Nishant Jindal

Law of Motion

Tension :→

↳ [It is a restoring force produce within the body when an external force applied on the body in order to restore the initial State.]

Tension in a string

String → [Whose mass is negligible]

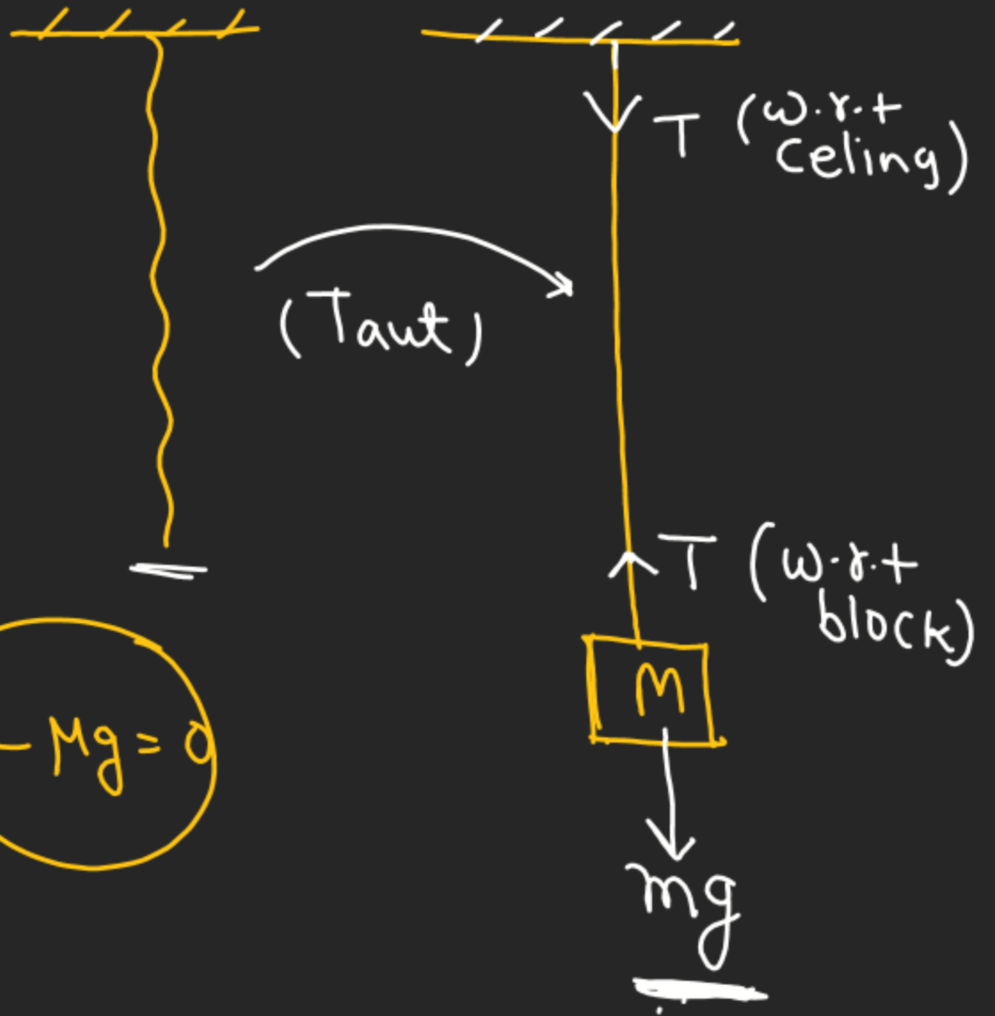
⇓

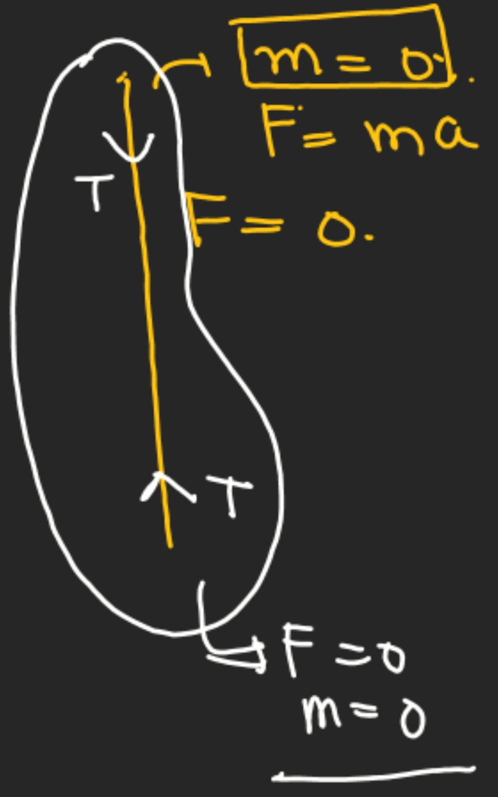
[ना के बराबर]

F.B.D of block

⇒ Equilibrium

$\boxed{T = Mg} \Leftarrow T - Mg = 0$





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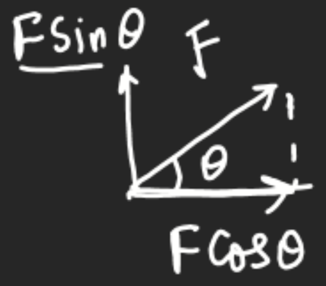
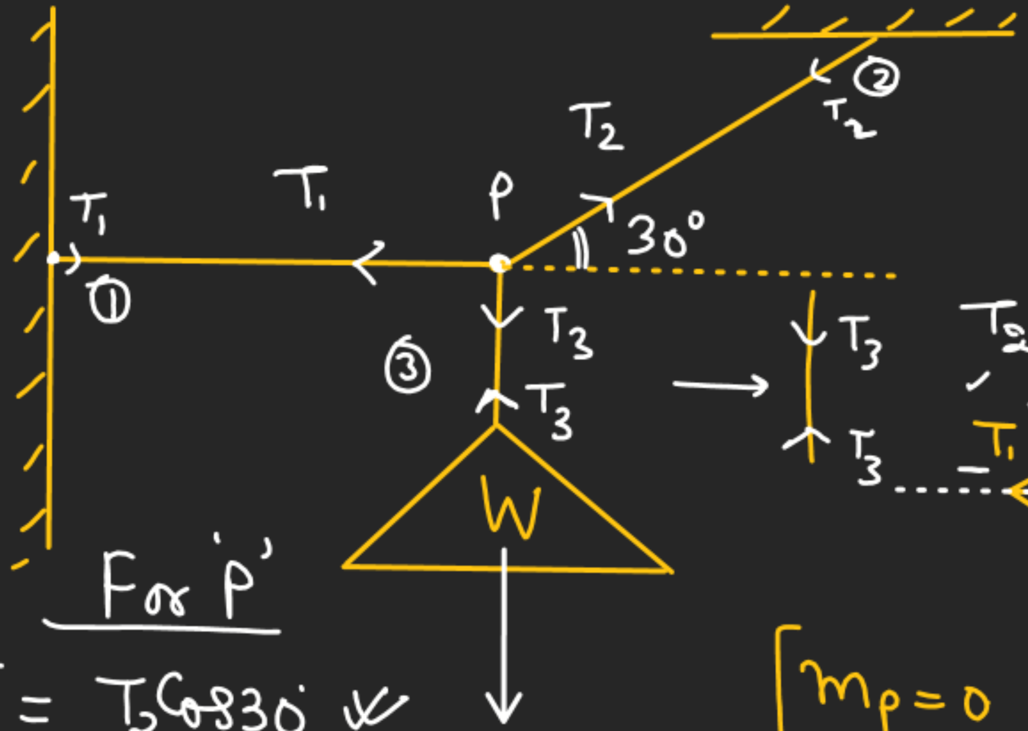


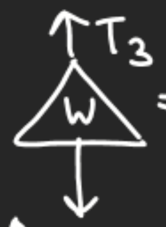
Note

(*) [For String, tension in the String always same untill & unless String not going to change.]

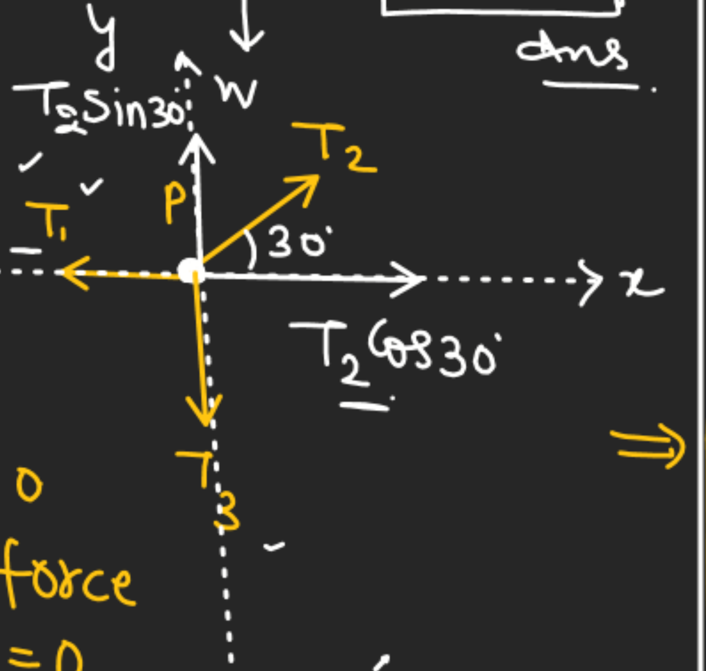
W = Weight



For W.



⇒ $\boxed{T_3 = W}$ Ans



For 'P'

$T_1 = T_2 \cos 30^\circ$

$T_1 = \frac{\sqrt{3}\,T_2}{2}$

$W = mg.$

[$m_P = 0$
Net force at $P = 0$]

$T_3 = T_2 \sin 30^\circ \Rightarrow T_3 = \frac{T_2}{2} \Rightarrow T_2 = 2T_3 = 2W$ Ans

$T_1 = \frac{\sqrt{3}}{2} \times 2W \Rightarrow T_1 = \sqrt{3}\,W$ Ans

Note :- How to Choose refrance axis :-

⇒ [If body is in equlibrium then Choose any refrance axis but prefer to choose refrance axis along which we have to minimum no of component.]

⇒ [If body is in acclerated motion then take x-axis along acclerated direction & perpendicular to x-axis is our y-axis]

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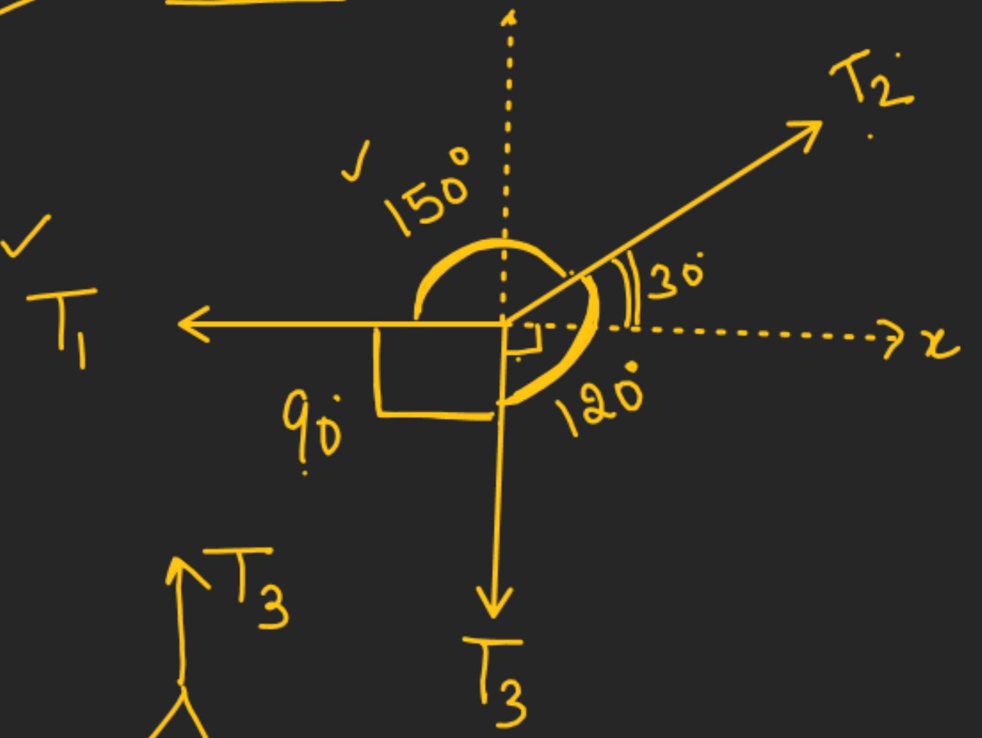
Law of Motion

Force → $\underline{\text{Unit}}$ Newton

(*) M-2 :-



$\Rightarrow T_3 = (W)\ N$

Sine Rule

$$\frac{T_1}{\sin 120^\circ} = \frac{T_2}{\sin 90^\circ} = \frac{T_3}{\sin 150^\circ}$$

$$\frac{T_1}{\sin(180-60^\circ)} = \frac{T_2}{\sin 90^\circ} = \frac{T_3}{\sin(180-30^\circ)}$$

$$\frac{T_1}{\sin 60^\circ} = \frac{T_2}{\sin 90^\circ} = \frac{T_3}{\sin 30^\circ}$$

$$\frac{T_1}{\sin 60^\circ} = 2W$$

$$T_1 = \cancel{2}W \times \frac{\sqrt{3}}{\cancel{2}} = (\sqrt{3}W)\ N$$

$$T_2 = \frac{T_3}{\sin 30^\circ} \times \sin 90^\circ$$

$$T_2 = \frac{W}{1/2} \times 1 = (2W)\ N$$

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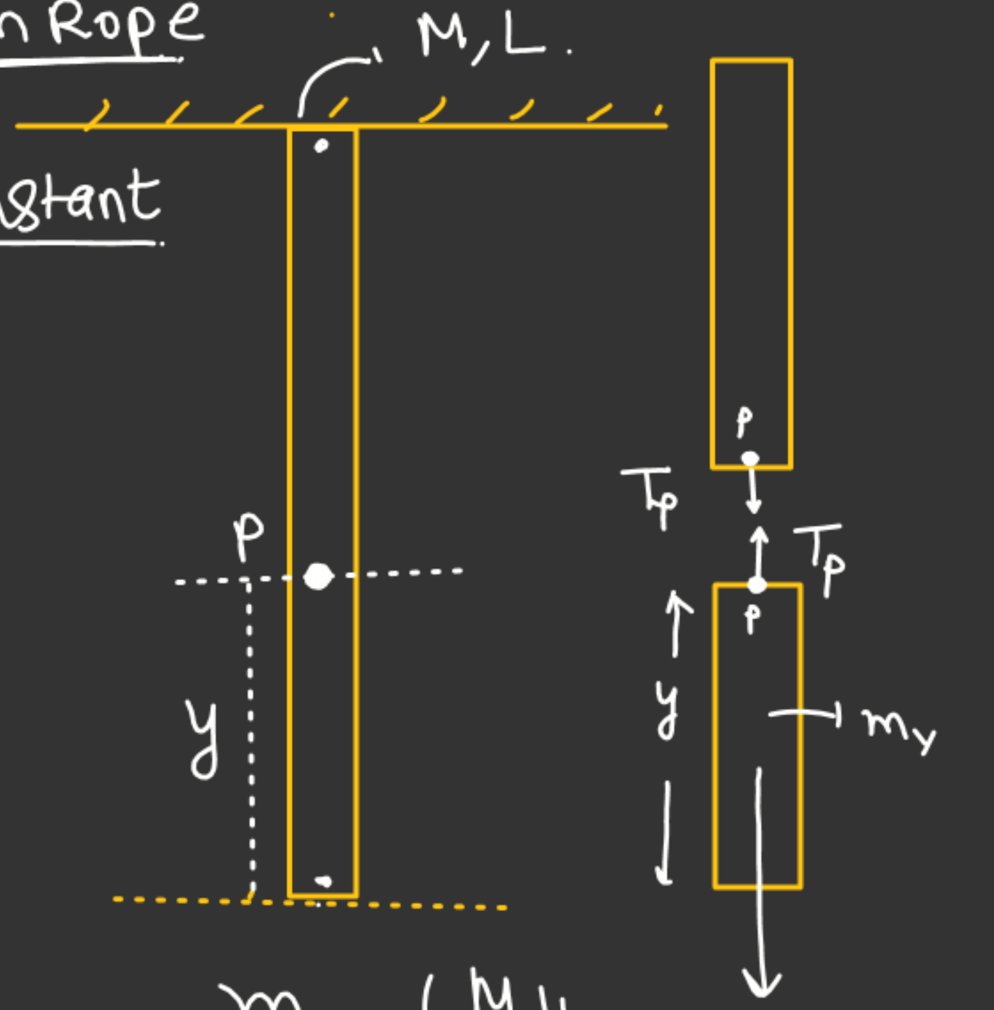
Tension in a Rope/Rod

① Uniform Rope

$\frac{M}{L}$ = Constant



$m_y = \left(\frac{M}{L}\right)y$

$m_y g = W_y$

✓ Uniform Rope/Rod.

↳ If rope or rod is uniform then Mass per unit length is constant.

$$\frac{M}{L} = \lambda = (\text{Constant})$$

λ = (Linear mass density)

✓ Non-uniform Rod/Rope

$\frac{M}{L} = \underline{\lambda}$ is not Constant.

T_p = (Weight of y-length of the rope)

$$T_p = \left(\underbrace{\frac{M}{L} \times y}_{m_y}\right) g \Rightarrow \boxed{T_p = \frac{Mg}{L} y} \checkmark$$

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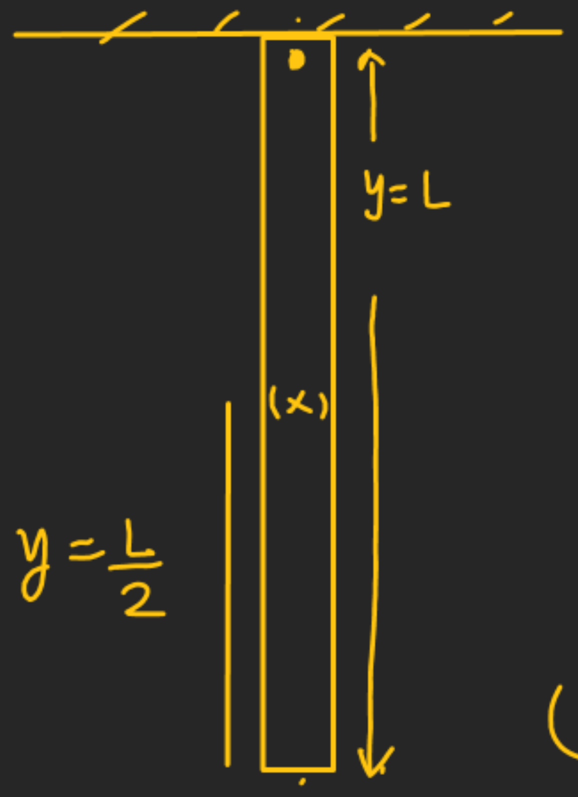
$$\boxed{T_p = \left(\frac{Mg}{L} \cdot y\right)} \Rightarrow$$

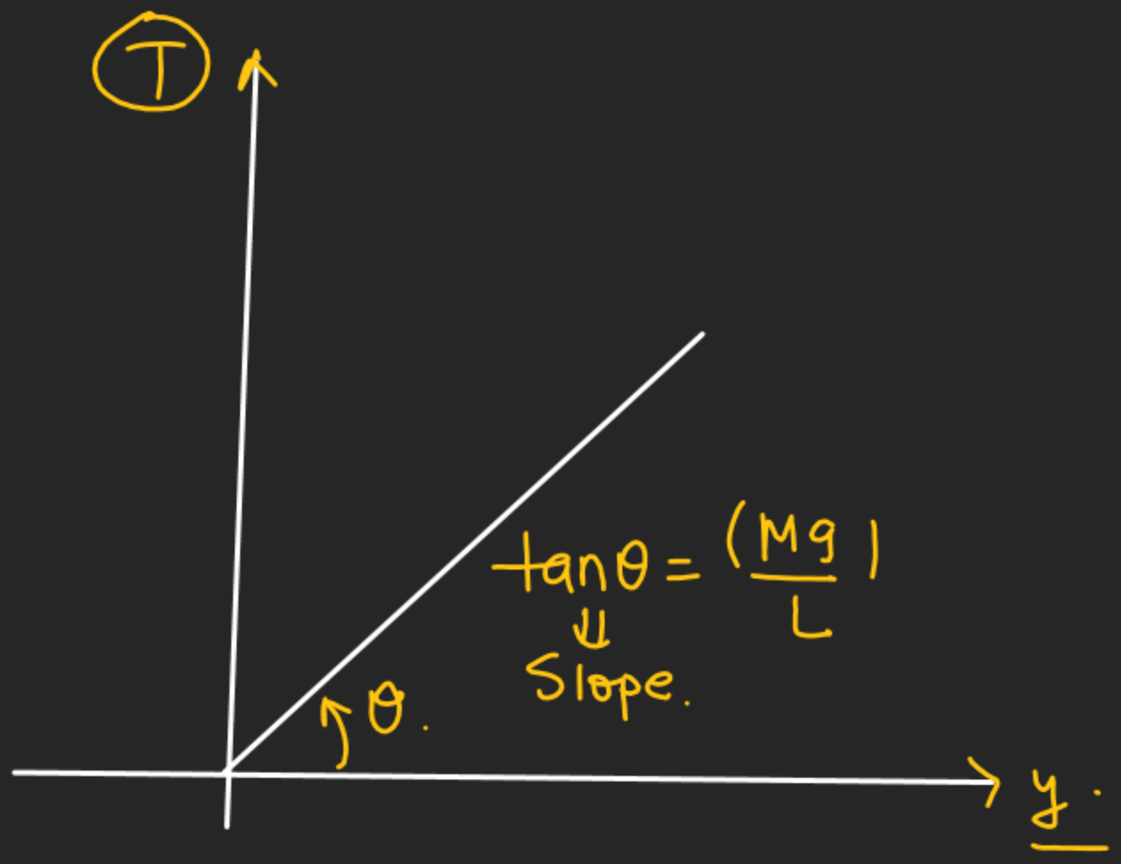


For $y = \frac{L}{2}$ (Mid-point of Rod)

$$T_p = \frac{Mg}{L} \times \frac{L}{2}$$

$$\left[T_p = \frac{Mg}{2}\right]$$

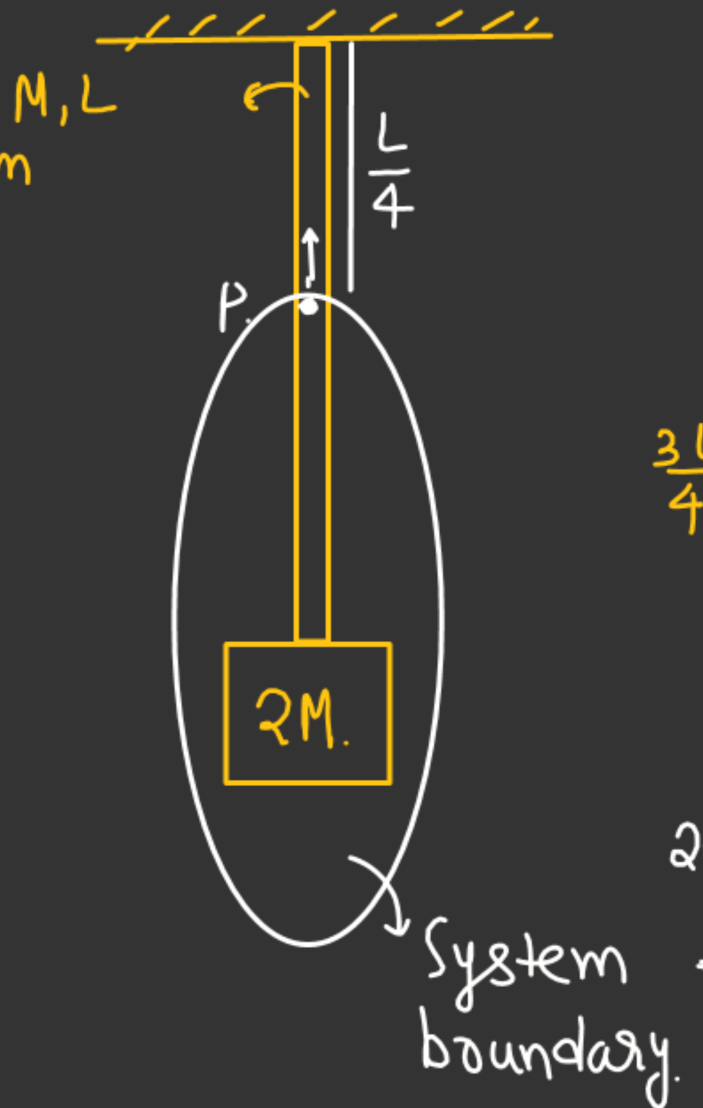
$$(T_p)_{maximum} = Mg.$$
at $y = L$



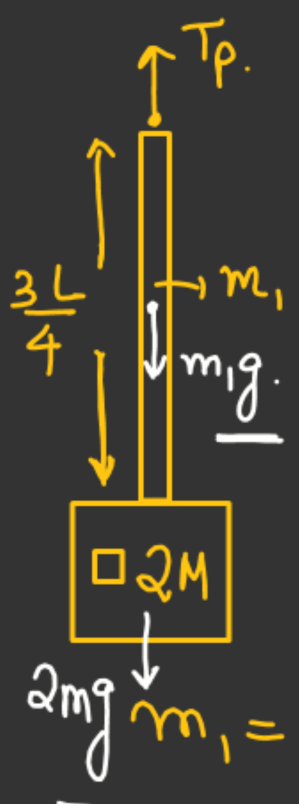
$\tan\theta = \left(\frac{Mg}{L}\right)$
⇓
Slope.

48.

(Uniform rope)



$T_P = ??$



$$T_P = m_1 g + 2mg$$

$$T_P = \frac{3Mg}{4} + 2mg$$

$$T_P = \left(\frac{11mg}{4}\right) \text{ Ans.}$$

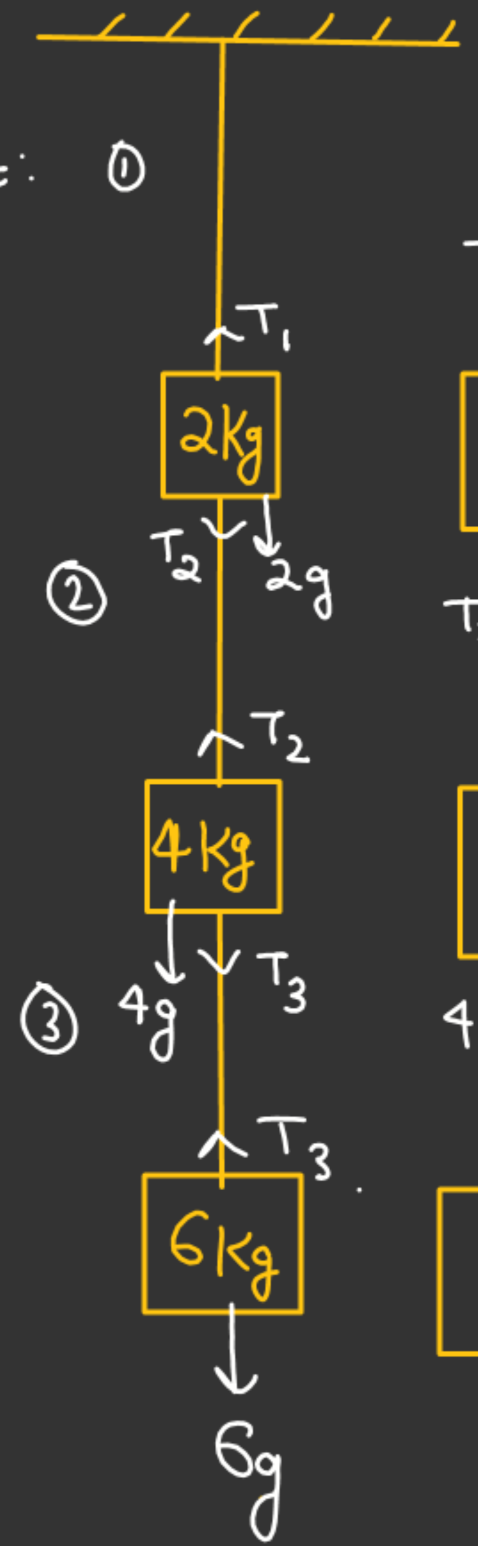
m_1 = mass of $\frac{3L}{4}$ Length of rope.

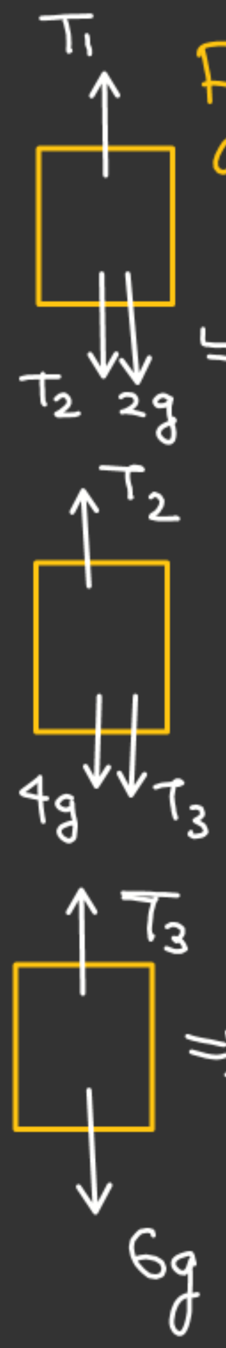
$$m_1 = \left(\frac{M}{L}\right) \times \left(\frac{3L}{4}\right) = \left(\frac{3M}{4}\right)$$

$$m_1 g = \left(\frac{3Mg}{4}\right).$$

M_1:

All the Strings are massless. Find tension in all the string. $[g = 10\,m\,s^{-2}]$





$$\Rightarrow T_1 = T_2 + 2g$$
$$T_1 = 10g + 2g$$
$$T_1 = 12g$$

$$T_2 = 4g + T_3 = 10g.$$

$$\Rightarrow T_3 = 6g.$$

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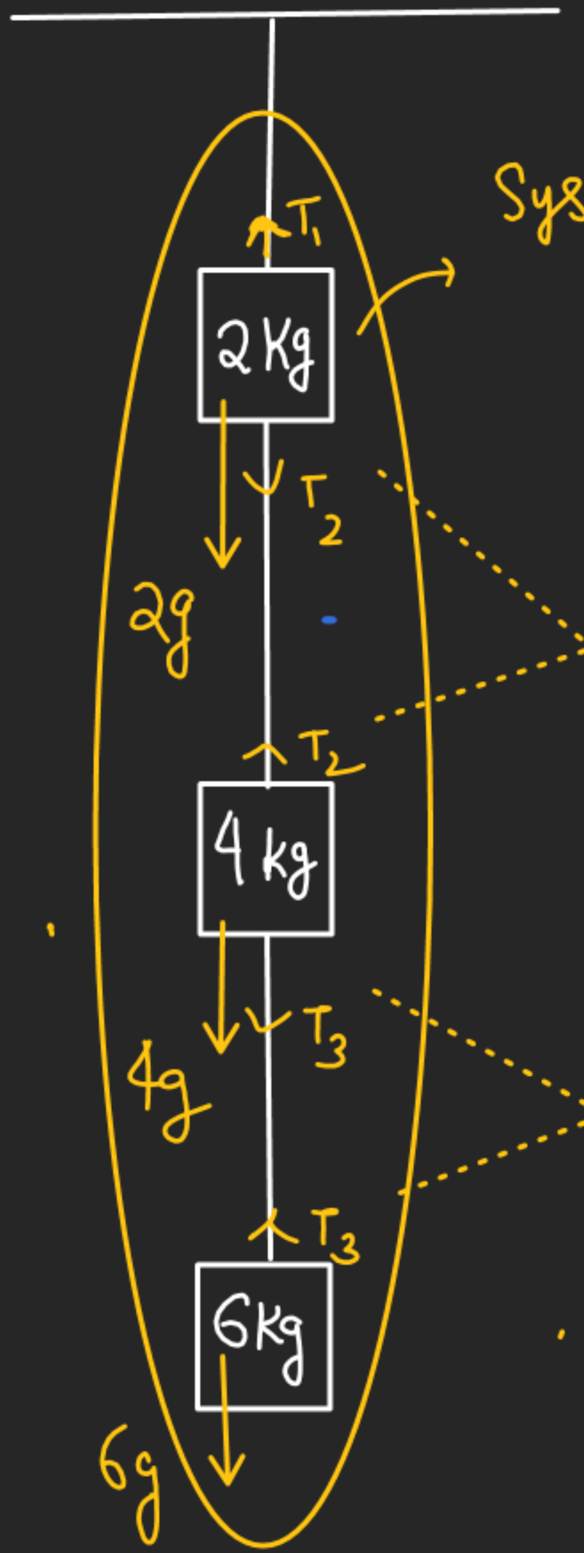
Law of Motion

M-2



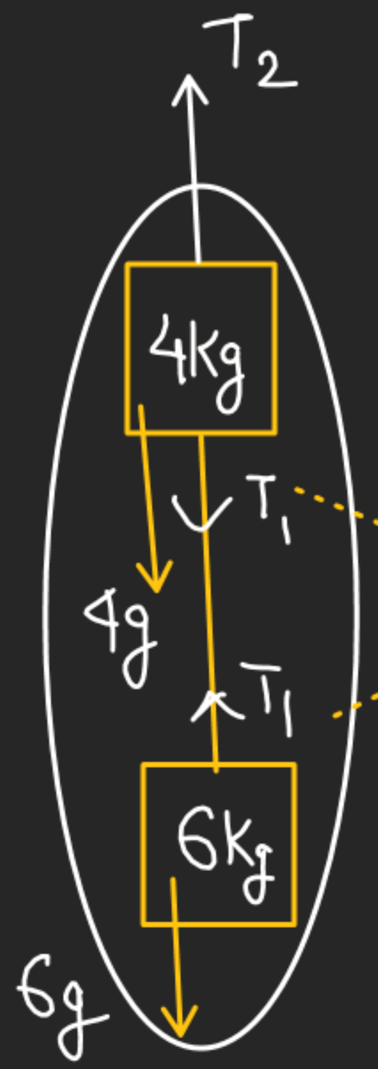
System boundary

$\Rightarrow T_1 = 12g$
$= 120N$

T_2 internal force.

$T_3 \Rightarrow$ internal force.

$\Rightarrow T_3 = 6g = 60N$



$T_2 = 4g + 6g$

$T_2 = 10g = 100N$

T_1 is internal force.