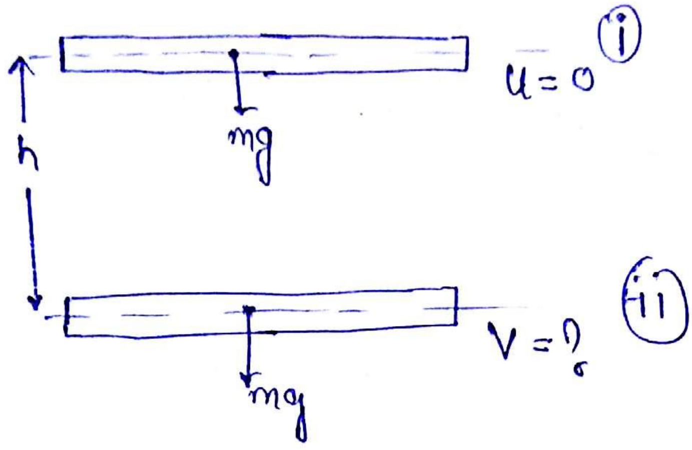
Work Energy Theorem :-

Total work done = change in K. E.

Case 1

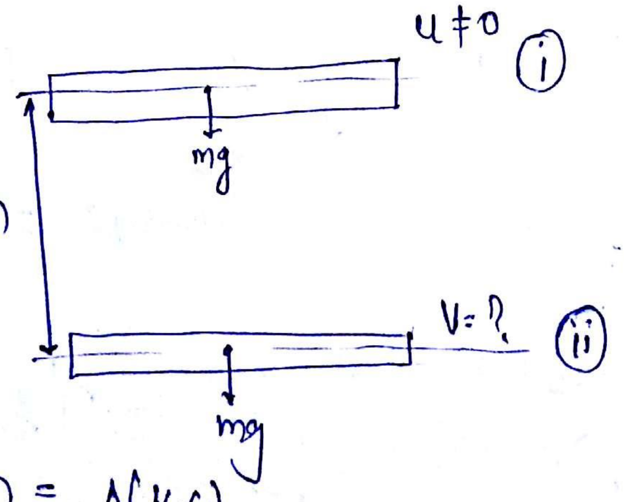


$$TWD = \Delta(K.E.)$$

$$W_{mg} = mgh = \left[\frac{1}{2}mv^2 - 0\right]$$

$$\boxed{v = \sqrt{2gh}}$$

Case-2

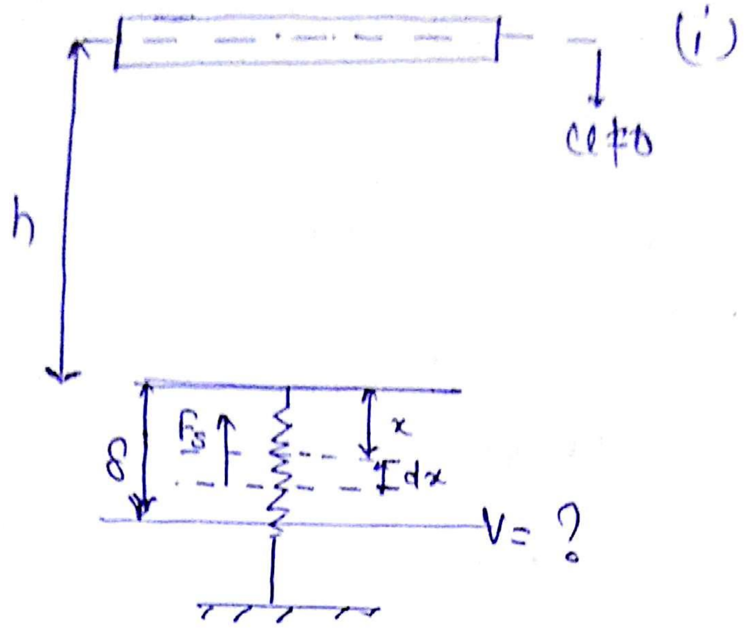


$$TWD = \Delta(K.E.)$$

$$W_{mg} = mgh = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$$

$$\boxed{v = \sqrt{2gh + u^2}}$$

Case. 3



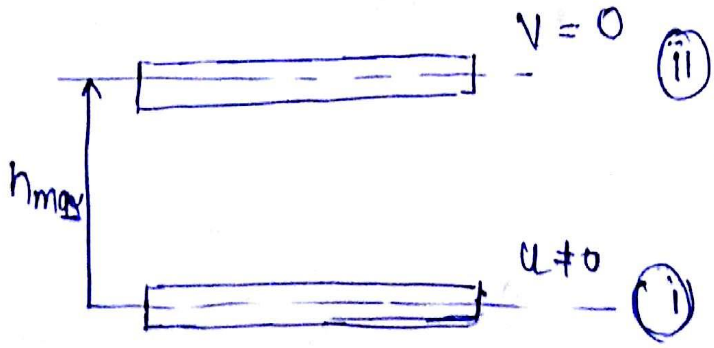
Total work done = $\Delta(K.E.)$

$TWD = W_{mg} + W_{F_s}$

$TWD = mg(h+\delta) + \frac{1}{2}(-k\delta^2)$

$$\boxed{mg(h+\delta) - \frac{1}{2}k\delta^2 = \frac{1}{2}mv^2 - \frac{1}{2}mu^2}$$ (work Energy thm)

Case-4

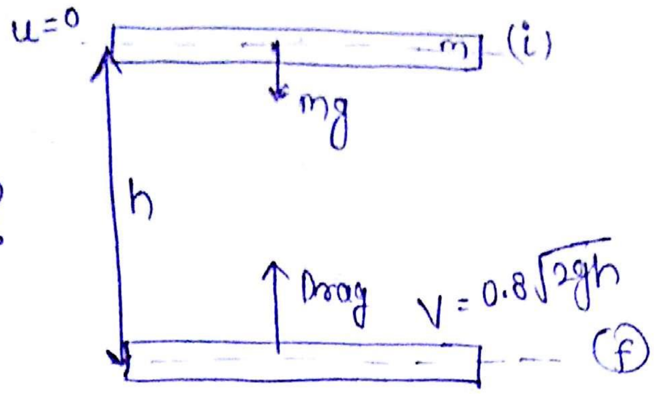


$TWD = \Delta(K.E.)$

$W_{mg} = -mgh_{max} = 0 - \frac{1}{2}mu^2$

$$\boxed{h_{max} = \frac{u^2}{2g}}$$

Ques.



$W_{drag} = ?$

Sol^n

$$TWD = \Delta(K.E)$$

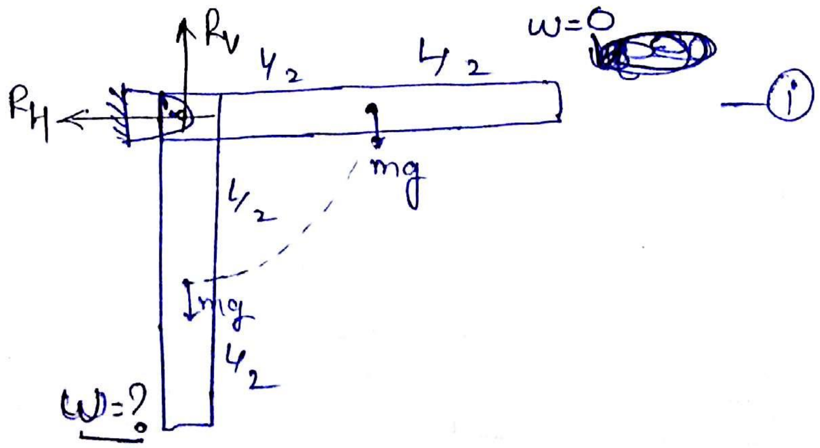
$$W_{mg} + W_{drag} = \Delta(KE)$$

$$mgh - W_{drag} = \frac{m}{2}(0.64 \times 2gh)$$

$$W_{drag} = 0.36\ mgh$$

$$W_{drag} = 0.36\ W_{mg}$$

Ques:



$\omega = ?$

$$TWD = \Delta(K.E.)$$

$$W_{mg} = mg \times \frac{L}{2} = \frac{1}{2} I\omega^2 - 0$$

$$mg\frac{l}{2} = \frac{1}{2} \times \frac{ml^2}{3} \times \omega^2$$

$$\omega = \sqrt{3g/l}$$

Linear Momentum :- (P)

$$\vec{P} = m\vec{V}_{cm}$$

$$\frac{d\vec{P}}{dt} = \frac{d(m\vec{V}_{cm})}{dt} = m\frac{d\vec{V}_{cm}}{dt} = m\vec{a}_{cm} = (\vec{F}_R)_{ext.}$$

Conservation of linear momentum :-

$$\vec{P} = \text{Constant}$$

$$d\vec{P} = 0 \quad ; \text{ when } (\vec{F}_R)_{ext} = 0$$

If the resultant force on a system is zero then its a linear moment will remain conserve.

e.g. → Collisions / Impacts

Impulse - Momentum equn

$$\frac{d\vec{P}}{dt} = \vec{F}$$

$$\boxed{\underbrace{\vec{F}\,dt}_{\text{Implyse}} = \underbrace{d\vec{P}}_{\text{Change in momentum}}}$$

$$\boxed{\int_{t_1}^{t_2} \vec{F}\,dt = \vec{P}_f - \vec{P}_i}$$