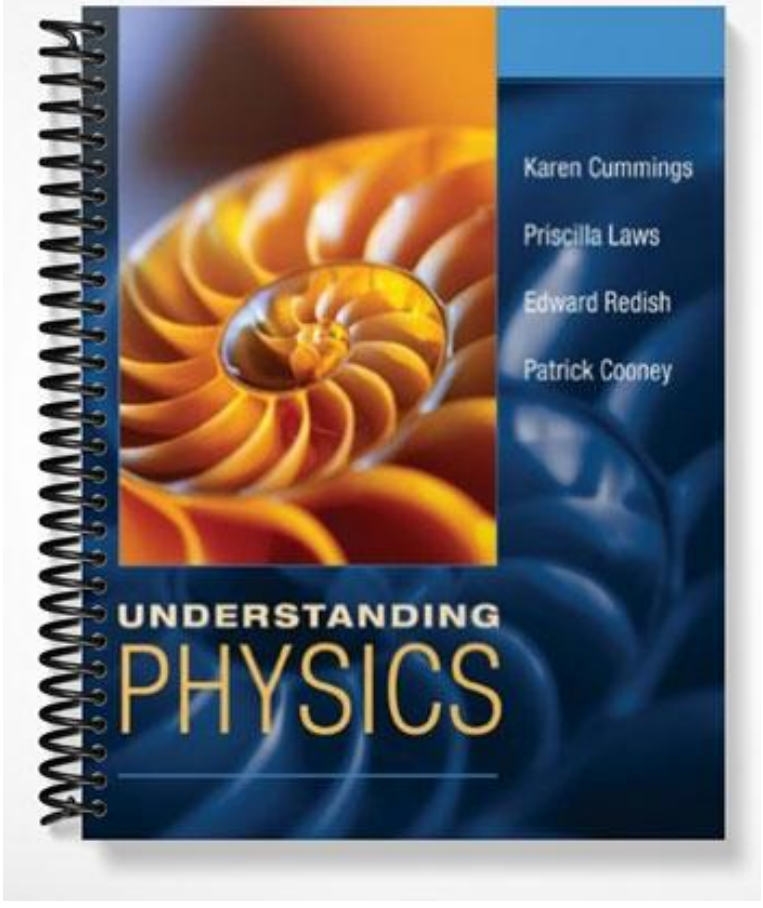
TEST BANK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UNDERSTANDING
PHYSICS

Chapter 2: MOTION ALONG A STRAIGHT LINE

1. A particle moves along the x axis from x_1 to x_2. Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?

   A. $x_1 = 4\,\text{m}$, $x_2 = 6\,\text{m}$
   B. $x_1 = -4\,\text{m}$, $x_2 = -8\,\text{m}$
   C. $x_1 = -4\,\text{m}$, $x_2 = 2\,\text{m}$
   D. $x_1 = 4\,\text{m}$, $x_2 = -2\,\text{m}$
   E. $x_1 = -4\,\text{m}$, $x_2 = 4\,\text{m}$

   Ans: E

2. A particle moves along the x axis from x_1 to x_2. Of the following values of the initial and final coordinates, which results in a displacement that is in the negative x direction?

   A. $x_1 = 4\,\text{m}$, $x_2 = 6\,\text{m}$
   B. $x_1 = -4\,\text{m}$, $x_2 = -8\,\text{m}$
   C. $x_1 = -4\,\text{m}$, $x_2 = 2\,\text{m}$
   D. $x_1 = -4\,\text{m}$, $x_2 = -2\,\text{m}$
   E. $x_1 = -4\,\text{m}$, $x_2 = 4\,\text{m}$

   Ans: B

3. 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. the magnitude of its acceleration multiplied by the time interval
   E. one-half the magnitude of its acceleration multiplied by the time interval.

   Ans: B

4. Two automobiles are 150 kilometers apart and traveling toward each other on a straight road. One automobile is moving at 60 km/h and the other is moving at 40 km/h mph. In how many hours will they meet?

   A. 2.5
   B. 2.0
   C. 1.75
   D. 1.5
   E. 1.25

   Ans: D

5. 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. 48 km/h
   D. 53 km/h
   E. 80 km/h

   Ans: D

6. 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
   B. 50 km/hr
   C. 100 km/hr
   D. 200 km/hr
   E. cannot be calculated without knowing the acceleration

   Ans: A

7. 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
   B. 50 km/h
   C. 100 km/h
   D. 200 km/h
   E. cannot be calculated without knowing the acceleration

   Ans: B

8. 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. 5.3 s
   D. 7.3 s
   E. 9.3 s

   Ans: B

9. A drag racing car starts from rest at time $t = 0$ and moves along a straight line with velocity given by $\vec{v} = bt^2\,\hat{\imath}$, 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

10. A ball rolls up a slope. At the end of three seconds its velocity is $(20\,\text{cm/s})\hat{\imath}$; at the end of eight seconds its velocity is 0. Its average acceleration from the third to the eighth second is:

    A. $2.5\,\text{cm/s}^2$
    B. $4.0\,\text{cm/s}^2$
    C. $5.0\,\text{cm/s}^2$
    D. $6.0\,\text{cm/s}^2$
    E. $6.67\,\text{cm/s}^2$

    Ans: B

11. 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. The magnitude of its average velocity over the interval from $t = 0$ to $t = 4\,\text{s}$ is:

A. $5\,\text{m/s}$
B. $-5\,\text{m/s}$
C. $11\,\text{m/s}$
D. $-11\,\text{m/s}$
E. $-14.5\,\text{m/s}$

Ans: B

12. The velocity of an object is given as a function of time by $\vec{v} = (4t - 3t^2)\,\hat{\text{i}}$, where $\vec{v}$ is in m/s and t is in seconds. Its average velocity over the interval from $t = 0$ to $t = 2\,\text{s}$:

A. is 0
B. is $(-2\,\text{m/s})\,\hat{\text{i}}$
C. is $(2\,\text{m/s})\,\hat{\text{i}}$
D. is $(-4\,\text{m/s})\,\hat{\text{i}}$
E. cannot be calculated unless the initial position is given

Ans: A

13. 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 $t = 2\,\text{s}$ is:

A. $(-4\,\text{m/s}^2)\,\hat{\text{i}}$
B. $(4\,\text{m/s}^2)\,\hat{\text{i}}$
C. $(-10\,\text{m/s}^2)\,\hat{\text{i}}$
D. $(10\,\text{m/s}^2)\,\hat{\text{i}}$
E. $(-13\,\text{m/s}^2)\,\hat{\text{i}}$

Ans: C

14. Each of four particles move 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: $x(t) = 3.5 + 2.7t^3$
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

15. 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: $x(t) = 3.5 + 2.7t^3$
    particle 3: $x(t) = 3.5 + 2.7t^2$
    particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$

    Which of these particles is speeding up 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: A

16. An object starts from rest at the origin and moves along the x axis with a constant acceleration of $(4\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$. Its average velocity as it goes from $x = 2\,\mathrm{m}$ to $x = 8\,\mathrm{m}$ is:

    A. $(1\,\mathrm{m/s})\,\hat{\mathrm{i}}$
    B. $(2\,\mathrm{m/s})\,\hat{\mathrm{i}}$
    C. $(3\,\mathrm{m/s})\,\hat{\mathrm{i}}$
    D. $(5\,\mathrm{m/s})\,\hat{\mathrm{i}}$
    E. $(6\,\mathrm{m/s})\,\hat{\mathrm{i}}$

    Ans: E

17. 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

    Ans: E

18. Throughout a time interval, while the speed of a particle increases as it moves along the x axis, its velocity and acceleration:

    A. might be in the positive and negative x directions, respectively
    B. might be in the negative and positive x directions, respectively
    C. might both be in the negative x direction
    D. might be in the negative x direction and zero, respectively
    E. might be in the positive x direction and zero, respectively

    Ans: C

19. A particle moves on the x axis. When its acceleration is in the positive x direction and increasing in magnitude:

A. its velocity must be in the positive x direction
B. its velocity must be in the negative x direction
C. it must be slowing down
D. it must be speeding up
E. none of the above must be true

Ans: E

20. 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 $(6\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
B. t cannot be negative
C. the particle follows a parabolic path
D. each second the speed of the particle changes by 9.8 m/s
E. none of the above

Ans: E

21. 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. $(27\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
B. $(4.0\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
C. $(-4.0\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
D. $(-12\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
E. $(-24\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$

Ans: E

22. 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; $(12\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
B. 0; $(24\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
C. $(27\,\mathrm{m/s})\,\hat{\mathrm{i}}$; 0
D. $(27\,\mathrm{m/s})\,\hat{\mathrm{i}}$; $(12\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$
E. $(27\,\mathrm{m/s})\,\hat{\mathrm{i}}$; $(24\ \mathrm{m/s^2})\,\hat{\mathrm{i}}$

Ans: C

23. At time $t = 0$ a car has a velocity of $(16\,\mathrm{m/s})\,\hat{\mathrm{i}}$. It slows down with an acceleration given by $) - 0.50\,\mathrm{m/s^3})t\,\hat{\mathrm{i}}$. It stops at $t =$

A. 64 s
B. 32 s
C. 16 s
D. 8.0 s
E. 4.0 s

Ans: D

24. At time $t = 0$ a car has a velocity of $(16\,\mathrm{m/s})\,\hat{\mathrm{i}}$. It slows down with an acceleration given by $(-0.50\,\mathrm{m/s^3})t\,\hat{\mathrm{i}}$. At the end of 4.0 s it has traveled:

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

Ans: E

25. At time $t = 0$ a car has a velocity of $(16\,\mathrm{m/s}\hat{\mathrm{i}}$. It slows down with an acceleration given by $(-0.50\,\mathrm{m/s^3})t\,\hat{\mathrm{i}}$. 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

26. Starting at time $t = 0$, an object moves along a straight line with velocity given by $\vec{v} = \left[(98\,\mathrm{m/s}) - (2\,\mathrm{m/s^3})t^2\right]\,\hat{\mathrm{i}}$. When it momentarily stops its acceleration is:

A. 0
B. $(-4.0\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
C. $(-9.8\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
D. $(-28\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
E. $(49\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$

Ans: D

27. Starting at time $t = 0$, an object moves along the x axis. Its coordinate is given by $x(t) = (75\,\mathrm{m/s})t - (1.0\,\mathrm{m/s^3})t^3$, where t is in seconds. When it momentarily stops its acceleration is:

A. 0
B. $(-73\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
C. $(-30\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
D. $(-9.8\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$
E. $(9.2 \times 10^3\,\mathrm{m/s^2})\,\hat{\mathrm{i}}$

Ans: C

28. A car, initially at rest, travels 20 m in 4 s along a straight line with constant acceleration. The magnitude of the acceleration of the car is:

A. $0.4\,\mathrm{m/s^2}$
B. $1.3\,\mathrm{m/s^2}$
C. $2.5\,\mathrm{m/s^2}$
D. $4.9\,\mathrm{m/s^2}$
E. $9.8\,\mathrm{m/s^2}$

Ans: C

29. A racing car traveling with constant acceleration increases its speed from 10 m/s to 50 m/s over a distance of 60 m. How long does this take?

A. 2.0 s
B. 4.0 s
C. 5.0 s
D. 8.0 s
E. The time cannot be calculated since the speed is not constant

Ans: B

30. A car starts from rest and goes down a slope with a constant acceleration of magnitude 5 m/s^2. After 5 s its speed, in meters per second, is:

A. 1
B. 12.5
C. 25
D. 50
E. 160

Ans: C

31. 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

32. 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. 12 m
B. 24 m
C. 36 m
D. 54 m
E. 144 m

Ans: D

33. 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 forward direction?

A. 12 m
B. 14 m
C. 24 m
D. 36 m
E. 48 m

Ans: E

34. 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 will it take for the car to catch up to the truck?

A. 5 s
B. 10 s
C. 15 s
D. 20 s
E. 25 s

Ans: B

35. The area under a velocity-time graph represents:

A. acceleration
B. change in acceleration
C. speed
D. change in velocity
E. displacement

Ans: E

36. 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

37. An object has a constant acceleration of magnitude 3 m/s^2. The coordinate versus time graph for this object has a slope:

A. that increases with time
B. that is constant
C. that decreases with time
D. of 3 m/s
E. of 3 m/s^2

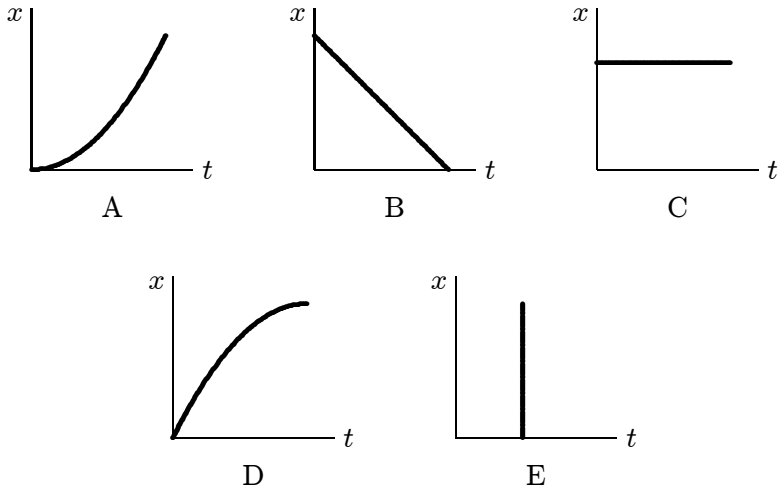
Ans: A

38. 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

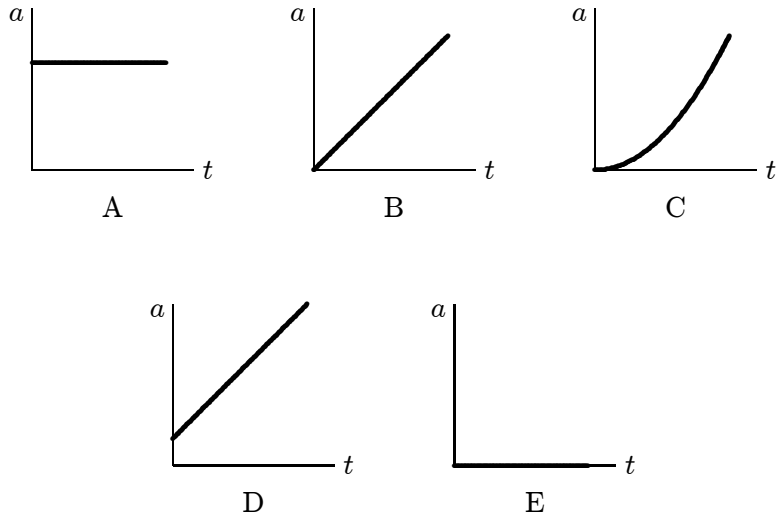
Ans: D

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



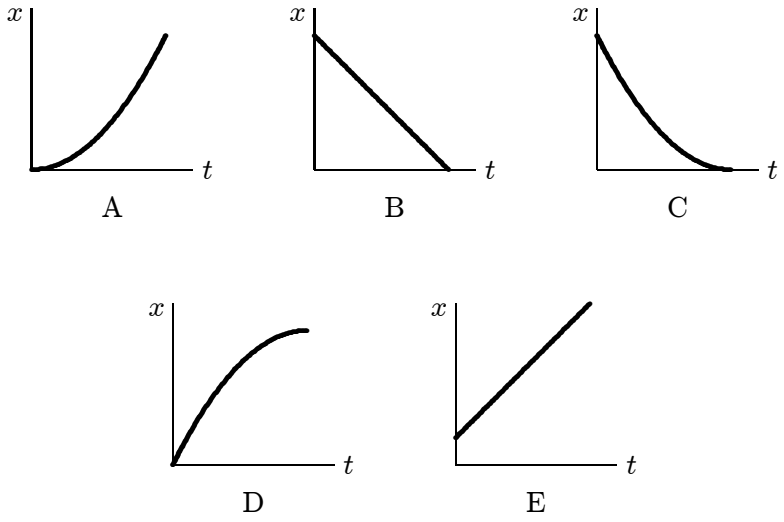
Ans: B

40. 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?



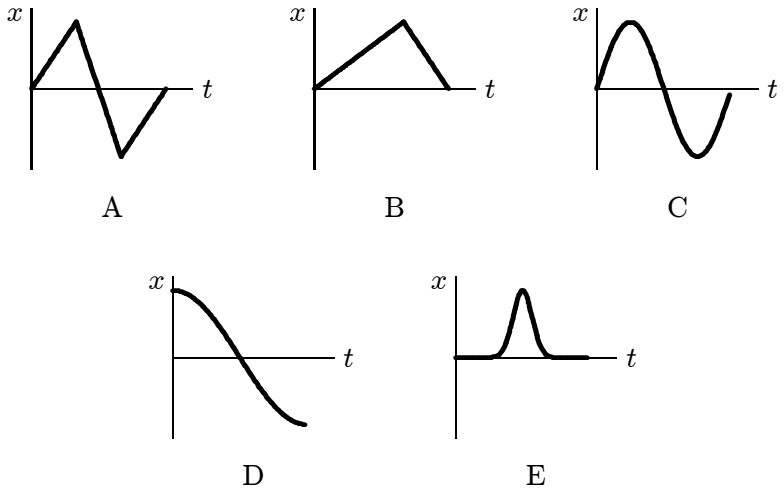
Ans: E

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



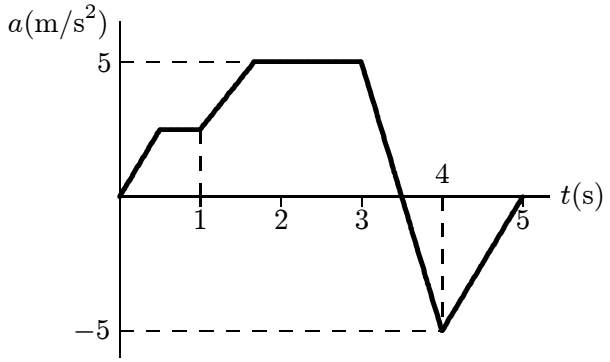
Ans: A

42. 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 first speeding up and then slowing to a stop. Which of the following five coordinate versus time graphs best describes the motion?



Ans: E

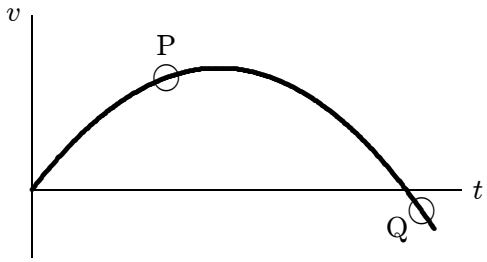
43. The acceleration of an object, starting from rest, is shown in the graph below. Other than at $t = 0$, when is the velocity of the object equal to zero?



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

Ans: E

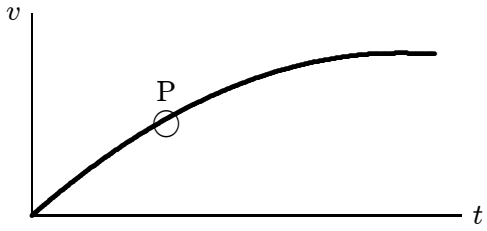
44. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be:



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

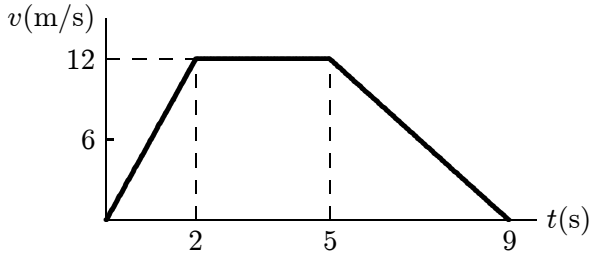
45. The diagram shows a velocity-time graph for a car moving in a straight line. At point P the car must be:



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

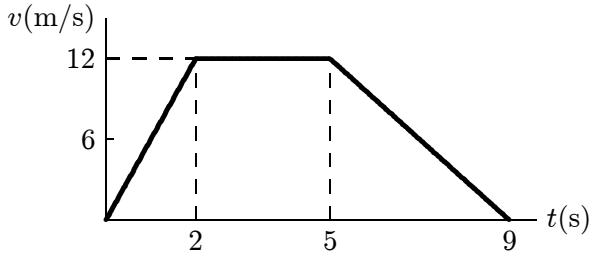
46. The graph represents the straight line motion of a car. How far does the car travel between $t = 2$ s and $t = 5$ s?



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

Ans: D

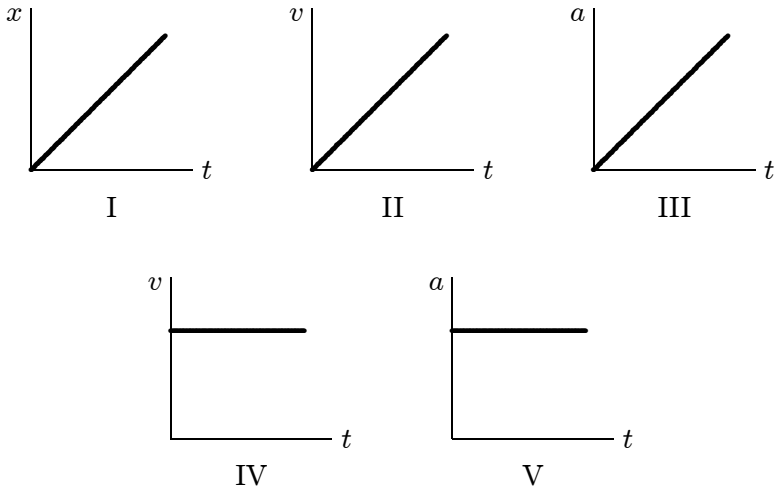
47. The diagram represents the straight line motion of a car. Which of the following statements is true?



A. The car accelerates, 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 decelerates at 12 m/s^2 for the last 4 s
E. The car returns to its starting point when $t = 9$ s

Ans: B

48. Consider the following five graphs (note the axes carefully). Which of these represents 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