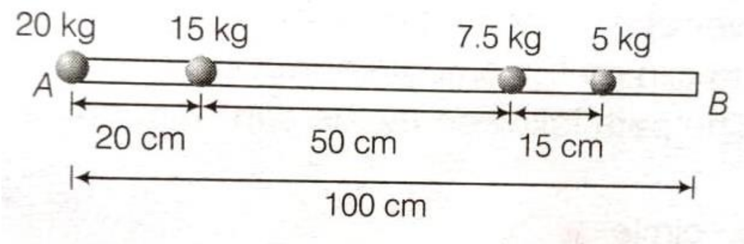
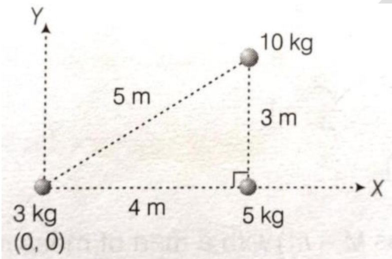
1. For the figure shown, a rod of mass 10 kg (of length 100cm) with some point masses tied to it at different positions. Find the distance of the point (from A) at which if the rod is picked over a knife edge, It will be in



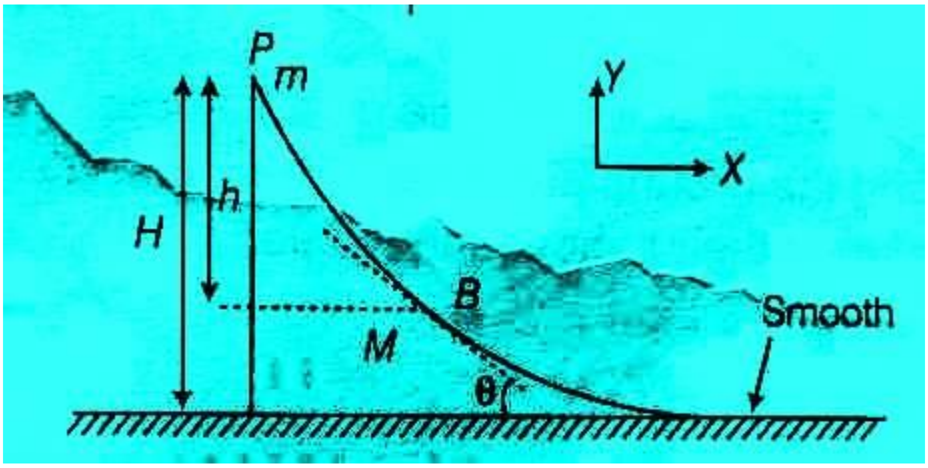
a. 26.32cm b. 30.43cm c.28.72cm d. 32.50cm

2. Three point masses are present at the vertices of a right angled triangle as shown in the figure. With respect to the coordinate system shown, the coordinates of centre of mass (X_{COM}, Y_{com}) of the three point mass system are

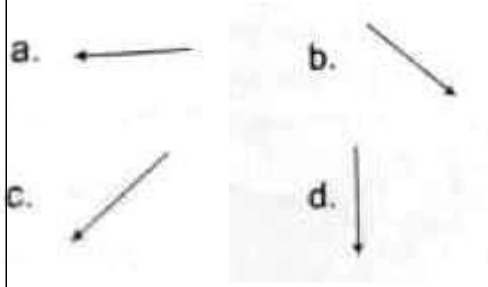


a. (3.33, 1.67) m c. (3.67, 1.33) m
b. (1.67, 3.33) m d. (1.33 3.67) m

3. A particle P of mass m is released from the top of a wedge Q of mass M. Wedge is free to move on a smooth horizontal surface. There is no information regarding the nature of surface of wedge. The speed of particle when it reaches B is V_2 and speed of wedge at this instant is v_1.



The centre of mass of the system comprising P and Q will be moving in which direction?

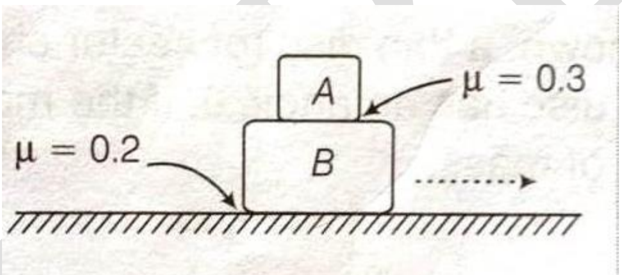


4. uniform thin rod of mass m and length L is standing vertically along the Y-axis on a smooth horizontal surface with its lower end at the origin (0.0). A slight disturbance at t = 0 causes the lower end to slip on the smooth surface along the positive X-axis and the rod starts falling. The path followed by the centre of mass during its fall, is

a. parabola b. circle

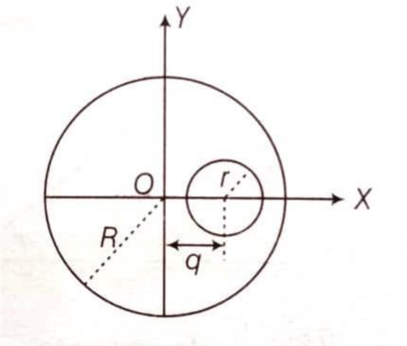
c)straight line d. ellipse

5.Both the blocks shown in the given arrangement are given together a horizontal velocity towards right. If x ms^{-2} be the subsequent acceleration of centre of mass of the system of blocks, find the minimum value of x (in ms^{-2}). (Given, $m_A = 2m_B$, and g = 10 ms^{-2}, all in SI units)

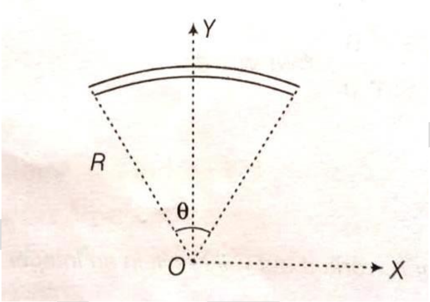


6. A bullet of mass 10 g moving horizontally with speed of 400 ms^{-1} and embedded into a block of mass 390 g initially at rest. If ratio of final KE of centre of mass to initial KE of bullet is r, then find the value of 200r.

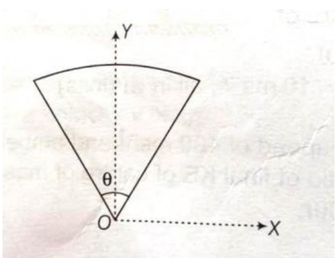
7. From a solid sphere of radius R and mass M, a spherical portion of radius r is removed as shown in the figure. With respect to the coordinate system shown, find out the position of centre of mass of residual body.



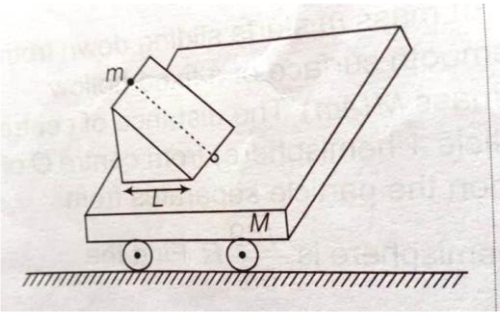
8. For the figure there is an arc of a thin ring, that subtends at an angle θ at the centre. The mass of the arc is m and its radius is R. Locate the centre of mass of the arc.



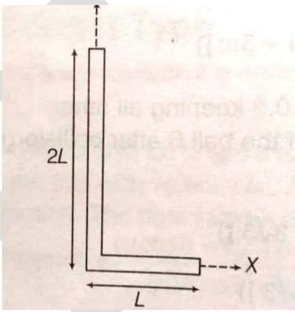
9. For the figure shown, a thin disc (of sector shape) which is part of a circular disc of radius R. The disc has an angle θ. If the mass of the shown disc is m, then locate its centre of mass.



10 For the given figure, a flat car of mass M on a frictionless road is shown. A small massless wedge is fitted on it as shown. A small ball of mass m is released from the top of the wedge. It slides over it and falls into the hole at a horizontal distance L from the initial position of the ball. Find the distance travelled by the flat car till the ball gets into the hole from its initial position.



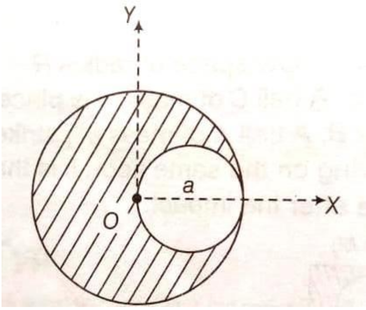
11. A thin rod of length 3L is bent at right angles at a distance L from one end. Locate the centre of mass of the arrangement w.r.t. the corner (see figure). (Given, L= 1.2 m)



Find the coordinates of centre of mass of the uniform lamina shown in the figure.
In the

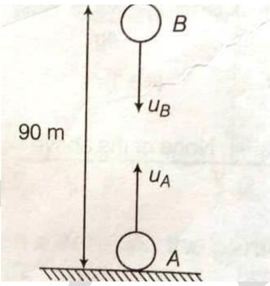
a $r_{com} = (0.2\,\hat{i} + 0.8\hat{j})$m | **C. $r_{com} = (0.5\,\hat{i} + \hat{j})$m**
b. $r_{com} = (0.4\,\hat{i} + 0.6\hat{j})$m | **d. $r_{com} = (0.2\,\hat{i} + 0.6\hat{j})$m**

12. Find the coordinates of centre of mass of the uniform lamina shown in the figure.



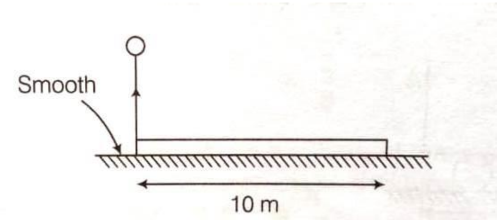
A $\left(\frac{a}{6}, 0\right)$ $\left(-\frac{a}{6}, 0\right)$ $\left(-\frac{a}{4}, 0\right)$ $\left(\frac{a}{4}, 0\right)$

13. Two particles A and B of masses 1 kg and 2 kg respectively are projected in the directions shown in the figure with speeds u_A = 200 ms^{-1} and u_B = 55 ms^{-1}. Initially, they were 90 m apart. Find the maximum height attained by the centre of mass of the particles. Assume g is constant and is equal to 10 ms^{-2}



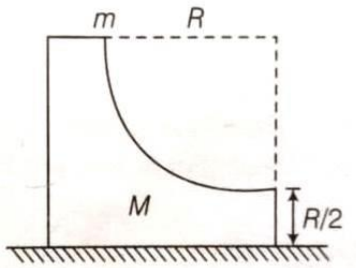
a. 125m b.145m c.115m d. 105m

14. A wooden plank of mass 20 kg is resting on a smooth horizontal floor. A man of mass 60 kg starts moving from one end of the plank to the other end. The length of the plank is 10 m. Find the displacement of the plank over the floor when the man reaches the other end of the plank



a. 5 m **c. 2.5 m**
b. 6.5 m **d. 7.5 m**

15. A small particle of mass *m* slides down a circular path of radius R cut into a large block of mass M as shown in the figure. M rests on a table and both block and particle move without friction. The particle and the block are initially at rest and m starts from the top of the path. The honizontal distance from the bottom of the block to where the particle hits the table is



a. $R\sqrt{\frac{2(M+m)}{M}}$ **b.** $R\sqrt{\frac{2(M+m)}{m}}$

c. $R\sqrt{\frac{M+m}{M}}$ **d.** $R\sqrt{2m}$

16. A wagon of mass M can move without friction along horizontal rails. A simple pendulum consisting of a sphere of mass m is suspended from the ceiling of the wagon by an ideal string of length l At the initial moment, the wagon and the pendulum are at rest and the string is making angleα with the vertical. The velocity of wagon when the pendulum passes through its mean position is

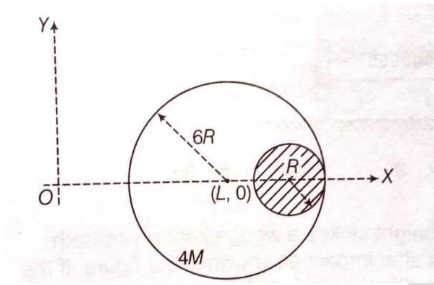
a. $m \sin\left(\frac{\alpha}{2}\right)\sqrt{\frac{gl}{(M+m)M}}$

b. m sin $\left(\frac{\alpha}{2}\right)\sqrt{\frac{2gl}{(M+m)M}}$

c. 2m sin $\left(\frac{\alpha}{2}\right)\sqrt{\frac{gl}{(M+m)M}}$

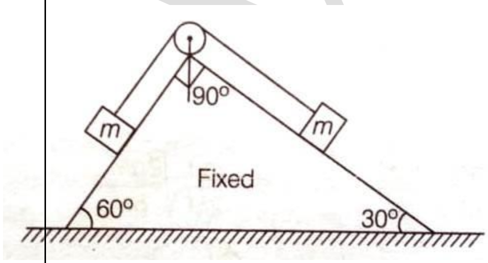
d. 2m sin $\left(\frac{\alpha}{2}\right)\sqrt{\frac{gl}{(M+m)M}}$

17. A small sphere of radius R is held against the inner surface of larger sphere of radius 6R (as shown in the figure). The masses of large and small spheres are 4M and M, respectively. This arrangement is placed on a horizontal table. There is no friction between any surfaces of contact. The small sphere is now released. Find the coordinates of the centre of the large sphere, when the smaller sphere reaches the opposite extreme position.



a. (L+2R,0) **b. (L+R,0)**
C. (L-2R,0) **d. (L-R,0)**

18.Two blocks each of mass m are connected by an ideal string and are placed on a smooth wedge as shown Pulley shown is ideal. Find the magnitude of acceleration of centre of mass of two block system



a. $g\left(\frac{\sqrt{3}-1}{2\sqrt{2}}\right)$ b. $g\left(\frac{\sqrt{3}-1}{\sqrt{2}}\right)$ c. $g\left(\frac{\sqrt{3}-1}{4\sqrt{2}}\right)$ d. $\frac{g}{\sqrt{2}}$

19. A thin rod of length L is lying along the X-axis with its ends at x = 0 and x = L. Its linear density (mass/length) varies with x as $k\left(\frac{x}{L}\right)^n$, where n can be zero or any positive number. If the position X_{cm} of the centre of mass of the rod is plotted against n, which of the following graphs best approximates the dependence of X_{cm} on n?