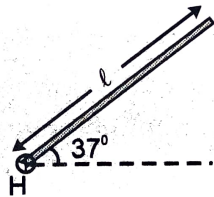


A uniform rod of mass m and length ℓ can rotate in vertical plane about a smooth horizontal axis hinged at point H. Find angular acceleration α of the rod just after it is released from initial position making an angle of 37° with horizontal from rest. Just after the rod is released from rest, find (a) Angular acceleration of rod (b) Acceleration of Centre of Mass of the rod (c) force exerted by the hinge



Solution :

(a) Torque about hing = $\tau_H = I \alpha$

$$mg \cos 37^\circ \frac{\ell}{2} = \frac{m\ell^2}{3} \alpha$$

$$\alpha = 6g / 5\ell$$

(b) $a_{CM} = \alpha \cdot \frac{\ell}{2} = \frac{3g}{5}$

(c) $mg \cos 37^\circ - N_1 = ma_t$

$$N_1 = \frac{mg}{5}$$

angular velocity of rod is zero. so $N_2 = mg \sin 37^\circ = 3mg/5$

$$N = \sqrt{N_1^2 + N_2^2} = \sqrt{\left(\frac{mg}{5}\right)^2 + \left(\frac{3mg}{5}\right)^2} = \frac{mg\sqrt{10}}{5}$$

