

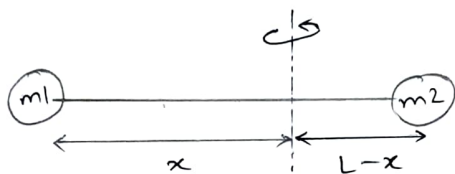
Q. The object shown in Fig consists of two particles of  $m_1$  and  $m_2$ , connected by a light rod of length  $L$

(a) Neglecting mass of rod, find the rotational inertia  $I$  of this system for rotations of this object about an axis perpendicular to the rod and a distance  $x$  from  $m_1$

(b) Show that  $I$  is minimum when  $x = x_{cm}$

Solution:

(a)  $I_{sys} = m_1 r_1^2 + m_2 r_2^2$



$$I_{sys} = m_1 x^2 + m_2 (L-x)^2$$

(b) To show this  $I = I_{min}$  when  $x = x_{cm}$   
i.e. axis passes through 'C' of rod,

$$\frac{dI_{sys}}{dx} = 0$$

$$2m_1 x + 2m_2 (L-x) = 0$$

$$x = \frac{m_2 L}{m_1 + m_2} \rightarrow x_{cm}$$

$$x = x_{cm}$$