Physics Objective Questions: Kinematics – Typical

{Each question is tagged with Level and Type SC (Single Choice) or MC Multiple Choice)}

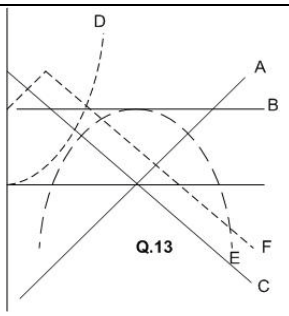
No of Question: 61] **[Time Allotted: 3 Hours**

(All questions are compulsory)

Q-1	A plane travels 200 km on a straight line making an angle 30^0 east of due north How far north the plane travels from its starting point? (a) 200 km (b) $100\sqrt{3}$ km (c) 100 km (d) 150 km
Q-2	A vehicle travels 30 km due north and then takes a turn to Left travels 40 km before stopping. Find (i) total distance travelled and (ii) total displacement (a) (i) 70 km (ii) 50km Due $\left(\frac{\pi}{2}+\tan^{-1}\left(\frac{4}{3}\right)\right)^0$ West of North (b) (i) 70 km (ii) 50km Due $\left(\tan^{-1}\left(\frac{4}{3}\right)\right)^0$ West of North (c) (i) 70 km (ii) 50km Due $\left(\pi-\tan^{-1}\left(\frac{4}{3}\right)\right)^0$ West of North (d) (i) 50 km (ii) 70km Due $\left(\frac{\pi}{2}+\tan^{-1}\left(\frac{4}{3}\right)\right)^0$ West of North
Q-3	Displacement of a particle in three consecutive steps is $\vec{d}_1 = 3.5\hat{\imath} + 4\hat{\jmath}$, $\vec{d}_2 = -4.5\hat{\imath}$ and $\vec{d}_3 = -4.5\hat{\jmath}$. What is net displacement after third step (a) $1\hat{\imath} + 0.5\hat{\jmath}$ (b) $1\hat{\imath} - 0\hat{\jmath}$ (c) $-1\hat{\imath} - 0.5\hat{\jmath}$ (d) $0\hat{\imath} - 0.5\hat{\jmath}$
Q-4	Position of a particle on a line is represented by expression $x = At + Bt^2 - Ct^3$, here A, B and C are constants having values $2\ ms^{-1}$, $3\ ms^{-2}$ and $1\ ms^{-3}$ and t is time. Position, velocity and acceleration of particle at $t = 5$sec of particle are – (a) (i) 40 m (ii) $43\ ms^{-1}$ (iii) $24\ ms^{-2}$ (b) (i) 40 m (ii) $43\ ms^{-1}$ (iii) $-24\ ms^{-2}$ (c) (i) 40 m (ii) $43\ ms^{-1}$ (iii) $-24\ ms^{-2}$ (d) (i) -40 m (ii) $-43\ ms^{-1}$ (iii) $-24\ ms^{-2}$
Q-5	A ball is thrown vertically upward with a velocity $30\ ms^{-1}$. At what time ball would be at 25 m, while descending. (a)5 sec (b) 6 sec (c) 1 Sec (d) 4 sec

Q-6	Position of a particle on X-Y plane is represented by expression $x = A + Bt + Ct^2 - Dt^3$, here A, B, C and D are constants having values 5m, 2 ms^{-1}, 3 ms^{-2} and 1 ms^{-3}. Average velocity and acceleration particle between $t = 0$sec and $t = 3$sec are – (a) (i) 15 ms^{-1} (ii) $-3\,ms^{-2}$ (b) (i) $-15\,ms^{-1}$ (ii) $-3\,ms^{-2}$ (c) (i) $-15\,ms^{-1}$ (ii) $3\,ms^{-2}$ (d) (i) $15\,ms^{-1}$ (ii) $3\,ms^{-2}$
Q-7	An object is moving with a velocity $\vec{v}(t) = v_y(t)\hat{j} + v_z(t)\hat{k}$,where $v_z(t) = 0$. From this can it be concluded that acceleration $\vec{a}(t)$ (a) Will have no components that are identically zero (b) May have components that are identically zero, (c) Will have only Z component that is identically zero (d) Will have an identically zero z component and may be identically zero component in x or y direction.
Q-8	An object is moving in x-y plane with position defined as $\overrightarrow{r_P}(t) = x(t)\hat{\imath} + y(t)\hat{\jmath}$. Reference point O is at $\overrightarrow{r_O}(t) = 0$. The object is definitely moving towards O when- (a) $v_x > 0$ and $v_y > 0$ (b) $v_x < 0$ and $v_y < 0$ (c) $x \cdot v_x + y \cdot v_y < 0$ (d) $x \cdot v_x + y \cdot v_y > 0$
Q-9	An object is moving with a velocity $\vec{v}(t) = v_y(t)\hat{j} + v_z(t)\hat{k}$,where $v_z(t) = 0$. From this can it be concluded that position $\vec{r}(t)$ - (a) Will have no components that are identically zero (b) May have components that are identically zero, (c) Will have only Z component that is identically zero (d) Will have an identically zero z component and may be identically zero component in x or y direction.
Q-10	An object is launched straight up into the air from the ground with an initial vertical velocity of 30 ms^{-1}. The object rises to a highest point approximately 30 m above the ground in 3 secs; it then falls back to ground in another 3 secs immediately at a velocity of 30 ms^{-1}. Then Average speed ($\overline{s}$) and average velocity ($\overline{v}$) are a. $\overline{s} = 10\,ms^{-1}$ and $\overline{v} = 5\,ms^{-1}$ b. $\overline{s} = 10\,ms^{-1}$ and $\overline{v} = 0\,ms^{-1}$ c . $\overline{s} = 0\,ms^{-1}$ and $\overline{v} = 0\,ms^{-1}$ d. $\overline{s} = 0\,ms^{-1}$ and $\overline{v} = 10\,ms^{-1}$
Q-11	An object is moving along X-axis with position as a function of time $x = x(t)$, such that at $x = 0$ is point O. The object is definitely moving towards O when – (a) $\frac{dx}{dt} < 0$ (b) $\frac{dx}{dt} > 0$ (c) $\frac{\boldsymbol{dx^2}}{\boldsymbol{dt}} < 0$ (d) $\frac{dx^2}{dt} > 0$
Q-12	An object starts from rest at $x = 0$ when $t = 0$. The object moves in x direction with +ve velocity. The instantaneous velocity and average velocity are related by – (a) $\frac{dx}{dt} < \frac{x}{t}$ (b) $\frac{dx}{dt} = \frac{x}{t}$ (c) $\frac{dx}{dt} > \frac{x}{t}$ (d) $\frac{dx}{dt} (> \text{OR} = \text{OR} <) \frac{x}{t}$

Q-13 Figure shows few graphs with unlabelled axes. Match: i) which graph would best represent velocity as a function of time for an object moving constant speed? ii) Which graph best represents velocity as a function of time for acceleration given by $a = 3t$? iii) Which graph best represents distance as function of time for a constant negative acceleration iv) Which graph best represents velocity as a function of time if Graph E shows distance as a function of time? Match each case to the graph(s) in the following table.



Q.13

Case	Graph
(i)	A
(ii)	B
(iii)	C
(iv)	D
	E
	F

Q-14 An object is moving in x direction with velocity $v_x(t)$ and $\frac{dv_x}{dt}$ is non-zero constant. With $v_x = 0$ when $t = 0$, then for $t > 0$ the quantity $v_x \cdot \frac{dv_x}{dt}$ is –

(a) Negative (b) Zero (c) Positive (d) Cannot be determined from given information

Q-15 A statement "A freely falling object traverses a distance in each second greater than that traversed till beginning of the second" Comment that the statement is –

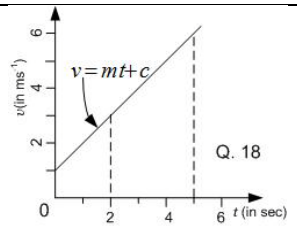
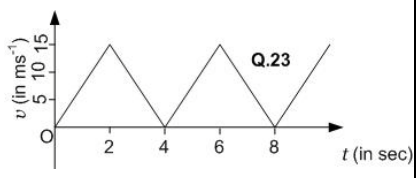
(a) Always true
(b) Only true for sufficiently short time
(c) True for sufficiently long time
(d) Never true

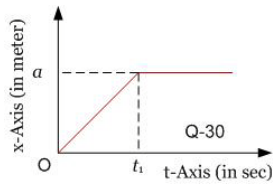
Q-16 An object is tossed vertically into the air with an initial velocity of 8 ms^{-1}. Using the sign convention (+)ve for upward, how does the vertical component of acceleration a (after it is tossed) varies during the flight of the object?

(a) On the way up $a_y > 0$, On the way down $a_y > 0$
(b) On the way up $a_y < 0$, On the way down $a_y > 0$
(c) On the way up $a_y > 0$, On the way down $a_y < 0$
(d) On the way up $a_y < 0$, On the way down $a_y < 0$

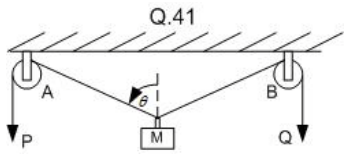
Q-17 A boy jumps off a high diving board above a swimming pool. Halfway between the board and the water he tosses a ball upward. Ignoring air friction, the instant after the ball leaves his hands the vertical component of acceleration of the ball is-

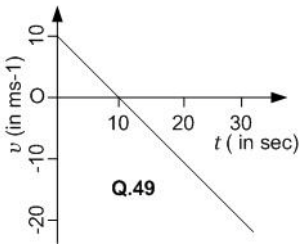
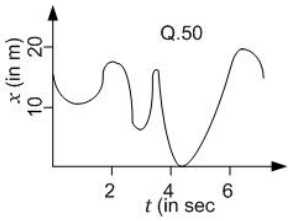
(a) (+)ve, but then decreases through Zero to $(-)9.8ms^{-2}$
(b) Zer0, but then decreases through Zero to $(-)9.8ms^{-2}$
(c) In between Zero and $(-)9.8ms^{-2}$, but then decreases to $(-)9.8ms^{-2}$
(d) $(-)9.8ms^{-2}$

Q-18	Speed-vrs-time graph of motion of a particle is shown in the figure, find distance traversed by the article during $2 \leq t \leq 5$ - (a) 13 m (b) 14 m (c) 15 m (d) 10 m 
Q-19	A particle starts with initial velocity 5 ms^{-1} along x direction with a uniform acceleration 0.75 ms^{-2}. Find, Distance travelled in between $3 \leq t \leq 5$ seconds. (a) 16 m (b) 10 m (c) 20 m (d) 5 m
Q-20	A ball is thrown up at a speed of 15 ms^{-1} . Find maximum height reached by ball is approximated to - (a) 120 m (b) 100 m (c) 110 m (d) 90 m
Q-21	A nut-bolt is thrown with a velocity 2 ms^{-1} ms from a stand of 1.5 m height at an angle of 45^0 . How far, from the building, it would reach on the ground- (a) 2 m (b) 1 m (c) $\sqrt{2}$ m (d) $\frac{1}{\sqrt{2}}$ m
Q-22	A man is walking on road at a uniform speed of 4 kmph while it is raining vertically at 3 kmph The speed of rain drops experienced by the man is – (a) 7 kmph (b) 1 kmph (c) 5 kmph (d) None of these
Q-23	Q. Graph shows velocity of a ball w.r.t. time. Then – (i) distance travelled by the particle during $0 \leq t \leq 4$ sec, (ii) change of acceleration of particle at point $t = 6$sec is - (a) (i) 30 m (ii) -15 ms^{-3} (b) (i) 30 m (ii) 15 ms^{-3} (c) (i) -30 m (ii) -15 ms^{-3} (d) (i) 15 m (ii) 30 ms^{-4} 
Q-24	A plane flying at an altitude of 125 m at a horizontal velocity of 150 kmph drops relief packet at mid-noon. The material will reach the ground at a distance w.r.t. shadow of plane on the ground at the time of drop - (a) 200 m (b) 220 m (c) 210 m (d) 230 m
Q-25	A car is moving with velocity a kmph along a straight road towards a huge wall at a distance D km and takes a sharp turn to the left on reaching the wall. An insect starts flying from wall towards the car, when it is at a Distance D from it, at a uniform velocity b kmph, such that $b > a$. After reaching the wind-pane of the car, it abruptly, without loosing time, turn back and starts flying towards the wall. Likewise, after reaching wall, it again abruptly turn back and continues to fly till it reaches the wall. Then (i) distance covered by insect is km, and(ii) number of trips made by the fly are – (a) (i) ∞ km (ii) 1000 (b) (i) $2D$ km (ii) 1000 (c) (i) D km (ii) 1000 (d) (i) $D\left(\frac{b}{a}\right)$ km (ii) ∞

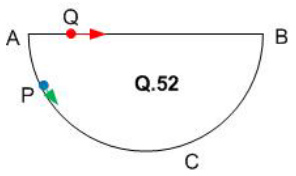
Q-26	A particle is projected horizontally with a speed u from from the top of plane inclined at an angle θ with the horizontal. Distance along the plane where the particle will strike it is – (a) $\frac{2u^2}{g}$ (b) $\frac{2u^2}{g}\tan\theta$ (c) $\frac{2u^2}{g}\sin\theta$ (d) $\frac{2u^2}{g}\sec\theta$
Q-27	A bullet is fired horizontally at an object which starts making a free fall from the height of gun.. The bullet will – (a) Hit the object, irrespective of its horizontal velocity (b) Hit the object, irrespective of its distance from the gun (c) Hitting object is independent of its distance from the gun and velocity of the bullet (d) Hitting object dependents of its distance from the gun and velocity of the bullet
Q-28	Four particles A,B,C and D are placed at vertices of a square of side ABCD. A is tracking particle B with a uniform speed v, likewise particle B towards C, particle C towards D and D towards A with uniform speed v. All particles start at same instant $t = 0$ sec. They shall converge, after start, at a time – (a) $\sqrt{\frac{a}{v}}$ sec (b) $\frac{a}{2v}$ sec **(c)** $\mathbf{2}\frac{a}{v}$ sec (d) $\frac{a}{v}$ sec
Q-29	A is going due north at a speed of 50 kmph. It makes a 90^0 without change of speed. The change of speed at the instance is - (a) 50 kmph towards west (b) 70 kmph towards south-west (c) 70 kmph towards north-west (d) Zero
Q-30	Displacement of a particle is shown in the $x-t$ graph. Which of the following statement is true – (a) The particle is continuously moving along X-direction. (b) The particle is at rest (c) Velocity of the particle increases upto time t_1 and then becomes constant (d) The particle moves with constant velocity during $0 \le t \le t_1$ and then stops. 
Q-31	A particle has a velocity u towards east at $t = 0$ sec. Its acceleration is towards west and is constant. Let x_A and x_B be the magnitude of displacements in its first 10 secs and next 10 secs, then – (a) $x_A < x_B$ (b) $x_A = x_B$ (c) $x_A > x_B$ (d) Information is incomplete to relate x_A and x_B
Q-32	Q. A person is travelling on a straight line moves with a uniform velocity v_1 for some time and with uniform velocity v_2 for next equal time. The average velocity v is – (a) $\boldsymbol{v = \frac{v_1+v_2}{2}}$ (b) $v = \sqrt{v_1 v_2}$ (c) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$ (d) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Q-33	A person is travelling on a straight line moves with a uniform velocity v_1 for a distance x and with uniform velocity v_2 for next equal distance. The average velocity $\bar{v}$ is – (a) $\bar{v} = \frac{v_1+v_2}{2}$ (b) $\bar{v} = \sqrt{v_1 v_2}$ (c) $\frac{\mathbf{2}}{\bar{v}} = \frac{\mathbf{1}}{\boldsymbol{v_1}} + \frac{\mathbf{1}}{\boldsymbol{v_2}}$ (d) $\frac{1}{\bar{v}} = \frac{1}{v_1} + \frac{1}{v_2}$
Q-34	A with stone is released from an elevator going up an acceleration a. The acceleration of stone after it is released is – (a) a upward (b) $(g-a)$ upward (c) $(g-a)$ downward (d) g downward
Q-35	A person standing near the edge of the top of a building throws two ball A and B. The ball A is thrown vertically upward and ball A is thrown vertically downward with same speed. The ball A hits the ground with a speed v_A , and ball A hits the ground with a speed v_B . Then – (a) $v_A > v_B$ (b) $v_A < v_B$ (c) $v_A = v_B$ (d) v_A and v_B would depend upon height of building, which is unknown
Q-36	In projectile motion velocity – (a) is always perpendicular to the acceleration (b) is never perpendicular to the acceleration (c) is perpendicular to the motion at one instant only (d) is perpendicular to the motion at two instants.
Q-37	Two bullets are fired simultaneously, horizontally and with different speeds from the same place. Which bullet would hit the ground first – (a) the faster one (b) the slower one (c) both simultaneously (d) bullet of heavier mass
Q-38	Range of a projectile fired at an angle 15^0 with the horizontal is 50 m. If keeping the speed to be same it is fired at an angle 45^0 the range would be – (a) 25 m (b) 37 m (c) 50 m (d) 100 m
Q-39	Two projectiles A and B are projected with an angle of projection 15^0 and 45^0, respectively. The range of projectiles will be – (a) $R_A < R_A$ (b) $R_A = R_B$ (c) $R_A > R_B$ (d) Information given is incomplete to decide relation between R_A and R_B
Q-40	A river is flowing from west to east at a speed of 5 metres per minute. A man on the south bank of the river, capable of swimming at 10 metres per minute in still water, wants to swim across the river in the shortest time. He should swim in direction - (a) Due north (b) 30^0 east of north (c) 30^0 north of west (d) 60^0 east of north

Q-41	In the arrangement shown in the figure, the ends P and Q of an inextensible string m0ve downwards with uniform speed u. Pulleys A and B are fixed. The mass M moves upwards with a speed –  (a) $2u\cos\theta$ (b) $\frac{u}{\cos\theta}$ (c) $\frac{2u}{\cos\theta}$ (d) $u\cos\theta$
Q-42	Consider motion of the tip of the minute hand of a clock in One hour – (a) The displacement is zero. (b) The distance covered is Zero (c) Average speed is Zero (d) Average velocity is Zero
Q-43	Motion of a particle moves along X-axis is expressed as $x = u(t-2s) + a(t-2s)^2$ - (a) Initial velocity of the particle is u (b) Acceleration of particle is a (c) Acceleration of the particle is $2a$ (d) At $t = 2$ sec particle is at origin
Q-44	Pick the correct statements (a) Average speed of a particle in a given time is never less than the magnitude of average velocity. (b) It is possible to have a situation in which $\left\|\frac{d\vec{v}}{dt}\right\| \neq 0$ but $\frac{d}{dt}\|\vec{v}\| = 0$ (c) The average velocity of a particle is zero in a time interval. It is possible that instantaneous velocity is never zero in the interval (d) The average velocity of a particle moving on a straight line is zero on a time interval. It is possible that instantaneous velocity is never zero in the interval (infinite accelerations are not allowed)
Q-45	An object may have – (a) Varying speed without having varying velocity (b) Varying velocity without having varying speed (c) Nonzero acceleration without having varying velocity (d) Nonzero acceleration without having varying speed
Q-46	Mark the correct statement for a particle moving on a straight line – (a) f the velocity and acceleration have opposite sign the object is slowing down (b) If the position and velocity have opposite sign, the particle is moving towards the origin (c) If velocity is zero at an instant, the acceleration should also be zero at that instant (d) If the velocity is zero for a time interval, the acceleration is zero at any instant within the time interval

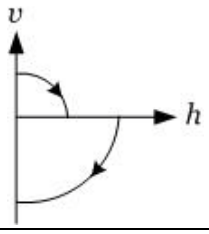
Q-47	The velocity of a particle is zero at $t = 0$ - (a) Acceleration at time $t = 0$ must be zero (b) Acceleration at time $t = 0$ may be zero (c) If acceleration is zero from $t = 0$ to $t = 10$ sec, the speed is also zero in this interval (d) If speed is zero from $t = 0$ to $t = 10$ sec, the acceleration also zero in this interval
Q-48	Mark the correct statements – (a) Magnitude of velocity of a particle is equal to its speed (b) Magnitude of average velocity in an interval is equal to its average speed in that interval (c) It is possible to have a situation in which speed of a particle is always zero, but average speed is not zero. (d) It is possible to have a situation in which speed of a particle is never zero, but average speed is zero.
Q-49	Q. Velocity-time graph for a particle moving on a straight line is shown in figure. Mark correct statements - a. The particle has a constant acceleration b. The particle has never turned around c. The particle has zero displacement d. Average speed of the particle in interval 0 to 10 sec is same as average speed of particle in interval 10 to 20 sec. 
Q-50	Position of a particle moving on X-axis is shown as a function of time in the figure.- (a) The particle comes to rest 6 times (b) Maximum speed is at $t = 6$ sec (c) Velocity remains positive for $t = 0$ sec to $t = 6$ sec (d) Average velocity for the total period shown in figure is negative 
Q-51	Acceleration of a particle as seen from Two frames of reference S_1 and S_2 have equal magnitude 4 ms^{-2} - (a) The frames must be at rest with respect to each other (b) The frames may be moving with respect to each other, but neither is accelerated with respect to each other (c) The acceleration of S_2 with respect to S_1 may be either zero or 8 ms^{-2} (d) The acceleration of S_2 with respect to S_1 may be anywhere between zero and 8 ms^{-2}

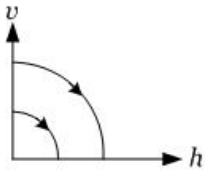
Q-52 A particle passes through a frictionless hemispherical bowl. It passes the point A at $t = 0$. At this instant of time the horizontal component of velocity is v. A bead Q of the same mass as P is ejected from A at $t = 0$ along the horizontal frictionless string AB with speed v. Let t_p and t_q be the time taken by P and Q to reach point B. Then –

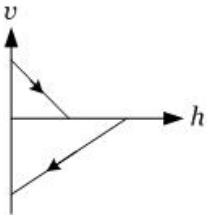


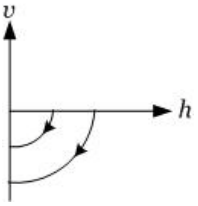
(a) $t_p < t_q$ (b) $t_p = t_q$ (c) $t_p > t_q$ (d) $\frac{t_p}{t_q} = \frac{\text{Length of arc ACB}}{\text{Length of chord AB}}$

Q-53 A ball is dropped vertically from height h above the ground. It hits the ground and bounces up vertically to a height $\frac{h}{2}$. Neglecting subsequent motion and air resistance, velocity v varies with height h above the ground as –

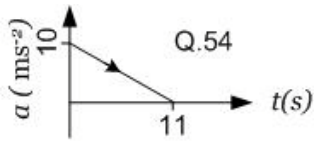
(a) 

(b) 

(c) 

(d) 

Q-54 A particle starts from rest. Its acceleration (a) vrs time (t) is shown in graph. The maximum speed of particle will be –

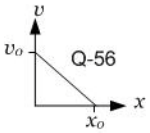


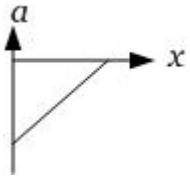
(a) 110 ms^{-1} (b) 55 ms^{-1} (c) 550 ms^{-1} (d) 660 ms^{-1}

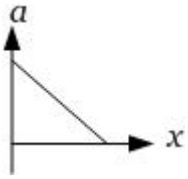
Q-55 A block slides down a frictionless plane starting from rest. Let s_n be the distance travelled in n^{th} sec . Then $\frac{s_n}{s_{n+1}}$ will be –

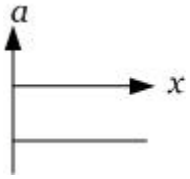
(a) $\frac{2n-1}{2n}$ (b) $\frac{2n+1}{2n-1}$ (c) $\frac{2n-1}{2n+1}$ (d) $\frac{2n}{2n+1}$

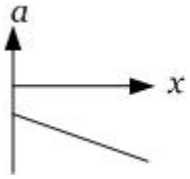
Q-56 The graph shows the variation of velocity with displacement, Which one of the options correctly represent variation of acceleration with displacement.



(a) 

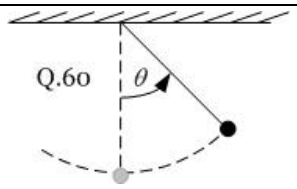
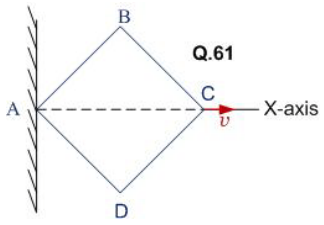
(b) 

(c) 

(d) 

Q-57 Moving magnitude of displacement of a particle moving in a circle of radius a with constant angular speed ω varies with time t as –

(a) $2a \sin \omega t$ (b) $2a \sin \frac{\omega t}{2}$ (c) $2a \cos \omega t$ (d) $2a \cos \frac{\omega t}{2}$

Q-58	A smooth square platform ABCD is moving towards right with uniform velocity v. At what angle θ must a a particle be projected from A with a speed u so that it strikes the point B - (a) $\sin^{-1}\left(\frac{u}{v}\right)$ (b) $\cos^{-1}\left(\frac{v}{u}\right)$ (c) $\cos^{-1}\left(\frac{u}{v}\right)$ (d) $\sin^{-1}\left(\frac{v}{u}\right)$
Q-59	Two stones are thrown up from edge of a cliff with initial speeds v and $2v$. The relative position of the second stone with respect to the first varies with time till both stones strike the ground as – (a) Linearly (b) First linearly and then parabolically (c) Para bolically (d) First parabolically and then linearly
Q-60	A pendulum of length 1 m is released from an angle 60^0 from its mean position. The rate of change of speed of the bob at $\theta = 30^0$ is $\left(g = 10\text{ms}^{-2}\right)$ - (a) $5\sqrt{3}\,\text{ms}^{-2}$ (b) $5\ \text{ms}^{-2}$ (c) $10\ \text{ms}^{-2}$ (d) $2.5\ \text{ms}^{-2}$ 
Q-61	Fours rods of equal length (l) have been hinged to form a rhombus. Vertex A is fixed to a rigid support, vertex C is being moved along X-axis with a constant velocity $v\ \text{ms}^{-1}$ as shown in the figure. The rate at which vertex B is approaching X-axis at a moment when rhombus is in shape of a square is – (a) $\frac{v}{4}$ (b) $\frac{v}{3}$ (c) $\frac{v}{2}$ (d) $\frac{v}{\sqrt{2}}$ 

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