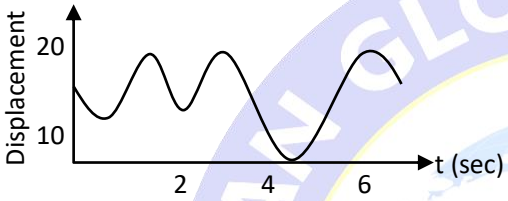
Chapter 03

Kinematics

NEET-RANKER'S STUFF

SINGLE CORRECT QUESTIONS

Q.1 Figure shows the position of a particle moving on the x-axis as a function of time



(1) The particle has come to rest 6 times
(2) The maximum speed is at t = 6 sec
(3) The velocity remains positive for t = 0 to t = 6 sec
(4) The average velocity for the total period show in negative

Q.2 A car starts from rest and has an acceleration a = t m/s^2. A truck is moving with a uniform velocity of 6 m/s. At what distance will the car overtake the truck? (at t = 0 both start their motion in the same direction from the same position)
(1) 36 m (2) 8 m (3) 32 m (4) 4 m

Q.3 Between two stations a train accelerates uniformly at first, then moves with constant speed and finally retards uniformly to come to rest. If the ratios of time taken are 1 : 8 : 1 and the greatest speed is 60 km/hour. Then the average speed over the whole journey
(1) 45 km/hr (2) 54 km/hr
(3) 35 km/hr (4) 53 km/hr

Q.4 A ball is thrown vertically upwards with a velocity of 30 m/s. If the acceleration due to gravity is 10 m/s^2, what will be the distance travelled by it in the last second of motion before again come to his hand?
(1) 5 m (2) 10 m (3) 25 m (4) 30 m

Q.5 Two balls are dropped from different heights. One ball is dropped 2 sec after the other but they both strike the ground at the same time, 3 sec after the first is dropped. The difference in the heights at which they were dropped is (g = 9.8 m/s^2)
(1) 7.8 m (2) 78 m (3) 15.6 m (4) 39.2 m

Q.6 Two bodies are thrown vertically upward, with the same initial velocity of 98 m/s but 4 sec apart. How long after the first one is thrown when they meet? (g = 9.8 m/s^2)
(1) 10 sec (2) 11 sec (3) 12 sec (4) 13 sec

Q.7 Two balls are dropped from the same point after an interval of 1 s. If acceleration due to gravity is 10 m/s^2, what will be the separation 3 seconds after the release of first ball?
(1) 5 m (2) 10 m (3) 25 m (4) 30 m

Q.8 Juggler keeps on moving four balls in the air continuously such that each ball attains 20m height. When the first ball leaves his hand, the position of the other balls (in metre height) will be
(1) 10, 20, 10 (2) 15, 20, 15
(3) 5, 51, 20 (4) 5, 10, 20

Q.9 A particle moves with constant speed v along a regular hexagon ABCDEF in same order (ie., A to B, B to C, C to D, D to E, E to F, F to A....) Then magnitude of average velocity for its motion from A to C
(1) V (2) V/2
(3) $\sqrt{3}V/2$ (4) None of these

Q.10 A ball is dropped from a height of 20 m and rebounds with a velocity which is 3/4th of the velocity with which it hits the ground. What is the time interval between the first and second bounces (g = 10 m/s^2)
(1) 3 sec (2) 4 sec (3) 5 sec (4) 6 sec

Q.11 A hall has the dimensions 10 m × 10 m × 10 m. A fly starting at one corner ends up at a diagonally opposite corner. The magnitude of its displacement is nearly

(1) $5\sqrt{3}$ m (2) $10\sqrt{2}$ m

(3) $20\sqrt{3}$ m (4) $30\sqrt{3}$ m

Q.12 A car runs at constant speed on a circular track of radius 100 m taking 62.8 s on each lap. What is the average speed and average velocity on each complete lap?

(1) velocity 10m/s, speed 10 m/s

(2) velocity zero, speed 10 m/s

(3) velocity zero, speed zero

(4) velocity 10 m/s, speed zero

Q.13 Mark the correct statements:

(1) The magnitude of the instantaneous velocity of a particle is equal to its instantaneous speed.

(2) The magnitude of average velocity in an interval is equal to its average speed in that interval.

(3) It is possible to have a situation in which the speed of a particle is always zero but the average speed is not zero

(4) It is possible to have a situation in which the speed of the particle is never zero but the average speed in an interval is zero.

Q.14 A particle is thrown upwards from ground. It experiences a constant air resistance which can produce a retardation of 2 m/s^2 opposite to the direction of velocity of particle. The ratio of time of ascent to the time of descent is:

[g = 10 m/s^2]

(1) 1: 1 (2) $\sqrt{\frac{2}{3}}$ (3) $\frac{2}{3}$ (4) $\sqrt{\frac{3}{2}}$

Q.15 A truck travelling due to North at 20 m/s turns East and travels at the same speed. The change in its velocity is

(1) $20\sqrt{2}$ m/s North-East

(2) $20\sqrt{2}\,m/s\,South-East$

(3) $40\sqrt{2}\,m/s\,North-East$

(4) $20\sqrt{2}\,m/s\,North-West\ s$

Q.16 If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

(1) 1 cm (2) 2 cm (3) 3 cm (D) 4 cm

Q.17 From a building two balls A and B are thrown such that A is thrown upwards and B downwards (both vertically with same speed). If V_A and V_B are their respective velocities on reaching the ground, then

(1) $v_B > v_A$

(2) $v_A = v_B$

(3) $v_A > v_B$

(4) Their velocities depends on their masses

Q.18 The coordinates of a moving particle at any time t are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time t is given by :

(1) $\sqrt{\alpha^2+\beta^2}$ (2) $3t^2\sqrt{\alpha^2+\beta^2}$

(3) $t^2\sqrt{\alpha^2+\beta^2}$ (4) $\sqrt{\alpha^2+\beta^2}$

Q.19 The relation between time t and distance x is $t = ax^2 + bx$, where a and b are constants. The acceleration is :

(1) $-2abv^2$ (2) $2bv^2$ (3) $-2av^3$ (4) $2av^3$

Q.20 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 travelled is 15 S, then :

(1) S = ft (2) S = $\frac{1}{6}$ ft^2

(3) S = $\frac{1}{72}$ ft^2 (4) S = $\frac{1}{4}$ ft^2

Q.21 A particle is moving eastwards with a velocity of 5 ms^{-1}. In 10 second the velocity changes to 5 ms^{-1} northwards. The average acceleration in this time is :

(1) $\frac{1}{\sqrt{2}}$ ms^{-2} towards north-west

(2) $\frac{1}{2}$ ms^{-2} towards north

(3) zero

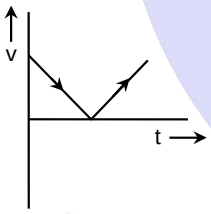
(4) $\frac{1}{2}$ ms^{-2} towards north-west.

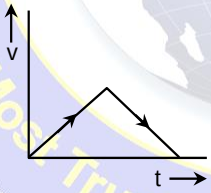
Q.22 A particle located at x = 0 at time t = 0, starts moving along the positive x-direction with a velocity v that varies as $v = \alpha\sqrt{x}$. The displacement of the particle varies with time as
(1) $t^{1/2}$ (2) t^3 (3) t^2 (4) t

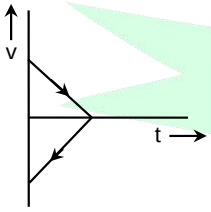
Q.23 The velocity of a particle is $v = v_0 + gt + ft^2$. If its position is x = 0 at t = 0, then its displacement after unit time (t = 1) is
(1) $v_0 + 2g + 3f$ (2) $v_0 + \frac{g}{2} + \frac{f}{3}$
(3) $v_0 + g + f$ (4) $v_0 + \frac{g}{2} + f$

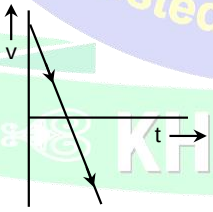
Q.24 From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is a n times that taken by it to reach the highest point of its path. The relation between H, u and n is :
(1) $2gH = n^2u^2$ (2) $gH = (n-2)^2u^2$
(3) $2gH = nu^2(n-2)$ (4) $gH = (n-2)u^2$

Q.25 A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity vs time ?

(1) 

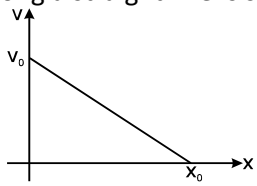
(2) 

(3) 

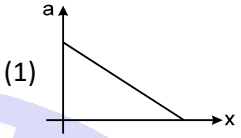
(4) 

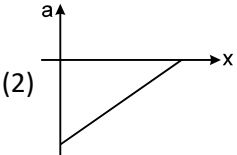
Q.26 A block is moving down a smooth inclined plane starting from rest at time t = 0. Let S_n be the distance travelled by the block in the interval t = n – 1 to t = n. The ratio $\frac{S_n}{S_{n+1}}$ is
(1) $\frac{2n-1}{2n}$ (2) $\frac{2n-1}{2n+1}$
(3) $\frac{2n+1}{2n-1}$ (4) $\frac{2n}{2n-1}$

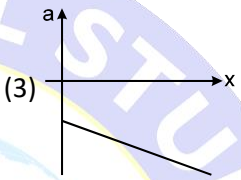
Q.27 The velocity displacement graph of a particle moving along a straight line is shown.

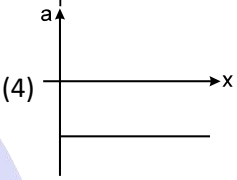


The most suitable acceleration-displacement graph will be

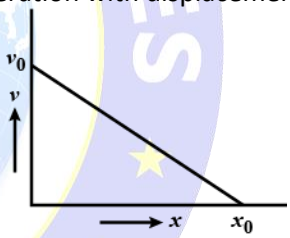
(1) 

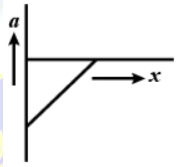
(2) 

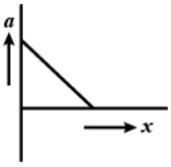
(3) 

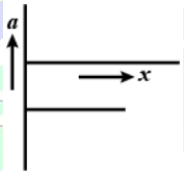
(4) 

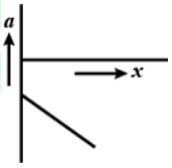
Q.28 The given graph shows the variation of velocity with displacement. Which one of the graph given below correctly represents the variation of acceleration with displacement?



(1) 

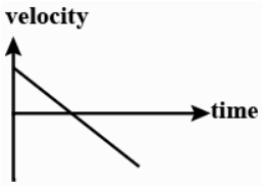
(2) 

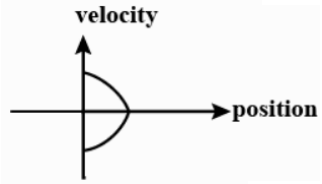
(3) 

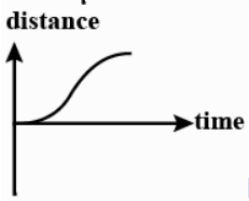
(4) 

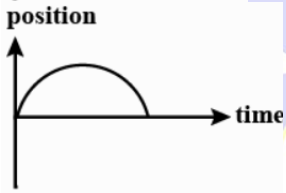
Q.29 A projectile is given an initial velocity of (i + 2j) m/s, where, i is along the ground and j is along the vertical. If $g = 10 m/s^2$, then the equation of its trajectory is
(1) $y = x - 5x^2$ (2) $y = 2x - 5x^2$
(3) $4y = 2x - 5x^2$ (4) $4y = 2x - 25x^2$

Q.30 All the graph below are intended to represented the same motion. One of them does it incorrectly. Pick it up.

(1) 

(2) 

(3) 

(4) 

Q.31 A particle is moving with speed $v = b\sqrt{x}$ along positive x-axis. Calculate the speed of the particle at time t = τ (assume that the particle is at origin at t = 0).

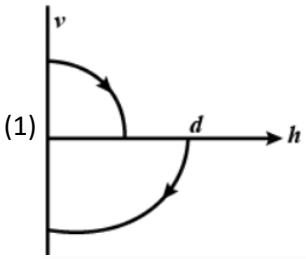
(1) $\frac{b^2\tau}{4}$ (2) $\frac{b^2\tau}{2}$ (3) $b^2\tau$ (4) $\frac{b^2\tau}{\sqrt{2}}$

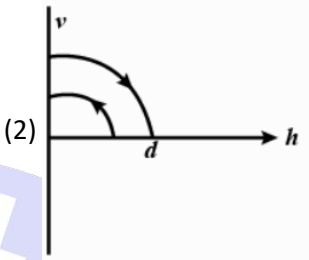
Q.32 A particle is projected at an angle of 60° above the horizontal with a speed of 10 m/s. after some time the direction of its velocity makes an angle of 30° above the horizontal. The speed of the particle at this instant is

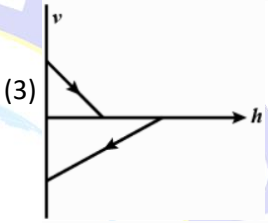
(1) $\frac{5}{\sqrt{3}}$ m/s (2) $5\sqrt{3}$ m/s

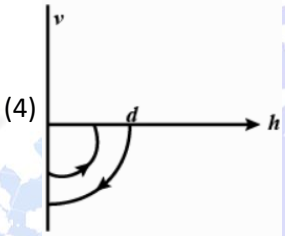
(3) 5 m/s (4) $\frac{10}{\sqrt{3}}$ m/s

Q.33 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 height h above the ground as

(1) 

(2) 

(3) 

(4) 

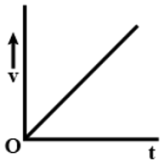
Q.34 A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60° with ground level. But he finds the aeroplane right vertically above his position. If v is the speed of sound, the speed of the plane is

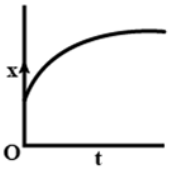
(1) $\frac{\sqrt{3}}{2}$v (2) v (3) $\frac{2v}{\sqrt{3}}$ (4) $\frac{v}{2}$

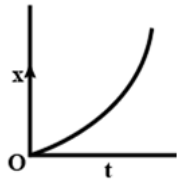
Q.35 A particle starts from origin O from rest and moves with a uniform acceleration along the positive X-axis. Identify all figures that correctly represent the motion qualitatively.

(a = acceleration, v = velocity, x = displacement, t = time)

(A) 

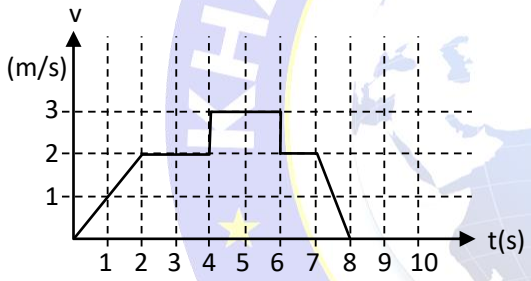
(B) 

(C) 

(D) 

(1) A (2) A, B, C (3) B, C (4) A, B, D

Q.36 A particle starts from the origin at time t = 0 and moves along the positive X-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time t = 5 s?



(1) 6 m (2) 3 m (3) 10 m (4) 9 m

Q.37 The trajectory of a projectile near the surface of the earth is given as $y = 2x - 9x^2$.
If it were launched at angel θ_0 with speed v_0, then (Take, g = 10 ms^{-2})

(1) $\theta_0 = \sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$ & $v_0 = \frac{5}{3} ms^{-1}$

(2) $\theta_0 = \cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ & $v_0 = \frac{3}{5} ms^{-1}$

(3) $\theta_0 = \cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$ & $v_0 = \frac{5}{3} ms^{-1}$

(4) $\theta_0 = \sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$ & $v_0 = \frac{3}{5} ms^{-1}$

Q.38 In three dimensional system, the position coordinates of a particle (in motion) are given below

$x = a \cos \omega t$

$y = a \sin \omega t$

$z = a\omega t$

The velocity of particle will be

(1) $\sqrt{2}\, a\omega$ (2) $2a\omega$ (3) $a\omega$ (4) $\sqrt{3}\, a\omega$

Q.39 A particle is moving with a velocity with a velocity $v = k(y\hat{i} + x\hat{j})$, where k is a constant.
The general equation for its path is

(1) $y = x^2$ + constant (2) $y^2 = x$ + constant
(3) xy = constant (4) $y^2 = x^2$ + constant

Q.40 A person who aims to reach the exact opposite point on the bank of a stream swims at a speed of 0.5 m/s at an angle of 120° following the direction of the water flow. What is the speed of water in the stream?

(1) 1 m/s (2) 0.25 m/s
(3) 0.5 m/s (4) 0.433 m/s

Q.41 A deer being preyed upon by the lion runs at a speed of 9 m/s. The lion chases the deer running at a speed of 10 m/s. If the instantaneous separation of deer from the lion is 100 m. How long would it take the lion to catch the deer?

(1) 1 second (2) 19 seconds
(3) 90 seconds (4) 100 seconds

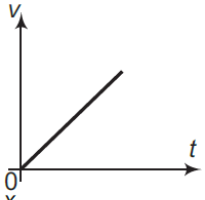
Q.42 A man travelling in a bus moves from west to east with a speed of 40 km/hr. He observes that the raindrops are falling vertically down. To another man standing on the ground, the rain will appear

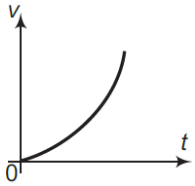
(1) To be falling vertically down
(2) To be falling at an angle going from east to west
(3) To be falling at an angle going from west to east
(4) Insufficient information is given to determine the direction of the rain

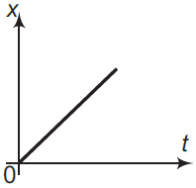
Q.43 An object moves with constant acceleration a. Which of the following expressions are also constant?

(1) $\frac{d|v|}{dt}$ (2) $\left|\frac{dv}{dt}\right|$ (3) $\frac{d(v)^2}{dt}$ (4) None of these

Q.44 Identify the correct graph representing the motion of a particle along a straight line with constant acceleration with zero initial velocity.

(1) 

(2) 

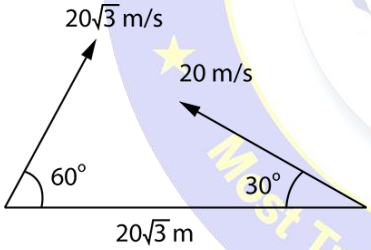
(3) 

(4) None of these

Q.45 A projectile is projected with speed u at an angle of 60° with horizontal from the foot of an inclined plane. If the projectile hits the inclined plane horizontally, the range on inclined plane will be

(1) $\frac{u^2\sqrt{21}}{2g}$ (2) $\frac{3u^2}{4g}$ (3) $\frac{u^2}{2\beta}$ (4) $\frac{\sqrt{21}u^2}{8g}$

Q.46 In the figure shown, the two projectiles are fired simultaneously. The minimum distance between them during their flight is



(1) 20 m (2) 10 $\sqrt{3}$ m
(3) 10 m (4) None of the above

Q.47 A swimmer crosses a flowing stream of width d to and fro in time t_1. The time taken to cover the same distance up and down the stream is t_2. Then the time the swimmer would take to swim a distance 2d in still water is –

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

ASSERTION REASON

Directions Choose the correct option.

(A) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

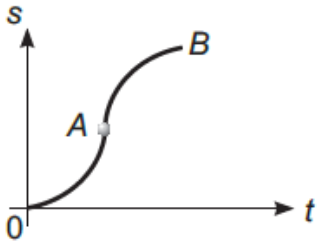
(B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(C) If Assertion is true, but the Reason is false.

(D) If Assertion is false but the Reason is true.

Q.48 **Assertion:** In displacement-time graph of a particle as shown in figure, velocity of particle changes its direction at point A.

Reason: Sign of slope of s-t graph decides the direction of velocity.



(1) A (2) B (3) C (4) D

Q.49 **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, the direction of acceleration vector also changes.

(1) A (2) B (3) C (4) D

Q.50 **Assertion:** We know the relation $a = v\frac{dv}{ds}$

Therefore, if velocity of a particle is zero, then acceleration is also zero.

Reason: In the above equation, a is the instantaneous acceleration.

(1) A (2) B (3) C (4) D

Q.51 **Assertion:** Speed of a particle may decrease, even if acceleration is increasing.

Reason: This will happen if acceleration is positive.

(1) A (2) B (3) C (4) D

Q.52 **Assertion:** A body may be accelerated even when it is moving uniformly.

Reason: When direction of motion of the body is changing, the body must have acceleration.

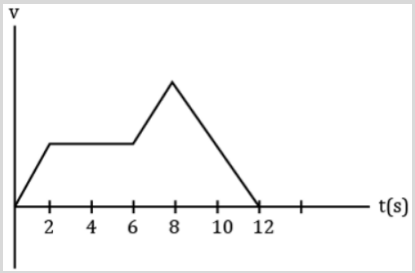
(1) A (2) B (3) C (4) D

Q.53 **Assertion:** The position-time graph of a uniform motion, in one dimension of a body cannot have negative slope.
Reason: In one – dimensional motion the position does not reverse, so it cannot have a negative slope.
(1) A (2) B (3) C (4) D

Q.54 **Assertion:** Two particles of different mass, projected with same velocity at same angles. The maximum height attained by both the particle will be same.
Reason: The maximum height of projectile is independent of particle mass.
(1) A (2) B (3) C (4) D

Q.55 **Assertion:** Two balls of different masses are thrown vertically upward with same speed. They will pass through their point of projection in the downward direction with the same speed.
Reason: The maximum height and downward velocity attained at the point of projection are independent of the mass of the ball.
(1) A (2) B (3) C (4) D

Q.56 **Assertion:** A body is moving along a straight line such that its velocity varies with time as shown in figure. Magnitude of displacement of the body from t = 10 to t = 12 s is the same as the distance travelled by it in the given time duration.



Reason: For unidirectional motion of a body, |displacement|=distance.
(1) A (2) B (3) C (4) D

Q.57 **Assertion:** In projectile motion, the angle between the instantaneous velocity and acceleration at the highest point is 180°.
Reason: At the highest point, velocity of projectile will be in horizontal direction only.
(1) A (2) B (3) C (4) D

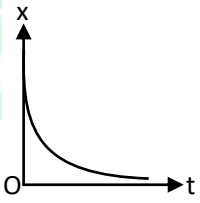
Q.58 **Assertion:** A particle has constant acceleration is x -y plane. But neither of its acceleration components (a_x and a_y) is zero. Under this condition particle cannot have parabolic path.
Reason: In projectile motion, horizontal component of acceleration is zero.
(1) A (2) B (3) C (4) D

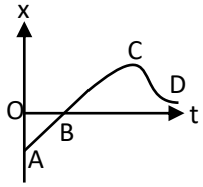
Q.59 **Assertion:** In projectile motion at any two positions $\frac{v_2 - v_1}{t_2 - t_1}$ always remains constant.
Reason: The given quantity is average acceleration, which should remain constant as acceleration is constant.
(1) A (2) B (3) C (4) D

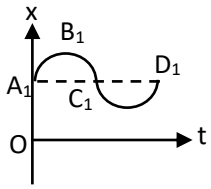
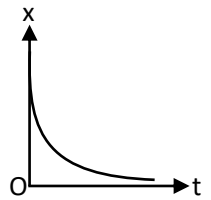
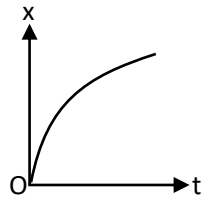
Q.60 **Assertion:** If g = 10 ms^2 then in projectile motion speed of particle in every second will change by 10 ms^{-1}.
Reason: Acceleration is nothing but rate of change of velocity.
(1) A (2) B (3) C (4) D

MATCH THE COLUMN TYPE QUESTIONS

Q.61 Refer to the graph in figure, match the following



Column - I		Column - II	
(A)		(p)	Has v > 0 and a > 0 thorughout

(B)		(q)	Has x > 0 throughout and has a point with v = 0 and appoint with a = 0
(C)		(r)	Has a point with zero displacement for t > 0
(D)		(s)	Has v > 0 and a > 0

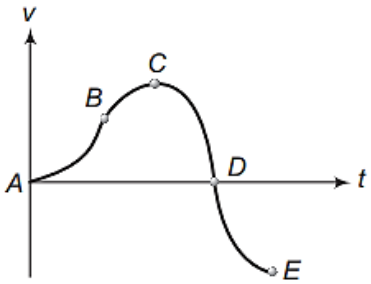
(1) (A→r),(B→q), (C→s), (D→p)

(2) (A→p),(B→q), (C→s), (D→r)

(3) (A→r),(B→s), (C→q), (D→p)

(4) (A→p),(B→q), (C→r), (D→s)

Q.62 The velocity-time graph of a particle moving along X-axis is shown in figure. Match the entries of Column I with the entries of Column II.



Column - I		Column - II	
(A)	For AB, particle is	**(p)**	Moving in +ve X-direction with increasing speed
(B)	For BC, particle is	**(q)**	Moving in +ve X-direction with decreasing speed
(C)	For CD, particle is	**(r)**	Moving in −ve X-direction with increasing speed
(D)	For DE, particle is	**(s)**	Moving in −ve X-direction with decreasing speed

(1) (A→r),(B→q), (C→s), (D→p)

(2) (A→p),(B→p), (C→q), (D→r)

(3) (A→r),(B→s), (C→q), (D→p)

(4) (A→q),(B→q), (C→r), (D→s)

Q.63 A particle is moving along x-axis. Its x-coordinate varies with time as:

$x^2 = -20 + 5t^2$

For the given equation match the following two columns:

Column - I		Column - II	
(A)	Particle will cross the origin at	(p)	Zero second
(B)	At what time velocity and acceleration are equal	(q)	1 s
(C)	At what time particle changes its direction of motion	(r)	2 s
(D)	At what time velocity is zero	(s)	None of the above

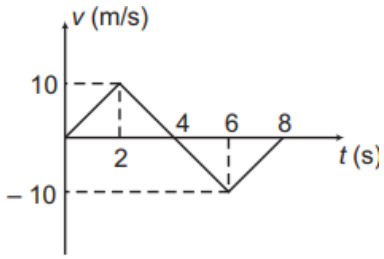
(1) (A→p),(B→q), (C→r), (D→p)

(2) (A→p),(B→q), (C→s), (D→r)

(3) (A→r),(B→s), (C→q), (D→p)

(4) (A→r),(B→q), (C→s), (D→p)

Q.64 Corresponding to velocity-time graph in one dimensional motion of a particle as shown in figure, match the following two columns.



Column - I		Column - II	
(A)	Average velocity between zero second and 4 s	(p)	10 SI units
(B)	Average acceleration between 1 s and 4 s	(q)	2.5 SI units
(C)	Average speed between zero seccond and 6 s	(r)	5 SI units
(D)	Rate of change of speed at 4 s	(s)	None of the above

(1) (A→p),(B→q), (C→r), (D→r)

(2) (A→ s),(B→q), (C→s), (D→r)

(3) (A→r),(B→s), (C→p), (D→p)

(4) (A→r),(B→s), (C→r), (D→r)

ANSWER KEY

NEET-RANKER'S STUFF

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	2	3	4	3	3	2	3	1	2	2	1	2	2
Que.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	1	2	2	3	3	1	3	2	3	4	2	2	1	2	3
Que.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Ans.	2	4	1	4	4	4	3	1	4	2	4	3	2	1	4
Que.	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans.	2	1	4	1	4	3	1	3	1	1	1	4	4	1	4
Que.	**61**	**62**	**63**	**64**											
Ans.	1	2	4	4											