

1. Which one of the following is *not* an area of physics?
  - A) Mechanics
  - B) Optics
  - C) Algebra
  - D) Acoustics
  
2. Motion necessarily involves
  - A) a change in velocity.
  - B) a change in speed.
  - C) a change in direction.
  - D) a change in position.
  - E) all of these
  
3. The magnitude of a displacement is \_\_\_\_\_ the magnitude of the distance traveled.
  - A) always unequal to
  - B) less than or equal to
  - C) always equal to
  - D) greater than or equal to
  - E) none of these; the two cannot be compared.
  
4. Displacement divided by time gives
  - A) average acceleration.
  - B) average velocity.
  - C) average speed.
  - D) average distance.
  
5. Average speed multiplied by time gives
  - A) average acceleration.
  - B) displacement.
  - C) instantaneous speed.
  - D) distance.
  
6. Distance covered per unit of time is called
  - A) speed.
  - B) acceleration.
  - C) velocity.
  - D) displacement.

7. The straight-line distance and direction between two points are, together, called
- A) velocity.
  - B) displacement.
  - C) distance.
  - D) acceleration.
8. The magnitudes of two horizontal displacements are 1 m and 9 m, respectively. Given that the vectors may be in either the plus or the minus direction, they *cannot* be added together to give a total displacement of
- A) 10 m.
  - B) -8 m.
  - C) 8 m.
  - D) 9 m.
  - E) 7 m.
9. A speedometer indicates \_\_\_\_\_ if the automobile is traveling forward.
- A) instantaneous acceleration
  - B) instantaneous speed
  - C) instantaneous velocity
  - D) average speed
  - E) average acceleration
10. If an object moves with constant velocity,
- A) its speed is constant.
  - B) its direction is constant.
  - C) its average speed is constant.
  - D) its distance traveled per unit time is constant.
  - E) all of these
11. If the instantaneous velocity of an object is constant, then so is its
- A) velocity.
  - B) distance.
  - C) acceleration.
  - D) displacement.
12. The rate at which an object's velocity changes with time is called its
- A) instantaneous velocity.
  - B) motion.
  - C) speed.
  - D) acceleration.

13. An automobile's acceleration may be changed by using the
- A) windshield wipers.
  - B) steering wheel.
  - C) radio.
  - D) horn.
14. An automobile's acceleration *cannot* be changed by using the
- A) gas pedal.
  - B) brake pedal.
  - C) steering wheel.
  - D) stick shift.
  - E) turn signal.
15. An acceleration may result from
- A) a change in speed.
  - B) a change in direction.
  - C) a change in both speed and direction.
  - D) all of these
16. For which of the following is the acceleration constant?
- A) Nonuniform speed
  - B) Free fall
  - C) Uniform circular motion
  - D) None of these
17. Velocity is similar to speed, but a \_\_\_\_\_ is also involved in velocity.
- A) acceleration
  - B) direction
  - C) position
  - D) scalar
18. Which one of the following is true for deceleration?
- A) The acceleration is in the direction opposite the motion.
  - B) The acceleration is zero.
  - C) The acceleration is necessarily negative.
  - D) The velocity remains constant.

19. The distance traveled by an automobile moving at a constant velocity is
- A) directly proportional to the time.
  - B) directly proportional to the time squared.
  - C) inversely proportional to the time squared.
  - D) inversely proportional to the time.
  - E) none of these
20. An object that is moving in a linear path with an acceleration in the direction opposite to the motion has a(n) \_\_\_\_\_ velocity.
- A) constant
  - B) increasing
  - C) decreasing
  - D) none of these
21. An object that is moving in a linear path with an acceleration at a right angle to the motion has a(n) \_\_\_\_\_ velocity.
- A) changing
  - B) increasing
  - C) decreasing
  - D) constant
22. An object that is moving in a linear path with an acceleration in the direction of motion has a(n) \_\_\_\_\_ velocity.
- A) constant
  - B) increasing
  - C) decreasing
  - D) none of these
23. As a block slides down a  $40^\circ$  frictionless incline, its acceleration
- A) decreases with distance.
  - B) remains constant.
  - C) is greatest at the bottom of the incline.
  - D) is greatest at the top of the incline.
24. Which of the following is a possible unit of acceleration?
- A)  $\text{m/s}^2$
  - B)  $\text{m} \times \text{s}$
  - C)  $\text{m}^2/\text{s}$
  - D)  $\text{m/s}$

25. If the magnitude of the velocity of an object increases, we may be sure that during the time of this increase,
- A) the object is accelerated.
  - B) the acceleration of the object increases.
  - C) the object is moving in a straight path.
  - D) the object is changing direction.
  - E) none of these
26. A freely falling object
- A) has a uniformly increasing velocity.
  - B) is unaffected by gravity.
  - C) has a uniformly increasing acceleration.
  - D) has a uniformly increasing displacement.
27. An object in free fall has
- A) a constant speed.
  - B) a constant velocity.
  - C) a velocity that changes 9.8 m/s each second.
  - D) an acceleration that depends on its mass.
28. An object with a mass of 8 kg is dropped and takes 5 s to hit the ground. Then another object with a mass of 16 kg is dropped from the same point. How long does it take to hit the ground?
- A) 5 s
  - B) 10 s
  - C) 3 s
  - D) 25 s
  - E) 125 s
29. A car is moving down a freeway in a straight line at a constant rate of 24.0 m/s for 4.0 s. Its acceleration is
- A)  $9.8 \text{ m/s}^2$ .
  - B) 9.8 m/s.
  - C) zero.
  - D) 24.0 m/s.
  - E)  $6.0 \text{ m/s}^2$ .

30. An object is dropped from a vertical distance of 31.7 m above the ground, and it takes 2.54 sec to fall that distance. A second identical object is launched from the same height, with a horizontal velocity of 64.0 m/s. How long does the second object take to fall the 31.7 m?
- A) More than 2.54 sec
  - B) Almost 2.54 sec.
  - C) Less than 2.54 sec
  - D) Exactly 2.54 sec
  - E) Much less than 2.54 sec
31. A freely falling object has a constant acceleration of  $9.8 \text{ m/s}^2$ . This means that
- A) the object's displacement changes by 9.8 m every second squared.
  - B) the object's speed increases by 9.8 m/s each second.
  - C) the object's acceleration increases by  $9.8 \text{ m/s}^2$  each second.
  - D) the object travels 9.8 m each second.
32. An object that is moving with an acceleration different from zero will always have a(n) \_\_\_\_\_ velocity.
- A) changing
  - B) increasing
  - C) constant
  - D) decreasing
33. The distance traveled by a dropped object in free fall is directly proportional to
- A) the time squared.
  - B) its weight.
  - C) its mass.
  - D) none of these.
34. Which of the following statements is *not* true?
- A) Displacement has a direction and a magnitude.
  - B) Acceleration has a magnitude only.
  - C) Speed has a magnitude only.
  - D) Velocity has a magnitude and a direction.
35. All the following may be represented by vectors *except*
- A) velocity.
  - B) acceleration.
  - C) speed.
  - D) displacement.

36. An object in uniform circular motion has
- A) constant acceleration.
  - B) variable radial distances.
  - C) constant velocity.
  - D) constant speed.
37. In the equation  $a_c = v^2/r$  for centripetal acceleration, the  $r$  stands for
- A) diameter.
  - B) distance.
  - C) radius.
  - D) rate.
38. In the equation  $a_c = v^2/r$  for centripetal acceleration, the  $v$  stands for
- A) volume.
  - B) very.
  - C) speed.
  - D) velociraptor.
39. An object travels in a circle of radius 10.0 m with a constant speed of 3.0 m/s. What is the direction of its acceleration?
- A) Toward the center of the circle
  - B) Normal to the plane of the circle
  - C) Insufficient data given for determination
  - D) Tangential to the circle
  - E) None of these
40. Centripetal means
- A) center seeking
  - B) pulls outward
  - C) constant
  - D) fast
  - E) none of these
41. The magnitude of the acceleration of an object moving in a circle at constant speed is
- A) variable.
  - B) directly proportional to the speed squared.
  - C) directly proportional to the speed.
  - D) directly proportional to the radius of the circle squared.

42. The direction of the acceleration of an object moving in a circle at constant speed is
- A) changing, but pointing in a predictable direction.
  - B) constant and pointing in only one direction.
  - C) constant and pointing in two directions.
  - D) none of these
43. The magnitude of the acceleration of an object moving in a circle at constant speed is
- A) inversely proportional to the speed squared.
  - B) inversely proportional to the speed.
  - C) inversely proportional to the radius of the circle squared.
  - D) inversely proportional to the radius of the circle.
44. If the speed of an object in circular motion is increased by a factor of 5, its centripetal acceleration for the same radius will be multiplied by a factor of
- A) 0.04.
  - B) 0.2.
  - C) 2.24.
  - D) 25.
  - E) 5.
45. A projectile's vertical velocity component
- A) changes most rapidly near the top of its trajectory.
  - B) changes at a constant rate.
  - C) changes most rapidly near the bottom of its trajectory.
  - D) does not change.
46. A projectile's horizontal velocity component (ignoring air resistance)
- A) does not change.
  - B) changes most rapidly near the bottom of its trajectory.
  - C) changes at a variable rate.
  - D) changes at a constant rate.
47. In projectile motion, which of the following is *not* constant?
- A) Vertical velocity
  - B) Horizontal velocity
  - C) Acceleration
  - D) None of these



48. A golfer hits a ball on a level fairway at an angle of  $55^\circ$  relative to the horizontal, and it lands on the green. Another golfer hits a ball with the same speed but at another angle, and it lands on the green by the other ball. What was the launch angle for the second golfer?
- A)  $35^\circ$
  - B)  $25^\circ$
  - C)  $40^\circ$
  - D)  $45^\circ$
  - E)  $15^\circ$
49. A golfer hits a ball on a level fairway at an angle of  $35^\circ$  relative to the horizontal, and it lands on the green. Another golfer hits a ball with the same speed but at an angle of  $55^\circ$ , and it lands on the green by the other ball. Which statement is accurate for this situation?
- A) One ball is in the air longer than the other.
  - B) One ball experiences a greater acceleration while in free flight.
  - C) One ball experiences a smaller acceleration while in free flight.
  - D) Two balls hit at the same speed but different angles will always land in the same location.
  - E) Two balls hit at the same speed but different angles can never land in the same location.
50. When running and jumping to score, a basketball player seems to “hang” in the air because
- A) his or her acceleration is zero.
  - B) his or her horizontal velocity is quite small.
  - C) both components of motion are zero.
  - D) his or her vertical velocity is quite small.
  - E) levitation is possible with practice.
51. A continuous change in position is called \_\_\_\_\_.
52. The straight-line distance and direction between two points are, together, called \_\_\_\_\_.
53. Distance is a(n) \_\_\_\_\_ quantity.
54. A speedometer registers \_\_\_\_\_.

55. A compass registers \_\_\_\_\_.
56. Speed is a(n) \_\_\_\_\_ quantity.
57. For there to be an acceleration, there must necessarily be a change in \_\_\_\_\_.
58. If an object has a constant velocity, then its acceleration is \_\_\_\_\_.
59. In free fall, the \_\_\_\_\_ is constant.
60. Physics deals with matter, motion, force, and \_\_\_\_\_.
61. Physics deals with force, energy, motion, and \_\_\_\_\_.
62. Free-fall motion neglects \_\_\_\_\_.
63. A rifle bullet shot horizontally has a vertical acceleration of \_\_\_\_\_.
64. Dropped objects on the Moon fall at a slower rate than on Earth because of a smaller \_\_\_\_\_.
65. The distance a dropped object travels is proportional to the \_\_\_\_\_ of the time.
66. In straight-line motion, if a moving object slows down, the direction of the acceleration is \_\_\_\_\_ the direction of the velocity.
67. In straight-line motion, if a moving object speeds up, the direction of the acceleration is \_\_\_\_\_ the direction of the velocity.
68. On Earth, the magnitude of the acceleration of a vertical projectile at its maximum height is equal to \_\_\_\_\_.

69. On Earth, the magnitude of the velocity of a vertical projectile at its maximum height is equal to \_\_\_\_\_.
70. A(n) \_\_\_\_\_ quantity has both magnitude and direction.
71. A(n) \_\_\_\_\_ quantity has only magnitude.
72. Temperature is an example of a(n) \_\_\_\_\_ quantity.
73. An object moving in a circle with a constant speed has a(n) \_\_\_\_\_ directed toward the center of the circle.
74. \_\_\_\_\_ acceleration is necessary for uniform circular motion.
75. What two quantities are constant in uniform circular motion? \_\_\_\_\_ and \_\_\_\_\_
76. The SI unit of centripetal acceleration is \_\_\_\_\_.
77. The centripetal acceleration of an automobile in uniform circular motion on a flat circular track is supplied by \_\_\_\_\_.
78. For an object in uniform circular motion, the acceleration points toward \_\_\_\_\_.
79. A rifle bullet shot horizontally at a velocity of 9.8 m/s has a horizontal acceleration of \_\_\_\_\_.
80. Two objects are in uniform circular motion at the same speed but at different radii. The one with the \_\_\_\_\_ radius has the largest centripetal acceleration.

81. At the maximum height of a projectile launched at an angle to the horizontal, the projectile's velocity is in a \_\_\_\_\_ direction.
82. Under ideal conditions, a projectile with a given initial speed at an angle of  $85^\circ$  has the same range as a projectile at an angle of \_\_\_\_\_ with the same initial speed.
83. Because of air resistance, an object falling a great distance may reach a \_\_\_\_\_ velocity.
84. A student travels from St. Louis to Indianapolis, a distance of 210 mi, in 6.0 h. The return trip over the same route takes 7.0 h. What is the average speed for
- the first half of the trip?
  - the second half of the trip?
  - the total trip?
85. On a trip, a family travels 200 km in 2.5 h on the first day, 300 km in 4.0 h on the second day, and 250 km in 3.5 h on the third day. What was the average speed, in kilometers per hour, for the total trip?
86. An automobile traveling on a straight, level road at 15 km/h speeds up to 90 km/h in 30 s. What was the magnitude of the auto's acceleration, in meters per second squared?
87. An object is dropped ( $g = 9.80 \text{ m/s}^2$ ) and falls for 5.00 s before hitting the ground.
- How far has the object fallen?
  - What is the final velocity?
  - What is the final acceleration?
88. A ball is thrown up in the air with an initial velocity of 78.4 m/s upward. How long does it take the ball
- to go up?
  - to come down after reaching maximum height?

89. The following data refer to a car traveling west:

$t$ (s)	0	1	2	3	4
-----					
$v$ (m/s)	30	25	20	15	10

Find the magnitude and direction of the acceleration.

90. A car travels at a constant speed of 100.0 km/h around a circular track with a diameter of 1.00 km. What is the magnitude of the car's centripetal acceleration, and what supplies this?

91. The following are data for an accelerating car:

$t$ (s)	0	5	10	15	20
-----					
$v$ (m/s)	0	3	6	9	12

- a. Is this car undergoing uniform acceleration?  
b. If so, what is the acceleration?

92. A ball dropped from the top of a building hits the ground 8.0 s later. How high is the building (in meters)?

93. On the Moon, what is the approximate value for the acceleration due to gravity?

94. A stone is dropped from the top of a well that has water in it at a depth of 65.0 m. How long does it take the stone to reach the water?

95. A rock dropped down a well takes 1.8 s to hit the water. How far below the top of the well is the surface of the water?

96. What is the displacement of a hiker who travels 3.0 km east and then 4.0 km north?

97. An ant on a picnic table travels 30 cm eastward, then 15 cm northward, then 20 cm westward, and finally 15 cm southward. What is the magnitude of its net displacement?

## **Answer Key**

1. C
2. D
3. B
4. B
5. D
6. A
7. B
8. E
9. B
10. E
11. A
12. D
13. B
14. E
15. D
16. B
17. B
18. A
19. A
20. C
21. A
22. D
23. B
24. A
25. A
26. A
27. C
28. A
29. C
30. D
31. B
32. A
33. A
34. B
35. C
36. D
37. C
38. C
39. A
40. A
41. B
42. A
43. D
44. D

- 45. B
- 46. A
- 47. A
- 48. A
- 49. A
- 50. D
- 51. motion
- 52. displacement
- 53. scalar
- 54. instantaneous speed
- 55. direction
- 56. scalar
- 57. velocity
- 58. zero
- 59. acceleration
- 60. energy
- 61. matter
- 62. frictional effects, or air resistance
- 63.  $9.8 \text{ m/s}^2$ , or  $32 \text{ ft/s}^2$  (gravity)
- 64. acceleration due to gravity
- 65. square
- 66. opposite to, or antiparallel to
- 67. along, the same as, or parallel to
- 68.  $g$ , or  $9.8 \text{ m/s}^2$
- 69. zero
- 70. vector
- 71. scalar
- 72. scalar
- 73. acceleration
- 74. Centripetal
- 75. radial distance (radius); speed
- 76. meters per second squared ( $\text{m/s}^2$ )
- 77. friction
- 78. the center of the circle
- 79. zero
- 80. smallest or least
- 81. horizontal
- 82.  $5^\circ$
- 83. terminal
- 84. a. 35 mi/h  
b. 30 mi/h  
c. 32 mi/h
- 85. 75 km/h
- 86.  $0.69 \text{ m/s}^2$
- 87. a. 123 m  
b. 49 m/s, downward

- c.  $9.80 \text{ m/s}^2$ , downward
- 88. a. 8.0 s  
b. 8.0 s
- 89.  $-5.0 \text{ m/s}^2$ , or  $5.0 \text{ m/s}^2$  east
- 90.  $1.54 \text{ m/s}^2$ , friction
- 91. a. Yes  
b.  $0.6 \text{ m/s}^2$
- 92. 310 m (rounded to two significant figures)
- 93.  $1.6 \text{ m/s}^2$
- 94. 3.6 s
- 95. 16 m
- 96. 5.0 km
- 97. 10 cm