39. A particle is projected from the ground with an initial speed of v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectory is

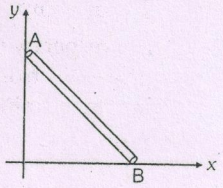
(a) $\frac{v}{2}\sqrt{1+2\cos^2\theta}$ (b) $\frac{v}{2}\sqrt{1+\cos^2\theta}$

(c) $\frac{v}{2}\sqrt{1+3\cos^2\theta}$ (d) $v\cos\theta$

40. A particle is dropped from point A at a certain height from ground. It falls freely and passes through three points B, C and D with $BC = CD$. The time taken by the particle to move from B to C is 2 s and from C to D is 1 s. The time taken to move from A to B is

(a) 0.5 s (b) 1.5 s (c) 0.75 s (d) 0.25 s

41. A rigid rod leans against a vertical wall (y-axis) as shown in figure. The other end of the rod is on the horizontal floor. Point A is pushed downwards with constant velocity. Path of the centre of the rod is



(a) a straight line passing through origin

(b) a straight line not passing through origin

(c) a circle of radius $l/2$ and centre at origin

(d) a circle of radius $l/2$ but centre not at origin

42. A particle starts travelling on a circle with constant tangential acceleration. The angle between velocity vector and acceleration vector, at the moment when particle completes half the circular track, is

(a) $\tan^{-1}(2\pi)$ (b) $\tan^{-1}(\pi)$

(c) $\tan^{-1}(3\pi)$ (d) zero

43. Two particles A and B are projected simultaneously from a point situated on a horizontal plane. The particle A is projected vertically up with a velocity v_A while the particle B is projected up at an angle of 30° with horizontal with a velocity v_B. After 5 s the particles were observed moving mutually perpendicular to each other. The velocity of projection of the particle v_A and v_B respectively are

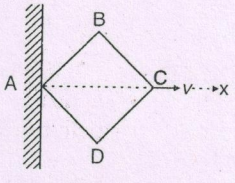
(a) $50\ ms^{-1}$, $100\ ms^{-1}$

(b) $100\ ms^{-1}$, $50\ ms^{-1}$

(c) v_A can have any value greater than $25\ ms^{-1}$, $100\ ms^{-1}$

(d) None of the above

44. Four rods each of length l have been hinged to form a rhombus. Vertex A is fixed to rigid support, vertex C is being moved along the x-axis with a constant velocity v as shown in the figure. The rate at which vertex B is approaching the x-axis at the moment the rhombus is in the form of a square is



(a) $\frac{v}{4}$ (b) $\frac{v}{3}$ (c) $\frac{v}{2}$ (d) $\frac{v}{\sqrt{2}}$

45. A car leaves station X for station Y every 10 min. The distance between X and Y is 60 km. The car travels at speed 60 km/h. A man drives a car from Y towards X at speed 60 km/h. If he starts at the moment when first car leaves station X, how many cars would he meet on route?

(a) 20 (b) 7 (c) 10 (d) 5

46. A projectile is fired at an angle of 30° to the horizontal such that the vertical component of its initial velocity is 80 m/s. Its time of flight is T. Its velocity at $t = T/4$ has a magnitude of nearly

(a) 200 m/s (b) 300 m/s

(c) 140 m/s (d) 100 m/s

47. A particle A is projected vertically upwards. Another particle B of same mass is projected at an angle of 45°. Both reach the same height. The ratio of the initial kinetic energy of A to that of B is

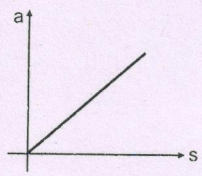
(a) 1 : 2 (b) 2 : 1 (c) $1:\sqrt{2}$ (d) $\sqrt{2}:1$

48. A particle starts from the origin of co-ordinates at time $t = 0$ and moves in the xy plane with a constant acceleration α in the y-direction. Its equation of motion is $y = \beta x^2$. Its velocity component in the x-direction is

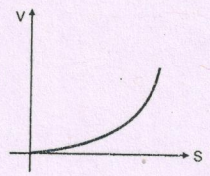
(a) variable (b) $\sqrt{2\alpha/\beta}$

(c) $\alpha/2\beta$ (d) $\sqrt{\alpha/2\beta}$

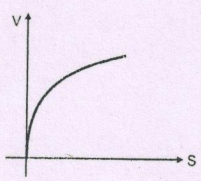
49. Acceleration (a)-displacement (s) graph of a particle moving in a straight line is as shown in the figure. The initial velocity of the particle is zero. The v-s graph of the particle would be



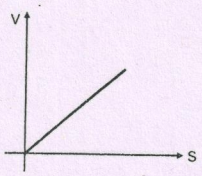
(a)



(b)



(c)



(d) None of these

50. A horizontal wind is blowing with a velocity v towards north-east. A man starts running towards north with acceleration a. The time after which man will feel the wind blowing towards east is

(a) $\frac{v}{a}$ (b) $\frac{\sqrt{2}v}{a}$

(c) $\frac{v}{\sqrt{2}a}$ (d) $\frac{2v}{a}$

51. A point moves in x-y plane according to the law $x = 4\sin 6t$ and $y = 4(1-\cos 6t)$. The distance traversed by the particle in 4 s is (x and y are in metre)

(a) 96 m (b) 48 m (c) 24 m (d) 108 m