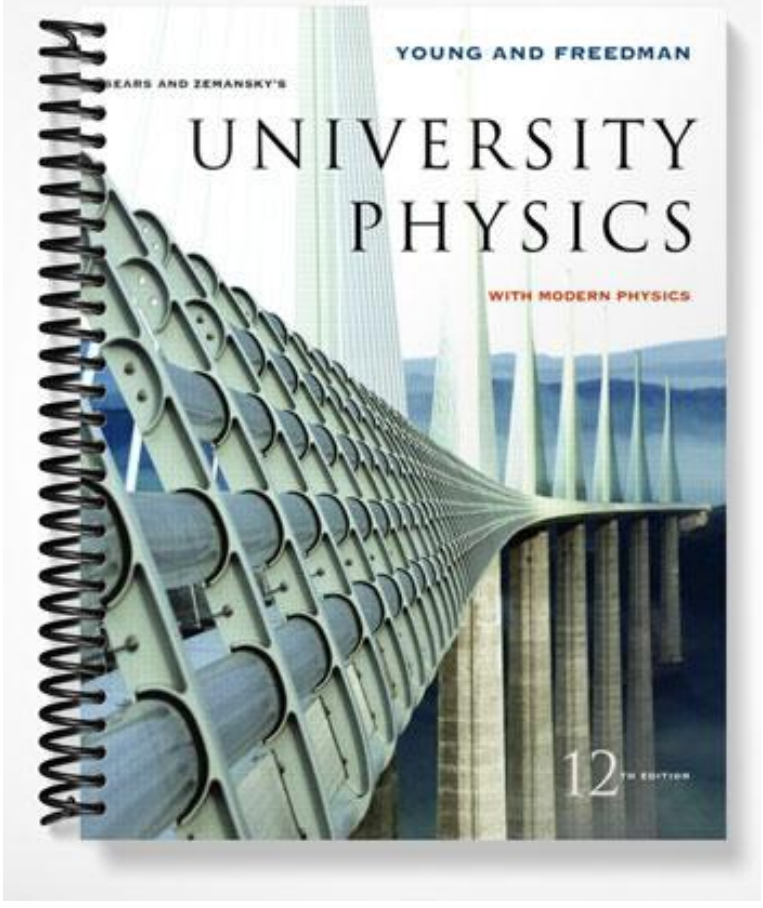
TEST BANK


YOUNG AND FREEDMAN
SEARS AND ZEMANSKY'S
UNIVERSITY PHYSICS
WITH MODERN PHYSICS
12TH EDITION

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) A train starts from rest and accelerates uniformly, until it has traveled 5.9 km and acquired a velocity of $35\ \text{m/s}$. The train then moves at a constant velocity of $35\ \text{m/s}$ for 400 s. The train then decelerates uniformly at $0.065\ \text{m/s}^2$, until it is brought to a halt. The acceleration during the first 5.9 km of travel is closest to: 1) _____

A) $0.093\ \text{m/s}^2$
B) $0.10\ \text{m/s}^2$
C) $0.11\ \text{m/s}^2$
D) $0.12\ \text{m/s}^2$
E) $0.13\ \text{m/s}^2$

Answer: B

2) A train starts from rest and accelerates uniformly, until it has traveled 5.4 km and acquired a velocity of $31\ \text{m/s}$. The train then moves at a constant velocity of $31\ \text{m/s}$ for 400 s. The train then decelerates uniformly at $0.065\ \text{m/s}^2$, until it is brought to a halt. The distance traveled by the train during deceleration, in km, is closest to: 2) _____

A) 7.0 B) 7.4 C) 6.0 D) 6.3 E) 6.7

Answer: B

3) A train starts from rest and accelerates uniformly, until it has traveled 6.1 km and acquired a velocity of $41\ \text{m/s}$. The train then moves at a constant velocity of $41\ \text{m/s}$ for 420 s. The train then decelerates uniformly at $0.065\ \text{m/s}^2$, until it is brought to a halt. The velocity of the train, when it has decelerated for 260 s, is closest to: 3) _____

A) 24.1 m/s
B) 21.7 m/s
C) 22.9 m/s
D) 19.3 m/s
E) 20.5 m/s

Answer: A

4) A car moving at a velocity of 20 m/s is behind a truck moving at a constant velocity of $18\ \text{m/s}$. When the car is 50 m behind the front of the truck, the car accelerates uniformly at $1.8\ \text{m/s}^2$. The car continues at the same acceleration until it reaches a velocity of $25\ \text{m/s}$, which is the legal speed limit. The car then continues at a constant velocity of $25\ \text{m/s}$, until it passes the front of the truck. The distance the car travels while accelerating, in meters, is closest to: 4) _____

A) 50 B) 62 C) 54 D) 66 E) 58

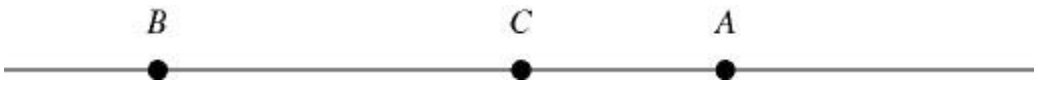
Answer: B

Situation 2.1

A cat runs along a straight line (the x-axis) from point A to point B to point C, as shown in Fig. 2.1. The distance between points A and C is 5.00 m, the distance between points B and C is 10.0 m,

and the positive direction of the x-axis points to the right. The time to run from A to B is 20.0 s, and the time from B to C is 8.00 s.

Figure 2.1



5) In Situation 2.1, the x-component of the average velocity of the cat between points A and C is closest to: 5) _____
A) -0.179 m/s
B) 0.179 m/s
C) 0.893 m/s
D) -0.893 m/s
E) -0.536 m/s
Answer: A

6) In Situation 2.1, the average speed of the cat between points A and C is closest to: 6) _____
A) 0.893 m/s
B) -0.893 m/s
C) 0.179 m/s
D) 0.536 m/s
E) -0.179 m/s
Answer: A

7) A motorist makes a trip of 180 miles. For the first 90 miles she drives at a constant speed of 30 mph. At what constant speed must she drive the remaining distance if her average speed for the total trip is to be 40 mph? 7) _____
A) 50 mph
B) 45 mph
C) 52.5 mph
D) 55 mph
E) 60 mph
Answer: E

8) A racquetball strikes a wall with a speed of 30 m/s and rebounds with a speed of $26\ \text{m/s}$. The collision takes $20\ \text{ms}$. What is the average acceleration of the ball during collision? 8) _____
A) zero
B) $1300\ \text{m/s}^2$
C) $200\ \text{m/s}^2$
D) $2800\ \text{m/s}^2$
E) $1500\ \text{m/s}^2$
Answer: D

9) Which of the following situations is impossible? 9) _____
A) An object has constant nonzero velocity and changing acceleration.
B) An object has velocity directed east and acceleration directed east.
C) An object has velocity directed east and acceleration directed west.

D) An object has constant nonzero acceleration and changing velocity.
E) An object has zero velocity but nonzero acceleration.
Answer: A

10) A ball is projected upward at time t = 0.0 s, from a point on a roof 80 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 56.7 m/s. Consider all quantities as positive in the upward direction. At time $t = 2.9$ s, the acceleration of the ball is closest to: 10) _____
A) zero
B) +5 m/s^2
C) +10 m/s^2
D) -10 m/s^2
E) -5 m/s^2
Answer: D

11) A ball is projected upward at time t = 0.0 s, from a point on a roof 60 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 48.2 m/s. Consider all quantities as positive in the upward direction. At time $t = 4.92$ s, the velocity of the ball is closest to: 11) _____
A) zero
B) -119 m/s
C) +119 m/s
D) +12 m/s
E) -12 m/s
Answer: A

12) A ball is projected upward at time t = 0.0 s, from a point on a roof 60 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 73.3 m/s. Consider all quantities as positive in the upward direction. The average velocity of the ball, during the first 4.12 s, is closest to: 12) _____
A) zero
B) +106 m/s
C) +53 m/s
D) -53 m/s
E) -106 m/s
Answer: C

13) A ball is projected upward at time t = 0.0 s, from a point on a roof 90 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 82.4 m/s. Consider all quantities as positive in the upward direction. The velocity of the ball when it is 73 m above the ground is closest to: 13) _____
A) -101 m/s
B) -84 m/s
C) -34 m/s
D) -68 m/s
E) -51 m/s

Answer: B

14) A ball is projected upward at time $t = 0.0$ s, from a point on a roof 70 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 31.9 m/s. Consider all quantities as positive in the upward direction. The time when the ball strikes the ground is closest to: 14) _____

A) 8.8 s B) 8.2 s C) 7.7 s D) 8.0 s E) 8.5 s

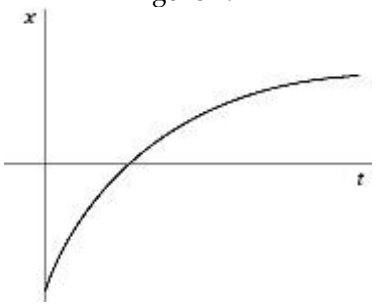
Answer: B

15) A motorist traveling at a constant speed of 130 km/h in a 50-km/h speed zone passes a parked police car. Three seconds after the car passes, the police car starts off in pursuit. The policeman accelerates at 2 m/s^2 up to a speed of 50 m/s, and then continues at this speed until he overtakes the speeding motorist. How long from the time he started does it take the police car to overtake the motorist? The motorist continues at a constant speed during this process. 15) _____

A) 28 s B) 53 s C) 25 s D) 120 s E) 38 s

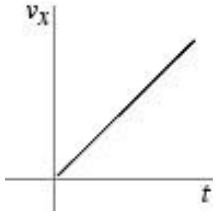
Answer: B

Figure 2.2

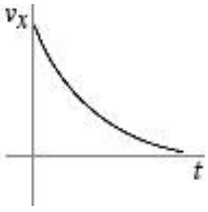


16) Figure 2.2 shows the graph of the position x as a function of time for an object moving in the straight line (the x-axis). Which of the following graphs best describes the x-component of the velocity as a function of time for this object? 16) _____

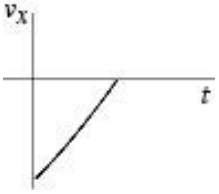
A)



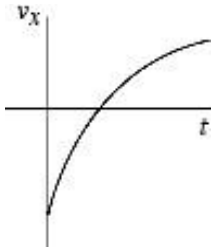
B)



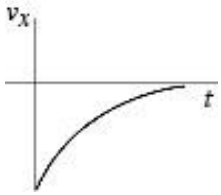
C)



D)



E)



Answer: B

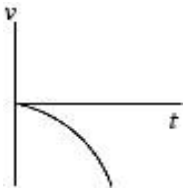
17) A test rocket is fired straight up from rest with a net acceleration of 20 m/s^2. After 4 seconds the motor turns off, but the rocket continues to coast upward. What maximum elevation does the rocket reach? 17) _____

A) 408 m
B) 487 m
C) 327 m
D) 320 m
E) 160 m

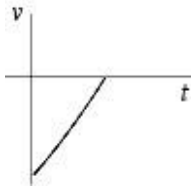
Answer: B

18) A child standing on a bridge throws a rock straight down. The rock leaves the child's hand at $t = 0$. Which of the graphs shown here best represents the velocity of the stone as a function of time? 18) _____

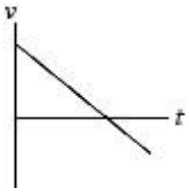
A)



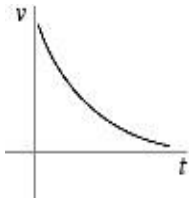
B)



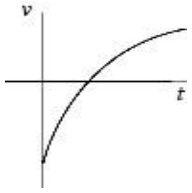
C)



D)



E)



Answer: E

19) Two identical balls are thrown vertically with the same initial speed from the roof of a building and feel no air resistance. Ball A is thrown straight up and ball B is thrown straight down. Which of the following statements about these balls are correct? (There may be more than one correct answer.) 19) _____

A) Between the instant at which each ball is thrown and the instant at which it hits the ground, both balls have the same average speed.
B) Ball B has a greater velocity just before it hits the ground than ball A.
C) Between the instant at which each ball is thrown and the instant at which it hits the ground, both balls have the same average velocity.
D) Both balls have the same velocity just before they hit the ground.
E) Between the instant at which each ball is thrown and the instant at which it hits the ground, both balls experience the same displacement.

Answer: D, E

20) A toy rocket is launched vertically from ground level (y = 0 m), at time t = 0.0 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 82 m and acquired a velocity of $90\ \text{m/s}$. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground. The time interval, during which the rocket engine provides upward acceleration, is closest to: 20) _____

A) 1.8 s B) 2.0 s C) 1.3 s D) 1.6 s E) 1.5 s

Answer: A

21) A toy rocket is launched vertically from ground level (y = 0 m), at time t = 0.0 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 64 m and acquired a velocity of $90\ \text{m/s}$. The rocket continues to rise in unpowered flight, reaches maximum height, and

unpowered flight, reaches maximum height, and

falls back to the ground. The upward acceleration of the rocket during the burn phase is closest to:

21) ___
___

A) $59\ m/s^2$
B) $63\ m/s^2$
C) $56\ m/s^2$
D) $58\ m/s^2$
E) $61\ m/s^2$

Answer: B

22) A toy rocket is launched vertically from ground level (y = 0 m), at time t = 0.0 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 74 m and acquired a velocity of $30\ m/s$. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground. The maximum height reached by the rocket is closest to:

22) _____

A) 120 m
B) 132 m
C) 108 m
D) 126 m
E) 114 m

Answer: A

23) A toy rocket is launched vertically from ground level (y = 0 m), at time t = 0.0 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 68 m and acquired a velocity of $90\ m/s$. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground. The time interval, during which the rocket is in unpowered flight, is closest to:

23) _____

A) 19 s B) 14 s C) 18 s D) 16 s E) 15 s

Answer: A

24) A toy rocket is launched vertically from ground level (y = 0 m), at time t = 0.0 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 74 m and acquired a velocity of $50\ m/s$. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground. The speed of the rocket upon impact on the ground is closest to:

24) _____

A) 52 m/s

B) 77 m/s
C) 70 m/s
D) 58 m/s
E) 63 m/s
Answer: E

Situation 2.2

A rock is projected upward from the surface of the moon, at time t = 0.0 s, with a velocity of 30 m/s. The acceleration due to gravity at the surface of the moon is $1.62\ m/s^2$.

25) In Situation 2.2, the time when the rock is ascending at a height of 180 m is closest to: 25) _____
A) 23 s B) 12 s C) 8 s D) 30 s E) 17 s
Answer: C

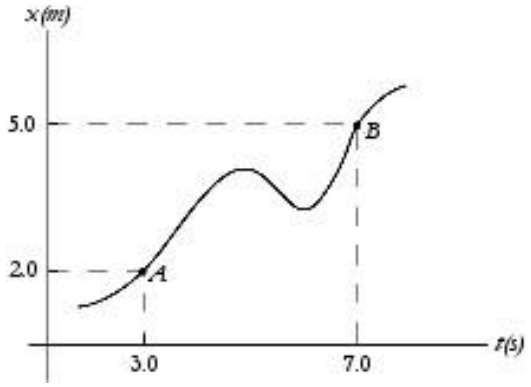
26) In Situation 2.2, the height of the rock when it is descending with a velocity of 20 m/s is closest to: 26) _____
A) 125 m
B) 145 m
C) 135 m
D) 115 m
E) 155 m
Answer: E

27) In Situation 2.2, the average velocity of the rock during the first 22.0 s of flight is closest to: 27) _____
A) 14 m/s
B) 16 m/s
C) 12 m/s
D) 18 m/s
E) 10 m/s
Answer: C

28) On the earth, when an astronaut throws a 0.250-kg stone vertically upward, it returns to his hand 8.00 s later. On planet X he finds that, under the same circumstances, the stone returns to his hand in 16.0 s. In both cases, he throws the stone with the same initial velocity and it feels negligible air resistance. The acceleration due to gravity on planet X (in terms of g) is closest to: 28) _____
A) $g\sqrt{2}$ B) g/4 C) $g/\sqrt{2}$ D) 2g E) g/2
Answer: E

29) Two identical stones are dropped from rest and feel no air resistance as they fall. Stone A is dropped from height h, and stone B is dropped from height $2h$. If stone A takes time t to reach the ground, stone B will take time: 29) _____
A) $t/\sqrt{2}$ B) $t\sqrt{2}$ C) $2t$ D) $4t$ E) $t/2$
Answer: B

Figure 2.3



30) An object is moving in a straight line (the x-axis). The graph in Fig. 2.3 shows the x-coordinate of this object as a function of time. Which one of the following statements about this object is correct? 30) _____

A) Between points A and B, the x-component of its average velocity is 0.75 m/s, but its average speed is greater than 0.75 m/s.
B) Between points A and B, both the x-component of its average velocity and its average speed are greater than 0.75 m/s.
C) Between points A and B, both the x-component of its average velocity and its average speed are less than 0.75 m/s.
D) Between points A and B, the x-component of its average velocity is 0.75 m/s, but its average speed is less than 0.75 m/s.
E) Between points A and B, both the x-component of its average velocity and its average speed are equal to 0.75 m/s.

Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

31) A soccer ball is released from rest at the top of a grassy incline. After 6.3 seconds, the ball travels 51 meters. One second later, the ball reaches the bottom of the incline. 31) _____
a) What was the ball's acceleration? (Assume that the acceleration was constant.)
b) How long was the incline?
Answer: a) $2.6\ \text{m/s}^2$
b) 68 m

32) A rock is thrown directly upward from the edge of the roof of a building that is 37.5 meters tall. The rock misses the building on its way down, and is observed to strike the ground 4.00 seconds after being thrown. Take the acceleration due to gravity to have magnitude $9.80\ \text{m/s}^2$ and neglect any effects of air resistance. With what speed was the rock thrown? 32) _____
Answer: 10.2 m/s

33) The position of an object as a function of time is given by $x(t) = at^3 - bt^2 + ct - d$, where $a = 3.6\ \text{m/s}^3$, $b = 5.0\ \text{m/s}^2$, $c = 6.0\ \text{m/s}$ and $d = 7.0\ \text{m}$. 33) _____
(a) Find the instantaneous acceleration at $t =$ 2.4 s.
(b) Find the average acceleration over the first 2.4 seconds.
Answer:

(a) 42 m/s^2 (b) 16 m/s^2

34) The acceleration of a rocket ship obeys the equation $a(t) = (8.6\ \text{m/s}^3)t + 1.0\ \text{m/s}^2$. Find the speed of the ship at $t = 5.2$ s if it is at rest at $t = 0$. 34) _____
Answer: 120 m/s

35) A rocket takes off vertically from the launchpad with no initial velocity but a constant upward acceleration of 2.25 m/s^2. At 15.4 s after blastoff, the engines fail completely so the only force on the rocket from then on is the pull of gravity. 35) _____
(a) What is the maximum height the rocket will reach above the launchpad?
(b) How fast is the rocket moving at the instant before it crashes onto the launchpad?
(c) How longer after engine failure does it take for the rocket to crash onto the launchpad?
Answer: (a) 328 m
(b) 80.2 m/s
(c) 11.7 s

36) Two runners start from opposite ends of a 200.0-m track and at the same instant begin running toward each other. Runner A runs with constant velocity, while runner B starts from rest but has a constant acceleration of 0.150 m/s^2. How fast must runner A run so that they will meet at the midpoint of the track? 36) _____
Answer: 2.74 m/s

1) B
2) B
3) A
4) B
5) A
6) A
7) E
8) D
9) A
10) D
11) A
12) C
13) B
14) B
15) B
16) B
17) B
18) E
19) D, E
20) A
21) B
22) A
23) A
24) E
25) C
26) E
27) C
28) E
29) B
30) A
31) a) 2.6 m/s^2
    b) 68 m
32) 10.2 m/s
33) (a) 42 m/s^2
    (b) 16 m/s^2
34) 120 m/s
35) (a) 328 m
    (b) 80.2 m/s
    (c) 11.7 s
36) 2.74 m/s