Fundamentals of Physics 11th edition Halliday Test Bank

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Chapter: Chapter 2

Learning Objectives
LO 2.1.0 Solve problems related to position, displacement, and average velocity to solve problems.
LO 2.1.1 Identify that if all parts of an object move in the same direction and at the same rate, we can treat the object as if it were a (point-like) particle. (This chapter is about the motion of such objects.)
LO 2.1.2 Identify that the position of a particle is its location as read on a scaled axis, such as an *x* axis.
LO 2.1.3 Apply the relationship between a particle's displacement and its initial and final positions.
LO 2.1.4 Apply the relationship between a particle's average velocity, its displacement, and the time interval for that displacement.
LO 2.1.5 Apply the relationship between a particle's average speed, the total distance it moves, and the time interval for the motion.
LO 2.1.6 Given a graph of a particle's position versus time, determine the average velocity between any two particular times.
LO 2.2.0 Solve problems related to instantaneous velocity and speed
LO 2.2.1 Given a particle's position as a function of time, calculate the instantaneous velocity for any particular time.
LO 2.2.2 Given a graph of a particle's position versus time, determine the instantaneous velocity for any particular time.
LO 2.2.3 Identify speed as the magnitude of the instantaneous velocity.
LO 2.3.0 Solve problems related to acceleration.
LO 2.3.1 Apply the relationship between a particle's average acceleration, its change in velocity, and the time interval for that change.
LO 2.3.2 Given a particle's velocity as a function of time, calculate the instantaneous acceleration for any particular time.
LO 2.3.3 Given a graph of a particle's velocity versus time, determine the instantaneous acceleration for any particular time and the average acceleration between any two particular times.
LO 2.4.0 Solve problems related to constant acceleration.
LO 2.4.1 For constant acceleration, apply the relationships between position, displacement, velocity, acceleration, and elapsed time (Table 2.1)
LO 2.4.2 Calculate a particle's change in velocity by integrating its acceleration function with respect to time.
LO 2.4.3 Calculate a particle's change in position by integrating its velocity function with respect to time.
LO 2.5.0 Solve problems related to free-fall acceleration.
LO 2.5.1 Identify that if a particle is in free flight (whether upward or downward) and if we can neglect the effects of air on its motion, the particle has a constant downward acceleration with a magnitude *g* that we take to be 9.8 m/s^2.
LO 2.5.2 Apply the constant-acceleration equations (Table 2.1) to free-fall motion.
LO 2.6.0 Solve problems related to graphical integration in motion analysis.
LO 2.6.1 Determine a particle's change in velocity by graphical integration on a graph of

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acceleration versus time.
LO 2.6.2 Determine a particle's change in position by graphical integration on a graph of velocity versus time.

Multiple Choice

1. When can you treat a moving object as if it were a point-like particle?
A) Only if it really is a point-like particle.
B) You can always treat a moving object as if it were a point-like particle.
C) Only if the object is moving with constant acceleration.
D) Only if all parts of the object are moving in the same direction and at the same rate.
E) This question has no physical meaning.

Ans: D
Difficulty: Easy
Section 2-1
Learning Objective 2.1.1

2. A particle moves along the x axis from x_i to x_f. Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?
A) $x_i = 4\text{m}, x_f = 6\text{m}$
B) $x_i = -4\text{m}, x_f = -8\text{m}$
C) $x_i = -4\text{m}, x_f = 2\text{m}$
D) $x_i = 4\text{m}, x_f = -2\text{m}$
E) $x_i = -4\text{m}, x_f = 4\text{m}$

Ans: E
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.3

3. A particle moves along the x axis from x_i to x_f. Of the following values of the initial and final coordinates, which results in a negative displacement?
A) $x_i = 4\text{m}, x_f = 6\text{m}$
B) $x_i = -4\text{m}, x_f = -8\text{m}$
C) $x_i = -4\text{m}, x_f = 2\text{m}$
D) $x_i = -4\text{m}, x_f = -2\text{m}$
E) $x_i = -4\text{m}, x_f = 4\text{m}$

Ans: B
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.3

4. A particle moves from point x_1 to point x_2. Its displacement is given by:
A) $x_2 - x_1$

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B) $x_1 - x_2$
C) $x_1 + x_2$
D) x_1
E) x_2

Ans: A.
Difficulty: Easy
Section 2-1
Learning objective 2.1.3

5. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The magnitude of the average velocity of the car for this round trip is:
A) 0 km/hr
B) 50 km/hr
C) 100 km/hr
D) 200 km/hr
E) cannot be calculated without knowing the acceleration

Ans: A
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.4

6. The coordinate of an object is given as a function of time by $x = 7t - 3t^2$, where x is in meters and t is in seconds. Its average velocity over the interval from $t = 0$ to $t = 2$ s is:
A) 5 m/s
B) –5 m/s
C) 11 m/s
D) –11 m/s
E) 1 m/s

Ans: E
Difficulty: Medium
Section: 2-1
Learning Objective 2.1.4

7. The position y of a particle moving along the y axis depends on the time t according to the equation $y = at - bt^2$. The dimensions of the quantities a and b are respectively:
A) L^2/T, L^3/T^2
B) L/T^2, L^2/T
C) L/T, L/T^2
D) L^3/T, T^2/L
E) none of these

Ans: C

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Difficulty: Easy
Section: 2-1
Learning Objective 2.1.5

8. The average speed of a moving object during a given interval of time is always:
A) the magnitude of its average velocity over the interval
B) the distance covered during the time interval divided by the time interval
C) one-half its speed at the end of the interval
D) its acceleration multiplied by the time interval
E) one-half its acceleration multiplied by the time interval.

Ans: B
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.5

9. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h. In how many hours will they meet?
A) 2.5 h
B) 2.0 h
C) 1.75 h
D) 1.5 h
E) 1.25 h

Ans: D
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.5

10. A car travels 40 kilometers at an average speed of 80 km/h and then travels 40 kilometers at an average speed of 40 km/h. The average speed of the car for this 80 km trip is:
A) 40 km/h
B) 45 km/h
C) 53 km/h
D) 60 km/h
E) 80 km/h

Ans: D
Difficulty: Medium
Section: 2-1
Learning Objective 2.1.5

11. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The average speed of the car for this round trip is:
A) 0 km/h

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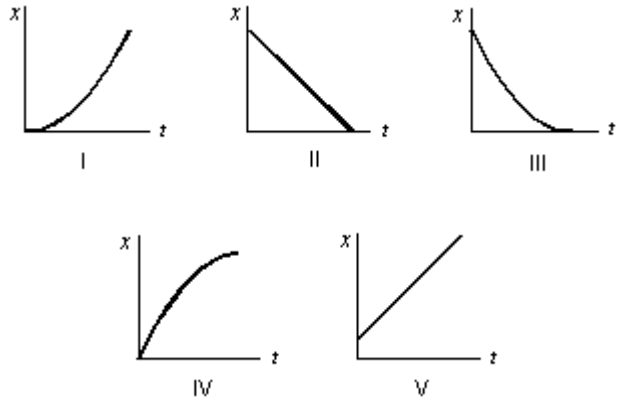
B) 25 km/h
C) 50 km/h
D) 100 km/h
E) cannot be calculated without knowing the acceleration

Ans: B
Difficulty: Easy
Section: 2-1
Learning Objective 2.1.5

12. You leave your house and drive to your friend's house, where you stay a while. Then you come back home. Which of the following must be true of your trip?
A) Your instantaneous velocity was never zero.
B) Your average velocity was zero.
C) Your acceleration was constant.
D) Your net displacement was not zero.
E) Your average speed was zero.

Ans: B
Difficulty: Easy
Section 2-1
Learning objective 2.1.5

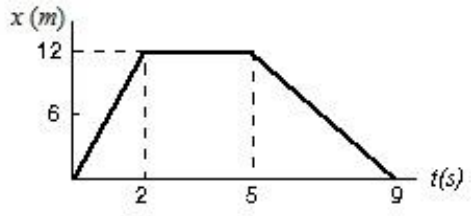
13. Which of the following five coordinate versus time graphs represents the motion of an object whose speed is increasing?



A) I
B) II
C) III
D) IV
E) V

Ans: A
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.0

14. This graph shows the position of a particle as a function of time. What is its average velocity between t = 5s and t = 9s?



A) 3 m/s
B) -3 m/s
C) 12 m/s
D) -12 m/s
E) Need additional information.

Ans: B
Difficulty: Easy
Section 2-1
Learning objective 2.1.6

15. The coordinate of a particle in meters is given by $x(t) = 16t - 3.0t^3$, where the time t is in seconds. The particle is momentarily at rest at t =
A) 0.75 s
B) 1.3 s
C) 1.8 s
D) 5.3 s
E) 7.3 s

Ans: B
Difficulty: Medium
Section: 2-2
Learning Objective 2.2.1

16. Each of four particles moves along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by
particle 1: $x(t) = 3.5 - 2.7t^3$
particle 2: $x(t) = 3.5 + 2.7t^3$

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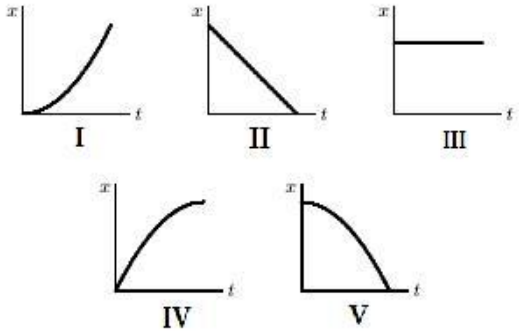
particle 3: $x(t) = 3.5 + 2.7t^2$
particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$
For which of these particles is the velocity increasing for $t > 0$?
A) All four
B) Only 1
C) Only 2 and 3
D) Only 2, 3, and 4
E) None of them

Ans: C
Difficulty: Medium
Section: 2-2
Learning Objective 2.2.1

17. The coordinate of an object is given as a function of time by $x = 7t - 3t^2$, where x is in meters and t is in seconds. Its velocity at $t = 3$s is:
A) -6 m/s
B) -11 m/s
C) -21 m/s
D) 9 m/s
E) 18 m/s

Ans: B
Difficulty: Easy
Section 2-2
Learning objective 2.2.1

18. Which of the following five coordinate versus time graphs represents the motion of an object moving with a constant nonzero speed?

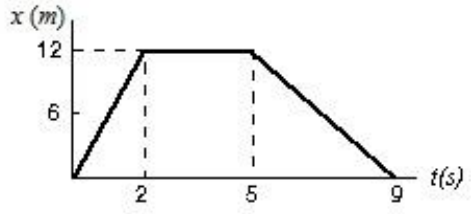


A) I
B) II
C) III
D) IV
E) V

Ans: B

Difficulty: Easy
Section: 2-2
Learning Objective 2.2.2

19. This graph shows the position of a particle as a function of time. What is its instantaneous velocity at t = 7s?



A) 3 m/s
B) -3 m/s
C) 12 m/s
D) -12 m/s
E) Need additional information.

Ans: B
Difficulty: Easy
Section 2-2
Learning objective 2.2.2

20. The coordinate-time graph of an object is a straight line with a positive slope. The object has:
A) constant displacement
B) steadily increasing acceleration
C) steadily decreasing acceleration
D) constant velocity
E) steadily increasing velocity

Ans: D
Difficulty: Easy
Section: 2-2
Learning Objective 2.2.2

21. What is the relationship between instantaneous speed and instantaneous velocity?
A) They are identical.
B) Instantaneous speed is the rate at which the instantaneous velocity is changing.
C) Instantaneous speed is the magnitude of the instantaneous velocity.
D) They are unrelated.
E) Instantaneous speed is the initial speed minus the final speed.

Ans: C
Difficulty: Easy

Section 2-2
Learning objective 2.2.3

22. A ball rolls up a slope. At the end of three seconds its velocity is 20 cm/s; at the end of eight seconds its velocity is 0 cm/s. What is the magnitude of its average acceleration from the third to the eighth second?
A) 2.5 cm/s^2
B) 4.0 cm/s^2
C) 5.0 cm/s^2
D) 6.0 cm/s^2
E) 6.67 cm/s^2

Ans: B
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.1

23. Over a short interval near time $t = 0$ the coordinate of an automobile in meters is given by $x(t) = 27t - 4.0t^3$, where t is in seconds. At the end of 1.0 s the acceleration of the auto is:
A) 23 m/s^2
B) 15 m/s^2
C) –4.0 m/s^2
D) –12 m/s^2
E) –24 m/s^2

Ans: E
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.1

24. The coordinate of an object is given as a function of time by $x = 4t^2 - 3t^3$, where x is in meters and t is in seconds. Its average acceleration over the interval from $t = 0$ to $t = 2$ s is:
A) –8 m/s^2
B) 4 m/s^2
C) –10 m/s^2
D) 10 m/s^2
E) –13 m/s^2

Ans: C
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.1

25. Each of four particles moves along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by
particle 1: $x(t) = 3.5 - 2.7t^3$

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particle 2: $x(t) = 3.5 + 2.7t^3$
particle 3: $x(t) = 3.5 + 2.7t^2$
particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$
Which of these particles have constant acceleration?
A) All four
B) Only 1 and 2
C) Only 2 and 3
D) Only 3 and 4
E) None of them

Ans: D
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.1

26. Throughout a time interval, while the speed of a particle increases as it moves along the x axis, its velocity and acceleration could be:
A) positive and negative, respectively
B) negative and positive, respectively
C) negative and negative, respectively
D) negative and zero, respectively
E) positive and zero, respectively

Ans: C
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.1

27. A particle moves on the x axis. When its acceleration is positive and increasing:
A) its velocity must be positive
B) its velocity must be negative
C) it must be slowing down
D) it must be speeding up
E) none of the above must be true

Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.1

28. Of the following situations, which one is impossible?
A) A body having velocity east and acceleration east
B) A body having velocity east and acceleration west
C) A body having zero velocity and non-zero acceleration
D) A body having constant acceleration and variable velocity
E) A body having constant velocity and variable acceleration

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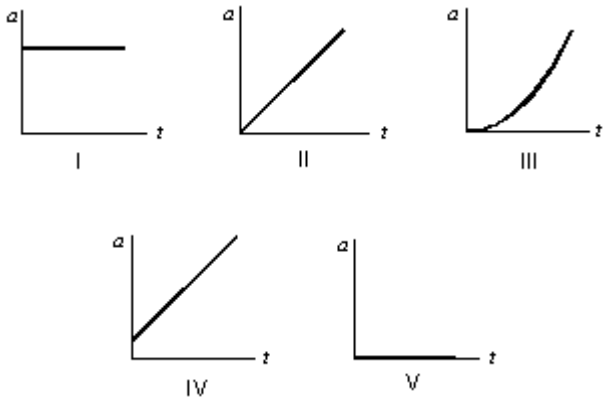
Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.1

29. Can an object have positive acceleration and decreasing speed?
A) No, this is not possible.
B) Yes, speed will always decrease if acceleration is positive.
C) Yes, this is possible if the initial velocity is zero.
D) Yes, this is possible if the initial velocity is negative.
E) Yes, this is possible but only if the object is moving in two dimensions.

Ans: D
Difficulty: Easy
Section 2-3
Learning objective 2.3.1

30. Which of the following five acceleration versus time graphs is correct for an object moving in a straight line at a constant velocity of 20 m/s?



A) I
B) II
C) III
D) IV
E) V

Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.0

31. All falling objects experience some air resistance, the effect of which is to decrease acceleration. When the falling object's acceleration reaches zero, the acceleration stops changing. Therefore, if you drop an object and it falls far enough for this to happen,
A) its speed continues to increase all the way down.

B) its speed reaches a maximum value and then decreases.
C) its speed reaches a maximum value and then doesn't change.
D) its speed reaches a maximum value, decreases, and then increases again.
E) Any of these things could happen.

Ans: C
Difficulty: Easy
Section 2-3
Learning objective 2.3.2

32. Is it possible for an object to have zero velocity and constant nonzero acceleration?
A) Yes, but only if it is not moving at all.
B) No, if its velocity is zero its acceleration must also be zero.
C) Yes, all objects with zero velocity have nonzero acceleration.
D) No, if its acceleration is not zero its velocity cannot be zero.
E) Yes, but its velocity must only be zero for an instant.

Ans: E
Difficulty: Easy
Section 2-3
Learning objective 2.3.2

33. Over a short interval, starting at time $t = 0$, the coordinate of an automobile in meters is given by $x(t) = 27t - 4.0t^3$, where t is in seconds. The magnitudes of the initial (at $t = 0$) velocity and acceleration of the auto respectively are:
A) 0 m/s; 12 m/s^2
B) 0 m/s; 24 m/s^2
C) 27 m/s; 0 m/s^2
D) 27 m/s; 12 m/s^2
E) 27 m/s; 24 m/s^2

Ans: C
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.2

34. Starting at time $t = 0$, an object moves along a straight line with velocity in m/s given by $v(t) = 98 - 2t^2$, where t is in seconds. When it momentarily stops its acceleration is:
A) 0 m/s^2
B) –4.0 m/s^2
C) –9.8 m/s^2
D) –28 m/s^2
E) 49 m/s^2

Ans: D
Difficulty: Medium

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Section: 2-3
Learning Objective 2.3.2

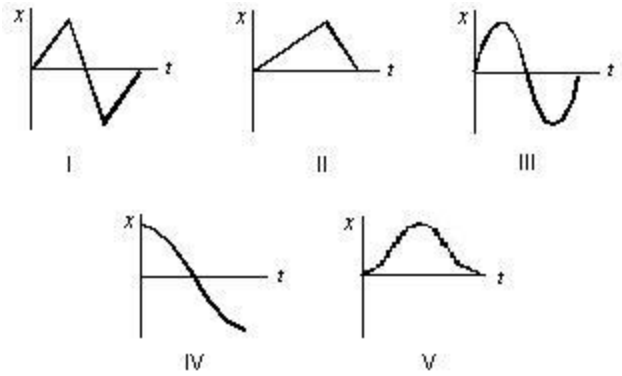
35. Starting at time $t = 0$, an object moves along a straight line. Its coordinate in meters is given by $x(t) = 75t - 1.0t^3$, where t is in seconds. When it momentarily stops its acceleration is:
A) 0 m/s^2
B) –73 m/s^2
C) –30 m/s^2
D) –9.8 m/s^2
E) 9.2 x 10^3 m/s^2

Ans: C
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.2

36. A particle moves along the x axis according to the equation $x = 6t^2$ where x is in meters and t is in seconds. Therefore:
A) the acceleration of the particle is 6 m/s^2
B) t cannot be negative
C) the particle follows a parabolic path
D) each second the velocity of the particle changes by 9.8 m/s
E) none of the above

Ans: E
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.2

37. A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following five coordinate versus time graphs best describes the motion?



A) I
B) II
C) III

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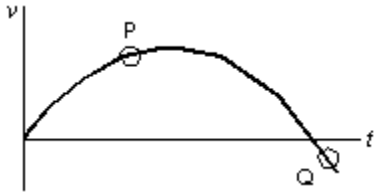
D) IV
E) V

Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.3

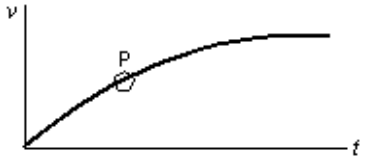
38. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be:



A) moving with zero acceleration
B) traveling downhill
C) traveling below ground-level
D) reducing speed
E) traveling in the reverse direction to that at point P

Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.3

39. The diagram shows a velocity-time graph for a car moving in a straight line. At point P the car must be:



A) moving with zero acceleration
B) climbing the hill
C) accelerating
D) stationary
E) moving at about 45° with respect to the x axis

Ans: C
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.3

40. The diagram represents the straight line motion of a car. Which of the following statements is true?

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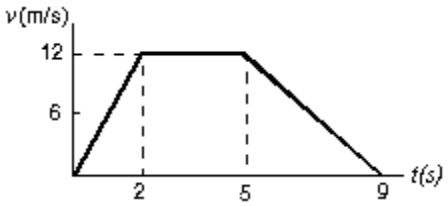
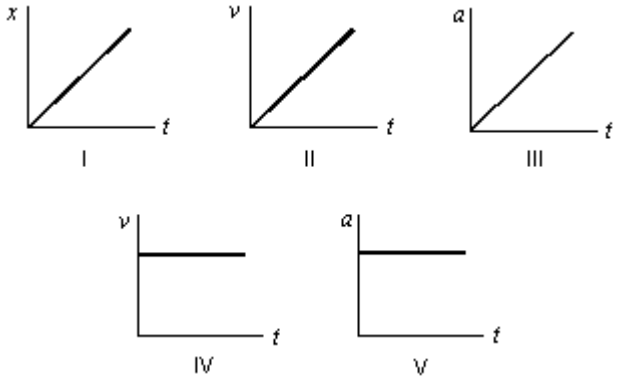


A) The car's speed increases, then it stops, and reverses
B) The car accelerates at 6 m/s^2 for the first 2 s
C) The car is moving for a total time of 12 s
D) The car accelerates at –12 m/s^2 for the last 4 s
E) The car returns to its starting point when t = 9 s

Ans: B
Difficulty: Medium
Section: 2-3
Learning Objective 2.3.3

41. Consider the following five graphs (note the axes carefully). Which of these represent(s) motion at constant speed?



A) IV only
B) IV and V only
C) I, II, and III only
D) I and II only
E) I and IV only

Ans: E
Difficulty: Easy
Section: 2-3
Learning Objective 2.3.3

42. A car, initially at rest, travels 20 m in 4 s along a straight line with constant acceleration. The acceleration of the car is:
A) 1.3 m/s^2
B) 2.5 m/s^2
C) 4.9 m/s^2

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D) 9.8 m/s^2
E) There is not enough information to answer this question.

Ans: B
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.1

43. A racing car traveling with constant acceleration increases its speed from 10 m/s to 30 m/s over a distance of 60 m? How long does this take?
A) 2.0 s
B) 3.0 s
C) 5.0 s
D) 6.0 s
E) The time cannot be calculated since the speed is not constant

Ans: B
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.1

44. A car starts from rest and goes down a slope with a constant acceleration of 5 m/s^2. After 5 seconds the car reaches the bottom of the hill. What is its speed at the bottom of the hill?
A) 1 m/s
B) 12.5 m/s
C) 25 m/s
D) 50 m/s
E) 160 m/s

Ans: C
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.1

45. A car moving with an initial velocity of 25 m/s north has a constant acceleration of 3 m/s^2 south. After 6 seconds its velocity will be:
A) 7 m/s north
B) 7 m/s south
C) 43 m/s north
D) 20 m/s north
E) 20 m/s south

Ans: A
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.1

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46. An object with an initial velocity of 12 m/s west experiences a constant acceleration of 4 m/s^2 west for 3 seconds. During this time the object travels a distance of:
A) 18 m
B) 24 m
C) 36 m
D) 54 m
E) 144 m

Ans: D
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.1

47. How far does a car travel in 6 s if its initial velocity is 2 m/s and its acceleration is 2 m/s^2 in the same direction as its initial velocity?
A) 12 m
B) 14 m
C) 24 m
D) 36 m
E) 48 m

Ans: E
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.1

48. At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at 3 m/s^2. How much time does the car take to catch up to the truck?
A) 5 s
B) 10 s
C) 15 s
D) 20 s
E) 25 s

Ans: B
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.1

49. An object starts from rest and has a constant acceleration of 3 m/s^2. The position versus time graph for this object has a slope:
A) that increases with time
B) that is constant
C) that decreases with time

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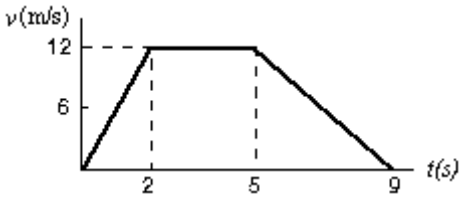
D) of 3 m/s
E) of 3 m/s^2

Ans: A
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.1

50. An object starts from rest at the origin and moves along the x axis with a constant acceleration of 4 m/s^2. Its average velocity as it goes from x = 2 m to x = 8 m is:
A) 1 m/s
B) 2 m/s
C) 3 m/s
D) 5 m/s
E) 6 m/s

Ans: E
Difficulty: Hard
Section: 2-4
Learning Objective 2.4.1

51. The graph represents the straight line motion of a car. How far does the car travel between t = 2 seconds and t = 5 seconds?



A) 4 m
B) 12 m
C) 24 m
D) 36 m
E) 60 m

Ans: D
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.1

52. The acceleration of an object, starting from rest, is shown in the graph below. Other than at t = 0, when is the velocity of the object equal to zero?

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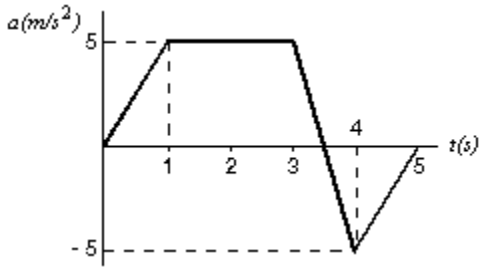

A) During the interval from 1.0 s to 3.0 s
B) At $t = 3.5$ s
C) At $t = 4.0$ s
D) At $t = 5.0$ s
E) At no other time less than or equal to 5 s.

Ans: E
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.2

53. At time $t = 0$ a car has a velocity of 16 m/s. It slows down with an acceleration given by $a = -0.50t$, in m/s^2 for t in seconds. By the time it stops it has traveled:
A) 15 m
B) 31 m
C) 62 m
D) 85 m
E) 100 m

Ans: D
Difficulty: Hard
Section: 2-4
Learning Objective 2.4.2

54. At time $t = 0$ a car has a velocity of 16 m/s. It slows down with an acceleration given by $a = -0.50t$, in m/s^2 for t in seconds. It stops at $t =$
A) 64 s
B) 32 s
C) 16 s
D) 8.0 s
E) 4.0 s

Ans: D
Difficulty: Hard
Section: 2-4
Learning Objective 2.4.2

55. At time $t = 0$ a car has a velocity of 16 m/s. It slows down with an acceleration given by $a = -0.50t$, in m/s^2 for t in seconds. At the end of 4.0 s it has traveled:

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A) 0
B) 12 m
C) 14 m
D) 25 m
E) 59 m

Ans: E
Difficulty: Hard
Section: 2-4
Learning Objective 2.4.2

56. The area under a velocity-time graph represents:
A) acceleration
B) change in acceleration
C) speed
D) change in velocity
E) displacement

Ans: E
Difficulty: Easy
Section: 2-4
Learning Objective 2.4.3

57. The velocity of an object is given as a function of time by $v = 4t - 3t^2$, where v is in m/s and t is in seconds. Its average velocity over the interval from $t = 0$ s to $t = 2$ s:
A) is 0
B) is –2 m/s
C) is 2 m/s
D) is –4 m/s
E) cannot be calculated unless the initial position is given

Ans: A
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.3

58. Displacement can be obtained from:
A) the slope of an acceleration-time graph
B) the slope of a velocity-time graph
C) the area under an acceleration-time graph
D) the area under a velocity-time graph
E) the slope of an acceleration-time graph

Ans: D
Difficulty: Easy
Section: 2-4

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Learning Objective 2.4.3

59. A drag racing car starts from rest at $t = 0$ and moves along a straight line with velocity given by $v = bt^2$, where b is a constant. The expression for the distance traveled by this car from its position at $t = 0$ is:
A) bt^3
B) $bt^3/3$
C) $4bt^2$
D) $3bt^2$
E) $bt^{3/2}$

Ans: B
Difficulty: Medium
Section: 2-4
Learning Objective 2.4.3

NOTE: For problems involving motion in free fall, use $g = 9.80$ m/s^2 unless otherwise specified.

60. A ball is in free fall motion. Upward is taken to be the positive direction. The displacement of the ball is:
A) positive during both ascent and descent
B) negative during both ascent and descent
C) negative during ascent and positive during descent
D) positive during ascent and negative during descent
E) none of the above

Ans: D
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

61. Which of the following is NOT true of an object in free fall in the absence of air resistance?
A) Its acceleration is constant.
B) If its initial velocity is upwards, it will reach a maximum height and then begin to fall.
C) If its initial velocity is zero, its position below its starting point can be calculated knowing only how long ago it began falling.
D) Its velocity will always be zero at some point along its path.
E) Its velocity changes by the same amount every second.

Ans: D
Difficulty: Easy
Section 2-5
Learning objective 2.5.1

62. An object is shot vertically upward. While it is rising:
A) its velocity and acceleration are both upward

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B) its velocity is upward and its acceleration is downward
C) its velocity and acceleration are both downward
D) its velocity is downward and its acceleration is upward
E) its velocity and acceleration are both decreasing

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

63. A baseball is thrown vertically into the air. The acceleration of the ball at its highest point is:
A) zero
B) g, down
C) g, up
D) $2g$. down
E) $2g$, up

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

64. A feather, initially at rest, is released in a vacuum 12 m above the surface of the Earth. Which of the following statements is correct?
A) The maximum velocity of the feather is 9.8 m/s
B) The acceleration of the feather decreases until terminal velocity is reached
C) The acceleration of the feather remains constant during the fall
D) The acceleration of the feather increases during the fall
E) The acceleration of the feather is zero

Ans: C
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

65. A ball is thrown upwards. Its acceleration is:
A) downward during both ascent and descent
B) downward during ascent and upward during descent
C) upward during ascent and downward during descent
D) upward during both ascent and descent
E) downward at all times except at the very top, when it is zero

Ans: A
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

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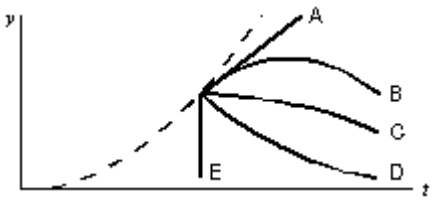
66. An elevator is moving upward with constant acceleration. The dashed curve shows the position *y* of the ceiling of the elevator as a function of the time *t*. At the instant indicated by the dot, a bolt breaks loose and drops from the ceiling. Which curve best represents the position of the bolt as a function of time?



A) A
B) B
C) C
D) D
E) E

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

67. If you drop a rock and a feather, the rock hits the ground first. This demonstrates that:
A) The acceleration of gravity is not constant.
B) Heavier objects are accelerated faster by gravity than lighter objects are.
C) Air resistance has a larger effect on feathers than on rocks.
D) Rocks can't fly.
E) Gravity has little effect on a feather.

Ans: C
Difficulty: Easy
Section 2-5
Learning objective 2.5.1

68. As a rocket is accelerating vertically upward at 9.8 m/s^2 near the Earth's surface, it releases a projectile. Immediately after release the acceleration of the projectile is:
A) 9.8 m/s^2 down
B) 0 m/s^2
C) 9.8 m/s^2 up
D) 19.6 m/s^2 up
E) none of the above

Ans: A
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.1

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69. Which one of the following statements is correct for an object in free fall released from rest?
A) The average velocity during the first second of time is 4.9 m/s
B) During each second the object falls 9.8 m
C) The acceleration changes by 9.8 m/s every second
D) The object falls 9.8 m during the first second of time
E) The acceleration of the object is proportional to its weight

Ans: A
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

70. A freely falling body has a constant acceleration of 9.8 m/s^2. This means that:
A) the body falls 9.8 m during each second
B) the body falls 9.8 m during the first second
C) the speed of the body increases by 9.8 m/s during each second
D) the acceleration of the body increases by 9.8 m/s^2 during each second
E) the acceleration of the body decreases by 9.8 m/s^2 during each second

Ans: C
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

71. An object is thrown straight up from ground level with a speed of 50 m/s. If g = 10 m/s^2 its distance above ground level 1.0 second later is:
A) 40 m
B) 45 m
C) 50 m
D) 55 m
E) 60 m

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

72. An object is thrown straight up from ground level with a speed of 50 m/s. If g = 10 m/s^2 its distance above ground level 6.0 s later is:
A) 0.00 m
B) 270 m
C) 330 m
D) 480 m
E) none of these

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Ans: E
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

73. At a location where $g = 9.80$ m/s^2, an object is thrown vertically down with an initial speed of 1.00 m/s. After 5.00 s the object will have traveled:
A) 125 m
B) 128 m
C) 245 m
D) 250 m
E) 255 m

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

74. An object is thrown vertically upward at 35 m/s. Taking $g = 10$ m/s^2, the velocity of the object 5 seconds later is:
A) 7.0 m/s up
B) 15 m/s down
C) 15 m/s up
D) 85 m/s down
E) 85 m/s up

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

75. An object is released from rest. How far does it fall during the second second of its fall?
A) 4.9 m
B) 9.8 m
C) 15 m
D) 20 m
E) 25 m

Ans: C
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

76. A heavy ball falls freely, starting from rest. Between the third and fourth second of its fall it travels a distance of:
A) 4.9 m.

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B) 9.8 m.
C) 29.4 m
D) 34.3 m.
E) 39.8 m.

Ans: D
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

77. A stone is released from a balloon that is descending at a constant speed of 10 m/s. Neglecting air resistance, after 20 s the speed of the stone is:
A) 2160 m/s
B) 1760 m/s
C) 206 m/s
D) 196 m/s
E) 186 m/s

Ans: C
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

78. An object dropped from a window of a tall building hits the ground in 12.0 s. If its acceleration is 9.80 m/s^2, the height of the window above the ground is (you may neglect air resistance):
A) 29.4 m
B) 58.8 m
C) 118 m
D) 353 m
E) 706 m

Ans: E
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

79. Neglecting the effect of air resistance, a stone dropped off a 175-m high building lands on the ground in:
A) 3 s
B) 4 s
C) 6 s
D) 18 s
E) 36 s

Ans: C

Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

80. A stone is thrown vertically upward with an initial speed of 19.5 m/s. It will rise to a maximum height of:
A) 4.9 m
B) 9.8 m
C) 19.4 m
D) 38.8 m
E) none of these

Ans: C
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

81. A baseball is hit straight up and is caught by the catcher 2.0 s later, at the same height at which it left the bat. The maximum height of the ball during this interval is:
A) 4.9 m
B) 7.4 m
C) 12.4 m
D) 19.6 m
E) 38.8 m

Ans: A
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

82. An object is thrown straight down with an initial speed of 4 m/s from a window which is 8 m above the ground. The time it takes the object to reach the ground is:
A) 0.80 s
B) 0.93 s
C) 1.3 s
D) 1.7 s
E) 2.0 s

Ans: B
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

83. A stone is released from rest from the edge of a building roof 190 m above the ground. Neglecting air resistance, the speed of the stone, just before striking the ground, is:
A) 43 m/s

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B) 61 m/s
C) 120 m/s
D) 190 m/s
E) 1400 m/s

Ans: B
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

84. An object is thrown vertically upward with a certain initial velocity in a world where the acceleration due to gravity is 19.6 m/s^2. The height to which it rises is ____ that to which the object would rise if thrown upward with the same initial velocity on the Earth. Neglect air resistance.
A) one fourth
B) half
C) twice
D) four times
E) cannot be calculated from the given data

Ans: B
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

85. A projectile is shot vertically upward with a given initial velocity. It reaches a maximum height of 100 m. If on a second shot the initial velocity is doubled, then the projectile will reach a maximum height of:
A) 70.7 m
B) 141.4 m
C) 200 m
D) 241 m
E) 400 m

Ans: E
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

86. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The maximum height reached by the first object will be _____ that of the other.
A) 10 times
B) 100 times
C) 1000 times
D) 10,000 times

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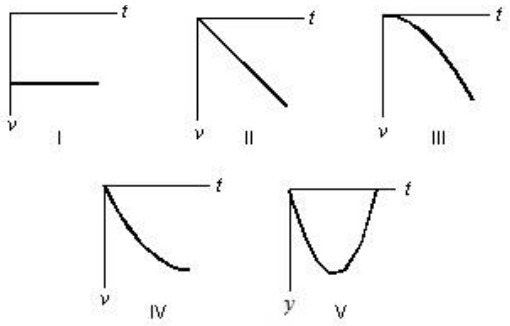
E) none of these

Ans: B
Difficulty: Medium
Section: 2-5
Learning Objective 2.5.2

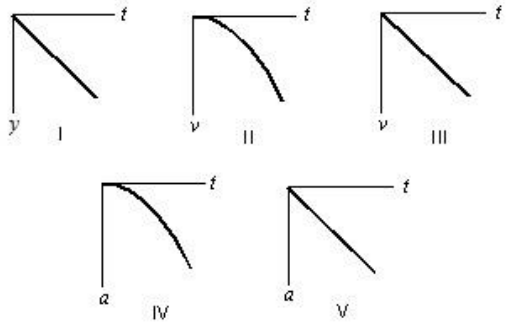
87. An object is dropped from rest. Which of the five following graphs correctly represents its motion? The positive direction is taken to be upward. Take careful note of the axes.



A) I
B) II
C) III
D) IV
E) V

Ans: B
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

88. A stone is dropped from a cliff. The graph (carefully note the axes) that best represents its motion while it falls is:

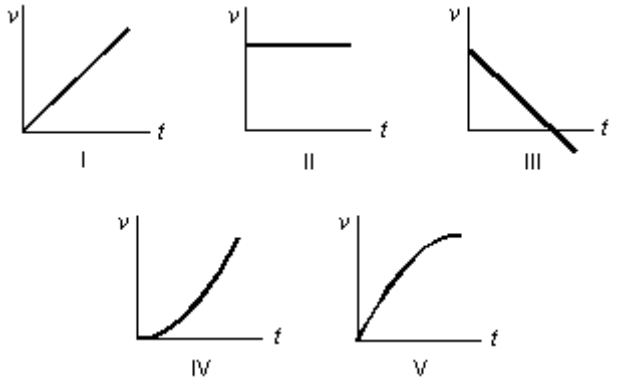


A) I
B) II
C) III
D) IV

E) V

Ans: C
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

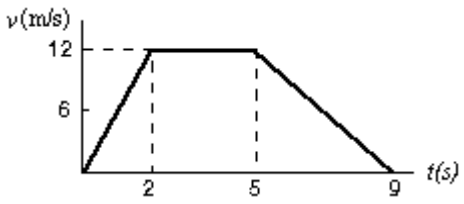
89. An object is thrown vertically into the air. Which of the following five graphs represents the velocity (v) of the object as a function of the time (t)? The positive direction is taken to be upward.



A) I
B) II
C) III
D) IV
E) V

Ans: C
Difficulty: Easy
Section: 2-5
Learning Objective 2.5.2

90. This graph shows the velocity of a particle as a function of time. During what interval is its displacement negative?



A) 0 – 2 s
B) 2s – 5 s
C) 5 s – 9 s
D) 0 – 9 s

E) Its displacement is not negative between 0 and 9 s.

Ans: E
Difficulty: Easy
Section 2-6
Learning objective 2.6.2