5) A stone is thrown straight up. What is its acceleration on the way up?
   Answer: 9.8 m/s^2 downward
   Diff: 1   Page Ref: Sec. 2-7

6) A stone is thrown straight up. What is its acceleration on the way down?
   Answer: 9.8 m/s^2 downward
   Diff: 1   Page Ref: Sec. 2-7

7) A stone is thrown straight up. What is its acceleration at the highest point?
   Answer: 9.8 m/s^2 downward
   Diff: 1   Page Ref: Sec. 2-7

10) When the velocity and acceleration of an object have opposite signs, the speed of the object increases.
    Answer: True   False
    Diff: 1   Page Ref: Sec. 2-4

18) You drive 6.00 km at 50.0 km/h and then another 6.00 km at 90.0 km/h. Your average speed over the 12.0 km drive will be
    A) greater than 70.0 km/h.
    B) equal to 70.0 km/h.
    C) less than 70.0 km/h.
    D) exactly 38.0 km/h.
    E) cannot be determined from the information given, must also know directions traveled
    Answer: C
    Diff: 1   Page Ref: Sec. 2-2

20) The slope of a tangent line at a given time value on a position versus time graph gives
    A) displacement.
    B) instantaneous velocity.
    C) average velocity.
    D) instantaneous acceleration.
    E) average acceleration
    Answer: B
    Diff: 1   Page Ref: Sec. 2-3

21) When is the average velocity of an object equal to the instantaneous velocity?
    A) always
    B) never
    C) only when the velocity is constant
    D) only when the velocity is increasing at a constant rate
    E) only when the velocity is decreasing at a constant rate
    Answer: C
    Diff: 2   Page Ref: Sec. 2-3

24) The slope of a line connecting two points on a velocity versus time graph gives
    A) displacement.
25) The slope of a tangent line at a given time value on a velocity versus time graph gives
   A) displacement.
   B) instantaneous velocity.
   C) average velocity.
   D) instantaneous acceleration.
   E) average acceleration.
Answer: D
Diff: 1 Page Ref: Sec. 2-4

27) During the time that the acceleration of a particle is constant, its velocity-vs.-time curve is
   A) a straight line.
   B) a parabola opening downward.
   C) a parabola opening upward.
   D) a parabola opening toward the left.
   E) a parabola opening toward the right.
Answer: A
Diff: 1 Page Ref: Sec. 2-4

29) Suppose that a car traveling to the East (+x direction) begins to slow down as it approaches a traffic light. Make a statement concerning its acceleration.
   A) The car is decelerating, and its acceleration is positive.
   B) The car is decelerating, and its acceleration is negative.
   C) The acceleration is zero.
   D) A statement cannot be made using the information given.
Answer: B
Diff: 1 Page Ref: Sec. 2-4
30) When is the average acceleration of an object equal to the instantaneous acceleration?
   A) always
   B) never
   C) only when the acceleration is constant
   D) only when the acceleration is increasing at a constant rate
   E) only when the acceleration is decreasing at a constant rate
   Answer: C

32) An object is moving with constant non-zero velocity in the +x axis. The position versus time graph of this object is
   A) a horizontal straight line.
   B) a vertical straight line.
   C) a straight line making an angle with the time axis.
   D) a parabolic curve.
   E) a hyperbolic curve.
   Answer: C

35) An object is moving with constant non-zero acceleration in the +x axis. The velocity versus time graph of this object is
   A) a horizontal straight line.
   B) a vertical straight line.
   C) a straight line making an angle with the time axis.
   D) a parabolic curve.
   E) a hyperbolic curve.
   Answer: C

36) If the position versus time graph of an object is a horizontal line, the object is
   A) moving with constant non-zero speed.
   B) moving with constant non-zero acceleration.
   C) at rest.
   D) moving with infinite speed.
   E) none of the above
   Answer: C

37) If the position versus time graph of an object is a vertical line, the object is
   A) moving with constant non-zero speed.
   B) moving with constant non-zero acceleration.
   C) at rest.
   D) moving with infinite speed.
   E) none of the above
   Answer: D

38) If the velocity versus time graph of an object is a horizontal line, the object is
   A) moving with constant non-zero speed.
   B) moving with constant non-zero acceleration.
C) at rest.
D) moving with infinite speed.
E) none of the above
Answer: A
Diff: 1 Page Ref: Sec. 2-5

42) A car traveling with velocity $v$ is decelerated by a constant acceleration of magnitude $a$. It travels a distance $d$ before coming to rest. If its initial velocity were doubled, the distance required to stop would
   A) double as well.
   B) decrease by a factor of two.
   C) stay the same.
   D) quadruple.
   E) decrease by a factor of four.
Answer: D
Diff: 2 Page Ref: Sec. 2-5 & 2-6

44) A car traveling with velocity $v$ is decelerated by a constant acceleration of magnitude $a$. It takes a time $t$ to come to rest. If its initial velocity were doubled, the time required to stop would
   A) double as well.
   B) decrease by a factor of two.
   C) stay the same.
   D) quadruple.
   E) decrease by a factor of four.
Answer: A
Diff: 2 Page Ref: Sec. 2-5 & 2-6

45) A car traveling with velocity $v$ is decelerated by a constant acceleration of magnitude $a$. It takes a time $t$ to come to rest. If both its initial velocity and magnitude of acceleration were doubled, the time required to stop would
   A) double as well.
   B) decrease by a factor of two.
   C) stay the same.
   D) quadruple.
   E) decrease by a factor of four.
Answer: C
Diff: 2 Page Ref: Sec. 2-5 & 2-6

46) A stone is thrown straight up. When it reaches its highest point,
   A) both its velocity and its acceleration are zero.
   B) its velocity is zero and its acceleration is not zero.
   C) its velocity is not zero and its acceleration is zero.
   D) neither its velocity nor its acceleration is zero.
Answer: B
Diff: 1 Page Ref: Sec. 2-7

48) A ball is thrown straight up, reaches a maximum height, then falls to its initial height. Make a statement about the direction of the velocity and acceleration as the ball is coming down.
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A) Both its velocity and its acceleration point upward.  
B) Its velocity points upward and its acceleration points downward.  
C) Its velocity points downward and its acceleration points upward.  
D) Both its velocity and its acceleration point downward.  

Answer: D  
Diff: 1  Page Ref: Sec. 2-7

49) Two athletes jump straight up. John has twice the initial speed of Harry. Compared to Harry, John stays in the air

A) 0.50 times as long.  
B) 1.41 times as long.  
C) twice as long.  
D) three times as long.  
E) four times as long.  

Answer: C  
Diff: 1  Page Ref: Sec. 2-7

51) Two objects are dropped from a bridge, an interval of 1.0 s apart. During the time that both objects continue to fall, their separation

A) increases.  
B) decreases.  
C) stays constant.  
D) increases at first, but then stays constant.  
E) decreases at first, but then stays constant.  

Answer: A  
Diff: 1  Page Ref: Sec. 2-7

52) From the edge of a roof top you toss a green ball upwards with initial velocity \( v_0 \) and a blue ball downwards with the same initial velocity. When they reach the ground below,

A) the green ball will be moving faster than the blue ball.  
B) the blue ball will be moving faster than the green ball.  
C) the two balls will have the same speed.  

Answer: C  
Diff: 1  Page Ref: Sec. 2-7

53) You drop a stone from a bridge to the river below. After this stone has traveled a distance \( d \), you drop a second stone. The distance between the two stones will always

A) increases.  
B) decreases.  
C) stays constant.  
D) increases at first, but then stays constant.  
E) decreases at first, but then stays constant.  

Answer: A  
Diff: 2  Page Ref: Sec. 2-7
2) Figure 2-2 represents the position of a particle as it travels along the x-axis. What is the average speed of the particle between \( t = 2 \) s and \( t = 4 \) s?
   
   Answer: 1 m/s  
   Diff: 1  Page Ref: Sec. 2-2

3) Figure 2-2 represents the position of a particle as it travels along the x-axis. What is the average velocity of the particle between \( t = 0 \) s and \( t = 3 \) s?
   
   Answer: 2 m/s  
   Diff: 1  Page Ref: Sec. 2-2

4) Figure 2-2 represents the position of a particle as it travels along the x-axis. What is the average velocity of the particle between \( t = 2 \) s and \( t = 4 \) s?
   
   Answer: 0 m/s  
   Diff: 1  Page Ref: Sec. 2-2

8) The position of a particle as a function of time is given by \( x(t) = (3.5 \text{ m/s})t - (5.0 \text{ m/s}^2)t^2 \). What is the average velocity of the particle between \( t = 0.30 \) s and \( t = 0.40 \) s?
   
   Answer: 0 m/s  
   Diff: 2  Page Ref: Sec. 2-2

9) Figure 2-3 represents the position of a particle as it travels along the x-axis. What is the magnitude of the instantaneous velocity of the particle when \( t = 1 \) s?
10) A certain car can accelerate from 0 to 100 km/hr in 6.0 seconds. What is the average acceleration of that car in m/s^2?
Answer: 4.6 m/s^2
Diff: 1 Page Ref: Sec. 2-4

12) Figure 2-4 represents the velocity of a particle as it travels along the x-axis. In what direction is the acceleration at t = 0.5 s?
Answer: in the negative x direction
Diff: 1 Page Ref: Sec. 2-4

13) Figure 2-4 represents the velocity of a particle as it travels along the x-axis. In what direction is the acceleration at t = 3.0 s?
Answer: in the positive x direction
Diff: 1 Page Ref: Sec. 2-4

14) Figure 2-4 represents the velocity of a particle as it travels along the x-axis. What is the average acceleration of the particle between t = 2 s and t = 4 s?
Answer: 1.5 m/s^2
Diff: 1 Page Ref: Sec. 2-4

15) Figure 2-4 represents the velocity of a particle as it travels along the x-axis. At what value of t is the instantaneous acceleration equal to zero m/s^2?
Answer: At t = 1 s
Diff: 1 Page Ref: Sec. 2-4
16) Figure 2-5 shows the velocity-versus-time graph for a basketball player traveling up and down the court in a straight-line path. Find the displacement of the player for each of the segments A, B, C and D.

Answer: A, 4 m; B, 6 m; C, 8 m; D, 0 m

Diff: 1 Page Ref: Sec. 2-4

17) A water rocket can reach a speed of 75 m/s in 0.050 seconds from launch. What is its average acceleration?

Answer: 1500 m/s²

Diff: 2 Page Ref: Sec. 2-4

Multiple Choice
19) Refer to Figure 2-6. If you start from the Bakery, travel to the Cafe, and then to the Art Gallery, what is the magnitude of your displacement?
   A) 6.5 km  
   B) 2.5 km  
   C) 10.5 km  
   D) 9.0 km  
   E) 1.5 km  
   Answer: B  
   Diff: 1  
   Page Ref: Sec. 2-1

21) Refer to Figure 2-6. If you start from the Bakery, travel to the Art Gallery, and then to the Cafe, in 1.0 hour, what is your average speed?
   A) 6.5 km/hr  
   B) 2.5 km/hr  
   C) 9.0 km/hr  
   D) 10.5 km/hr  
   E) 1.5 km/hr  
   Answer: C  
   Diff: 1  
   Page Ref: Sec. 2-2

24) A car is making a 12-mile trip. It travels the first 8.0 miles at 30 miles per hour and the last 4.0 miles at 60 miles per hour. What is the car’s average speed for the entire trip?
   A) 36 mph  
   B) 40 mph  
   C) 44 mph  
   D) 48 mph  
   E) 52 mph  
   Answer: A  
   Diff: 1  
   Page Ref: Sec. 2-2

25) Figure 2-7 represents the position of a particle as it travels along the x-axis. What is the magnitude of the average velocity of the particle between t = 1 s and t = 4 s?
   A) 0.25 m/s  
   B) 0.50 m/s  
   Diff: 1  
   Page Ref: Sec. 2-2
26) Figure 2-7 represents the position of a particle as it travels along the x-axis. What is the average speed of the particle between t = 1 s and t = 4 s?
   A) 1.0 m/s
   B) 1.3 m/s
   C) 0.67 m/s
   D) 0.50 m/s
   E) 0.25 m/s
   Answer: B
   Diff: 2       Page Ref: Sec. 2-2

28) The position of a particle as a function of time is given by x(t) = (3.1 m/s)t - (4.2 m/s²)t². What is the average velocity of the particle between t = 1.0 s and t = 2.0 s?
   A) -11.7 m/s
   B) 11.7 m/s
   C) -9.5 m/s
   D) 9.5 m/s
   E) 0 m/s
   Answer: C
   Diff: 2       Page Ref: Sec. 2-2
31) Figure 2-9 represents the velocity of a particle as it travels along the x-axis. What is the average acceleration of the particle between $t = 1$ second and $t = 4$ seconds?

A) 0.33 m/s$^2$
B) 1.7 m/s$^2$
C) 2.0 m/s$^2$
D) 2.5 m/s$^2$
E) 3.0 m/s$^2$

Answer: B

Diff: 1 Page Ref: Sec. 2-4

32) Figure 2-10 shows the velocity-versus-time graph for a basketball player traveling up and down the court in a straight-line path. Find the net displacement of the player for the 10 s shown on the graph.

A) 20 m
B) 18 m
C) 16 m
D) 14 m
E) 12 m

Answer: B

Diff: 2 Page Ref: Sec. 2-4
33) Figure 2-10 shows the velocity-versus-time graph for a basketball player traveling up and down the court in a straight-line path. Find the total distance run by the player in the 10 s shown in the graph.
   A) 20 m
   B) 18 m
   C) 16 m
   D) 14 m
   E) 12 m
   Answer: A
   Diff: 2 Page Ref: Sec. 2-4

34) The velocity of a particle as a function of time is given by $v(t) = (2.3 \text{ m/s}) + (4.1 \text{ m/s}^2)t - (6.2 \text{ m/s}^3)t^2$. What is the average acceleration of the particle between $t = 1.0 \text{ s}$ and $t = 2.0 \text{ s}$?
   A) -13 m/s$^2$
   B) -15 m/s$^2$
   C) 13 m/s$^2$
   D) 15 m/s$^2$
   E) 0 m/s$^2$
   Answer: B
   Diff: 2 Page Ref: Sec.
37) A car is moving with a constant acceleration. At \( t = 5.0 \) s its velocity is 8.0 m/s and at \( t = 8.0 \) s its velocity is 12.0 m/s. What is the distance traveled in that interval of time?
   A) 10 m  
   B) 20 m  
   C) 30 m  
   D) 40 m  
   E) 50 m  
   Answer: C  
   Diff: 2  
   Page Ref: Sec. 2.5 & 2.6

38) An airplane starts from rest and accelerates at 10.8 m/s\(^2\). What is its speed at the end of a 400 m-long runway?
   A) 37.0 m/s  
   B) 93.0 m/s  
   C) 65.7 m/s  
   D) 4320 m/s  
   E) 186 m/s  
   Answer: B  
   Diff: 2  
   Page Ref: Sec. 2.5 & 2.6

39) A car is moving with a speed of 32.0 m/s. The driver sees an accident ahead and slams on the brakes, giving the car a deceleration of 3.50 m/s\(^2\). How far does the car travel after the driver put on the brakes before it comes to a stop?
   A) 4.57 m  
   B) 9.14 m  
   C) 112 m  
   D) 146 m  
   E) 292 m  
   Answer: D  
   Diff: 2  
   Page Ref: Sec. 2.5 & 2.6

40) A car is traveling with a constant speed when the driver suddenly applies the brakes, giving the car a deceleration of 3.50 m/s\(^2\). If the car comes to a stop in a distance of 30.0 m, what was the car's original speed?
   A) 10.2 m/s  
   B) 14.5 m/s  
   C) 105 m/s  
   D) 210 m/s  
   E) 315 m/s  
   Answer: B  
   Diff: 2  
   Page Ref: Sec. 2.5 & 2.6

41) A car is traveling at 30.0 m/s when the driver suddenly applies the brakes, giving the car a constant deceleration. The car comes to a stop in a distance of 120.0 m. What was the deceleration of the car?
   A) 3.75 m/s\(^2\)  
   B)
4.00 m/s²

C) 4.25 m/s²
D) 4.50 m/s²
E) 4.75 m/s²
Answer: A
Diff: 2 Page Ref: Sec. 2-5 & 2-6

42) Assuming that it takes 0.10 s for the driver to react before applying the brakes, what is the stopping distance (the distance from the point where the driver first sees the need to stop to the point where the car comes to a stop) for a car traveling at 25 m/s if the deceleration due to the brakes is 3.5 m/s²?
   A) 92 m
   B) 87 m
   C) 186 m
   D) 174 m
   E) 46 m
Answer: A
Diff: 2 Page Ref: Sec. 2-5 & 2-6

43) Assuming that it takes 0.20 s for the driver to react before applying the brakes, what is the stopping distance (the distance from the point where the driver first sees the need to stop to the point where the car comes to a stop) for a car traveling at 35 m/s if the deceleration due to the brakes is 3.5 m/s²?
   A) 93 m
   B) 87 m
   C) 182 m
   D) 175 m
   E) 61 m
Answer: C
Diff: 2 Page Ref: Sec. 2-5 & 2-6

44) A car is traveling with a constant speed when the driver suddenly applies the brakes, giving the car a deceleration of 3.50 m/s². The car comes to a stop in a distance of 34.0 m. What was the car’s speed when it had traveled 17.0 m from the point where the brakes were applied?
   A) 10.9 m/s
   B) 14.5 m/s
   C) 10.7 m/s
   D) 21.0 m/s
   E) 15.3 m/s
Answer: A
Diff: 3 Page Ref: Sec. 2-5 & 2-6

46) A car is traveling at 26.0 m/s when the driver suddenly applies the brakes, giving the car a constant deceleration. The car comes to a stop in a distance of 120.0 m. How fast was the car moving when it was 30.0 m past the point where the brakes were applied?
   A) 7.50 m/s
   B) 15.0 m/s
C) 23.5 m/s  
D) 22.5 m/s  
E) 28.0 m/s  
Answer: D

48) In a relay race, runner A is carrying the baton and has a speed of 2.80 m/s. When he is 25.0 m behind the starting line, runner B starts from rest and accelerates at 0.0800 m/s². How long afterwards will A catch up with B to pass the baton to B?  
A) 5.17 s  
B) 10.5 s  
C) 11.9 s  
D) 20.4 s  
E) A never catches up.  
Answer: B

50) A car is traveling at 25 m/s when it runs off the road and hits a utility pole. The car stops instantly, but the driver continues to move forward at 25 m/s. The airbag starts from rest with a constant acceleration from a distance of 50 cm away from the driver and makes contact with him in 9 ms. What is the acceleration of the airbag?  
A) 68 m/s²  
B) 680 m/s²  
C) 6800 m/s²  
D) 68000 m/s²  
E) 370000 m/s²  
Answer: C

51) An object is thrown upwards with a speed of 14 m/s. How high above the projection point does it reach?  
A) 5.0 m  
B) 10 m  
C) 15 m  
D) 20 m  
E) 25 m  
Answer: B
53) An object is thrown upwards with a speed of 14 m/s. How high above the projection point is it after 0.50 s?
   A) 0 m  
   B) 2.9 m  
   C) 5.8 m  
   D) 7.0 m  
   E) 8.2 m  
   Answer: C  
   Diff: 1     Page Ref: Sec. 2-7

57) To determine the height of a bridge above the water, a person drops a stone and measures the time it takes for it to hit the water. If the height of the bridge is 41 m, how long will it take for the stone to hit the water?
   A) 2.3 s  
   B) 2.6 s  
   C) 2.9 s  
   D) 3.2 s  
   E) 3.6 s  
   Answer: C  
   Diff: 2     Page Ref: Sec. 2-7

60) An object is thrown upwards with a speed of 16 m/s. How long does it take it to reach a height of 7.0 m on the way up?
   A) 0.52 s  
   B) 1.2 s  
   C) 2.4 s  
   D) 3.1 s  
   E) 4.2 s  
   Answer: A  
   Diff: 3     Page Ref: Sec. 2-7
62) To determine the height of a flagpole, Abby throws a ball straight up and times it. She sees that the ball goes by the top of the pole after 0.5 s and then reaches the top of the pole again after a total elapsed time of 4.1 s. How high is the pole above the point where the ball was launched?
   A) 10 m  
   B) 13 m  
   C) 16 m  
   D) 18 m  
   E) 26 m  
Answer: A  
Diff: 3  
Page Ref: Sec. 2-7

63) Abby throws a ball straight up and times it. She sees that the ball goes by the top of a flagpole after 0.500 s and reaches the level of the top of the pole after a total elapsed time of 4.10 s. What was the speed of the ball at launch?
   A) 11.3 m/s  
   B) 22.6 m/s  
   C) 33.9 m/s  
   D) 45.2 m/s  
   E) 48.3 m/s  
Answer: B  
Diff: 3  
Page Ref: Sec. 2-7

64) Abby throws a ball straight up and times it. She sees that the ball goes by the top of a flagpole after 0.50 s and reaches the level of the top of the pole after a total elapsed time of 4.10 s. What was the speed of the ball at as it passed the top of the flagpole?
   A) 6.40 m/s  
   B) 16.2 m/s  
   C) 17.6 m/s  
   D) 29.0 m/s  
   E) 33 m/s  
Answer: C  
Diff: 3  
Page Ref: Sec. 2-7