SECTION - A

Objective Type Questions

(Position, Path length and Displacement, Average Velocity and Average Speed)

1. A particle is moving along a circle such that it completes one revolution in 40 seconds. In 2 minutes 20 seconds, the ratio $\frac{|\text{displacement}|}{\text{distance}}$ is

(1) 0 (2) $\frac{1}{7}$

(3) $\frac{2}{7}$ (4) $\frac{1}{11}$

2. Consider the motion of the tip of the second hand of a clock. In one minute (R be the length of second hand), its

(1) Displacement is $2\pi R$

(2) Distance covered is $2R$

(3) Displacement is zero

(4) Distance covered is zero

3. The position of a body moving along x-axis at time t is given by $x = (t^2 - 4t + 6)$ m. The distance travelled by body in time interval $t = 0$ to $t = 3$ s is

(1) 5 m (2) 7 m

(3) 4 m (4) 3 m

4. A particle moves along x-axis with speed 6 m/s for the first half distance of a journey and the second half distance with a speed 3 m/s. The average speed in the total journey is

(1) 5 m/s (2) 4.5 m/s

(3) 4 m/s (4) 2 m/s

5. A car moves with speed 60 km/h for 1 hour in east direction and with same speed for 30 min in south direction. The displacement of car from initial position is

(1) 60 km (2) $30\sqrt{3}$ km

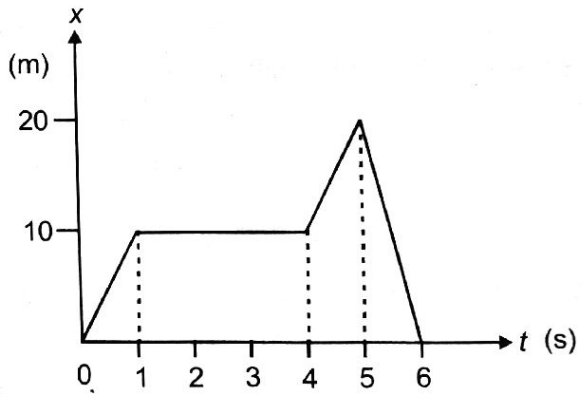
(3) $30\sqrt{5}$ km (4) $60\sqrt{2}$ km

6. A person travels along a straight road for the first $\frac{t}{3}$ time with a speed v_1 and for next $\frac{2t}{3}$ time with a speed v_2. Then the mean speed v is given by

(1) $v = \frac{v_1 + 2v_2}{3}$ (2) $\frac{1}{v} = \frac{1}{3v_1} + \frac{2}{3v_2}$

(3) $v = \frac{1}{3}\sqrt{2v_1v_2}$ (4) $v = \sqrt{\frac{3v_2}{2v_1}}$

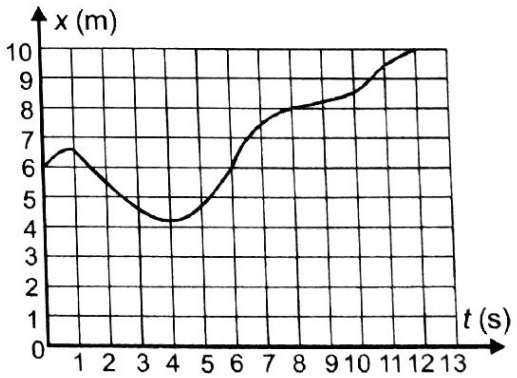
7. Figure shows the graph of x-coordinate of a particle moving along x-axis as a function of time. Average velocity during $t = 0$ to 6 s and instantaneous velocity at $t = 3$ s respectively, will be



(1) 10 m/s, 0 (2) 60 m/s, 0

(3) 0, 0 (4) 0, 10 m/s

8. Position-time graph for a particle is shown in figure. Starting from $t = 0$, at what time t, the average velocity is zero?



(1) 1 s (2) 3 s

(3) 6 s (4) 7 s

(Instantaneous Velocity and Speed, Acceleration)

9. A body in one dimensional motion has zero speed at an instant. At that instant, it must have
   (1) Zero velocity
   (2) Zero acceleration
   (3) Non-zero velocity
   (4) Non-zero acceleration

10. If a particle is moving along straight line with increasing speed, then
   (1) Its acceleration is negative
   (2) Its acceleration may be decreasing
   (3) Its acceleration is positive
   (4) Both (2) & (3)

11. At any instant, the velocity and acceleration of a particle moving along a straight line are v and a. The speed of the particle is increasing if
   (1) $v > 0, a > 0$ (2) $v < 0, a > 0$
   (3) $v > 0, a < 0$ (4) $v > 0, a = 0$

12. If magnitude of average speed and average velocity over a time interval are same, then
   (1) The particle must move with zero acceleration
   (2) The particle must move with non-zero acceleration
   (3) The particle must be at rest
   (4) The particle must move in a straight line without turning back

13. If v is the velocity of a body moving along x-axis, then acceleration of body is
   (1) $\frac{dv}{dx}$ (2) $v\frac{dv}{dx}$
   (3) $x\frac{du}{dx}$ (4) $v\frac{dx}{dv}$

14. If a body is moving with constant speed, then its acceleration
   (1) Must be zero (2) May be variable
   (3) May be uniform (4) Both (2) & (3)

15. When the velocity of body is variable, then
   (1) Its speed may be constant
   (2) Its acceleration may be constant
   (3) Its average acceleration may be constant
   (4) All of these

16. An object is moving with variable speed, then
   (1) Its velocity may be zero
   (2) Its velocity must be variable
   (3) Its acceleration may be zero
   (4) Its velocity must be constant

17. The position of a particle moving along x-axis is given by $x = 10t - 2t^2$. Then the time (t) at which it will momently come to rest is
   (1) 0 (2) 2.5 s
   (3) 5 s (4) 10 s

18. If the displacement of a particle varies with time as $\sqrt{x} = t + 7$, then
   (1) Velocity of the particle is inversely proportional to t
   (2) Velocity of the particle is proportional to t^2
   (3) Velocity of the particle is proportional to $\sqrt{t}$
   (4) The particle moves with constant acceleration

19. The initial velocity of a particle is u (at $t = 0$) and the acceleration a is given by $\alpha t^{3/2}$. Which of the following relations is valid?
   (1) $v = u + \alpha t^{3/2}$ (2) $v = u + \frac{3\alpha t^3}{2}$
   (3) $v = u + \frac{2}{5}\alpha t^{5/2}$ (4) $v = u + \alpha t^{5/2}$

20. The position x of particle moving along x-axis varies with time t as $x = A\sin(\omega t)$ where A and ω are positive constants. The acceleration a of particle varies with its position (x) as
   (1) $a = Ax$ (2) $a = -\omega^2 x$
   (3) $a = A\,\omega\,x$ (4) $a = \omega^2\,x\,A$

21. A particle moves in a straight line and its position x at time t is given by $x^2 = 2 + t$. Its acceleration is given by
   (1) $\frac{-2}{x^3}$ (2) $-\frac{1}{4x^3}$
   (3) $-\frac{1}{4x^2}$ (4) $\frac{1}{x^2}$

22. A body is moving with variable acceleration (a) along a straight line. The average acceleration of body in time interval t_1 to t_2 is
   (1) $\frac{a[t_2 + t_1]}{2}$ (2) $\frac{a[t_2 - t_1]}{2}$
   (3) $\frac{\int_{t_1}^{t_2} a\,dt}{t_2 + t_1}$ (4) $\frac{\int_{t_1}^{t_2} a\,dt}{t_2 - t_1}$

23. The position of a particle moving along x-axis given by $x = (-2t^3 + 3t^2 + 5)$m. The acceleration of particle at the instant its velocity becomes zero is

(1) 12 m/s^2 (2) -12 m/s^2

(3) -6 m/s^2 (4) Zero

24. A particle move with velocity v_1 for time t_1 and v_2 for time t_2 along a straight line. The magnitude of its average acceleration is

(1) $\frac{v_2 - v_1}{t_1 - t_2}$ (2) $\frac{v_2 - v_1}{t_1 + t_2}$

(3) $\frac{v_2 - v_1}{t_2 - t_1}$ (4) $\frac{v_1 + v_2}{t_1 - t_2}$

(Kinematic Equations for Uniformly Accelerated Motion)

25. A particle starts moving with acceleration 2 m/s^2. Distance travelled by it in 5th half second is

(1) 1.25 m (2) 2.25 m

(3) 6.25 m (4) 30.25 m

26. The two ends of a train moving with constant acceleration pass a certain point with velocities u and $3u$. The velocity with which the middle point of the train passes the same point is

(1) $2u$ (2) $\frac{3}{2}u$

(3) $\sqrt{5}\,u$ (4) $\sqrt{10}\,u$

27. A train starts from rest from a station with acceleration 0.2 m/s^2 on a straight track and then comes to rest after attaining maximum speed on another station due to retardation 0.4 m/s^2. If total time spent is half an hour, then distance between two stations is [Neglect length of train]

(1) 216 km (2) 512 km

(3) 728 km (4) 1296 km

28. A body is projected vertically upward direction from the surface of earth. If upward direction is taken as positive, then acceleration of body during its upward and downward journey are respectively

(1) Positive, negative (2) Negative, negative

(3) Positive, positive (4) Negative, positive

29. A particle start moving from rest state along a straight line under the action of a constant force and travel distance x in first 5 seconds. The distance travelled by it in next five seconds will be

(1) x (2) $2x$

(3) $3x$ (4) $4x$

30. A body is projected vertically upward with speed 40 m/s. The distance travelled by body in the last second of upward journey is [take g = 9.8 m/s^2 and neglect effect of air resistance]

(1) 4.9 m (2) 9.8 m

(3) 12.4 m (4) 19.6 m

31. A body is projected vertically upward with speed 10 m/s and other at same time with same speed in downward direction from the top of a tower. The magnitude of acceleration of first body w.r.t. second is {take g = 10 m/s^2}

(1) Zero (2) 10 m/s^2

(3) 5 m/s^2 (4) 20 m/s^2

32. A car travelling at a speed of 30 km/h is brought to rest in a distance of 8 m by applying brakes. If the same car is moving at a speed of 60 km/h then it can be brought to rest with same brakes in

(1) 64 m (2) 32 m

(3) 16 m (4) 4 m

33. A particle is thrown with any velocity vertically upward, the distance travelled by the particle in first second of its decent is

(1) g (2) $\frac{g}{2}$

(3) $\frac{g}{4}$ (4) Cannot be calculated

34. A body is thrown vertically upwards and takes 5 seconds to reach maximum height. The distance travelled by the body will be same in

(1) 1st and 10th second (2) 2nd and 8th second

(3) 4th and 6th second (4) Both (2) & (3)

35. A ball is dropped from a bridge of 122.5 metre above a river. After the ball has been falling for two seconds, a second ball is thrown straight down after it. Initial velocity of second ball so that both hit the water at the same time is

(1) 49 m/s (2) 55.5 m/s

(3) 26.1 m/s (4) 9.8 m/s

36. A balloon starts rising from ground from rest with an upward acceleration 2 m/s^2. Just after 1 s, a stone is dropped from it. The time taken by stone to strike the ground is nearly

(1) 0.3 s (2) 0.7 s

(3) 1 s (4) 1.4 s

37. A boy throws balls into air at regular interval of 2 second. The next ball is thrown when the velocity of first ball is zero. How high do the ball rise above his hand? [Take $g = 9.8\ m/s^2$]

(1) 4.9 m (2) 9.8 m

(3) 19.6 m (4) 29.4 m

38. A ball projected from ground vertically upward is at same height at time t_1 and t_2. The speed of projection of ball is [Neglect the effect of air resistance]

(1) $g[t_2 - t_1]$ (2) $\frac{g[t_1 + t_2]}{2}$

(3) $\frac{g[t_2 - t_1]}{2}$ (4) $g[t_1 + t_2]$

39. Two balls are projected upward simultaneously with speeds 40 m/s and 60 m/s. Relative position (x) of second ball w.r.t. first ball at time t = 5 s is [Neglect air resistance].

(1) 20 m (2) 80 m

(3) 100 m (4) 120 m

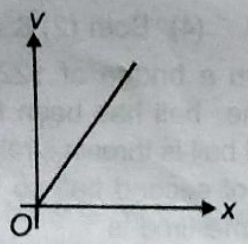
40. A ball is dropped from a height h above ground. Neglect the air resistance, its velocity (v) varies with its height y above the ground as

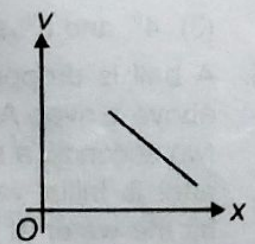
(1) $\sqrt{2g(h-y)}$ (2) $\sqrt{2gh}$

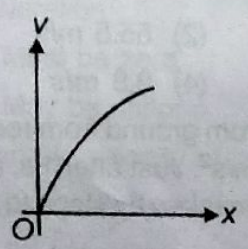
(3) $\sqrt{2gy}$ (4) $\sqrt{2g(h+y)}$

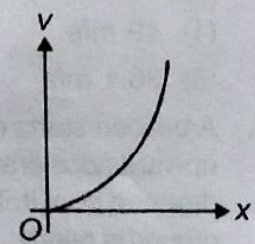
(Graphs)

41. For a body moving with uniform acceleration along straight line, the variation of its velocity (v) with position (x) is best represented by

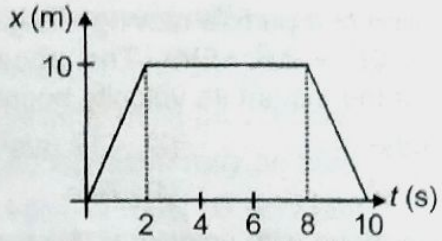
(1) 

(2) 

(3) 

(4) 

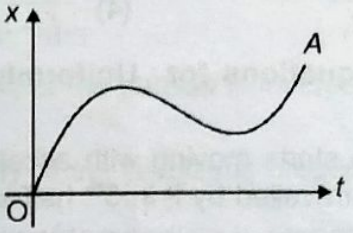
42. The position-time graph for a particle moving along a straight line is shown in figure. The total distance travelled by it in time t = 0 to t = 10 s is



(1) Zero (2) 10 m

(3) 20 m (4) 80 m

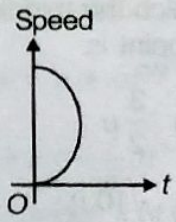
43. The position-time graph for a body moving along a straight line between O and A is shown in figure. During its motion between O and A, how many times body comes to rest?

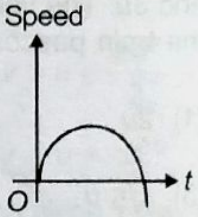


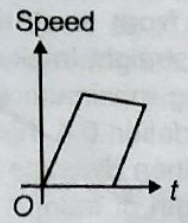
(1) Zero (2) 1 time

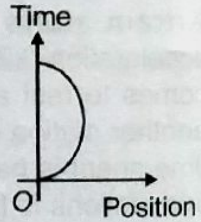
(3) 2 times (4) 3 times

44. Which one of the following graph for a body moving along a straight line is possible?

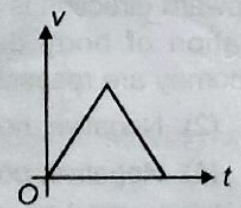
(1) 

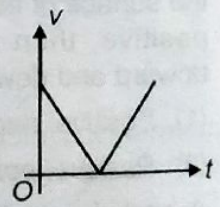
(2) 

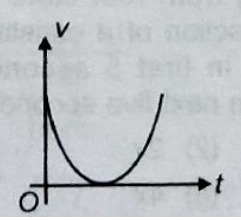
(3) 

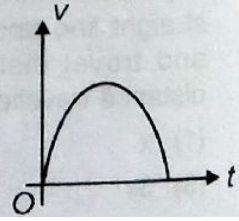
(4) 

45. A body is projected vertically upward from ground. If we neglect the effect of air, then which one of the following is the best representation of variation of speed (v) with time (t)?

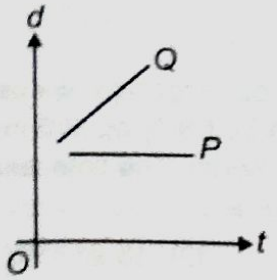
(1) 

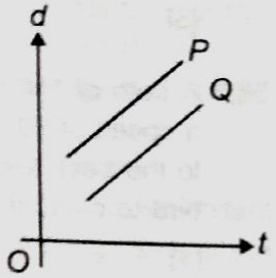
(2) 

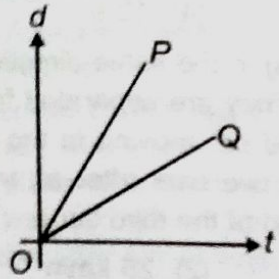
(3) 

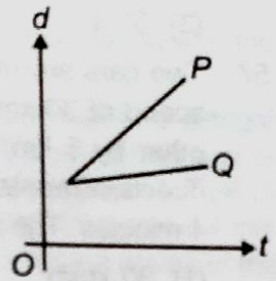
(4) 

46. Which one of the following time-displacement graph represents two moving objects P and Q with zero relative velocity?

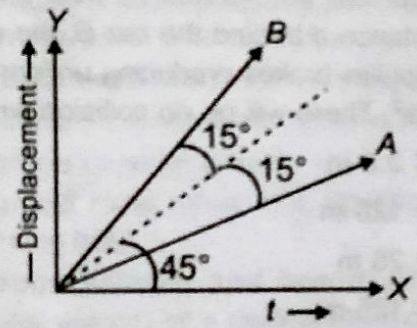
(1) 

(2) 

(3) 

(4) 

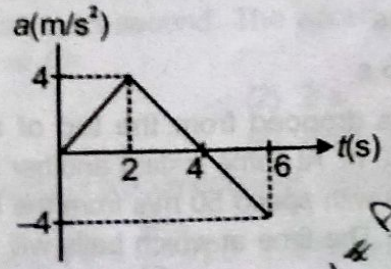
47. The displacement-time graph for two particles A and B is as follows. The ratio $\frac{v_A}{v_B}$ is



(1) 1 : 2 (2) $1:\sqrt{3}$

(3) $\sqrt{3}:1$ (4) 1 : 3

48. For the acceleration-time (a-t) graph shown in figure, the change in velocity of particle from $t = 0$ to $t = 6$ s is



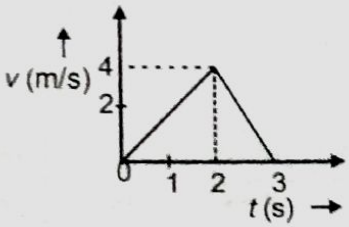
(1) 10 m/s

(2) 4 m/s

(3) 12 m/s

(4) 8 m/s

49. The velocity versus time graph of a body moving in a straight line is as shown in the figure below



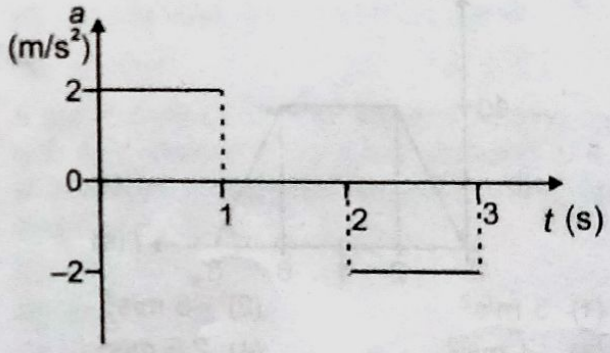
(1) The distance covered by the body in 0 to 2s is 8m

(2) The acceleration of the body in 0 to 2s is 4 ms^{-2}

(3) The acceleration of the body in 2 to 3s is 4 ms^{-2}

(4) The distance moved by the body during 0 to 3 s is 6 m

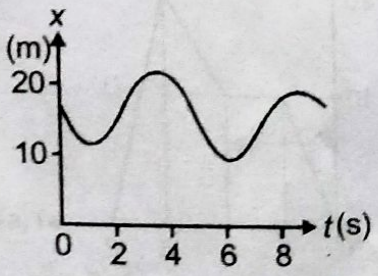
50. Acceleration-time graph for a particle is given in figure. If it starts motion at $t = 0$, distance travelled in 3 s will be



(1) 4 m (2) 2 m

(3) 0 (4) 6 m

51. Figure shows the position of a particle moving on the x-axis as a function of time



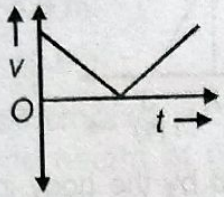
(1) The particle has come to rest 4 times

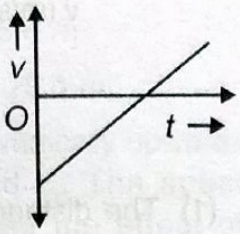
(2) The velocity at $t = 8$ s is negative

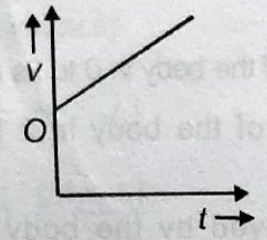
(3) The velocity remains positive for $t = 2$ s to $t = 6$ s

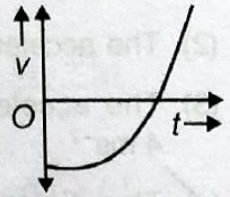
(4) The particle moves with a constant velocity

. A particle moves along x-axis in such a way that its x-co-ordinate varies with time according to the equation $x = 4 - 2t + t^2$. The speed of the particle will vary with time as

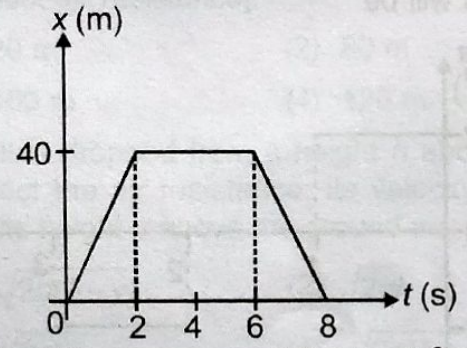
(1) 

(2) 

(3) 

(4) 

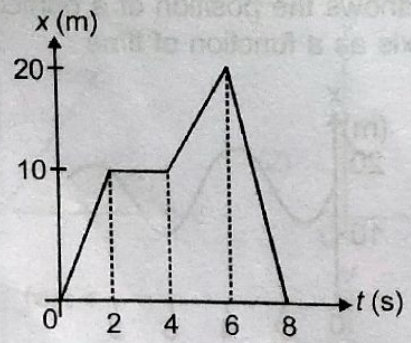
53. The position (x) of a particle moving along x-axis varies with time (t) as shown in figure. The average acceleration of particle in time interval $t = 0$ to $t = 8$ s is



(1) 3 m/s^2 (2) –5 m/s^2

(3) –4 m/s^2 (4) 2.5 m/s^2

54. The position (x)-time (t) graph for a particle moving along a straight line is shown in figure. The average speed of particle in time interval $t = 0$ to $t = 8$ s is



(1) Zero (2) 5 m/s

(3) 7.5 m/s (4) 9.7 m/s

(Relative Motion)

55. A boat covers certain distance between two spots in a river taking t_1 hrs going downstream and t_2 hrs going upstream. What time will be taken by boat to cover same distance in still water?

(1) $\frac{t_1 + t_2}{2}$ (2) $2(t_2 - t_1)$

(3) $\frac{2t_1t_2}{t_1 + t_2}$ (4) $\sqrt{t_1t_2}$

56. A train of 150 m length is going towards North at a speed of 10 m/s. A bird is flying at 5 m/s parallel to the track towards South. The time taken by the bird to cross the train is

(1) 10 s (2) 15 s

(3) 30 s (4) 12 s

57. Two cars are moving in the same direction with a speed of 30 km/h. They are separated from each other by 5 km. Third car moving in the opposite direction meets the two cars after an interval of 4 minutes. The speed of the third car is

(1) 30 km/h (2) 25 km/h

(3) 40 km/h (4) 45 km/h

58. Two cars A and B are moving in same direction with velocities 30 m/s and 20 m/s. When car A is at a distance d behind the car B, the driver of the car A applies brakes producing uniform retardation of 2 m/s^2. There will be no collision when

(1) $d < 2.5$ m

(2) $d > 125$ m

(3) $d > 25$ m

(4) $d < 125$ m

59. Two trains each of length 100 m moving parallel towards each other at speed 72 km/h and 36 km/h respectively. In how much time will they cross each other?

(1) 4.5 s

(2) 6.67 s

(3) 3.5 s

(4) 7.25 s

60. A ball is dropped from the top of a building of height 80 m. At same instant another ball is thrown upwards with speed 50 m/s from the bottom of the building. The time at which balls will meet is

(1) 1.6 s

(2) 5 s

(3) 8 s

(4) 10 s