PHYSICS

NEET

CRASH COURSE

KINEMATICS

SMART ACHIEVERS

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KINEMATICS

Q.1 A person standing at some distance from a high tree, throws a stone taking aim at a fruit hanging from that free, and at the same instant of time the fruit begins to fall freely. Of the following statement which is correct?
(1) the stone always remins above the falling fruit
(2) the stone strikes the fruit if the stone is thrown with a definite minimum velocity
(3) the stone moves below the falling stone
(4) the stone always hits the fruit.

Q.2 A sphere thrown from a flying aeroplane shows ..... path-
(1) Parabolic (2) Circular (3) Straight line (4) Spiral

Q.3 A ball is projected from a certain point on the surface of a planet at a certain angle with the horizontal surface. The horizontal and vertical displacement x and y vary with time t in second as:

$$x = 10\sqrt{3}\,t \text{ and } y = 10t - t^2$$

The maximum height attained by the ball is
(1) 100 m (2) 75 m (3) 50 m (4) 25 m.

Q.4 A body covered a distance of L m along a curved path of a quarter circle. The ratio of distance to displacement is

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

Q.5 A car travels a distance of 2000m. If the first half distance is covered at 40 km/hour and the second half at velocity v and if the average velocity is 48 km/hour then the value of v is
(1) 56 km/hour (2) 60 km/hour (3) 50 km/hour (4) 48 km/hour

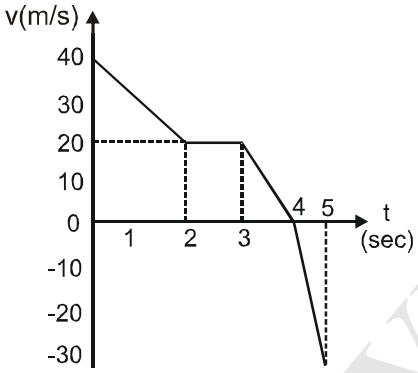
Q.6 Two bodies of different masses m_a and m_b are dropped from two different heights, viz a and b. The ratio of times taken by the two to drop through these distance is

(1) a : b (2) $\frac{m_a}{m_b} : \frac{b}{a}$ (3) $\sqrt{a} : \sqrt{b}$ (4) $a^2 : b^2$

Q.7 The initial velocity of a particle (at t = 0) is u and the acceleration of particle at time t is given by f = at. Where a is a constant which of the following relation for velocity v of particle after time t is true?
(1) $v = u + at^2$ (2) $v = u + at^2/2$ (3) $v = u + at$ (4) none of these

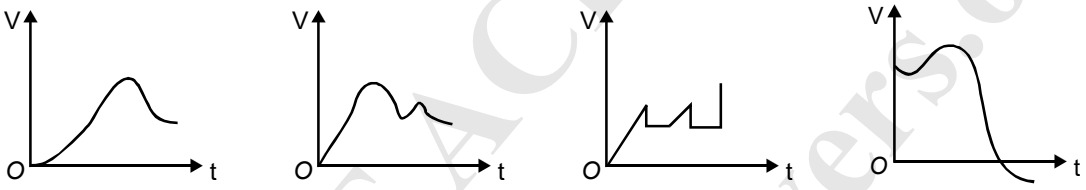
Q.8 A man standing on the edge of a cliff throws a stone straight up with initial speed u and then throws another stone straight down with same initial speed u from the same position. Find the ratio of speeds, the stones would have attained when they hit the ground at the base of the cliff?
(1) 2 : 1 (2) 1 : 2 (3) 1 : 1 (4) 3 : 1

Q.9 In the following velocity-time graph of a body, the distance and displacement travelled by the body in 5 second in meters will be



(1) 70, 110 (2) 105, 75 (3) 40, 70 (4) 90, 50

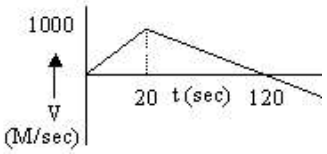
Q.10 The following figures show some velocity V versus time t curves. But only some of these can be realised in practice. These are



(1) (2) (3) (4)

(1) Only a,b and d (2) only a,b,c (3) only b and c (4) all of them

Q.11 A rocket is projected vertically upwards and its time velocity graph is shown in the figure. The maximum height attained by the rocket is



(1) 1 km (2) 10 km (3) 100 km (4) 60 km

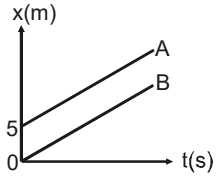
Q.12 If velocity of a particle is given by $V = 10 + 2t^2\ m/s$. The average acceleration between 2 and 5 s is

(1) 2 m/s^2 (2) 4 m/s^2 (3) 12 m/s^2 (4) 14 m/s^2

Q.13 Juggler keeps on moving four balls in the air continuously such that each ball attains 20 m 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.14 Figure shows position-time graph of two cars A and B.



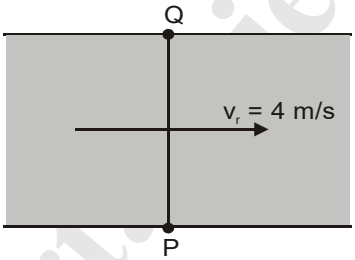
(1) Car A is faster than car B. (2) Car B is faster than car A.
(3) Both cars are moving with same velocity. (4) Both cars have positive acceleration.

Q.15 A motorcycle is moving with a velocity 80 km/hr ahead of a car moving with a velocity of 65 km/hr in the same direction. What is the relative velocity of the motorcycle with respect to the car-
(1) 15 km/hr (2) 20 km/hr (3) 25 km/hr (4) 145 km/hr

Q.16 A train in moving in the north at a speed 10 m/sec. Its length is 150 m. A parrot is flying parallel to the train in the south with a speed of 5m/s. The time taken by the parrot to cross the train will be-
(1) 12 sec. (2) 8 sec. (3) 15 sec. (4) 10 sec.

Q.17 The speed of a boat is 5 km/hr in still water. If it crosses a river of width 1 km along the shortest possible path in 15 min., then velocity of the river is-
(1) 4 km/hr (2) 3 km/hr (3) 2 km/hr (4) 1 km/hr

Q.18 A boat man could row his boat with a speed 10 m/sec. He wants to take his boat from P to a point Q just opposite on the other bank of the river flowing at a speed 4 m/sec. He should row his boat-

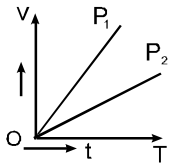


(1) At right angle to the stream
(2) At an angle of $\sin^{-1}\left(\frac{2}{5}\right)$ with PQ up the stream
(3) At an angle of $\sin^{-1}\left(\frac{2}{5}\right)$ with PQ down the stream
(4) At an angle of $\cos^{-1}\left(\frac{2}{5}\right)$ with PQ down the stream

Q.19 During a rainstorm, raindrops are observed to be striking the ground at an angle θ with the vertical. A wind is blowing horizontaly at the speed of 5.0 m/s. The speed of raindrops is

(1) $5 \sin\theta$ (2) $\frac{5}{\sin\theta}$ (3) $5 \cos\theta$ (4) $\frac{5}{\cos\theta}$

Q.20 Shown in the figure are the velocity time graphs of the two particles P_1 and P_2. Which of the following statements about their relative motion is true? Their relative velocity : (consider 1-D motion)



(1) is zero
(2) is non-zero but constant
(3) continuously decreases
(4) continuously increases

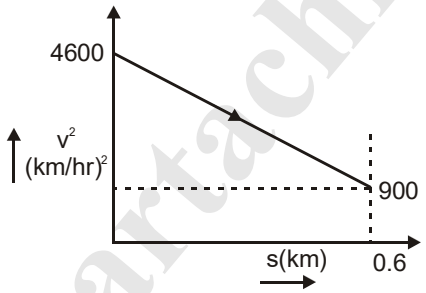
Q.21 A body A is going from South to North and body B is going from West to East with identical velocity. Then direction of relative velocity of A with respect to B is-

(1) North-West (2) South-West (3) North-East (4) South-East

Q.22 It is raining vertically downwards with a velocity of 3 km h^{-1} . A man walks in the rain with a velocity of 4 kmh^{-1}. The rain drops will fall on the man with a relative velocity of ;

(1) 1 kmh^{-1} (2) 3 kmh^{-1} (3) 4 kmh^{-1} (4) 5 kmh^{-1}

Q.23 A graph between the square of the velocity of a particle and the distance (s) moved is shown in figure. The acceleration of the particle in kilometers per hour square is :–



(1) 2250 (2) 3084 (3) – 2250 (4) – 3084

Q.24 A jet air plane travelling at a speed of 500 km/h ejects its products of combustion at a speed of 1500km/h relative to the jet plane. The speed of the latter with respect to an observer on the ground is :–

(1) 1500 km/h (2) 2000 km/h (3) 1000 km/h (4) 500 km/h

Q.25 A particle located at x = 0 at time t = 0, starts moving along the positive x–direction with a velocity 'v' which varies as $v = \alpha\sqrt{x}$ then velocity of particle varies with time as :– (α is a constant)

(1) $v \propto t$ (2) $v \propto t^2$ (3) $v \propto \sqrt{t}$ (4) v = constant

Q.26 A body covers one-third of the distance with a velocity v_1 the second one-third of the distance with a velocity v_2, and the last one-third of the distance with a velocity v_3. The average velocity is :–

(1) $\frac{v_1 + v_2 + v_3}{3}$ (2) $\frac{3v_1v_2v_3}{v_1v_2 + v_2v_3 + v_3v_1}$ (3) $\frac{v_1v_2 + v_2v_3 + v_3v_1}{3}$ (4) $\frac{v_1v_2v_3}{3}$

Q.27 The deceleration experienced by a moving motor boat, after its engine is cut off is given by $\frac{dv}{dt} = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut off, the magnitude of the velocity at a time t after the cut-off is :–

(1) $\frac{v_0}{2}$ (2) v_0 (3) $v_0e^{-k/t}$ (4) $\frac{v_0}{\sqrt{(2v_0^2kt + 1)}}$

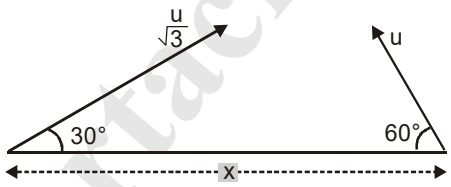
Q.28 A ball is thrown at an angle θ with the horizontal and the range is maximum. The value of tanθ is :–

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

Q.29 If the range of a gun which fires a shell with muzzle speed v, is R, then the angle of elevation of the gun is

(1) $\cos^{-1}\left(\frac{v^2}{Rg}\right)$ (2) $\cos^{-1}\left(\frac{Rg}{v^2}\right)$ (3) $\frac{1}{2}\sin^{-1}\left(\frac{v^2}{Rg}\right)$ (4) $\frac{1}{2}\sin^{-1}\left(\frac{Rg}{v^2}\right)$

Q.30 Two particles separated at a horizontal distance x as shown in fig. they projected at the same line as shown in fig. with different initial speeds. The time after which the horizontal distance between them become zero :–



(1) $\frac{x}{u}$ (2) $\frac{u}{2x}$ (3) $\frac{2u}{x}$ (4) none of these

Q.31 A particle is constrained to move on a straight line path. It returns to the starting point after 10 sec. The total distance covered by the particle during this time is 30 m. Which of the following statements about the motion of the particle is false

(1) Displacement of the particle is zero (2) Average speed of the particle is 3 m/s
(3) Displacement of the particle is 30 m (4) Both (1) and (2)

Q.32 Two balls are dropped from heights h and 2h respectively from the earth surface. The ratio of time of these balls to reach the earth is

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

Q.33 Time taken by an object to reach the height of h_1 and h_2 is respectively t_1 and t_2 then the ratio of t_1 to t_2 is :

(1) $h_1 : h_2$ (2) $\sqrt{h_1} : \sqrt{h_2}$ (3) $h_1 : 2h_2$ (4) $2h_1 : h_2$

Q.34 A bus accelerates from the rest for time 't_1' at a constant rate α and then retards at a constant rate β for time 't_2' and comes to rest, then 't_1/t_2' :

(1) $\frac{\alpha}{\beta+\alpha}$ (2) $\frac{\beta+\alpha}{2}$ (3) $\frac{\beta+\alpha}{\alpha}$ (4) $\frac{\beta}{\alpha}$

Q.35 A particle moves along a straight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4$ meters. The velocity when the acceleration is zero is :

(1) 3 ms^{-1} (2) –12 ms^{-1} (3) 42 ms^{-1} (4) –9 ms^{-1}

Q.36 The x and y co–ordinates of a particle at any time t are given by
$x = 7t + 4t^2$ and $y = 5t$
where x and y are in m and t in s. The acceleration of the particle at 5s is :
(1) zero (2) 8 m/s^2 (3) 20 m/s^2 (4) 40 m/s^2

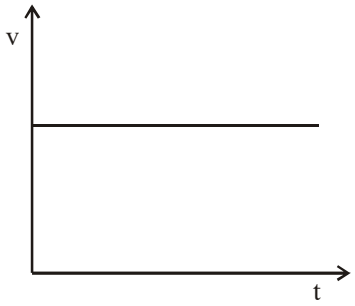
Q.37 If for a particle $x \propto t^2$ then :
(1) velocity is constant (2) acceleration is constant
(3) acceleration is variable (4) None of these

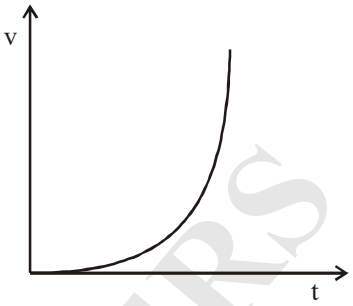
Q.38 If a body starts from rest and travels 120 m in the 8th second, then acceleration is :
(1) 16 m/s^2 (2) 10 m/s^2 (3) 0.227 m/s^2 (4) 0.03 m/s^2

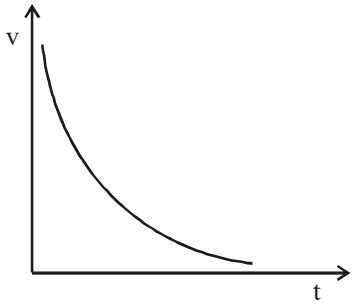
Q.39 A rocket is fired upward from the earth's surface such that it creates an acceleration of $19.6\,m/sec^2$. If after 5 sec its engine is switched off, the maximum height of the rocket from earth's surface would be
(1) 245 m (2) 490 m (3) 980 m (4) 735 m

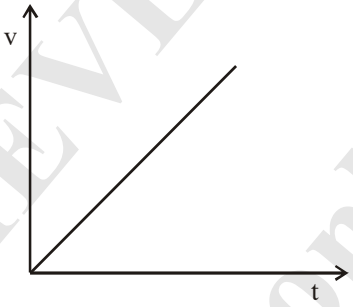
Q.40 A body is moving according to the equation $x = at + bt^2 - ct^3$ where x = displacement and a, b and c are constants. The acceleration of the body is
(1) a + 2bt (2)2b + 6ct (3) 2b–6ct (4) $3b - 6ct^2$

Q.41 Which of the following velocity–time graphs represent uniform velocity :

(1) 

(2) 

(3) 

(4) 

Q.42 The horizontal and vertical distances travelled by a particle in time t are given by $x = 6t$ and $y = 8t - 5t^2$. If $g = 10$ m/sec^2, then the initial velocity of the particle is :-

(1) 8 m/sec (2) 10 m/sec (3) 5 m/sec (4) zero

Q.43 The equation of a projectile is

$y = \sqrt{3}\,x - \frac{gx^2}{2}$. The angle of projection is :-

(1) 30º (2) 60º (3) 45º (4) None

Q.44 A stone is thrown at an angle θ to the horizontal reaches a maximum height h. The time of flight of the stone is :

(1) $\sqrt{(2h\sin\theta)/g}$ (2) $2\sqrt{(2h\sin\theta)/g}$ (3) $2\sqrt{(2h)/g}$ (4) $\sqrt{(2h)/g}$

Q.45 An object is projected with a velocity of 20 m/s making an angle of 45° with horizontal. The equation for the trajectory is $h = Ax - Bx^2$ where h is height, x is horizontal distance, A and B are constants. The ratio A : B is ($g = 10$ m/s^2) :

(1) 1 : 5 (2) 5 : 1 (3) 1 : 40 (4) 40 :1

Q.46 A man projects a coin upwards from the gate of a uniformly moving train. The path of coin for the man will be :

(1) Parabolic (2) Inclined straight line
(3) Vertical straight line (4) Horizontal straight line

Q.47 Many bullets are projected at equal angles with the horizontal in different direction. The maximum area in which these bullets are spread is :-

(1) $\pi v^2/g$ (2) $\pi v^4/g^2$ (3) $\pi^2 v^4/g^2$ (4) $\pi v^2/g^2$

Q.48 An aeroplane moving horizontally with a speed of 180 km/hr. drops a food packet while flying at a height of 490m. The horizontal range of the packet is :

(1) 180 m (2) 980 m (3) 500 m (4) 670 m

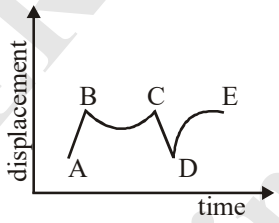
Q.49 A ball is thrown from a point with a speed 'v_0' at an elevation angle of θ. From the same point and at the same instant, a person starts running with a constant speed 'v_0'/2 to catch the ball. Will the person be able to catch the ball ? If yes, what should be the angle of projection θ ?

(1) Yes, 60° (2) Yes, 30° (3) No (4) Yes, 45°

Q.50 Fig. shows the displacement of a particle going along x–axis as a function of time. The acceleration of the particle is zero in the region :

(a) AB (b) CB (c) CD (d) DE

(1) a, b (2) a, c (3) b, d (4) c, d



Q.51 A point moves with uniform acceleration and v_1, v_2 and v_3 denote the average velocities in the three successive intervals of time t_1, t_2 and t_3. Which of the following relations is correct

(1) $(v_1 - v_2):(v_2 - v_3) = (t_1 - t_2):(t_2 + t_3)$ (2) $(v_1 - v_2):(v_2 - v_3) = (t_1 + t_2):(t_2 + t_3)$

(3) $(v_1 - v_2):(v_2 - v_3) = (t_1 - t_2):(t_1 - t_3)$ (4) $(v_1 - v_2):(v_2 - v_3) = (t_1 - t_2):(t_2 - t_3)$

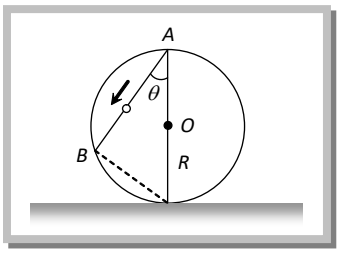
Q.52 A stone projected with a velocity of *u* at angle 30° with horizontal reaches maximum height *x*. When it is projected with velocity *u* at angle 30° with vertical it reaches maximum height *y*. Then range of particle is :-

(1) $4(x + y)$ (2) $4\sqrt{xy}$ (3) $\frac{2xy}{x+y}$ (4) $4(x - y)$

Q.53 A frictionless wire AB is fixed on a sphere of radius R. A very small spherical ball slips on this wire. The time taken by this ball to slip from A to B is

(1) $\frac{2\sqrt{gR}}{g\cos\theta}$ (2) $2\sqrt{gR}.\frac{\cos\theta}{g}$

(3) $2\sqrt{\frac{R}{g}}$ (4) $\frac{gR}{\sqrt{g\cos\theta}}$



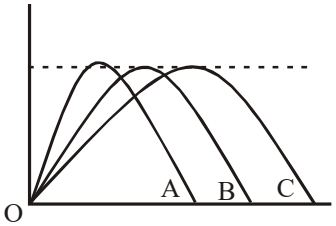
Q.54 Three projectile A, B and C are thrown from the same point in the same plane. Their trajectories are shown in the figure. Then which of the following statement is false :-

(1) the time of flight is the same for all the three

(2) the launch speed is greatest for particle C

(3) the horizontal velocity component is greatest for particle C

(4) all of the above



Q.55 A balloon starts rising from the ground with an acceleration of 1.25 m/s^2, after 8s a stone is released from the balloon. The stone will (g = m/s^2)

(1) Reach the ground in 4 second
(2) Begin to move down after being released
(3) Have a displacement of 50 m
(4) Cover a distance of 40 m in reaching the ground

Q.56 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 B is given a deceleration of 20 km/h^2 After how much time will B catch up with A

(1) 1 hr (2) 1/2 hr (3) 1/4 hr (4) 1/8 hr

Q.57 A balloon rises from rest with a constant acceleration g/8. A stone is released from it when it has risen to height h, the time taken by the stone to reach the ground is :

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

AIIMS SPECIAL

Direction for Assertion & Reason Questions

Q.58 **STATEMENT-1 :** In a projectile motion, the velocity at its highest point is zero.
STATEMENT-2 : In a projectile motion from ground to ground projection, the acceleration is g downwards due to which speed of the projectile first increases then decreases to the same value.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.59 **STATEMENT-1 :** Two stones are simultaneously projected from level ground from same point with same speeds but different angles with horizontal. Both stones move in same vertical plane. Then the two stones may collide in mid air.
STATEMENT-2 : For two stones projected simultaneously from same point with same speed at different angles with horizontal, their trajectories never intersect at any point.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.60 **STATEMENT-1 :** Horizontal component of velocity is constant in a projectile motion under gravity.
STATEMENT-2 : Acceleration is along the vertical direction in projectile motion under gravity.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.61 **STATEMENT-1 :** Magnitude of average velocity is equal to average speed.
STATEMENT-2 : Magnitude of instantaneous velocity is not equal to instantaneous speed.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.62 **STATEMENT-1 :** When velocity of a particle is zero then acceleration of particle must be zero at that instant.

STATEMENT-2 : Acceleration is equal to $a = v^2\left(\frac{dv}{dx}\right)$, where v is the velocity at that instant..

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.63 **STATEMENT-1 :** A particle moves in a straight line with constant accleration. The average velocity of this particle cannot be zero in any time interval
STATEMENT-2 : For a particle moving in straight line with constant acceleration, the average velocity in a time interval is not equal to $\frac{u+v}{2}$, where u and v are initial and final velocity of the particle in the given time interval.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.64 **STATEMENT-1 :** Three projectiles are moving in different paths in the air. Vertical component of relative velocity between any of the pair does not change with time as long as they are in air. Neglect the effect of air friction.
STATEMENT-2 : Relative acceleration between any of the pair of projectiles is zero.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.65 **STATEMENT-1 :** If seperation between two particles does not change then their relative velocity will be zero.
STATEMENT-2 : Relative velocity is the rate of change of velocity of one particle w.r.t. another.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is False

Q.66 **STATEMENT-1 :** If speed of two particles is increasing at the same rate then their relative velocity will be constant.

STATEMENT-2 : If the acceleration vector of the two particles is same then their relative acceleration will be non zero.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is False

ANSWER KEY

Q.1 2	Q.2 1	Q.3 4	Q.4 1	Q.5 2
Q.6 3	Q.7 2	Q.8 3	Q.9 2	Q.10 1
Q.11 4	Q.12 4	Q.13 2	Q.14 3	Q.15 1
Q.16 4	Q.17 2	Q.18 2	Q.19 2	Q.20 4
Q.21 1	Q.22 4	Q.23 4	Q.24 3	Q.25 1
Q.26 2	Q.27 4	Q.28 1	Q.29 4	Q.30 1
Q.31 3	Q.32 1	Q.33 2	Q.34 4	Q.35 4
Q.36 2	Q.37 2	Q.38 1	Q.39 4	Q.40 3
Q.41 1	Q.42 2	Q.43 2	Q.44 3	Q.45 4
Q.46 3	Q.47 2	Q.48 3	Q.49 1	Q.50 2
Q.51 2	Q.52 2	Q.53 3	Q.54 2	Q.55 1
Q.56 2	Q.57 2	Q.58 4	Q.59 4	Q.60 1
Q.61 4	Q.62 4	Q.63 4	Q.64 1	Q.65 4
Q.66 4				