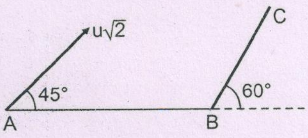
76. A particle is projected from a point A with velocity $u\sqrt{2}$ at an angle of 45° with horizontal as shown in figure. It strikes the plane BC at right angles. The velocity of the particle at the time of collision is



(a) $\frac{\sqrt{3}u}{2}$ (b) $\frac{u}{2}$

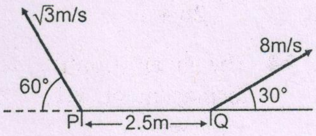
(c) $\frac{2u}{\sqrt{3}}$ (d) u

77. In the above problem time after which collision takes place is

(a) $\frac{u}{g}\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$ (b) $\frac{u}{g}$

(c) $\frac{\sqrt{3}\,u}{g}$ (d) $\left(\frac{\sqrt{3}}{\sqrt{3}-1}\right)\frac{u}{g}$

78. Two particles P and Q are moving as shown in the figure. At this moment of time the angular speed of P w.r.t. Q is



(a) 1 rad/s (b) 2 rad/s

(c) 5 rad/s (d) 4 rad/s

79. A projectile is thrown with a velocity of $10\sqrt{2}$ m/s at an angle of 45° with horizontal. The interval between the moments when speed is $\sqrt{125}$ m/s is (g = 10 m/s^2)

(a) 1.0 s (b) 1.5 s

(c) 2.0 s (d) 0.5 s

80. Position vector of a particle moving in x-y plane at time t is $\vec{\mathbf{r}} = a(1-\cos\omega t)\,\hat{\mathbf{i}} + a\sin\omega t\,\hat{\mathbf{j}}$. The path of the particle is

(a) a circle of radius a and centre at (a, 0)

(b) a circle of radius a and centre at (0, 0)

(c) an ellipse

(d) Neither a circle nor an ellipse

81. A particle moves in x-y plane. The position vector of particle at any time t is $\vec{\mathbf{r}} = \{(2t)\,\hat{\mathbf{i}} + (2t^2)\hat{\mathbf{j}}\}$ m. The rate of change of θ at time t = 2 s. (where θ is the angle which its velocity vector makes with positive x-axis) is

(a) $\frac{2}{17}$ rad/s (b) $\frac{1}{14}$ rad/s

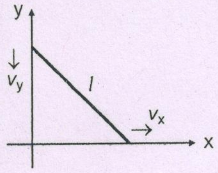
(c) $\frac{4}{7}$ rad/s (d) $\frac{6}{5}$ rad/s

82. Starting from rest, a particle rotates in a circle of radius $R = \sqrt{2}$ m with an angular acceleration $\alpha = \pi/4$ rad/s^2. The magnitude of average velocity of the particle over the time it rotates quarter circle is

(a) 1.5 m/s (b) 2 m/s

(c) 1 m/s (d) 1.25 m/s

83. A rod of length l leans by its upper end against a smooth vertical wall, while its other end leans against the floor. The end that leans against the wall moves uniformly downward. Then



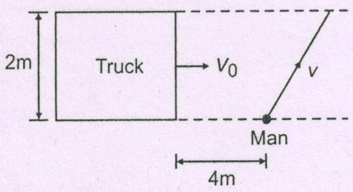
(a) the other end also moves uniformly

(b) the speed of other end goes on decreasing

(c) the speed of other end goes on increasing

(d) the speed of other end first decreases and then increases

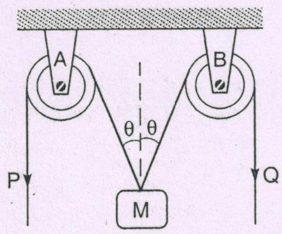
84. A 2 m wide truck is moving with a uniform speed v_0 = 8 m/s along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is 4 m away from him. The minimum value of v so that he can cross the road safely is



(a) 2.62 m/s (b) 4.6 m/s

(c) 3.57 m/s (d) 1.414 m/s

85. In the arrangement shown in the figure the ends P and Q of an unstretchable string move downwards with uniform speed U. Pulleys A and B are fixed.



Mass M moves upwards with a speed

(a) $2U\cos\theta$ (b) $U/\cos\theta$

(c) $2U/\cos\theta$ (d) $U\cos\theta$

86. A particle is moving eastwards with a velocity of 5 m/s. In 10 s the velocity changes to 5 m/s northwards. The average acceleration in this time is

(a) zero

(b) $\frac{1}{\sqrt{2}}$ m/s^2 towards north-east

(c) $\frac{1}{\sqrt{2}}$ m/s^2 towards north-west

(d) $\frac{1}{2}$ m/s^2 towards north

87. A river is flowing from west to east at a speed of 5 m/min. A man on the south bank of the river, capable of swimming at 10 m/min in still water, wants to swim across the river in the shortest time. He should swim in a direction

(a) due north (b) 30° east of north

(c) 30° west of north (d) 60° east of north

88. A boat which has a speed of 5 km/h in still water crosses a river of width 1 km along the shortest possible path in 15 min. The velocity of the river water in km/h is

(a) 1 (b) 3

(c) 4 (d) $\sqrt{41}$