MOTION IN STRAIGHT LINE

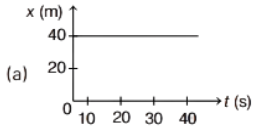
Multiple Choice Questions

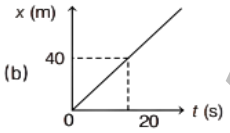
1. Which of the following is an example of one-dimensional motion?
(a) Landing of an aircraft
(b) Earth revolving around the sun
(c) Motion of wheels of moving train
(d) Train running on a straight track

2. The coordinates of object with respect to a frame of reference at $t = 0$ s are (- 1, 0, 3). If $t = 5$ s, its coordinates are (- 1, 0, 4), then the object is in
(a) motion along Z-axis
(b) motion along X-axis
(c) motion along Y-axis
(d) rest position between $t = 0$ s and $t = 5$ s

3. A person moves towards east for 3 m, then towards north for 4 m and then moves vertically up by 5 m. What is his distance now from the starting point?
(a) $5\sqrt{2}$ m (b) 5 m (c) 10 m (d) 20 m

4. For a stationary object at $x = 40$ m, the position-time graph is

(a) 

(b) 

(c) 

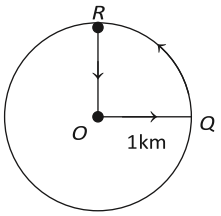
(d) None of the above

5. The displacement of a car is given as - 240 m, here negative sign indicates
(a) direction of displacement
(b) negative path length
(c) position of car at that point
(d) no significance of negative sign

6. Snehit starts from his home and walks 50 m towards north, then he turns towards east and walks 40 m and then reaches his school after moving 20 m towards south. Then, his displacement from his home to school is
(a) 50 m (b) 110 m (c) 80 m (d) 40 m

7. A vehicle travels half the distance l with speed v_1 and the other half with speed v_2, then its average speed is
(a) $\frac{v_1 + v_2}{2}$ (b) $\frac{2v_1 + v_2}{v_1 + v_2}$ (c) $\frac{2v_1\, v_2}{v_1 + v_2}$ (d) $\frac{l\,(v_1 + v_2)}{v_1 v_2}$

8. A runner starts from O and comes back to O following path $OQRO$ in 1h. What is his net displacement and average speed?



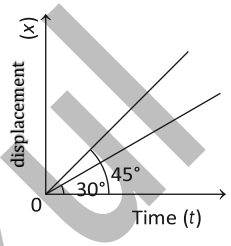
(a) 0,3.57 km/h
(b) 0,0 km/h
(c) 0,2.57 km/h
(d) 0,1 km/h

9. The sign (+ ve or - ve) of the average velocity depends only upon

(a) the sign of displacement
(b) the initial position of the object
(c) the final position of the object
(d) None of the above

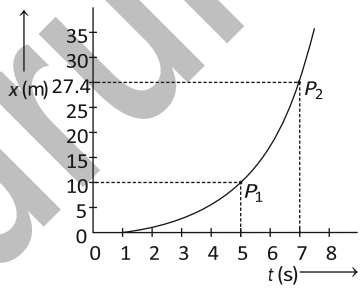
10. Find the average velocity, when a particle completes the circle of radius 1m in 10 s.
(a) 2m/s (b) 3.14 m/s (c) 6.28 m/s (d) zero

11. The displacement-time graph of two moving particles make angles of 30° and 45° with the X-axis. The ratio of their velocities is



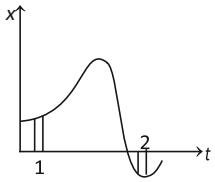
(a) 1: $\sqrt{3}$
(b) 1 : 2
(c) 1 : 1
(d) $\sqrt{3}$: 2

12. In figure, displacement-time $(x - t)$ graph given below, the average velocity between time $t = 5$s and $t = 7$s is



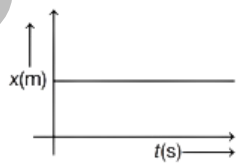
(a) 8 ms^{-1}
(b) 8.7 ms^{-1}
(c) 7.8 ms^{-1}
(d) 13.7 ms^{-1}

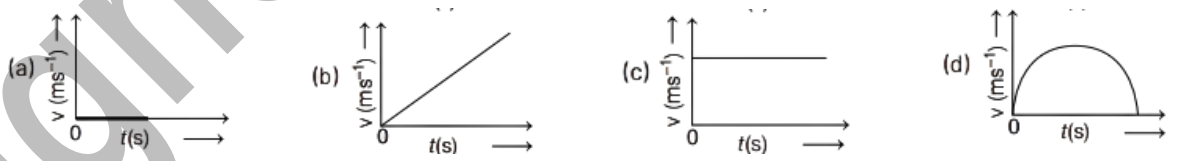
13. Figure shows the x-t plot of a particle in one-dimensional motion. Two different equal intervals of time show speed in time intervals 1 and 2 respectively, then



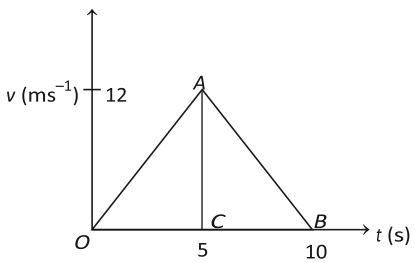
(a) $V_1 > V_2$
(b) $V_2 > V_1$
(c) $V_1 = V_2$
(d) Data insufficient

14. For the x-t graph given below, the v -t graph is shown correctly in





15. The speed-time graph of a particle moving along a fixed direction is as shown in the figure. The distance traversed by the particle between t = 0 s to t = 10 s is



(a) 20 m
(b) 40 m
(c) 60 m
(d) 80 m

16. If an object is moving in a straight line, then
(a) the directional aspect of vector can be specified by + ve and - ve signs
(b) instantaneous speed at an instant is equal to the magnitude of the instantaneous velocity at that instant
(c) Both (a) and (b)
(d) Neither (a) nor (b)

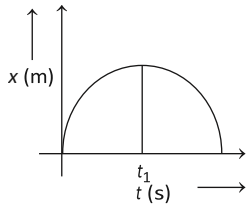
17. In one dimensional motion, instantaneous speed v satisfies $0 \leq v < v_0$. Then
(a) displacement in time T must always take non-negative values
(b) displacement x in time T satisfies - V_0 T < x < V_0 T
(c) acceleration is always a non-negative number
(d) motion has no turning points

18. The x-t equation is given as x = 2t + 1. The corresponding v -t graph is
(a) a straight line passing through origin
(b) a straight line not passing through origin
(c) a parabola
(d) None of the above

19. The displacement x of an object is given as a function of time, $x = 2t + 3t^2$. The instantaneous velocity of the object at t = 2 s is
(a) $16ms^{-1}$ (b) $14ms^{-1}$ (c) $10ms^{-1}$ (d) $12ms^{-1}$

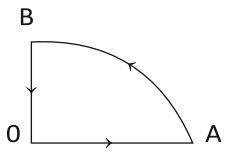
20. The displacement of a particle starting from rest (at t = 0) is given by $s = 6t^2 - t^3$. The time in seconds at which the particle will attain zero velocity again is
(a) 2 (b) 4 (c) 6 (d) 8

21. A car moves along a straight line according to the x-t graph given below. The instantaneous velocity of the car at $t = t_1$ is
(a) zero
(b) positive
(c) Data insufficient
(d) Cannot be determined



22. A particle moves in a straight line. It can be accelerated
(a) only, if its speed changes by keeping its direction same
(b) only, if its direction changes by keeping its speed same
(c) Either by changing its speed or direction
(d) None of the above

23. An object is moving along the path *OABO* with constant speed, then
(a) the acceleration of the object while moving along to path *OABO* is zero
(b) the acceleration of the object along the path *OA* and *BO* is zero
(c) there must be some acceleration along the path *AB*
(d) Both (b) and (c)



24. The average velocity of a body moving with uniform acceleration travelling a distance of 3.06 m is 0.34 ms^{-1}. If the change in velocity of the body is 0.18 ms^{-1} during this time, its uniform acceleration is

(a) 0.01 ms^{-2} (b) 0.02 ms^{-2} (c) 0.03 ms^{-2} (d) 0.04 ms^{-2}

25. The slope of the straight line connecting the points corresponding to (v_2, t_2) and (v_1, t_1) on a plot of velocity *versus* time gives

(a) average velocity (b) average acceleration

(c) instantaneous velocity (d) None of the above

26. The displacement x of a particle at time t along a straight line is given by $x = \alpha - \beta t + \gamma t^2$. The acceleration of the particle is

(a) $-\beta$ (b) $-\beta + 2\gamma$ (c) 2γ (d) -2γ

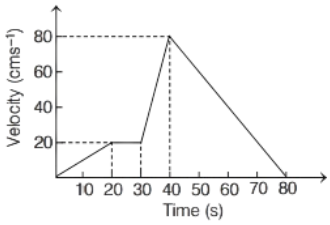
27. The displacement (in metre) of a particle moving along X-axis is given by $x = 18t + 5t^2$. The average acceleration during the interval $t_1 = 2$s and $t_2 = 4$ s is

(a) 13 ms^{-2} (b) 10 ms^{-2} (c) 27 ms^{-2} (d) 37 ms^{-2}

28. The relation between time and distance is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is

(a) $2\alpha v^3$ (b) $2\beta v^3$ (c) $2\alpha\beta v^3$ (d) $2\beta^2 v^3$

29. The v -t graph of a moving object is shown in the figure. The maximum acceleration is



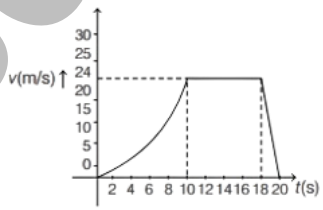
(a) 1 cm s^{-2}

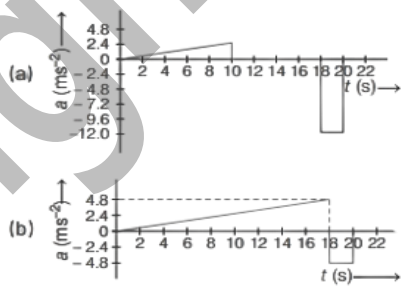
(b) 2 cm s^{-2}

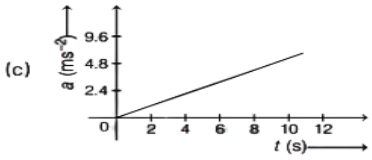
(c) 3 cm s^{-2}

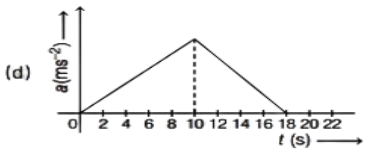
(d) 6 cm s^{-2}

30. The resulting graphs for the given V- t graph is correctly represented in







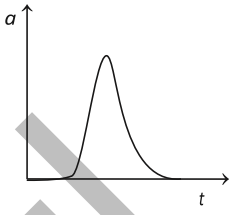


31. The kinematic equations of rectilinear motion for constant acceleration for a general situation, where the position coordinate at $t = 0$ is non-zero, say x_0 is

(a) $V = V_0 + at$ (b) $x = X_0 + V_0 t + \frac{1}{2}at^2$

(c) $V^2 = V_0^2 + 2a\,(x - x_0)$ (d) All of the above

32. The given acceleration-time graph represents which of the following physical situations?

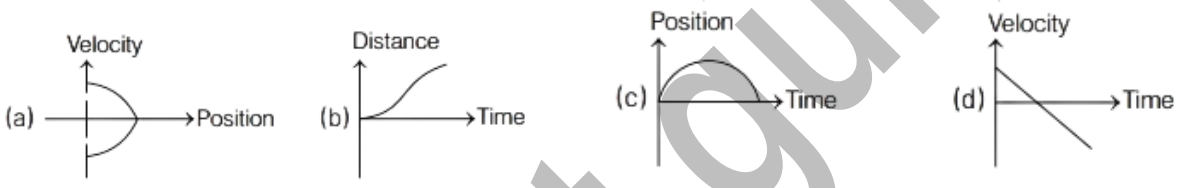


(a) A cricket ball moving with a uniform speed is hit with a bat for a very short time interval.
(b) A ball is falling freely from the top of a tower.
(c) A car moving with constant velocity on a straight road.
(d) A football is kicked into the air vertically upwards.

33. An object is moving with velocity 10 ms^{-1} A constant force acts for 4 s on the object and gives it a speed of 2 ms^{-1} in opposite direction. The acceleration produced is

(a) 3 ms^{-2} (b) - 3 ms^{-2} (c) 6 ms^{-2} (d) - 6 ms^{-2}

34. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.



35. Velocity of a body moving along a straight line with uniform acceleration a reduces by $(3/4)^{th}$ of its initial velocity in time t_0. The total time of motion of the body till its velocity becomes zero is

(a) $\frac{4}{3}t_0$ (b) $\frac{3}{2}t_0$ (c) $\frac{5}{3}t_0$ (d) $\frac{8}{3}t_0$

36. A particle is situated at $x = 3$ units at $t = 0$. It starts moving from rest with a constant acceleration of 4 ms^{-2}. The position of the particle at $t = 3$ s is

(a) $x = +21$units (b) $x = +18$ units
(c) $x = -21$units (d) None of these

37. Consider the relation for relative velocities between two objects A and B, $v_{BA} = -v_{AB}$. The above equation is valid, if

(a) VA and VB are average velocities (b) VA and VB are instantaneous velocities
(c) VA and VB are average speed (d) Both (a) and (b)

38. A person is moving with a velocity of 10 ms^{-1} towards north. A car moving with a velocity of 20 ms^{-1} towards south crosses the person. The velocity of car relative to the person is

(a) -30 ms^{-1} (b) +20 ms^{-1} (c) 10 ms^{-1} (d) -10 ms^{-1}

39. A motion of a body is said to be ....., if it moves along a straight line in any direction.

(a) one-dimensional (b) two dimensional
(c) three-dimensional (d) All of the above

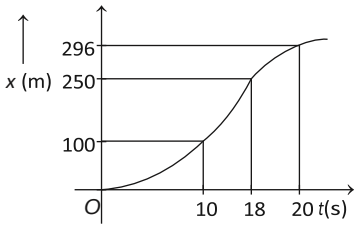
40. The numerical ratio of displacement to the distance covered by an object is always equal to or less than ……
(a) 1 (b) zero (c) Both (a) and (b) (d) infinity

41. The time taken by a 150 m long train to cross a bridge of length 850 m is 80 s. It is moving with a uniform velocity of …… km/h.
(a) 45 (b) 90 (c) 60 (d) 70

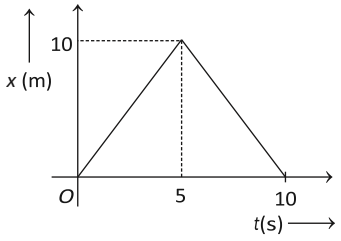
42. The distance-time graph of …… is a straight line.
(a) uniform motion (b) non-uniform motion
(c) uniform acceleration (d) None of the above

43. Which of the following statement is correct?
(a) The magnitude of average velocity is the average speed.
(b) Average velocity is the displacement divided by time interval.
(c) When acceleration of particle is constant, then motion is called as non-uniformly accelerated motion.
(d) When a particle returns to its starting point, its displacement is non-zero.

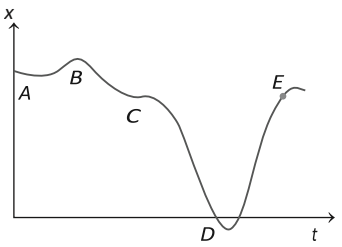
44. For motion of the car between $t = 18$ s and $t = 20$ s, which of the given statement is correct?
(a) The car is moving in a positive direction with a positive acceleration.
(b) The car is moving in a negative direction with a positive acceleration.
(c) The car is moving in positive direction with a negative acceleration.
(d) The car is moving in negative direction with a negative acceleration.



45. The *x*-*t* graph for motion of a car is given below, With reference to the graph, which of the given statement(s) is/are incorrect?
(a) The instantaneous speed during the interval $t = 5$ s to $t = 10$s is negative at all time instants during the interval.
(b) The velocity and the average velocity for the interval $t = 0$s to $t = 5$ s are equal and positive.
(c) The car changes its direction of motion at $t = 5$ s.
(d) The instantaneous speed and the instantaneous velocity are positive at all time instants during the interval
$t = 0$s to $t = 5$s.



46. A graph of *x versus t* is shown in figure. Choose correct statement given below.
(a) The particle having some initial velocity at $t = 0$.
(b) At point *B*, the acceleration $a > 0$.
(c) At point *C*, the velocity and the acceleration vanish.
(d) The speed at *E* exceeds that at *D*.



47. Match the Column I with Column II and select the correct option from the codes given below

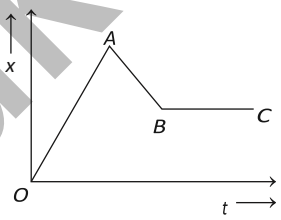
Column I	Column II

A. $d\mathbf{v}/dt$	p. Acceleration
B. $d\lvert\mathbf{v}\rvert/dt$	q. Rate of change of speed
C. $\frac{d\,r}{d\,t}$	r. Velocity
D. $\frac{d\,\lvert r\rvert}{d\,t}$	s. Magnitude of velocity

Codes

	A	B	C	D
(a)	p	q	r	s
(b)	p	r	s	q
(c)	q	p	r	s
(d)	s	r	p	q

48. Given x-t graph represents the motion of an object. Match the Column I (parts of graph) with Column II (representation) and select the correct option from the codes given below.

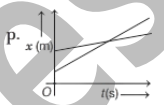
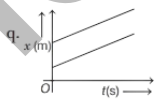
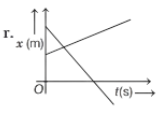


Column I	**Column II**
A. Part OA of graph	p. Positive velocity
B. Part AB of graph	q. Object at rest
C. Part BC of graph	r. Negative velocity
D. Point A in the graph	s. Change in direction of motion

Codes

	A	B	C	D
(a)	p	q	r	s
(b)	p	r	q	s
(c)	q	p	r	s
(d)	s	r	q	p

49. Match the Column I (position-time graph) with Column II (representation) and select the correct option from the codes given below.

	Column I	Column II
A.	Position-time graph of two objects with equal velocities.	p. 
B.	Position-time graph of two objects with unequal velocities but in same direction.	q. 
C.	Position-time graph of two objects with velocities in opposite direction.	r. 

CODES

	A	B	C		A	B	C
(a)	p	q	r	(b)	q	p	r
(c)	p	r	q	(d)	q	r	p

Assertion-Reasoning MCQs

Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

50. Assertion In real-life, in a number of situations, the object is treated as a point object.
Reason An object is treated as point object, as far as its size is much smaller than the distance, it moves in a reasonable duration of time.

51. Assertion If the displacement of the body is zero, the distance covered by it may not be zero.
Reason Displacement is a vector quantity and distance is a scalar quantity.

52. Assertion An object can have constant speed but variable velocity.
Reason SI unit of speed is m/s.

53. Assertion The speed of a body can be negative.
Reason If the body is moving in the opposite direction of positive motion, then its speed is negative.

54. Assertion For motion along a straight line and in the same direction, the magnitude of average velocity is equal to the average speed.
Reason For motion along a straight line and in the same direction, the magnitude of displacement is not equal to the path length.

55. Assertion An object may have varying speed without having varying velocity.
Reason If the velocity is zero at an instant, the acceleration is zero at that instant.

56. Assertion Acceleration of a moving particle can change its direction without any change in direction of velocity.
Reason If the direction of change in velocity vector changes, direction of acceleration vector does not changes.

57. Assertion The v-t graph perpendicular to time axis is not possible in practice.
Reason Infinite acceleration cannot be realised in practice.

58. Assertion In realistic situation, the x-t, v-t and a-t graphs will be smooth.
Reason Physically acceleration and velocity cannot change values abruptly at an instant.

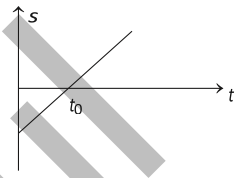
59. Assertion A body cannot be accelerated, when it is moving uniformly.
Reason When direction of motion of the body changes, then body does not have acceleration.

60. Assertion For uniform motion, velocity is the same as the average velocity at all instants.

Reason In uniform motion along a straight line, the object covers equal distances in equal intervals of time.

61. Assertion A body is momentarily at rest at the instant, if it reverses the direction.
Reason A body cannot have acceleration, if its velocity is zero at a given instant of time.

62. Assertion In the s-t diagram as shown in figure, the body starts moving in positive direction but not from $s = 0$.
Reason At $t = t_0$, velocity of body changes its direction of motion.

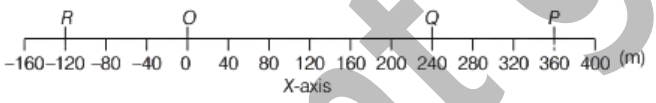


63. Assertion If acceleration of a particle moving in a straight line varies as $\alpha \propto t^n$, then $s\,s \propto t^{n+2}$.
Reason If s-t graph is a straight line, then s-t graph may be a parabola.

Case Based MCQs

Motion in a Straight Line

If the position of an object is continuously changing w.r.t. its surrounding, then it is said to be in the state of motion. Thus, motion can be defined as a change in position of an object with time. It is common to everything in the universe.
In the given figure, let P, Q and R represent the position of a car at different instants of time.



64. With reference to the given figure, the position coordinates of points P and R are
(a) $P \equiv (+360, 0, 0)$; $R = (-120, 0, 0)$ (b) $P \equiv (-360, 0, 0)$; $R = (+120, 0, 0)$
(c) $P \equiv (0, +360, 0)$; $R = (-120, 0, 0)$ (d) $P \equiv (0, 0, +360)$; R º (0, 0, -120)

65. Displacement of an object can be
(a) positive (b) negative (c) zero (d) All of the above

66. The displacement of a car in moving from O to P and its displacement in moving from P to Q are
(a) + 360m and -120m (b) -120m and + 360m
(c) + 360m and + 120m (d) + 360m and - 600m

67. If the car goes from O to P and returns back to O, the displacement of the journey is
(a) zero (b) 720 m (c) 420 m (d) 340 m

68. The path length of journey from O to P and back to O is
(a) 0 m (b) 720 m (c) 360 m (d) 480 m

Average Speed and Average Velocity

When an object is in motion, its position changes with time. So, the quantity that describes how fast is the position changing w.r.t. time and in what direction is given by average velocity.

It is defined as the change in position or displacement (Δx) divided by the time interval (Δt) in which that displacement occurs.
However, the quantity used to describe the rate of motion over the actual path, is average speed. It defined as the total distance travelled by the object divided by the total time taken.

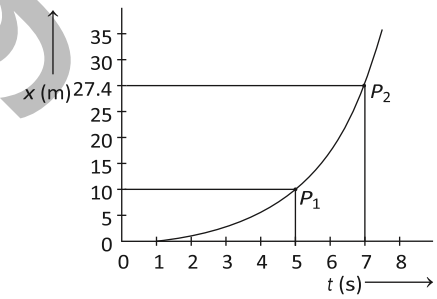
69. A 250 m long train is moving with a uniform velocity of 45 kmh^{-1}. The time taken by the train to cross a bridge of length 750 m is
(a) 56 s (b) 68 s (c) 80 s (d) 92 s

70. A truck requires 3 hr to complete a journey of 150 km. What is average speed?
(a) 50 km/h (b) 25 km/h (c) 15 km/h (d) 10 km/h

71. Average speed of a car between points A and B is 20 m/s, between B and C is 15 m/s and between C and D is 10 m/s. What is the average speed between A and D, if the time taken in the mentioned sections is 20s, 10s and 5s, respectively?
(a) 17.14 m/s (b) 15 m/s (c) 10 m/s (d) 45 m/s

72. A cyclist is moving on a circular track of radius 40 m completes half a revolution in 40 s. Its average velocity is
(a) zero (b) $2ms^{-1}$ (c) $4\pi\ ms^{-1}$ (d) $8\pi\ ms^{-1}$

73. In the following graph, average velocity is geometrically represented by
(a) length of the line $P_1 P_2$
(b) slope of the straight line $P_1 P_2$
(c) slope of the tangent to the curve at P_1
(d) slope of the tangent to the curve at P_2



Uniformly Accelerated Motion:
The velocity of an object, in general, changes during its course of motion. Initially, at the time of Galileo, it was thought that, this change could be described by the rate of change of velocity with distance. But, through his studies of motion of freely falling objects and motion of objects on an inclined plane, Galileo concluded that, the rate of change of velocity with time is a constant of motion for all objects in free fall.
This led to the concept of acceleration as the rate of change of velocity with time. The motion in which the acceleration remains constant is known as to be uniformly accelerated motion. There are certain equations which are used to relate the displacement (x), time taken (t), initial velocity (u), final velocity (v) and acceleration (a) for such a motion and are known as kinematics equations for uniformly accelerated motion.

74. The displacement of a body in 8 s starting from rest with an acceleration of 20 cms^{-2} is
(a) 64 m (b) 640 m (c) 64 cm (d) 0.064 m

75. A particle starts with a velocity of 2 $^{-1}$ ms - and moves in a straight line with a retardation of 01^{-2}. ms $^{-1}$. The first time at which the particle is 15 m from the starting point is
(a) 10s (b) 20s (c) 30s (d) 40s

76. If a body starts from rest and travels 120 cm in 6th second, then what is its acceleration?
(a) $0.20 ms^{-2}$ (b) $0.027 ms^{-2}$ (c) $0.218 ms^{-2}$ (d) $0.03 ms^{-2}$

77. An object starts from rest and moves with uniform acceleration *a*. The final velocity of the particle in terms of the distance *x* covered by it is given as
(a) $\sqrt{2ax}$ (b) $2ax$ (c) $\sqrt{\frac{ax}{2}}$ (d) $\sqrt{ax}$

78. A body travelling with uniform acceleration crosses two points *A* and *B* with velocities 20 ms^{-1} and 30 ms^{-1}, respectively. The speed of the body at mid-point of *A* and *B* is
(a) 25 ms^{-1} (b) 25.5 ms^{-1} (c) 24 ms^{-1} (d) $10\sqrt{6}$ ms^{-1}

MCQ

79. A boy starts from a point A, travels to a point B at a distance of 3 km from A and returns to A. If he takes two hours to do so, his speed is
(a) 3 km/h (b) zero (c) 2 km/h (d) 1.5 km/h

80. A body starts from rest and travels with uniform acceleration a to make a displacement of 6 m. If its velocity after making the displacement is 6 m/s, then its uniform acceleration a is
(a) 6 m/s^2 (b) 2 m/s^2 (c) 3 m/s^2 (d) 4 m/s^2

81. Which one of the following is the unit of acceleration?
(a) m/s (b) m/s^2 (c) km/hr (d) cm/s

82. The dimensional formula for speed is
(a) T^{-1} (b) LT^{-1} (c) $L^{-1}T^{-1}$ (d) $L^{-1}T$

83. A body starts from rest and travels for t second with uniform acceleration of 2 m/s^2. If the displacement made by it is 16 m, the time of travel t is
(a) 4 s (b) 3 s (c) 6 s (d) 8 s

84. The dimensional formula for acceleration is
(a) [LT2] (b) [LT?2] (c) [L2T] (d) [L2T2]

85. A body starts from rest and travels for five seconds to make a displacement of 25 m. If it has travelled the distance with uniform acceleration a then a is
(a) 3 m/s^2 (b) 4 m/s^2 (c) 2 m/s^2 (d) 1 m/s^2

86. A 180 metre long train is moving due north at a speed of 25 m/s. A small bird is flying due south, a little above the train, with a speed of 5 m/s. The time taken by the bird to cross the train is
(a) 10 s (b) 12 s (c) 9 s (d) 6 s

87. The dimensional formula for velocity is
(a) [LT] (b) $[LT^{-1}]$ (c) [L2T] (d) $[L^{-1}T]$

88. A body starts from rest and travels with an acceleration of 2 m/s^2. After t seconds its velocity is 10 m/s. Then t is
(a) 10 s (b) 5 s (c) 20 s (d) 6 s

89. A body starts from rest and travels with uniform acceleration of 2 m/s^2. If its velocity is v after making a displacement of 9 m, then v is
(a) 8 m/s (b) 6 m/s (c) 10 m/s (d) 4 m/s

90. Which one of the following is the unit of velocity?
(a) kilogram (b) metre (c) m/s (d) second

91. A boy moves on a circular distance of radius R. Starting from a point A he moves to a point B which is on the other end of the diameter AB. The ratio of the distance travelled to the displacement made by him is
(a) Π /2 (b) Π (c) 2 Π (d) 4 Π

92. A body starts from rest and travels with uniform acceleration on a straight line. If its velocity after making a displacement of 32 m is 8 m/s, its acceleration is
(a) 1 m/s^2 (b) 2 m/s^2 (c) 3 m/s^2 (d) 4 m/s^2

Answers

Multiple Choice Questions

1. (d) 2. (a) 3. (a) 4. (a) 5. (a) 6. (a) 7. (c) 8. (a) 9. (a) 10. (d)
11. (a) 12. (b) 13. (b) 14. (a) 15. (c) 16. (c) 17. (b) 18. (b) 19. (b) 20. (b)
21. (a) 22. (c) 23. (d) 24. (b) 25. (b) 26. (c) 27. (b) 28. (a) 29. (d) 30. (a)
31. (d) 32. (a) 33. (b) 34. (b) 35. (a) 36. (a) 37. (d) 38. (a) 39. (a) 40. (a)
41. (a) 42. (a) 43. (b) 44. (a) 45. (a) 46. (c) 47. (a) 48. (b) 49. (b)

Assertion-Reasoning MCQs

50. (a) 51. (b) 52. (b) 53. (d) 54. (c) 55. (d) 56. (d) 57. (a) 58. (a) 59. (d)
60. (b) 61. (c) 62. (c) 63. (b)

Case Based MCQs

64. (a) 65. (d) 66. (a) 67. (a) 68. (b) 69. (c) 70. (a) 71. (a) 72. (b) 73. (b)
74. (c) 75. (a) 76. (c) 77. (a) 78. (b)

MCQ

79. (a) 80. (c) 81. (b) 82. (b) 83. (b) 84. (b) 85. (c) 86. (d) 87. (b) 88. (b)
89. (b) 90. (c) 91. (a) 92. (a)