Chapter 2--Describing Motion

Student: _____

1. The average speed of an object is defined to be the
A. distance it travels divided by the time it takes.
B. distance it travels multiplied by the time it takes.
C. change in its velocity divided by the time it takes.
D. change in its velocity multiplied by the time it takes.

2. For an object traveling in uniform motion, the speed can be interpreted as
A. the number of meters that the object travels during each second of its motion
B. the number of seconds required for the object to travel one meter
C. niether of these interpretations is valid

3. An object moves uniformly along a straight-line path, covering *M* meters in *S* seconds. A student calculates the ratio *M/S*, obtaining the numerical value 0.6. This value, 0.6, can be interpreted as
A. the number of meters the object travels during each second.
B. the number of seconds the object requires to travel 1 meter.
C. the number of meters the object travels in *S* seconds.
D. the number of seconds the object requires to travel *M* meters.
E. this ratio has no physical interpretation; it is essentially meaningless

4. An object moves uniformly along a straight-line path, covering *N* meters in *T* seconds. A student calculates the ratio *T/N*, obtaining the numerical value 3.2. This value, 3.2, can be interpreted as
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C. the number of meters the object travels in *T* seconds
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5. A runner in the Boston marathon covered the first 20 miles in a time of 4 hours. How fast was he running when he passed the 15 mile marker?
A. 5 mph
B. 10 mph
C. 20 mph
D. We don't know.

6. A Honda Civic travels from milepost 405 to milepost 455 between 1:00 and 2:00 pm. A Subaru Legacy travels from milepost 200 to milepost 240 during the same time. Which car was traveling faster at 1:30 pm?
A. Honda
B. Subaru
C. They were traveling at the same speed.
D. There is not enough information to be able to say.

7. A train covers 60 miles between 2 pm and 4 pm. How fast was it traveling at 3 p.m.?
A. 15 mph
B. 30 mph
C. 60 mph
D. Not enough information is given to be able to say.

8. Car A travels from milepost 343 to milepost 349 in 5 minutes. Car B travels from milepost 493 to milepost 499 in 5 minutes. Which car has the greater average speed?
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9. A yellow car takes 10 minutes to go from milepost 101 to milepost 109. A red car takes 10 minutes to go from milepost 11 to milepost 21. Which car has the higher average speed?
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10. In Aesop's fable of the tortoise and the hare, the "faster" hare loses the race to the slow and steady tortoise. During the race, which animal has the greater average speed?
A. the tortoise
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11. Pat and Chris both travel from Los Angeles to New York along the same route. Pat rides a bicycle while Chris drives a fancy sports car. Unfortunately, Chris's car breaks down in Phoenix for over a week, causing the two to arrive in New York at exactly the same time. Which statement is true?
A. Pat and Chris had the same average speed.
B. Chris had the higher average speed.
C. Pat had the higher average speed.

12. In a cycling race, a rider covers the first 50 miles at a constant speed of 21 mph, and covers the second 50 miles at a constant speed of 19 mph. The average speed of the rider for the entire race is
A. exactly 20 mph
B. slightly greater than 20 mph
C. slightly less than 20 mph

13. On a trip to Helena, you stop for a 15-minute coffee break in Three Forks and arrive in Helena two hours after leaving Bozeman. If you assume that it is 100 miles to Helena, your average speed would be 50 mph. Which of the following statements about this trip is correct?
A. To average 50 mph the car must have gone 100 mph for 15 minutes of the trip.
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C. You cannot average 50 mph if the speed is zero for any part of the trip.
D. The car must have traveled faster than 50 mph for part of the trip.

14. A cruise ship covers a distance of 80 miles during the watch that lasts from midnight to 8 am. How fast was the ship going at 4 am if the speed of the ship was constant during the watch?
A. 80 miles/hour
B. 80 miles
C. 10 miles/hour
D. We don't have enough information to be able to say.

15. If a woman walks at a speed of 2 miles/hour for 3 hours, she will have walked
A. 2 miles.
B. 5 miles.
C. 6 miles.
D. 9 miles.

16. If a marathoner can run with an average speed of 10 mph, how far could she run in 2 hours?
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B. 10 miles
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D. 20 miles

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B. 50 h
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18. Approximately how fast can a person run?
A. 1 m/s
B. 10 m/s
C. 100 m/min
D. 1 km/h

19. The instantaneous speed of an object is defined to be the
A. distance it travels divided by the time it takes.
B. distance it travels multiplied by the time it takes.
C. average speed determined over an infinitesimally small time interval.
D. value of the average speed at the midpoint of the time interval.

20. Which of the following could be a velocity?
A. 5 meters west
B. 5 meters per second
C. 5 meters per second west
D. 5 meters per second per second

21. The average acceleration of an object is defined to be the
A. distance it travels divided by the time it takes.
B. change in its velocity divided by the time it takes.
C. change in its speed divided by the time it takes.
D. average of the accelerations during the two halves of the trip.

22. An object is accelerating
A. only when its speed changes.
B. only when its direction changes.
C. when its speed or direction changes.

23. An object moves along a straight-line path, steadily increasing its speed by a total of *W* miles per hour in *S* seconds. A student calculates the ratio *W/S*, obtaining the numerical value 2.1. This value, 2.1, can be interpreted as
A. the number of mph that the speed increases during each second
B. the number of seconds required for the speed to increase by 1 mph
C. the number of mph that the speed increases in *S* seconds
D. the number of seconds required for the speed to increase by *W* mph
E. this number has no physical intepretation; it is essentially meaningless

24. An object moves along a straight-line path, steadily increasing its speed by a total of *V* miles per hour in *T* seconds. A student calculates the ratio *V/T*, obtaining the numerical value 1.8. This value, 1.8, can be interpreted as
A. the number of mph that the speed increases during each second
B. the number of seconds required for the speed to increase by 1 mph
C. the number of mph that the speed increases in *T* seconds
D. the number of seconds required for the speed to increase by *V* mph
E. this number has no physical intepretation; it is essentially meaningless

25. Which of the following could be considered to be an "accelerator" in an automobile?
A. brake pedal
B. gas pedal
C. steering wheel
D. All of these can cause the car to accelerate.

26. If a car changes speed from 60 mph to 66 mph in 1 minute, its average acceleration is
A. 60 mph/minute.
B. 63 mph/minute.
C. 66 mph/minute.
D. 6 mph/minute.

27. If a car changes speed from 40 mph to 48 mph in 2 minutes, its average acceleration is
A. 4 miles/hour.
B. 44 miles/hour/minute.
C. 8 miles/hour/minute.
D. 4 miles/hour/minute.

28. If a car requires 10 seconds to accelerate from zero to 60 mph, its average acceleration is
A. 600 mph/second.
B. 60 mph/second.
C. 10 mph/second.
D. 6 mph/second.

29. A Chevrolet Corvette can accelerate from 0 to 60 mph in 5.2 s. What is the car's average acceleration?
A. 0 mph/s
B. 11.5 mph/s
C. 9.8 mph/s
D. 312 mph/s

30. A pitcher requires about 0.1 second to throw a baseball. If the ball leaves his hand with a speed of 40 m/s, what is the ball's average acceleration?
A. 40 m/s^2
B. 400 m/s^2
C. 400 m/s
D. 400 m

31. A car is accelerating at 4 m/s^2. At some time it is traveling at 40 m/s. How fast will it be going 1 s later?
A. 36 m/s
B. 40 m/s
C. 44 m/s
D. 36 m/s or 44 m/s

32. A child traveling 5 m/s on a sled passes her younger brother. If her average acceleration on the sledding hill is 2 m/s^2, how fast is she traveling when she passes her older brother 4 s later?
A. 7 m/s
B. 8 m/s
C. 10 m/s
D. 13 m/s

33. In the strobe diagram below the ball is moving from left to right. Which statement best describes the motion? The ball is

A. moving with a constant speed.
B. speeding up.
C. slowing down.
D. not accelerating.

34. Which of the following strobe diagrams corresponds to the situation where a ball rolls from left to right and continually speeds up?

A. 
B. 
C. 
D. 

35. Which of the following strobe diagrams corresponds to the situation where a ball rolls from right to left and continually slows down?

A. 
B. 
C. 
D. 

36. Which of the following strobe diagrams does NOT correspond to a situation where the ball is accelerating?

A. 
B. 
C. 
D. 

37. Which statement best describes the motion of the ball shown in the strobe diagram below? (Assume the ball moves from left to right.) The ball is

A. moving with constant speed.
B. speeding up.
C. accelerating.
D. slowing down.

38. Which statement best describes the motion of the ball shown in the strobe diagram below? (Assume the ball moves from left to right.) The ball is

A. moving with constant speed.
B. speeding up.
C. accelerating.
D. stopped

39. When we say that light objects and heavy objects fall at the same rate, what assumption are we making?
A. They have the same shape.
B. They are falling in a vacuum.
C. They are made of the same material.
D. They have the same size.

40. A ping-pong ball and a golf ball have approximately the same size but very different masses. Which hits the ground first if you drop them simultaneously while standing on the Moon?
A. the ping-pong ball
B. the golf ball
C. They hit simultaneously.
D. We are not able to predict the results.

41. The Moon is a nice place to study free-fall because it has no atmosphere. If an astronaut on the Moon simultaneously drops a hammer and a feather from the same height, which one hits the ground first?
A. the hammer
B. the feather
C. They hit at the same time.
D. They don't fall.

42. We claimed that if the air resistance could be neglected, all objects on the Moon would fall at
A. the same constant speed.
B. an increasing acceleration.
C. the same constant acceleration.
D. a decreasing acceleration.

43. A sheet of paper and a book fell at different rates in the classroom until the paper was wadded up into a ball. We then claimed that if the air resistance could be neglected, all objects would fall at
A. different constant speeds depending on the type of material.
B. the same constant speed regardless of the type of material.
C. the same constant speed regardless of how much they weigh.
D. the same constant acceleration.

44. A student decides to test Aristotle's and Galileo's ideas about free-fall by simultaneously dropping a 20-lb. ball and a 1-lb. ball from the top of a grain elevator. The two balls have the same size and shape. What actually happens? (Do not neglect air resistance!).
A. The 20-lb. ball hits first.
B. The 1-lb. ball hits first.
C. They hit simultaneously.
D. We are not able to predict the results.

45. A ping-pong ball and a golf ball have approximately the same size but very different masses. Which hits the ground first if you drop them simultaneously from a tall building? Do not ignore the effects of the air.
A. the ping-pong ball
B. the golf ball
C. They hit simultaneously.
D. We are not able to predict the results.

46. If we do *not* neglect air resistance, during which, if any, of the first 5 s of free fall does a ball's speed change the most?
A. first second
B. third second
C. fifth second
D. The speed changes the same amount each second.

47. If we ignore air resistance, the acceleration of an object that is falling downward is constant. How do you suppose the acceleration would change if we do *not* ignore air resistance?
A. The acceleration increases.
B. The acceleration does not change.
C. The acceleration decreases.

48. A ball is thrown straight up into the air. If we do not ignore air resistance, the acceleration of the ball as it is traveling upward is
A. 9.8 m/s^2.
B. greater than 9.8 m/s^2.
C. less than 9.8 m/s^2.
D. zero.

49. A ball is dropped in air. If we do not ignore air resistance, the acceleration of the ball is
A. 9.8 m/s^2.
B. greater than 9.8 m/s^2.
C. less than 9.8 m/s^2.
D. zero.

50. If the mass of an object in free fall is doubled, its acceleration
A. doubles.
B. increases by a factor of four.
C. stays the same.
D. is cut in half.

51. The motion of a block sliding down a frictionless ramp can be described as motion with
A. a constant speed.
B. a constant acceleration greater than 10 m/s/s.
C. a constant acceleration less than 10 m/s/s.
D. a constant speed that depends on the steepness of the ramp.

52. The motion of a ball or cylinder rolling down a ramp is one with
A. constant speed.
B. increasing acceleration.
C. constant acceleration.
D. decreasing acceleration.

53. You are bouncing on a trampoline while holding a bowling ball. As your feet leave the trampoline, you let go of the bowling ball. You will rise ____ than you would have if you had held onto the bowling ball.
A. higher
B. to the same height
C. lower

54. You are bouncing on a trampoline while holding a bowling ball. As your feet leave the trampoline, you let go of the bowling ball. When you reach your maximum height, the bowling ball is
A. above you.
B. beside you.
C. below you.

55. Suppose that you look out a tenth-floor window and see a ball falling at 5 m/s. How fast will this ball be falling 1 s later?
A. 5 m/s
B. 10 m/s
C. 15 m/s
D. 20 m/s

56. Suppose that you look out a tenth-floor window and see a ball falling at 5 m/s. How fast will this ball be falling 2 s later?
A. 5 m/s
B. 15 m/s
C. 25 m/s
D. 35 m/s

57. An object is dropped off a cliff. What is its instantaneous speed 3 s later?
A. 15 m/s
B. 30 m/s
C. 45 m/s
D. 60 m/s

58. If a ball is dropped from rest, it will fall 5 m during the first second. How far will it fall during the first 2 s?
A. 10 m
B. 15 m
C. 20 m
D. 25 m

59. If a ball is dropped from rest, it will fall 5 m during the first second. How far will it fall during the second second?
A. 5 m
B. 10 m
C. 15 m
D. 20 m

60. An object is dropped off a cliff. How far will the object fall during the next 4 s?
A. 20 m
B. 45 m
C. 80 m
D. 125 m

61. You decide to launch a ball vertically so that a friend located 45 m above you can catch it. What is the minimum launch speed you can use?
A. 4.5 m/s
B. 20 m/s
C. 30 m/s
D. 45 m/s

62. A ball is thrown vertically upward and you know that its speed is 20 m/s as it leaves the thrower's hand. What is the speed of the ball 1 s later?
A. 30 m/s
B. 20 m/s
C. 10 m/s
D. zero

63. A rock is thrown vertically upward with a speed of 15 m/s. What are its speed and direction 2 s later?
A. 10 m/s upward
B. 5 m/s upward
C. zero
D. 5 m/s downward

64. A golf ball is thrown vertically upward with a speed of 30 m/s. How long does it take to get to the top of its path?
A. 1 s
B. 2 s
C. 3 s
D. 4 s

65. You throw a ball straight up at 30 m/s. How many seconds elapse before it is traveling downward at 10 m/s?
A. 2 s
B. 3 s
C. 4 s
D. 5 s

66. If we use plus and minus signs to indicate the directions of velocity and acceleration, in which of the following situations does the object speed up?
A. positive velocity and negative acceleration
B. negative velocity and positive acceleration
C. positive velocity and zero acceleration
D. negative velocity and negative acceleration

67. A car traveling westward at 20 m/s turns around and travels eastward at 5 m/s. What is the change in velocity of the car?
A. 15 m/s west
B. 25 m/s
C. 25 m/s west
D. 25 m/s east

68. A car traveling westward at 20 m/s turns around and travels eastward at 15 m/s. If this takes place in 5 s, what is the average acceleration of the car?
A. 1 m/s^2 west
B. 7 m/s^2
C. 7 m/s^2 west
D. 7 m/s^2 east

69. A car initially traveling westward at 20 m/s has a constant acceleration of 1 m/s^2 westward. How far does the car travel in the first 10 s?
A. 200 m
B. 210 m
C. 250 m
D. 300 m

70. A car initially traveling westward at 20 m/s has a constant acceleration of 1 m/s^2 eastward. How far does the car travel in the first 10 s?
A. 150 m
B. 190 m
C. 200 m
D. 250 m

71. A small metal ball is given a quick shove and coasts up an inclined track. During this motion, the velocity vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

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73. A small metal ball is given a quick shove, coasts up an inclined track, and then turns around and rolls back down. The acceleration of the ball
A. is in the same direction on the way up and on the way down.
B. is in opposite directions on the way up and on the way down.
C. is zero during this entire motion.

74. A small metal ball is released from rest and rolls down an inclined track. During this motion, the velocity vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

75. A small metal ball is released from rest and rolls down an inclined track. During this motion, the acceleration vector of the ball
A. points up the incline
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77. A "paddle ball" toy consists of a small rubber ball attached by an elastic band to a wooden paddle. A child gives the ball a downward whack with the paddle such that the ball moves downward while stretching out the elastic band, turns around, and comes back up. During the downward segment of the motion, the acceleration of the ball is
A. upward
B. downward
C. zero

78. A "paddle ball" toy consists of a small rubber ball attached by an elastic band to a wooden paddle. A child gives the ball a downward whack with the paddle such that the ball moves downward while stretching out the elastic band, turns around, and comes back up. The acceleration and velocity of the ball are in the same direction
A. during the downward segment of the motion.
B. during the upward segment of the motion.
C. during both the downward and upward segments of the motion.
D. during neither the upward nor the downward segment of the motion.

79. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You see a red sportscar in the rear view mirror and realize that it is "gaining" on you. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
D. The sportscar is moving with a speed less than 60 mph.
E. More than one of these is correct.
F. None of these is correct.

80. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You see a blue sportscar in front of you and realize that you are "gaining" on it. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
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E. More than one of these is correct.
F. None of these is correct.

81. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You turn your head and see a pink sportscar passing you in the next lane. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
D. The sportscar is moving with a speed less than 60 mph.
E. The sportscar is moving at a speed of 60 mph.

82. While conducting a physics experiment, a student drops a bouncy ball from the window of her high rise dormitory. If the ball travels the first half of the distance in 1 second, how long will it take to travel the second half of the distance? (Ignore air resistance.)
A. less than 1 second
B. 1 second
C. more than 1 second

83. A compressed air potato gun, built as a project for a physics class, launches a potato directly upward at a speed of 20 m/s. Neglecting air resistance, how long will the potato be in the air?
A. 1 second
B. 2 seconds
C. 3 seconds
D. 4 seconds
E. more than 4 seconds

84. A compressed air potato gun, built as a project for a physics class, launches a potato directly upward with a speed of 20 m/s. What maximum height will the potato reach?
A. less than 10 meters
B. 10 meters
C. 20 meters
D. 40 meters
E. more than 40 meters

Chapter 2--Describing Motion Key

1. The average speed of an object is defined to be the
A. distance it travels divided by the time it takes.
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10. In Aesop's fable of the tortoise and the hare, the "faster" hare loses the race to the slow and steady tortoise. During the race, which animal has the greater average speed?
A. the tortoise
B. the hare
C. Both have the same average speed.
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11. Pat and Chris both travel from Los Angeles to New York along the same route. Pat rides a bicycle while Chris drives a fancy sports car. Unfortunately, Chris's car breaks down in Phoenix for over a week, causing the two to arrive in New York at exactly the same time. Which statement is true?
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12. In a cycling race, a rider covers the first 50 miles at a constant speed of 21 mph, and covers the second 50 miles at a constant speed of 19 mph. The average speed of the rider for the entire race is
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C. 6 miles.
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16. If a marathoner can run with an average speed of 10 mph, how far could she run in 2 hours?
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17. How many hours are required to make a 4400-km trip across the United States if you average 80 km/h?
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20. Which of the following could be a velocity?
A. 5 meters west
B. 5 meters per second
C. 5 meters per second west
D. 5 meters per second per second

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A. distance it travels divided by the time it takes.
B. change in its velocity divided by the time it takes.
C. change in its speed divided by the time it takes.
D. average of the accelerations during the two halves of the trip.

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B. only when its direction changes.
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B. the number of seconds required for the speed to increase by 1 mph
C. the number of mph that the speed increases in *S* seconds
D. the number of seconds required for the speed to increase by *W* mph
E. this number has no physical intepretation; it is essentially meaningless

24. An object moves along a straight-line path, steadily increasing its speed by a total of *V* miles per hour in *T* seconds. A student calculates the ratio *V/T*, obtaining the numerical value 1.8. This value, 1.8, can be interpreted as
A. the number of mph that the speed increases during each second
B. the number of seconds required for the speed to increase by 1 mph
C. the number of mph that the speed increases in *T* seconds
D. the number of seconds required for the speed to increase by *V* mph
E. this number has no physical intepretation; it is essentially meaningless

25. Which of the following could be considered to be an "accelerator" in an automobile?
A. brake pedal
B. gas pedal
C. steering wheel
D. All of these can cause the car to accelerate.

26. If a car changes speed from 60 mph to 66 mph in 1 minute, its average acceleration is
A. 60 mph/minute.
B. 63 mph/minute.
C. 66 mph/minute.
D. 6 mph/minute.

27. If a car changes speed from 40 mph to 48 mph in 2 minutes, its average acceleration is
A. 4 miles/hour.
B. 44 miles/hour/minute.
C. 8 miles/hour/minute.
D. 4 miles/hour/minute.

28. If a car requires 10 seconds to accelerate from zero to 60 mph, its average acceleration is
A. 600 mph/second.
B. 60 mph/second.
C. 10 mph/second.
D. 6 mph/second.

29. A Chevrolet Corvette can accelerate from 0 to 60 mph in 5.2 s. What is the car's average acceleration?
A. 0 mph/s
B. 11.5 mph/s
C. 9.8 mph/s
D. 312 mph/s

30. A pitcher requires about 0.1 second to throw a baseball. If the ball leaves his hand with a speed of 40 m/s, what is the ball's average acceleration?
A. 40 m/s^2
B. 400 m/s^2
C. 400 m/s
D. 400 m

31. A car is accelerating at 4 m/s^2. At some time it is traveling at 40 m/s. How fast will it be going 1 s later?
A. 36 m/s
B. 40 m/s
C. 44 m/s
D. 36 m/s or 44 m/s

32. A child traveling 5 m/s on a sled passes her younger brother. If her average acceleration on the sledding hill is 2 m/s^2, how fast is she traveling when she passes her older brother 4 s later?
A. 7 m/s
B. 8 m/s
C. 10 m/s
D. 13 m/s

33. In the strobe diagram below the ball is moving from left to right. Which statement best describes the motion? The ball is

A. moving with a constant speed.
B. speeding up.
C. slowing down.
D. not accelerating.

34. Which of the following strobe diagrams corresponds to the situation where a ball rolls from left to right and continually speeds up?

A. 
B. 
C. 
D. 

35. Which of the following strobe diagrams corresponds to the situation where a ball rolls from right to left and continually slows down?

A. 
B. 
C. 
D. 

36. Which of the following strobe diagrams does NOT correspond to a situation where the ball is accelerating?

A. 
B. 
C. 
D. 

37. Which statement best describes the motion of the ball shown in the strobe diagram below? (Assume the ball moves from left to right.) The ball is

A. moving with constant speed.
B. speeding up.
C. accelerating.
D. slowing down.

38. Which statement best describes the motion of the ball shown in the strobe diagram below? (Assume the ball moves from left to right.) The ball is

A. moving with constant speed.
B. speeding up.
C. accelerating.
D. stopped

39. When we say that light objects and heavy objects fall at the same rate, what assumption are we making?
A. They have the same shape.
B. They are falling in a vacuum.
C. They are made of the same material.
D. They have the same size.

40. A ping-pong ball and a golf ball have approximately the same size but very different masses. Which hits the ground first if you drop them simultaneously while standing on the Moon?
A. the ping-pong ball
B. the golf ball
C. They hit simultaneously.
D. We are not able to predict the results.

41. The Moon is a nice place to study free-fall because it has no atmosphere. If an astronaut on the Moon simultaneously drops a hammer and a feather from the same height, which one hits the ground first?
A. the hammer
B. the feather
C. They hit at the same time.
D. They don't fall.

42. We claimed that if the air resistance could be neglected, all objects on the Moon would fall at
A. the same constant speed.
B. an increasing acceleration.
C. the same constant acceleration.
D. a decreasing acceleration.

43. A sheet of paper and a book fell at different rates in the classroom until the paper was wadded up into a ball. We then claimed that if the air resistance could be neglected, all objects would fall at
A. different constant speeds depending on the type of material.
B. the same constant speed regardless of the type of material.
C. the same constant speed regardless of how much they weigh.
D. the same constant acceleration.

44. A student decides to test Aristotle's and Galileo's ideas about free-fall by simultaneously dropping a 20-lb. ball and a 1-lb. ball from the top of a grain elevator. The two balls have the same size and shape. What actually happens? (Do not neglect air resistance!).
A. The 20-lb. ball hits first.
B. The 1-lb. ball hits first.
C. They hit simultaneously.
D. We are not able to predict the results.

45. A ping-pong ball and a golf ball have approximately the same size but very different masses. Which hits the ground first if you drop them simultaneously from a tall building? Do not ignore the effects of the air.
A. the ping-pong ball
B. the golf ball
C. They hit simultaneously.
D. We are not able to predict the results.

46. If we do *not* neglect air resistance, during which, if any, of the first 5 s of free fall does a ball's speed change the most?
A. first second
B. third second
C. fifth second
D. The speed changes the same amount each second.

47. If we ignore air resistance, the acceleration of an object that is falling downward is constant. How do you suppose the acceleration would change if we do *not* ignore air resistance?
A. The acceleration increases.
B. The acceleration does not change.
C. The acceleration decreases.

48. A ball is thrown straight up into the air. If we do not ignore air resistance, the acceleration of the ball as it is traveling upward is
A. 9.8 m/s^2.
B. greater than 9.8 m/s^2.
C. less than 9.8 m/s^2.
D. zero.

49. A ball is dropped in air. If we do not ignore air resistance, the acceleration of the ball is
A. 9.8 m/s^2.
B. greater than 9.8 m/s^2.
C. less than 9.8 m/s^2.
D. zero.

50. If the mass of an object in free fall is doubled, its acceleration
A. doubles.
B. increases by a factor of four.
C. stays the same.
D. is cut in half.

51. The motion of a block sliding down a frictionless ramp can be described as motion with
A. a constant speed.
B. a constant acceleration greater than 10 m/s/s.
C. a constant acceleration less than 10 m/s/s.
D. a constant speed that depends on the steepness of the ramp.

52. The motion of a ball or cylinder rolling down a ramp is one with
A. constant speed.
B. increasing acceleration.
C. constant acceleration.
D. decreasing acceleration.

53. You are bouncing on a trampoline while holding a bowling ball. As your feet leave the trampoline, you let go of the bowling ball. You will rise ____ than you would have if you had held onto the bowling ball.
A. higher
B. to the same height
C. lower

54. You are bouncing on a trampoline while holding a bowling ball. As your feet leave the trampoline, you let go of the bowling ball. When you reach your maximum height, the bowling ball is
A. above you.
B. beside you.
C. below you.

55. Suppose that you look out a tenth-floor window and see a ball falling at 5 m/s. How fast will this ball be falling 1 s later?
A. 5 m/s
B. 10 m/s
C. 15 m/s
D. 20 m/s

56. Suppose that you look out a tenth-floor window and see a ball falling at 5 m/s. How fast will this ball be falling 2 s later?
A. 5 m/s
B. 15 m/s
C. 25 m/s
D. 35 m/s

57. An object is dropped off a cliff. What is its instantaneous speed 3 s later?
A. 15 m/s
B. 30 m/s
C. 45 m/s
D. 60 m/s

58. If a ball is dropped from rest, it will fall 5 m during the first second. How far will it fall during the first 2 s?
A. 10 m
B. 15 m
C. 20 m
D. 25 m

59. If a ball is dropped from rest, it will fall 5 m during the first second. How far will it fall during the second second?
A. 5 m
B. 10 m
C. 15 m
D. 20 m

60. An object is dropped off a cliff. How far will the object fall during the next 4 s?
A. 20 m
B. 45 m
C. 80 m
D. 125 m

61. You decide to launch a ball vertically so that a friend located 45 m above you can catch it. What is the minimum launch speed you can use?
A. 4.5 m/s
B. 20 m/s
C. 30 m/s
D. 45 m/s

62. A ball is thrown vertically upward and you know that its speed is 20 m/s as it leaves the thrower's hand. What is the speed of the ball 1 s later?
A. 30 m/s
B. 20 m/s
C. 10 m/s
D. zero

63. A rock is thrown vertically upward with a speed of 15 m/s. What are its speed and direction 2 s later?
A. 10 m/s upward
B. 5 m/s upward
C. zero
D. 5 m/s downward

64. A golf ball is thrown vertically upward with a speed of 30 m/s. How long does it take to get to the top of its path?
A. 1 s
B. 2 s
C. 3 s
D. 4 s

65. You throw a ball straight up at 30 m/s. How many seconds elapse before it is traveling downward at 10 m/s?
A. 2 s
B. 3 s
C. 4 s
D. 5 s

66. If we use plus and minus signs to indicate the directions of velocity and acceleration, in which of the following situations does the object speed up?
A. positive velocity and negative acceleration
B. negative velocity and positive acceleration
C. positive velocity and zero acceleration
D. negative velocity and negative acceleration

67. A car traveling westward at 20 m/s turns around and travels eastward at 5 m/s. What is the change in velocity of the car?
A. 15 m/s west
B. 25 m/s
C. 25 m/s west
D. 25 m/s east

68. A car traveling westward at 20 m/s turns around and travels eastward at 15 m/s. If this takes place in 5 s, what is the average acceleration of the car?
A. 1 m/s^2 west
B. 7 m/s^2
C. 7 m/s^2 west
D. 7 m/s^2 east

69. A car initially traveling westward at 20 m/s has a constant acceleration of 1 m/s^2 westward. How far does the car travel in the first 10 s?
A. 200 m
B. 210 m
C. 250 m
D. 300 m

70. A car initially traveling westward at 20 m/s has a constant acceleration of 1 m/s^2 eastward. How far does the car travel in the first 10 s?
A. 150 m
B. 190 m
C. 200 m
D. 250 m

71. A small metal ball is given a quick shove and coasts up an inclined track. During this motion, the velocity vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

72. A small metal ball is given a quick shove and coasts up an inclined track. During this motion, the acceleration vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

73. A small metal ball is given a quick shove, coasts up an inclined track, and then turns around and rolls back down. The acceleration of the ball
A. is in the same direction on the way up and on the way down.
B. is in opposite directions on the way up and on the way down.
C. is zero during this entire motion.

74. A small metal ball is released from rest and rolls down an inclined track. During this motion, the velocity vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

75. A small metal ball is released from rest and rolls down an inclined track. During this motion, the acceleration vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

76. A small metal ball is released from rest and rolls down an inclined track. During this motion, the acceleration vector of the ball
A. points up the incline
B. points down the incline
C. points vertically upward
D. points vertically downward

77. A "paddle ball" toy consists of a small rubber ball attached by an elastic band to a wooden paddle. A child gives the ball a downward whack with the paddle such that the ball moves downward while stretching out the elastic band, turns around, and comes back up. During the downward segment of the motion, the acceleration of the ball is
A. upward
B. downward
C. zero

78. A "paddle ball" toy consists of a small rubber ball attached by an elastic band to a wooden paddle. A child gives the ball a downward whack with the paddle such that the ball moves downward while stretching out the elastic band, turns around, and comes back up. The acceleration and velocity of the ball are in the same direction
A. during the downward segment of the motion.
B. during the upward segment of the motion.
C. during both the downward and upward segments of the motion.
D. during neither the upward nor the downward segment of the motion.

79. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You see a red sportscar in the rear view mirror and realize that it is "gaining" on you. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
D. The sportscar is moving with a speed less than 60 mph.
E. More than one of these is correct.
F. None of these is correct.

80. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You see a blue sportscar in front of you and realize that you are "gaining" on it. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
D. The sportscar is moving with a speed less than 60 mph.
E. More than one of these is correct.
F. None of these is correct.

81. You are driving on the freeway and note that your speedometer reads a constant 60 mph. You turn your head and see a pink sportscar passing you in the next lane. Which of the following conclusions can definitely be made?
A. The sportscar is moving with increasing speed.
B. The sportscar is moving with a speed greater than 60 mph.
C. The sportscar is moving with decreasing speed.
D. The sportscar is moving with a speed less than 60 mph.
E. The sportscar is moving at a speed of 60 mph.

82. While conducting a physics experiment, a student drops a bouncy ball from the window of her high rise dormitory. If the ball travels the first half of the distance in 1 second, how long will it take to travel the second half of the distance? (Ignore air resistance.)
A. less than 1 second
B. 1 second
C. more than 1 second

83. A compressed air potato gun, built as a project for a physics class, launches a potato directly upward at a speed of 20 m/s. Neglecting air resistance, how long will the potato be in the air?
A. 1 second
B. 2 seconds
C. 3 seconds
D. 4 seconds
E. more than 4 seconds

84. A compressed air potato gun, built as a project for a physics class, launches a potato directly upward with a speed of 20 m/s. What maximum height will the potato reach?
A. less than 10 meters
B. 10 meters
C. 20 meters
D. 40 meters
E. more than 40 meters