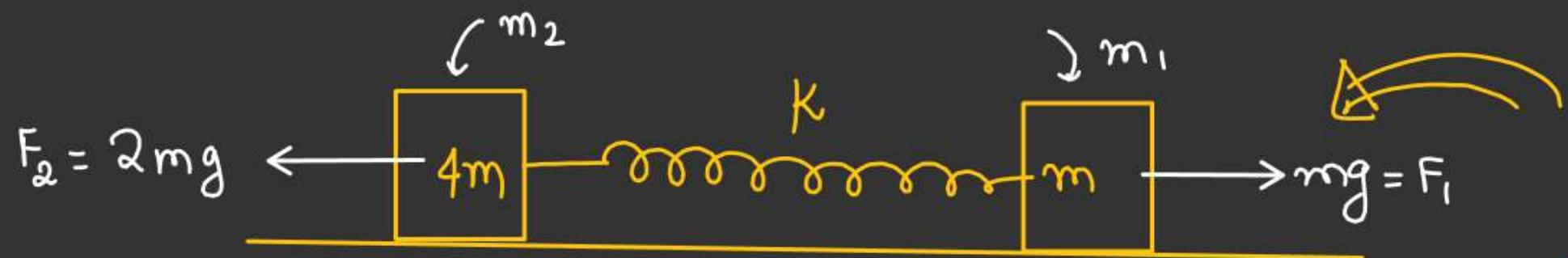


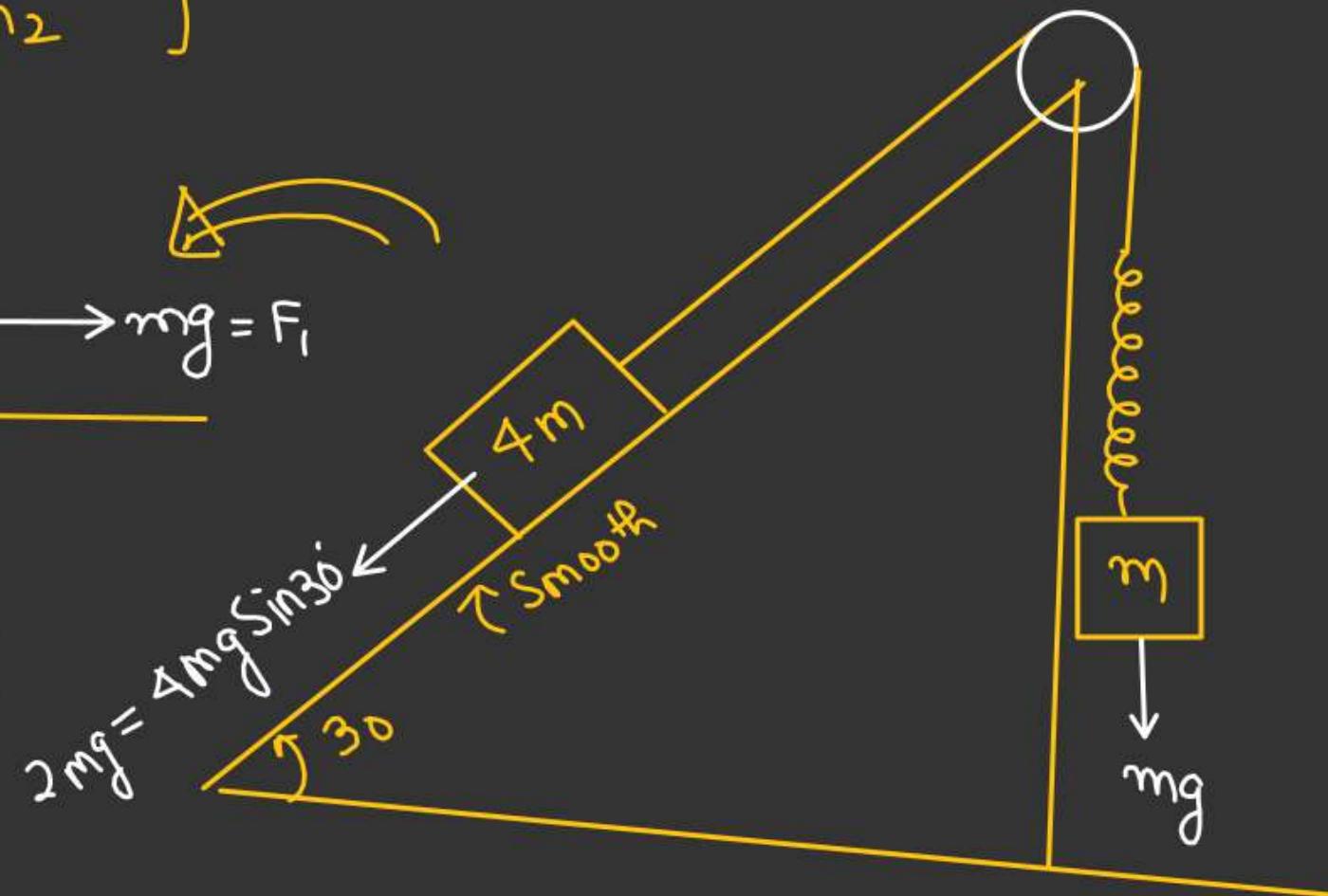
~~Δ~~

$$\chi_{\max} = \frac{2}{K} \left[\frac{m_1 F_2 + m_2 F_1}{m_1 + m_2} \right]$$



$$\chi_{\max} = \frac{2}{K} \left[\frac{(mg)(2mg) + (4m)mg}{5m} \right]$$

$$= \frac{2}{K} \left[\frac{6m^2 g}{5m} \right] = \left(\frac{12mg}{5K} \right)$$

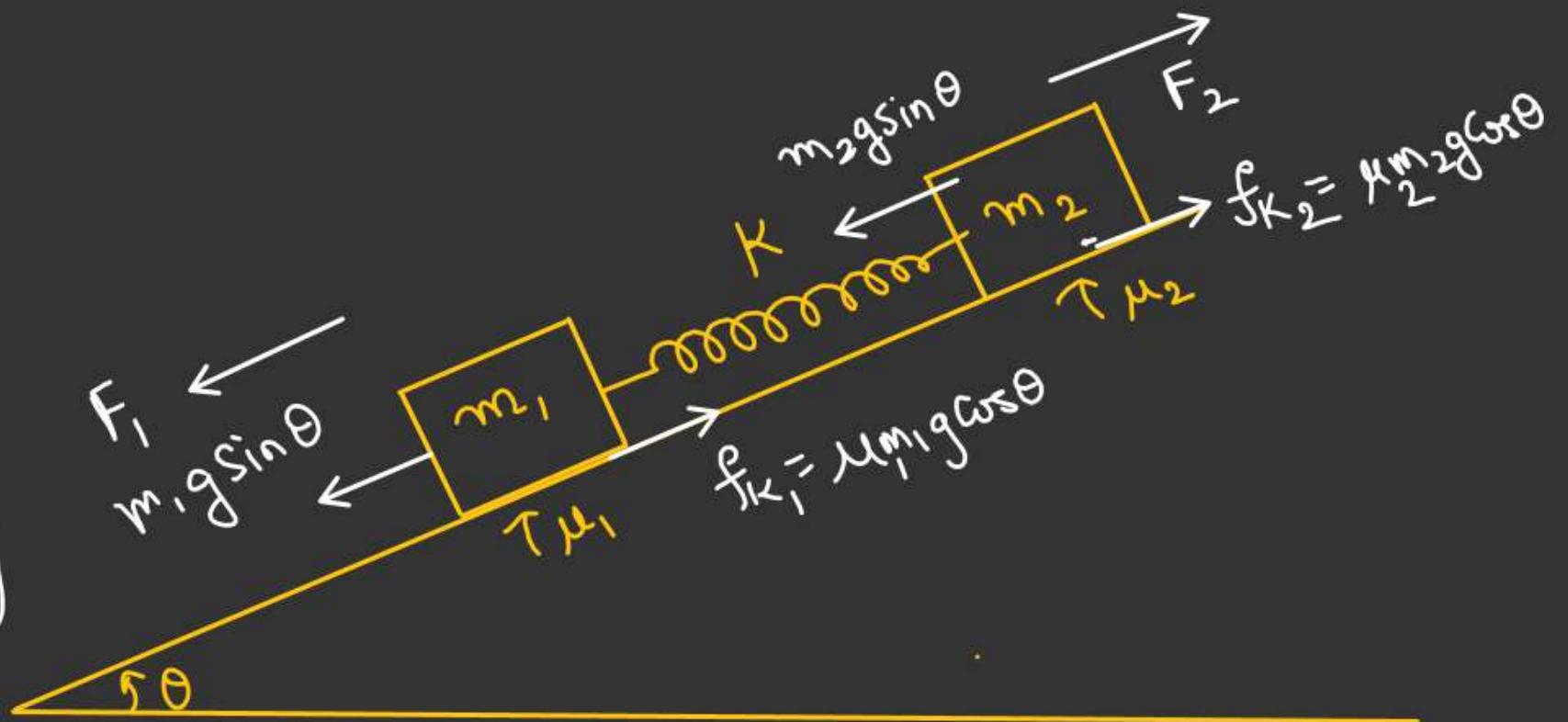


Kinetic friction acting b/w
 m_1 & m_2

Find x_{\max} in the Spring.

$$F_1 = [m_1 g \sin \theta - \mu_1 m_1 g \cos \theta]$$

$$F_2 = [\mu_2 m_2 g \cos \theta - m_2 g \sin \theta]$$



$$\chi_{\max} = \frac{2}{K} \left[\frac{m_2 (m_1 g \sin \theta - \mu_1 m_1 g \cos \theta) + m_1 (\mu_2 m_2 g \cos \theta - m_2 g \sin \theta)}{m_1 + m_2} \right]$$

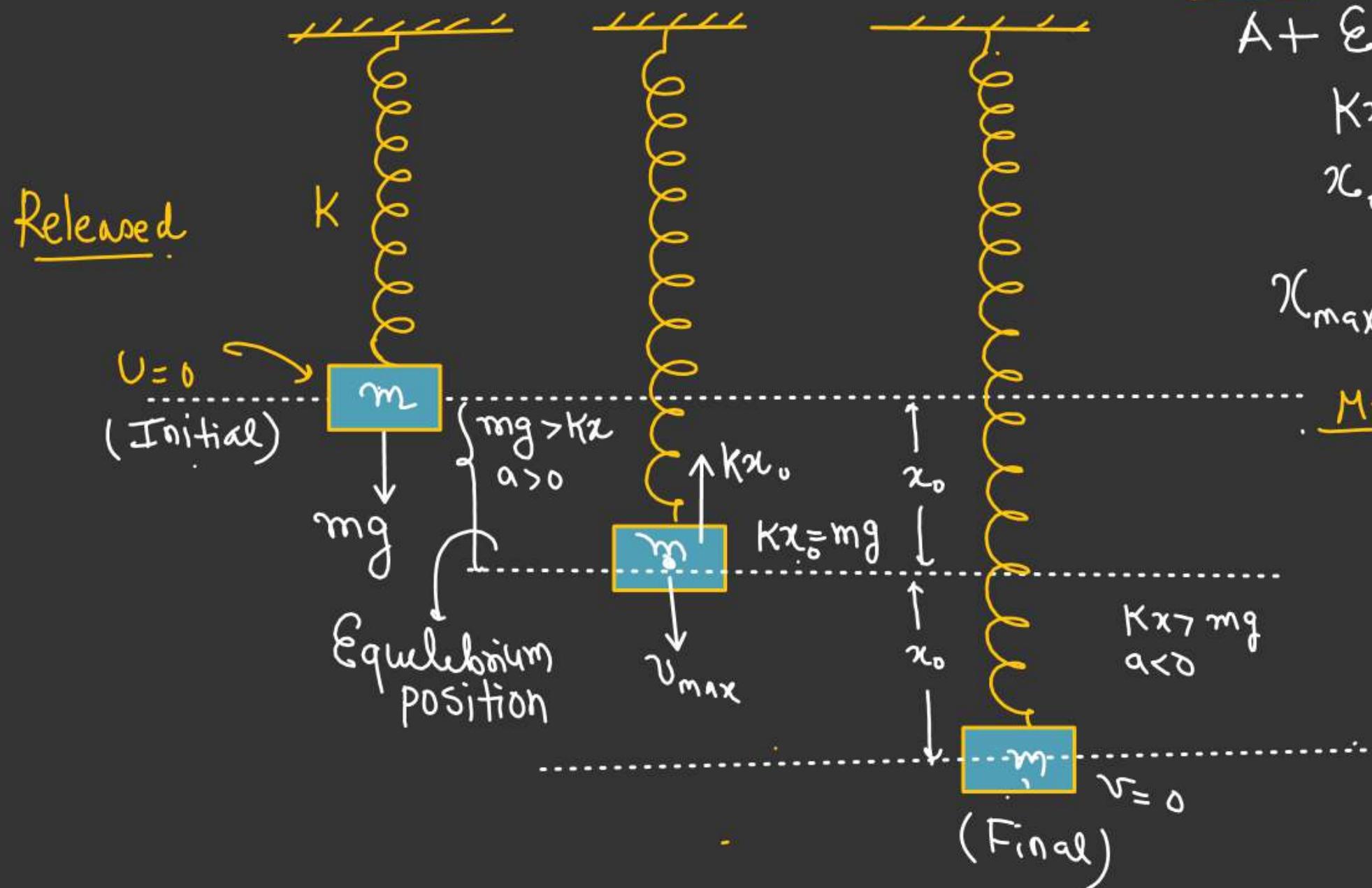
$$\chi_{\max} = \frac{2}{K} \left[\frac{(\mu_2 - \mu_1) m_1 m_2 g \cos \theta}{m_1 + m_2} \right]$$

- ① If $\mu_2 > \mu_1$, $\chi_{\max} > 0 \Rightarrow$ elongation.
- ② If $\mu_2 < \mu_1$, $\chi_{\max} < 0 \Rightarrow$ compression
- ③ $\mu_1 = \mu_2 \Rightarrow$ Spring at its Natural length.



Vertical Spring

Block is released when spring at its Natural length.



M-1 (Force Method)

A + Equilibrium

$$Kx_0 = mg$$

$$x_0 = \frac{mg}{K}$$

$$x_{max} = 2x_0 = \frac{2mg}{K}$$

M-2:- By work-Energy theorem
or Energy conservation.

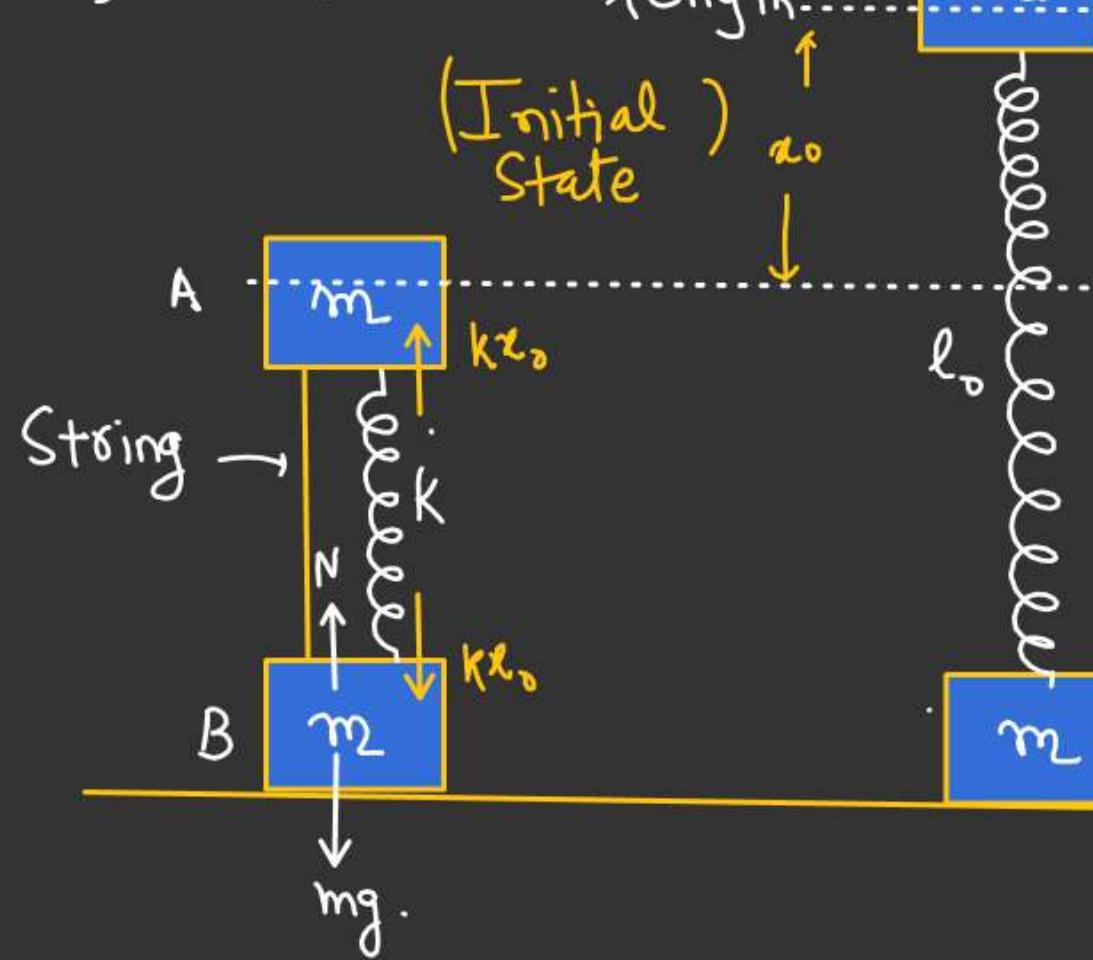
$$\begin{aligned} U_i + K \cdot E_i &= U_f + \cancel{K \cdot E_f} \\ 0 &= -mgx_{max} + \frac{1}{2}Kx_{max}^2 \\ \left(x_{max} = \frac{2mg}{K} \right) \end{aligned}$$

When Spring at Compressed State N of B never be zero.

Possibility of N to be zero

When Spring is

When spring in elongated position Natural length m



The diagram shows a mass-spring system at its final state. A spring with stiffness K connects two blue rectangular blocks, each labeled with mass m . The top block is suspended above a horizontal dashed line, with its center at a vertical distance x from the line. A downward arrow from the center of the top block is labeled Kx , indicating the extension of the spring. The bottom block rests on a horizontal solid line, with its center at a vertical distance N from the line. An upward arrow from the center of the bottom block is labeled Kx , indicating the compression of the spring. The left side of the diagram features handwritten text: '(Final State)' at the top left, 'C = 0' below it, and 'N = 0' further down. The right side has handwritten text: 'v = 0' at the top right, and 'mg' at the bottom right, indicating the weight of the bottom mass.

Two block tight with a string.
When string is burn find min. initial compression in the Spring so that block B loses contact with the ground.

Condition for N to be zero,

$$Kx > Mg$$

$\chi \rightarrow$ elongation in

$$kx = mg \Rightarrow x = \frac{mg}{k}$$

Energy Conservation

$$U_i + K \cdot E_i = U_f + K \cdot E_f \checkmark$$

$$-mgx_0 + \frac{1}{2}Kx_0^2 + 0 = mgx + \frac{1}{2}Kx^2 + 0$$

$$-mgx_0 + \frac{1}{2}Kx_0^2 = mg\left(\frac{mg}{K}\right) + \frac{1}{2}K\left(\frac{mg}{K}\right)^2$$

$$\frac{Kx_0^2}{2} - mgx_0 = \frac{m^2g^2}{K} + \frac{m^2g^2}{2K}$$

$$\frac{K}{2}x_0^2 - mgx_0 - \frac{3m^2g^2}{2K} = 0$$

$$x_0^2 - \frac{2mg}{K}x_0 - \frac{3m^2g^2}{2K} \times \frac{2}{K} = 0$$

$$x_0^2 - \frac{2mg}{K}x_0 - 3 \frac{m^2g^2}{K^2} = 0$$

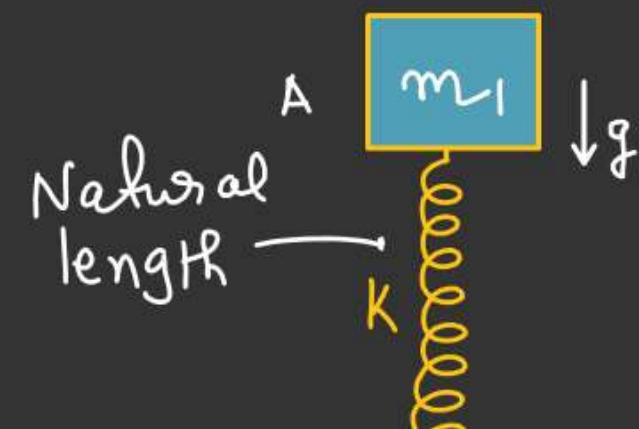
$$x_0 = \frac{2mg}{K} \pm \sqrt{\frac{4m^2g^2}{K^2} + \frac{12m^2g^2}{K^2}}$$

$$x_0 = \frac{1}{2} \left(\frac{2mg}{K} \pm \frac{4mg}{K} \right)^2$$

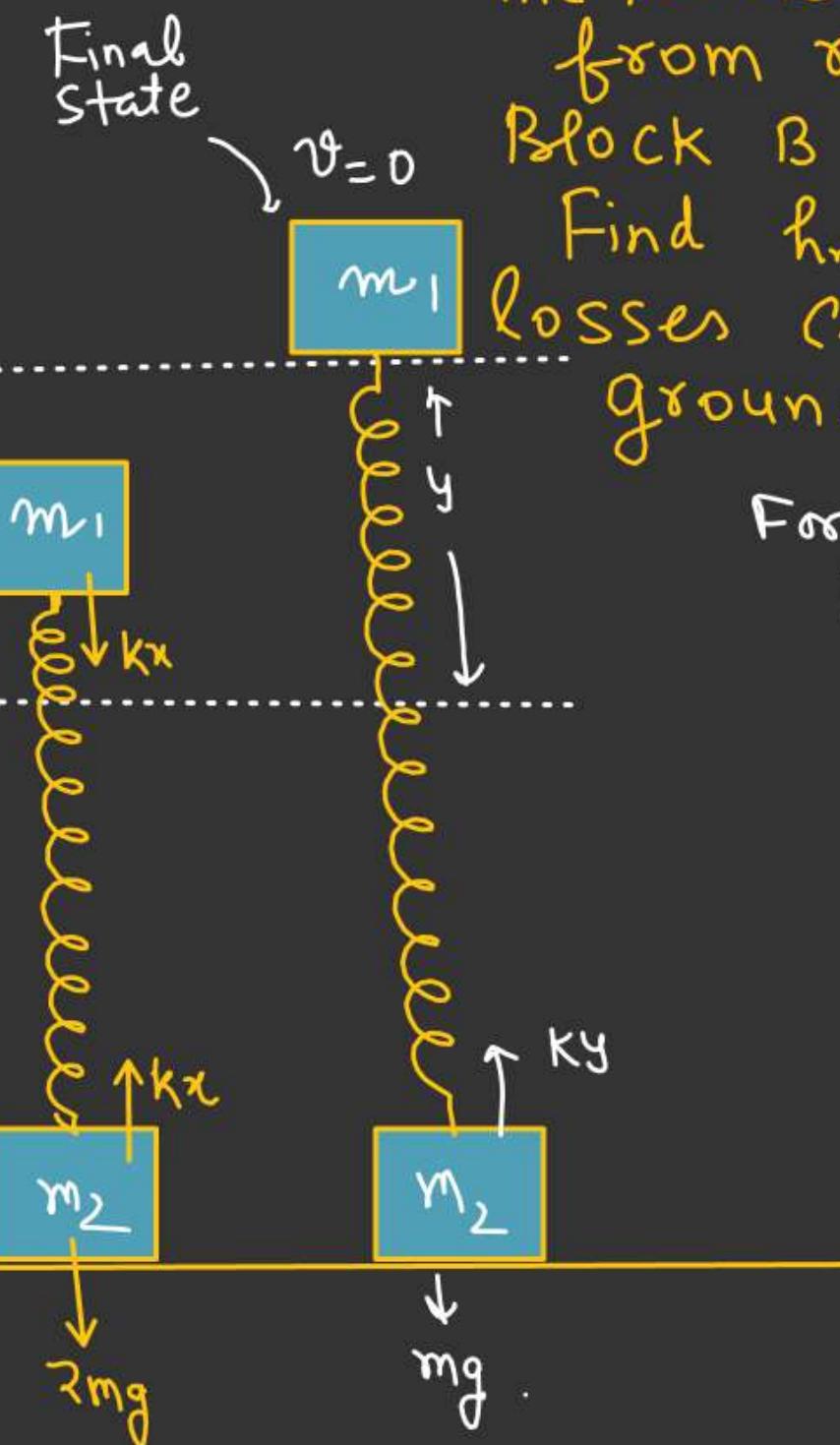
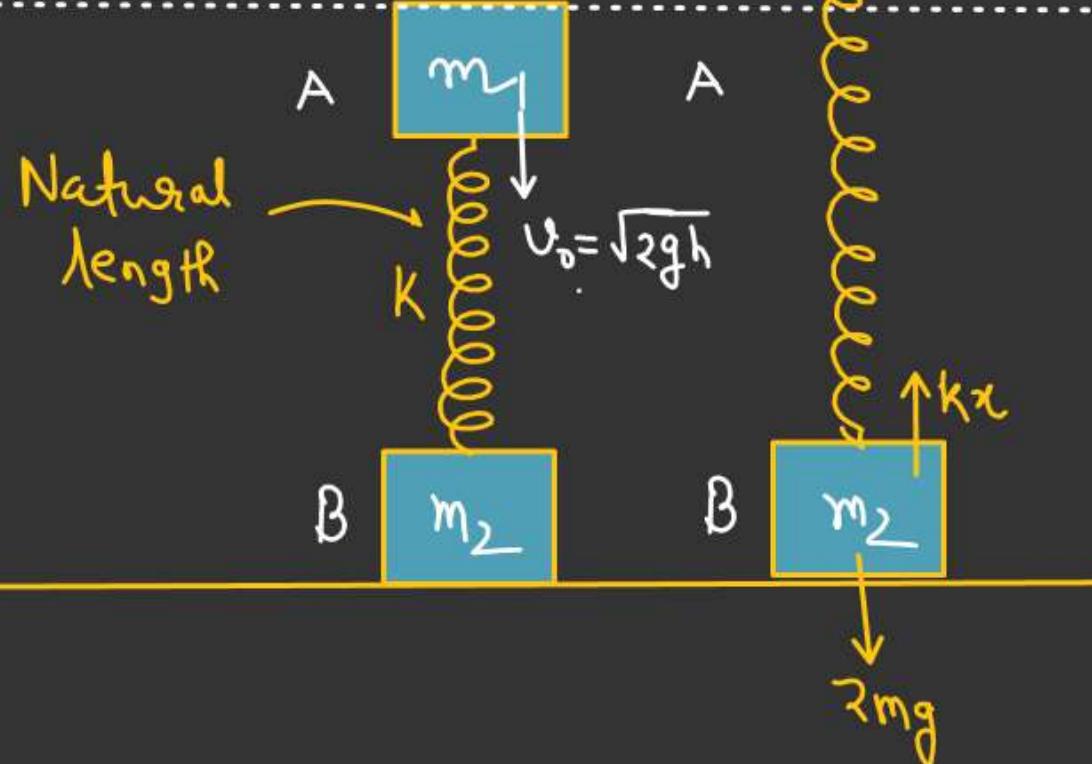
$$x_0 = \frac{1}{2} \left(\frac{6mg}{K} \right)$$

$$x_0 = \frac{3mg}{K} \quad \boxed{=} \quad \text{Ans}$$

$$\begin{aligned}a_{\text{rel}} &= 0 \\v_{\text{rel}} &= 0\end{aligned}$$



(Initial State) $\cup = 0$



The Whole System released from rest at height h .
Block B Stick to the ground.
Find h_{\min} so that block B losses contact from the ground.

For Block to loose
1 Contact
 $K_y > m_2 g$.

In limiting condition

$$K_y = m_2 g$$

$$y = \left(\frac{m_2 g}{K} \right)$$

$$v_0 = \sqrt{2gh}$$

Energy conservation from initial state to final state :

$$\frac{1}{2} m_1 v_0^2 = m_1 gy + \frac{1}{2} Ky^2$$

$$\frac{m_1}{2} \times (2gh) = m_1 g \left(\frac{m_2 g}{K} \right) + \frac{1}{2} K \left(\frac{m_2 g}{K} \right)^2$$

(h_{\min})

★ ★ /

$$h_{\min} = \frac{m_2 g}{K} \left(1 + \frac{m_2}{2m_1} \right)$$

$$m_1 g h_{\min} = \left(\frac{m_1 m_2 g^2}{K} + \frac{m_2^2 g^2}{2K} \right)$$

~~$$m_1 g h_{\min} = \frac{m_1 m_2 g^2}{K} \left(1 + \frac{m_2}{2m_1} \right)$$~~

$$h_{\min} = \frac{m_2 g}{K} \left(1 + \frac{m_2}{2m_1} \right)$$