2 Motion in a Straight Line

Conceptual MCQs

1. Which of the following is a 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

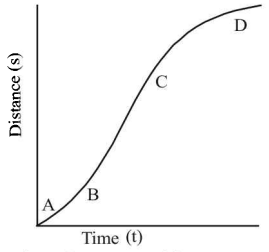
2. An athlete completes one round of a circular track of radius R in 40 sec. What will be his displacement at the end of 2 min. 20 sec?
(a) Zero (b) 2R (c) $2\pi R$ (d) $7\pi R$

3. A particle moves along a semicircle of radius 10m in 5 seconds. The average velocity of the particle is
(a) $2\pi\ ms^{-1}$ (b) $4\pi\ ms^{-1}$
(c) $2\ ms^{-1}$ (d) $4\ ms^{-1}$

4. The numerical ratio of average velocity to average speed is
(a) always less than one (b) always equal to one
(c) always more than one (d) equal to or less than one

5. A car travels half the distance with constant velocity of 40 kmph and the remaining half with a constant velocity of 60 kmph. The average velocity of the car (in kmph) is
(a) 40 (b) 45 (c) 48 (d) 50

6. A particle shows distance - time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point:

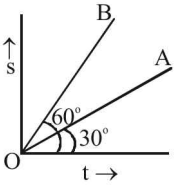


(a) B (b) C (c) D (d) A

7. A body moves from rest with a constant acceleration of 5 m/s^2. Its instantaneous speed (in m/s) at the end of 10 sec is
(a) 50 (b) 5 (c) 2 (d) 0.5

8. If a particle moves with an acceleration, then which of the following can remain constant?
(a) Both speed and velocity
(b) Neither speed nor velocity
(c) Only the velocity
(d) Only the speed

9. The displacement-time graph for two particles A and B are straight lines inclined at angles of 30^o and 60^o respectively with the time axis. The velocity ratio $V_A : V_B$ is

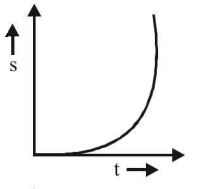


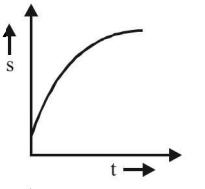
(a) 1 : 2 (b) $1 : \sqrt{3}$ (c) $\sqrt{3} : 1$ (d) 1 : 3

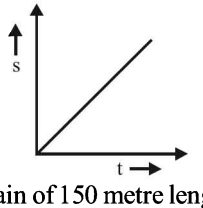
10. A motor car moving with a uniform speed of 20 m/sec comes to stop on the application of brakes after travelling a distance of 10 m, its acceleration is
(a) $20\ m/s^2$ (b) $-20\ m/s^2$
(c) $-40\ m/s^2$ (d) $+2m/s^2$

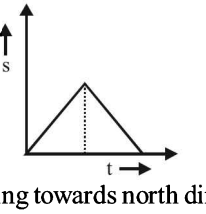
11. A stone falls from a balloon that is descending at a uniform rate of 12 m/s. The displacement of the stone from the point of release after 10 sec is
(a) 490m (b) 510m (c) 610m (d) 725m

12. Which of the following graphs represents the uniform acceleration?

(a) 

(b) 

(c) 

(d) 

13. A train of 150 metre length is going towards north direction at a speed of 10 m/s . A parrot flies at the speed of 5 m/s towards south direction parallel to the railway track. The time taken by the parrot to cross the train is
(a) 12 sec (b) 8 sec (c) 15 sec (d) 10 sec

14. A ball is released from the top of a tower of height h metre. It takes T seconds to reach the ground. What is the position of the ball at $\frac{T}{3}$ second from the ground ?

(a) $\frac{8h}{9}$ m (b) $\frac{7h}{9}$ m (c) $\frac{h}{9}$ m (d) $\frac{17h}{18}$ m

15. A body travels for 15 sec starting from rest with constant acceleration. If it travels distance S_1, S_2 and S_3 in the first five seconds, second five seconds and next five seconds respectively then the relation between S_1, S_2 and S_3 is

(a) $S_1 = S_2 = S_3$ (b) $5S_1 = 3S_2 = S_3$

(c) $S_1 = \frac{1}{3}S_2 = \frac{1}{5}S_3$ (d) $S_1 = \frac{1}{5}S_2 = \frac{1}{3}S_3$

Application Based MCQs

16. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If the total time elapsed is t, then the maximum velocity acquired by the car is

(a) $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$ (b) $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$

(c) $\frac{(\alpha+\beta)t}{\alpha\beta}$ (d) $\frac{\alpha\beta t}{\alpha+\beta}$

17. A car moving with a speed of 40 km/h can be stopped by applying brakes at least after 2 m. If the same car is moving with a speed of 80 km/h, what is the minimum stopping distance?

(a) 8m (b) 6m (c) 4m (d) 2m

18. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in t second. The value of t is

(a) 12 s (b) 9 s (c) 10 s (d) 1.8 s

19. A particle travels 10m in first 5 sec and 10m in next 3 sec. Assuming constant acceleration, what is the distance travelled in next 2 sec?

(a) 8.3m (b) 9.3m

(c) 10.3m (d) None of these

20. A man is 45 m behind the bus when the bus starts accelerating from rest with acceleration 2.5 m/s^2. With what minimum velocity should the man start running to catch the bus?

(a) 12 m/s (b) 14 m/s (c) 15 m/s (d) 16 m/s

21. A body moving with a uniform acceleration crosses a distance of 65 m in the 5 th second and 105 m in 9th second. How far will it go in 20 s?

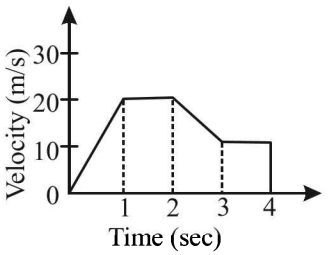
(a) 2040m (b) 240m (c) 2400m (d) 2004m

22. A particle moves along a straight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4$ metre. The velocity when the acceleration is zero is

(a) 3 ms^{-1} (b) -12 ms^{-1}

(c) 42 ms^{-1} (d) -9 ms^{-1}

23. The variation of velocity of a particle with time moving along a straight line is illustrated in the figure. The distance travelled by the particle in four seconds is



(a) 60m

(b) 55m

(c) 25m

(d) 30m

24. In a straight line motion, the distance covered is proportional to the square root of the time taken. Then the acceleration of the particle is proportional to

(a) $\sqrt{v}$ (b) v (c) v^2 (d) v^3

25. A ball is dropped from a high rise platform at t = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18s. What is the value of v (take g = 10 m/s^2)

(a) 60 m/s (b) 75 m/s (c) 55 m/s (d) 40 m/s

26. If a freely falling body travels in the last second a distance equal to the distance travelled by it in the first three second, the time of the travel is

(a) 6 sec (b) 5 sec (c) 4 sec (d) 3 sec

27. Three different objects of masses m_1, m_2 and m_3 are allowed to fall from rest from the same point along three different frictionless paths. The speeds of the three objects on reaching the ground will be in the ratio of

(a) $m_1 : m_2 : m_3$ (b) $m_1 : 2m_2 : 3m_3$

(c) 1:1:1 (d) $\frac{1}{m_1} : \frac{1}{m_2} : \frac{1}{m_3}$

28. The water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at an instant when the first drop touches the ground. How far above the ground is the second drop at that instant ? (Take g = 10 m/s^2)

(a) 1.25m (b) 2.50m (c) 3.75m (d) 5.00m

29. A man throws balls with the same speed vertically upwards one after the other at an interval of 2 seconds. What should be the speed of the throw so that more than two balls are in the sky at any time? [Given g = 9.8 m/s^2]

(a) Only with speed 19.6 m/s

(b) More than 19.6 m/s

(c) At least 9.8 m/s

(d) Any speed less than 19.6 m/s

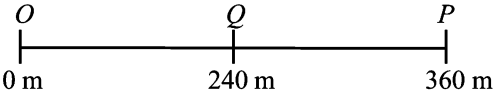
30. A particle is thrown vertically upwards. If its velocity at half of the maximum height is 10 m/s, then maximum height attained by it is (take g = 10 m/s^2)

(a) 8 m (b) 10 m (c) 12 m (d) 16 m

31. Two cars A and B are moving with same speed of 45 *km/h* along same direction. If a third car C coming from the opposite direction with a speed of 36 *km/hr* meets two cars in an interval of 5 minutes, the distance of separation of two cars A and B should be (in *km*)

(a) 6.75 (b) 7.25 (c) 5.55 (d) 8.35

32. A car is moving along a straight line *OP* as shown in the figure. It moves from *O* to *P* in 18 s and returns from *P* to *Q* in 6 s. Which of the following statements is not correct regarding the motion of the car ?



(a) The average speed of the car in going from *O* to *P* and come back to *Q* is 20 m s^{-1}.

(b) The average velocity of the car is going from *O* to *P* and come back to *Q* is 10 m s^{-1}.

(c) The average speed of the car in going from *O* to *P* and come back to *O* is 20 m s^{-1}.

(d) The average velocity of the car in going from *O* to *P* and come back to *O* is 20 m s^{-1}.

33. A person throws balls into air vertically upward in regular intervals of time of one second. The next ball is thrown when the velocity of the ball thrown earlier becomes zero. The height to which the balls rise is

(Assume, g = 10 ms^{-2})

(a) 5m (b) 50m (c) 7.5m (d) 20m

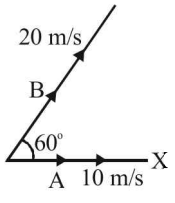
34. Particle A moves along X-axis with a uniform velocity of magnitude 10 m/s. Particle B moves with uniform velocity 20 m/s along a direction making an angle of 60° with the positive direction of X-axis as shown in figure. The relative velocity of B with respect to that of A is

(a) 10 m/s along X-axis

(b) $10\sqrt{3}$ m/s along Y-axis (perpendicular to X-axis)

(c) $10\sqrt{5}$ along the bisection of the velocity of A and B

(d) 30 m/s along negative x-axis.



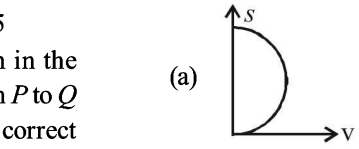
35. A man throws a ball downwards from the roof of a tower of height 400 meters. At the same time another ball is thrown upwards with velocity of 50 meter/sec from the surface of the tower, then at which height from the surface of the tower they will meet?

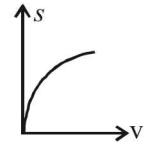
(a) 100m (b) 320m (c) 80m (d) 240m

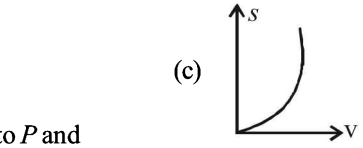
36. If a car covers 2/5th of the total distance with v_1 speed and 3/5th distance with v_2 then average speed is

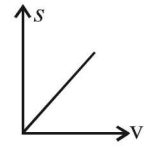
(a) $\frac{1}{2}\sqrt{v_1 v_2}$ (b) $\frac{v_1+v_2}{2}$ (c) $\frac{2v_1v_2}{v_1+v_2}$ (d) $\frac{5v_1v_2}{3v_1+2v_2}$

37. An object is moving with a uniform acceleration which is parallel to its instantaneous direction of motion. The displacement(s) – velocity (v) graph of this object is

(a) 

(b) 

(c) 

(d) 

38. A car *A* is travelling on a straight level road with a uniform speed of 60 km/h. It is followed by another car *B* which is moving with a speed of 70 km/h. When the distance between them is 2.5 km, the car *E* is given a deceleration of 20 km/h^2. After how much time will *B* catch up with A?

(a) 1 hr (b) 1/2 hr (c) 1/4 hr (d) 1/8 hr

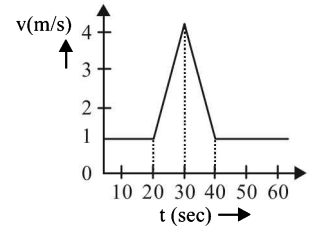
39. Velocity-time (v-t) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is

(a) 60m

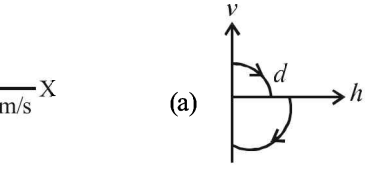
(b) 50m

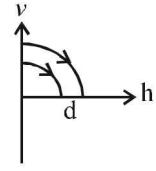
(c) 30m

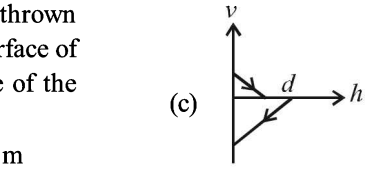
(d) 40m

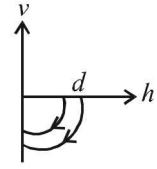


40. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height *d*/2. Neglecting subsequent motion and air resistance, its velocity *v* varies with the height *h* above the ground as

(a) 

(b) 

(c) 

(d) 

Skill Based MCQs

41. A ball is dropped from a bridge at a height of 176.4 m over a river. After 2 sec, a second ball is thrown straight downwards. What should be the initial velocity of the second ball so that both hit the water simultaneously?
(a) 2.45 m/s (b) 49 m/s (c) 14.5 m/s (d) 24.5 m/s

42. A car starts from rest and moves with uniform acceleration a on a straight road from time t = 0 to t = T. After that, a constant deceleration brings it to rest. In this process the average speed of the car is
(a) $\frac{aT}{4}$ (b) $\frac{3aT}{2}$ (c) $\frac{aT}{2}$ (d) aT

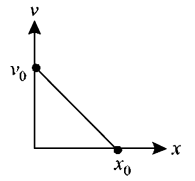
43. A particle starts from point A moves along a straight line path with an acceleration given by $a = p - qx$ where p, q are constants and x is distance from point A. The particle stops at point B. The maximum velocity of the particle is
(a) $\frac{p}{q}$ (b) $\frac{p}{\sqrt{q}}$ (c) $\frac{q}{p}$ (d) $\frac{\sqrt{q}}{p}$

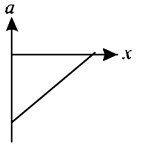
44. The motion of a body is given by the equation $\frac{dv}{dt} = 6 - 3v$ where v is the speed in m s^{-1} and t is time in s. The body is at rest at t = 0. The speed varies with time as
(a) $v = (1 - e^{-3t})$ (b) $v = 2(1 - e^{-3t})$
(c) $v = (1 + e^{-2t})$ (d) $v = 2(1 + e^{-2t})$

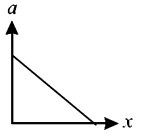
45. A particle moves rectilinearly. Its displacement x at time t is given by $x^2 = at^2 + b$ where a and b are constants. Its acceleration at time t is proportional to
(a) $\frac{1}{x^3}$ (b) $\frac{1}{x} - \frac{1}{x^2}$ (c) $-\frac{1}{x^2}$ (d) $\frac{1}{x} - \frac{t^2}{x^3}$

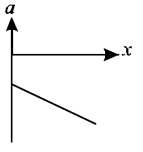
46. A car, starting from rest, accelerates at the rate f through a distance S, then continues at constant speed for time t and then decelerates at the rate $\frac{f}{2}$ to come to rest. If the total distance traversed is 15 S, then
(a) $S = \frac{1}{6}ft^2$ (b) $S = ft$
(c) $S = \frac{1}{4}ft^2$ (d) $S = \frac{1}{72}ft^2$

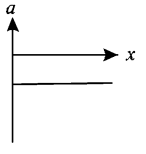
47. The velocity-displacement graph of a particle moving along a straight line is shown as follows



The most suitable acceleration-displacement graph will be
(a) 

(b) 

(c) 

(d) 

48. A stone dropped from a balloon which is at a height h, reaches the ground after t seconds. From the same balloon, if two stones are thrown, one upwards and the other downwards, with the same velocity u and they reach the ground after t_1 and t_2 seconds respectively, then
(a) $t = t_1 - t_2$ (b) $t = \frac{t_1 + t_2}{2}$
(c) $t = \sqrt{t_1 t_2}$ (d) $t = \sqrt{t_1^2 - t_2^2}$

49. A point moves in a straight line under the retardation av^2. If the initial velocity is u, the distance covered in t second is
(a) aut (b) $(1/a)\ln(aut)$
(c) $(1/a)\ln(1 + aut)$ (d) $a\ln(aut)$

50. Two cars P and Q start from a point at the same time in a straight line and their positions are represented by $x_P(t) = at + bt^2$ and $x_Q(t) = ft - t^2$. At what time do the cars have the same velocity?
(a) $\frac{f - a}{2(1 + b)}$ (b) $\frac{a - 1}{1 + b}$
(c) $\frac{a + 1}{2(b - 1)}$ (d) $\frac{a + f}{2(1 + b)}$

ANSWER KEY

Conceptual MCQs																		
1	(d)	**3**	(d)	**5**	(c)	**7**	(a)	**9**	(d)	**11**	(c)	**13**	(d)	**15**	(c)			
2	(b)	**4**	(d)	**6**	(b)	**8**	(d)	**10**	(b)	**12**	(a)	**14**	(a)					
Application Based MCQs																		
16	(d)	**19**	(a)	**22**	(d)	**25**	(b)	**28**	(c)	**31**	(a)	**34**	(b)	**37**	(b)	**40**	(a)	
17	(a)	**20**	(c)	**23**	(b)	**26**	(b)	**29**	(b)	**32**	(d)	**35**	(c)	**38**	(b)			
18	(b)	**21**	(c)	**24**	(d)	**27**	(c)	**30**	(b)	**33**	(a)	**36**	(d)	**39**	(b)			
Skill Based MCQs																		
41	(d)	**42**	(c)	**43**	(b)	**44**	(b)	**45**	(a)	**46**	(d)	**47**	(a)	**48**	(c)	**49**	(c)	**50**	(a)