A thin rod of length L and mass M is held vertically with one end hinged on the floor and is allowed to fall. Which of the following is the velocity of the other end when it hits the floor, assuming that the hinged end on the floor does not slip?

(A)
$$\sqrt{12gL}$$
 (B) $\sqrt{6gL}$ (C) $2\pi\sqrt{\frac{L}{g}}$ (D) $\sqrt{3gL}$

Solution



We have, Loss in PE = Gain in KE

$$\therefore Mg \frac{L}{2} = \frac{1}{2}I\omega^2 = \frac{1}{2}\frac{ML^2}{3}\omega^2$$
$$\therefore \omega = \sqrt{\frac{3g}{L}}$$

Now, $v = L\omega = \sqrt{3gL}$

Hence, (D)