MIND MAP FOR JEE ASPIRANTS

Physics

[redacted]

Newton Law of motion

By- Saleem Ahmed Sir

Today's Targets

1. पूरा NLM
2. [redacted]
3. [redacted]
4. [redacted]

$$(\vec{F}_{net})_{ext} = \frac{d\vec{P}}{dt}$$

$F = ma$

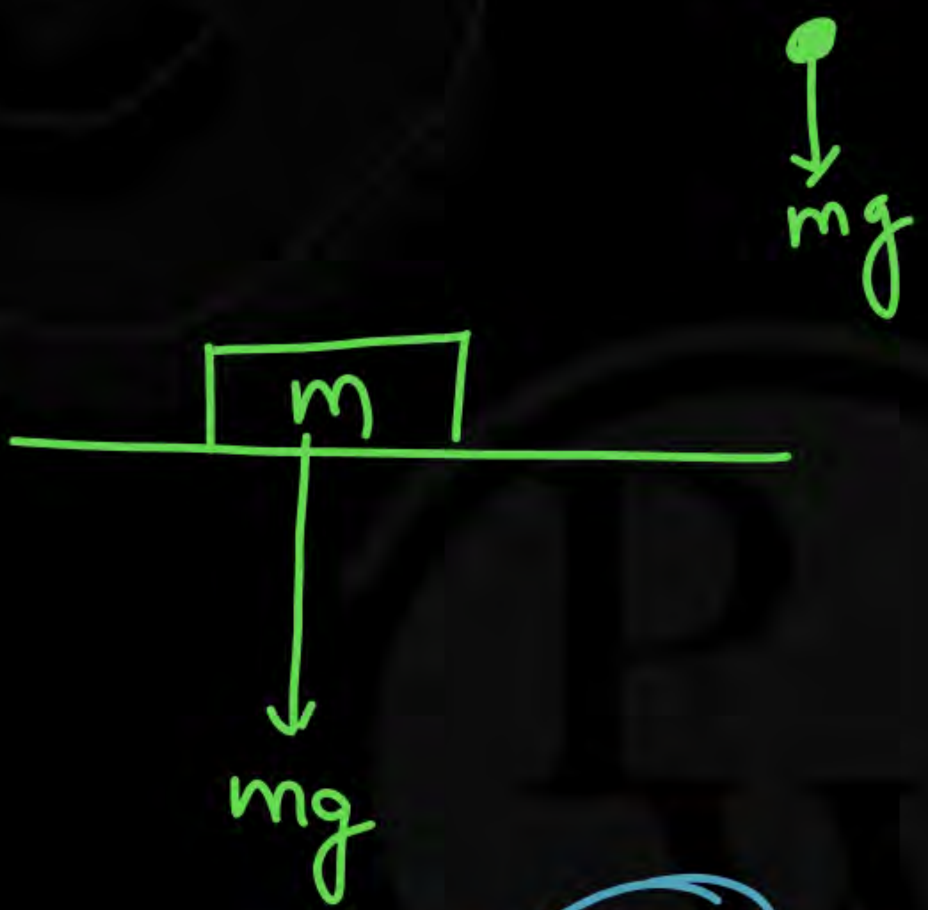
$$(\vec{F}_{net})_{ext} = \frac{d\,m\vec{v}}{dt} = m\frac{d\vec{v}}{dt} + \vec{v}\frac{dm}{dt}$$

If $m \rightarrow$ const

$$(\vec{F}_{net})_{ext} = m\vec{a}$$

$$\left(\vec{F}_{net}\right)_{ext} = m\vec{a}$$

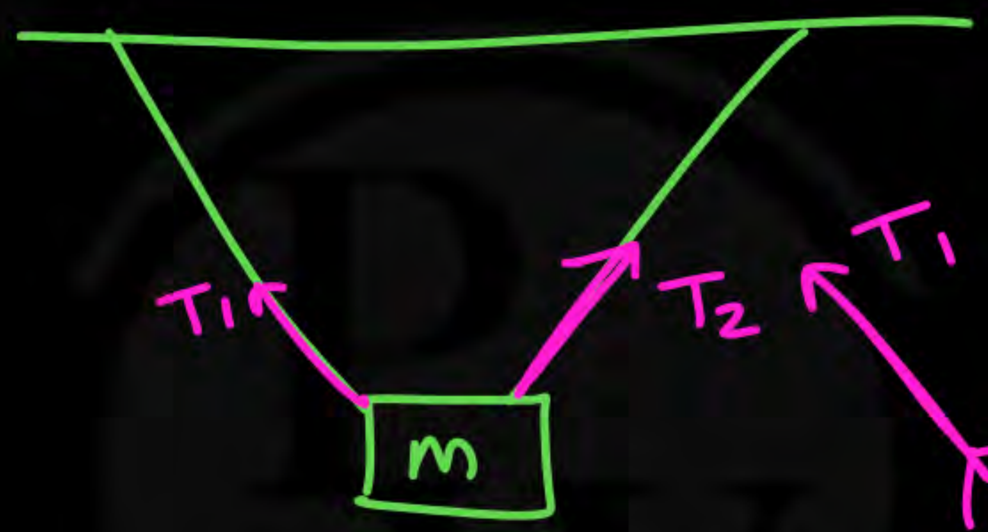
① 'Gravitational



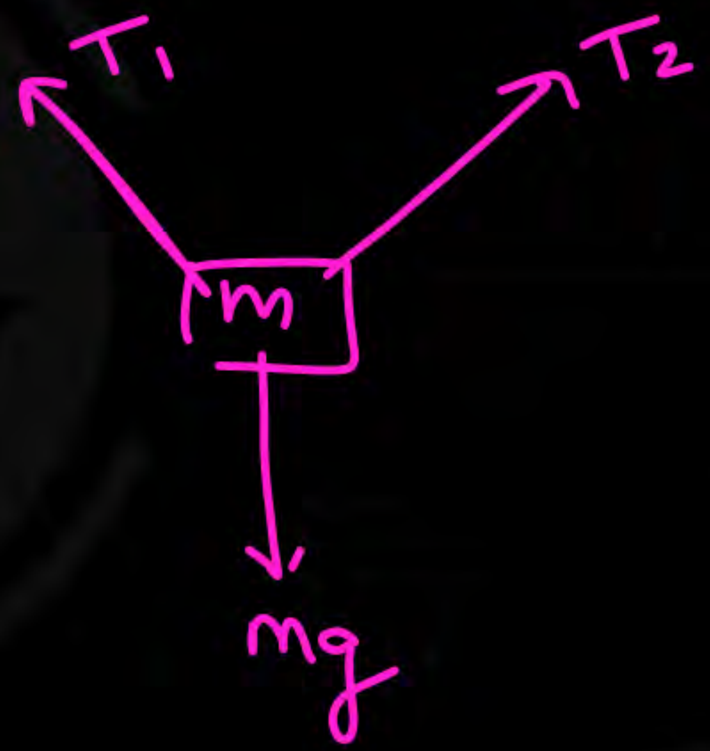
$$F = \frac{G M_2 m_1}{R^2}$$

$$\boxed{F = m_1 g}$$

T
T
m
mg



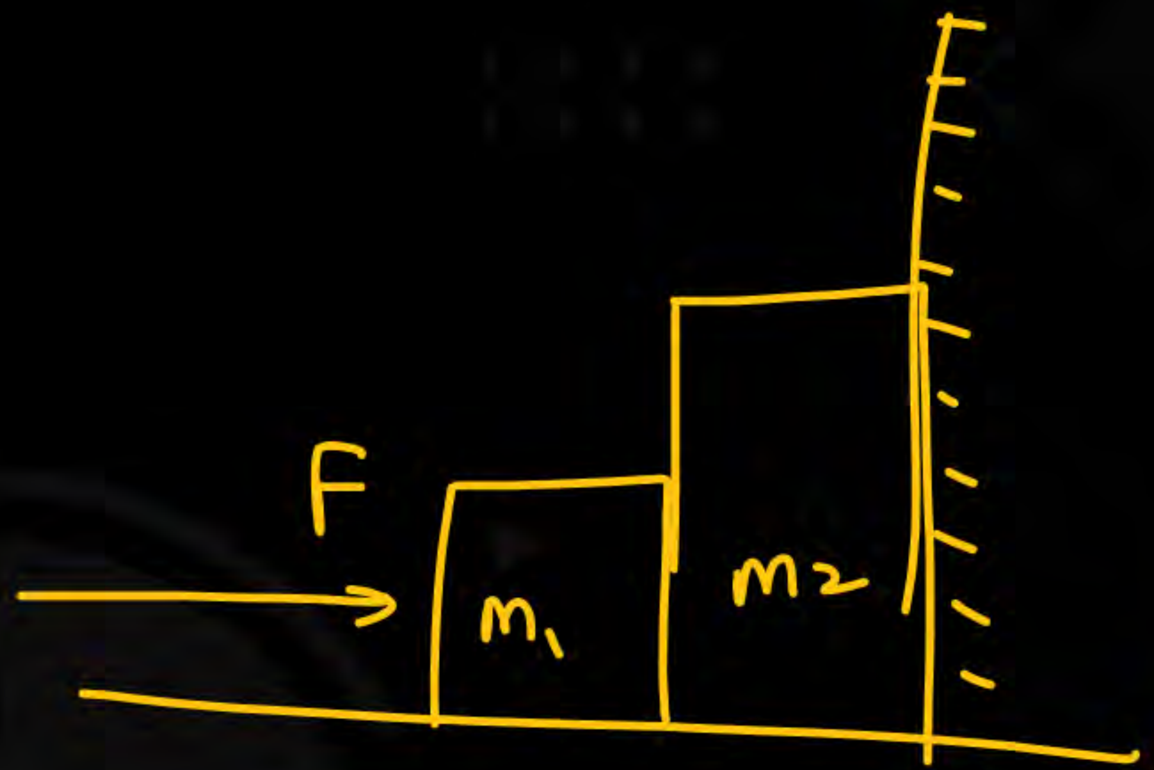
T1
T2
m

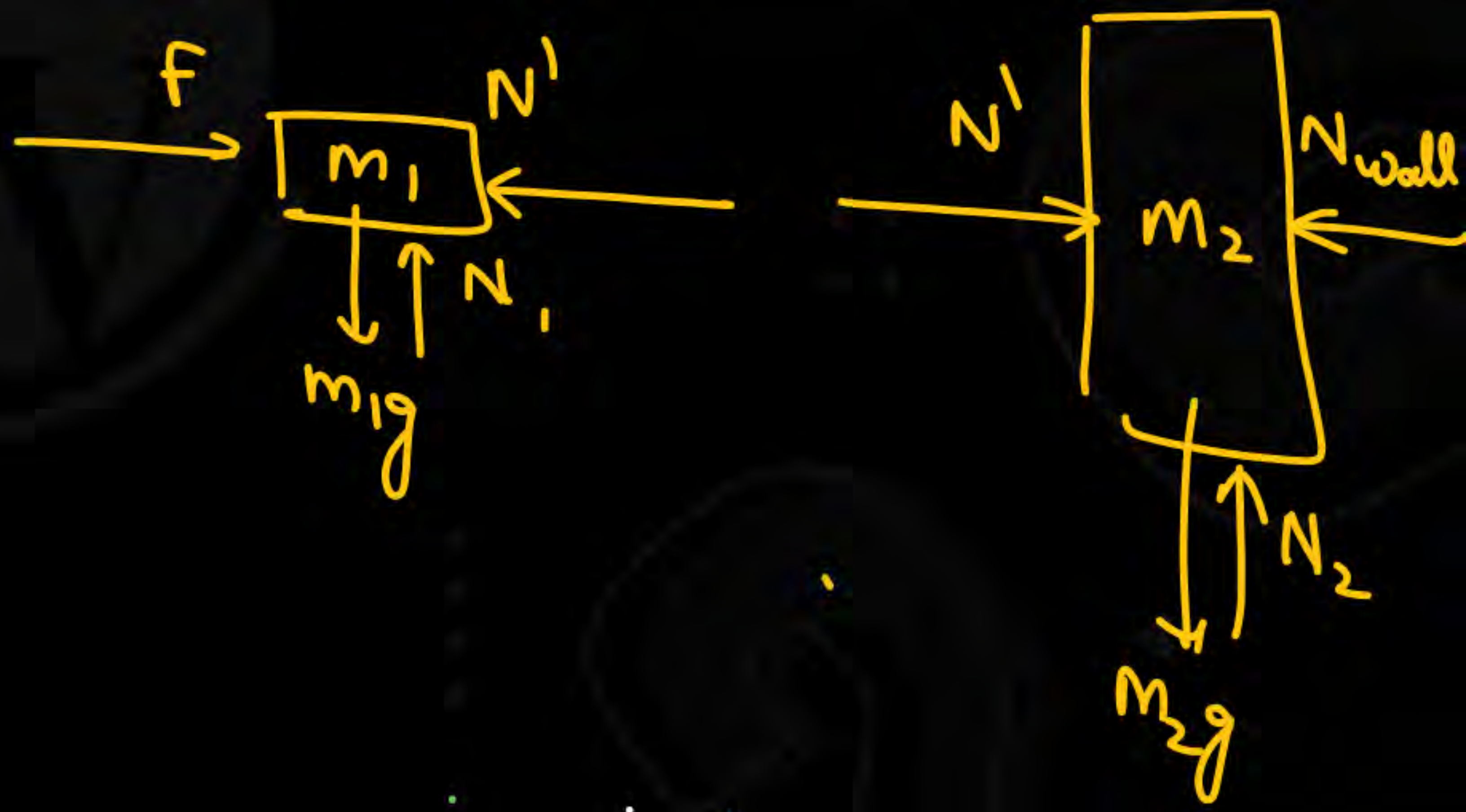


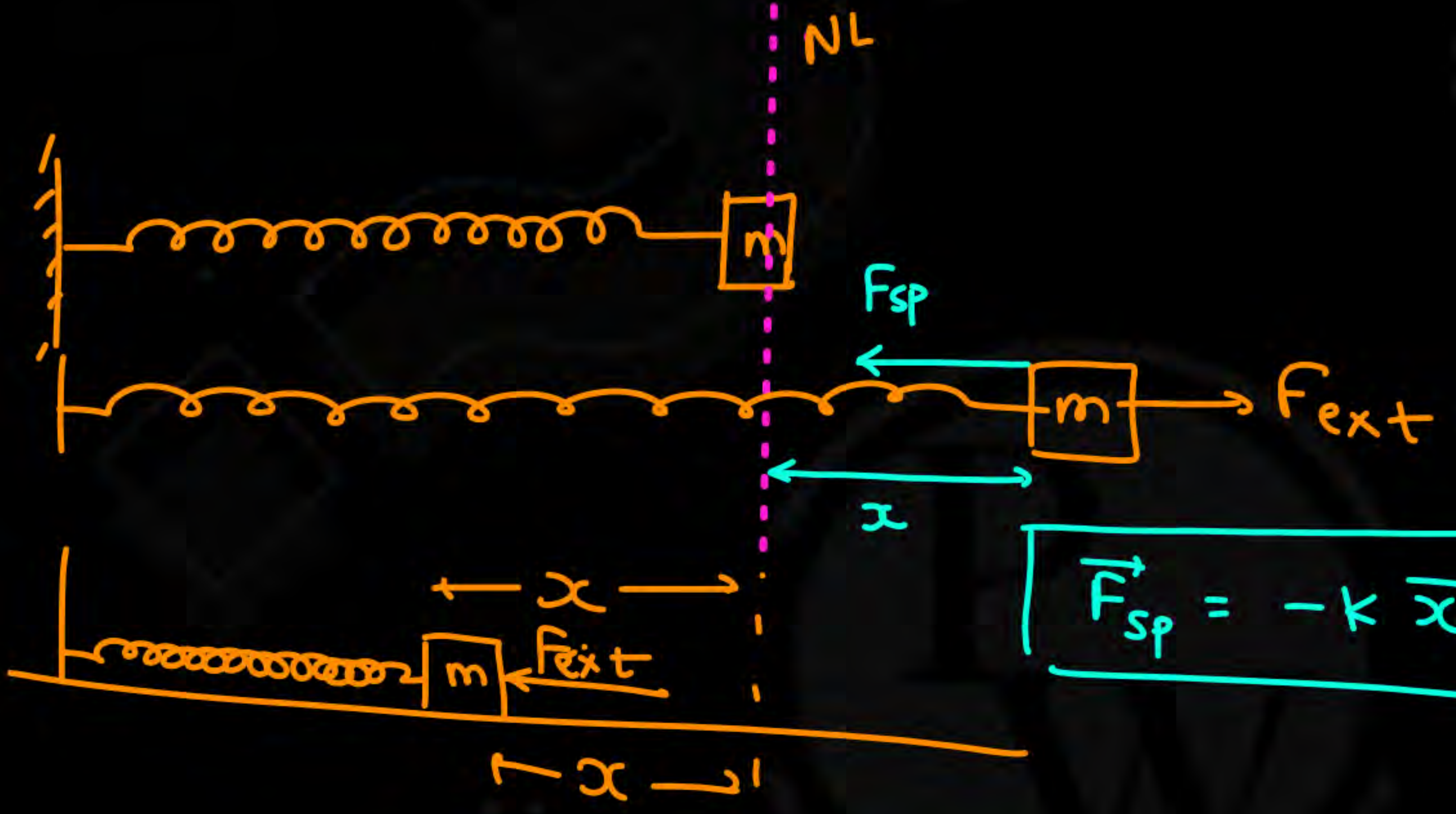
T1
T2
m
mg

Normal

$$N = mg$$

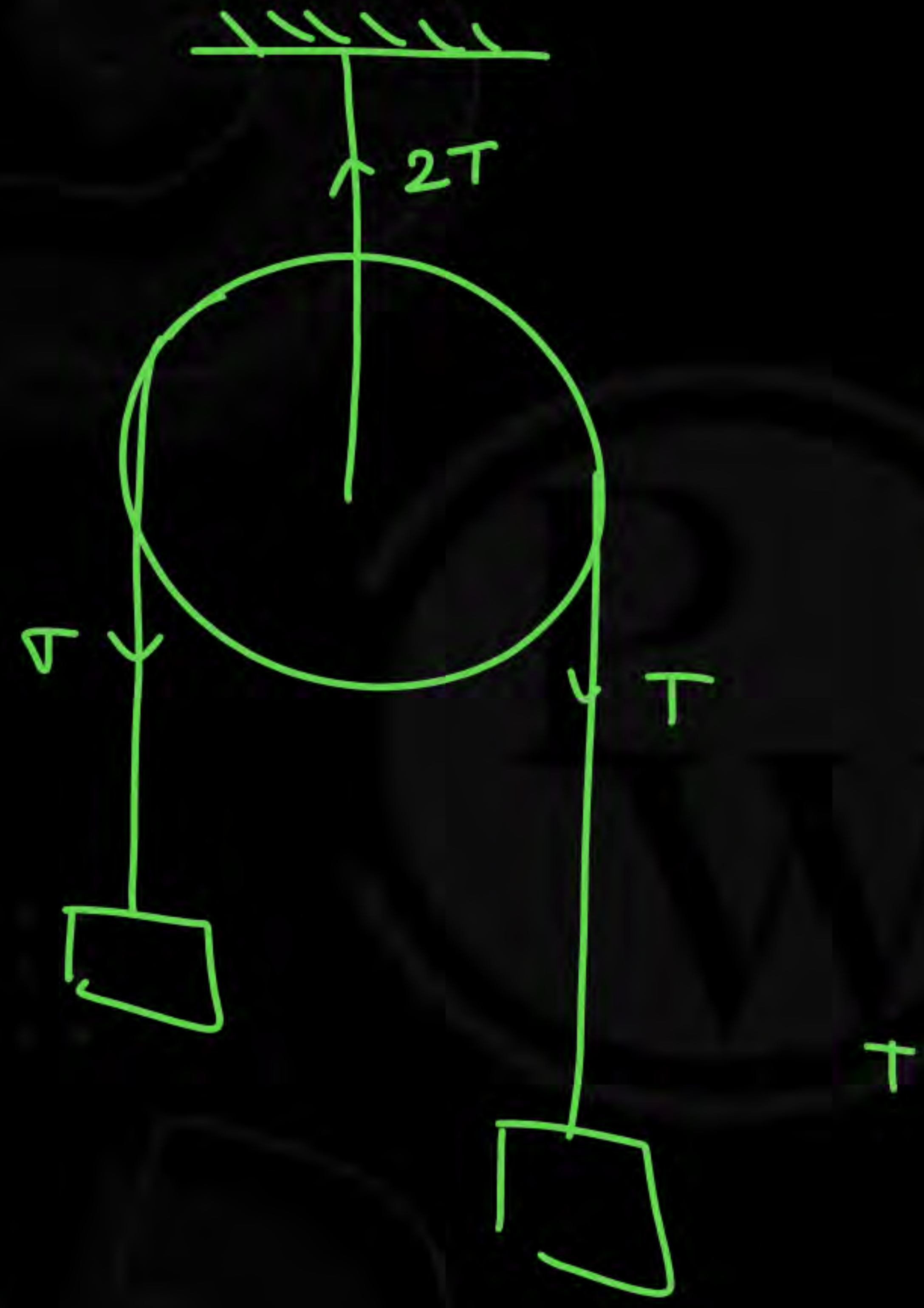


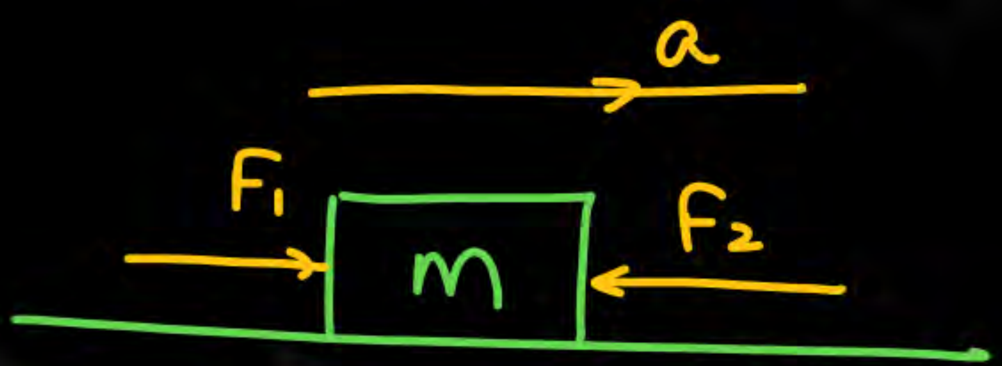




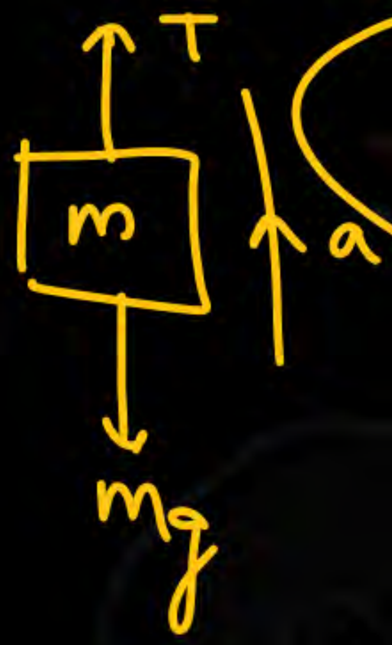
$$\boxed{\vec{F}_{sp} = -k\vec{x}}$$

$$\vec{F}_{sp} = -k\vec{x}$$



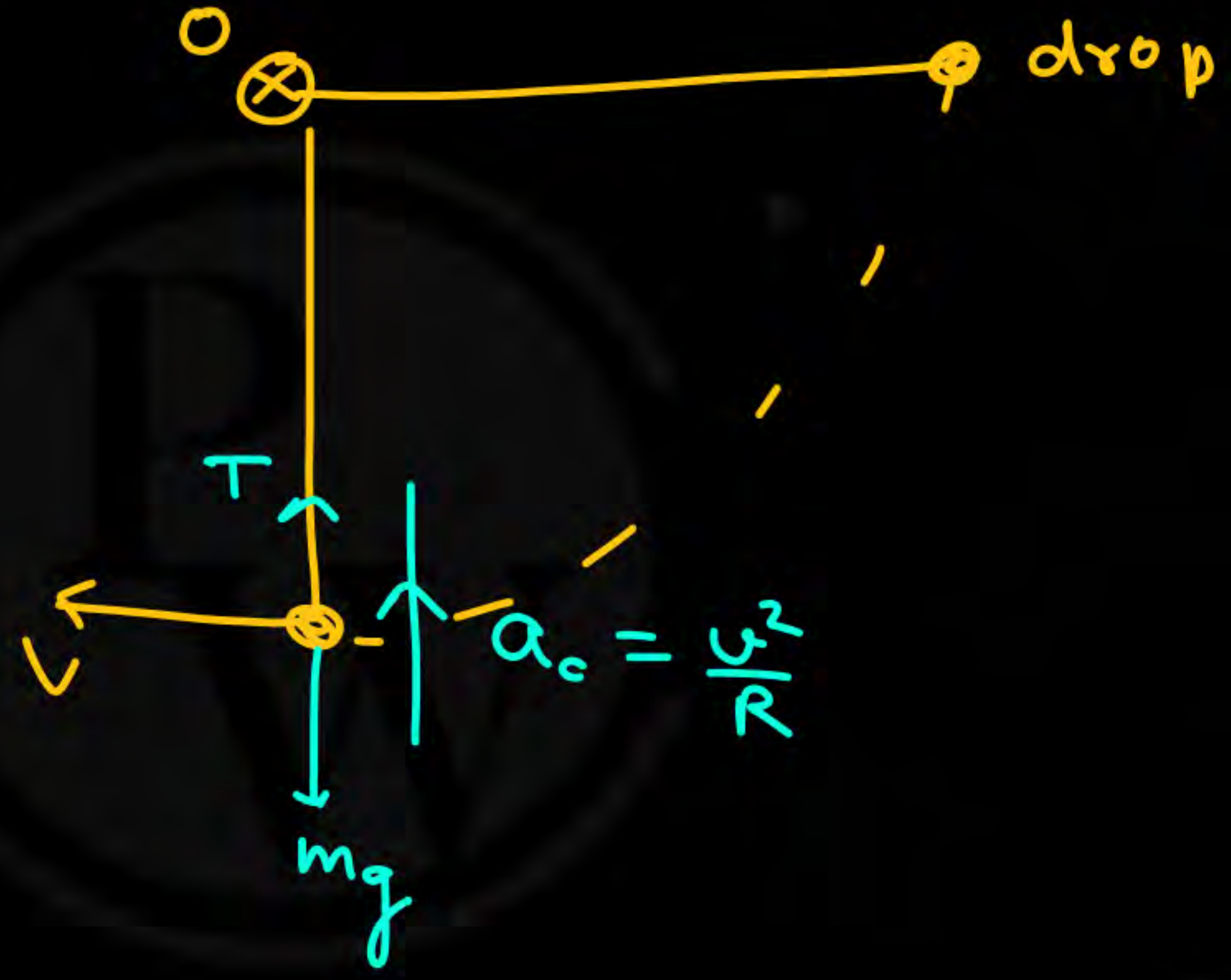


$$\boxed{F_1 - F_2 = ma}$$

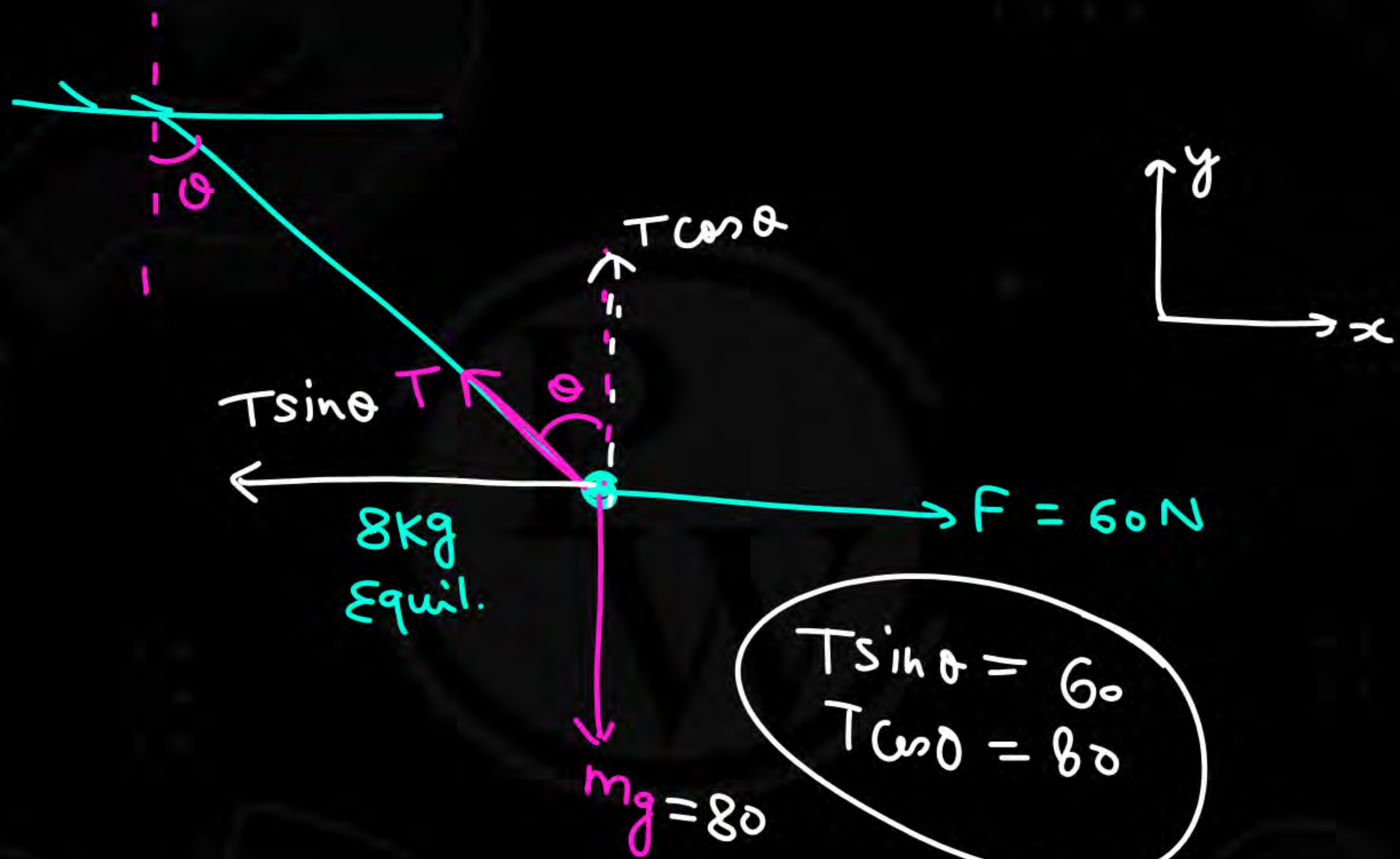


$$T - mg = ma$$

$$T - mg = m\frac{v^2}{R}$$

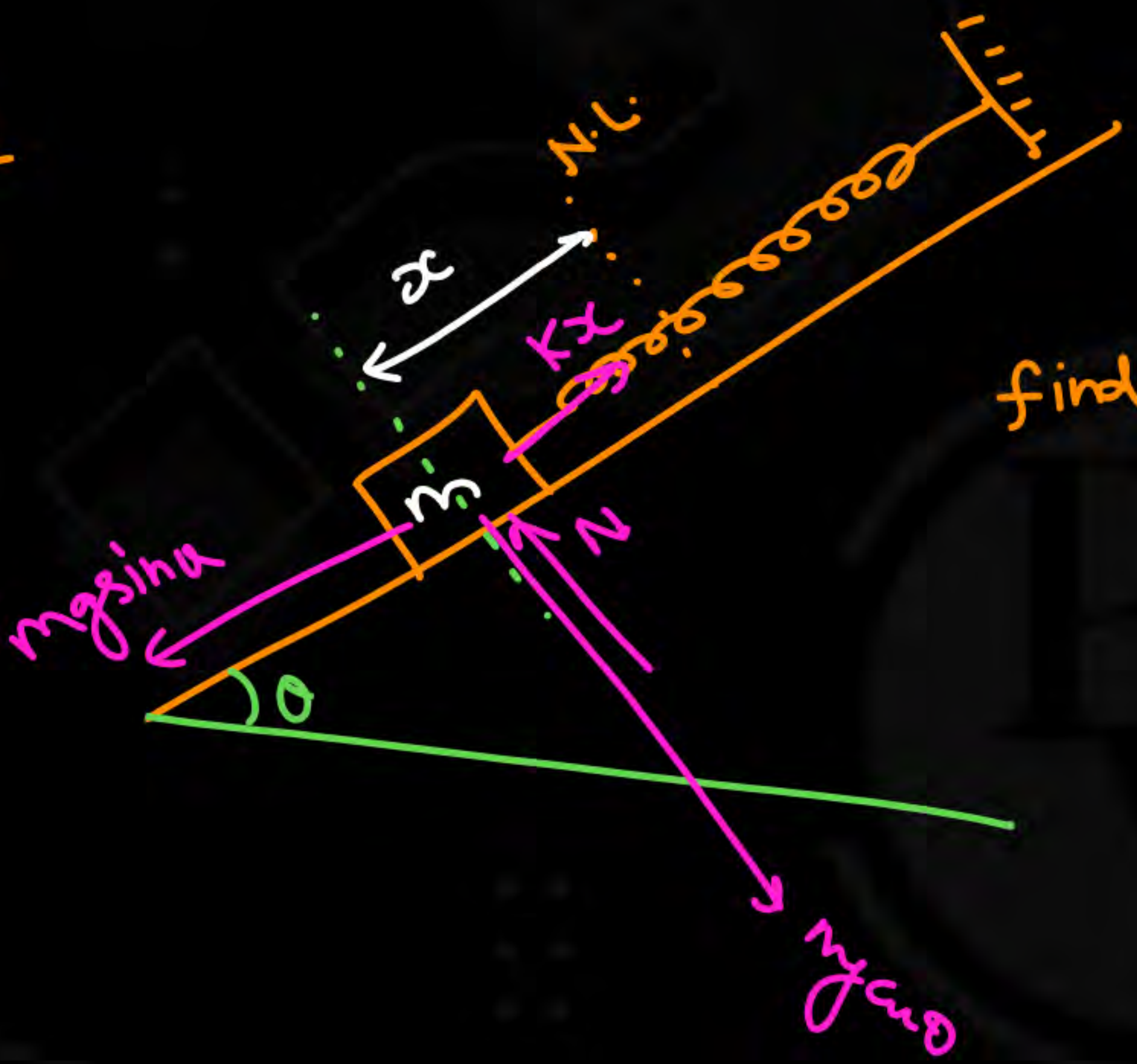


Q

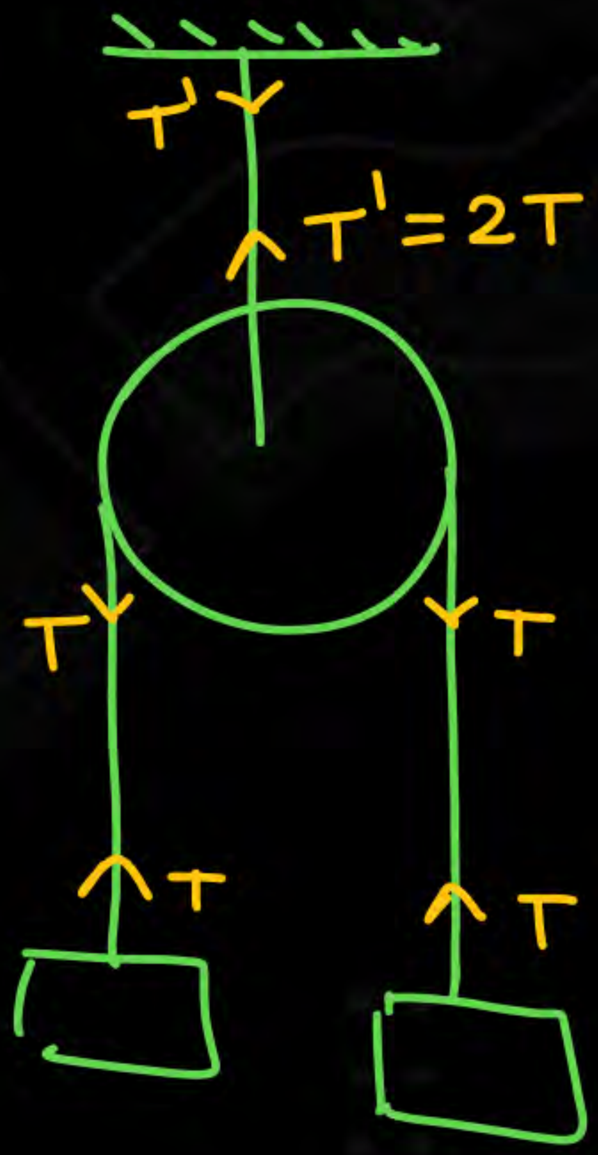


$$T\sin\theta = 60$$
$$T\cos\theta = 80$$

Q



find elongation in spring.

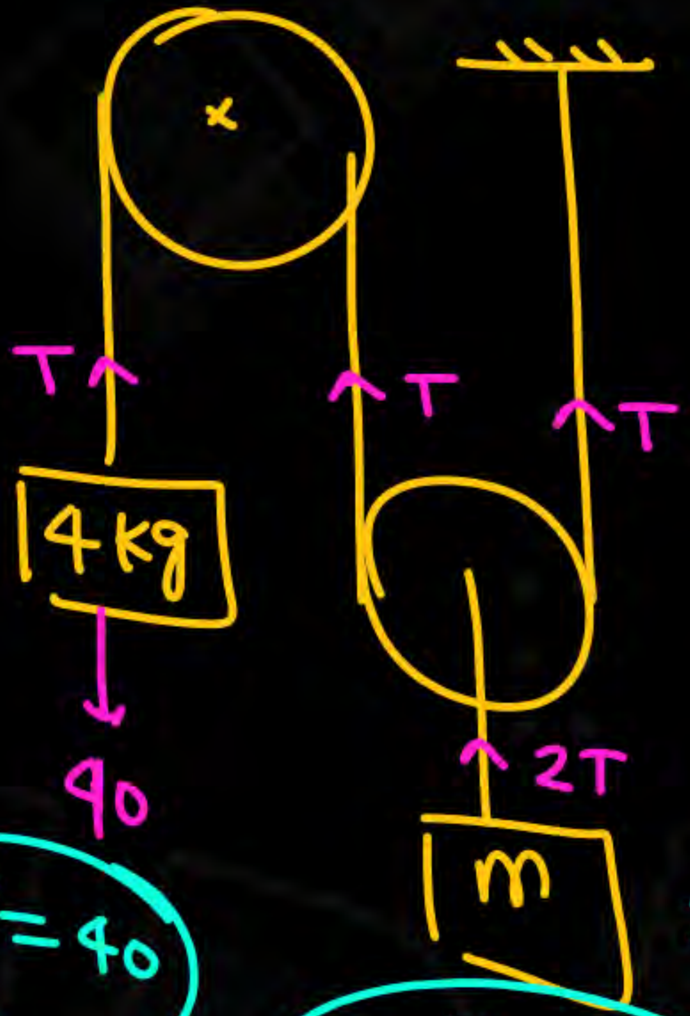

T'
T' = 2T
T
T
T
T


T
T
T' = 2T

Ques Based on Equilibrium

find value of unknown mass

①

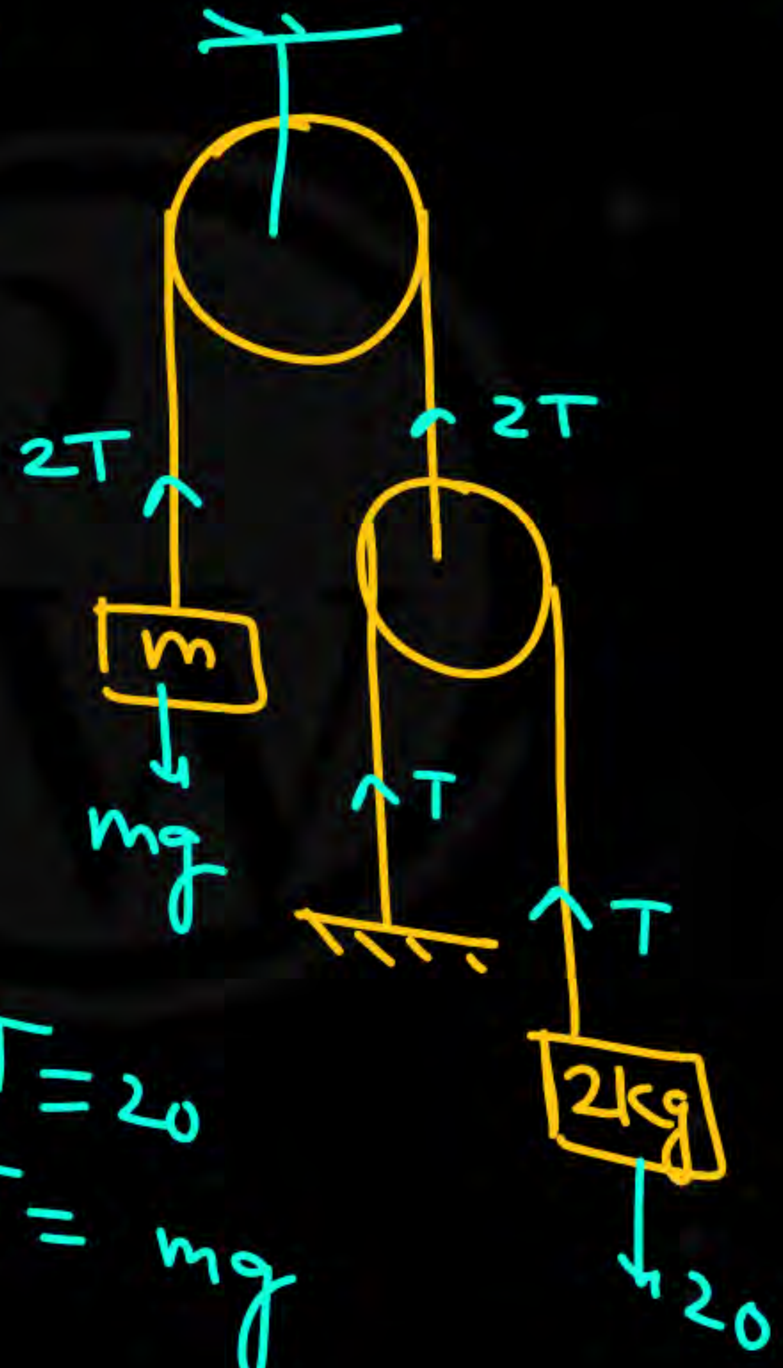


$T = 40$

$2T = mg$

$m = 8\,kg$

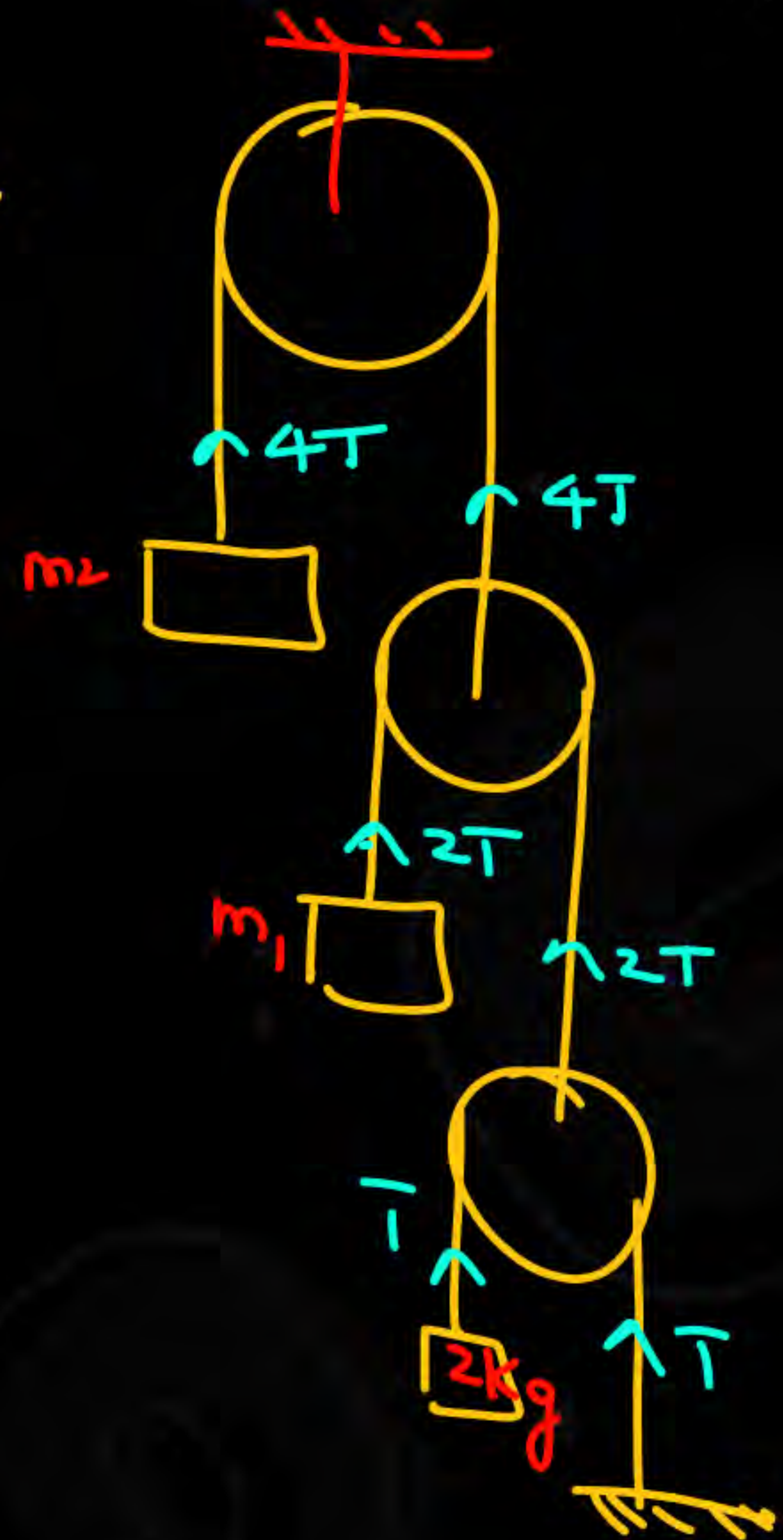
②



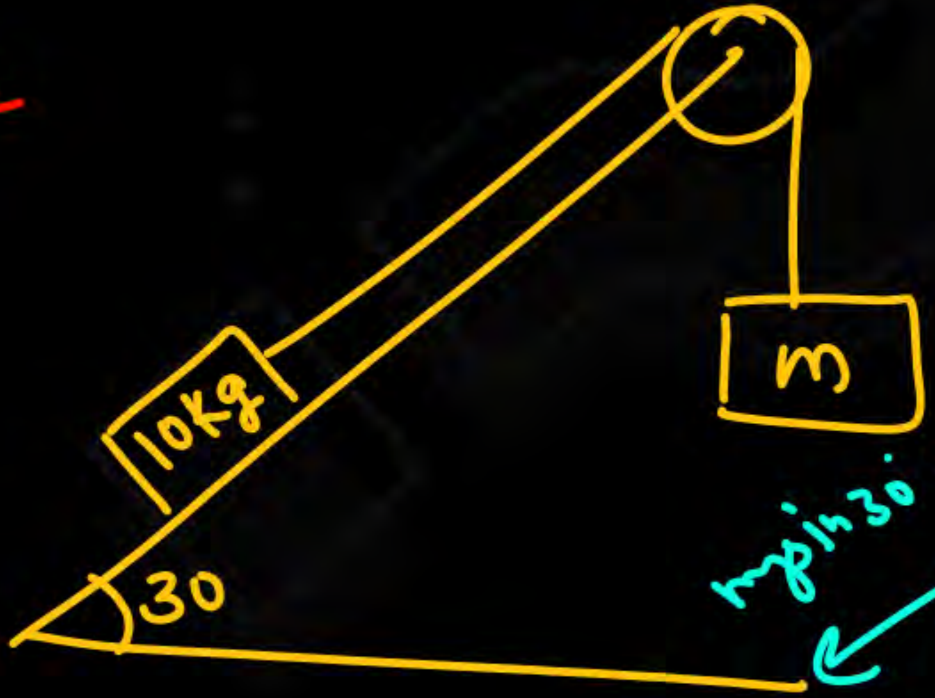
$T = 20$

$2T = mg$

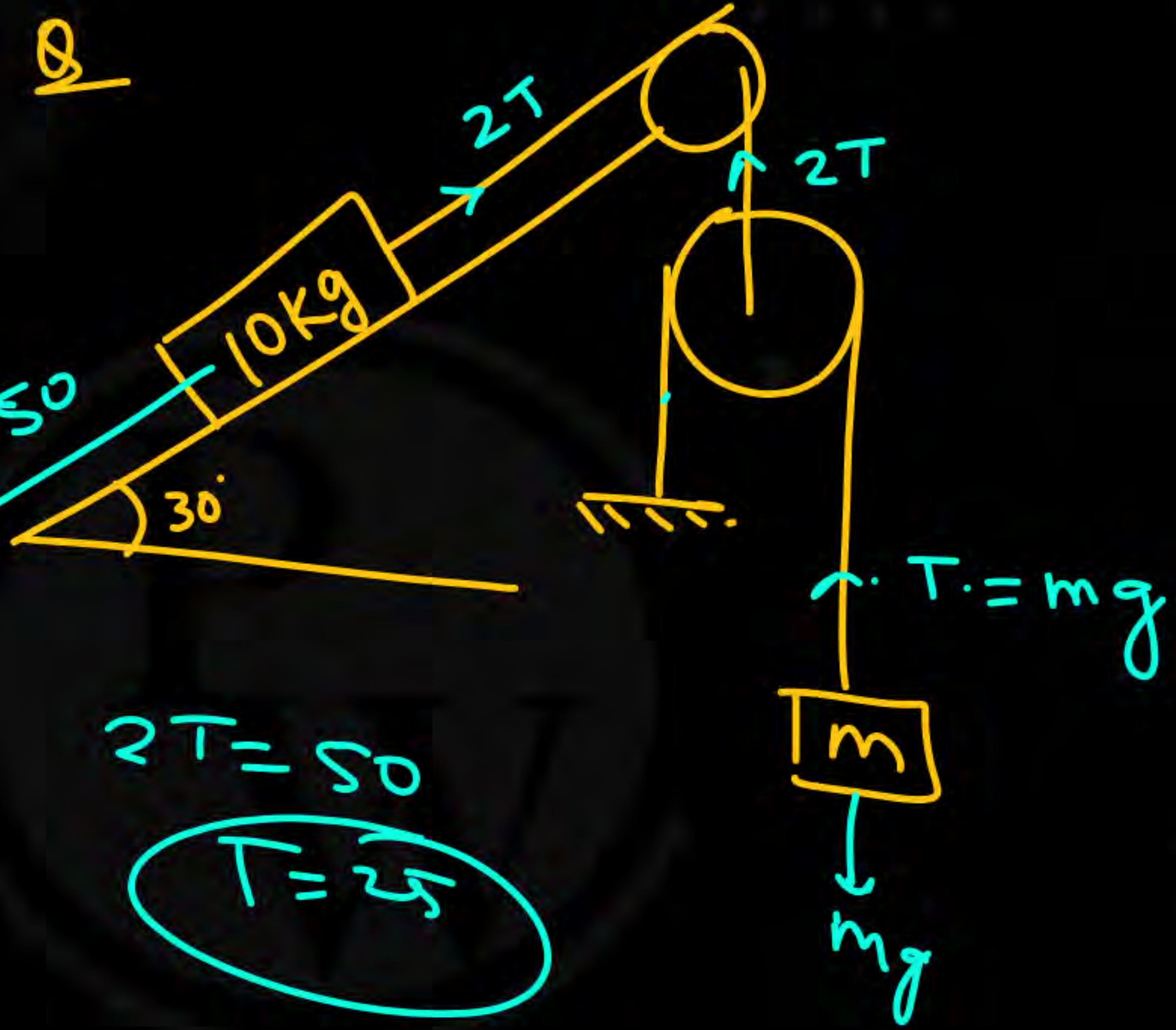
Q



Q



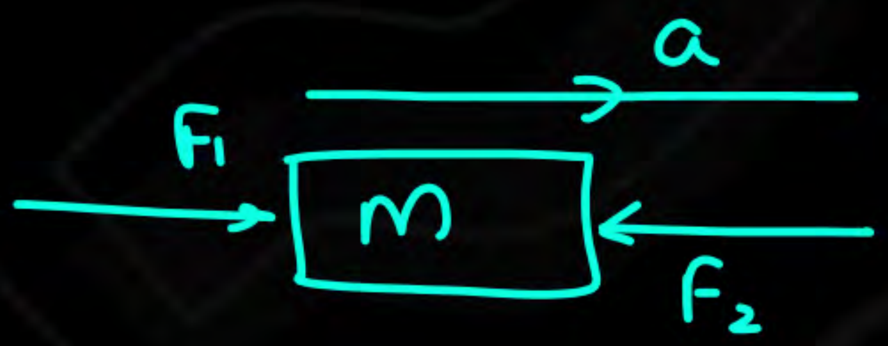
Q



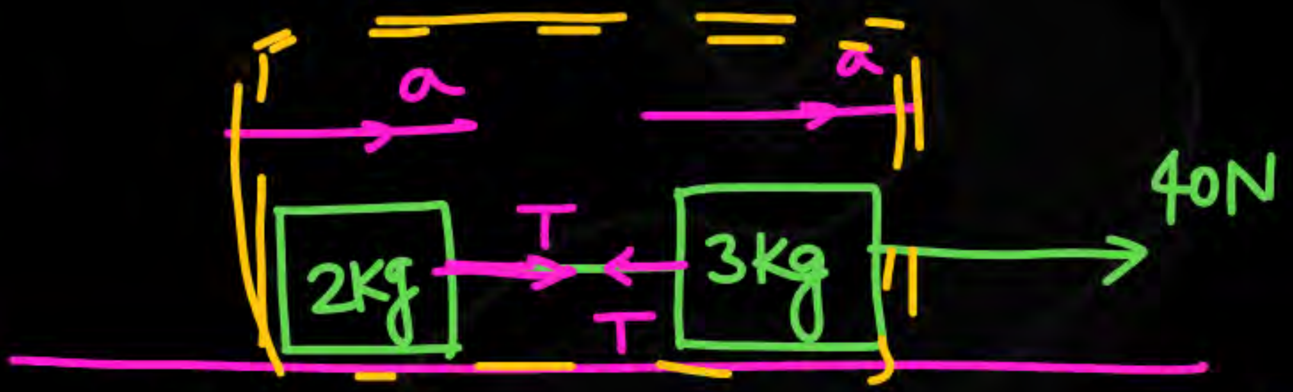
$mg\sin 30° = 50$

$2T = 50$

$T = 25$


a
F1
m
F2

①



$T = 2a$

$40 - T = 3a$

$a = 8$

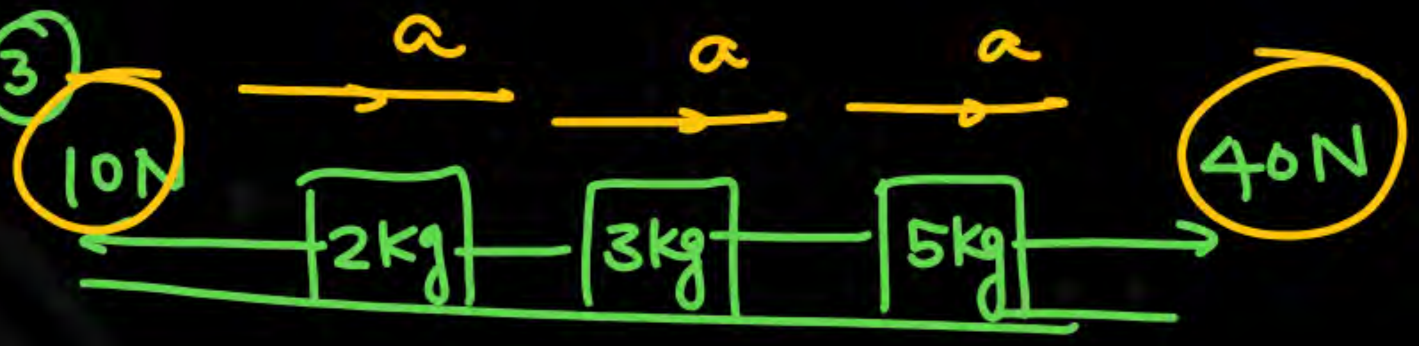
$40 = (2+3)a$

$a = 8$

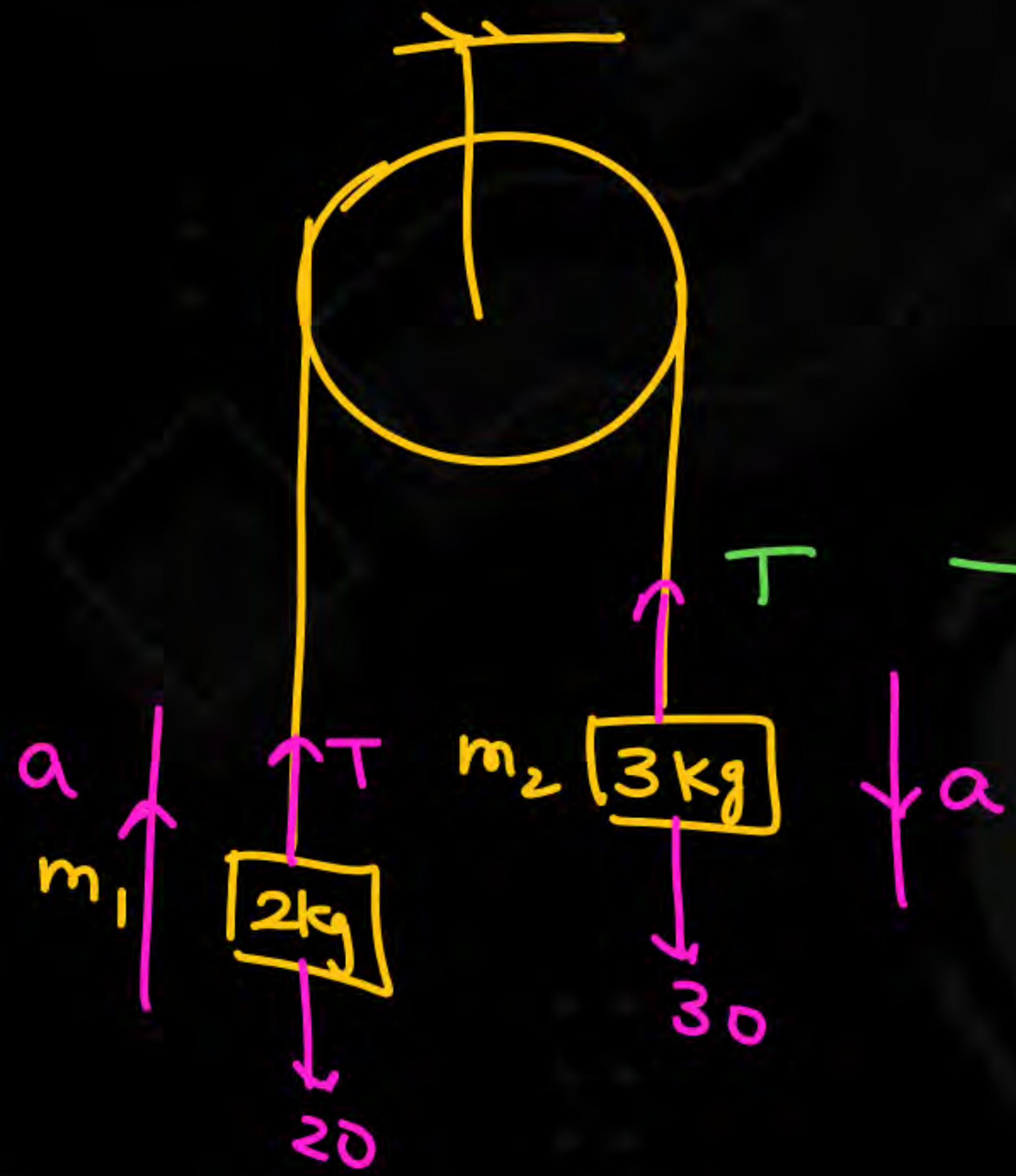
②

$$a = \frac{40 - 30}{2+3}$$

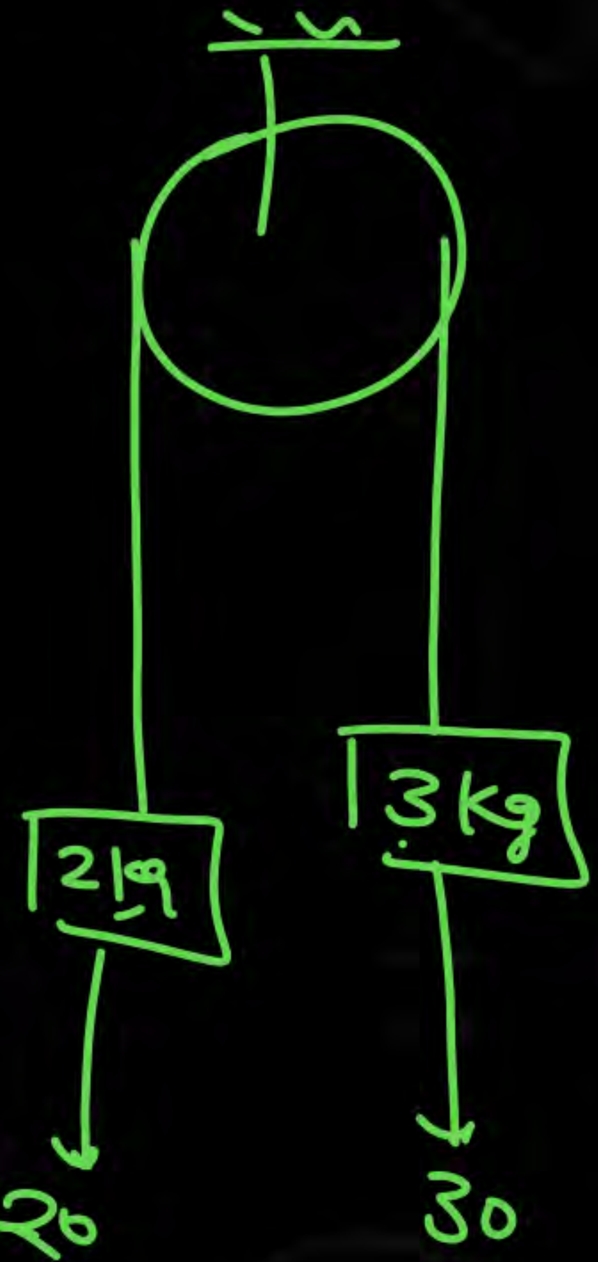
③



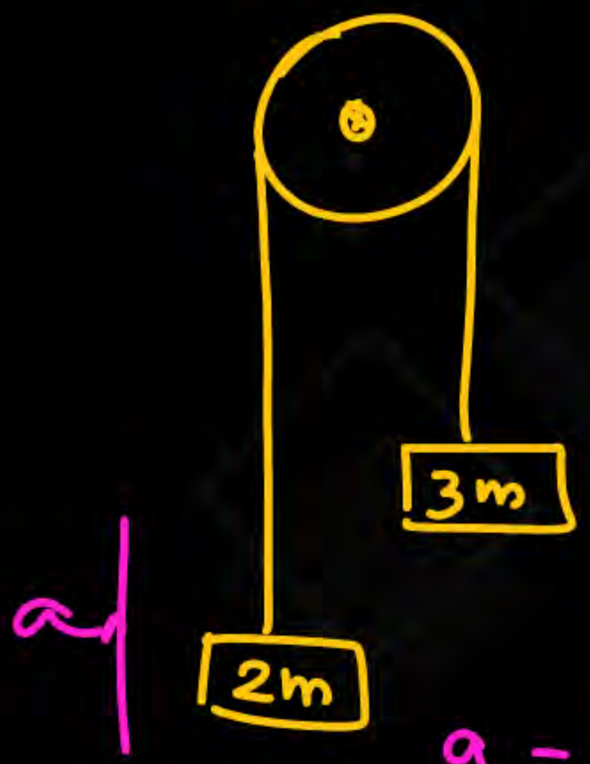
$$a = \frac{40 - 10}{10}$$



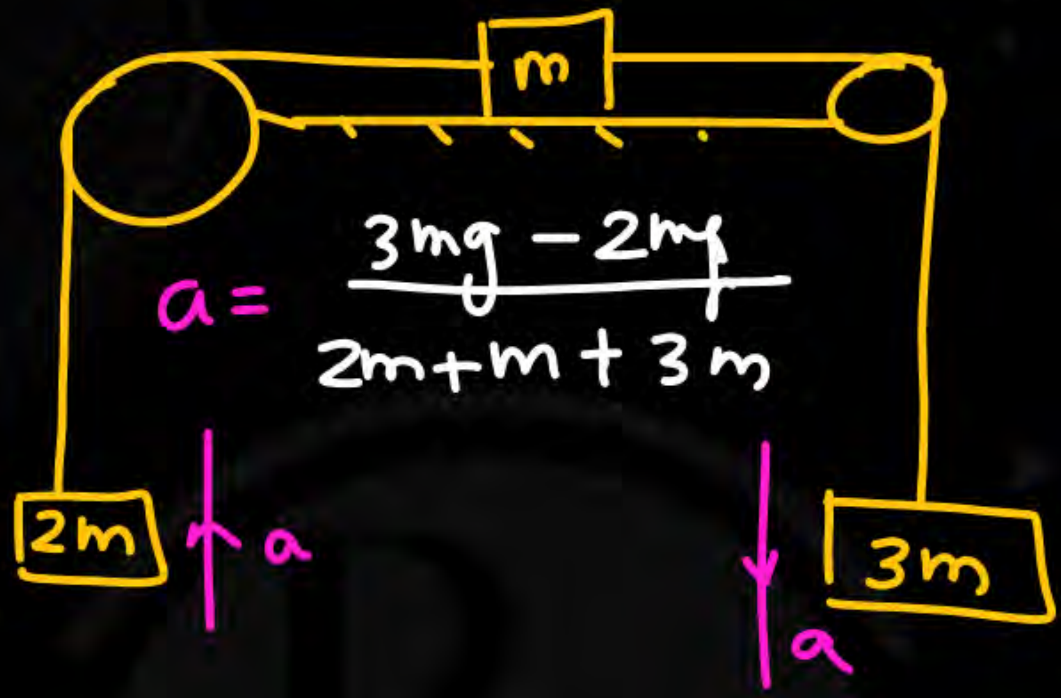
$$30 - T = 3a$$
$$T - 20 = 2a$$
$$a = 2$$



$$a = \frac{30 - 20}{2 + 3}$$

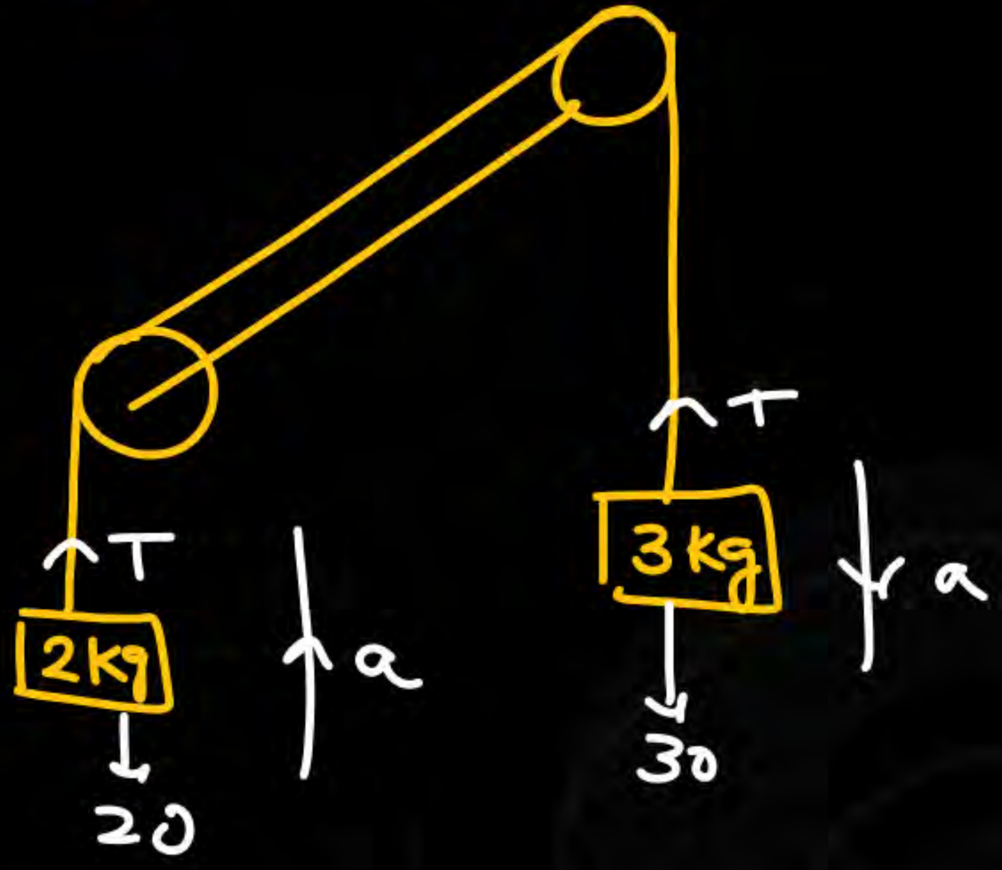


$$a = \frac{3mg - 2mg}{2m + 3m}$$



$$a = \frac{3mg - 2mg}{2m + m + 3m}$$

Q

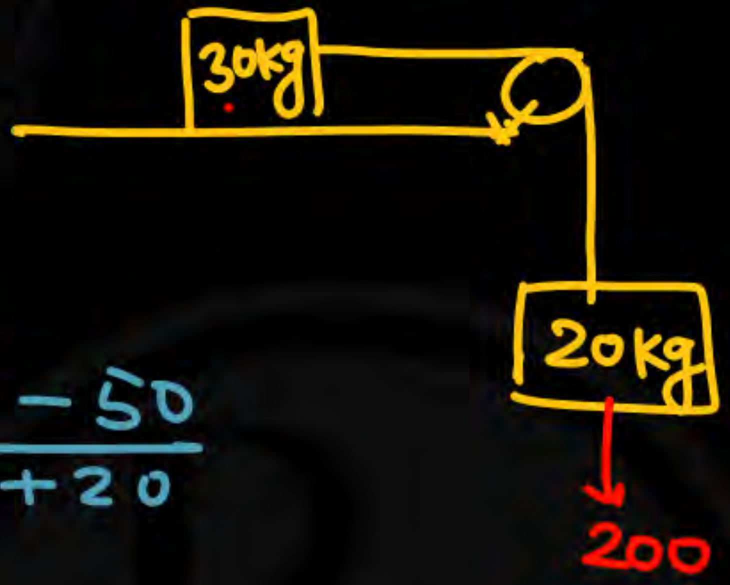


Q

$$a = \frac{200-50}{10+20}$$

$$200 - T = 20a$$

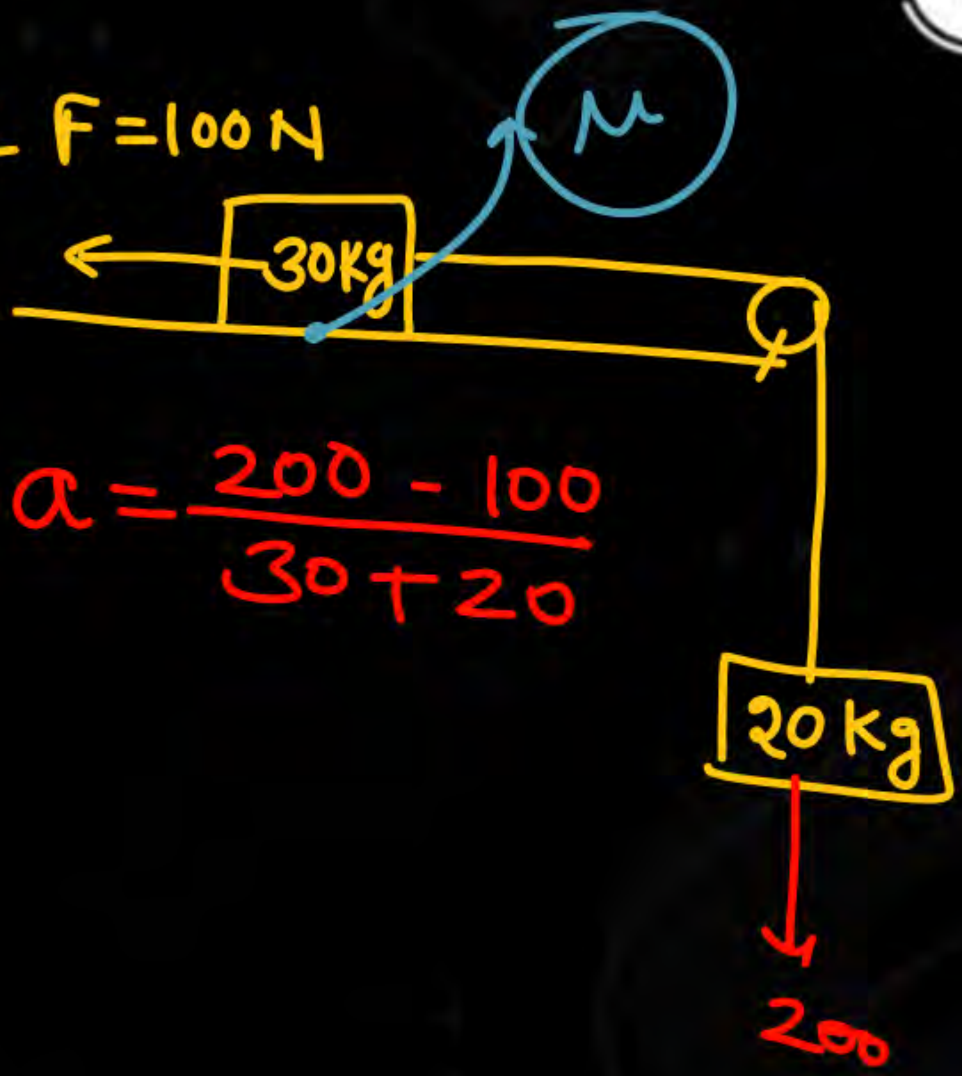
Q



$$a = \frac{200-0}{30+20}$$

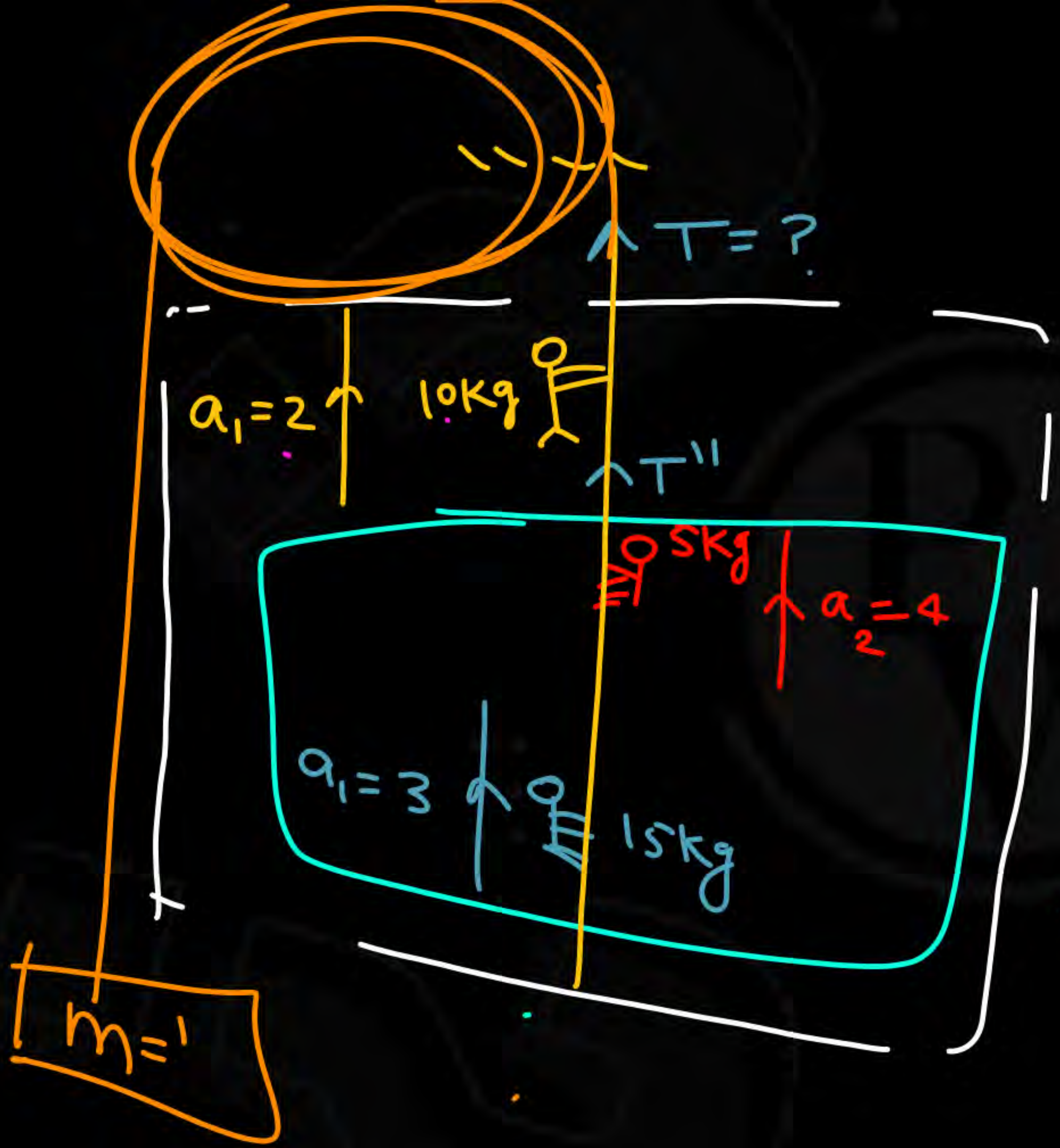
$$= 4$$

Q $F = 100\ N$



$$a = \frac{200-100}{30+20}$$

$$\left(\vec{F}_{net}\right)_{ext} = m_1\vec{a_1} + m_2\vec{a_2} + m_3\vec{a_3} + \text{- - - -}$$



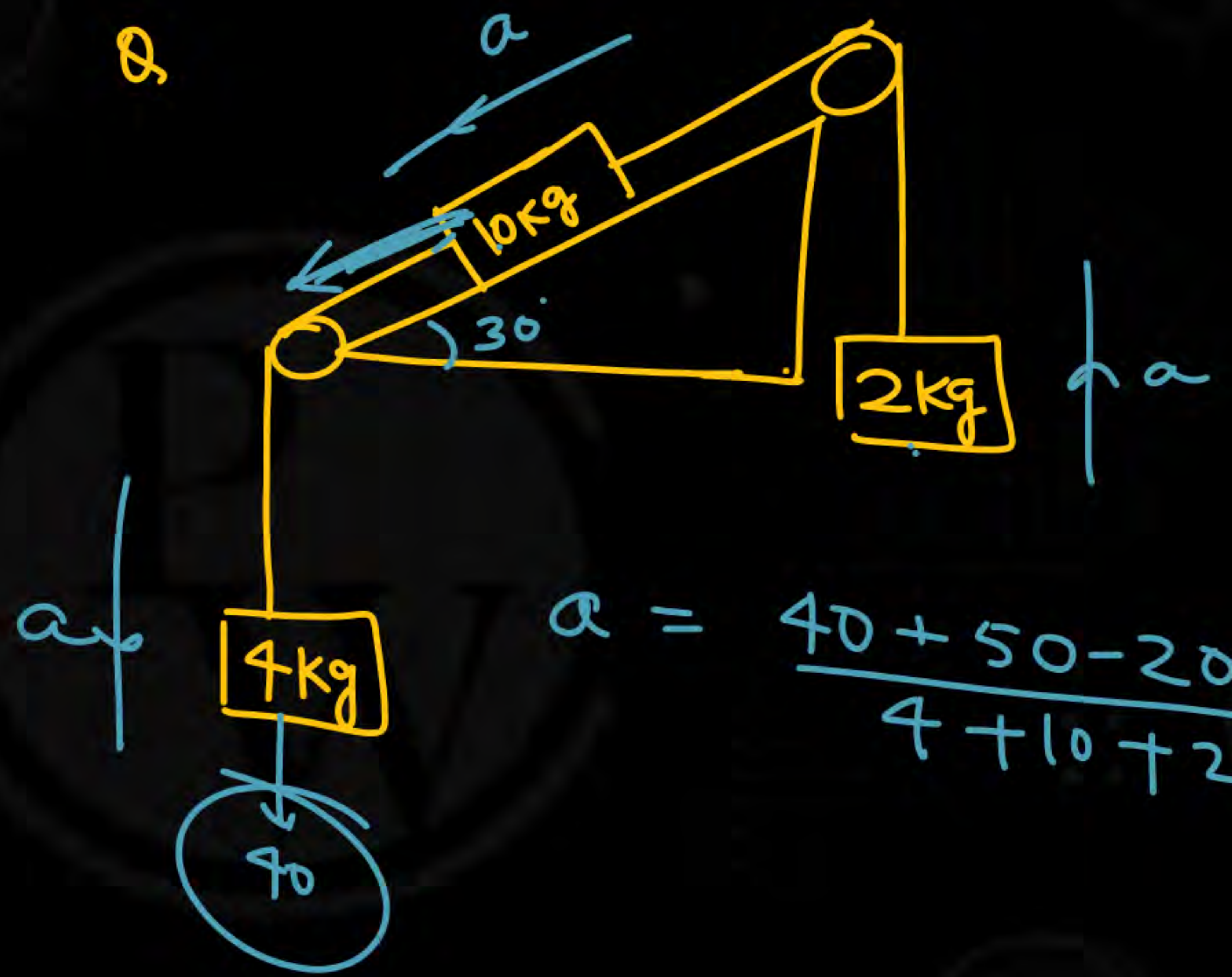
$$\left(\vec{F}_{net}\right)_{ext} = m_1\vec{a_1} + m_2\vec{a_2} + m_3\vec{a_3}.$$

$$T - 300 = 10\times 2 + 5\times 4 + 15\times 3$$

$$T'' - 200 = 20 + 45$$

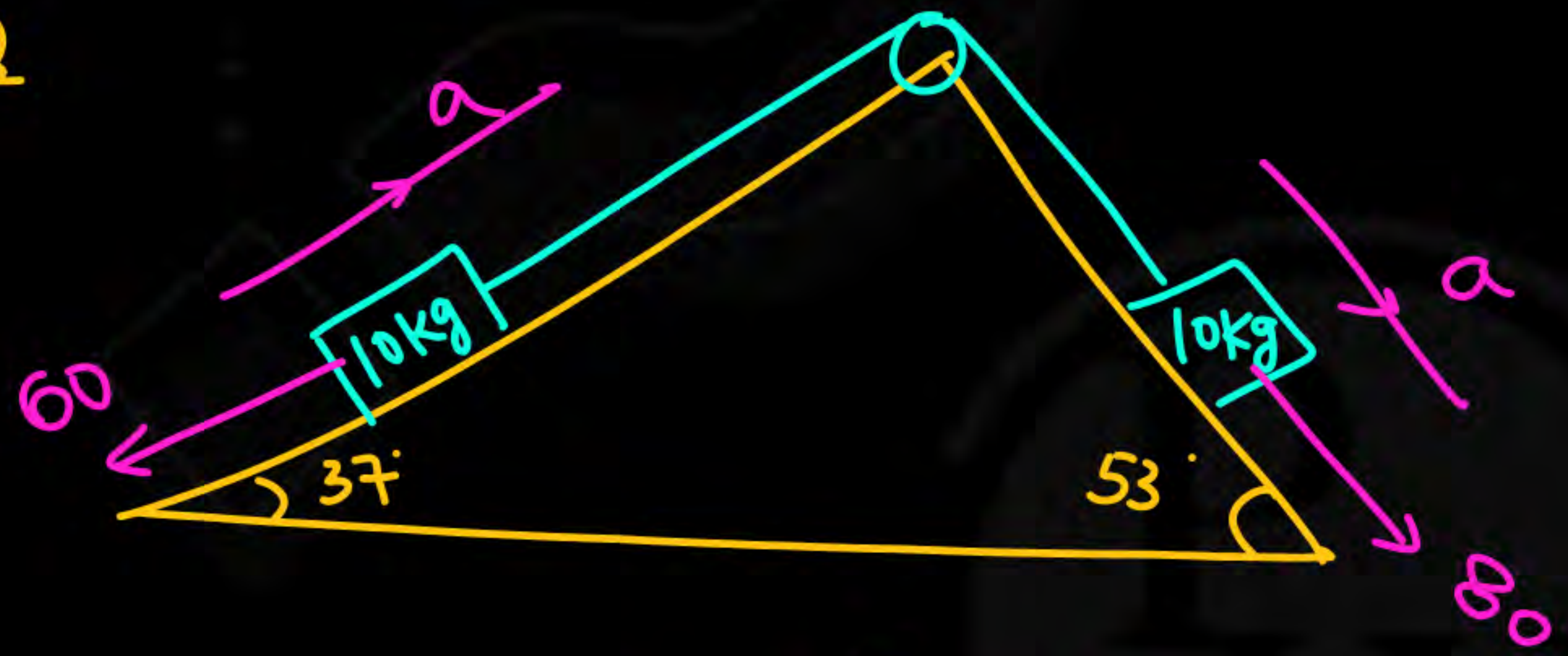
Q

Q.



$$a = \frac{40 + 50 - 20}{4 + 10 + 2}$$

Q



$$a = \frac{80 - 60}{20}$$

35. Find the acceleration of the 500 g block in figure (5-E18).

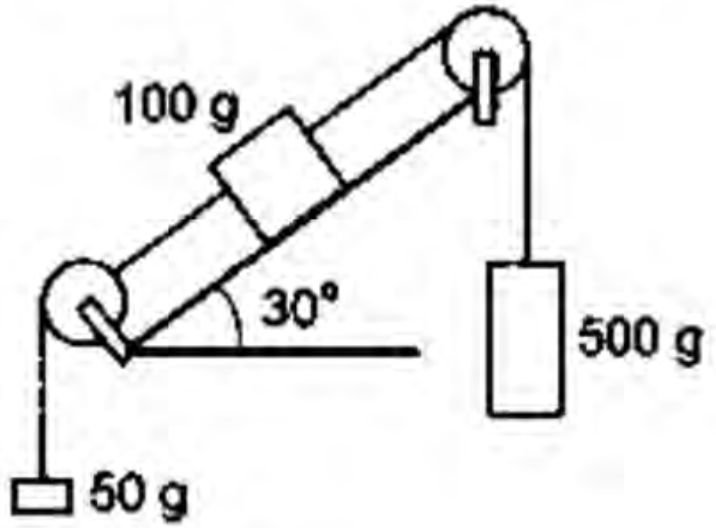


Figure 5-E18

25. Consider the situation shown in figure (5-E9). All the surfaces are frictionless and the string and the pulley are light. Find the magnitude of the acceleration of the two blocks.

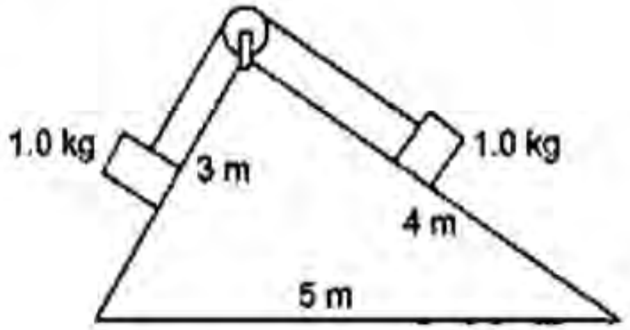


Figure 5-E9

26 A constant force $F = m_2 g/2$ is applied on the block of mass m_1 as shown in figure (5-E10). The string and the pulley are light and the surface of the table is smooth. Find the acceleration of m_1.

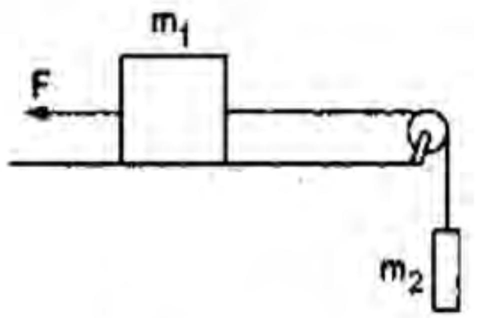
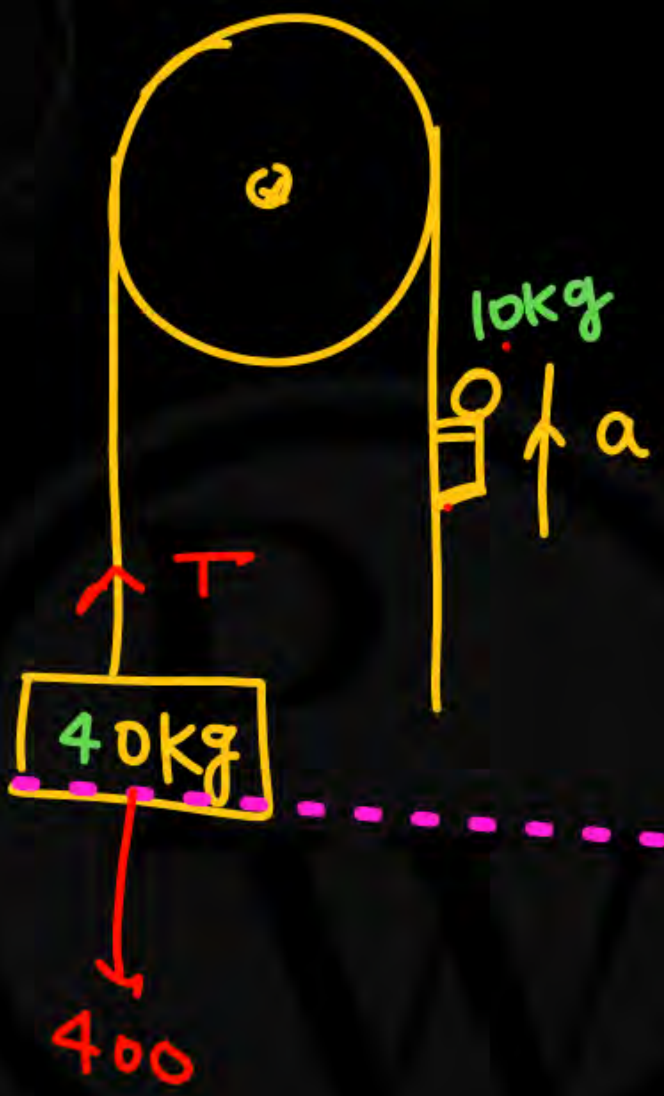
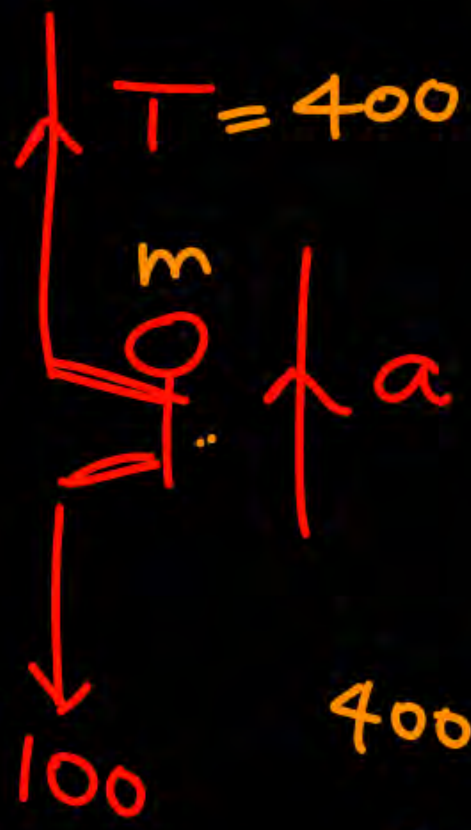


Figure 5-E10

Q

find min acc 'a' of monkey so that block lift off from ground.





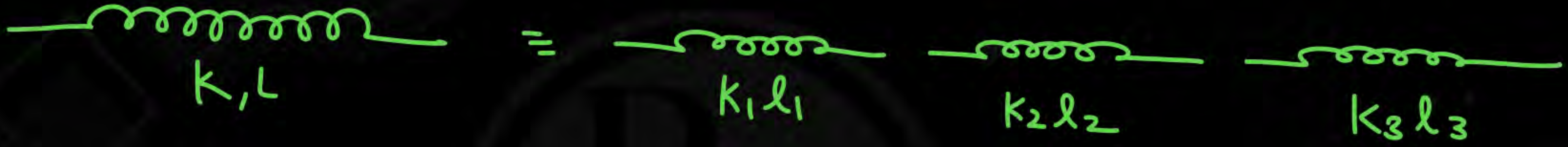
$T_m = 400$

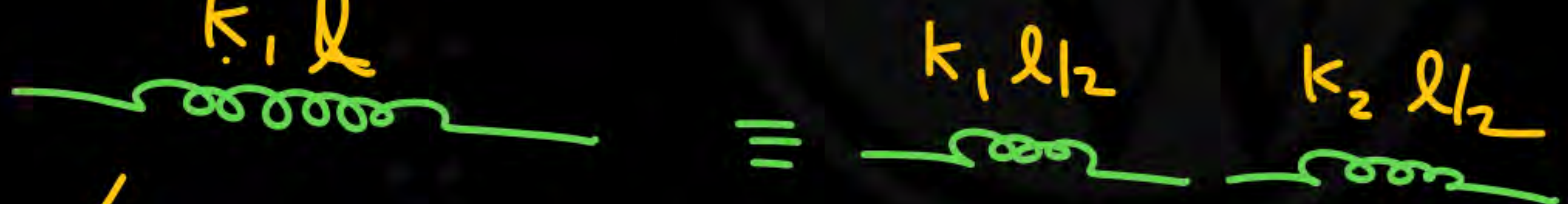
$400 - 100 = ma$

$300 = 10 \times a$

$a = 30$

$$KL = K_1 l_1 = K_2 l_2 = K_3 l_3$$



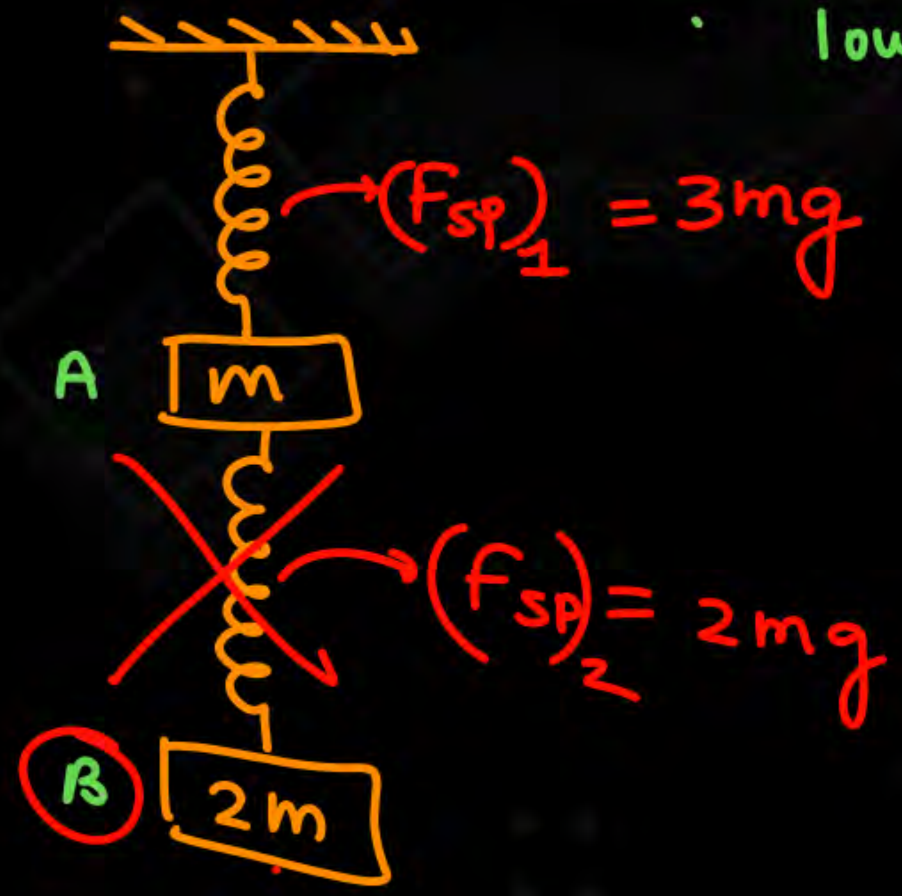


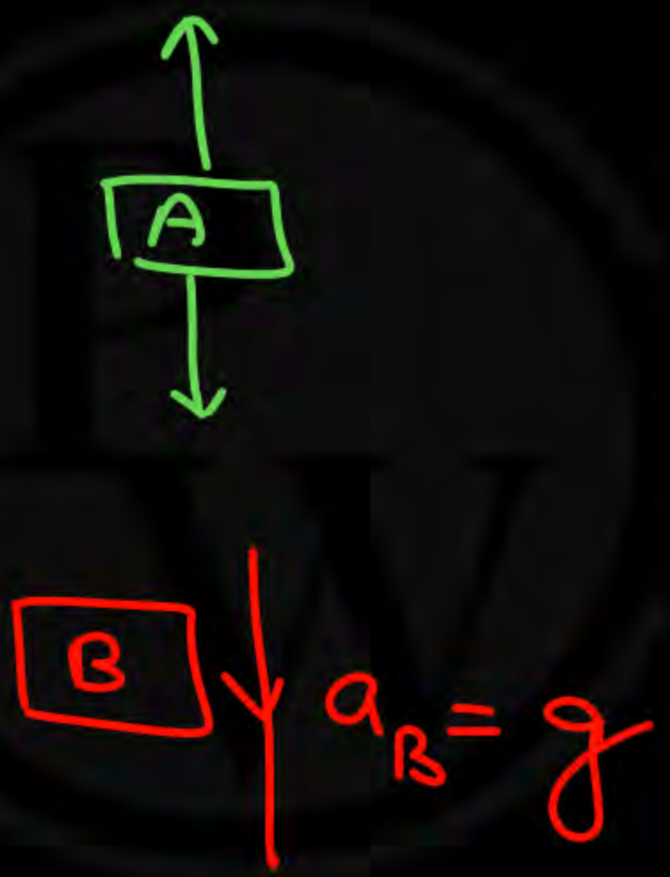
(two equal half)

$$Kl = K_1 \frac{l}{2} = K_2 \frac{l}{2}$$

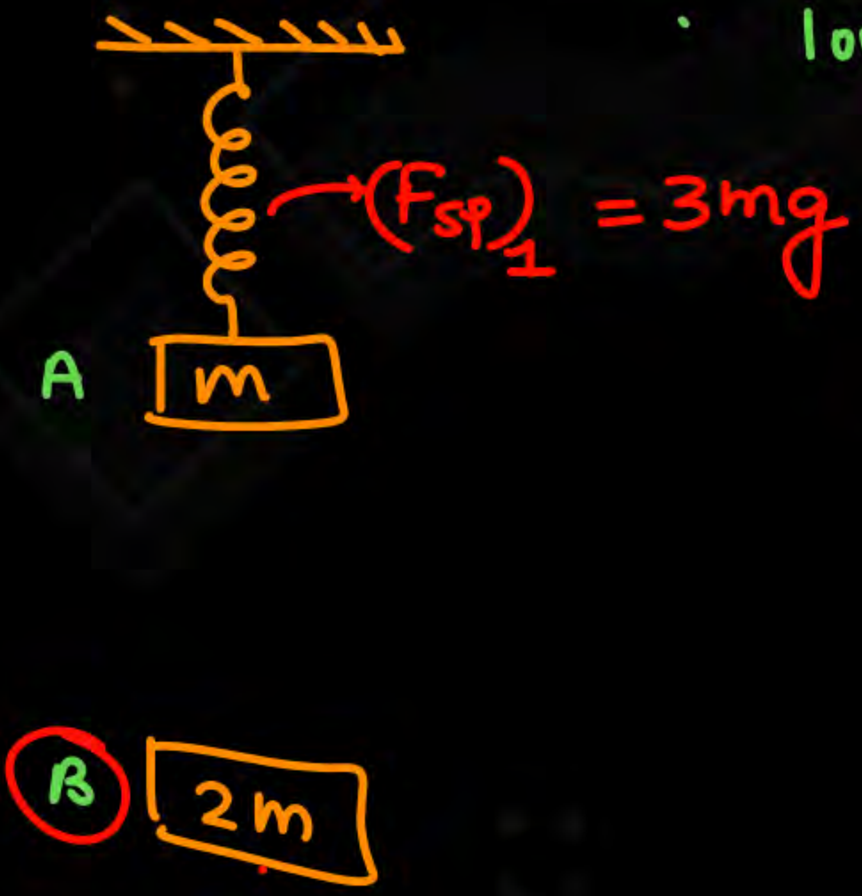
$$K_1 = K_2 = 2l$$

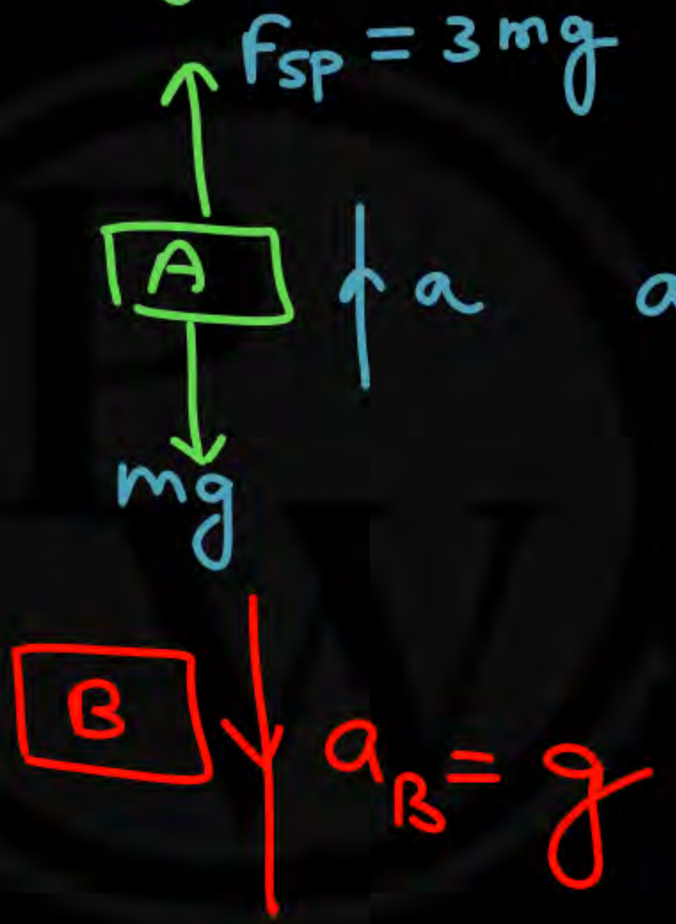
find acc of A & B just after lower spring is cut





find acc of A & B just after lower spring is cut





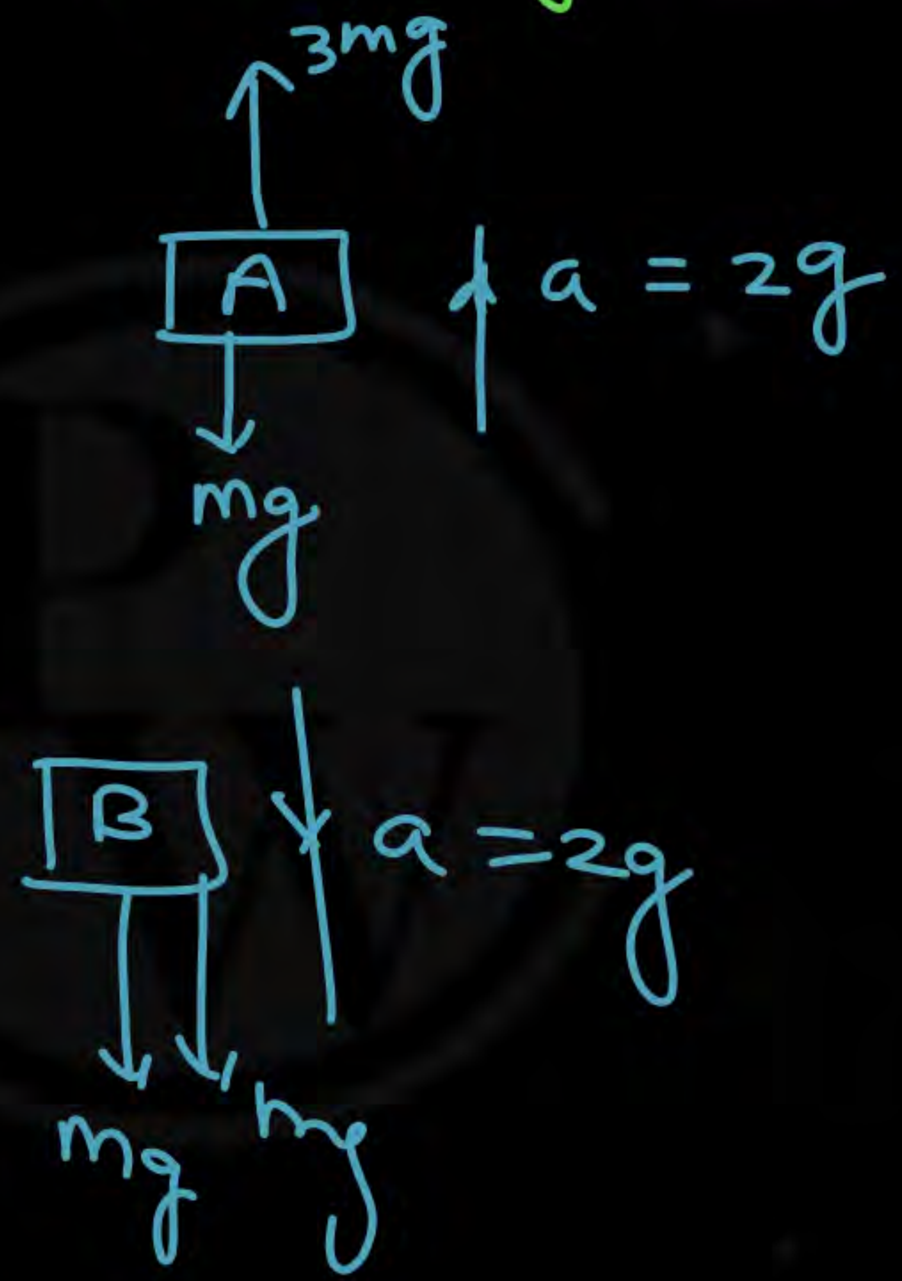
$$a = \frac{3mg - mg}{m}$$

$$= 2g \uparrow$$

Q

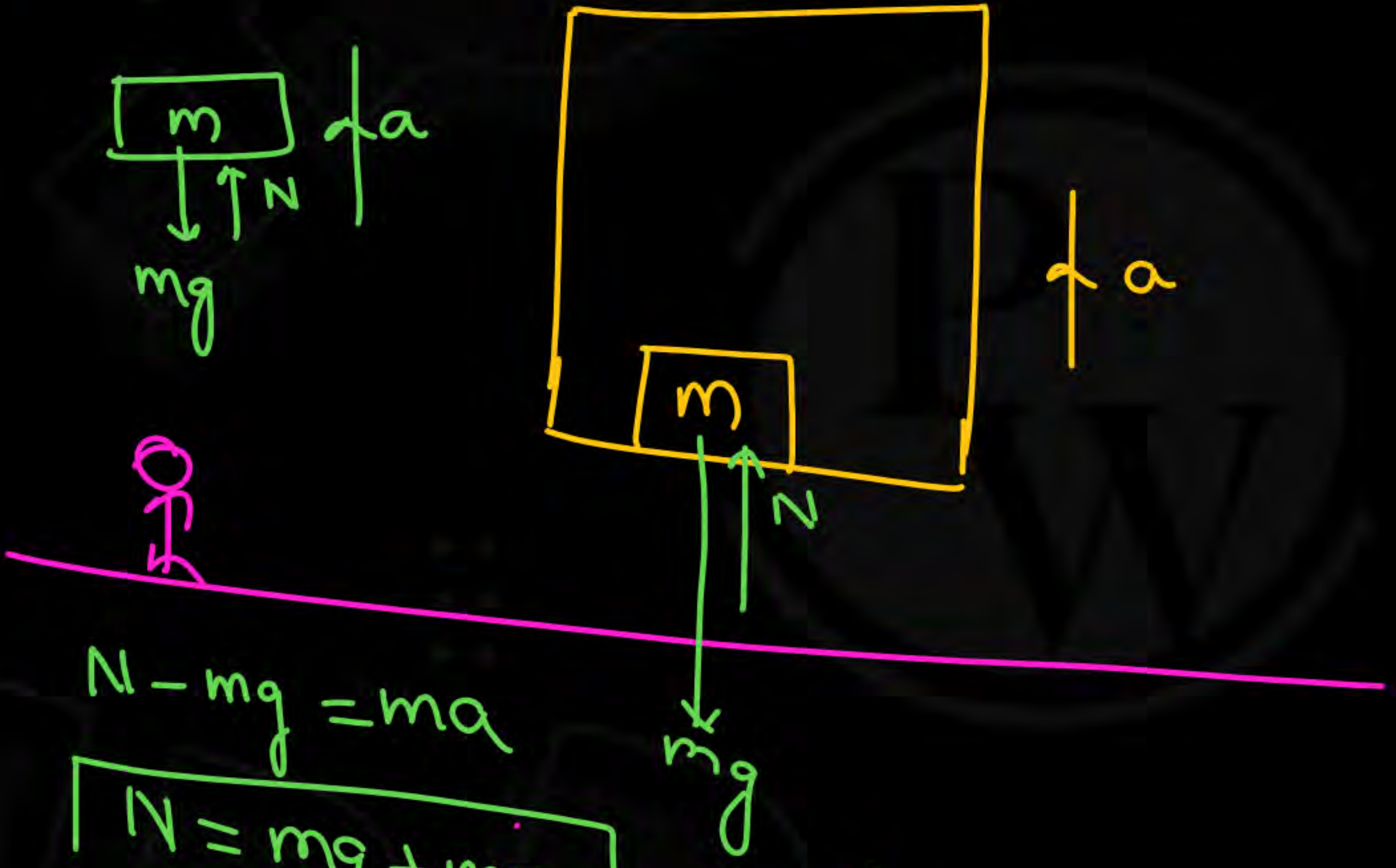
If middle spring is cut find acc of A, B, C.

just after spring cut.



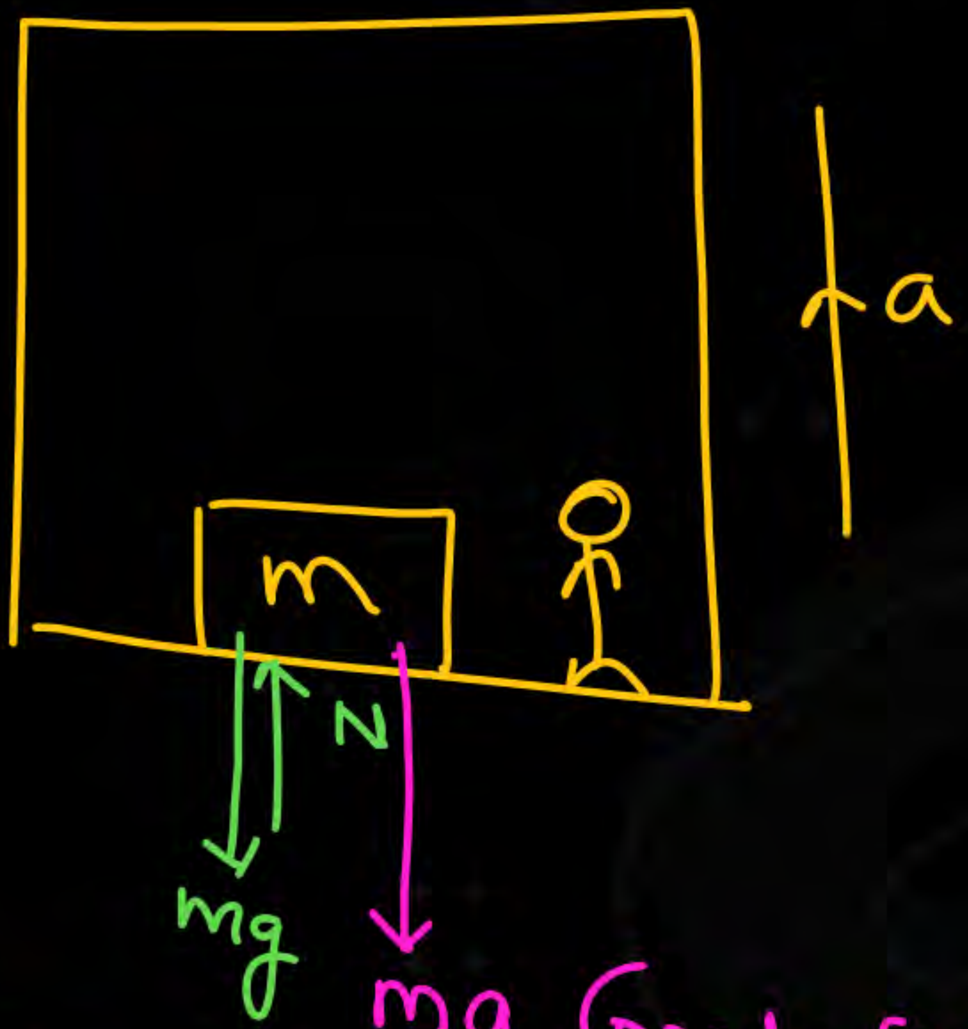
Pseudo force

$$\vec{F}_{\text{psedo force}} = -m_{\text{block}} \vec{a}_{\text{observer}}$$



$N - mg = ma$

$$\boxed{N = mg + ma}$$



ma (psedo force)

$$\boxed{N = mg + ma}$$

$$\vec{F}_{pseudo} = -\, m_{block}\, \vec{a}$$

$$\vec{F}_{psedo.} = -\, m_{block}\, \vec{a}_{N.I.F.}$$

Q Find acc. of B so that block A remains at rest wrt B.

$ma\cos\theta = mg\sin\theta$

$$\boxed{a = g\tan\theta}$$

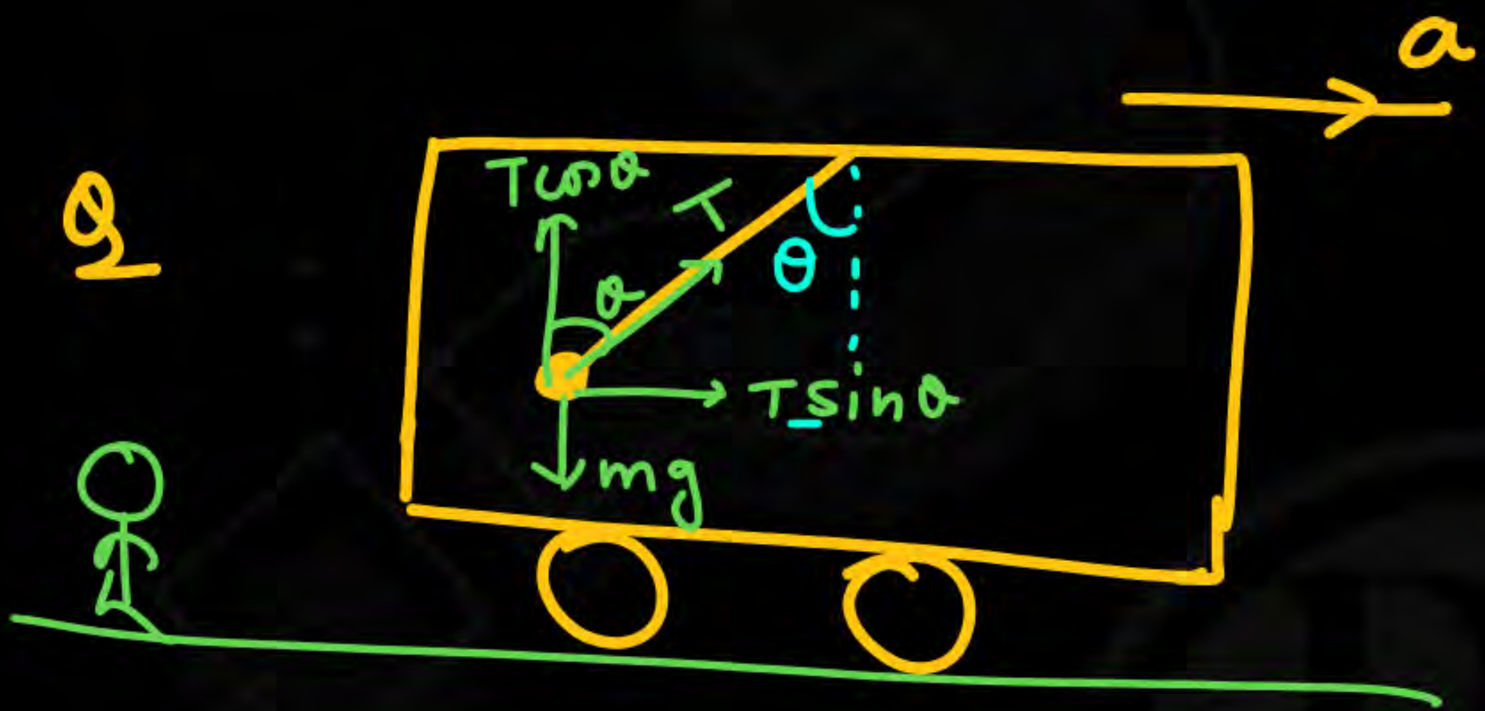
$N\sin\theta = ma$

$N\cos\theta = mg$

$\tan\theta = \frac{a}{g}$

$$\boxed{a = g\tan\theta}$$

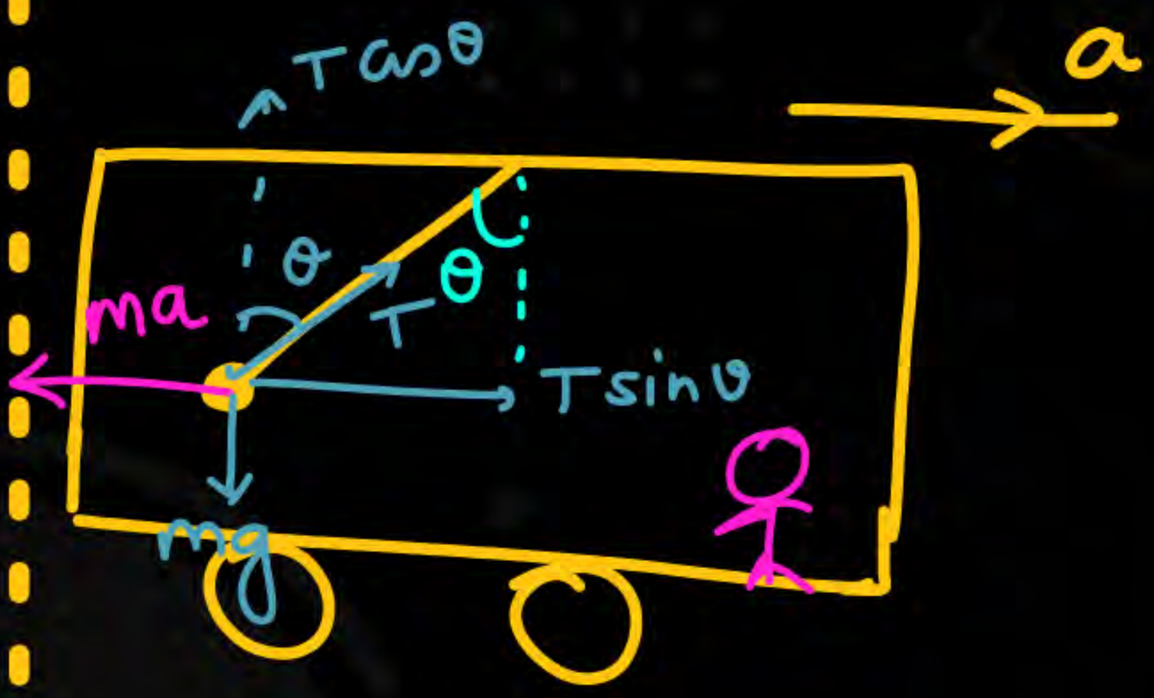
Q



$$T\sin\theta = ma$$

$$T\cos\theta = mg$$

$$a = g\tan\theta$$



$$T\sin\theta = ma$$

$$T\cos\theta = mg$$

$$a = g\tan\theta$$

33. Find the mass M of the hanging block in figure (5-E16) which will prevent the smaller block from slipping over the triangular block. All the surfaces are frictionless and the strings and the pulleys are light.

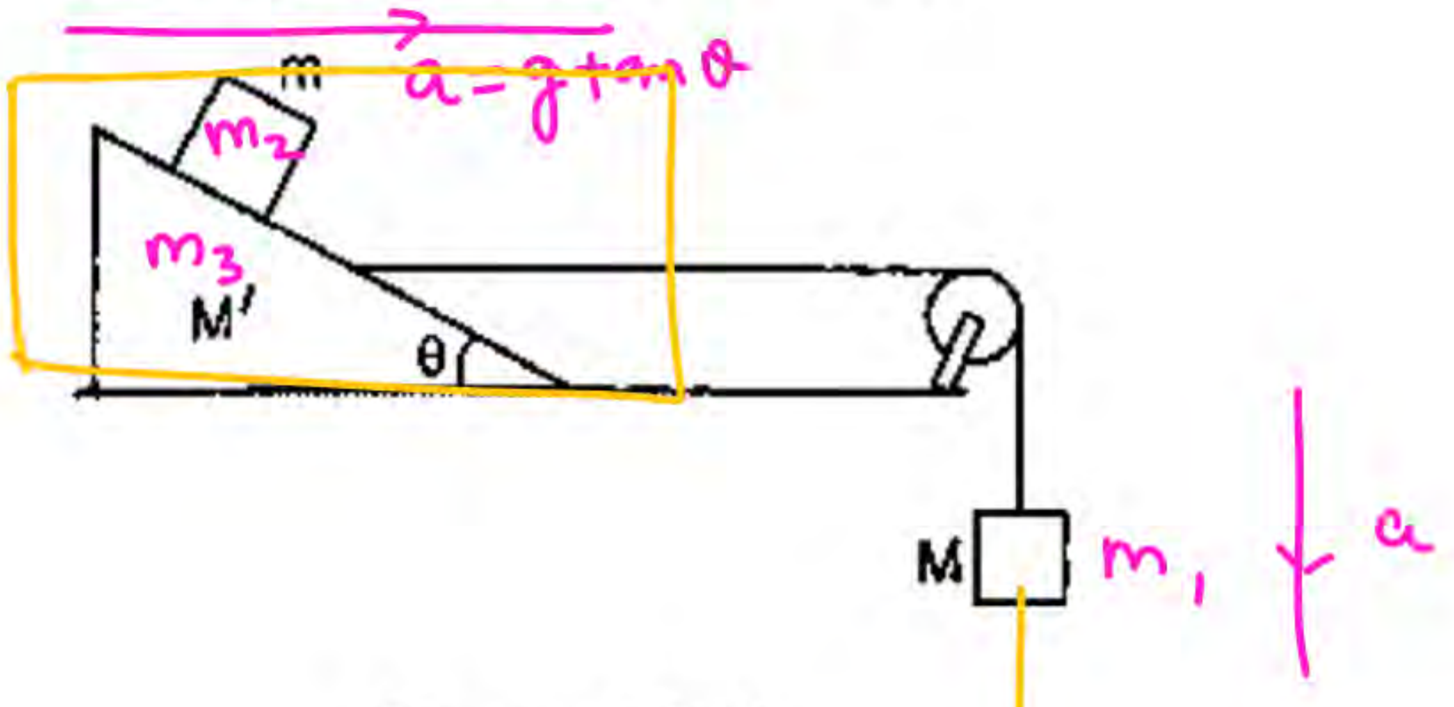
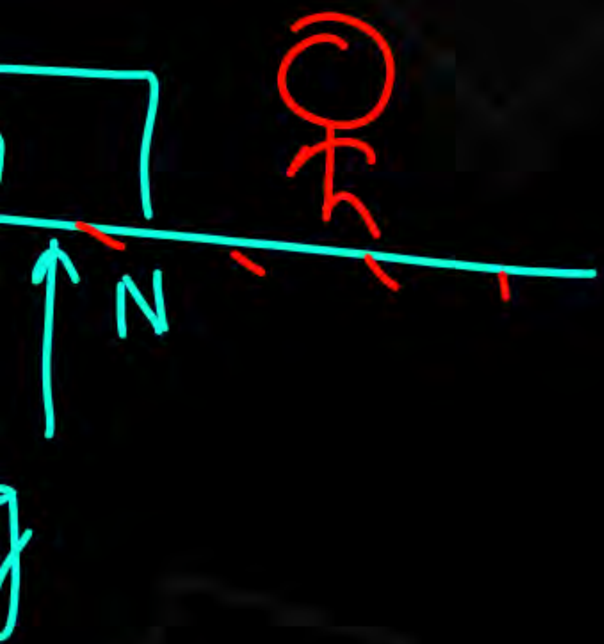
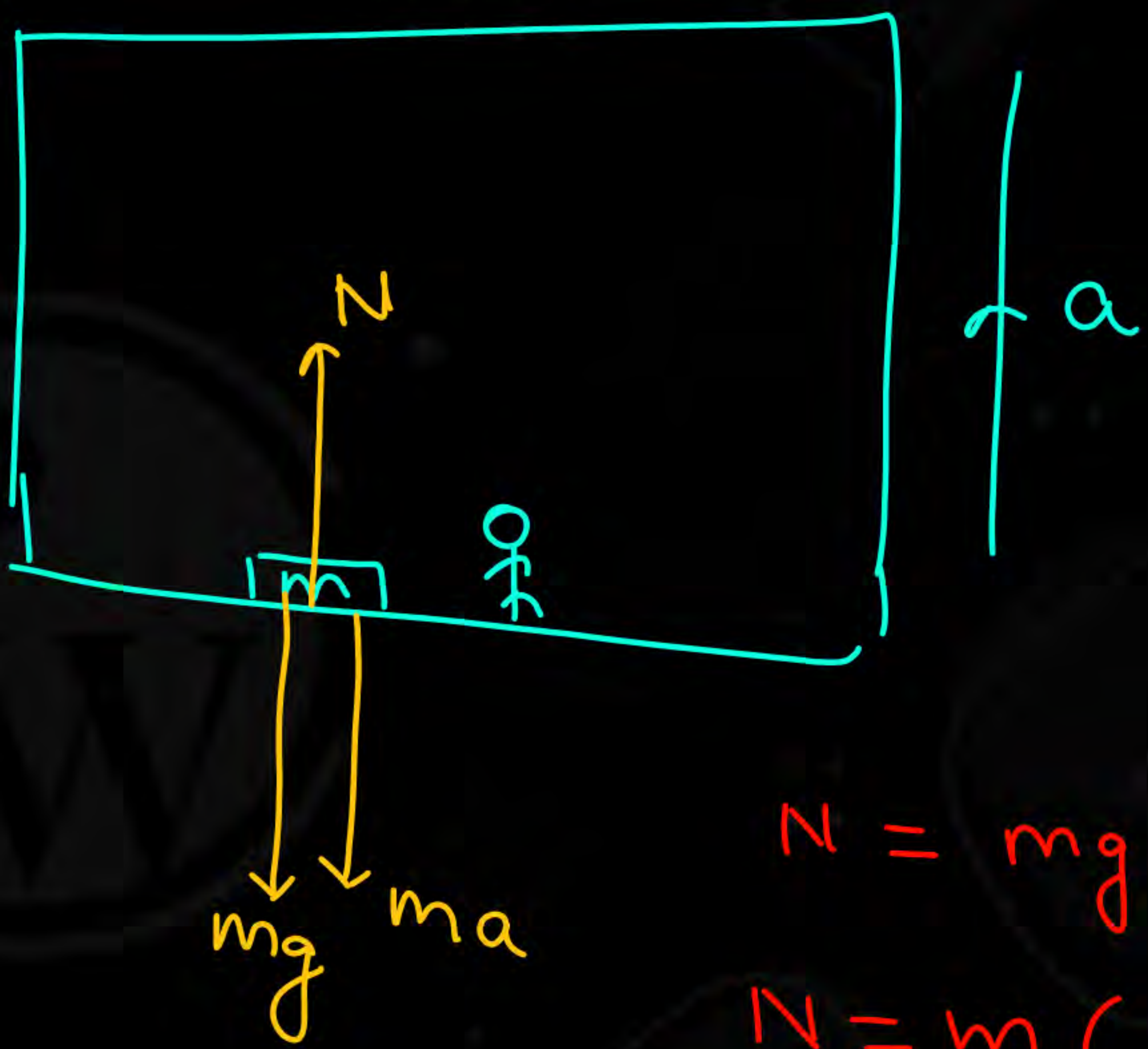


Figure 5-E16

$$a = \frac{m_1 g}{m_1 + m_2 + m_3} = g \tan\theta$$



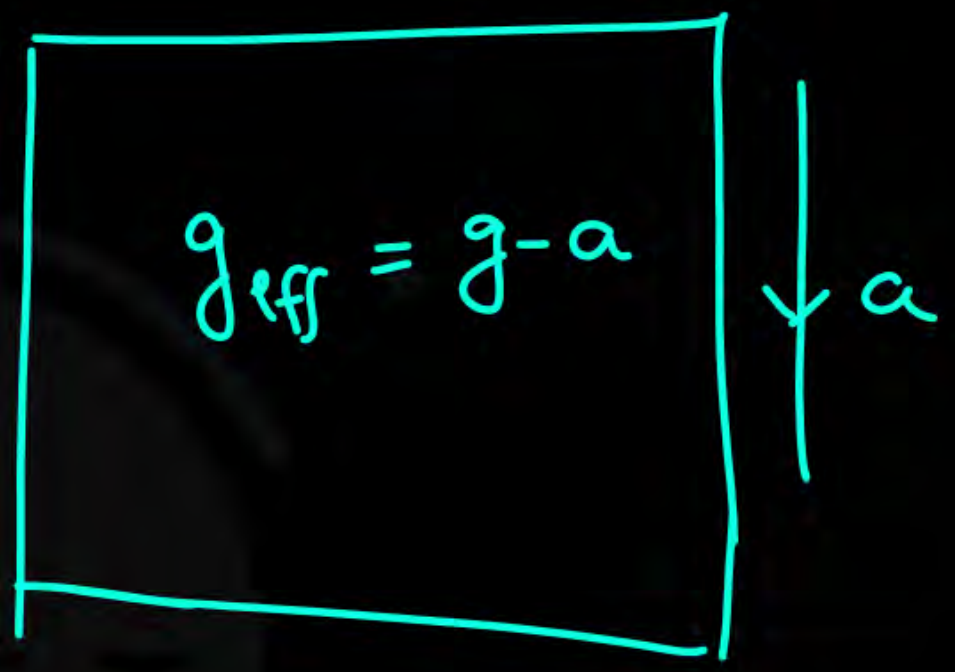


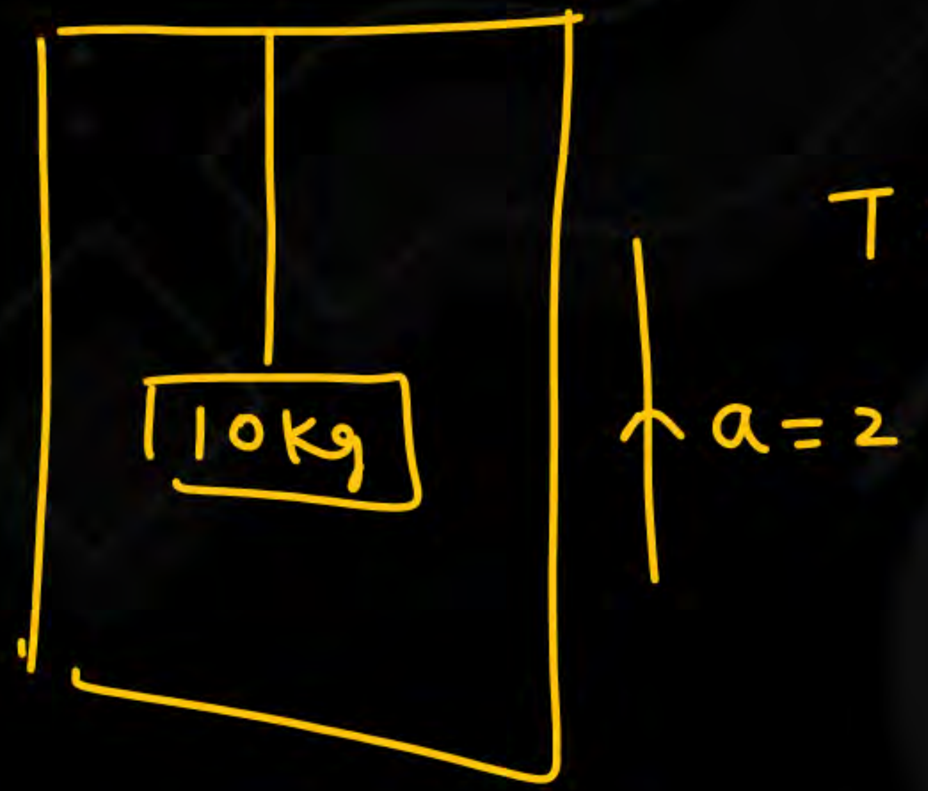
$N = mg + m$

$N = m(g +$

$$\boxed{N = m g_{eff}}$$

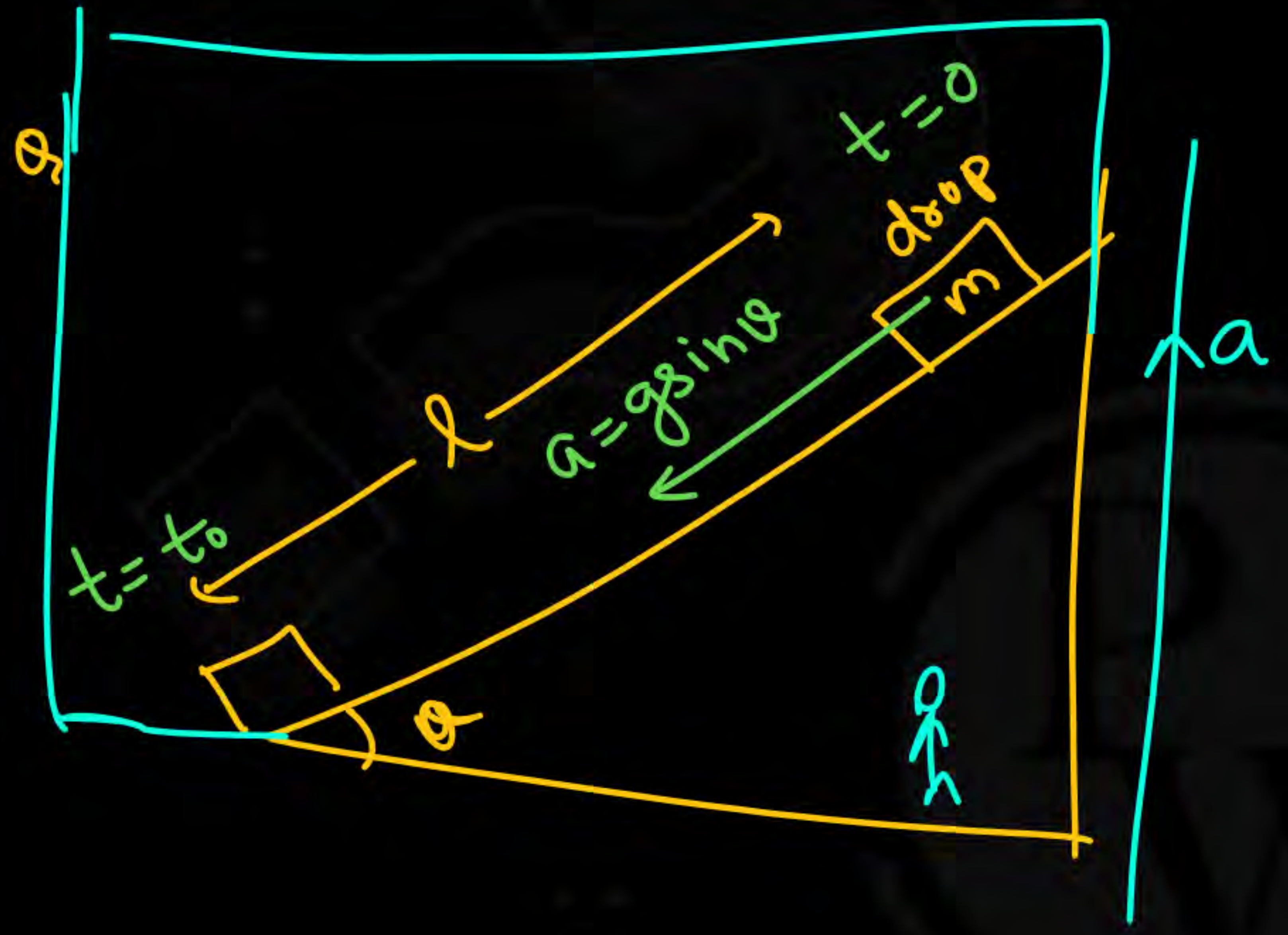

$g_{eff} = g + a$
a


$g_{eff} = g - a$
a



$$T = mg_{eff} = m\times(10+2)$$

$$= 10\times 12 = 120$$

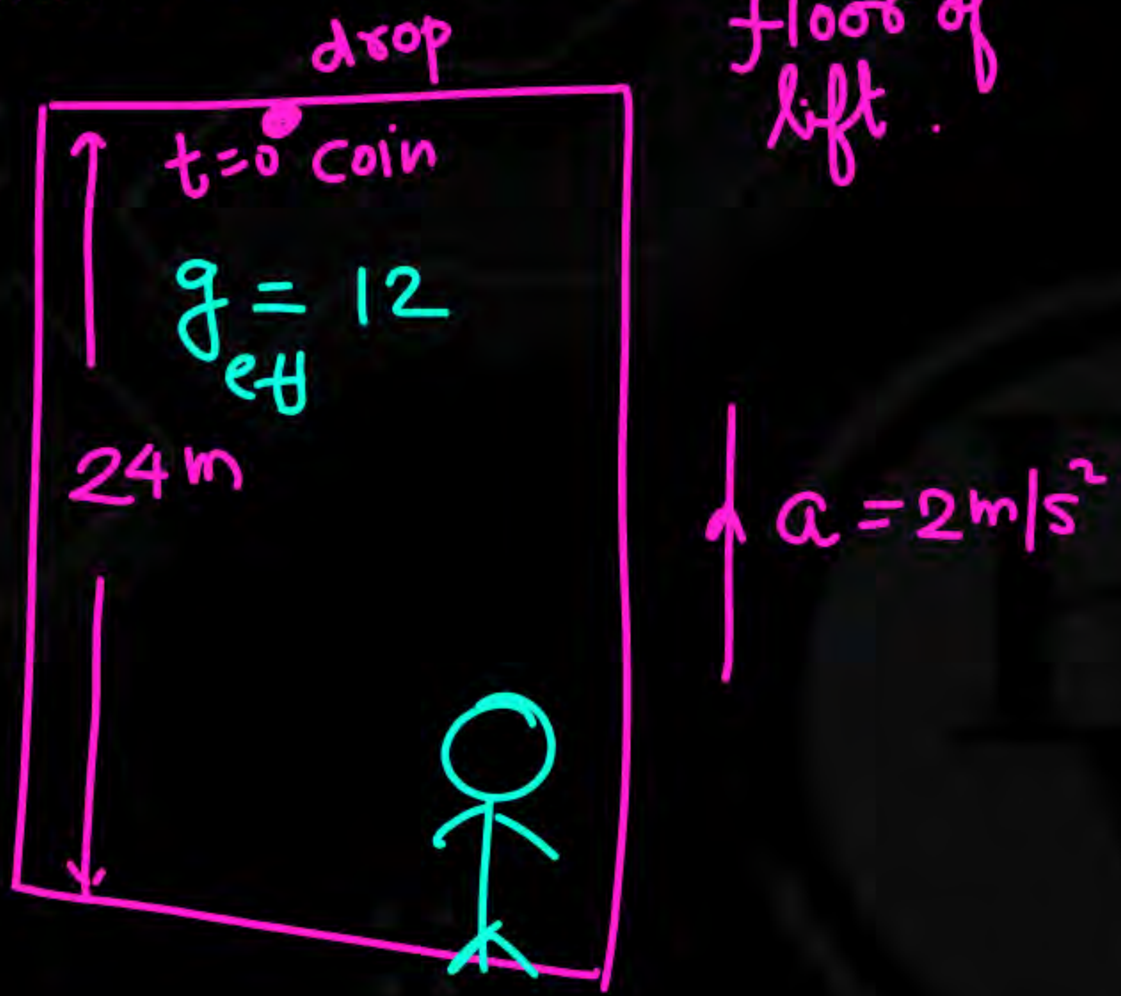


$$l = 0 + \frac{1}{2} \cdot g_{eff} \sin\theta \, t^2$$

$$t = \sqrt{\frac{2l}{g_{eff} \sin\theta}}$$

$$= \sqrt{\frac{2l}{(g+a)\sin\theta}}$$

Q When coin will strike the floor of lift.



$$24 = 0 + \frac{1}{2} \times g_{eff} \times t^2$$

$$24 = \frac{1}{2} \times 12 \times t^2$$

$$t = 2 \text{ sec}$$

$$\sum \vec{T} \cdot \vec{x} = 0$$

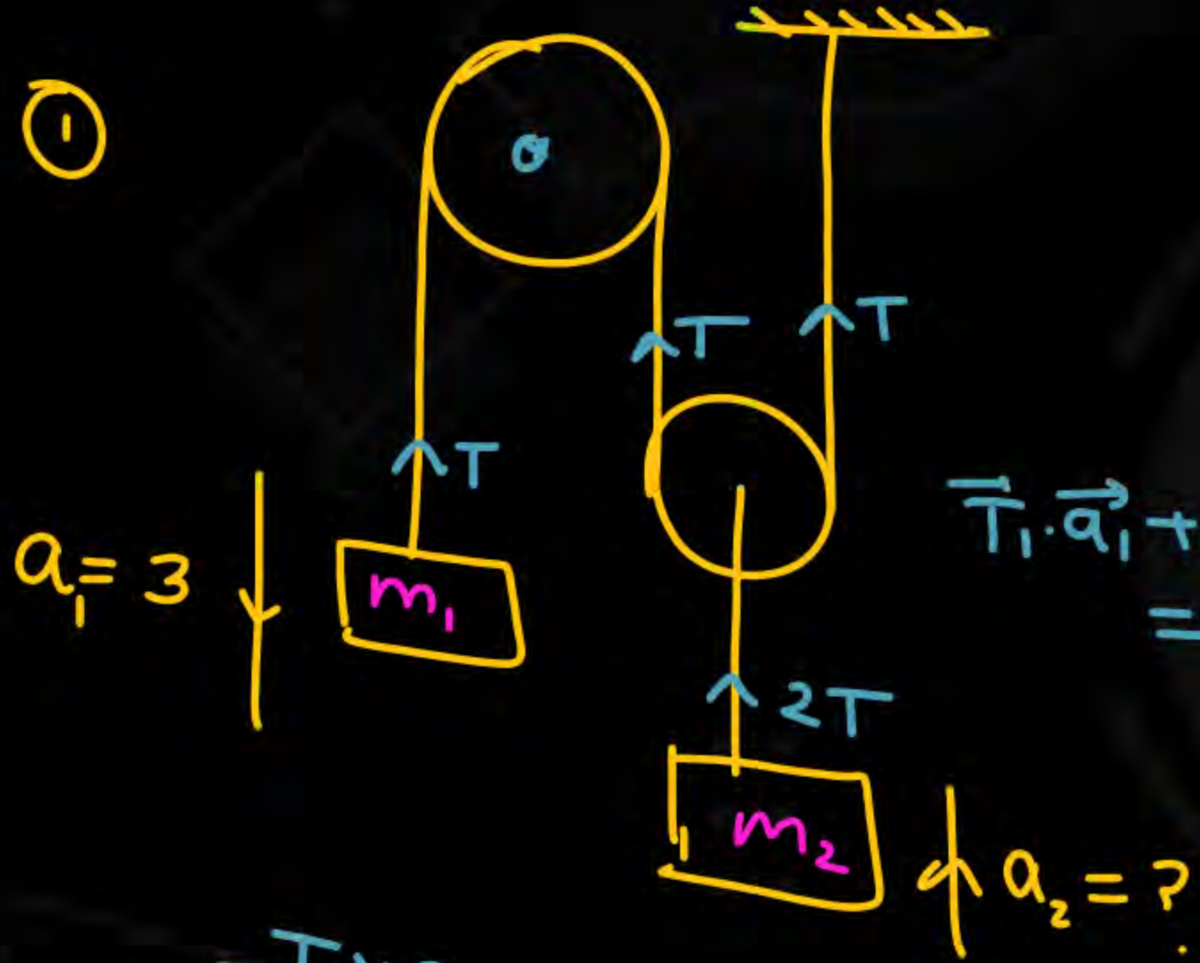
$$\vec{T} \cdot \vec{x_1} + \vec{T_2} \cdot \vec{x_2} + \dots = 0$$

$$\vec{T} \cdot \vec{v_1} + \vec{T_2} \cdot \vec{v_2} + \dots = 0$$

$$\vec{T} \cdot \vec{a_1} + \vec{T_2} \cdot \vec{a_2} + \dots = 0$$

Constraint motion

①

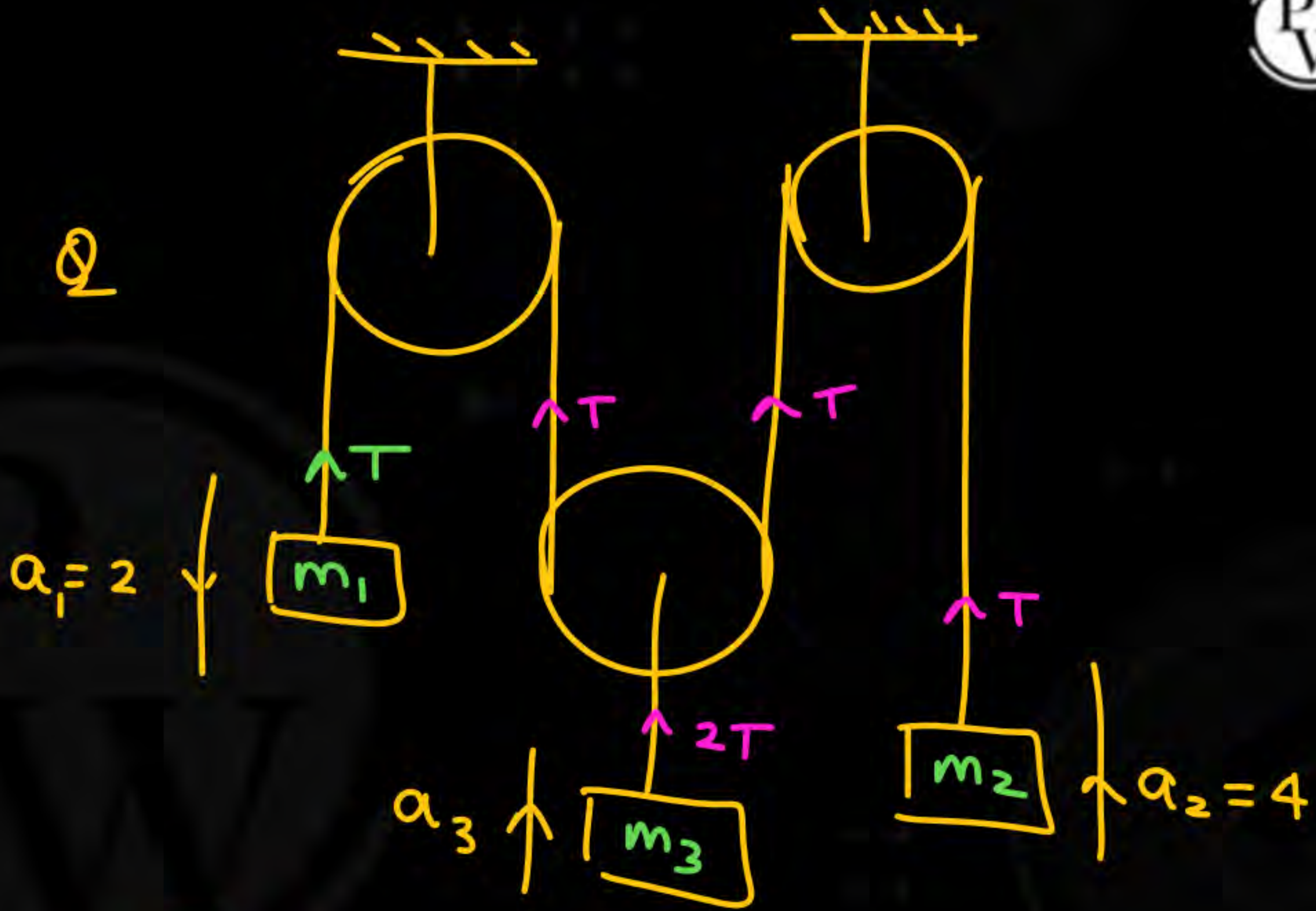


$$\vec{T}_1 \cdot \vec{a}_1 + \vec{T}_2 \vec{a}_2 = 0$$

$$-T \times 3 + 2T a_2 = 0$$

$$a_2 = 3/2$$

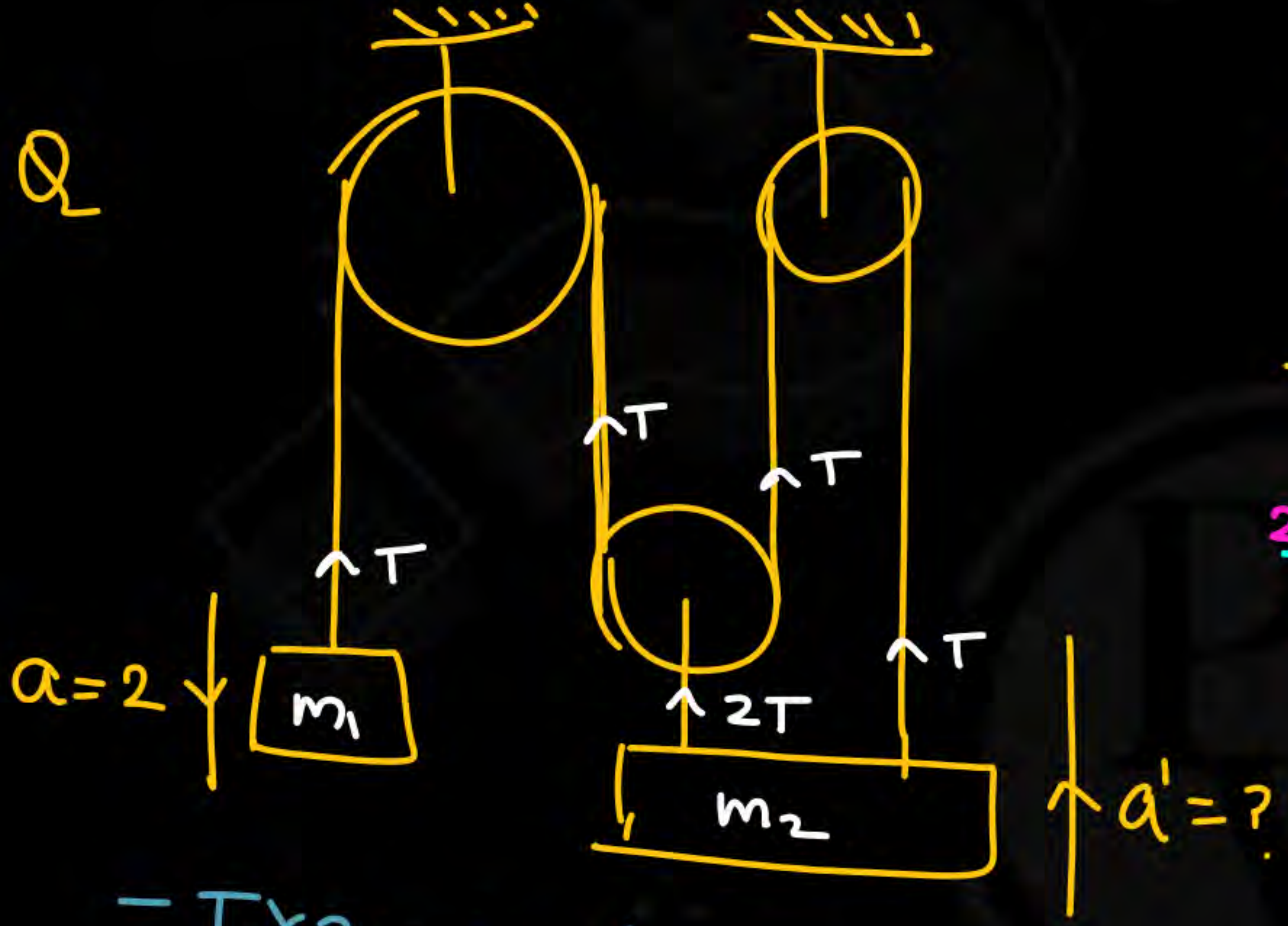
Q



$$-T \times 2 + 2T a_3 + T \times 4 = 0$$

$a_3 =$ ✓

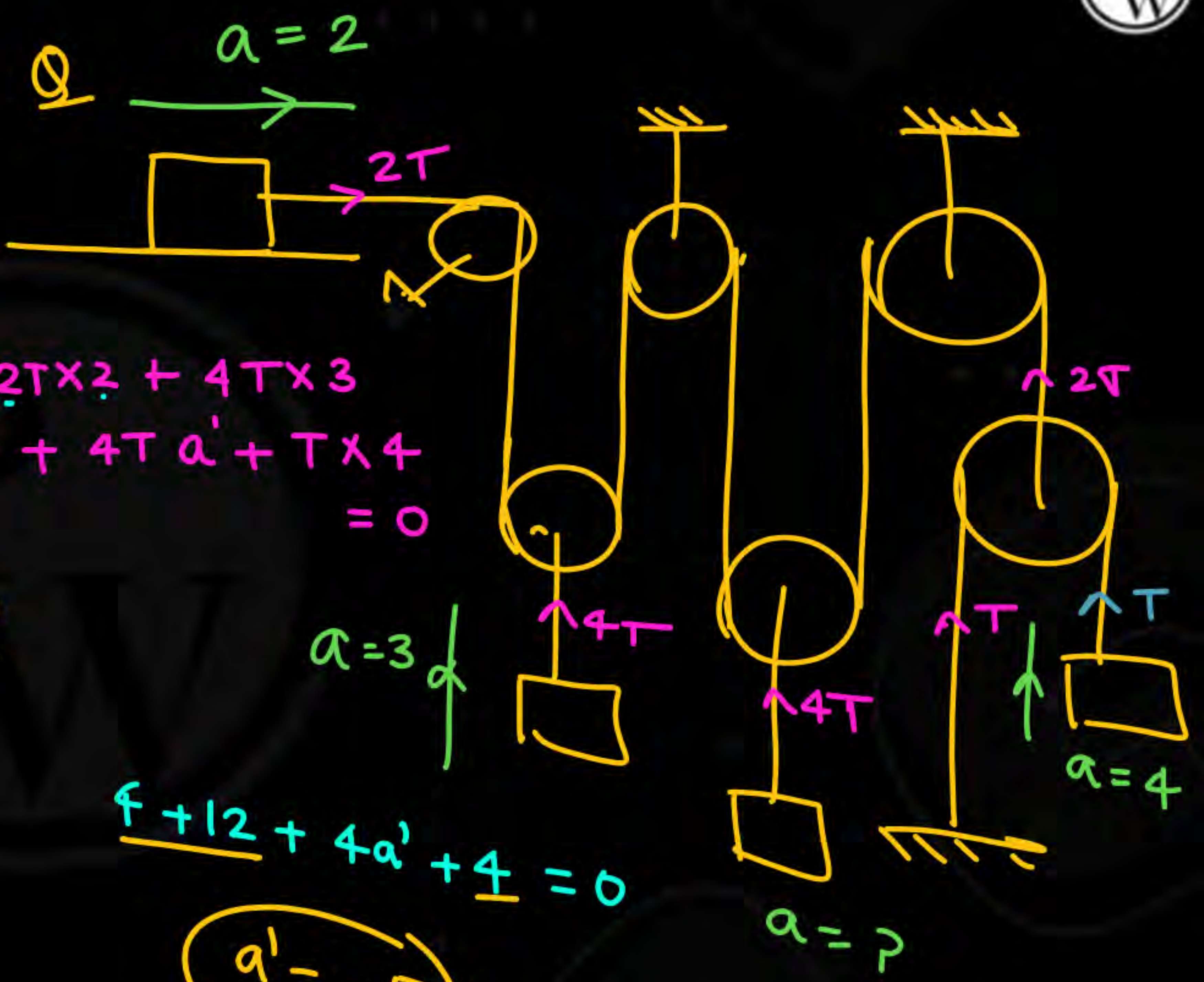
Q



$$-T\times 2 + 3T\cdot a' = 0$$

$$a' = -2/3$$

Q

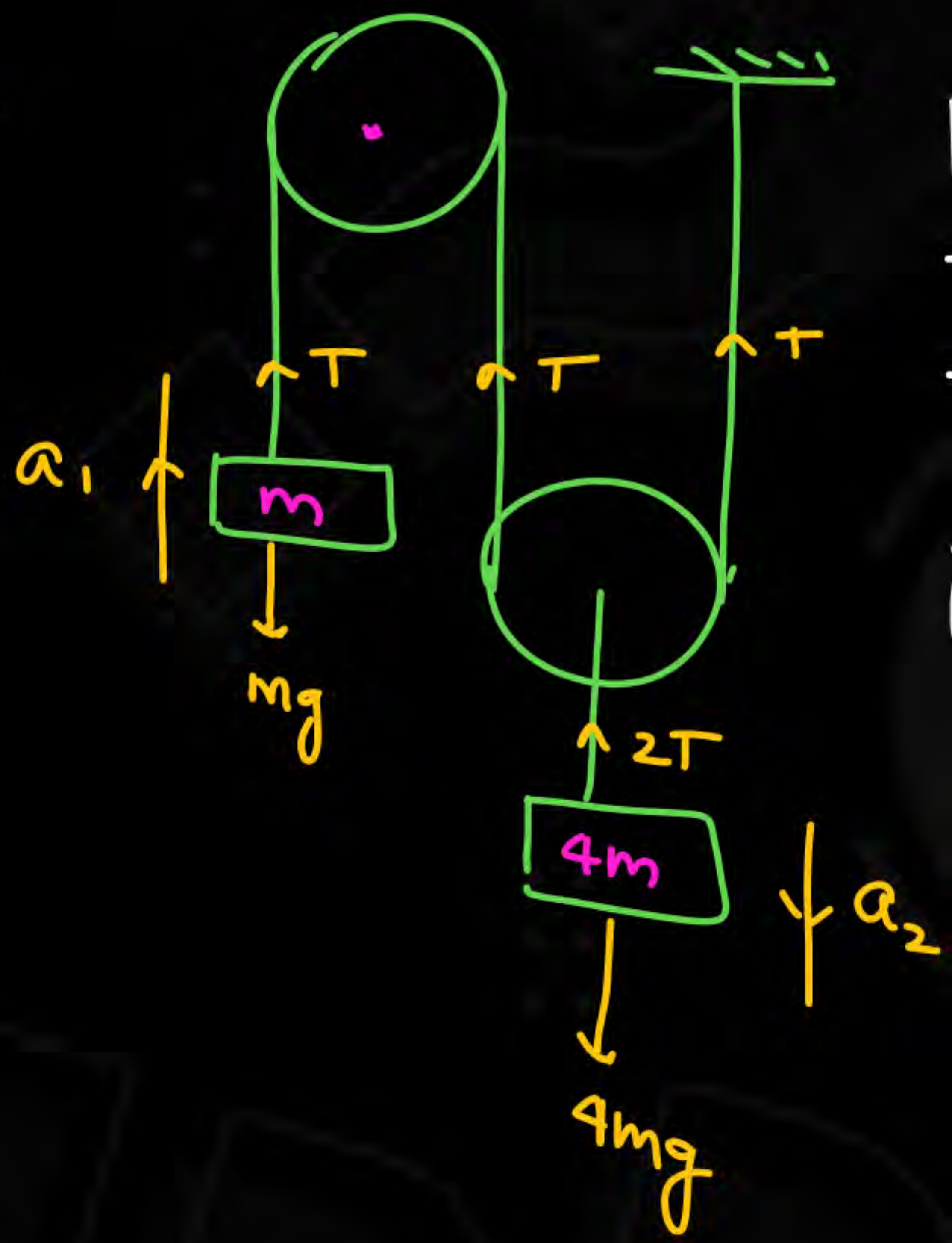


$$2T\times 2 + 4T\times 3 + 4T\,a' + T\times 4 = 0$$

$$4 + 12 + 4a' + 4 = 0$$

$$a' = -5$$

Q



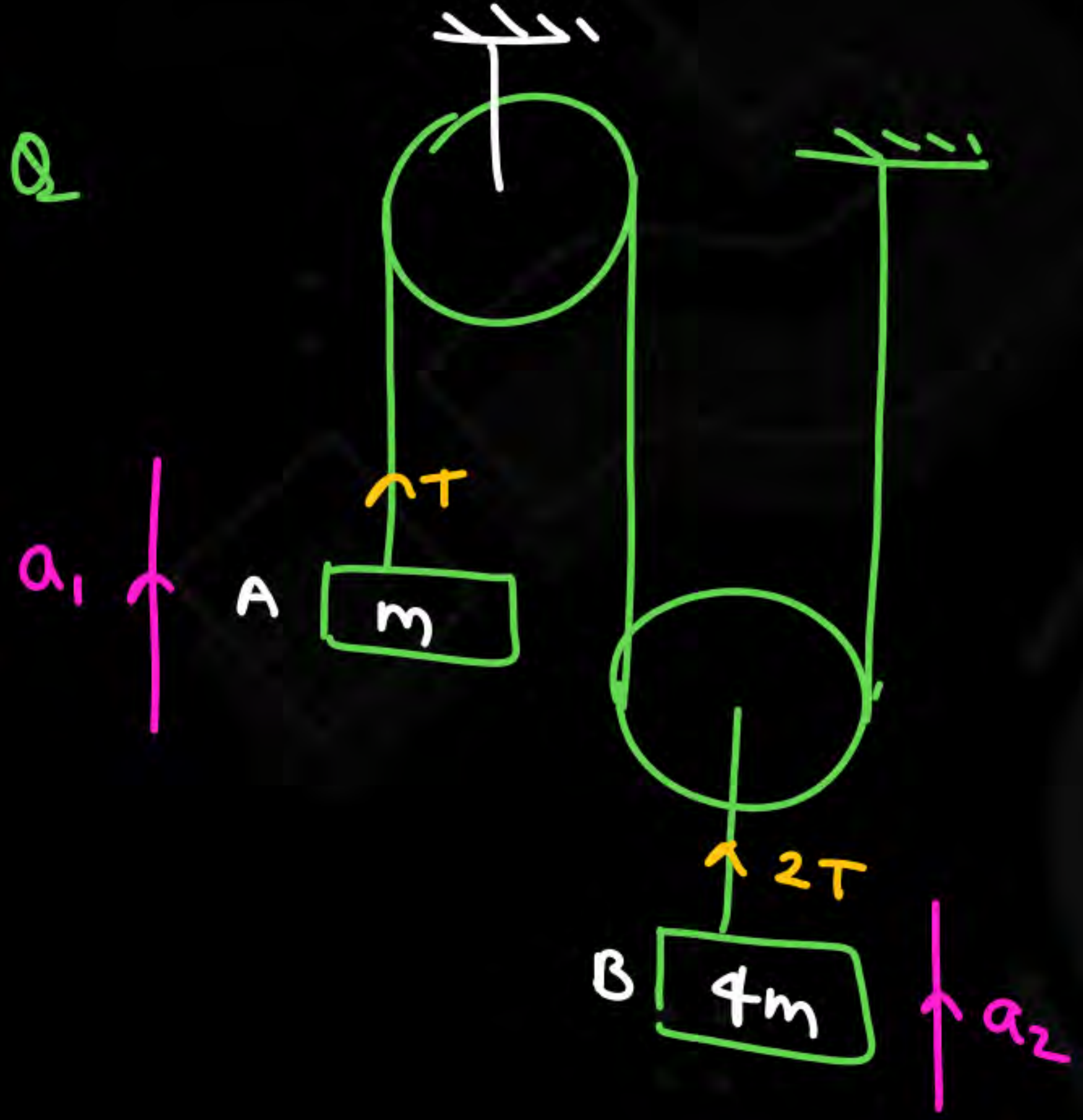
$$\boxed{T - mg = ma_1}$$

$$\boxed{4mg - 2T = 4ma_2}$$

$$Ta_1 - 2Ta_2 = 0$$

$$\boxed{a_1 = 2a_2}$$

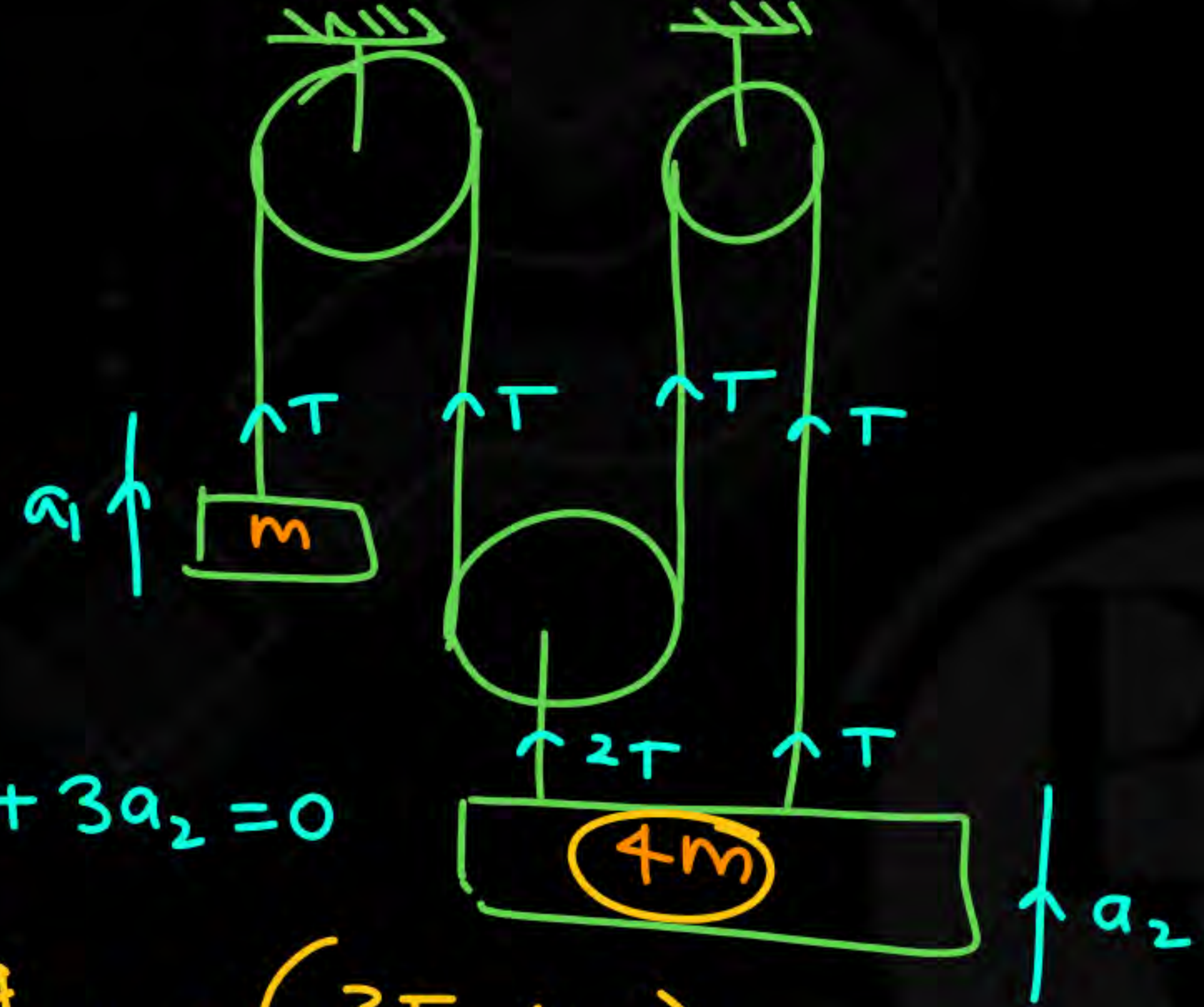
Q



$$a_1 + 2a_2 = 0$$

$$\frac{T - mg}{m} + 2\left(\frac{2T - 4mg}{4m}\right) = 0$$

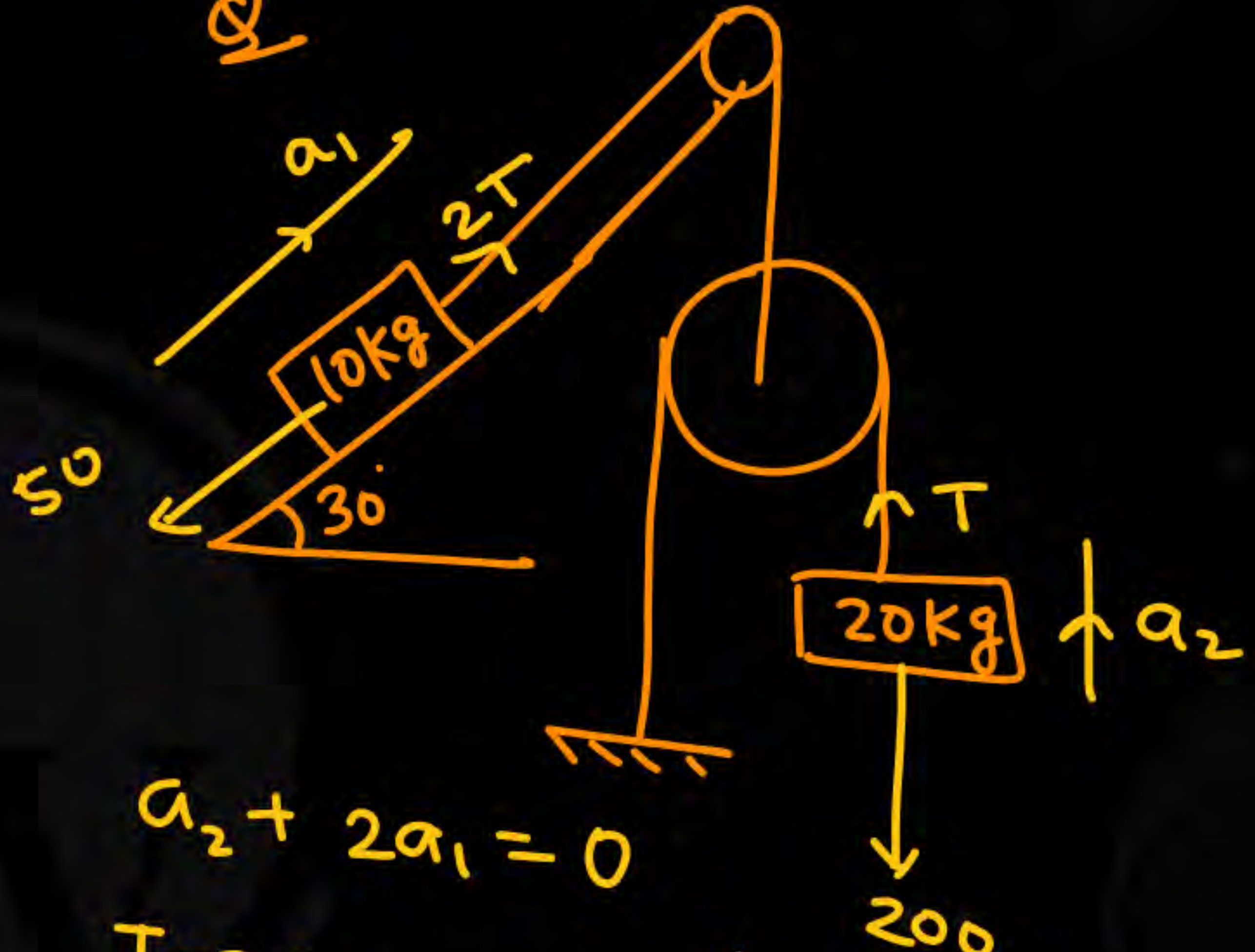
Q



$a_1 + 3a_2 = 0$

$$\frac{T-mg}{m} + 3\left(\frac{3T-4mg}{4m}\right) = 0$$

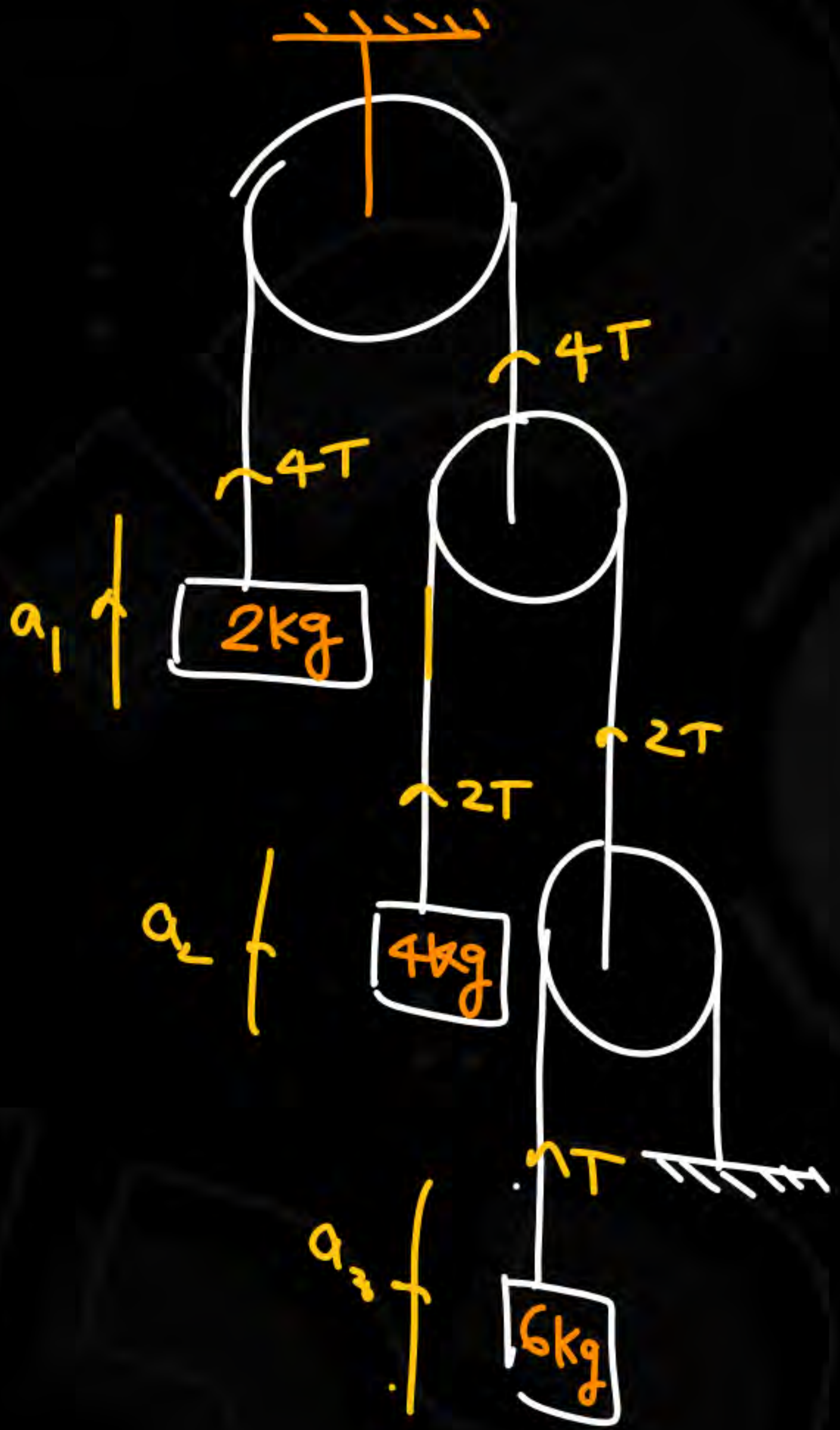
Q



$a_2 + 2a_1 = 0$

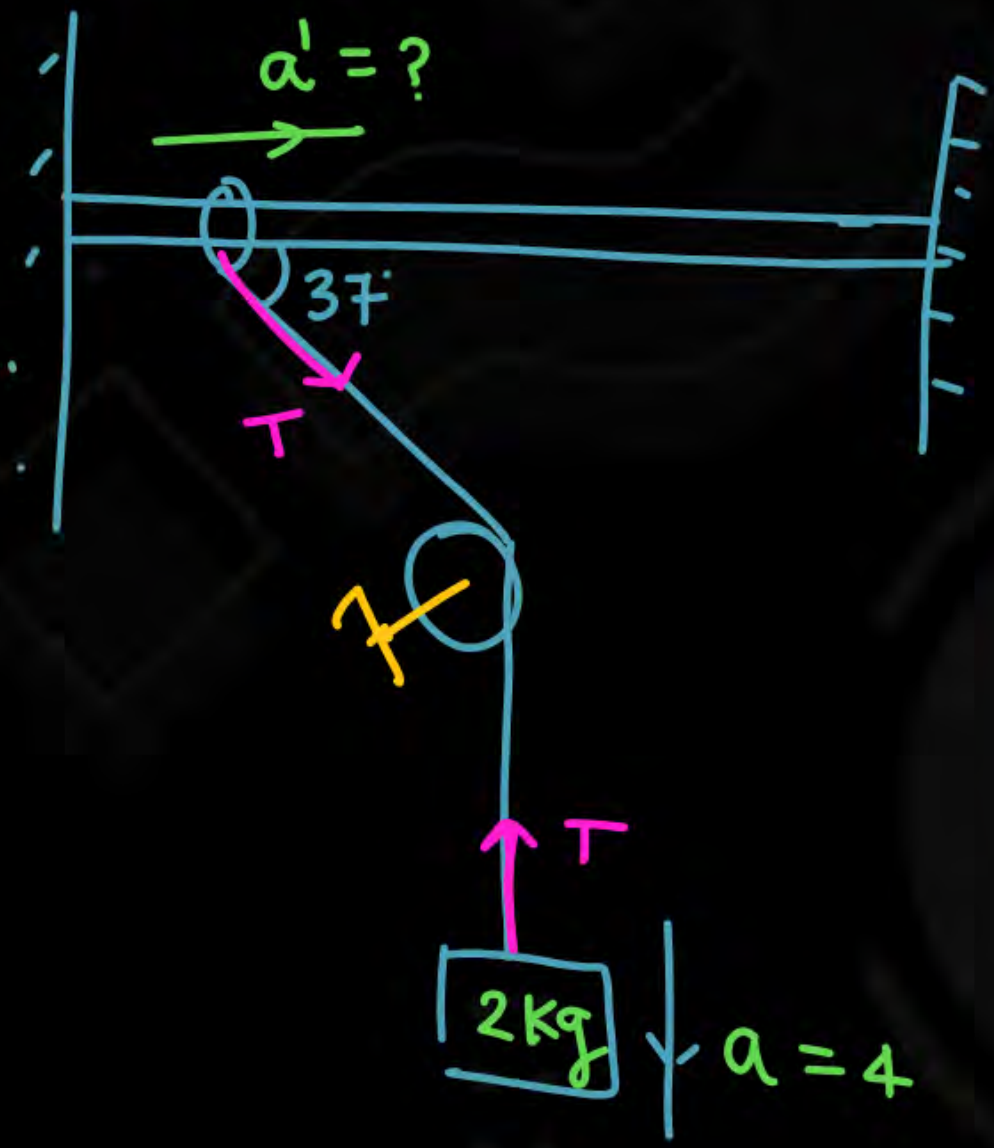
$$\frac{T-200}{20} + 2\times\left(\frac{2T-50}{10}\right) = 0$$

Q



$$4a_1 + 2a_2 + a_1 = 0$$

Q

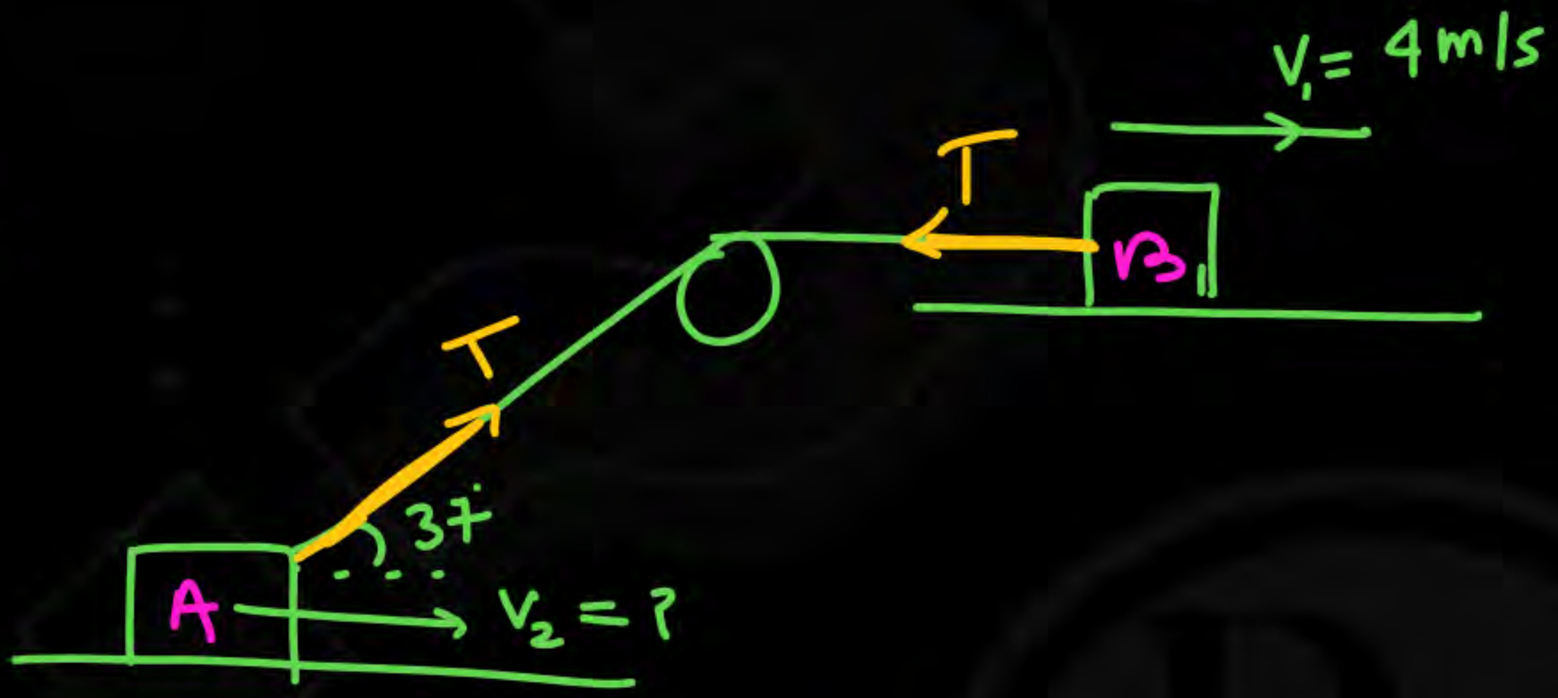


$$\vec{T}\cdot\vec{a'} + \vec{T}\cdot\vec{a} = 0$$

$$Ta'\cos 37 - T\times 4 = 0$$

$$a' = \frac{4}{\cos 37^\circ}$$

Q

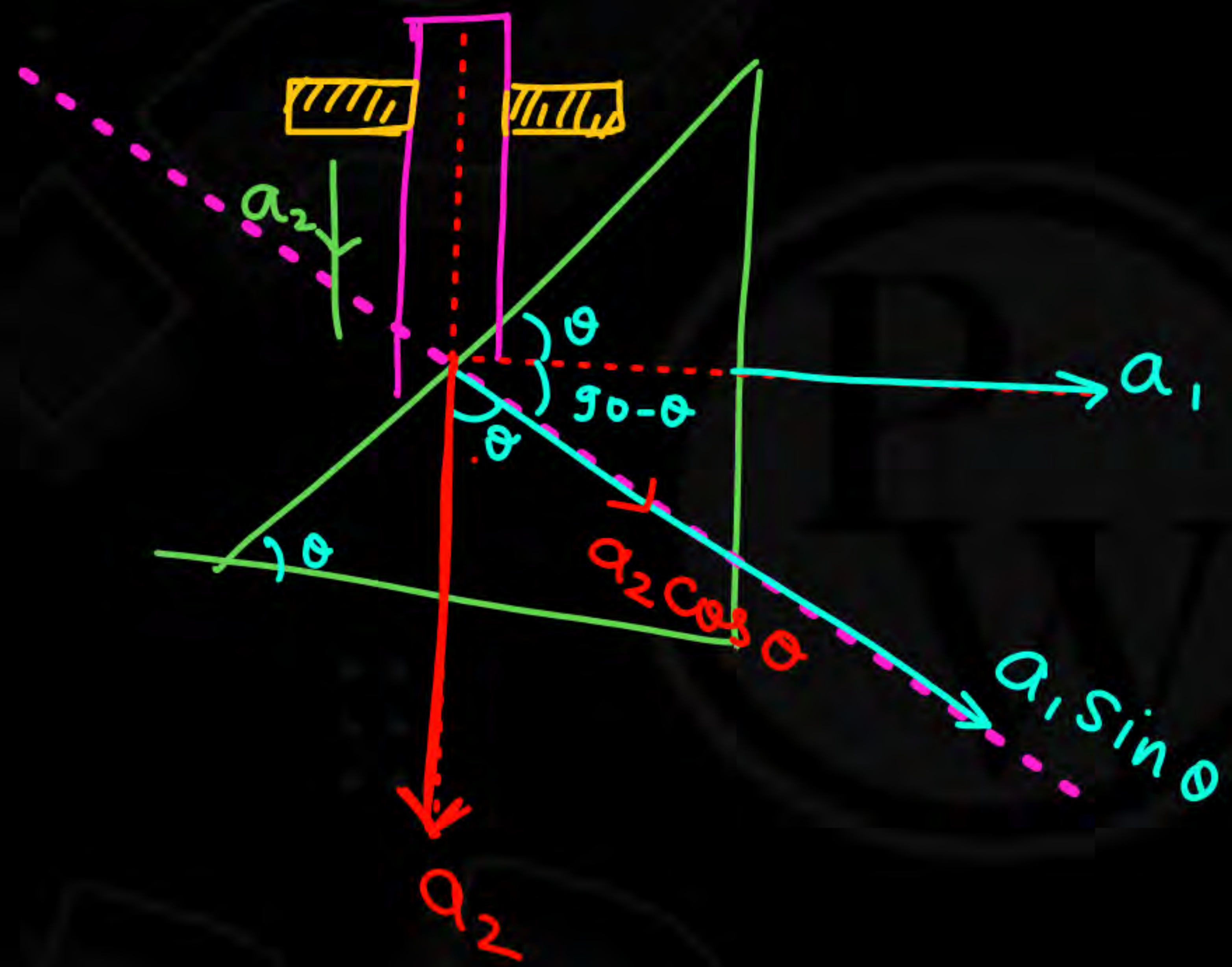


$$\vec{T}\cdot\vec{v_2} + \vec{T}\cdot\vec{v_1} = 0$$

$$\boxed{T V_2 \cos 37 - T \times 4 = 0}$$

$$V_2 = 4/\cos 37°$$

Wedge constraint



$$\boxed{a_2 \cos\theta = a_1 \sin\theta}$$

30. Calculate the tension in the string shown in figure (5-E13). The pulley and the string are light and all surfaces are frictionless. Take $g = 10\ m/s^2$.

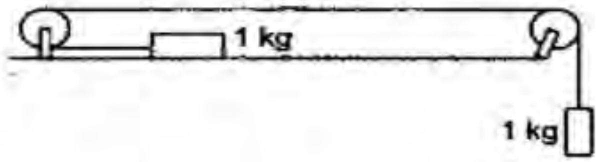


Figure 5-E13

31. Consider the situation shown in figure (5-E14). Both the pulleys and the string are light and all the surfaces are frictionless. (a) Find the acceleration of the mass M. (b) Find the tension in the string. (c) Calculate the force exerted by the clamp on the pulley A in the figure.

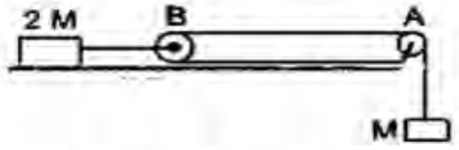


Figure 5-E14

32. Find the acceleration of the block of mass M in the situation shown in figure (5-E15). All the surfaces are frictionless and the pulleys and the string are light.

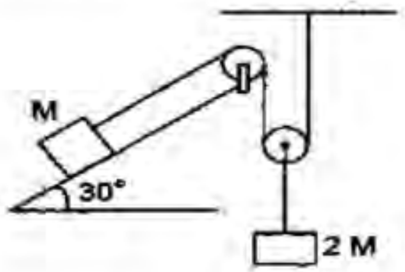


Figure 5-E15

THANK YOU