

# PRAYAS

## JEE 2025

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Lecture - 04

Physics

### Laws Of Motion

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# Topics *to be covered*

1

*Equilibrium*

2

*F = ma based ques.*

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3

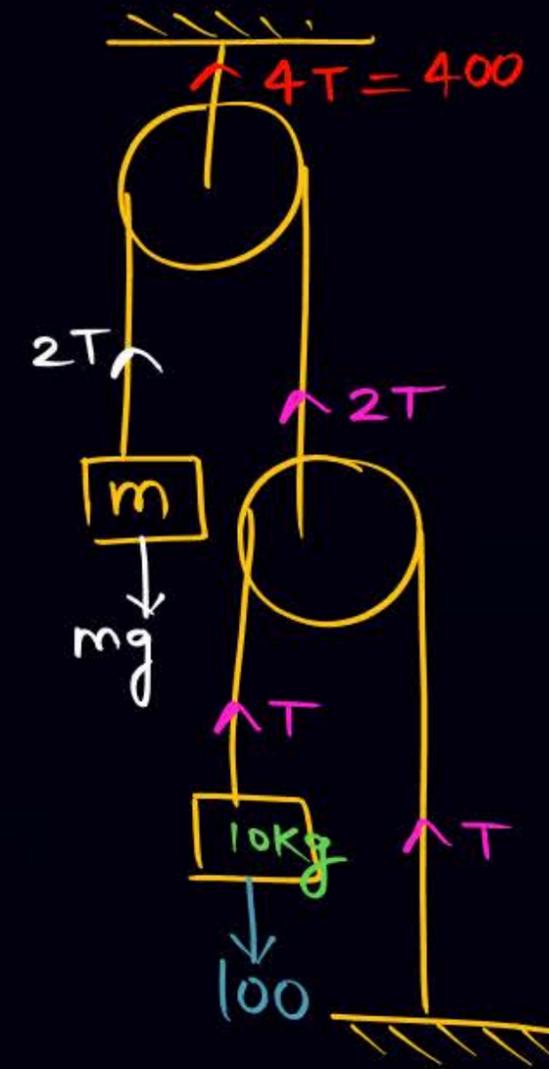
4



All masses are in equilibrium find the value of unknown mass

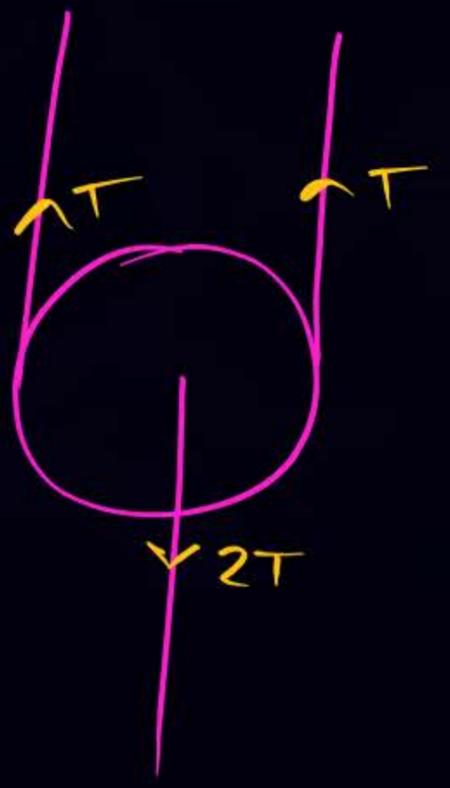
①

$2T = mg$



$T = 100$   
 $2T = mg$   
 $2 \times 100 = m \times 10$   
 $m = 20\text{kg}$

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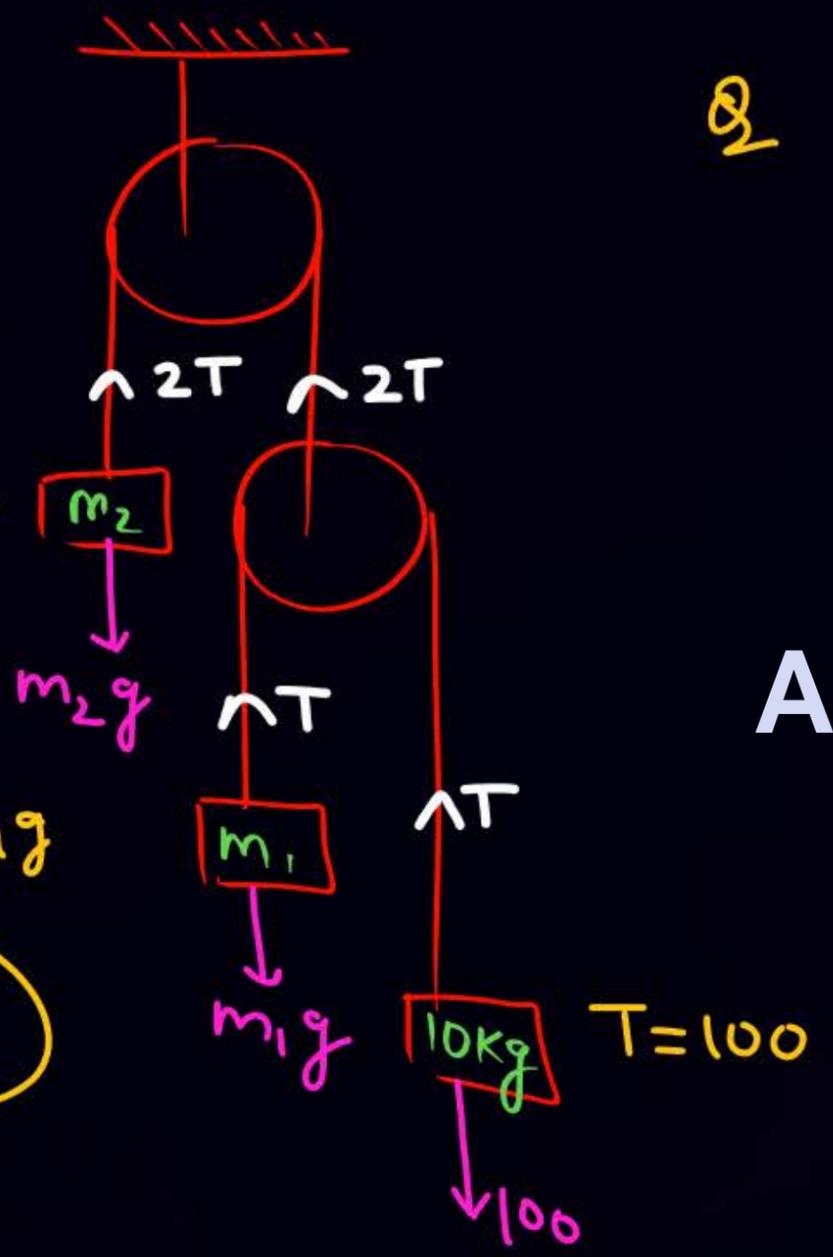
2

All masses are in equilibrium

$2T = m_2 g$

$T = m_1 g$

$m_1 = 10$   
 $m_2 = 20$



Q

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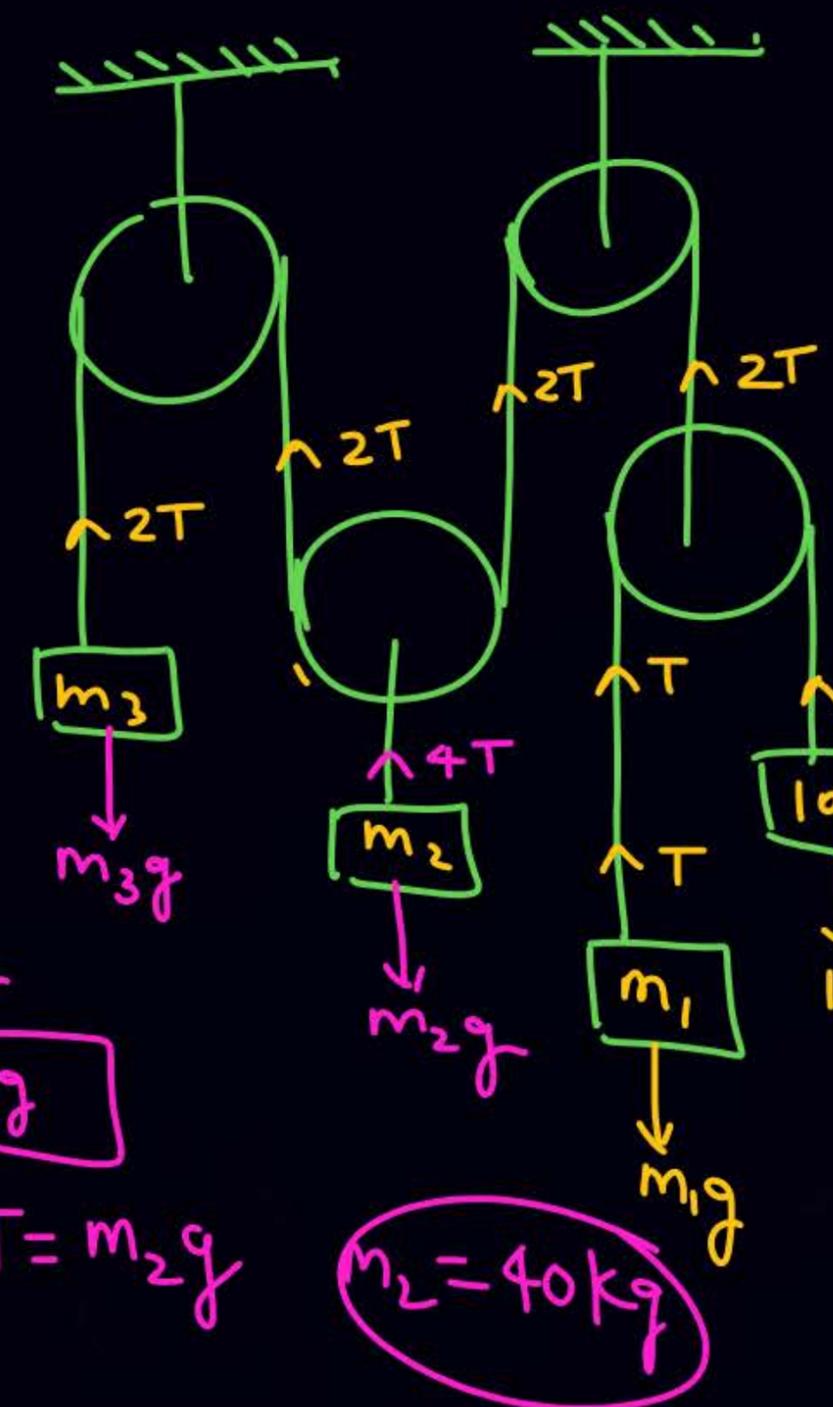
Both masses are in equil.

$2T = 100$ ,  $T = 50$   
 $T = mg$   
 $m = 5 \text{ Kg}$



Q

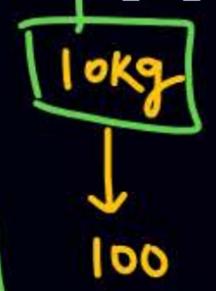
All masses are in equil.  
find  $m_1, m_2, m_3$



$$2T = m_3 g$$
$$m_3 = 20 \text{ kg}$$

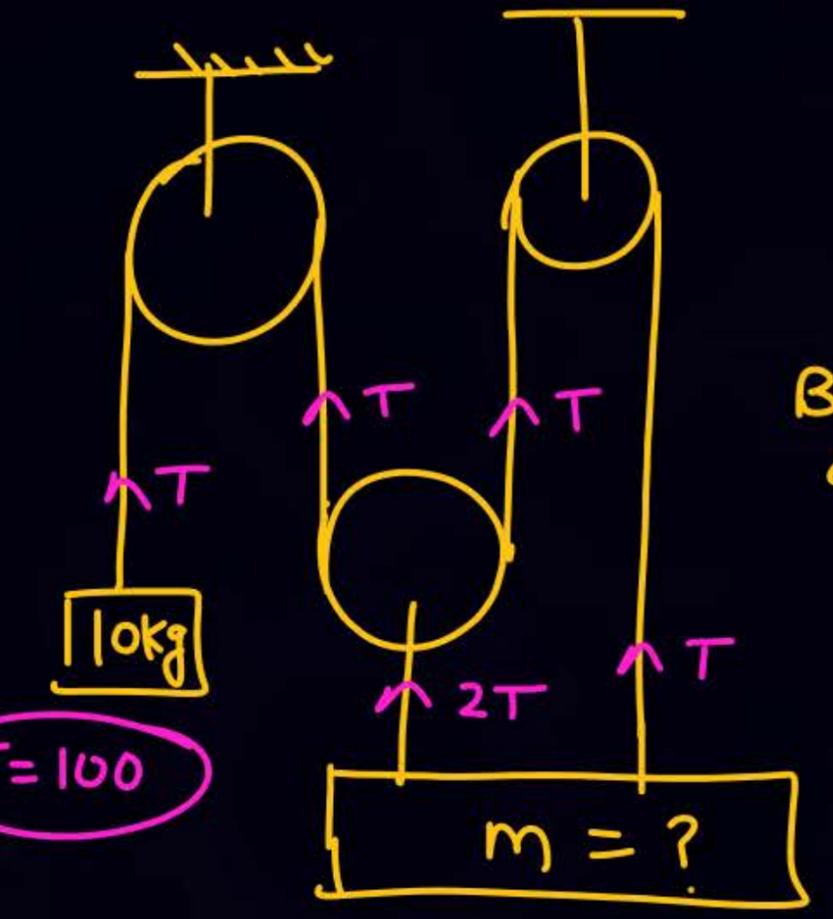
$$4T = m_2 g$$

$$m_2 = 40 \text{ kg}$$



$$T = 100$$
$$m_1 = 10 \text{ kg}$$

Q

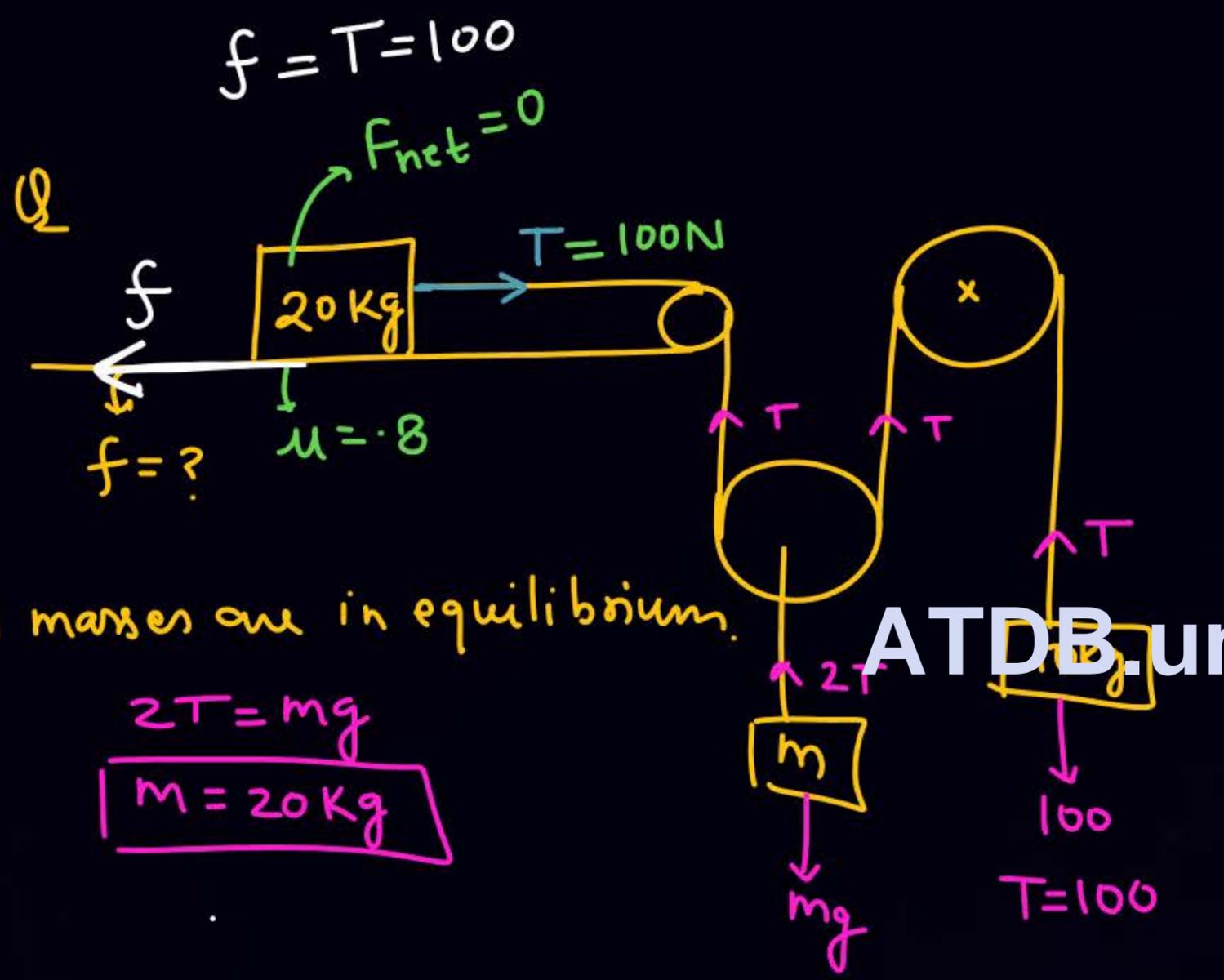


$$T = 100$$

$$3T = mg$$
$$300 = mg$$
$$m = 30 \text{ kg}$$

Both masses are in equil.

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All masses are in equilibrium.

$$2T = mg$$

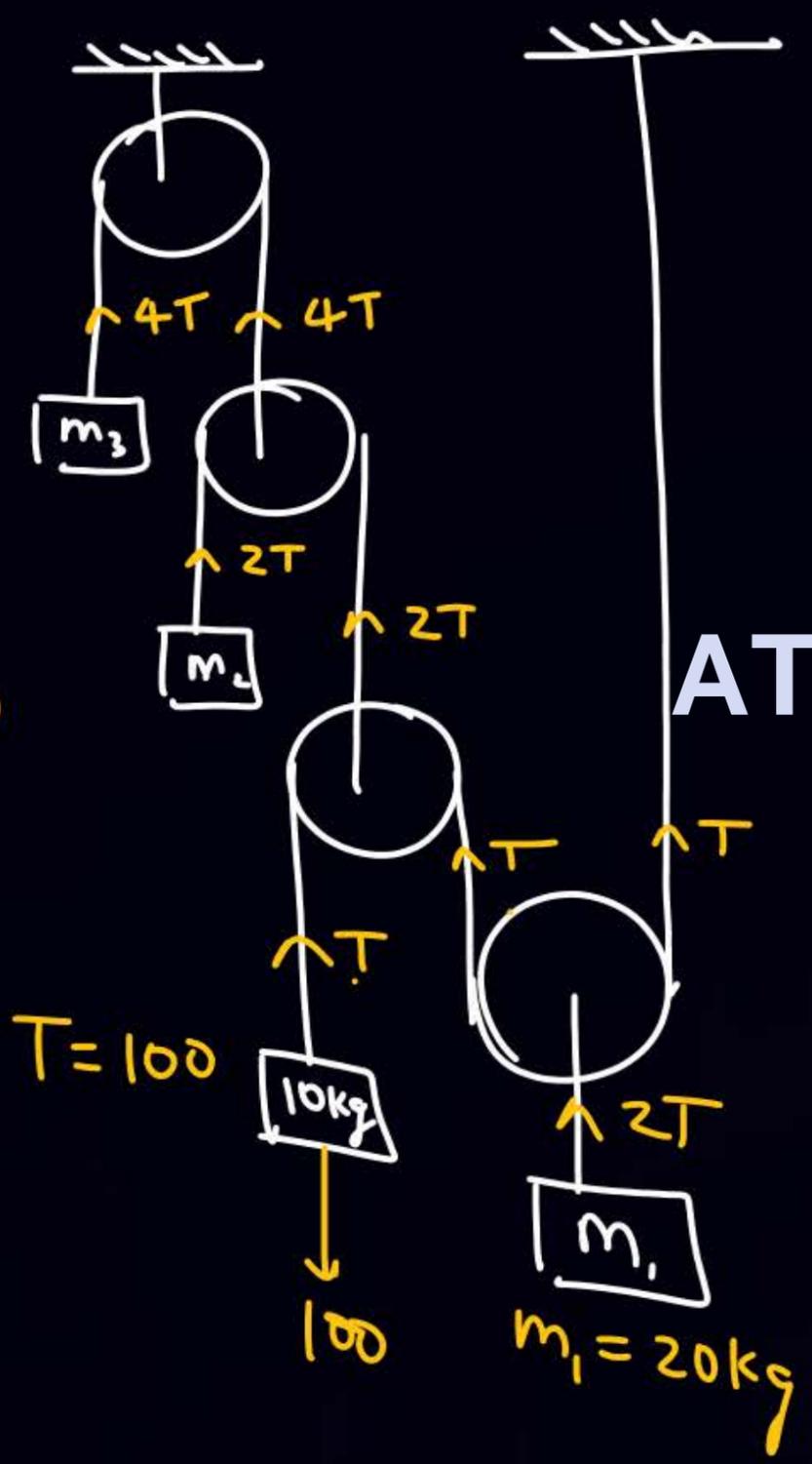
$$M = 20\text{ Kg}$$

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Q  
All masses are in equil.

$m_2 = 20$   
 $m_3 = 40$



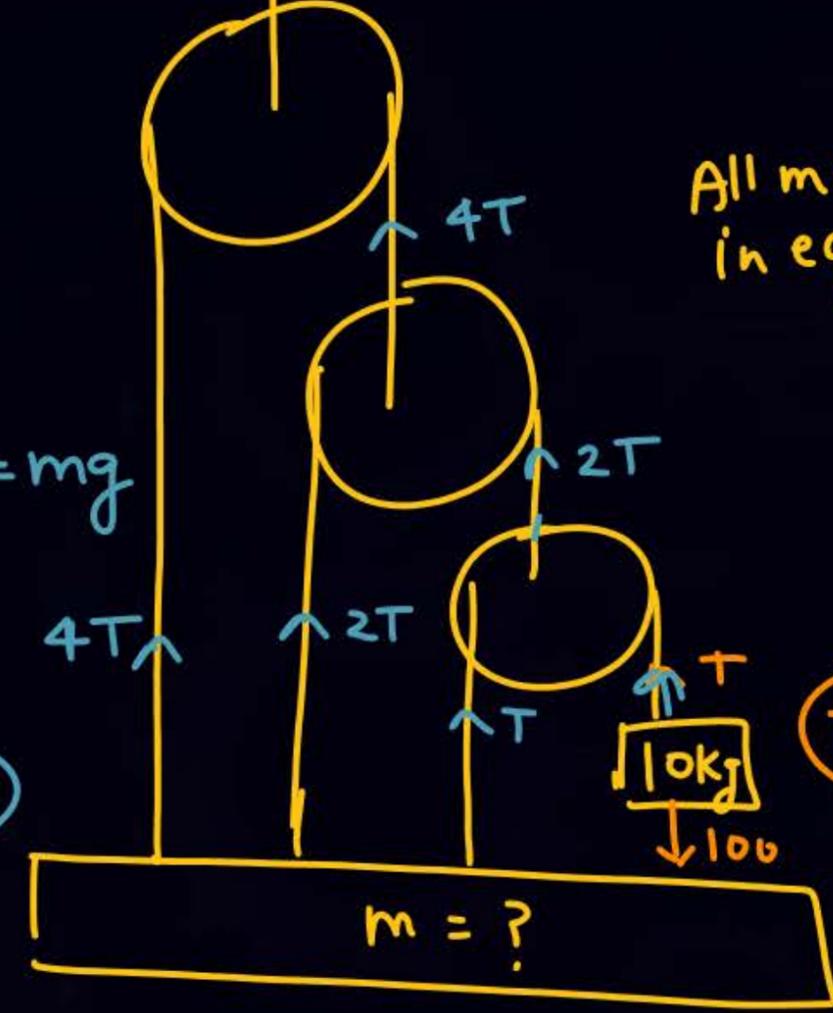
$T = 100$

$m_1 = 20\text{kg}$

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Q

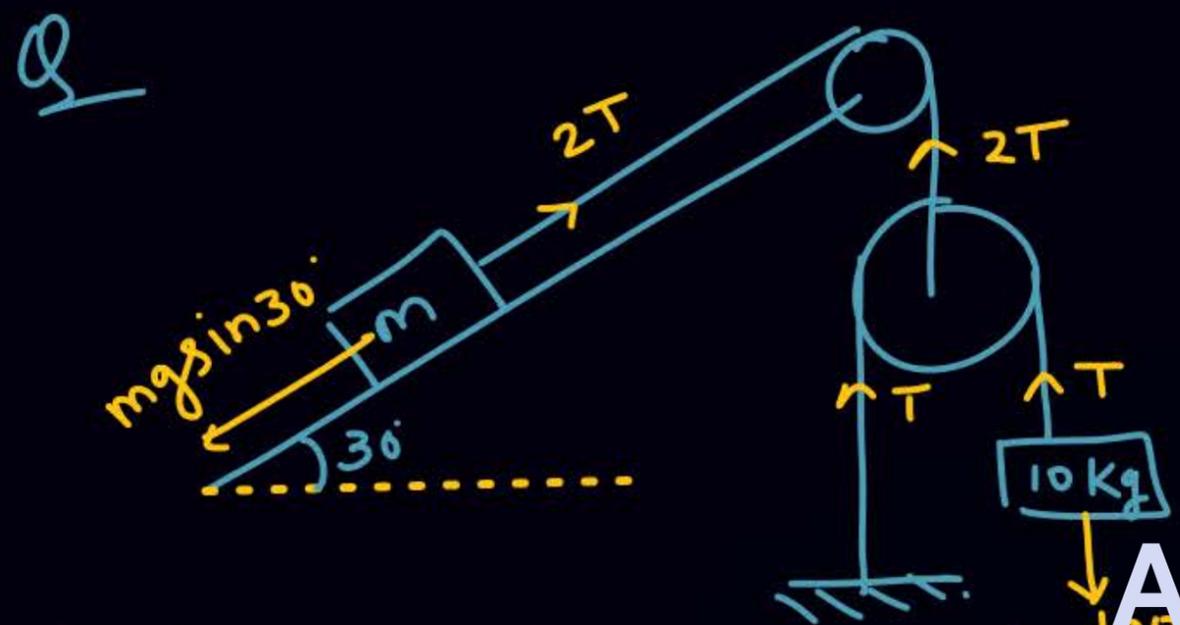
$4T + 2T + T = mg$   
 $7T = mg$   
 $700 = mg$   
 $m = 70\text{kg}$



All masses are in equil.

$T = 100$

$m = ?$

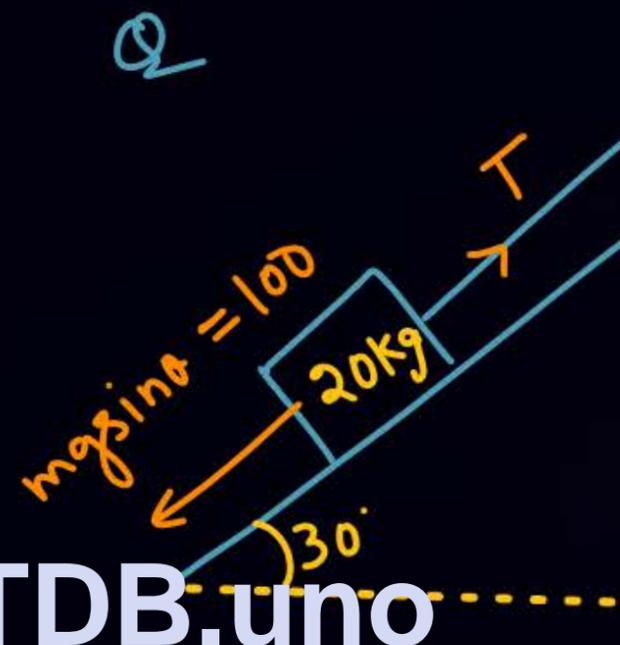


find  $m$  if all masses are in equil.

$$2T = mg \sin 30$$

$$200 = m \times 10 \times \frac{1}{2}$$

$$m = 40\text{ kg}$$

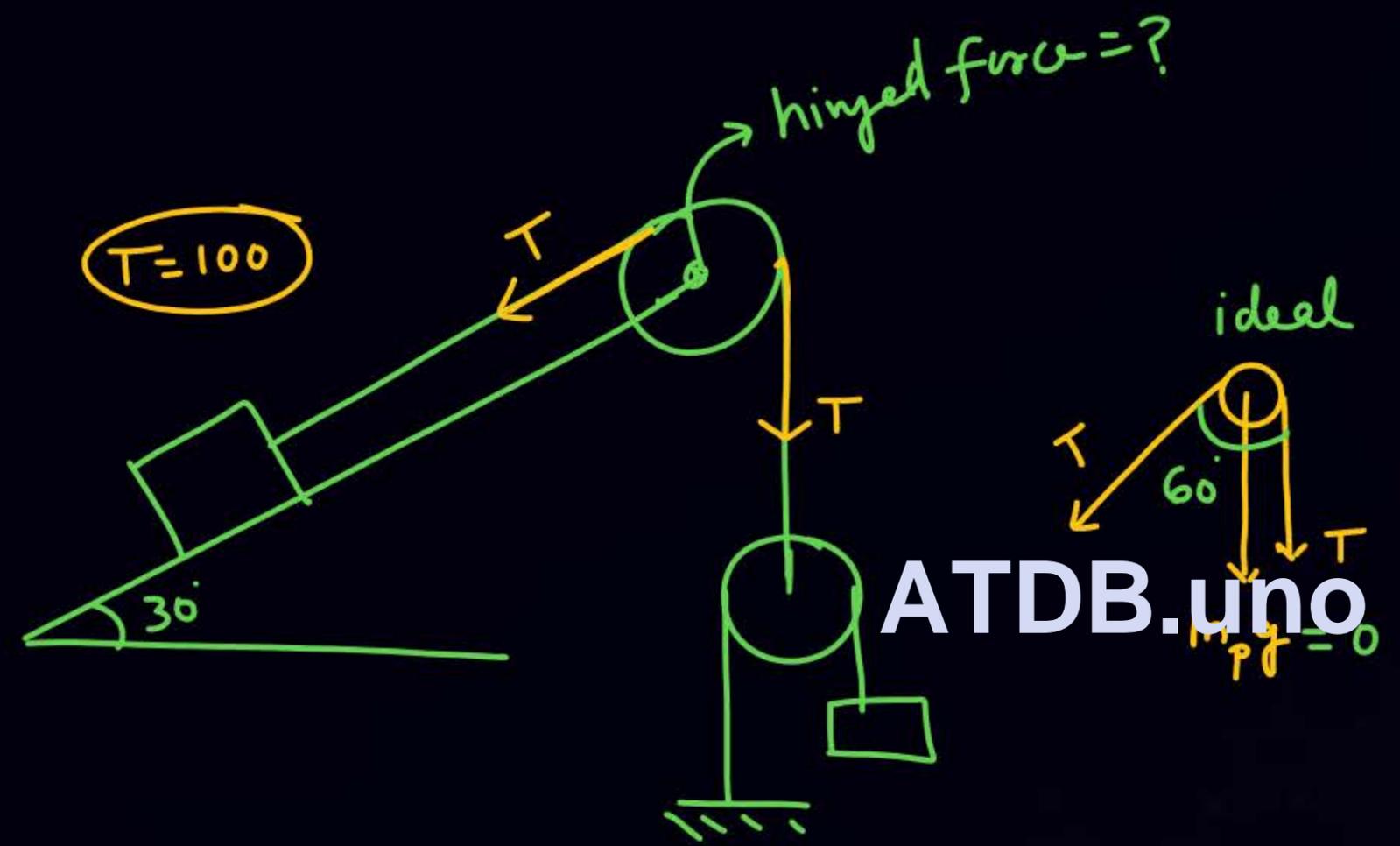


All masses are in equil.

$$2T + T = m'g$$

$$300 = m'g$$

$$m' = 30\text{ kg}$$



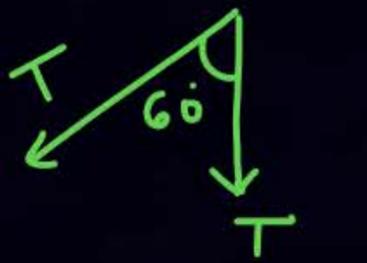
$T = 100$

hinged force = ?

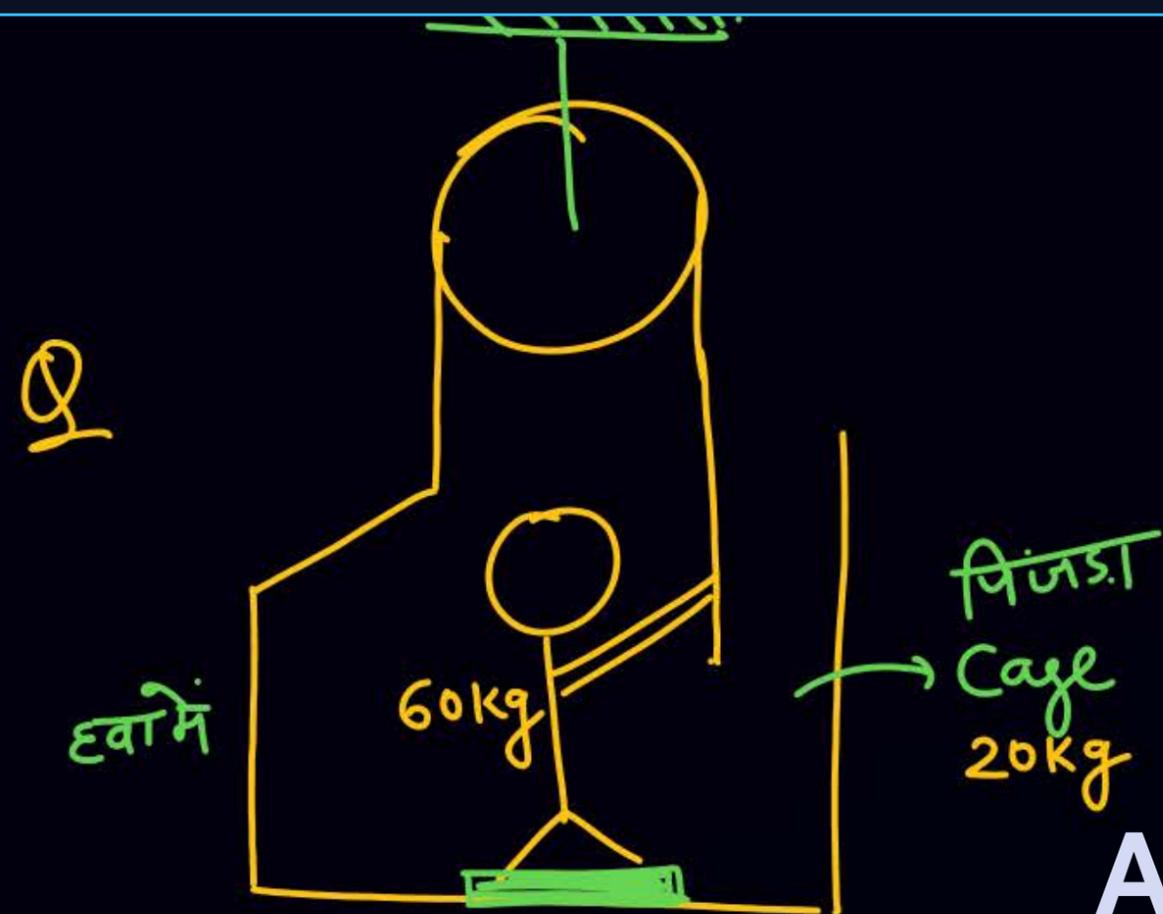
ideal

60°  
P.T = 0

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$T\sqrt{3} = 100\sqrt{3} = \text{hinged force}$



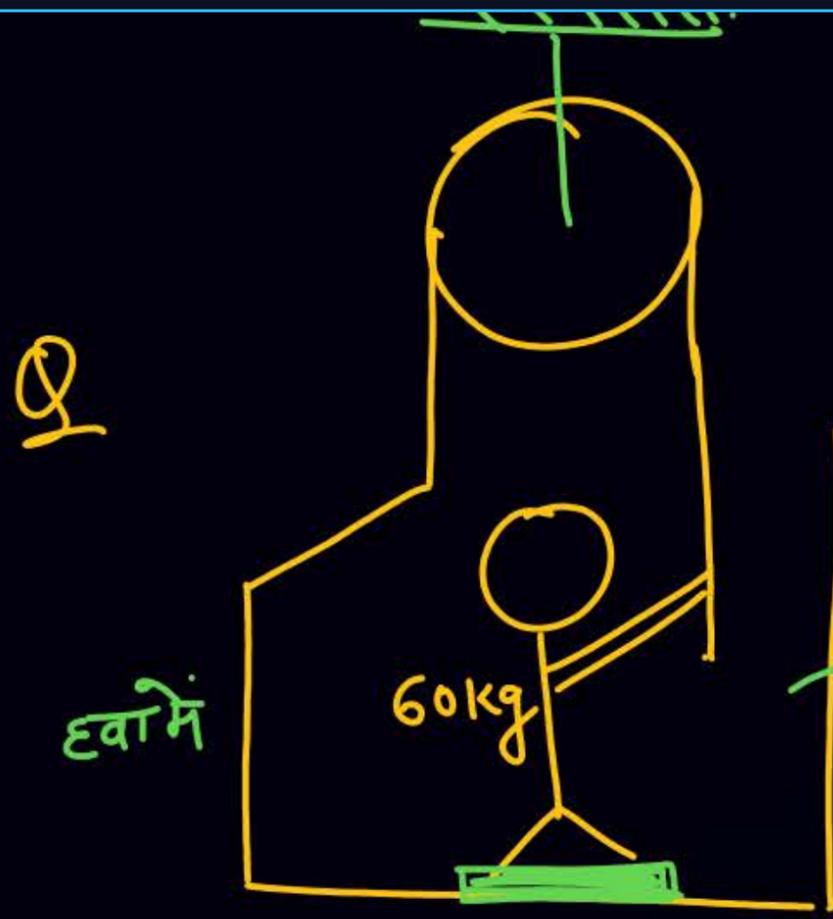
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HW

④  
⑤

- ① force applied by man on रस्सी =  $T$
- ② force applied by रस्सी on man =  $T$
- ③ Normal contact force b/w man & पिंजरा =  $N$
- ④ Reading of weighing machine =  $N$
- ⑤ what force man should apply on string so that weighing machine gives correct reading

Whole system is in equilibrium.



पिजडा  
Cage  
20kg



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$$T + N = 600$$

$$T = N + 200$$


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$$2T = 800$$

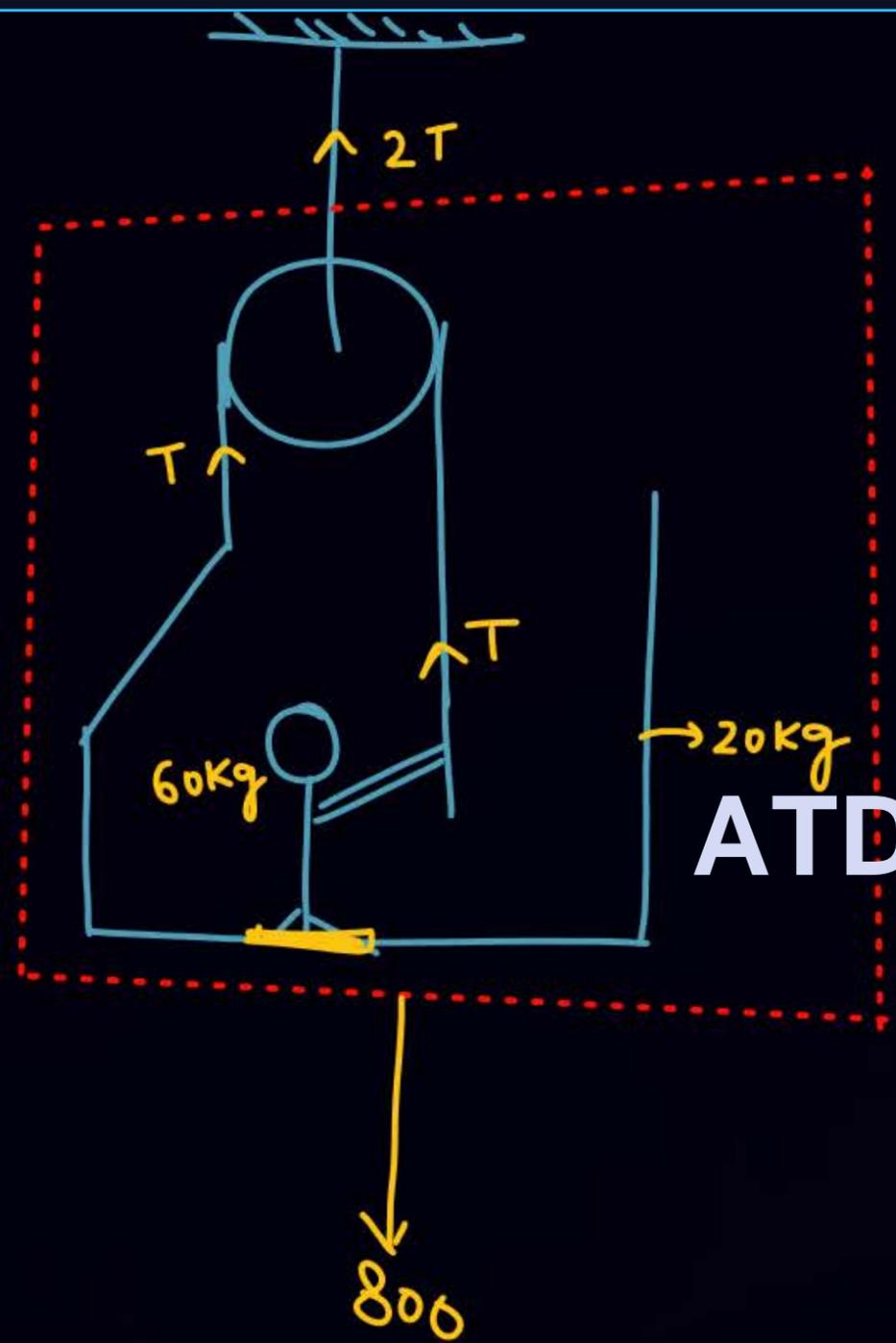
$$T = 400$$

$$N = 200$$



Reading of weighing machine.

Whole system is in equilibrium.



$$2T = 800$$

$$T = 400$$

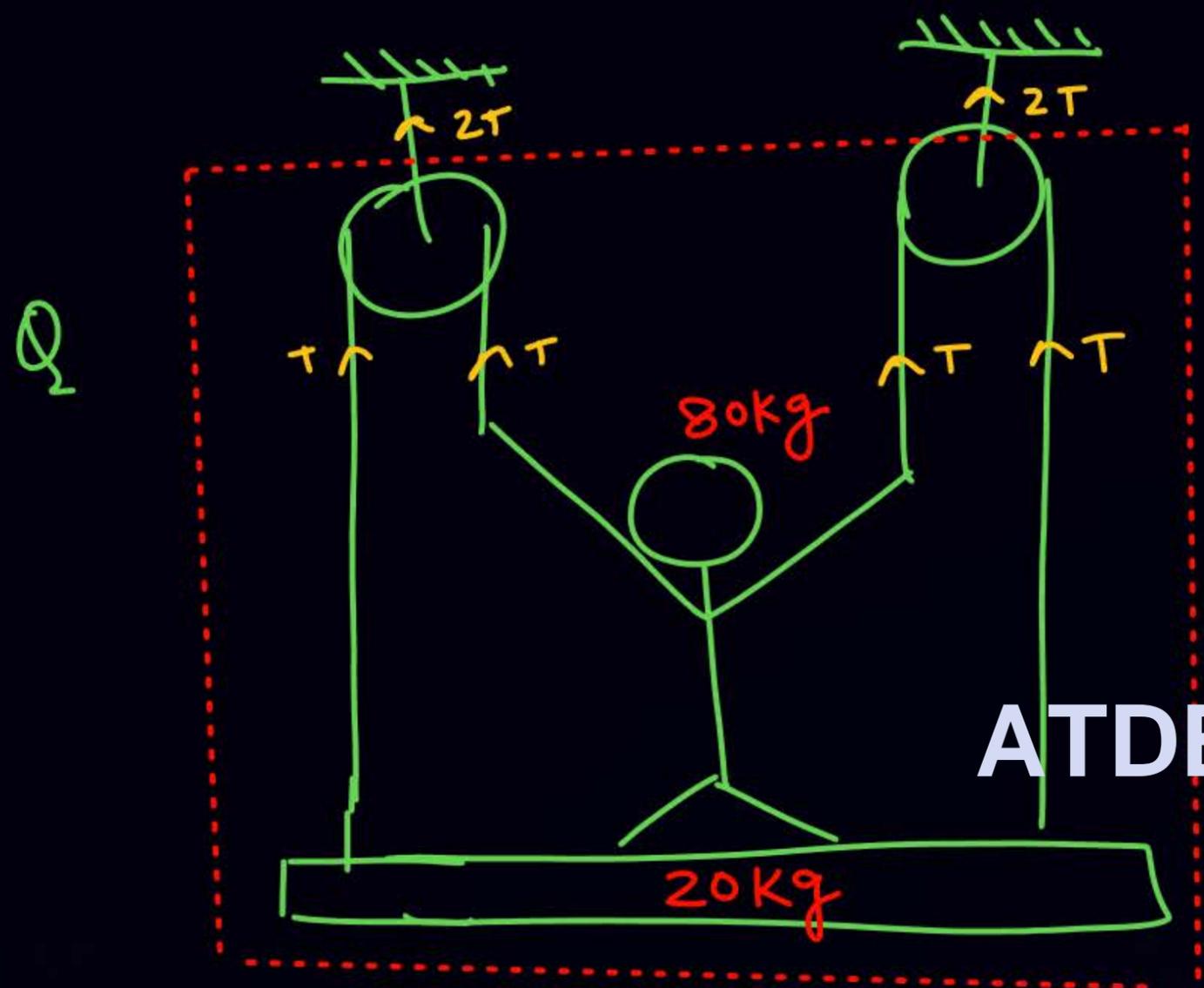


$$T + N = 600$$

$$400 + N = 600$$

$$N = 200$$

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If Dharmendra Sahab applied the same force on both string. & system is in equilibrium. find

- ① force applied by Dharmendra Sahab on string
- ② normal contact force.

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$$4T = (80 + 20)g$$

$$T = 250$$



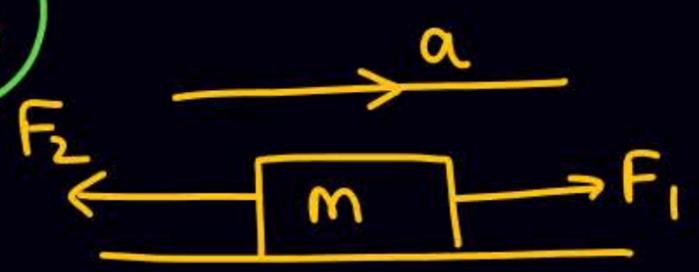
$$2T + N = 800$$

$$500 + N = 800$$

$$N = 300$$

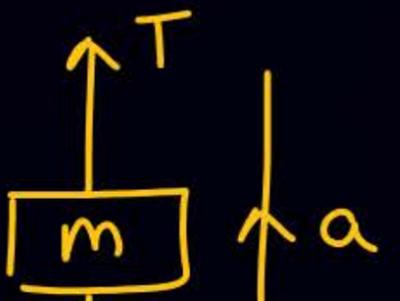


$$\vec{F}_{net} = m\vec{a}$$



$$F_1 - F_2 = ma$$

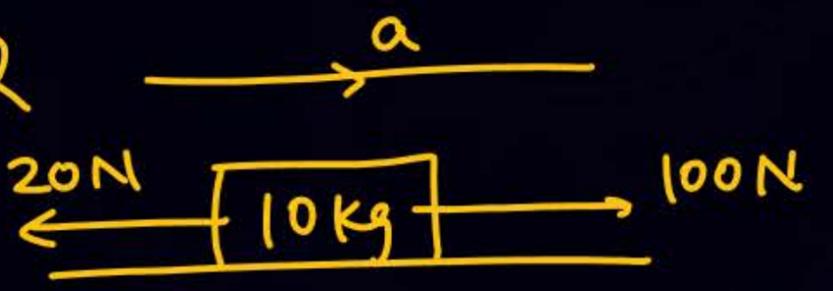
लगने वाला  
force नहीं है  
 $F_{net}$  है



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$$T - mg = ma$$

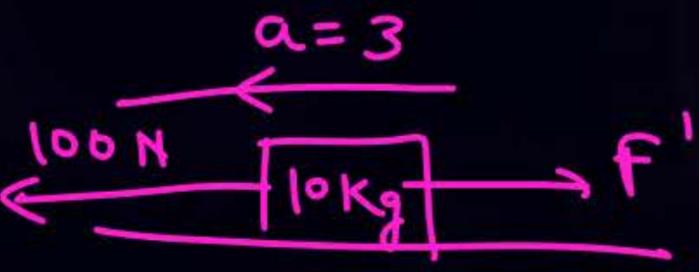
Q



$$100 - 20 = 20 \times a$$

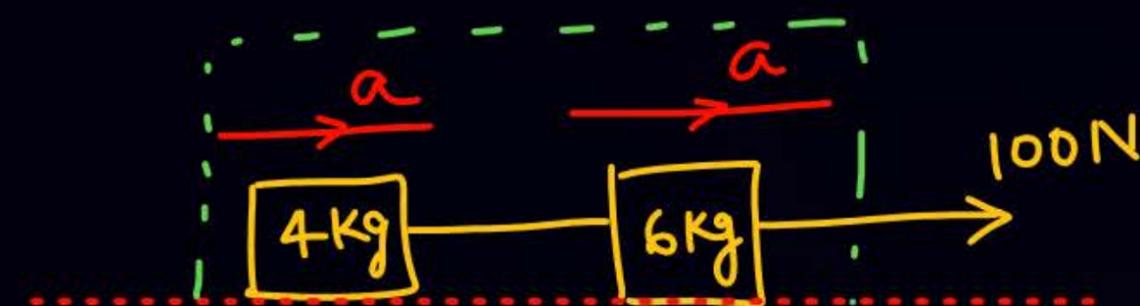
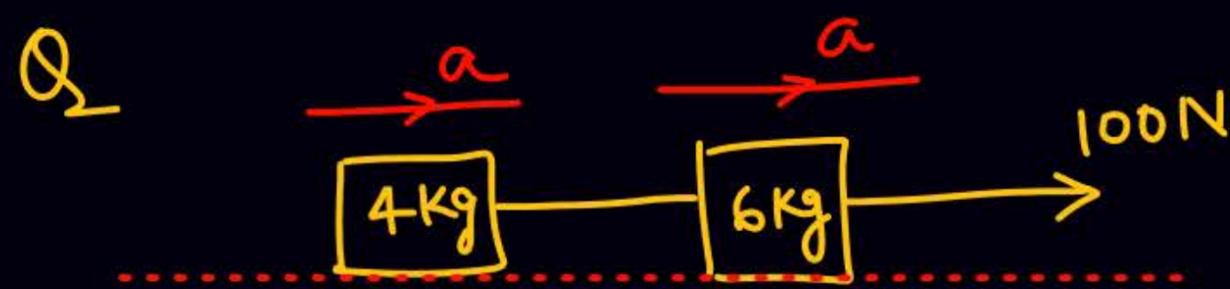
$$a = 8$$

Q

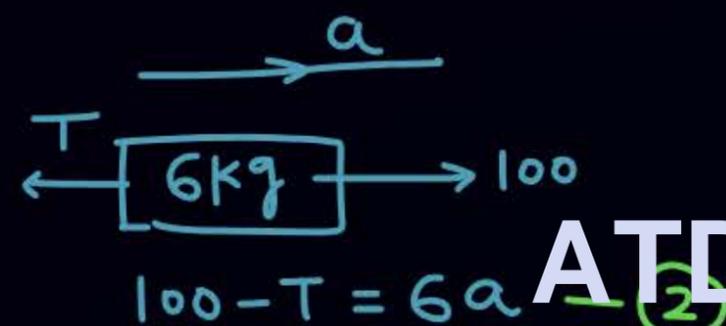
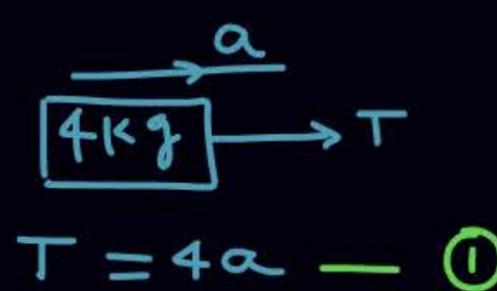


$$100 - F' = 10 \times 3$$

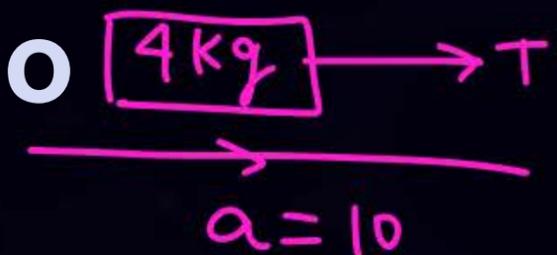
$$F' = 70$$



$$a = \frac{(F_{\text{net}})_{\text{ext}}}{m_{\text{total}}} = \frac{100}{4+6} = 10$$



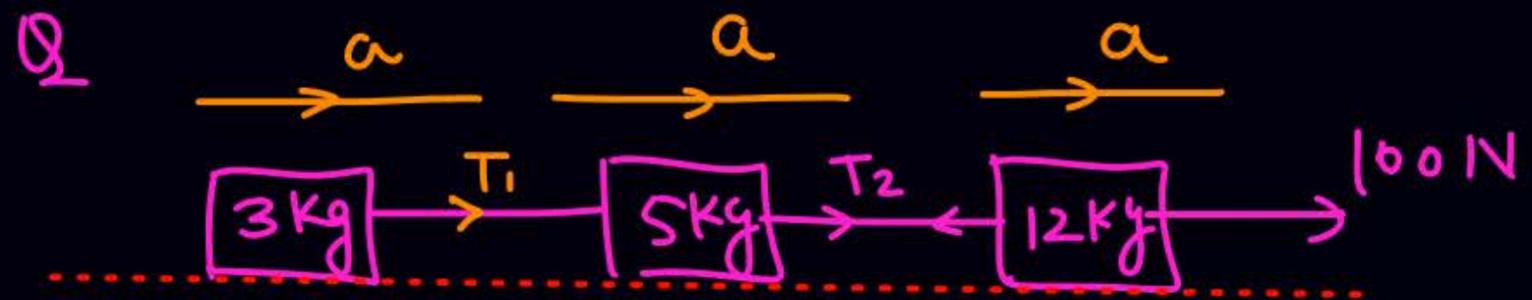
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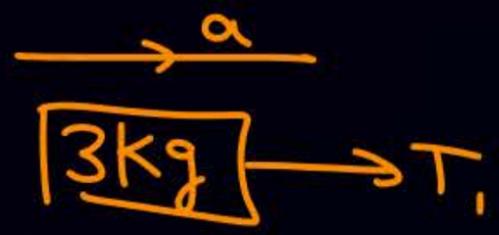
$$T = 4 \times 10 = 40$$

Solve  
& get

$$\boxed{\begin{matrix} a = 10 \\ T = 40 \end{matrix}}$$



$$a = \frac{100}{3+5+12} = 5$$



$$T_1 = 3 \times 5 = 15$$

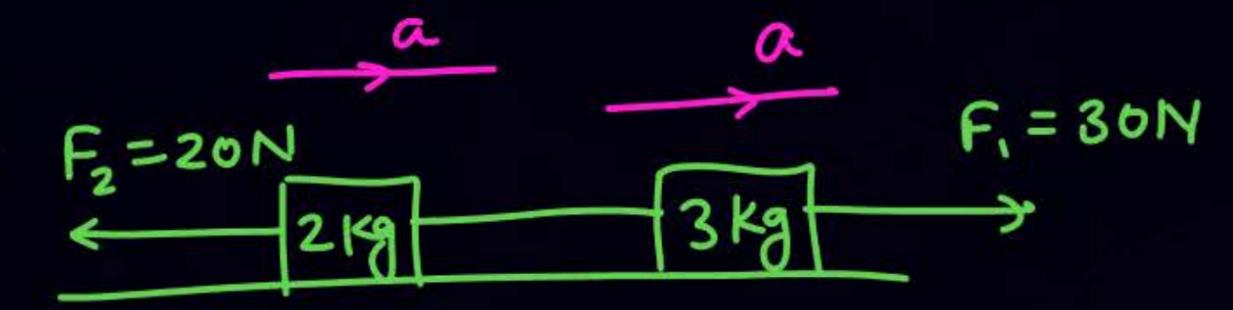


$$100 - T_2 = 12a$$

$$100 - T_2 = 12 \times 5$$

$$T_2 = 40$$

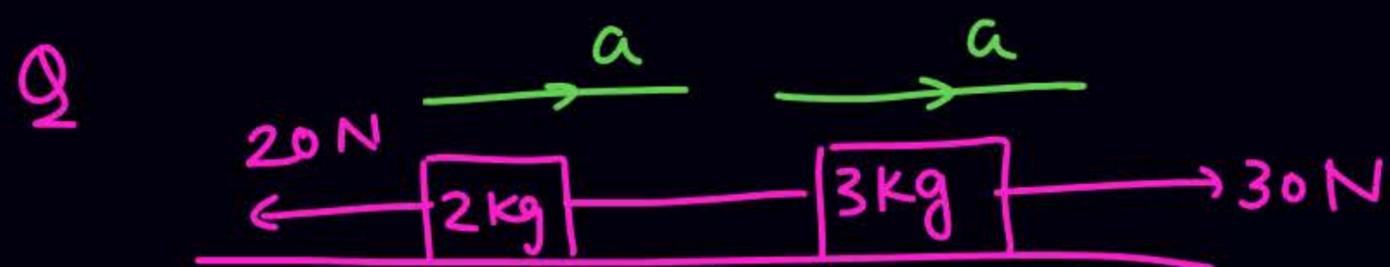
Q



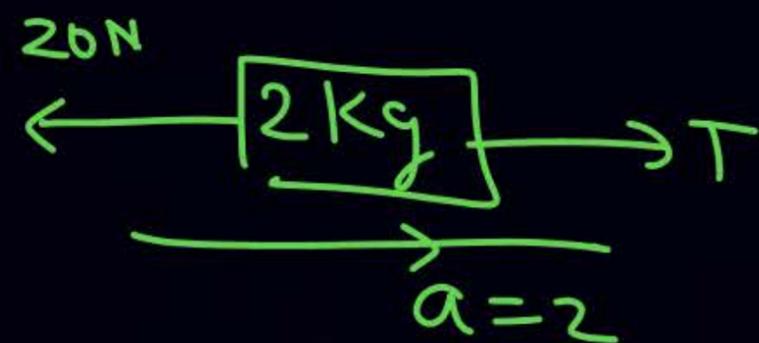
$$T - 20 = 2a$$

$$30 - T = 3a$$

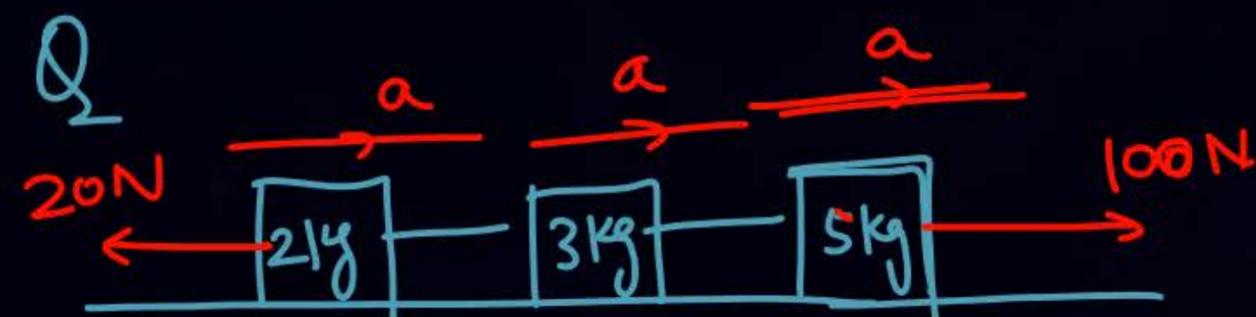
$$a = 2, T = 24$$



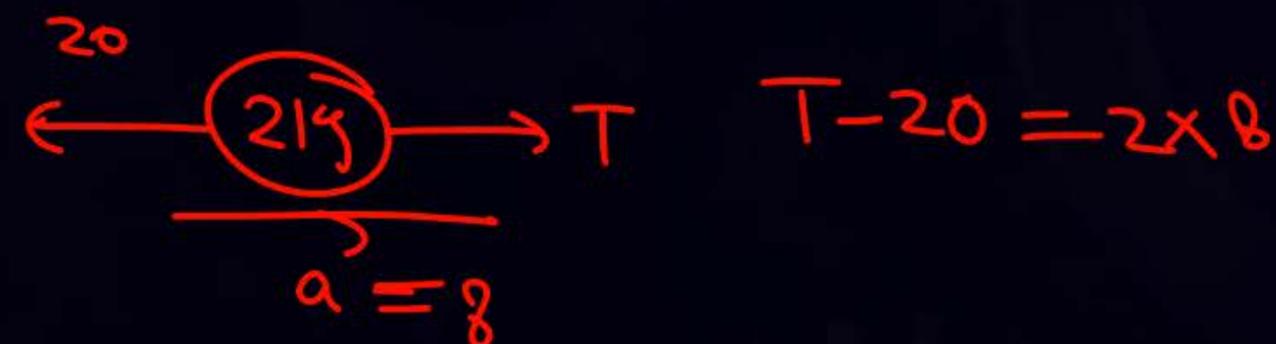
$$a = \frac{F_{\text{net}}}{M_{\text{total}}} = \frac{30 - 20}{2 + 3} = 2$$



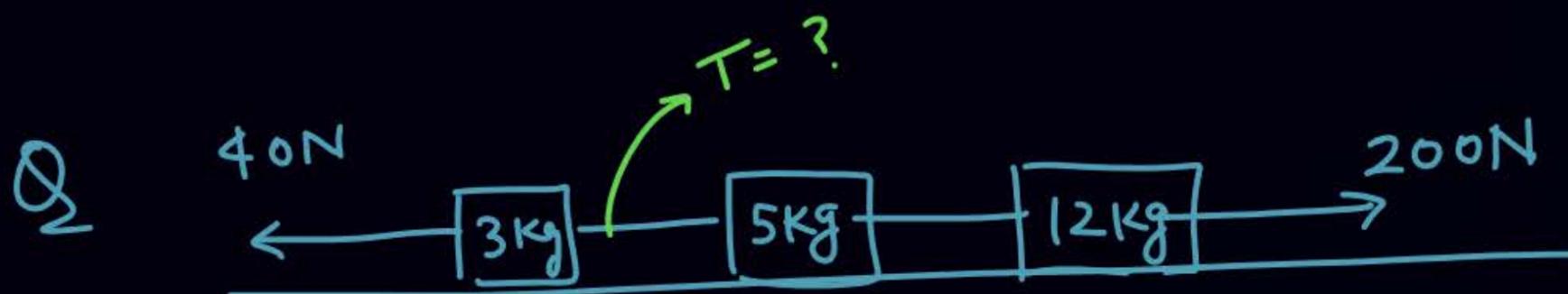
$$T - 20 = 2 \times 2$$



$$a = \frac{100 - 20}{2 + 3 + 5} = 8$$

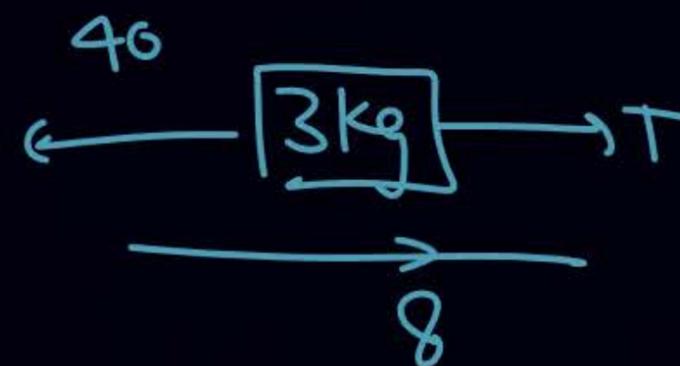


$$T - 20 = 2 \times 8$$



$$a = \frac{200 - 40}{20} = 8$$

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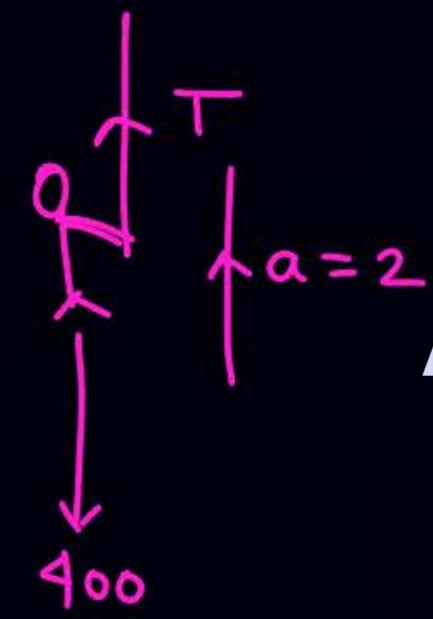
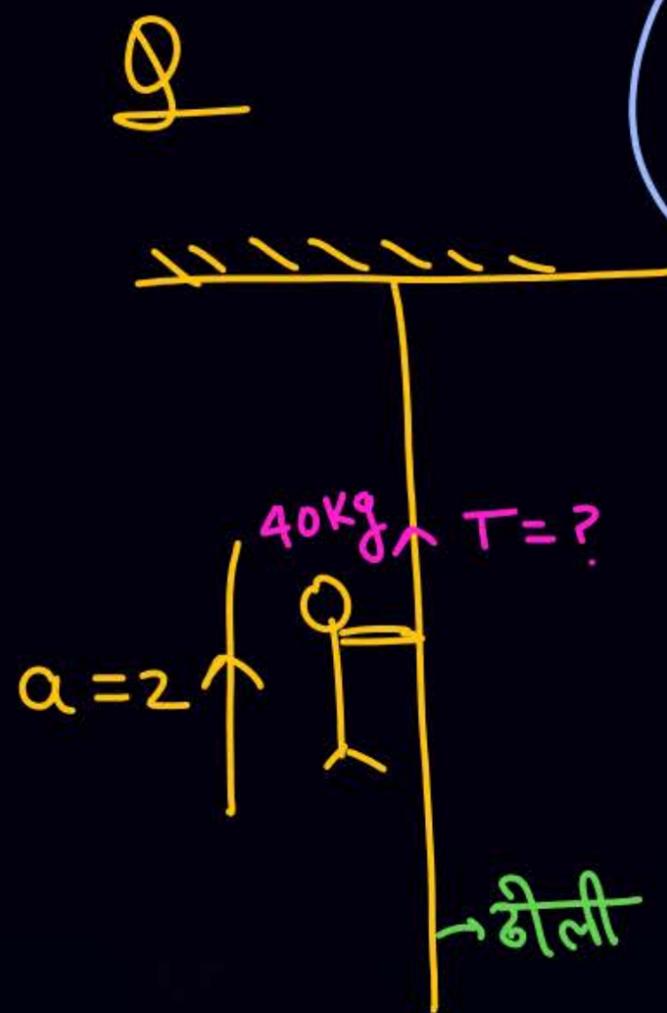
$$T - 40 = 8 \times 3$$

$$T = 64$$



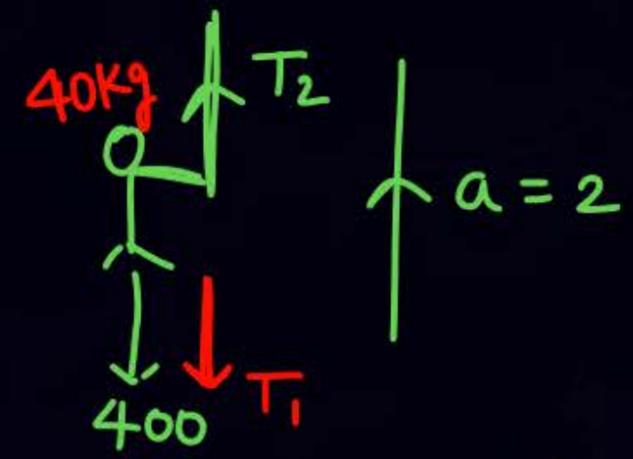
$$T - 400 = 40 \times 2$$

$$T = 480$$



$$T - 400 = 40 \times 2$$

$$\boxed{T = 480}$$



$T_1 = 100$

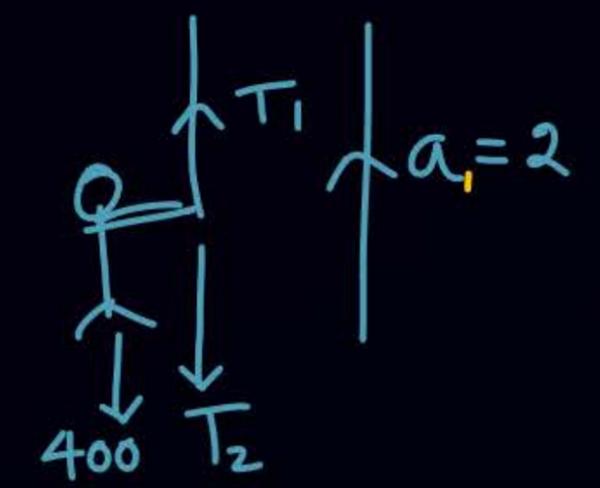
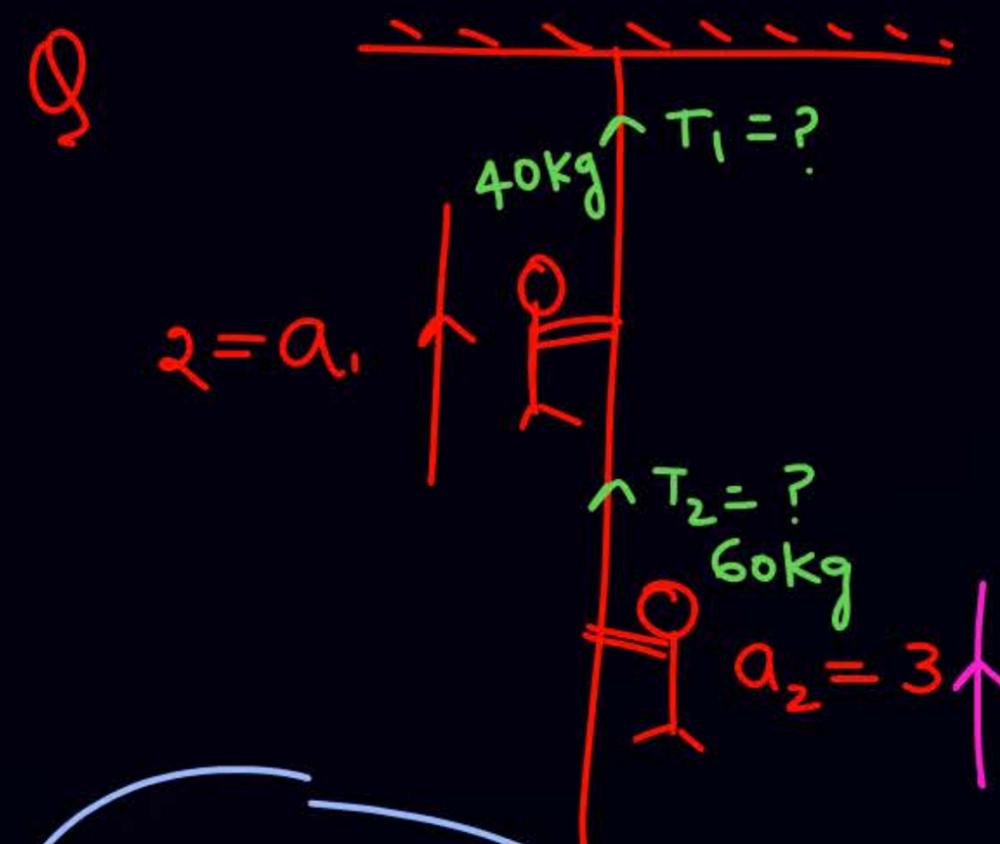
$$T_2 - 400 - T_1 = 40 \times 2$$

$$\boxed{T_2 = 580}$$

M2

$$T_2 - 500 = 80 + 0$$

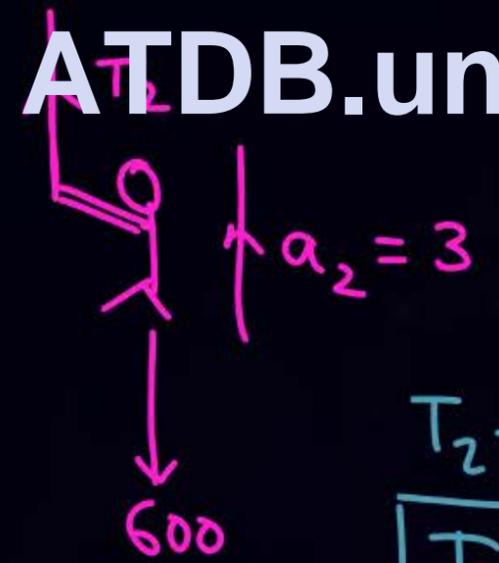
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$$T_1 - 400 - T_2 = 40 \times 2$$

$$T_1 = 400 + 780 + 80 = 1260$$

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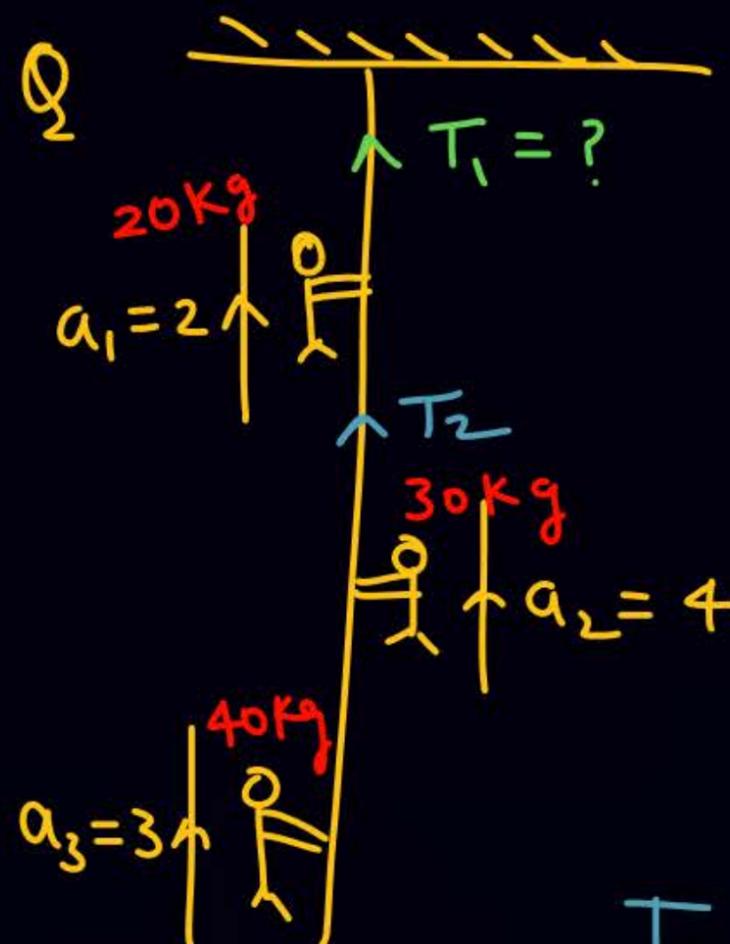


$$T_2 - 600 = 60 \times 3$$

$$T_2 = 780$$

$$T_1 - 1000 = 80 + 180$$

$$T_1 = 1260$$



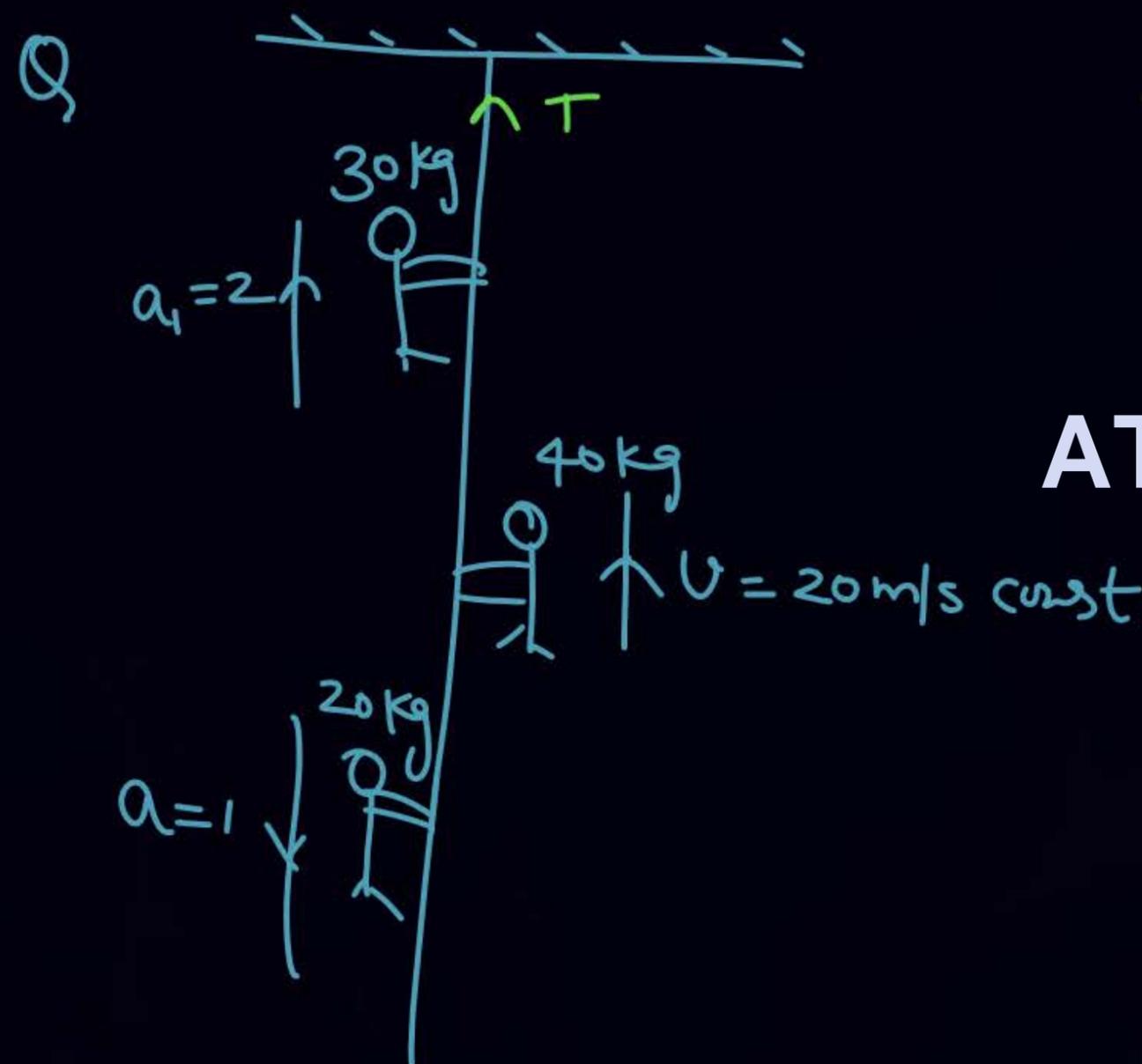
$$(\vec{F}_{\text{net}})_{\text{ext}} = m_1 \vec{a}_1 + m_2 \vec{a}_2 + m_3 \vec{a}_3$$

$$T_1 - 900 = 20 \times 2 + 30 \times 4 + 40 \times 3$$

$$(mg)_{\text{total}}$$

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$$T_2 - 700 = 30 \times 4 + 40 \times 3$$



$$T - 900 = 60 + 0 + 20(-1)$$

$$T = 940$$

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\*\*\*\*

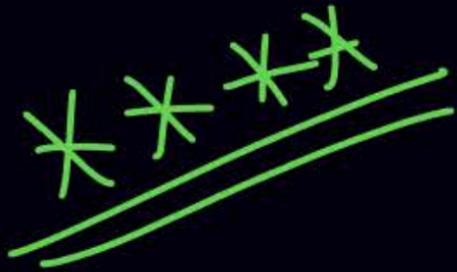
$$\left( \vec{F}_{\text{net}} \right)_{\text{ext}} = m_1 \vec{a}_1 + m_2 \vec{a}_2 + m_3 \vec{a}_3 + \dots$$

if  $\vec{a}_1 = \vec{a}_2 = \vec{a}_3 = \dots = \vec{a}$

$$\vec{a} = \frac{\vec{F}_{\text{net}}}{(m_{\text{total}})_{\text{sys}}}$$

$$\left( F_{\text{net}} \right)_{\text{ext}} = (m_1 + m_2 + \dots) \vec{a}$$

$$\left( F_{\text{net}} \right)_{\text{ext}} = (m_{\text{total}})_{\text{sys}} \vec{a} = m_{\text{total}} \vec{a}_{\text{com}}$$



$$(\vec{F}_{\text{net}})_{\text{ext}} = \frac{m_1 \vec{a}_1 + m_2 \vec{a}_2 + m_3 \vec{a}_3 + \dots}{(m_1 + m_2 + m_3 + \dots)} \cdot (m_1 + m_2 + \dots)$$

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$$(\vec{F}_{\text{net}})_{\text{ext}} = M_{\text{total}} \vec{a}_{\text{com}}$$



H.W

- Revise class Notes

- DPP-02

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# THANK YOU

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