+4.0 \times 10^{-6}$  C and sphere B has a charge of  $-2.0 \times 10^{-6}$  C, what is the magnitude of the force of sphere B on sphere A?

- A**  $4.5 \times 10^1$  N  
**B**  $1.4 \times 10^2$  N  
**C**  $1.7 \times 10^2$  N  
**D**  $1.8 \times 10^2$  N

Objective: 9.01

Thinking Skill: Applying

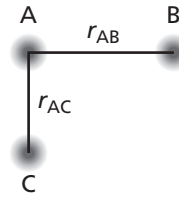
9. If sphere B in problem 8 is moved so it is only  $2.0 \times 10^{-2}$  m from sphere A, how does the force between the charges change?

- A** multiplied by 2  
**B** multiplied by 4  
**C** divided by 2  
**D** divided by 4

Objective: 9.01

Thinking Skill: Applying

10. The diagram shows three charged spheres.



Sphere A has a charge of  $2.0 \times 10^{-6}$  C, sphere B has a charge of  $3.0 \times 10^{-6}$  C, and sphere C has a charge of  $4.0 \times 10^{-6}$  C. What is the magnitude of the net force on sphere A?

( $r_{AB} = 2.0 \times 10^{-2}$  m and  $r_{AC} = 2.0 \times 10^{-2}$  m)

- A**  $1.4 \times 10^2$  N  
**B**  $1.6 \times 10^2$  N  
**C**  $2.0 \times 10^2$  N  
**D**  $2.3 \times 10^2$  N

Objective: 9.01

Thinking Skill: Information-gathering

11. An electroscope is negatively charged, with the leaf at an angle of about  $45^\circ$ . A rod is slowly brought to (but not touching) the knob of the electroscope and the leaf falls. This suggests that the rod is

- A** uncharged or positively charged.  
**B** uncharged or negatively charged.  
**C** positively charged.  
**D** negatively charged.

Objective: 9.02

Thinking Skill: Evaluating

## CHAPTER

## 21

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A positive test charge of  $4.0 \times 10^{-6}$  C is in an electric field that exerts a force of  $2.0 \times 10^{-4}$  N on it. What is the magnitude of the electric field at the location of the test charge?

**A**  $5.0 \times 10^1$  N/C  
**B**  $2.0 \times 10^2$  N/C  
**C**  $4.0 \times 10^2$  N/C  
**D**  $8.0 \times 10^2$  N/C

Objective: 9.01

Thinking Skill: Applying

2. An electric field strength of  $6.0 \times 10^4$  N/C is measured using a positive test charge of  $2.5 \times 10^{-6}$  C. What is the force on the test charge?

**A** 0.15 N  
**B** 0.42 N  
**C** 1.5 N  
**D** 4.2 N

Objective: 9.01

Thinking Skill: Applying

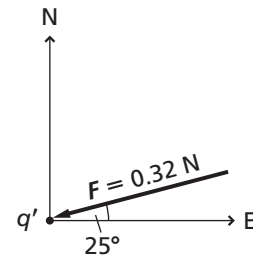
3. The ratio of charge stored to potential difference is called

**A** voltage  
**B** capacitance  
**C** a capacitor  
**D** resistance

Objective: 9.01

Thinking Skill: Remembering

Use the following diagram to answer problems 4 and 5.



4. The diagram shows a positive test charge in an electric field and the force the test charge experiences. What is the charge if the electric field strength is  $1.2 \times 10^5$  N/C?

**A**  $1.1 \times 10^{-6}$  C  
**B**  $2.7 \times 10^{-6}$  C  
**C**  $4.7 \times 10^{-6}$  C  
**D**  $6.4 \times 10^{-6}$  C

Objective: 9.01

Thinking Skill: Integrating

5. What is the direction of the electric field at the location of the test charge?

**A**  $25^\circ$  north of east  
**B**  $25^\circ$  north of west  
**C**  $25^\circ$  south of east  
**D**  $25^\circ$  south of west

Objective: 9.01

Thinking Skill: Information gathering

6. When a charge of  $4.2 \times 10^{-5}$  C is added to a capacitor, the potential difference increases from 10.6 V to 16.2 V. What is the capacitance of the capacitor?

**A** 1.3  $\mu\text{F}$   
**B** 2.4  $\mu\text{F}$   
**C** 7.5  $\mu\text{F}$   
**D** 9.1  $\mu\text{F}$

Objective: 9.01

Thinking Skill: Integrating

7. What is the electric potential difference of an electric field?

**A** the work done in moving a positive test charge between two points divided by the magnitude of the test charge  
**B** the force on a positive test charge divided by the magnitude of the test charge  
**C** the magnitude of a positive test charge divided by the work done in moving the test charge between two points  
**D** the magnitude of a positive test charge multiplied by the force on the test charge

Objective: 9.01

Thinking Skill: Remembering

8. Two charged parallel plates that are  $2.0 \times 10^{-2}$  m apart have an electric field between them with a magnitude of 1600 N/C. What is the electric potential difference between the plates?

**A** 4.0 V  
**B** 8.0 V  
**C** 32 V  
**D** 33 V

Objective: 9.01

Thinking Skill: Applying

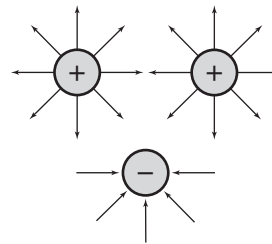
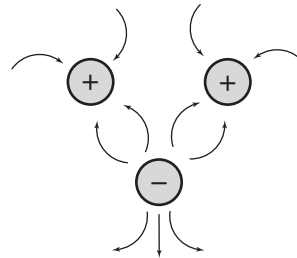
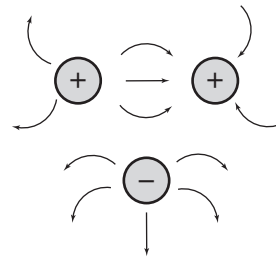
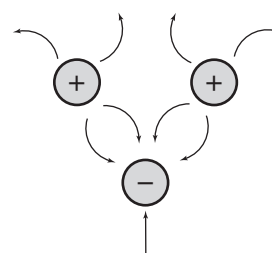
9. A sphere has an electric potential difference between it and Earth of 30.0 V when it has been charged to  $3.5 \times 10^{-6}$  C. What is its capacitance?

**A** 0.12  $\mu\text{F}$   
**B** 1.1  $\mu\text{F}$   
**C** 5.3  $\mu\text{F}$   
**D** 8.6  $\mu\text{F}$

Objective: 9.01

Thinking Skill: Applying

10. Which of the following shows the electric field lines for two protons and one electron?

**A****B****C****D**

Objective: 9.01

Thinking Skill: Analyzing

## CHAPTER

## 22

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A 9.0-V battery delivers a 1.1-A current to an electric motor. How much power is delivered to the motor?

**A** 8.2 W  
**B** 9.9 W  
**C** 11 W  
**D** 12 W

Objective: 10.03

Thinking Skill: Applying

2. If a 9.0-V battery is connected to a circuit with 0.55 A of current, what is the resistance?

**A** 5.0  $\Omega$   
**B** 6.1  $\Omega$   
**C** 16  $\Omega$   
**D** 45  $\Omega$

Objective: 10.01

Thinking Skill: Applying

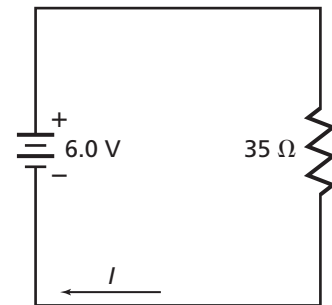
3. A burner on an electric stove top converts electric energy to thermal energy. How much thermal energy is supplied by the burner in 8.0 s if it draws 1.24 kW of power?

**A** 1.6 kJ  
**B** 6.5 kJ  
**C** 7.9 kJ  
**D** 9.9 kJ

Objective: 10.03

Thinking Skill: Applying

4. The diagram below shows a simple electric circuit. How much would the power increase if the 6.0-V battery were replaced with a 9.0-V battery?



**A** 1.3 W  
**B** 2.3 W  
**C** 2.5 W  
**D** 4.0 W

Objective: 10.02

Thinking Skill: Organizing

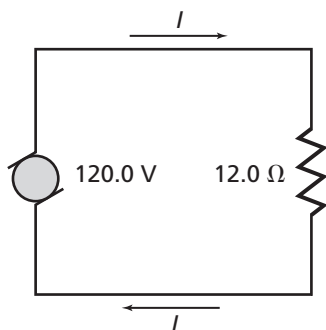
5. What is the resistance of a circuit connected to a 14.0-V battery if it supplies  $2.70 \times 10^2$  J of energy in 20.0 s?

**A** 7.56  $\Omega$   
**B** 10.4  $\Omega$   
**C** 14.5  $\Omega$   
**D** 18.9  $\Omega$

Objective: 10.01

Thinking Skill: Remembering

6. The diagram below shows the circuit for a heater. How much thermal energy does the heater provide in 20.0 s?



- A** 24.0 kJ  
**B** 12.0 kJ  
**C** 10.0 kJ  
**D** 8.0 kJ

Objective: 10.03

Thinking Skill: Focusing

Objective: 10.01

Thinking Skill: Integrating

8. A 9.0 volt battery delivers a 0.50-A current to a bulb connected across its terminals. What power is delivered to the bulb?

**A** 0.056 W**B** 4.5 W**C** 18 W**D** 41 W

Objective: 10.01

Thinking Skill: Applying

**A** 3.0 J**B** 12 J**C** 18 J**D** 180 J

Objective: 10.01

Thinking Skill: Applying

**A** 2.0 V**B** 3.0 V**C** 12 V**D** 18 V

Objective: 10.01

Thinking Skill: Analyzing

## CHAPTER

## 23

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

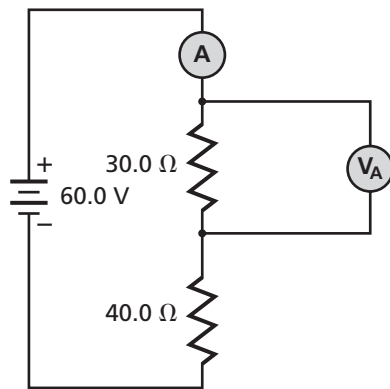
1. A circuit includes three resistors in parallel, each with a resistance of  $55\ \Omega$ . If one of the devices breaks, what is the ratio of the final current to the original current?

**A**  $\frac{1}{3}$   
**B**  $\frac{2}{3}$   
**C** 1  
**D**  $\frac{3}{2}$

Objective: 10.02

Thinking Skill: Evaluating

Use the diagram below to answer problems 2 and 3.



2. The diagram above shows a circuit with two resistors connected in series. What is the current in the circuit?

**A** 0.857 A  
**B** 0.923 A  
**C** 1.02 A  
**D** 1.21 A

Objective: 10.02

Thinking Skill: Applying

3. What is the voltage drop across the  $30.0\text{-}\Omega$  resistor in the circuit?

**A** 25.7 V  
**B** 27.7 V  
**C** 34.3 V  
**D** 60.0 V

Objective: 10.02

Thinking Skill: Evaluating

4. A circuit consists of a battery and two  $22\text{-}\Omega$  resistors in series. The current through the circuit is 0.55 A. A third resistor is then added to the circuit in parallel with the first two resistors. The current through the new branch of the circuit is 0.35 A. What is the resistance of the third resistor?

**A**  $15\ \Omega$   
**B**  $24\ \Omega$   
**C**  $28\ \Omega$   
**D**  $69\ \Omega$

Objective: 10.02

Thinking Skill: Remembering

5. A string of holiday lights has 15 bulbs with equal resistances. If one of the bulbs is removed, the other bulbs still glow. But when the entire string of bulbs is connected to a 120-V outlet, the current through the bulbs is 5.0 A. What is the resistance of each bulb?

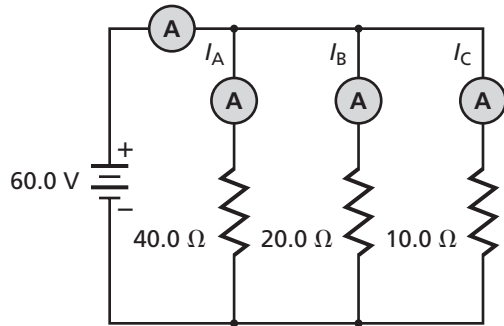
**A**  $2.4 \times 10^1\ \Omega$   
**B**  $4.0 \times 10^1\ \Omega$   
**C**  $6.3 \times 10^1\ \Omega$   
**D**  $3.6 \times 10^2\ \Omega$

Objective: 10.02

Thinking Skill: Generating

**23** **Physics Test Prep***continued*

6. The diagram below shows a circuit with three resistors connected in parallel. What is the total current for the circuit?



- A** 0.857 A  
**B** 1.50 A  
**C** 3.00 A  
**D** 10.5 A

Objective: 10.02

Thinking Skill: Applying

7. Which statement correctly describes how an ammeter and a voltmeter should be connected with a resistor?

- A** The ammeter is connected in series, and the voltmeter is connected in parallel.  
**B** The ammeter is connected in parallel, and the voltmeter is connected in series.  
**C** Both the ammeter and voltmeter are connected in series.  
**D** Both the ammeter and voltmeter are connected in parallel.

Objective: 10.02

Thinking Skill: Remembering

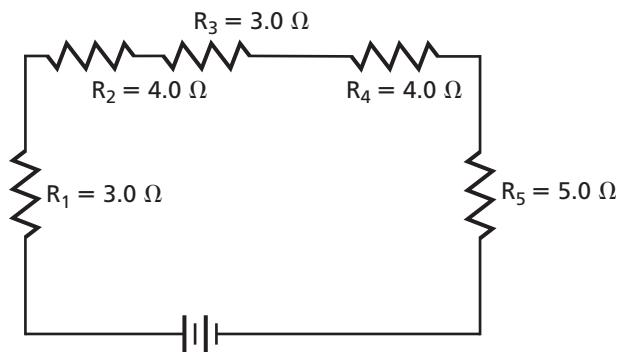
8. Two appliances, a lamp with a resistance of  $15.0\ \Omega$  and a curling iron with a resistance of  $20.0\ \Omega$ , are connected in parallel to a  $120.0\text{-V}$  source through a  $2.00\text{-}\Omega$  resistor in series. How much current passes through the circuit when both appliances are on?

- A** 10.7 A  
**B** 11.3 A  
**C** 14.8 A  
**D** 15.2 A

Objective: 10.02

Thinking Skill: Applying

9. The equivalent resistance in the circuit below is:



- A**  $1.5\ \Omega$   
**B**  $12\ \Omega$   
**C**  $19\ \Omega$   
**D**  $25\ \Omega$

Objective: 10.02

Thinking Skill: Analyzing

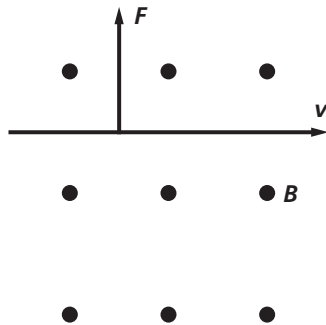
CHAPTER

24

Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

Use the illustration below to answer problems 1 and 2.



1. The illustration shows the direction in which a particle moves through a magnetic field. The particle moves with a velocity of  $2.8 \times 10^6$  m/s. The magnetic field,  $B = 3.7 \times 10^{-2}$  T, exerts a force of  $-2.2 \times 10^{-14}$  N on the particle. What is the particle's charge?

- A  $-1.7 \times 10^{-19}$  C
- B  $-2.1 \times 10^{-19}$  C
- C  $-4.7 \times 10^{-19}$  C
- D  $-6.0 \times 10^{-19}$  C

Objective: 9.03

Thinking Skill: Focusing

2. If a different particle, with charge  $-3.2 \times 10^{-19}$  C, then moves through the field at the same velocity, what would the field strength need to be to exert the same force?

- A  $1.9 \times 10^{-1}$  T
- B  $2.5 \times 10^{-1}$  T
- C  $4.0 \times 10^{-1}$  T
- D  $4.9 \times 10^{-1}$  T

Objective: 9.03

Thinking Skill: Generating

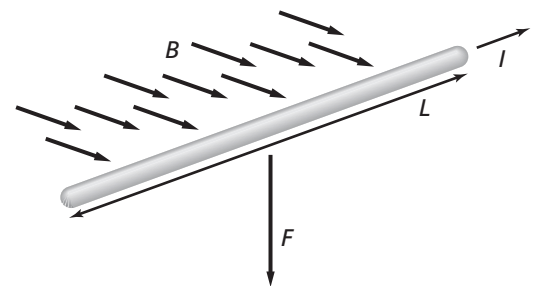
3. What current is required to produce a force of 0.62 N on a 9.4 cm length of wire at right angles to a 0.18-T field?

- A 0.37 A
- B 1.1 A
- C 11 A
- D 37 A

Objective: 9.03

Thinking Skill: Evaluating

4. The illustration below shows a straight current-carrying wire in a uniform magnetic field, oriented at right angles to the wire. The 0.25-m wire carries a 4.75-A current and experiences a force of 0.38 N. What is the strength of the magnetic field?



- A 0.32 T
- B 0.45 T
- C 0.56 T
- D 0.72 T

Objective: 9.03

Thinking Skill: Analyzing

5. What is the force on a 0.20-m straight wire carrying 4.0 A of current in a magnetic field with strength of 0.40 T if the wire is at right angles to the field?

**A** 0.32 N  
**B** 0.30 N  
**C** 0.18 N  
**D** 0.12 N

Objective: 9.03

Thinking Skill: Applying

6. A straight wire carrying a 6.0-A current moving in a magnetic field with strength 0.50 T at right angles to the field has 0.30 N of force on it. How long is the wire?

**A** 0.050 m  
**B** 0.10 m  
**C** 0.15 m  
**D** 0.20 m

Objective: 9.03

Thinking Skill: Applying

7. A particle with a charge of  $-3.2 \times 10^{-19}$  C passes through a magnetic field of strength 0.60 T at right angles to the field. The force on the particle is  $-2.6 \times 10^{-14}$  N. What is the particle's velocity?

**A**  $5.0 \times 10^4$  m/s  
**B**  $7.4 \times 10^4$  m/s  
**C**  $1.4 \times 10^5$  m/s  
**D**  $4.9 \times 10^5$  m/s

Objective: 9.03

Thinking Skill: Analyzing

8. What is the force on a particle moving at a velocity of  $3.0 \times 10^6$  m/s perpendicular to a magnetic field with a strength of 0.60 T, if the particle has a charge of  $-1.30 \times 10^{-18}$  C?

**A**  $-1.7 \times 10^{-12}$  N  
**B**  $-2.3 \times 10^{-12}$  N  
**C**  $-3.8 \times 10^{-12}$  N  
**D**  $-4.2 \times 10^{-12}$  N

Objective: 9.03

Thinking Skill: Applying

9. How are electric charges and magnetic poles similar?

**A** both are plus and minus  
**B** unlike attract and like repel  
**C** unlike repel and like attract  
**D** both change to positive and negative charges

Objective: 9.03

Thinking Skill: Comparing

10. How do you make an electromagnet?

**A** attach a natural magnet to a battery  
**B** line up the north and south poles of a magnet with an electric wire  
**C** run a current through a wire wrapped around an iron rod  
**D** wrap a magnet around a piece of wire with a current passing through it

Objective: 9.03

Thinking Skill: Analyzing

## CHAPTER

## 25

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A 0.15-m straight wire moves with a constant velocity of 7.0 m/s perpendicularly through a magnetic field. If the magnetic field has a strength of 0.40 T, what is the electromotive force?

**A** 0.42 V  
**B** 2.6 V  
**C** 2.8 V  
**D** 19 V

Objective: 9.03

Thinking Skill: Applying

2. A generator develops a maximum voltage of 155 V. A lightbulb that is placed in a series circuit with the generator draws an effective current of 0.60 A. What is the resistance of the bulb?

**A**  $1.3 \times 10^2 \Omega$   
**B**  $1.8 \times 10^2 \Omega$   
**C**  $2.6 \times 10^2 \Omega$   
**D**  $3.7 \times 10^2 \Omega$

Objective: 9.03

Thinking Skill: Evaluating

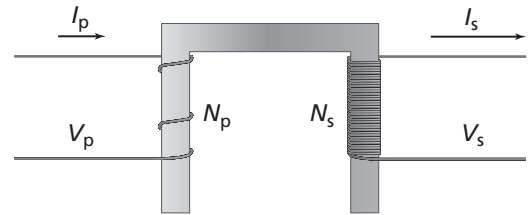
3. According to Lenz's law, the direction of an induced current in a conductor will be that which tends to produce which of the following effects?

**A** enhances the effect that produces it  
**B** produces a greater heating effect  
**C** produces the greatest voltage  
**D** opposes the effect that produces it

Objective: 9.03

Thinking Skill: Applying

Use the illustration below to answer problems 4 and 5.



4. The illustration shows a step-up transformer. The primary coil has  $N_p = 250$  turns and the secondary coil has  $N_s = 4750$  turns. If the input effective voltage is 83.0 V, what is the voltage in the secondary coil?

**A**  $1.12 \times 10^3$  V  
**B**  $1.58 \times 10^3$  V  
**C**  $2.07 \times 10^3$  V  
**D**  $2.23 \times 10^3$  V

Objective: 9.03

Thinking Skill: Applying

5. If the effective current in the secondary coil is 1.20 A, what is the current in the primary coil? (Assume the coil is 100 percent efficient.)

**A** 11.4 A  
**B** 16.1 A  
**C** 22.8 A  
**D** 32.2 A

Objective: 9.03

Thinking Skill: Applying

6. A 0.038-T magnetic field is directed horizontally. A 1.8-m straight wire moves in a direction  $55^\circ$  above horizontal. If an  $EMF$  of 0.21 V is induced in the wire, what is the wire's velocity?

**A** 2.5 m/s  
**B** 3.1 m/s  
**C** 3.7 m/s  
**D** 4.6 m/s

Objective: 9.03

Thinking Skill: Organizing

7. A 0.25-m straight wire moves at a speed of 4.4 m/s perpendicular to a magnetic field of strength of 0.052 T. The wire is part of a circuit with a resistance of  $0.48 \Omega$ . What is the current through the wire?

**A** 0.027 A  
**B** 0.12 A  
**C** 0.36 A  
**D** 0.44 A

Objective: 9.03

Thinking Skill: Evaluating

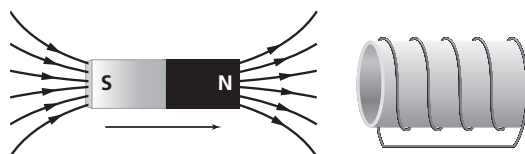
8. A transformer consists of a 500-turn primary coil and a 2000-turn secondary coil. If the current in the primary coils is 3.0 A, what is the current in the secondary?

**A** 0.75 A  
**B** 1.3 A  
**C** 12 A  
**D** 48 A

Objective: 9.03

Thinking Skill: Applying

9. The diagram shows a magnet and a coil of wire that is not carrying current. According to Lenz's law, what will happen if the north pole of the magnet is moved toward the left end of the coil?



- A** Induced current will flow in a clockwise direction (as viewed from the left end of the coil).  
**B** The left end of the coil will become a north pole.  
**C** Magnetic field lines will emerge from the right end of the coil.  
**D** A back- $EMF$  will be induced.

Objective: 9.03

Thinking Skill: Generating

10. A transformer is a device that

- A** operates only on AC  
**B** operates only on DC  
**C** operates on either DC or AC  
**D** increases the power level of a circuit

Objective: 9.03

Thinking Skill: Remembering

## CHAPTER

## 26

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. A cell phone is designed to receive electromagnetic waves with a frequency of 790 MHz. What length should the cell phone's antenna be to maximize the signal strength?

**A** 0.04 m  
**B** 0.09 m  
**C** 0.13 m  
**D** 0.19 m

Thinking Skill: Applying

2. An alpha particle ( $q = 3.20 \times 10^{-19}$  C) passes without deflection through a magnetic field of 0.48 T. It is balanced by an electric field of  $3.8 \times 10^3$  N/C. What is the speed of the particle?

**A**  $2.8 \times 10^3$  m/s  
**B**  $7.9 \times 10^3$  m/s  
**C**  $1.3 \times 10^4$  m/s  
**D**  $2.5 \times 10^4$  m/s

Thinking Skill: Applying

Use the table to answer question 3.

| Wavelengths of Visible Light |                 |
|------------------------------|-----------------|
| Color                        | Wavelength (nm) |
| Violet-indigo                | 390–455         |
| Blue                         | 455–492         |
| Green                        | 492–577         |
| Yellow                       | 577–597         |
| Orange                       | 597–622         |
| Red                          | 622–700         |

3. A beam of light has a frequency of  $5.15 \times 10^{14}$  Hz. What is the color of the light?

**A** blue  
**B** green  
**C** yellow  
**D** orange

Objective: 7.01

Thinking Skill: Analyzing

4. Why did Thompson observe two glowing dots when he put neon gas into a cathode-ray tube?

**A** The neon contained impurities.  
**B** The neon was made up of two different isotopes whose atoms had different chemical properties.  
**C** The neon was made up of two different isotopes whose atoms had different masses.  
**D** The neon was made up of two different isotopes whose atoms had different charges.

Objective: 9.03

Thinking Skill: Integrating

5. The speed of light traveling through an unknown material is  $2.15 \times 10^8$  m/s. What is the dielectric constant of the unknown material?

**A** 0.514  
**B** 1.12  
**C** 1.40  
**D** 1.95

Thinking Skill: Applying

6. A doubly ionized ( $2+$ ) cesium atom passes with a velocity of  $4.1 \times 10^5$  m/s through an electric field of  $5.3 \times 10^5$  N/C. What magnetic field is required to prevent deflection of the atom?

**A** 0.41 T  
**B** 1.3 T  
**C** 2.1 T  
**D** 4.2 T

Thinking Skill: Applying

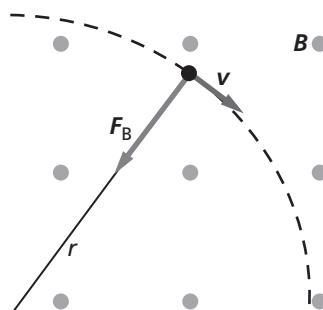
7. A light wave with a wavelength of 585 nm is traveling from the Sun to Earth. What is the frequency of the wave?

**A**  $5.13 \times 10^{-14}$  Hz  
**B**  $5.13 \times 10^{14}$  Hz  
**C**  $1.95 \times 10^{-12}$  Hz  
**D**  $1.95 \times 10^{12}$  Hz

Objective: 9.03

Thinking Skill: Applying

8. The illustration below shows a charged particle moving with a velocity of  $3.1 \times 10^6$  m/s through a magnetic field of  $4.2 \times 10^{-4}$  T. The path of the particle is perpendicular to the field. The charge of the particle is  $-1.60 \times 10^{-19}$  C, and its mass is  $9.11 \times 10^{-31}$  kg. What is the radius,  $r$ , of the circular path that is followed by the charged particle?



**A**  $2.4 \times 10^{-2}$  m  
**B**  $1.3 \times 10^{-2}$  m  
**C**  $4.2 \times 10^{-3}$  m  
**D**  $2.4 \times 10^{-3}$  m

Thinking Skill: Analyzing

9. A mass spectrometer shows that the charge-to-mass ratio for an isotope is  $9.2 \times 10^7$  C/kg. If the spectrometer uses a voltage of 41 V and the magnetic field is 0.095 T, what is the radius of curvature for the isotope?

**A**  $1.0 \times 10^{-1}$  m  
**B**  $1.0 \times 10^{-3}$  m  
**C**  $9.9 \times 10^{-3}$  m  
**D**  $9.9 \times 10^{-5}$  m

Thinking Skill: Analyzing

## CHAPTER

## 27

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

Use the following values to answer the problems on pages 53 and 54.

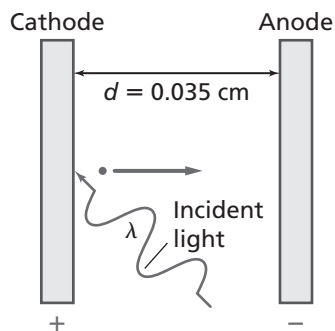
$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$$

$$q_e = -1.60 \times 10^{-19} \text{ C}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$h = 6.626 \times 10^{-34} \text{ J/Hz}$$

Use the illustration to answer problems 1 and 2.



1. The illustration shows electron emission after light strikes the cathode of a photocell. If the stopping potential of the photocell is 3.7 V, what kinetic energy is given to the electrons?

- A**  $7.3 \times 10^{-16} \text{ J}$   
**B**  $5.9 \times 10^{-19} \text{ J}$   
**C**  $6.4 \times 10^{-21} \text{ J}$   
**D**  $4.8 \times 10^{-22} \text{ J}$

Thinking Skill: Generating

2. The light that strikes the cathode has a frequency of  $6.4 \times 10^{14} \text{ Hz}$ . What is the energy of a photon at this frequency?

- A** 2.1 eV  
**B** 2.6 eV  
**C** 3.4 eV  
**D** 5.8 eV

Thinking Skill: Applying

3. Cobalt has a work function of 5.0 eV. What is its threshold wavelength?

- A** 248 nm  
**B** 387 nm  
**C** 434 nm  
**D** 620 nm

Thinking Skill: Applying

4. Which of the following best describes the nature of light?

- A** Light has wave properties only.  
**B** Light has particle properties only.  
**C** Light has neither wave nor particle properties.  
**D** Light has both wave and particle properties.

Objective: 7.02

Thinking Skill: Applying

5. Light from a mercury vapor lamp ( $\lambda = 254 \text{ nm}$ ) strikes a sample of rubidium. The rubidium has a work function of  $2.16 \text{ eV}$ . What is the kinetic energy of the electrons ejected from the sample?

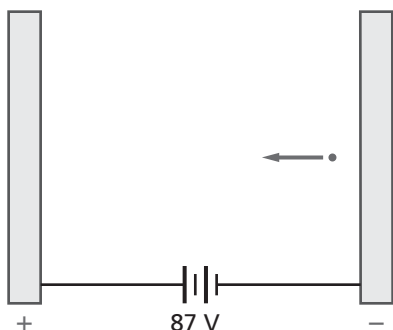
**A**  $1.90 \text{ eV}$   
**B**  $2.26 \text{ eV}$   
**C**  $2.72 \text{ eV}$   
**D**  $4.88 \text{ eV}$

Objective: 9.03

Thinking Skill: Applying

(p = 5)

6. The illustration shows two metal plates with a potential difference between them. An electron is accelerated from the cathode to the anode. What is the velocity of the electron when it reaches the anode?



**A**  $1.4 \times 10^6 \text{ m/s}$   
**B**  $2.3 \times 10^6 \text{ m/s}$   
**C**  $3.9 \times 10^6 \text{ m/s}$   
**D**  $5.5 \times 10^6 \text{ m/s}$

Thinking Skill: Analyzing

7. An electron has a velocity of  $9.3 \times 10^5 \text{ m/s}$ . What is its de Broglie wavelength?

**A**  $0.49 \text{ nm}$   
**B**  $0.78 \text{ nm}$   
**C**  $0.88 \text{ nm}$   
**D**  $1.3 \text{ nm}$

Thinking Skill: Applying

8. A positron has a de Broglie wavelength of  $2.07 \text{ nm}$ . What is its kinetic energy?

**A**  $0.300 \text{ eV}$   
**B**  $0.351 \text{ eV}$   
**C**  $0.599 \text{ eV}$   
**D**  $0.702 \text{ eV}$

Thinking Skill: Applying

9. Why can't you observe the wave nature of everyday objects?

**A** The wavelengths of everyday objects are very short.  
**B** The Heisenberg uncertainty principle prevents measurement of the wavelength.  
**C** The wavelengths of everyday objects are very long.  
**D** Everyday objects do not have a wave nature.

Objective: 7.02

Thinking Skill: Integrating

## CHAPTER

## 28

## Physics Test Prep

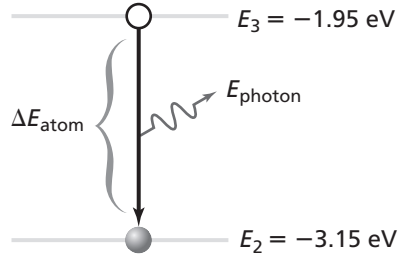
Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

- What conclusion did Rutherford reach when he observed that atoms of gold foil could deflect  $\alpha$  particles?
  - All of an atom's positive charge and virtually all of its mass are in a tiny central core.
  - Electrons contain so much energy that they can deflect  $\alpha$  particles.
  - Electrons are scattered throughout an atom like blueberries in a muffin.
  - The amount of space occupied by the electrons in an atom is insignificant.

Thinking Skill: Remembering

- A hydrogen atom absorbs energy, causing its electron to move from the first to the third energy level. What is the change in the atom's energy?
  - 3.19 eV
  - 10.2 eV
  - 12.1 eV
  - 13.6 eV

Thinking Skill: Generating

- The diagram shows the emission of a photon when a calcium atom drops from the third energy level ( $n = 3$ ) to the second energy level ( $n = 2$ ). What is the wavelength of the emitted photon?
 

- $7.50 \times 10^1$  nm
- $2.44 \times 10^2$  nm
- $5.09 \times 10^2$  nm
- $1.03 \times 10^3$  nm

Thinking Skill: Analyzing

- What was Bohr's contribution to modeling the atom?
  - Electrons travel in fixed orbits.
  - Energy levels in an atom are quantized.
  - Electrons have wave properties.
  - Electrons are found in electron clouds.

Thinking Skill: Remembering

**28 Physics Test Prep**

continued

5. An atom drops from an energy level of  $-7.64$  eV to a lower level and emits a photon with wavelength  $273$  nm. What is the energy of the lower level?

**A**  $-3.36$  eV  
**B**  $-4.54$  eV  
**C**  $-11.0$  eV  
**D**  $-12.2$  eV

Thinking Skill: Applying

6. The lasing energy levels of a laser are separated by  $1.95$  eV. What wavelength of light does it emit?

**A**  $242$  nm  
**B**  $420$  nm  
**C**  $636$  nm  
**D**  $845$  nm

Thinking Skill: Generating

7. What does the quantum model of the atom allow scientists to predict?

**A** the exact position and momentum of an electron  
**B** the radius of an electron's orbit  
**C** the probability that an electron is in a specific region  
**D** the angular momentum of an electron

Thinking Skill: Remembering

| Energy Levels for Mercury |             |
|---------------------------|-------------|
| $n$                       | Energy (eV) |
| 1                         | $-10.38$    |
| 2                         | $-5.74$     |
| 3                         | $-5.52$     |
| 4                         | $-4.95$     |
| 5                         | $-3.71$     |

8. The table above shows the first five energy levels for mercury. A mercury atom makes a transition that emits a photon with a frequency of  $4.91 \times 10^{14}$  Hz. What was the transition?

**A**  $E_3$  to  $E_1$   
**B**  $E_5$  to  $E_2$   
**C**  $E_4$  to  $E_3$   
**D**  $E_4$  to  $E_2$

Thinking Skill: Evaluating

9. What does the word *laser* stand for?

**A** light amplification by stimulated emission of radiation  
**B** light amplification by spontaneous emission of radiation  
**C** light amplification by stimulated excitation of radiation  
**D** light amplification by spontaneous excitation of radiation

Objective: 7.02

Thinking Skill: Remembering

## CHAPTER

## 29

## Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

1. The voltage across an LED is 1.5 V when it is in a circuit with a 9.0-V battery and a 225- $\Omega$  resistor. What is the current through the resistor?

**A** 0.0067 A  
**B** 0.033 A  
**C** 0.040 A  
**D** 0.047 A

Objective: 10.01

Thinking Skill: Applying

2. According to the band theory of solids, why is lead a good conductor?

**A** There is a wide energy gap between the valence band and conduction band of lead.  
**B** The valence band of lead is empty and the conduction band is filled.  
**C** A great deal of energy is needed to move valence electrons of lead to the conduction band.  
**D** The conduction band of lead overlaps the valence band.

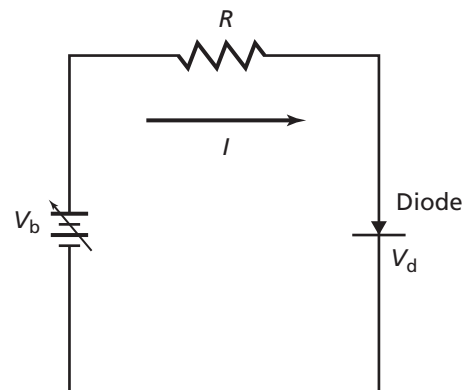
Thinking Skill: Integrating

3. Which of the following elements has the correct number of valence electrons to be used as a dopant for an  $n$ -type semiconductor?

**A** beryllium ( $Z = 4$ )  
**B** boron ( $Z = 5$ )  
**C** nitrogen ( $Z = 7$ )  
**D** aluminum ( $Z = 13$ )

Thinking Skill: Generating

4. The diagram shows a circuit connecting a diode, a 550- $\Omega$  resistor, and a power supply that forward-biases the diode. If the diode, with a voltage drop of 0.7 V, has a current of 0.015 A, what is the voltage of the power supply?



**A** 7 V  
**B** 8 V  
**C** 9 V  
**D** 10 V

Objective: 10.01

Thinking Skill: Integrating

**29** **Physics Test Prep***continued*

5. When arsenic is used as a dopant to improve the conductivity of silicon (Si), each arsenic atom donates one electron. If there are  $4.99 \times 10^{22}$  Si atoms per  $\text{cm}^3$  and 1 in every million Si atoms is replaced by an arsenic atom, how many free electrons from arsenic are there in  $1 \text{ cm}^3$  of doped silicon?

- A**  $4.99 \times 10^{16}$   
**B**  $5.24 \times 10^{16}$   
**C**  $6.78 \times 10^{20}$   
**D**  $4.99 \times 10^{22}$

Thinking Skill: Applying

6. How does a transistor affect voltage?

- A** It causes voltage to decrease.  
**B** It reduces large voltage changes.  
**C** It does not affect voltage.  
**D** It amplifies small voltage changes.

Thinking Skill: Remembering

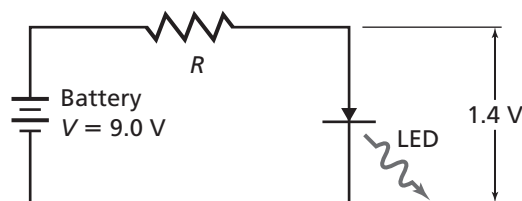
7. What is the approximate energy gap between the valence band and conduction band of a semiconductor?

- A** 0 eV  
**B** 1 eV  
**C** 5 eV  
**D** 10 eV

Objective: 10.01

Thinking Skill: Remembering

8. The diagram shows a series circuit with a battery, a resistor, and an LED. If the current is 15 mA, what is the resistance?



- A**  $9.3 \times 10^1 \Omega$   
**B**  $5.1 \times 10^2 \Omega$   
**C**  $6.0 \times 10^2 \Omega$   
**D**  $6.9 \times 10^2 \Omega$

Objective: 10.01

Thinking Skill: Integrating

9. How do dopants increase the conductivity of semiconductors?

- A** They add net charge to the semiconductor.  
**B** They increase the forbidden gap.  
**C** They make extra electrons or holes available.  
**D** They turn them into intrinsic semiconductors.

Objective: 10.01

Thinking Skill: Generating

CHAPTER

30

Physics Test Prep

Choose the best answer for each of the following questions. Mark your answers on the answer sheet provided by your teacher.

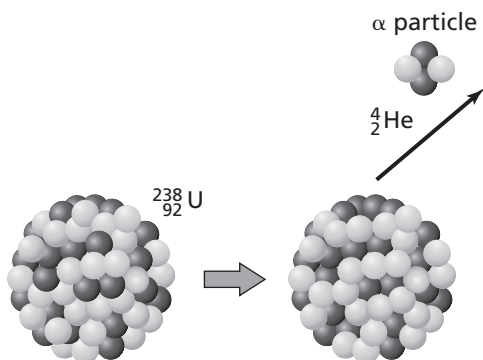
Use the following for the problems on pages 59 and 60.

$$m_{\text{neutron}} = 1.008665 \text{ u}$$

$$m_{\text{hydrogen}} = 1.007825 \text{ u}$$

$$\text{binding energy of } 1 \text{ u} = 931.49 \text{ MeV}$$

1. The diagram represents a nuclear reaction. Which symbol is missing from the diagram?



- A  ${}_{90}^{234}\text{Th}$
- B  ${}_{86}^{236}\text{Th}$
- C  ${}_{90}^{234}\text{Ra}$
- D  ${}_{86}^{236}\text{Ra}$

Thinking Skill: Generating

2. Which accurately shows beta decay of lead into bismuth?

- A  ${}_{82}^{209}\text{Pb} \rightarrow {}_{82}^{209}\text{Bi} + {}_{-1}^0\text{e} + {}_{+1}^0\bar{\nu}$
- B  ${}_{82}^{209}\text{Pb} \rightarrow {}_{81}^{209}\text{Bi} + {}_{+1}^0\text{e} + {}_{0}^0\bar{\nu}$
- C  ${}_{82}^{209}\text{Pb} \rightarrow {}_{83}^{209}\text{Bi} + {}_{-1}^0\text{e} + {}_{0}^0\bar{\nu}$
- D  ${}_{82}^{209}\text{Pb} \rightarrow {}_{82}^{209}\text{Bi} + {}_{-1}^0\text{e} + {}_{+1}^0\bar{\nu}$

Thinking Skill: Information gathering

3. An isotope of carbon,  ${}^{14}_6\text{C}$ , has a half-life of 5730 y. How much of a 4.0-g sample of the isotope will remain after 22,920 y?

- A 1.0 g
- B 0.50 g
- C 0.25 g
- D 0.13 g

Thinking Skill: Applying

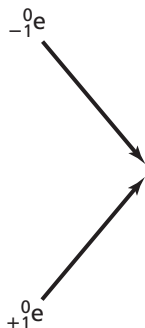
4. What is another name for an integrated circuit?

- A transistor
- B semiconductor
- C diode
- D microchip

Objective: 10.01

Thinking Skill: Remembering

5. The diagram shows a collision between two nuclear particles. What is the outcome of this collision?



- A** protons and neutrons  
**B** annihilation  
**C** antimatter  
**D** condensation trails
- Thinking Skill: Generating
6. A nitrogen isotope,  $^{13}_7\text{N}$ , has a mass of 13.00574 u. What is the mass defect?

- A**  $-0.08014$  u  
**B**  $-0.10102$  u  
**C**  $-0.10989$  u  
**D**  $-0.11998$  u

Thinking Skill: Applying

7. The mass defect of the carbon isotope  $^{13}_6\text{C}$  is  $-0.10425$  u. What is the mass of the isotope?

- A** 13.10761 u  
**B** 13.01365 u  
**C** 13.00734 u  
**D** 13.00336 u

Thinking Skill: Applying

8. An oxygen isotope,  $^{18}_8\text{O}$ , has a mass of 17.99916 u. What is its binding energy?

- A**  $-75.102$  MeV  
**B**  $-139.81$  MeV  
**C**  $-148.88$  MeV  
**D**  $-167.66$  MeV

Thinking Skill: Evaluating

9. When an atom of plutonium-245 is transmuted into an atom of americium-245, what type of decay has occurred?

- A** alpha decay  
**B** beta decay  
**C** gamma decay  
**D** proton decay

Thinking Skill: Applying