61. The speed of a projectile when it is at its greatest height is $\sqrt{2}/5$ times its speed at half the maximum height. The angle of projection is
(a) 30° (b) 60°
(c) 45° (d) $\tan^{-1}(3/4)$

62. After one second the velocity of a projectile makes an angle of 45° with the horizontal. After another one more second it is travelling horizontally. The magnitude of its initial velocity and angle of projection are ($g = 10\ m/s^2$)
(a) 14.62 m/s, 60° (b) 14.62 m/s, $\tan^{-1}(2)$
(c) 22.36 m/s, $\tan^{-1}(2)$ (d) 22.36 m/s, 60°

63. A particle is projected from the ground at an angle of 60° with horizontal with speed $u = 20$ m/s. The radius of curvature of the path of the particle, when its velocity makes an angle of 30° with horizontal is ($g = 10\ m/s^2$)
(a) 10.6 m (b) 12.8 m
(c) 15.4 m (d) 24.2 m

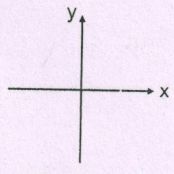
64. At a height of 0.4 m from the ground, the velocity of a projectile in vector form is $\vec{v} = (6\hat{i} + 2\hat{j})$ m/s (the x-axis is horizontal and y-axis is vertically upwards). The angle of projection is ($g = 10\ m/s^2$)
(a) 45° (b) 60°
(c) 30° (d) $\tan^{-1}(3/4)$

65. The horizontal range and maximun height attained by a projectile are R and H respectively. If a constant horizontal acceleration $a = g/4$ is imparted to the projectile due to wind, then its horizontal range and maximum height will be
(a) $(R + H), \frac{H}{2}$ (b) $\left(R + \frac{H}{2}\right), 2H$
(c) $(R + 2H), H$ (d) $(R + H), H$

66. A car 2 m long and 3 m wide is moving at 10 m/s when a bullet hits it in a direction making an angle of $\tan^{-1}(3/4)$ with the car as seen from the ground. The bullet enters one edge of the car at the corner and passes out at diagonally opposite corner. Neglecting gravity, the time for the bullet to cross the car is
(a) 1.0 s (b) 0.4 s
(c) 0.2 s (d) 0.6 s

67. Starting from rest a particle moves in a straight line with acceleration $a = \{2 + |t - 2|\}\ m/s^2$
Velocity of particle at the end of 4 s will be
(a) 16 m/s (b) 20 m/s
(c) 8 m/s (d) 12 m/s

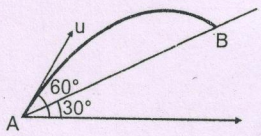
68. The x and y co-ordinates of a particle are $x = A \sin(\omega t)$ and $y = A \sin(\omega t + \pi/2)$. Then the motion of the particle is
(a) circular anticlockwise
(b) circular clockwise
(c) elliptical clockwise
(d) rectilinear



The x and y are in the directions shown in figure.

69. A particle is projected with a certain velocity at an angle α above the horizontal from the foot of an inclined plane of inclination 30°. If the particle strikes the plane normally then α is equal to
(a) $30° + \tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$
(b) 45°
(c) 60°
(d) $30° + \tan^{-1}(2\sqrt{3})$

70. Time taken by the projectile to reach from A to B is t. Then the distance AB is equal to
(a) $\frac{ut}{\sqrt{3}}$
(b) $\frac{\sqrt{3}ut}{2}$
(c) $\sqrt{3}ut$
(d) $2ut$

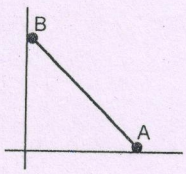


71. A projectile of mass 2 kg has velocities 3 m/s and 4 m/s at two points during its flight in the uniform gravitational field of the earth. If these two velocities are perpendicular to each other, then the minimum kinetic energy of the particle during its flight is
(a) 6.32 J (b) 8.40 J
(c) 16.32 J (d) 5.76 J

72. With what minimum speed must a particle be projected from origin so that it is able to pass through a given point (30 m, 40 m)? Take $g = 10\ m/s^2$
(a) 60 m/s (b) 30 m/s
(c) 50 m/s (d) 40 m/s

73. Velocity-time equation of a particle moving in a straight line is $v = 2t - 4$ for $t \le 2$ s and $v = 4 - 2t$ for $t > 2$ s. The distance travelled by the particle in the time interval from $t = 0$ to $t = 4$ s is (Here, t is in second and v in m/s)
(a) 12 m (b) 16 m
(c) 4 m (d) 8 m

74. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown. The velocity of A to the left is 10 m/s. What is the speed of B when angle $\theta = 45°$?



(a) 5 m/s (b) $5\sqrt{2}$ m/s
(c) 10 m/s (d) 7.5 m/s

75. The distance r from the origin of a particle moving in x-y plane varies with time as, $r = 2t$ and the angle made by the radius vector with positive x-axis is $\theta = 4t$. Here, t is in second, r in metre and θ in radian. The speed of the particle at $t = 1$ s is
(a) 12 m/s
(b) 10 m/s
(c) 5 m/s
(d) None of the above