

PRAYAS

JEE 2025



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Lecture - 08

Physics

Laws Of Motion

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Topics *to be covered*

- 1 *pseudo force*
- 2 *Idea of Jeff*
- 3 *Constraint motion.*
- 4

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Inertial frame \rightarrow NLM valid, (directly applicable),
all unaccelerated frame (Rest धरती , ground, $v \rightarrow \text{const}$, $a=0$)

Non inertial frame \rightarrow NLM are not valid, to validate NLM we apply pseudo force
All accelerated frame wrt ground.

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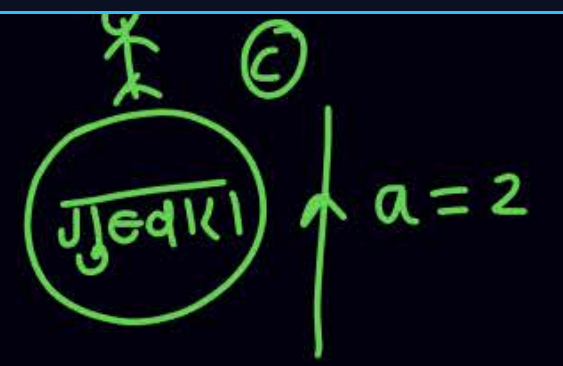
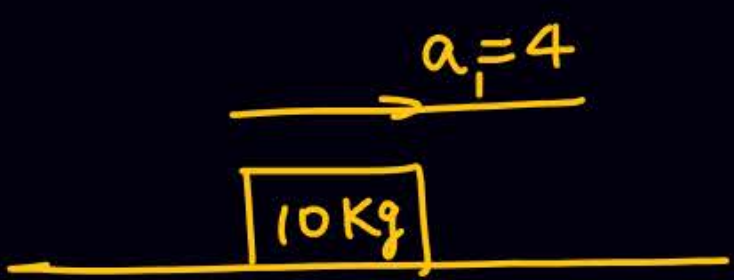


$$\vec{F}_{\text{pseudo}} = -m_{\text{block}} \vec{a}_{\text{stick}}$$

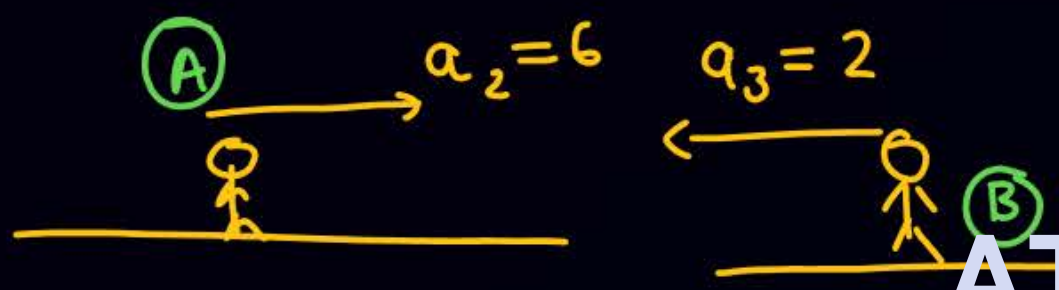
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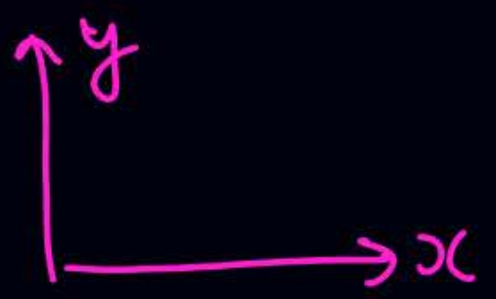
Q



Ⓟ stick free fall $a = g \downarrow$



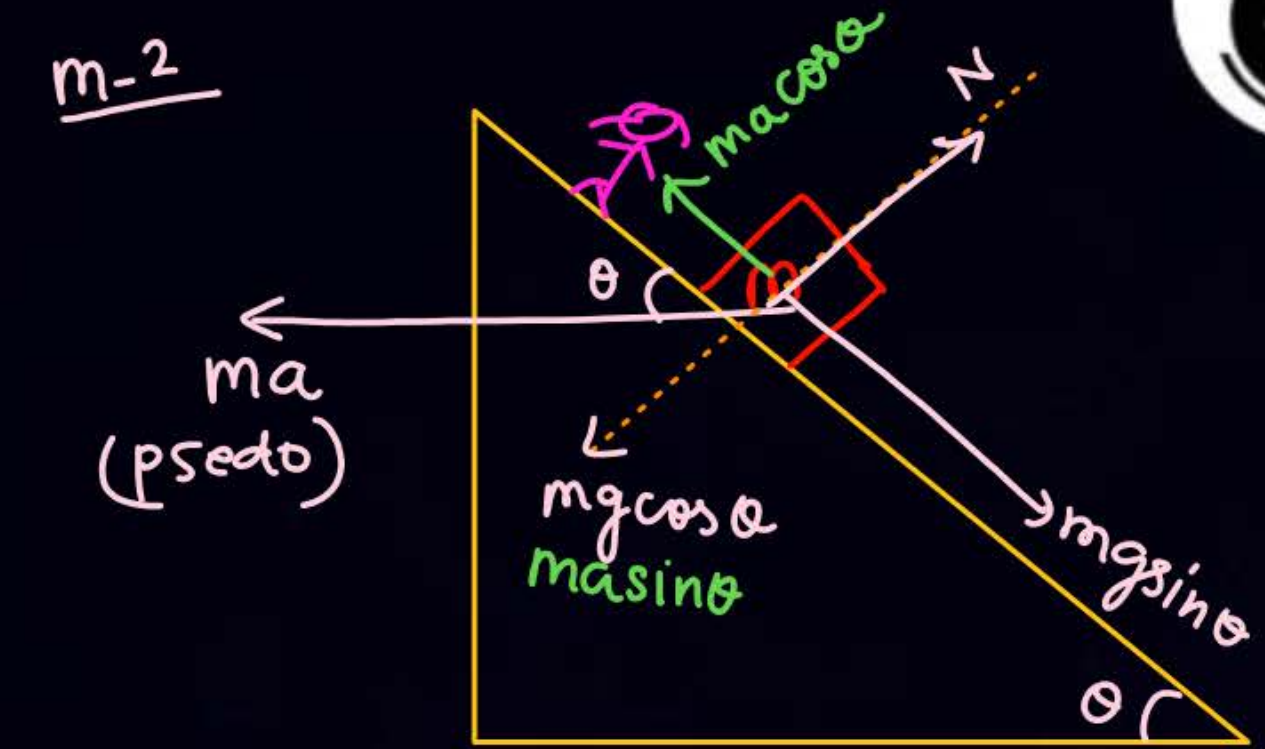
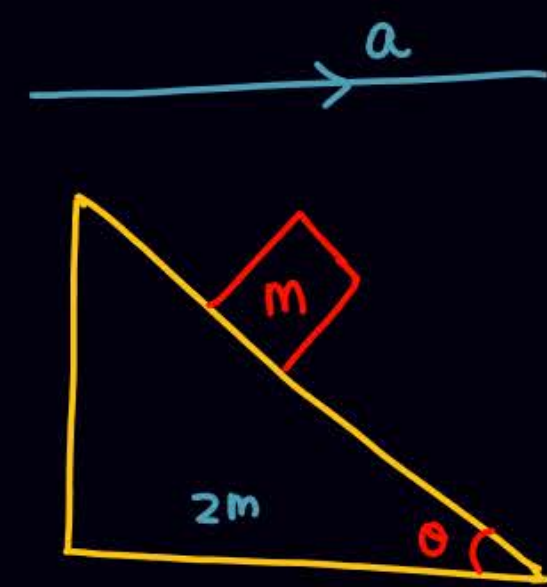
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- ① pseudo force in frame of A = $(10 \times 6) (-\hat{i})$
 ② " " " " B = $(10 \times 2) (+\hat{i})$
 ③ " " " " C = $(10 \times 2) (-\hat{j})$
 ④ " " " " D = $(10 \times 10) \hat{j}$



Q find value of a so that block remains at rest wrt wedge.



Solⁿ (wrt ground)

$$N \cos \theta = mg$$

$$N \sin \theta = ma$$

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

$$a = g \tan \theta$$



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

$$mg \sin \theta = ma \cos \theta \quad \boxed{a = g \tan \theta}$$



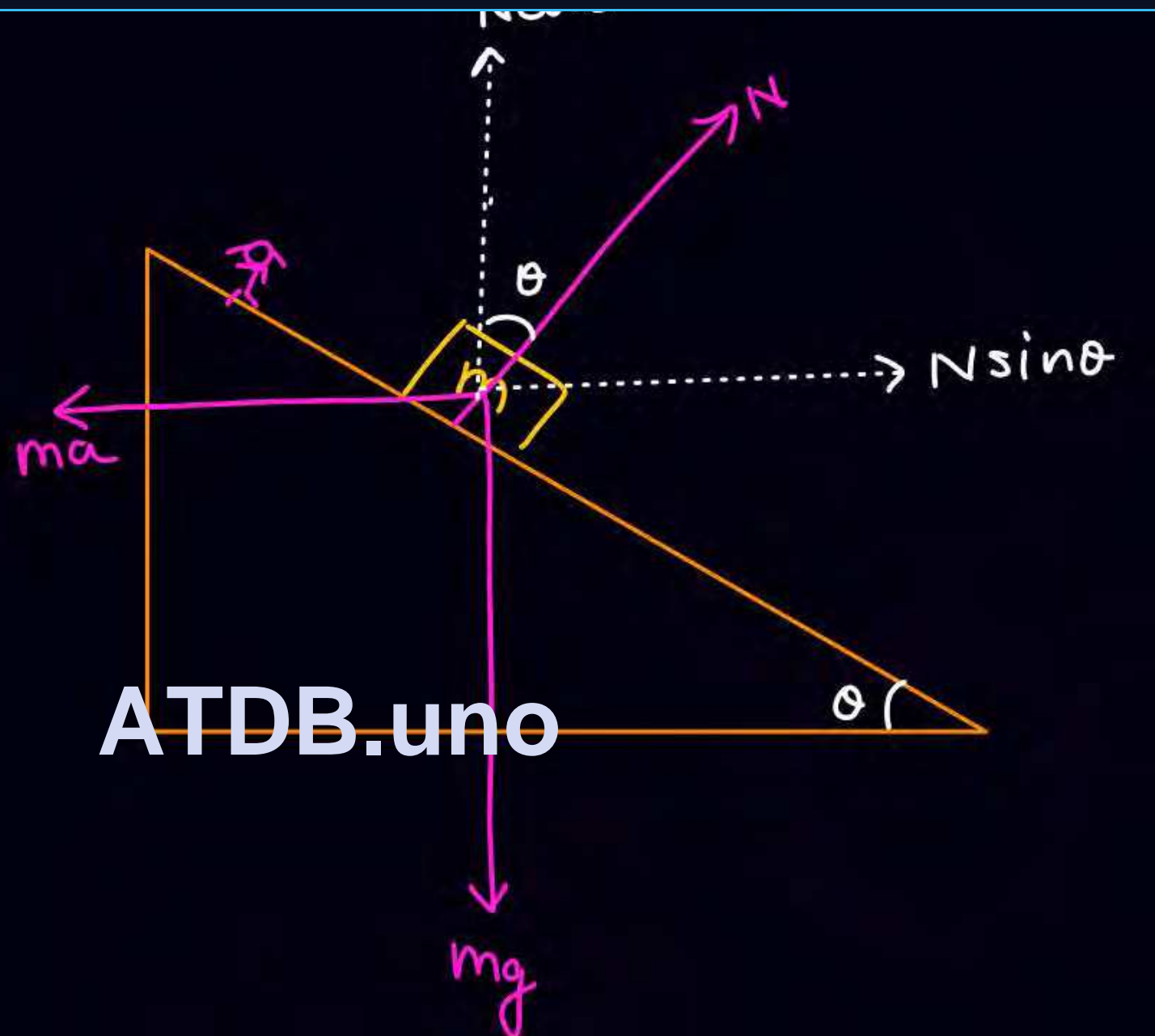
33

$$N \sin \theta = ma$$

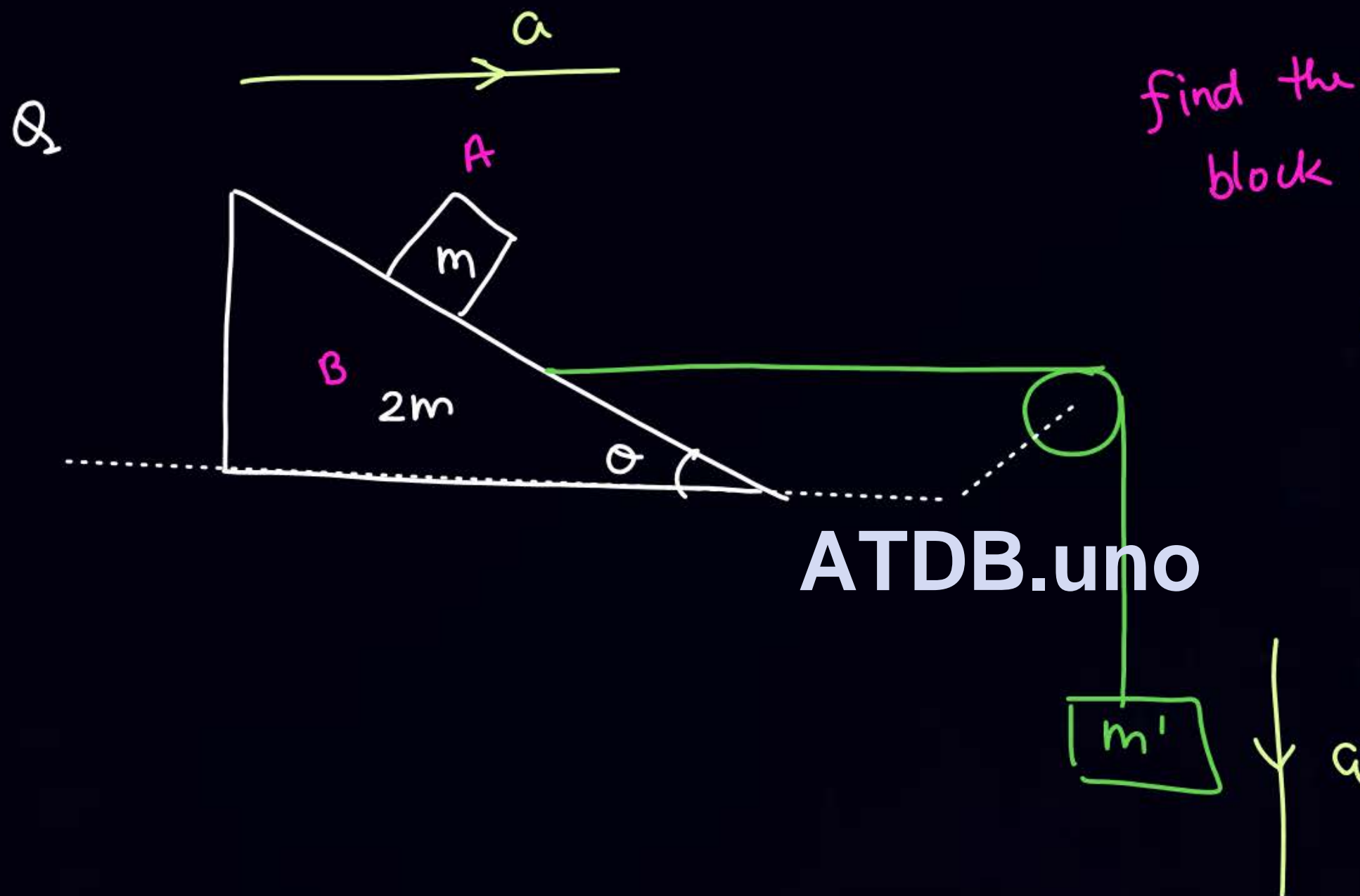
$$N \cos \theta = mg$$

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

$$a = g \tan \theta$$



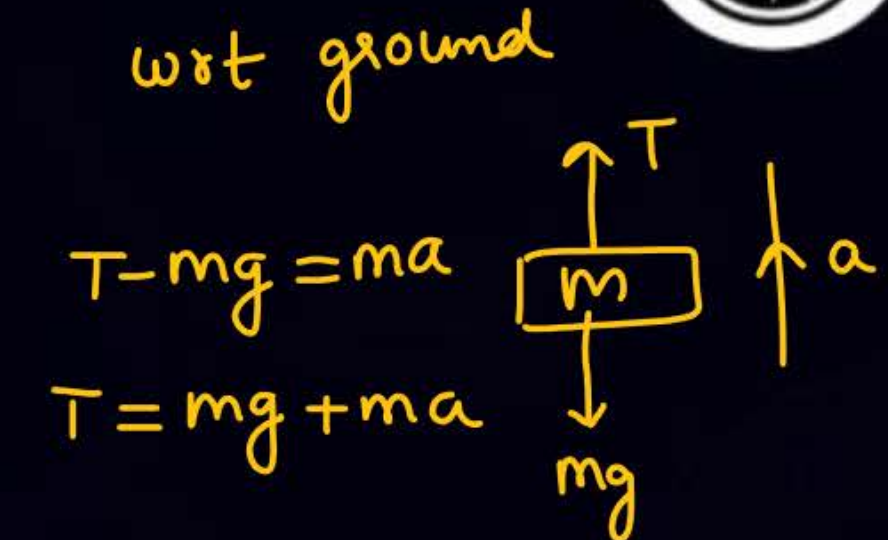
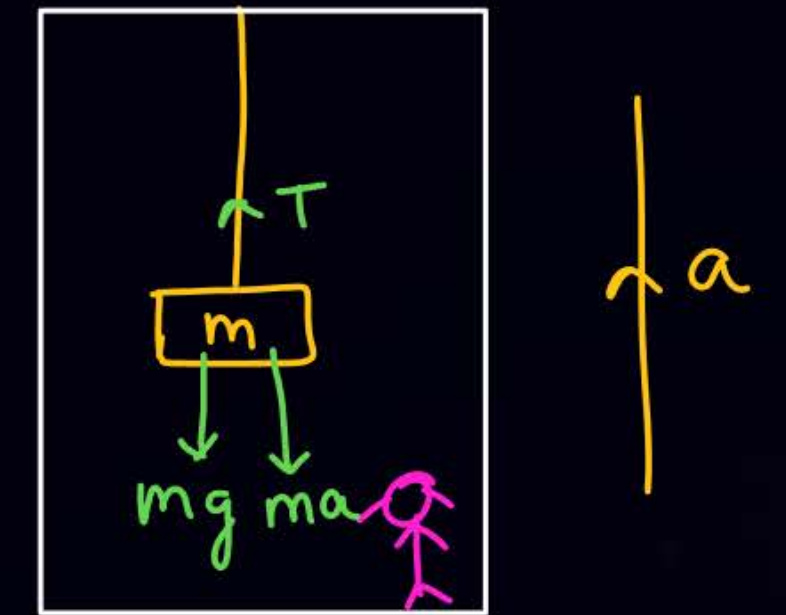
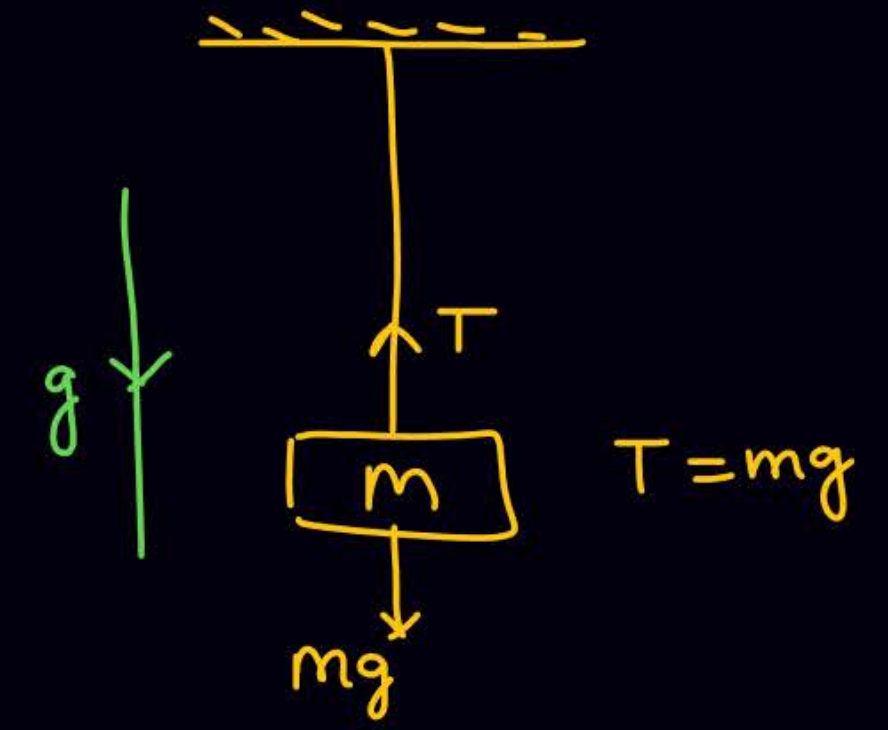
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find the value of m' so that block A remains at rest w.r.t wedge B

$$a = \frac{m'g - 0}{3m + m} = g \tan \theta$$

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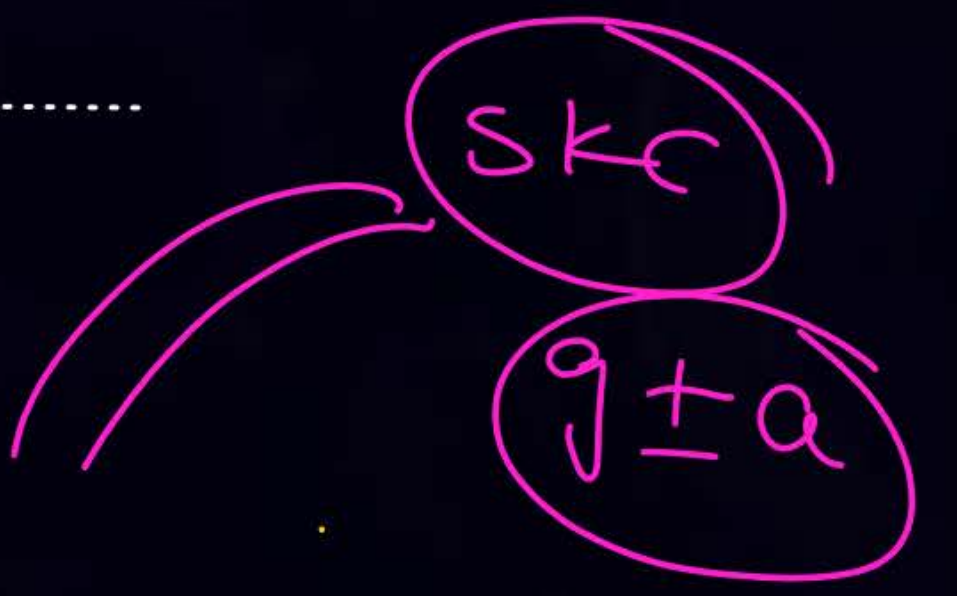
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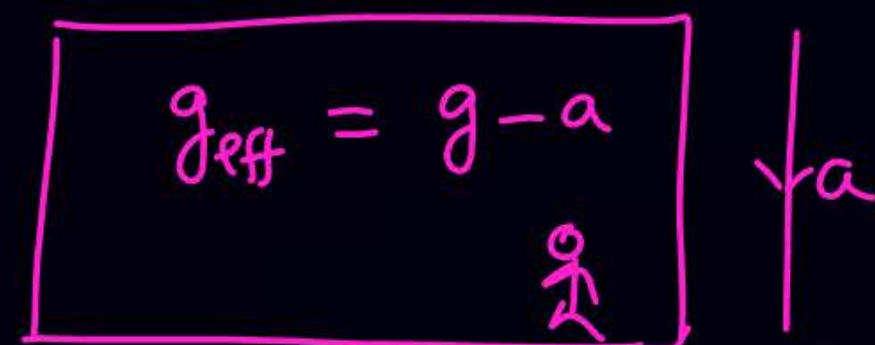
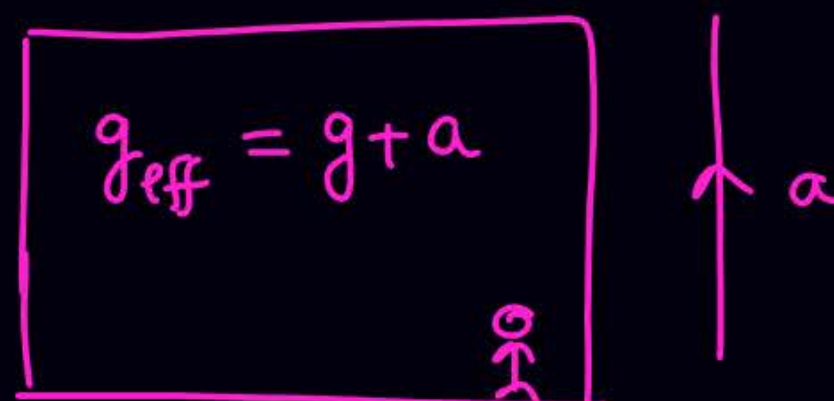
wrt lift

$T = mg + ma$

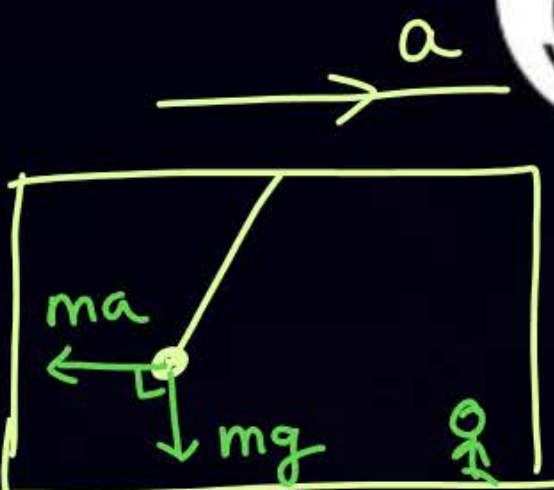
$T = m(g + a)$

$T = mg_{\text{eff}}$





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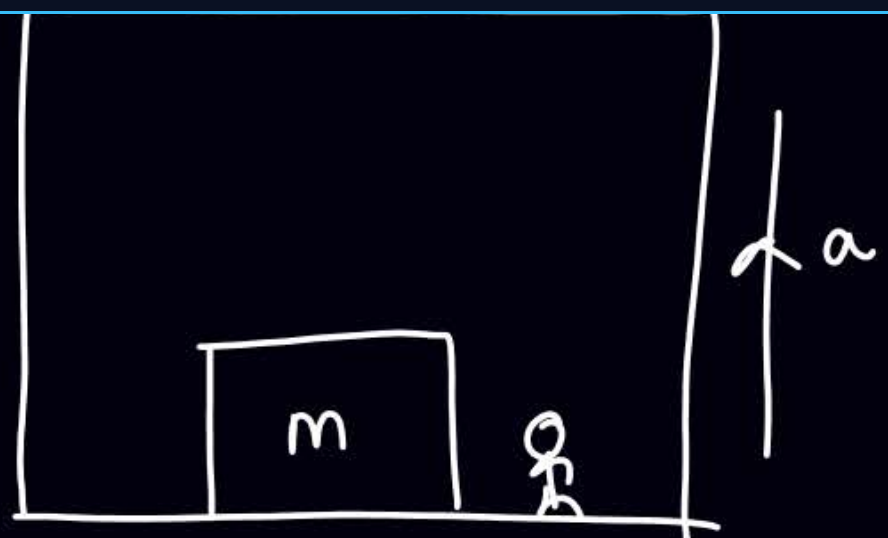


$$g_{\text{eff}} = \sqrt{a^2 + g^2}$$

$$T = 2\pi \sqrt{\frac{l}{g_{\text{eff}}}}$$

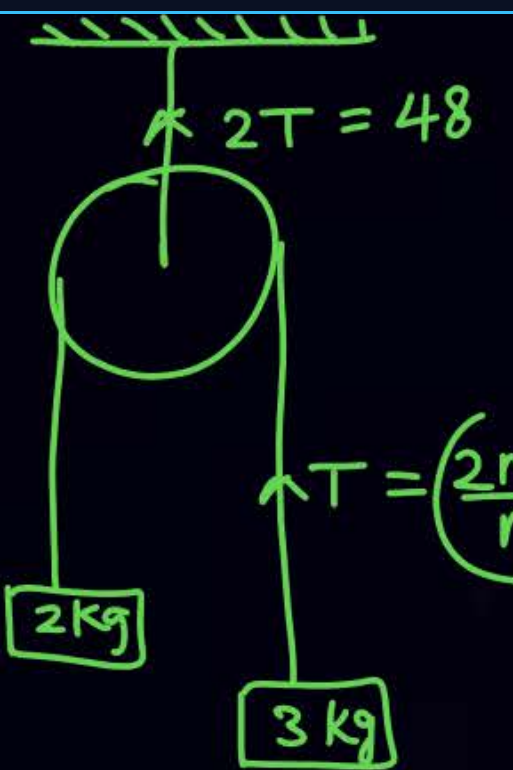


①



$$N = m(g + a)$$

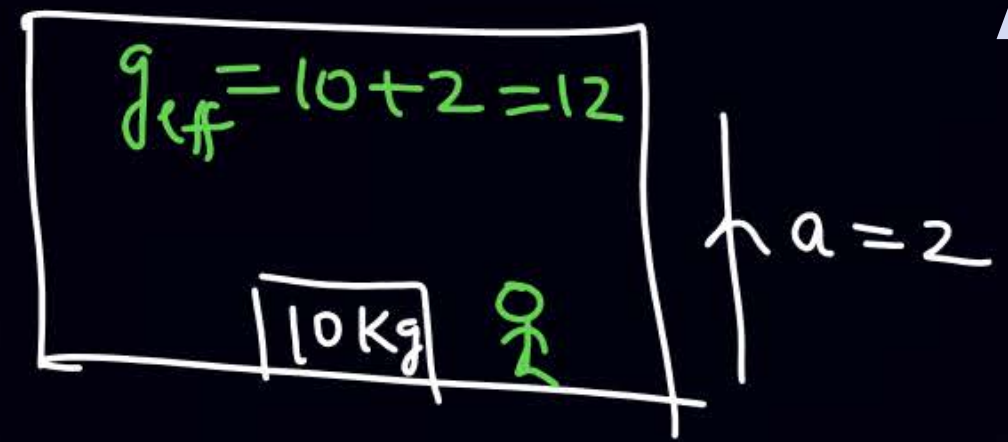
③



$$T = \left(\frac{2m_1 m_2}{m_1 + m_2} \right) g = \frac{2 \times 6}{5} \times 10 = 24$$

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②

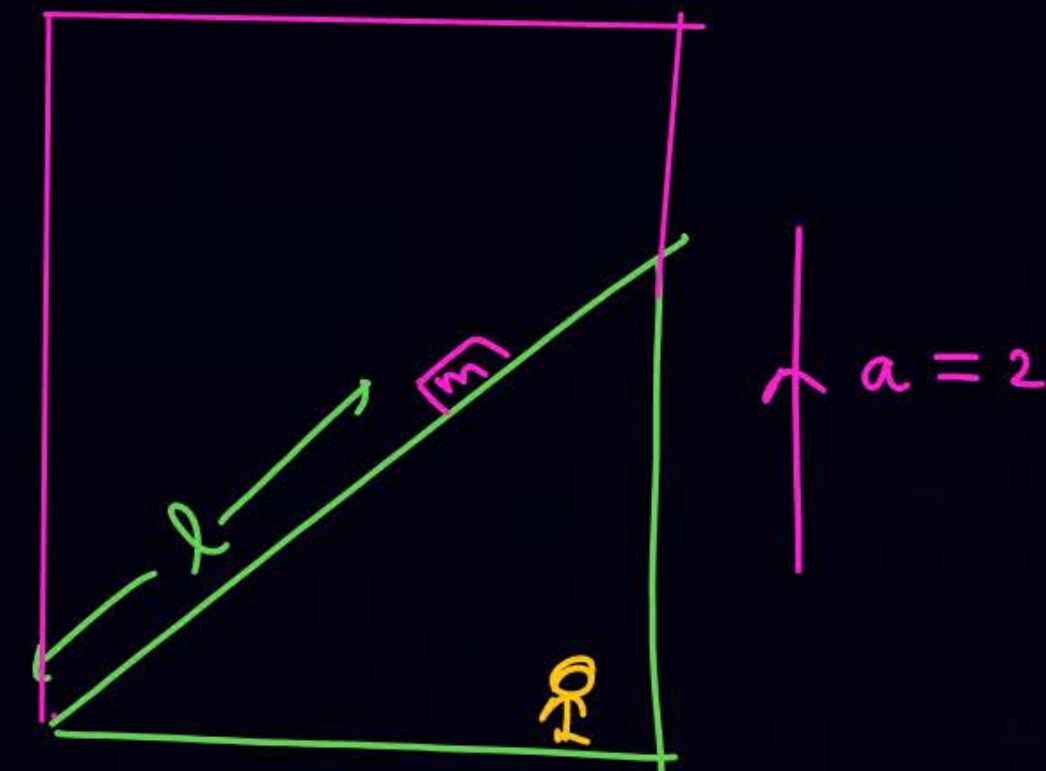


$$N = mg_{eff} = 10 \times 12$$



$$T = \frac{2m_1 m_2}{m_1 + m_2} g_{eff}$$
$$T = \frac{2 \times 6}{5} \times 12$$

4



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When mass will reach at lowest point

$$l = 0 + \frac{1}{2} g_{\text{eff}} \sin \alpha t^2$$

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

$$g_{\text{eff}} = 12$$

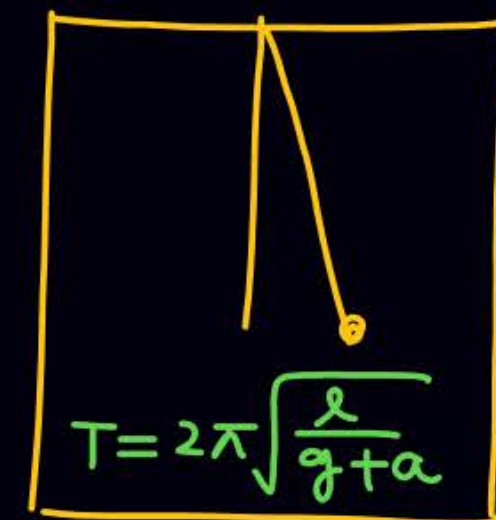
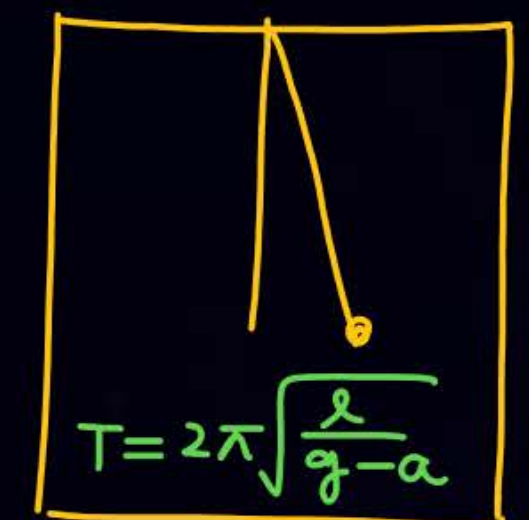


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$$T = 2\pi \sqrt{\frac{l}{g}}$$

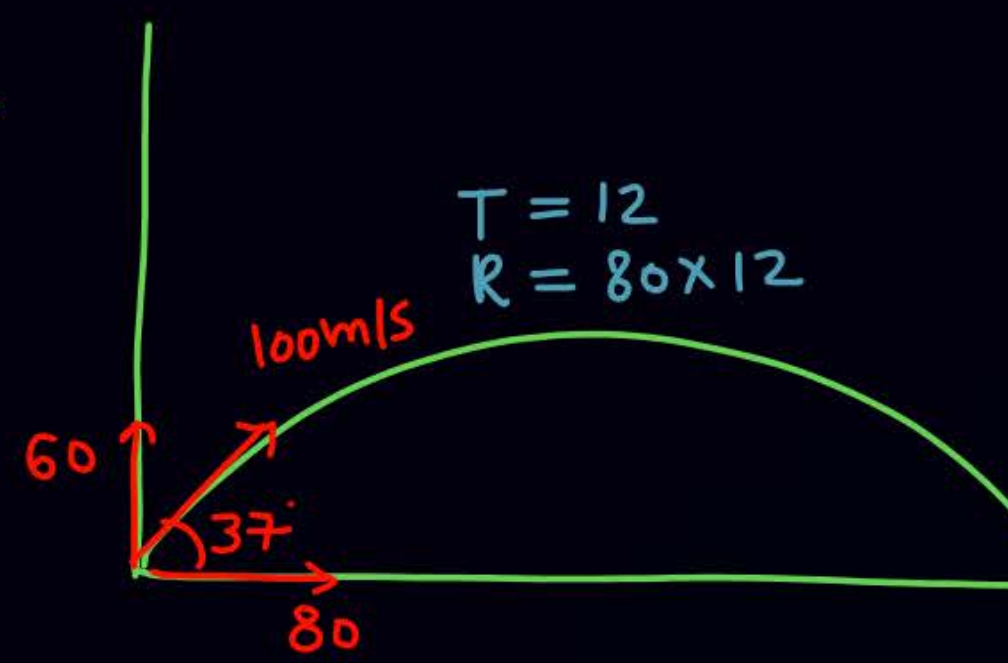
(Simple Pendulum)


 $\uparrow a$

 $\downarrow a$

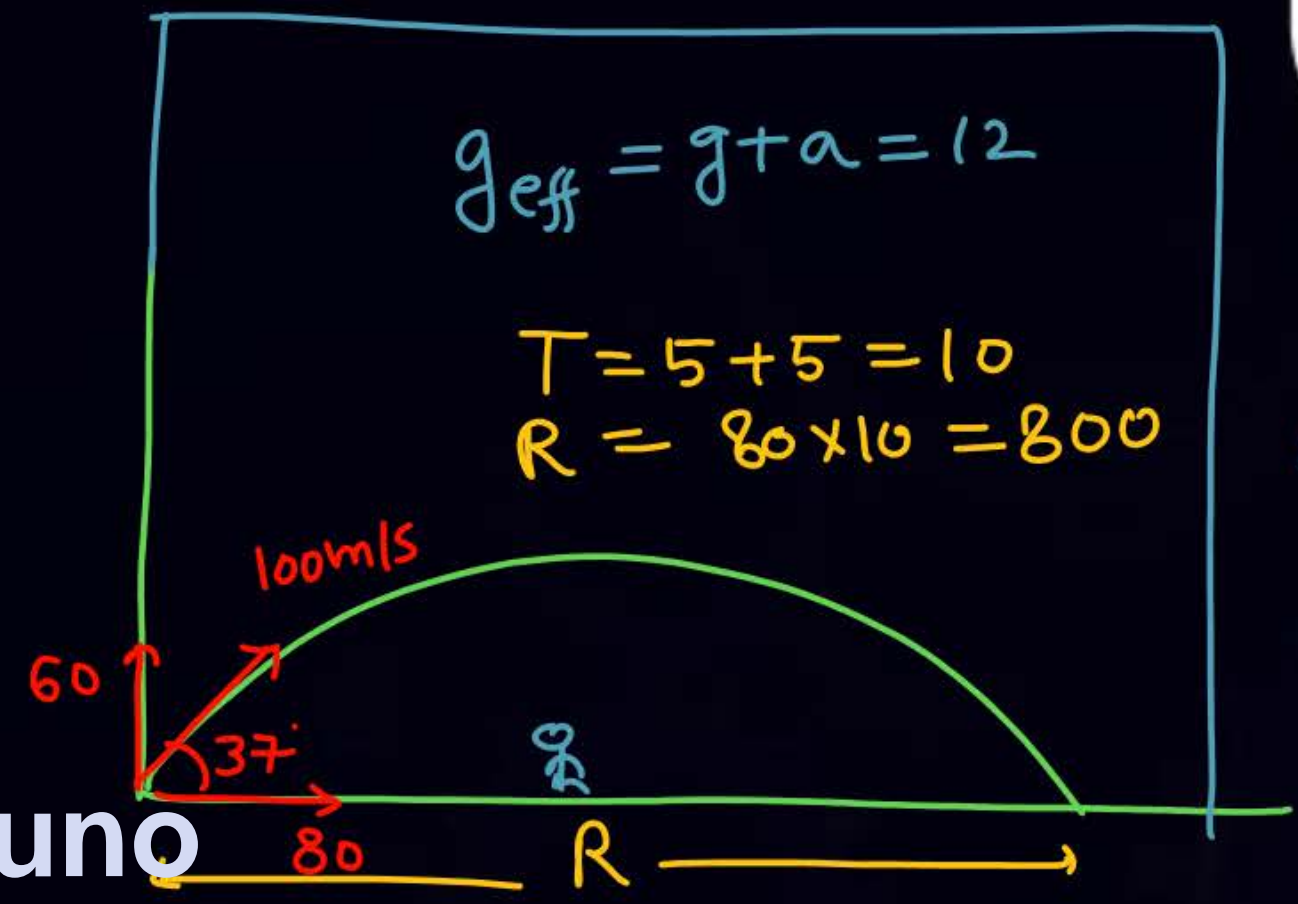
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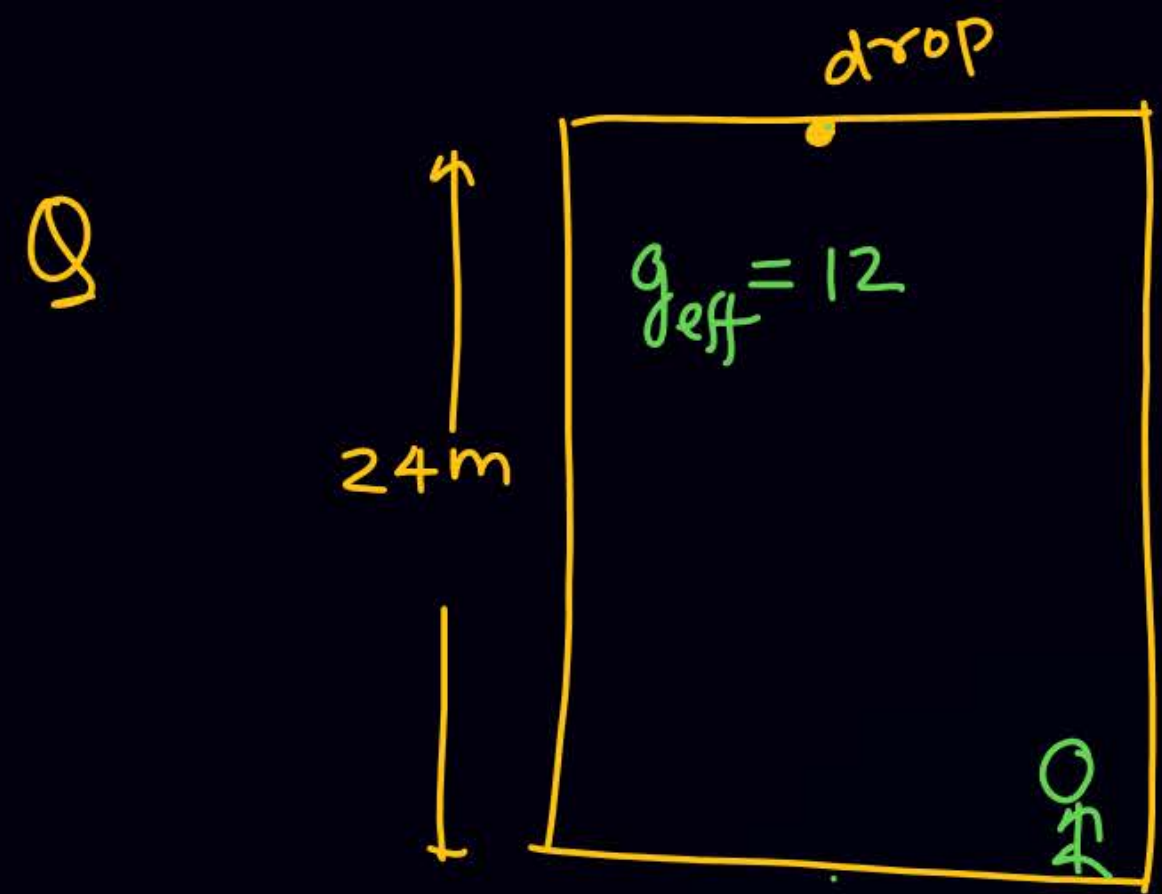


Q



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When it will hit the floor of lift.

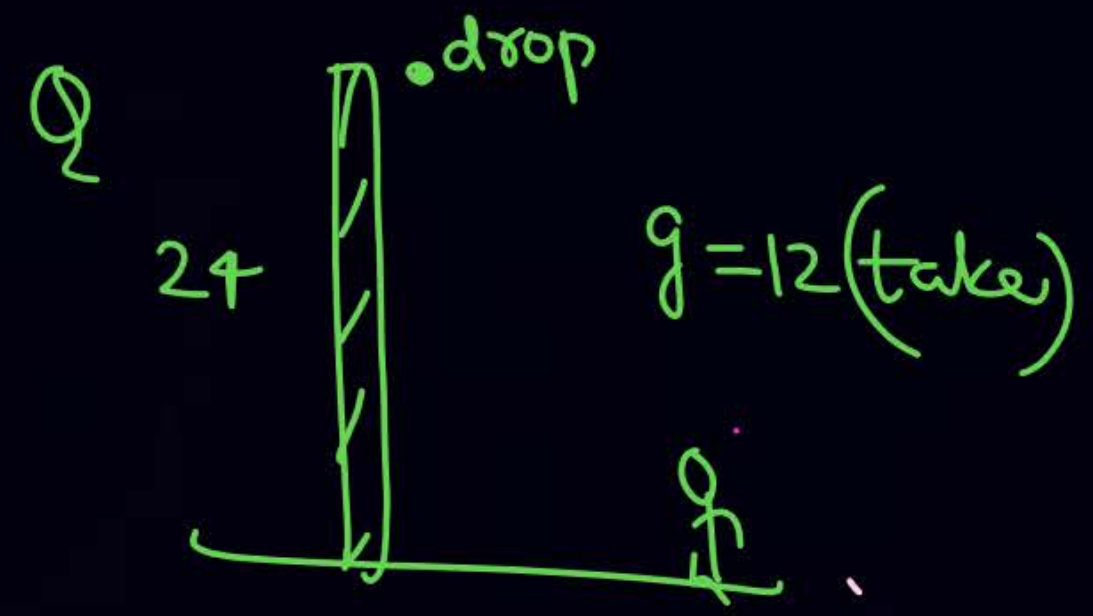
Solⁿ

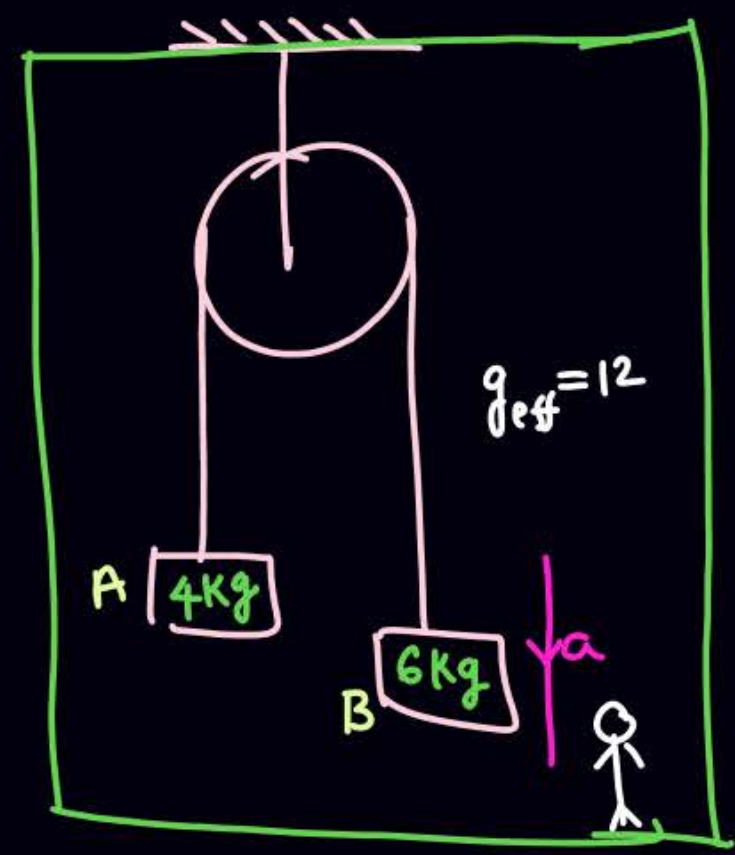
$$24 = 0 + \frac{1}{2} 12 t^2$$

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

drop

$$t = \sqrt{\frac{2h}{g_{\text{eff}}}}$$





find acc of 4kg & 6kg block. (wrt ground)

$$a = \frac{6g_{eff} - 4g_{eff}}{6+4} = \frac{2 \times 12}{10} = 2.4$$

wrt आदमी
lift

$$a = 2.4$$

$$\vec{a}_{B|lift} = \vec{a}_B - \vec{a}_{lift}$$

$$-2.4 = \vec{a}_B - 2$$

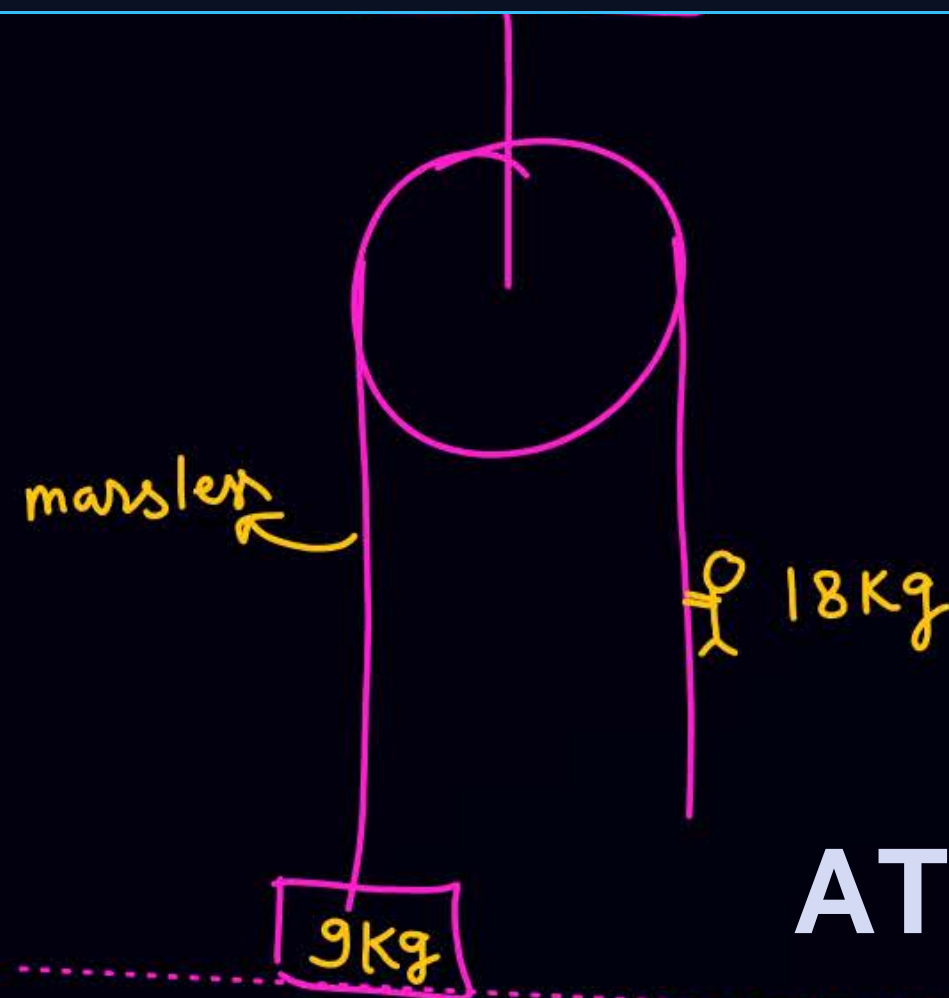
$$\vec{a}_B = -0.4 \hat{j}$$

$$\vec{a}_{A|lift} = \vec{a}_A - \vec{a}_{lift}$$

$$+2.4 = \vec{a}_A - 2$$

$$a_A = 4.4 \text{ ऊपर}$$

JEEZS
 HIW ♀



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वदर climb from another end of string with acc. $\frac{g}{6}$ upward relative to the rope
 find acc of block & T.



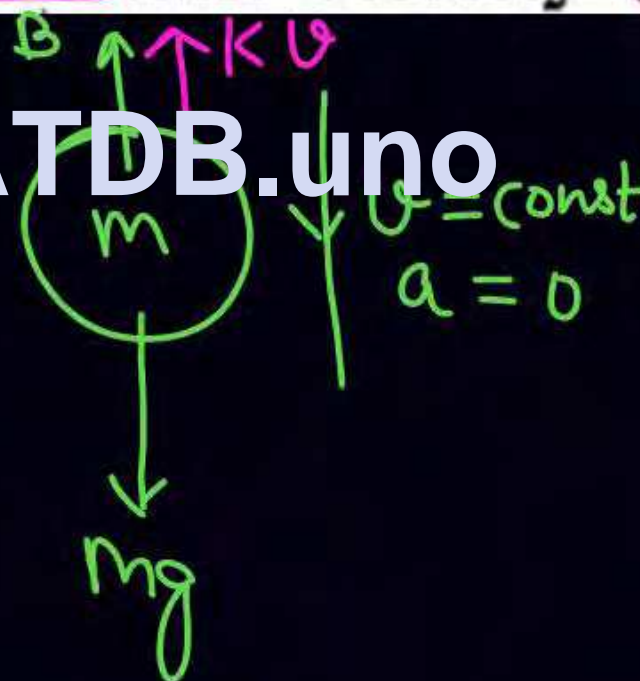
19. The force of buoyancy exerted by the atmosphere on a balloon is B in the upward direction and remains constant. The force of air resistance on the balloon acts opposite to the direction of velocity and is proportional to it. The balloon carries a mass M and is found to fall down near the earth's surface with a constant velocity v . How much mass should be removed from the balloon so that it may rise with a constant velocity v ?



$$f_{\text{air}} \propto -v$$

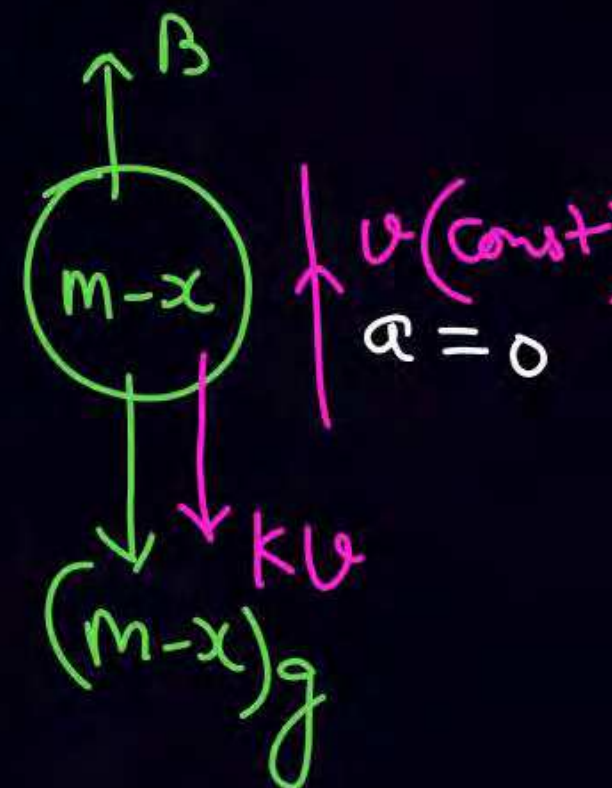
$$f \downarrow = -kv \downarrow$$

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$$mg = B + kv$$

$$B = (m-x)g + kv$$



20. An empty plastic box of mass m is found to accelerate up at the rate of $g/6$ when placed deep inside water. How much sand should be put inside the box so that it may accelerate down at the rate of $g/6$?

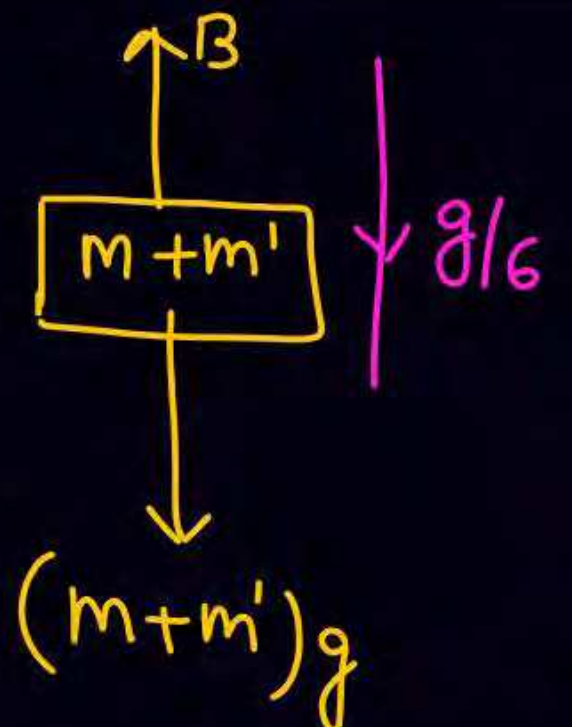
$$B = \rho_L V_d g$$

$$B - mg = m \frac{g}{6}$$



$$a = \frac{g}{6}$$

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$$(m + m')g - B = (m + m') \frac{g}{6}$$



the floor of an elevator. The elevator starts going up with some acceleration, moves with uniform velocity for a while and finally decelerates to stop. The maximum and the minimum weights recorded are 72 kg and 60 kg. Assuming that the magnitudes of the acceleration and the deceleration are the same, find (a) the true weight of the person and (b) the magnitude of the acceleration. Take $g = 9.9 \text{ m/s}^2$.

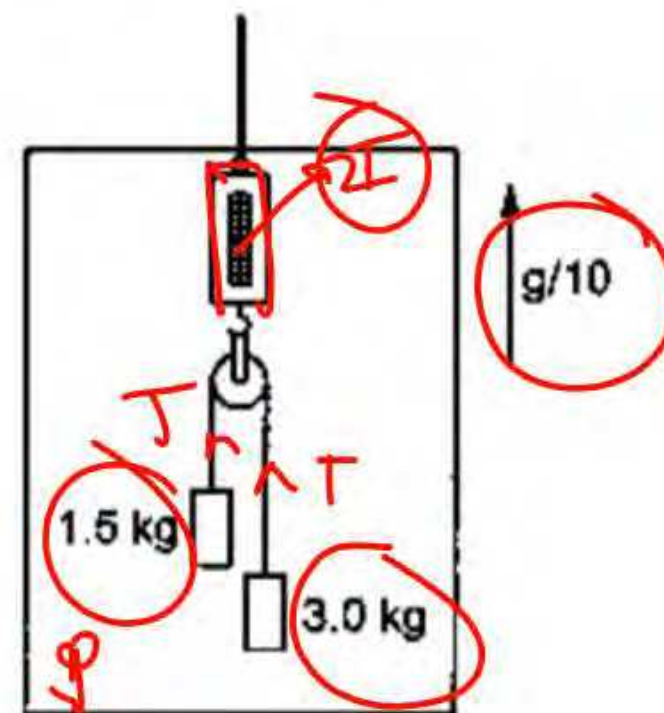
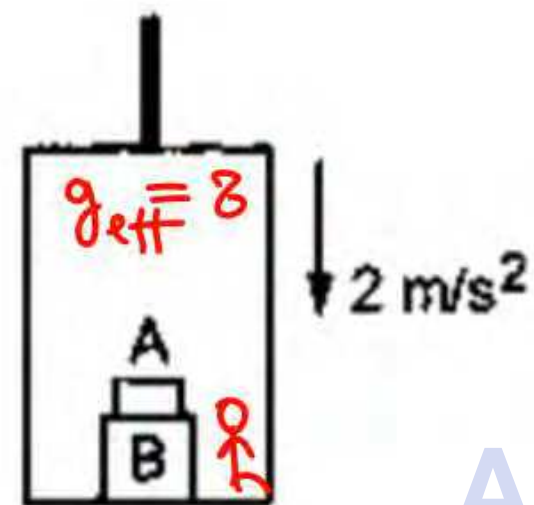


Figure 5-E6



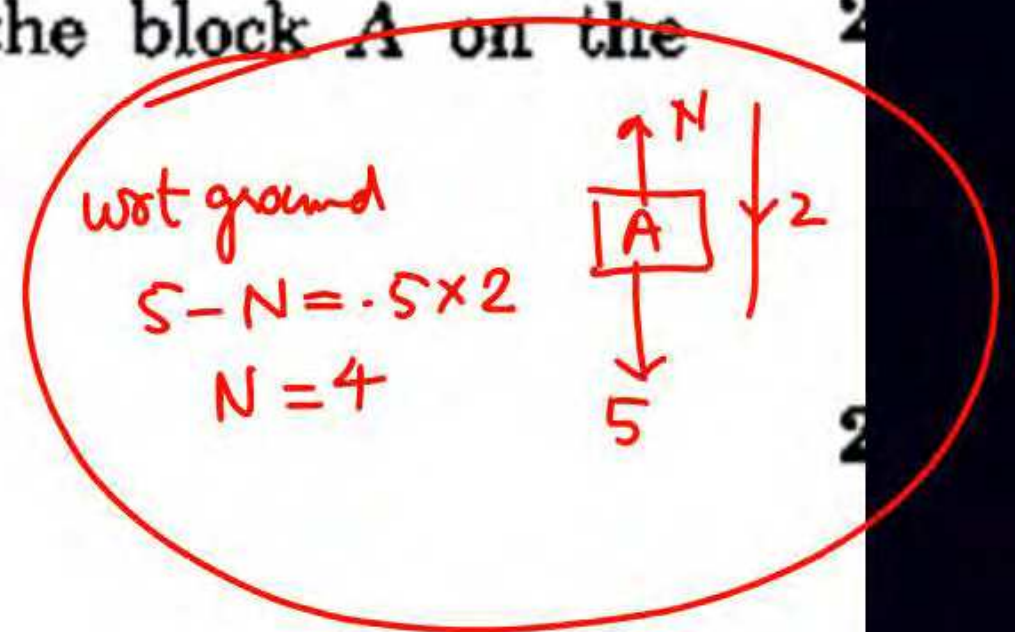
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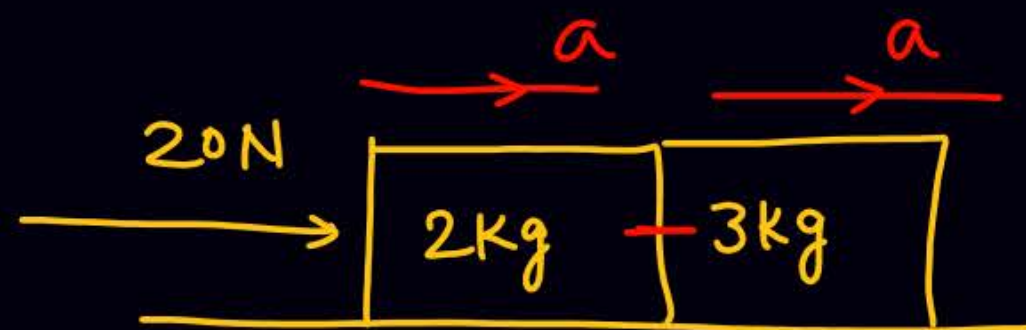
13. The elevator shown in figure (5-E5) is descending with an acceleration of 2 m/s^2 . The mass of the block A is 0.5 kg . What force is exerted by the block A on the block B?



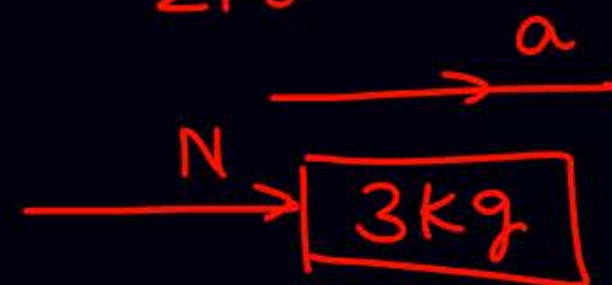
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Figure 5-E5

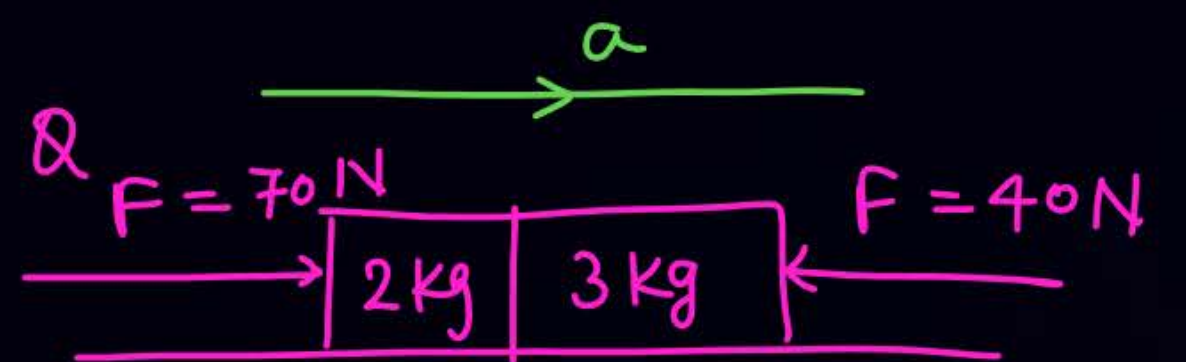




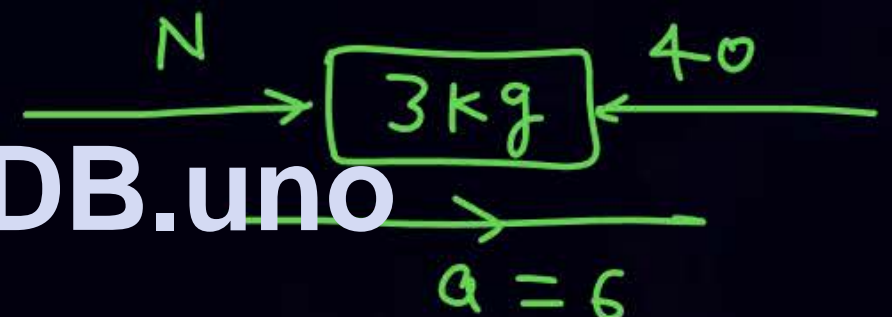
$$a = \frac{20}{2+3} = 4$$



$$N = 3 \times 4 = 12$$



$$a = \frac{70-40}{2+3} = 6$$



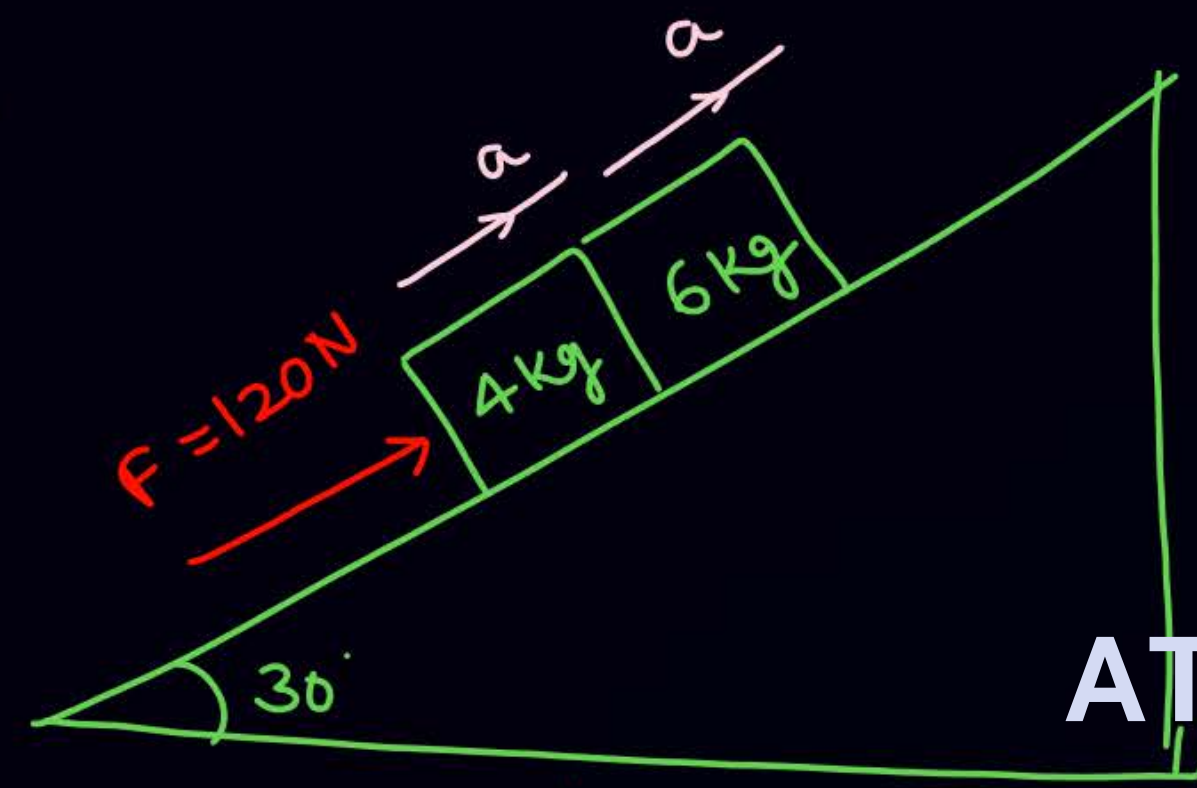
$$N - 40 = 3 \times 6$$

$$N = 58$$

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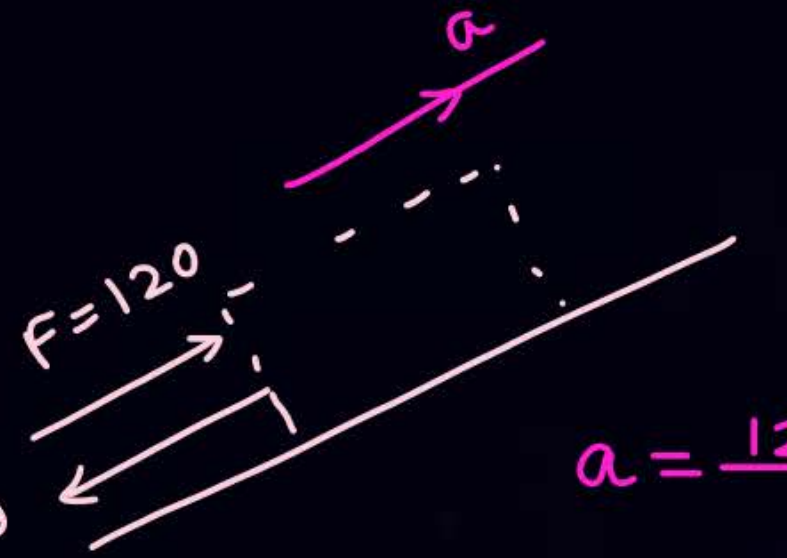


Q



||| friction*)

$mg \sin \theta = 50$



$$a = \frac{120 - 50}{4 + 6} = 7$$

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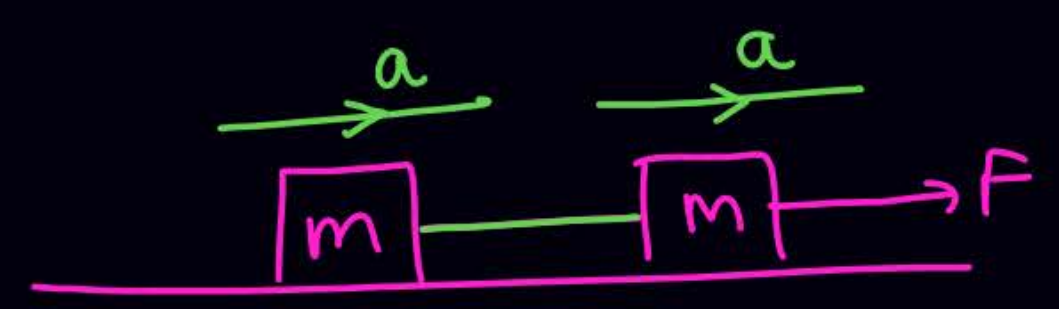


$$N - 30 = 6 \times 7$$

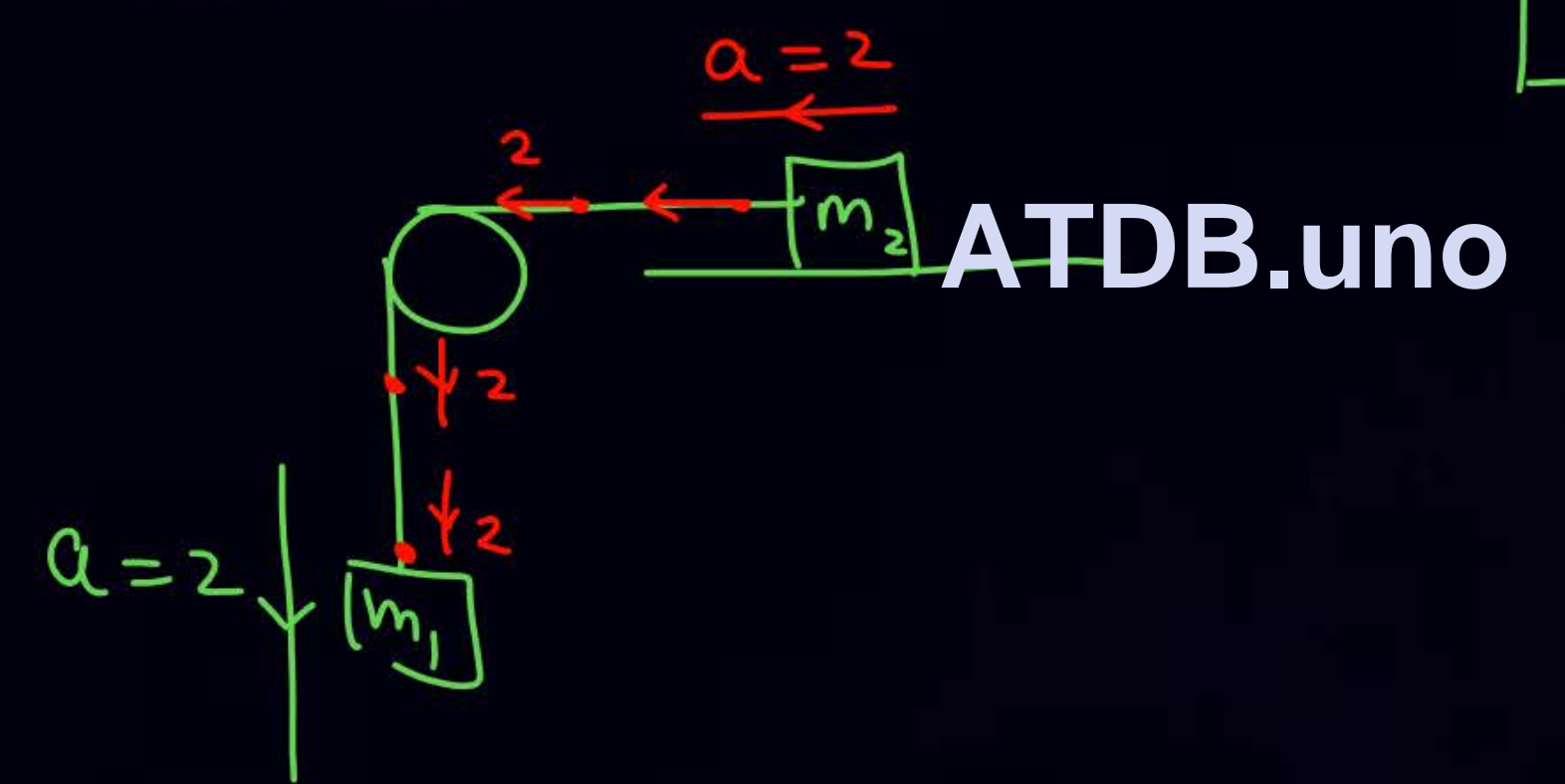
$$N = 72$$



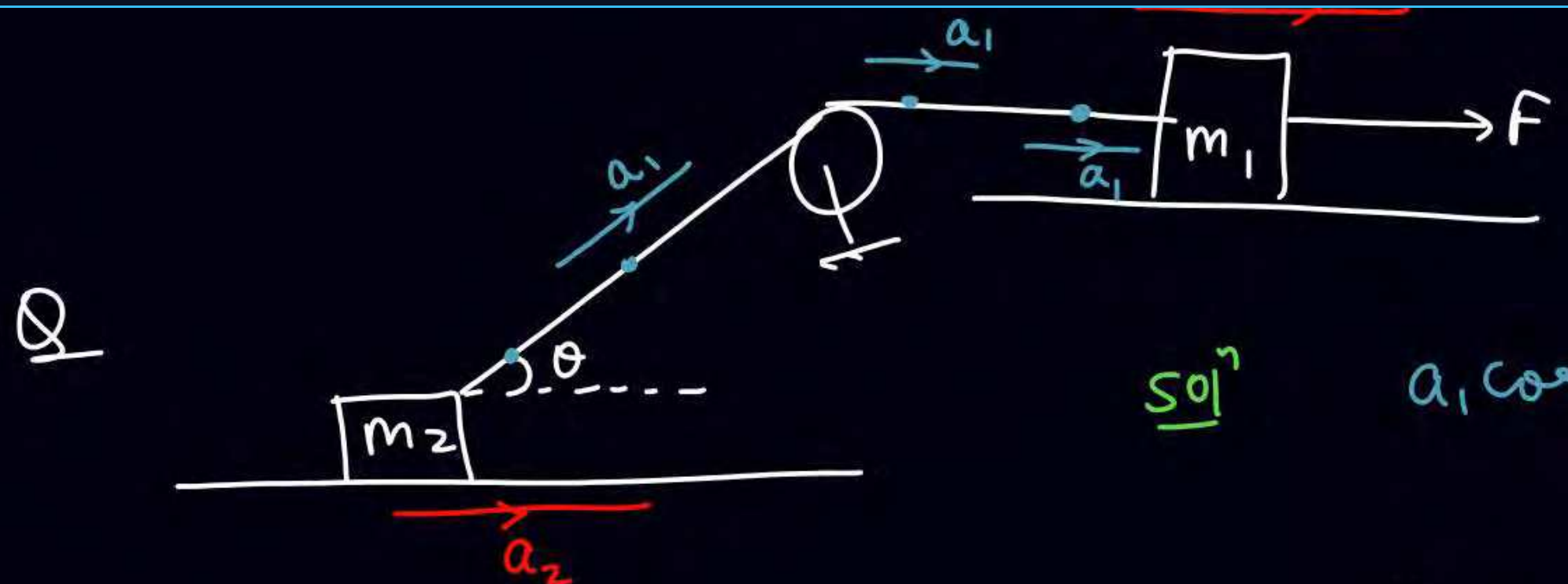
Constraint motion



for a taut string
 magnitude Component of acc (or velocity)
 along the string remains same
 at every point



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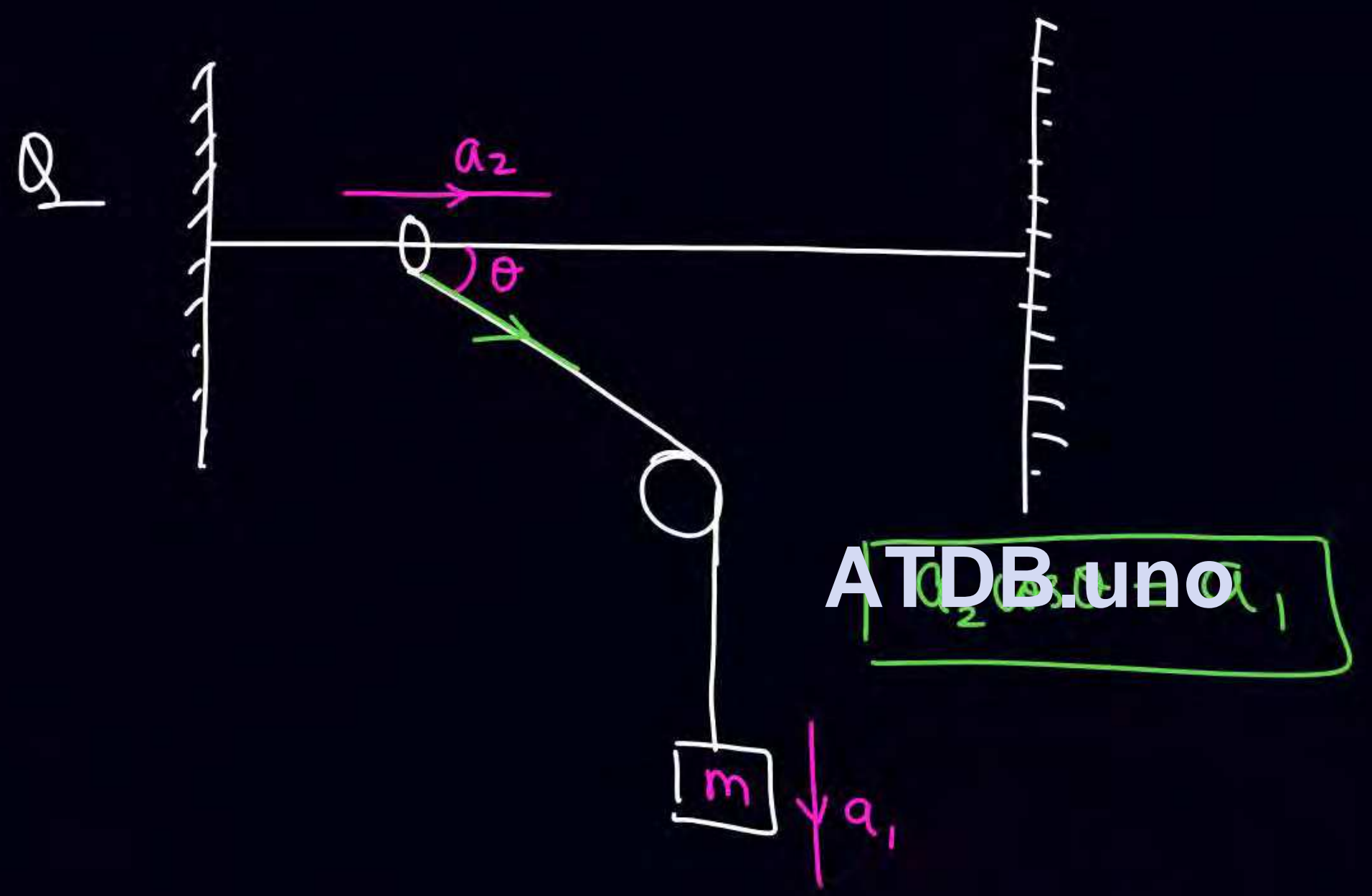
solⁿ

$$a_1 \cos \theta = a_2 \quad \times$$

$$a_2 \cos \theta = a_1 \quad \checkmark$$

find relation b/w a_1 & a_2

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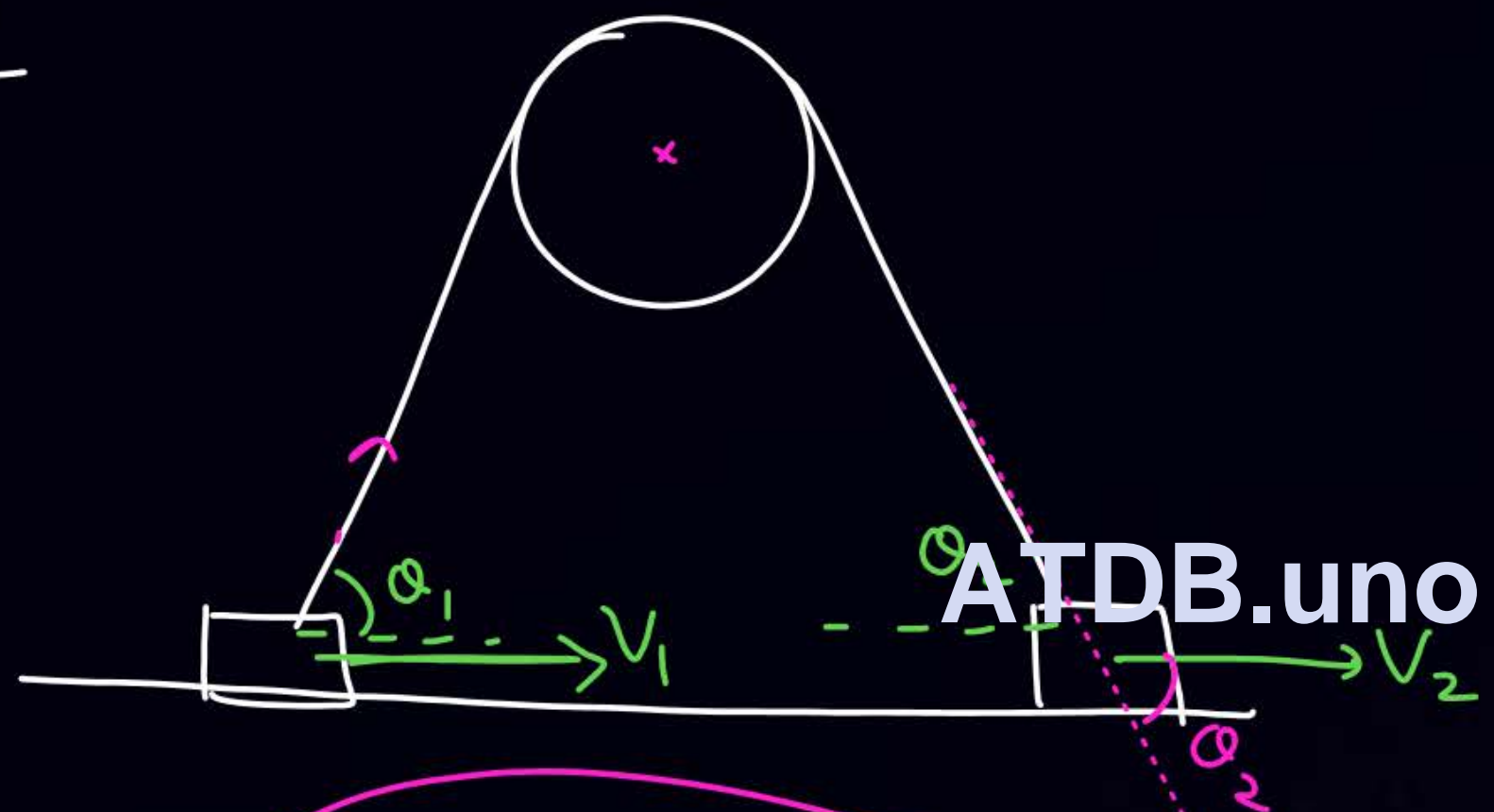


Block/body
 का सच्ची वाला acc / θ
 को रस्सी की तरफ
 तोड़ना Balance
 करना

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 $a_2 \cos(\theta) = a_1$



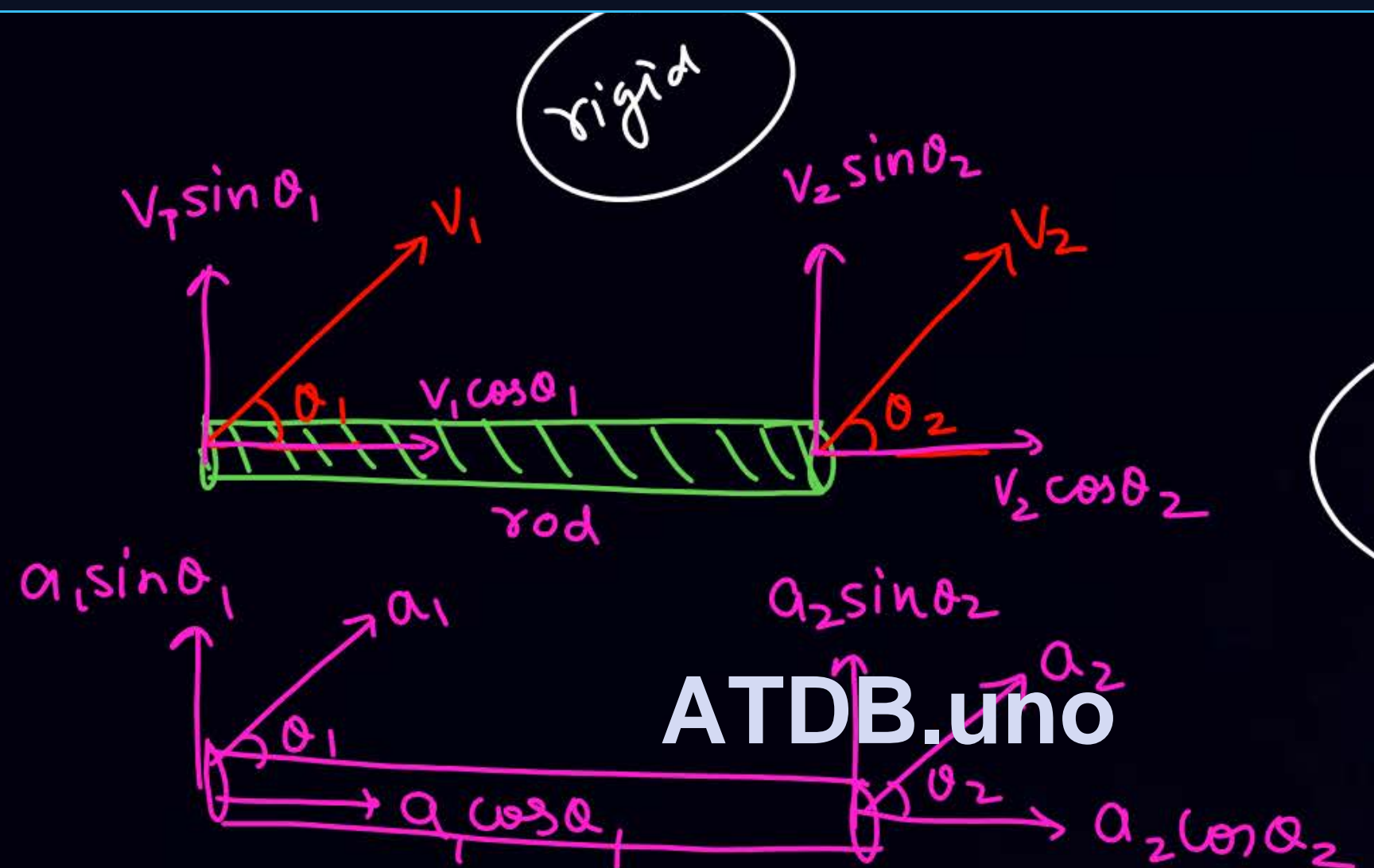
Q



$$V_1 \cos \theta_1 = V_2 \cos \theta_2$$



#



$$V_1 \cos \theta_1 = V_2 \cos \theta_2$$

$$a_1 \cos \theta_1 = a_2 \cos \theta_2$$



Homework

HCV \rightarrow page 80

13, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25, 26, 27, 30, 33, 35, 36, 37, 40
39, 42

Tryall. (mwt)

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THANK YOU

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