YAKEEN NEET 2.0

2026

Laws of Motion

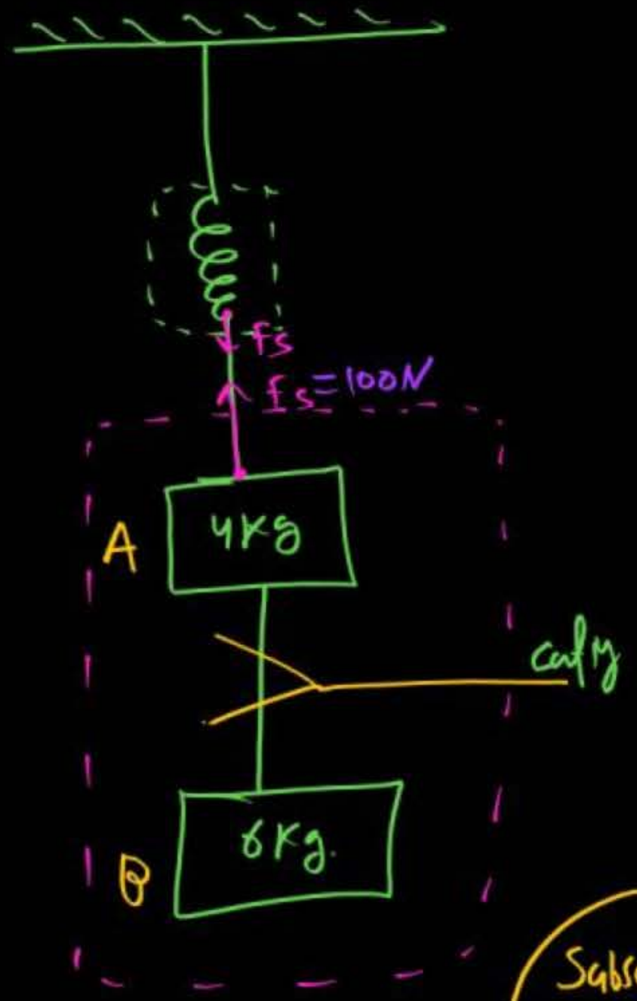
Physics | Lecture - 7

By- Manish Raj (MR Sir)

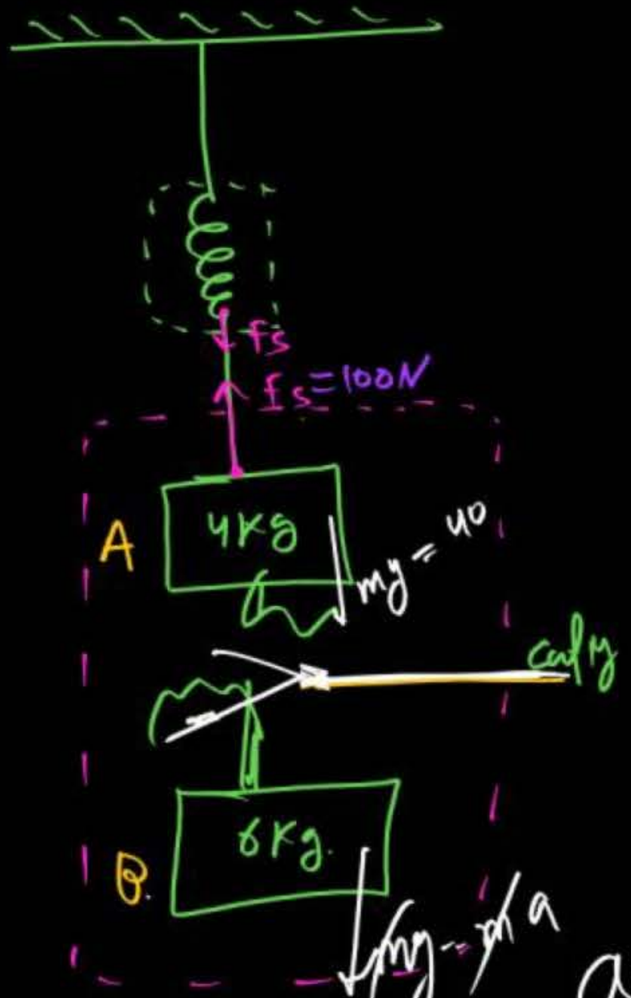
Topics to be covered

1. # Constrain Motion
2.
3.
4.

If string is cut then find acc^{n} of A & B
Just after cutting the string :—



Sabse Pahle equilibrium me Fs/T calculate



String cut $\Rightarrow a_B = g$ (down)

MR. BOX

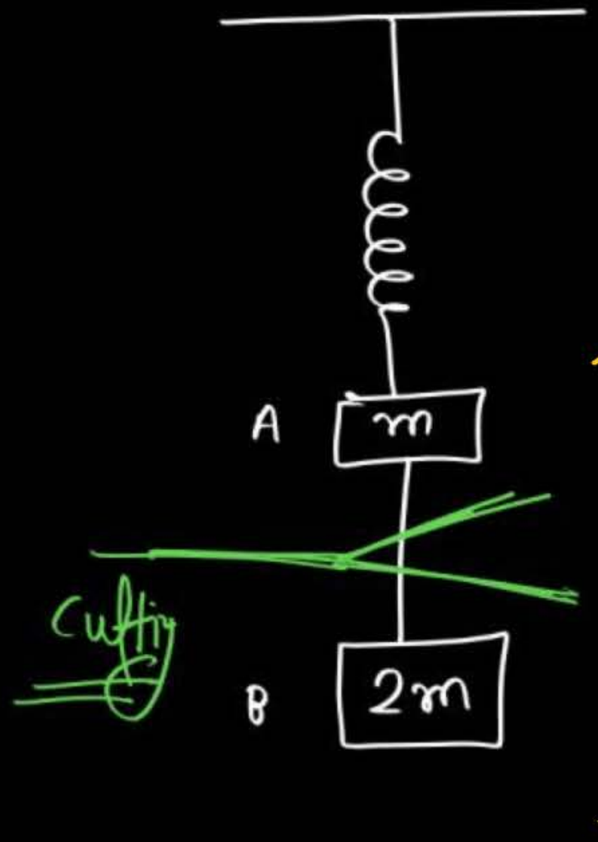
Just after cutting the string → T → become zero

but spring force remain same Just before cutting →

$$a_A = \frac{100-40}{4}$$

$$= \frac{60}{4} = 15\,m/s^2 \text{ (upward)}$$

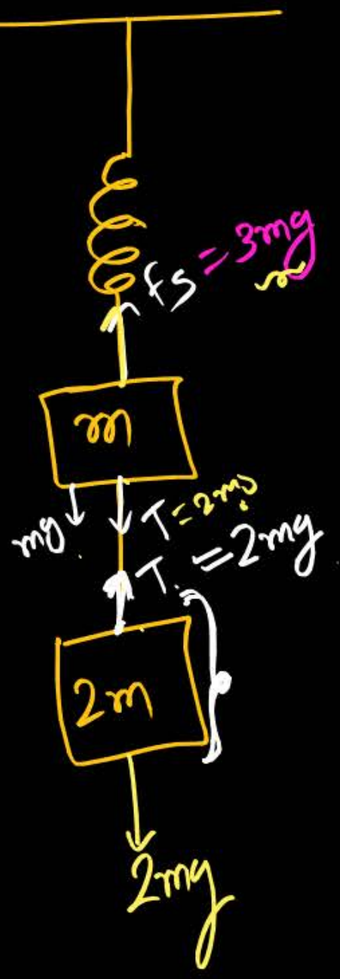
system is in equilibrium, and string is cut then find Acc^n of Block 'A' & 'B'



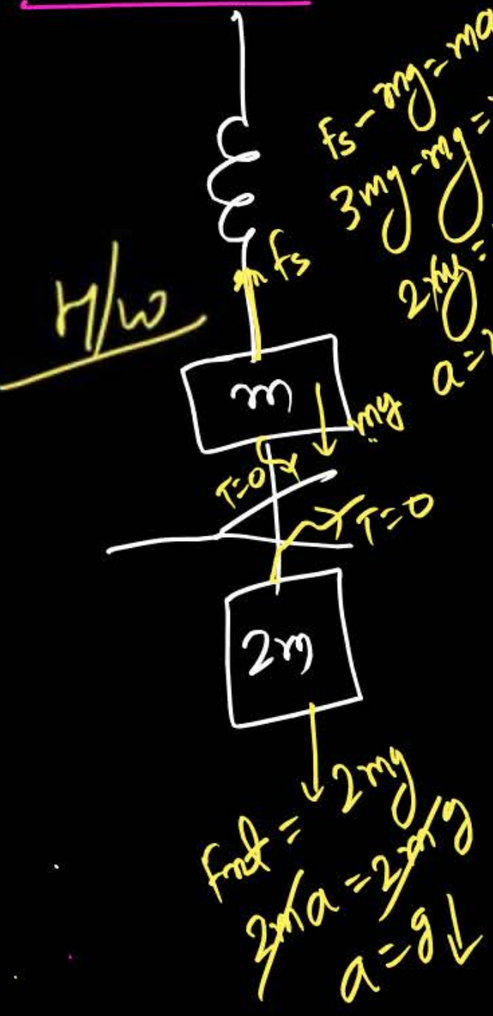
at equilibrium.

$a_A = 2g$ (Upward) ✓

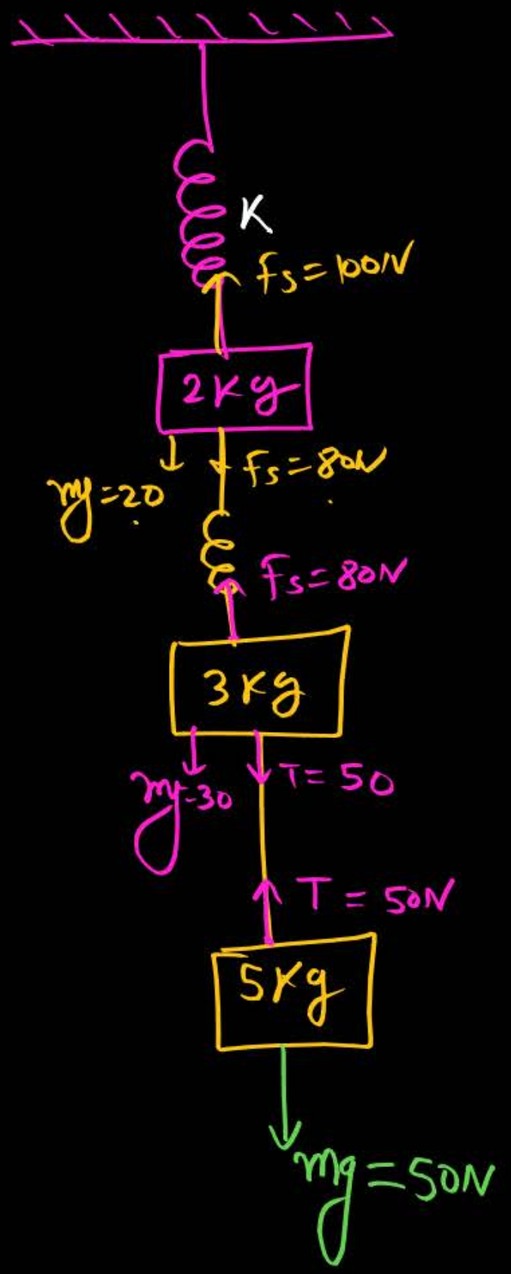
$a_B = g$ down.

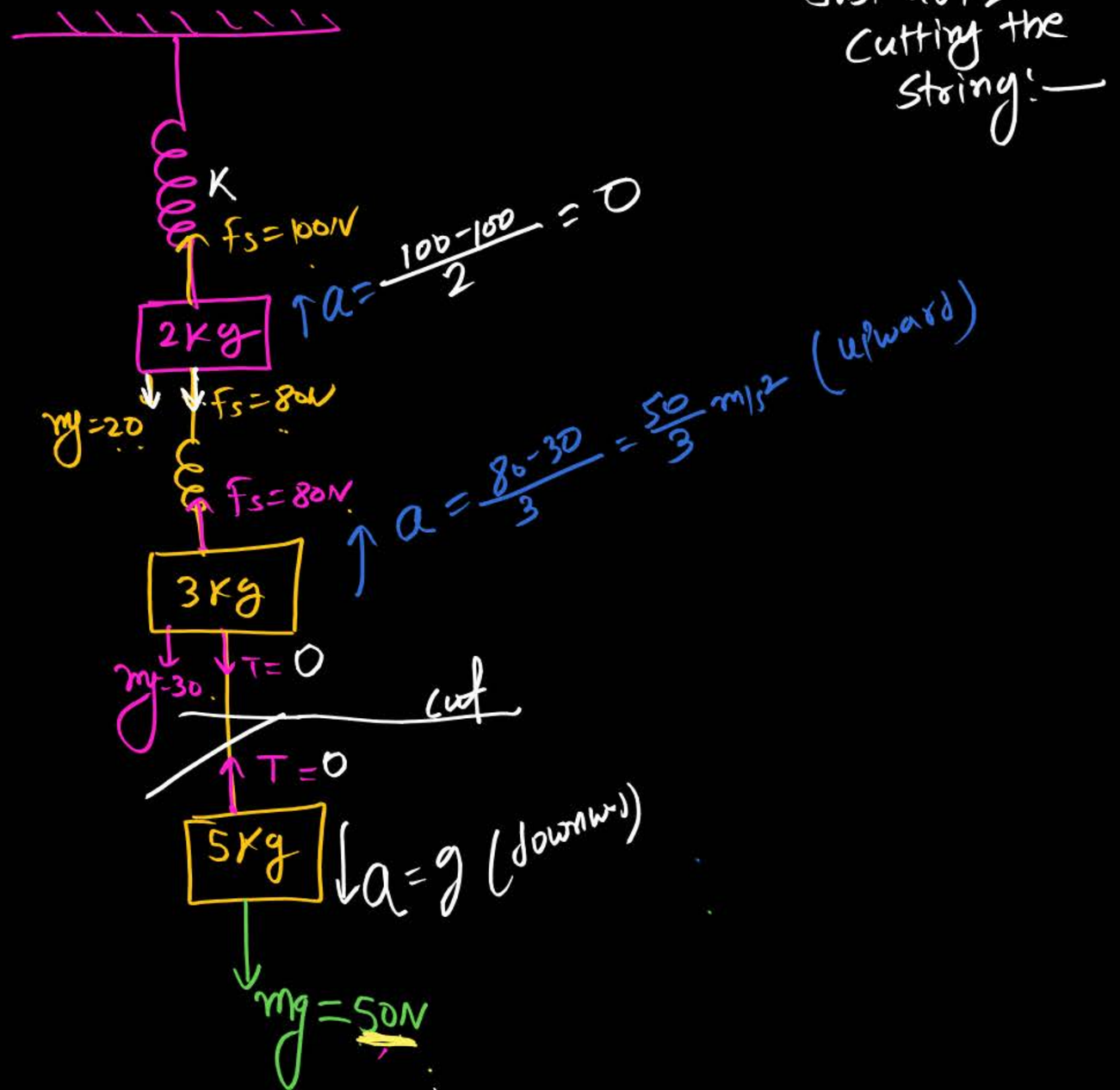


H/w



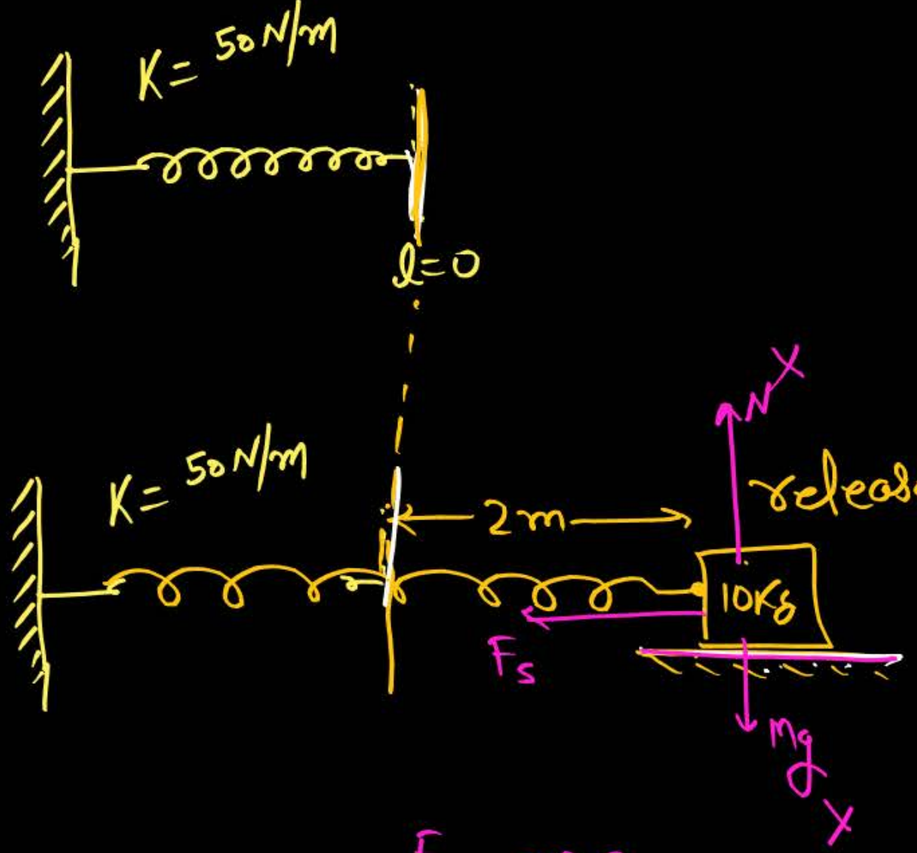
(a) System is at equilibrium, if string is cut then find acc^n of each block just after cutting the string:—





Q)

$F = K(x)$, $x \rightarrow$ elongation



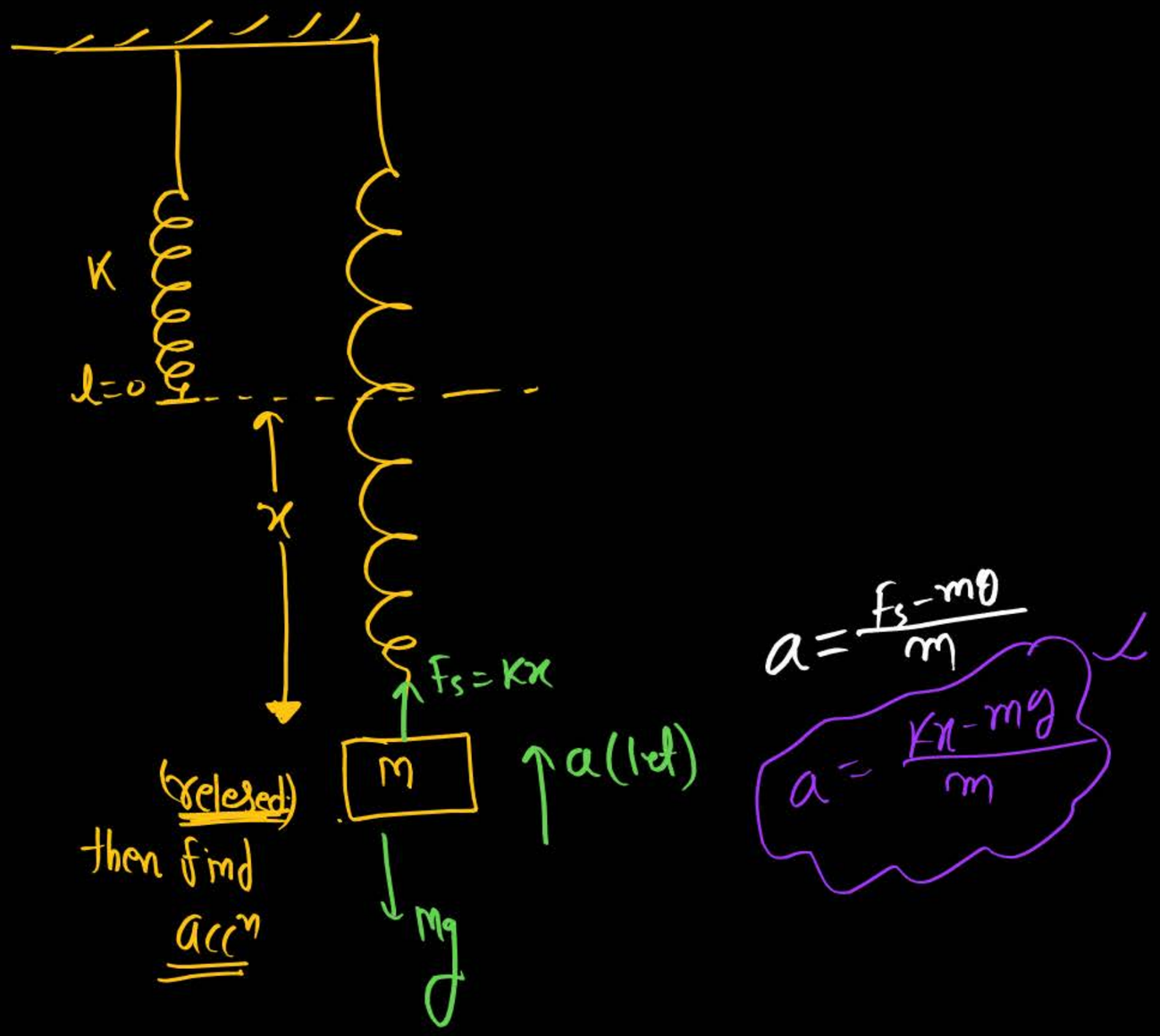
released. Then find acc^n of block ??

$F_s = ma$

$Kx = ma$

$50 \times 2 = 10\,a$

$a = 10\ m/s^2$.



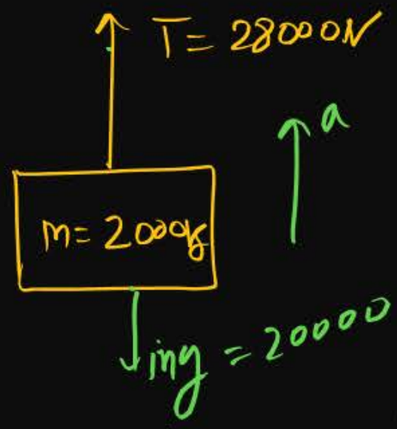
$$a = \frac{F_s - mg}{m}$$

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

Question

The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is: **[2019]**

1. $4\ ms^{-2}$ upwards
2. $4\ ms^{-2}$ downwards
3. $14\ ms^{-2}$ upwards
4. $30\ ms^{-2}$ downwards



$a = \frac{f_{net}}{m} = \frac{28000}{2000}$

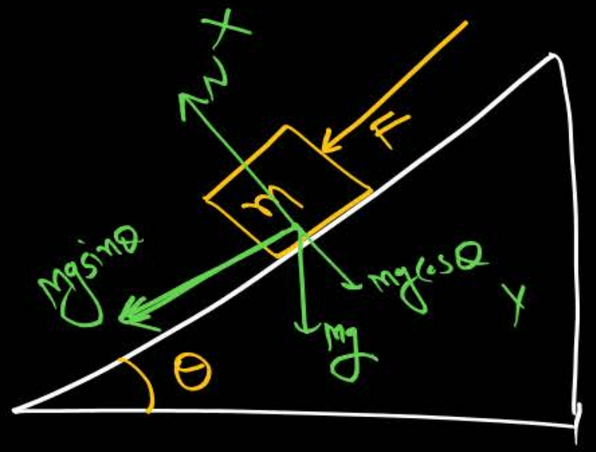
$= 14\ m/s^2$ upwards — wrong

$a = \frac{28000 - 20000}{2000}$

$= \frac{8000}{2000} = 4\ m/s^2$

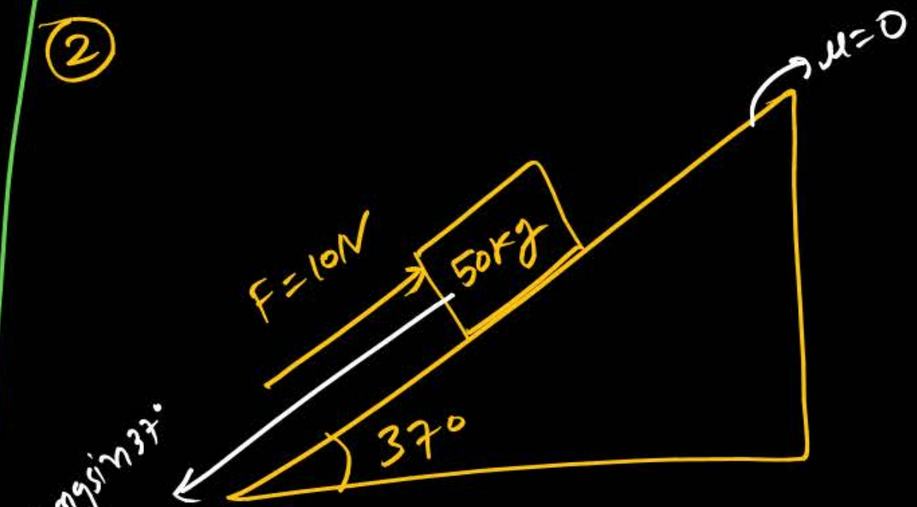
Acc^n on Inclined Plane

①



$$a = \frac{[f + mg\sin\theta]}{m} \quad \text{Net force along Inclined}$$

②



$mg\sin 37°$ to

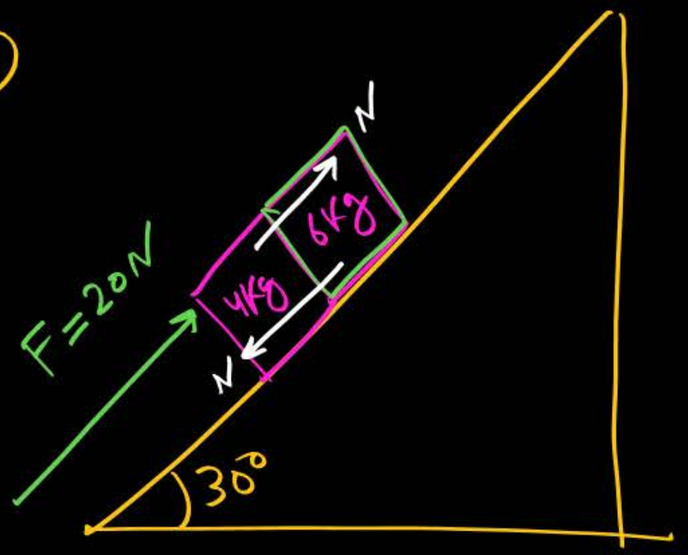
$= 5 \times 10 \times \frac{3}{5}$

$= 300$

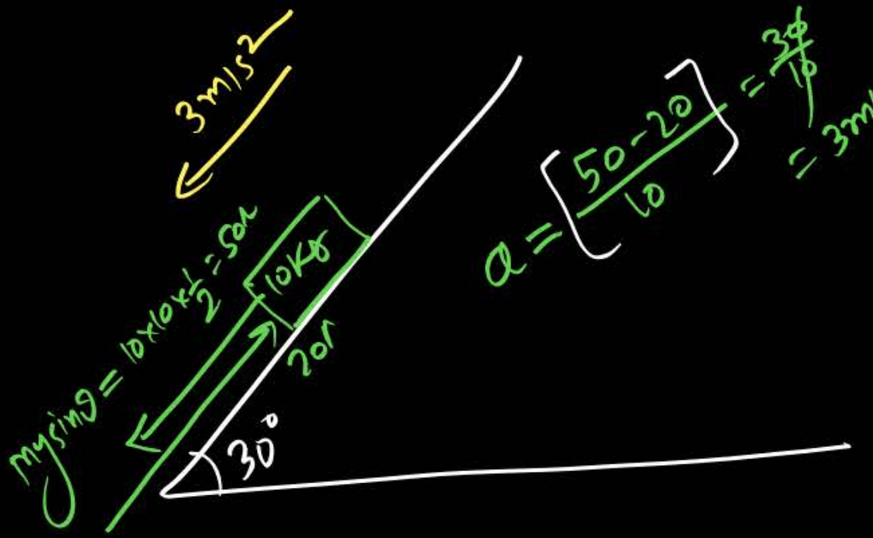
$$a(\text{down the Incline}) = \frac{300-10}{50}$$

$$= \frac{290}{50} = \frac{29}{5}\ m/s^2$$

(3)

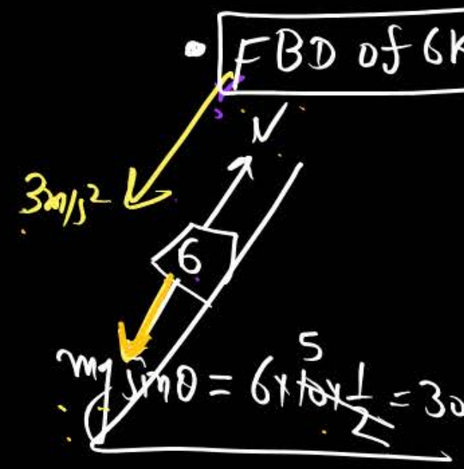


find normal force B/w 4Kg & 6Kg & acc^n of system:—



$$a = \left[\frac{50-20}{10}\right] = \frac{30}{10} = 3\,m/s^2$$

• FBD of 6Kg



$$30 - N = ma$$

$$30 - ma = N$$

$$30 - 6\times 3 = N$$

$$N = 30 - 18 = 12\ \text{New}$$

FBD of 4Kg

$$f_{nR} = 20 + N - 20$$

$$N = ma$$

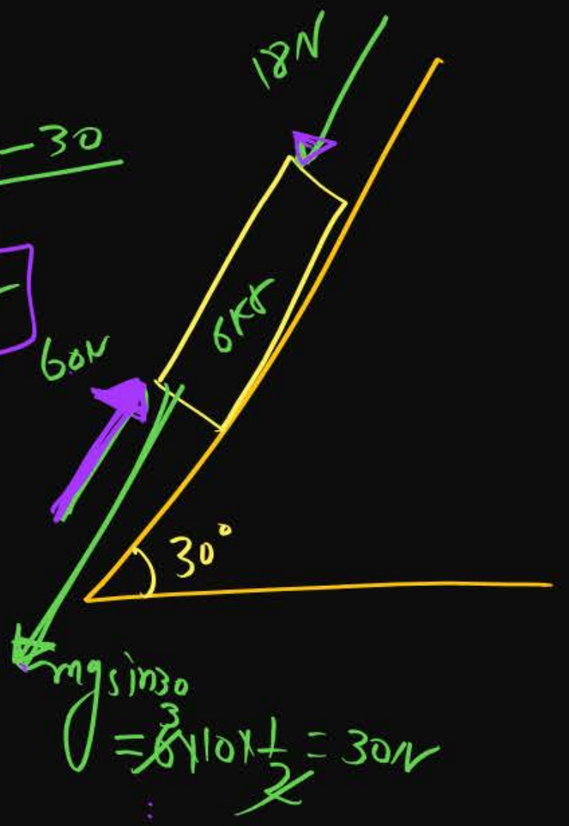
$$= 4\times 3 = 12N$$

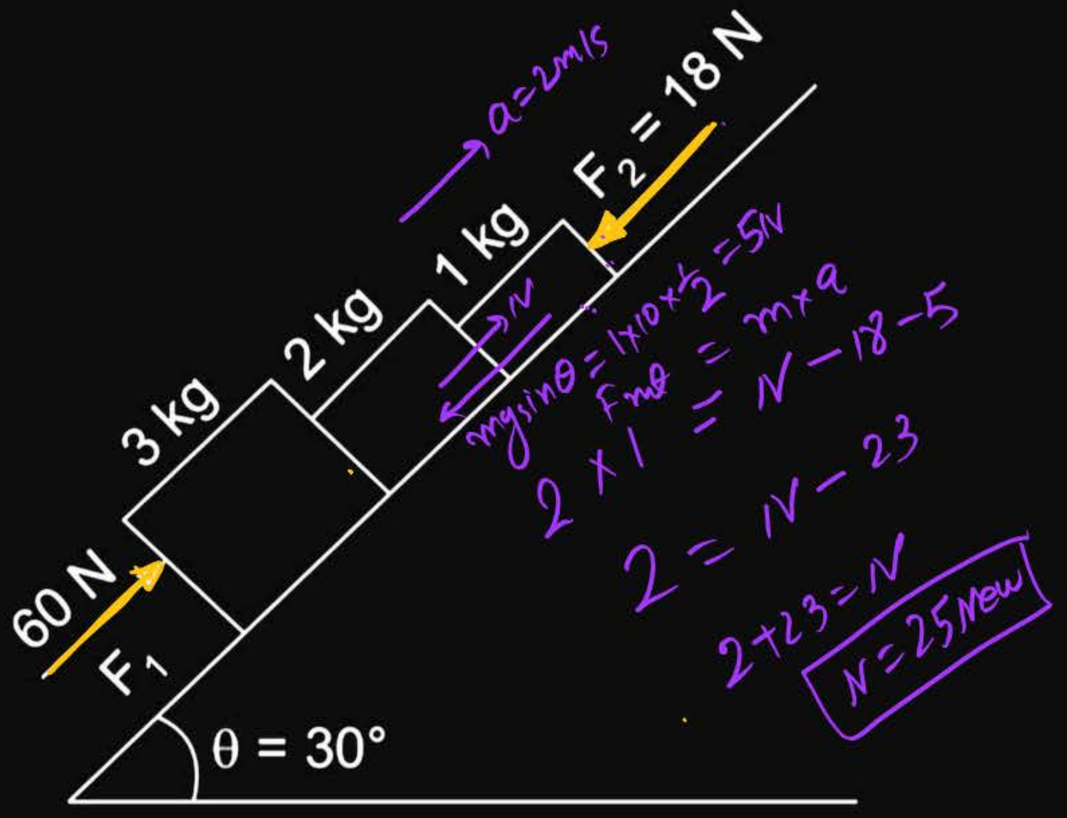
Question

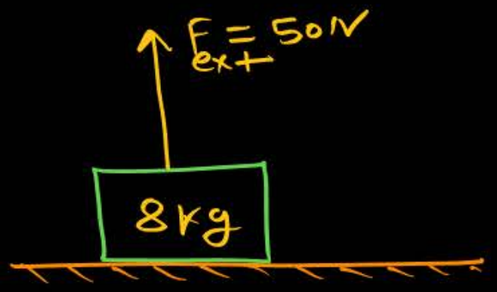
In the diagram shown, the normal reaction force between 2 kg and 1 kg is (Consider the surface, to be smooth): Given $g = 10\ ms^{-2}$

[2022 Pre]

1. 10 N
2. 25 N
3. 39 N
4. 6 N

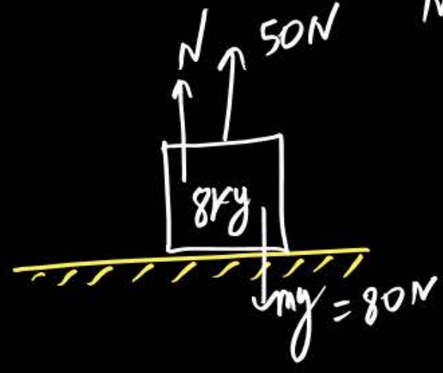




① 

find Normal force on 8kg by ground :— and accn of 8kg

Soln

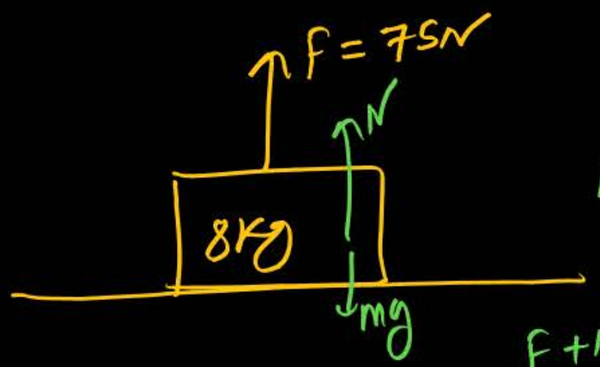


$N + 50 = 80$

$N = 80 - 50$

$= 30$ newton ✓

$a = 0$

② 

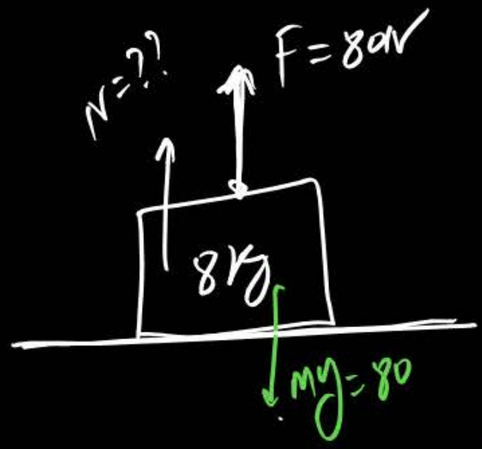
$N = ??$ on 8kg

$F + N = mg$

$N = 80 - 75$

$= 5N$

accn = 0

③ 

$N + F = mg$

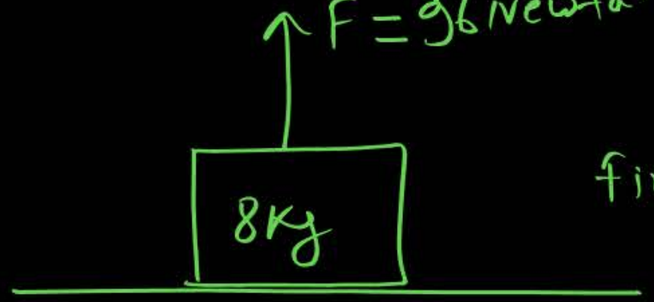
$N + 80 = 80$

Normal = 0 ✓

No Contact → Just about to lift

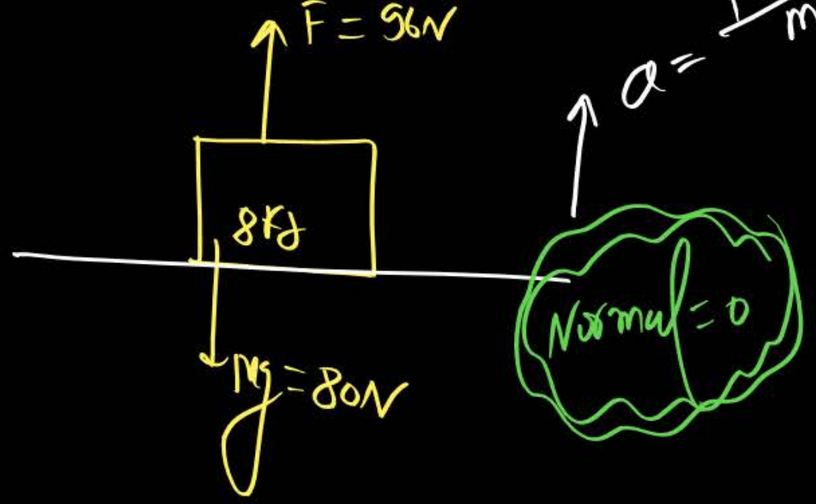
$a = 0$

(4)



find Normal & acc^{n} = ??

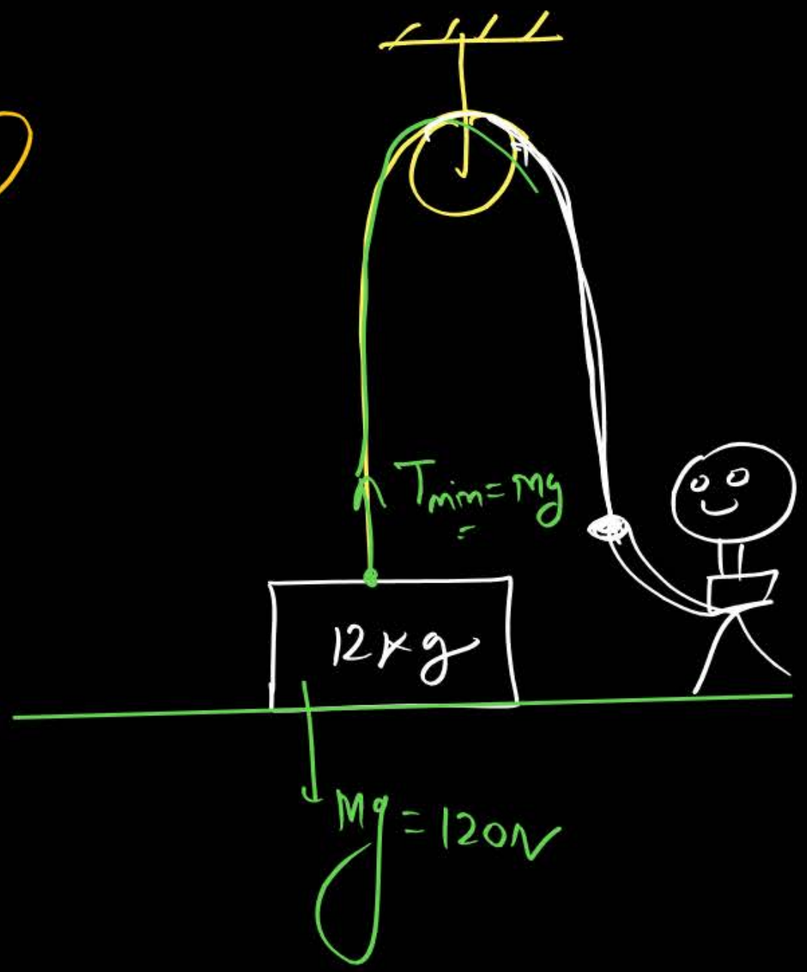
Sol^{n}



$$a = \frac{F - mg}{m} = \frac{96 - 80}{8}$$

$$= \frac{16}{8} = 2 m/s^2$$ ✓✓

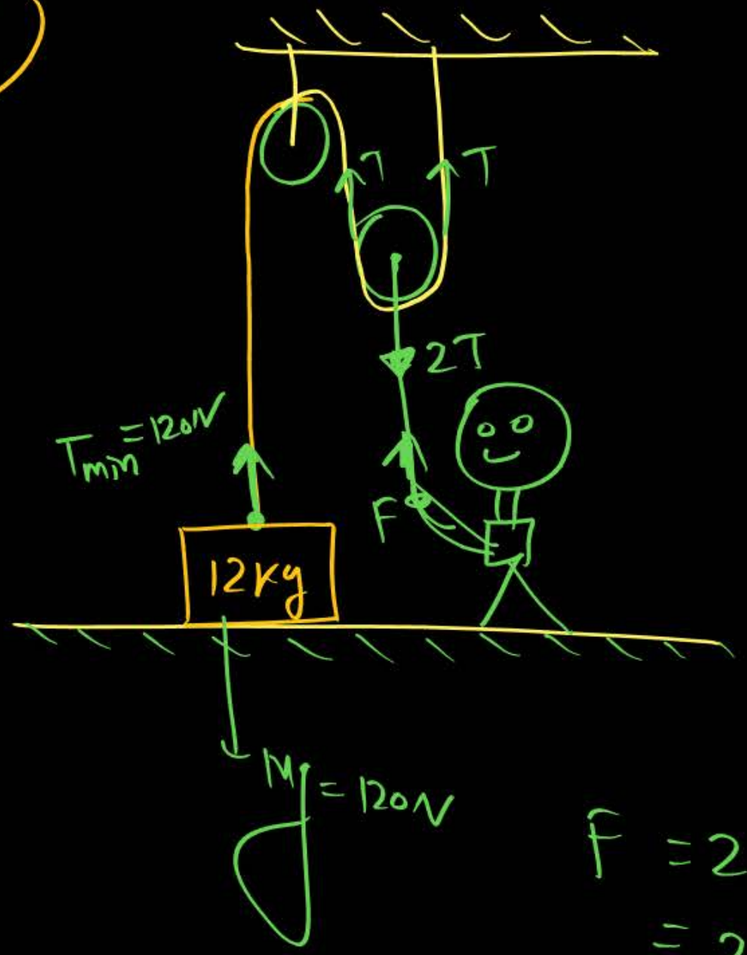
(5)



find minimum force applied by man on string so that block will just lift :—

$T_{minimum} = 120\,N$

6



$F = 2T$

$= 2(120)$

$= 240$ Newton

find f_{min} applied by man to lift the block ??

Mr* Boy
Jis Block ko just lift karne ke liye N=0 (T = mg) Tension wish string ka jis se Block Connected hai

Question

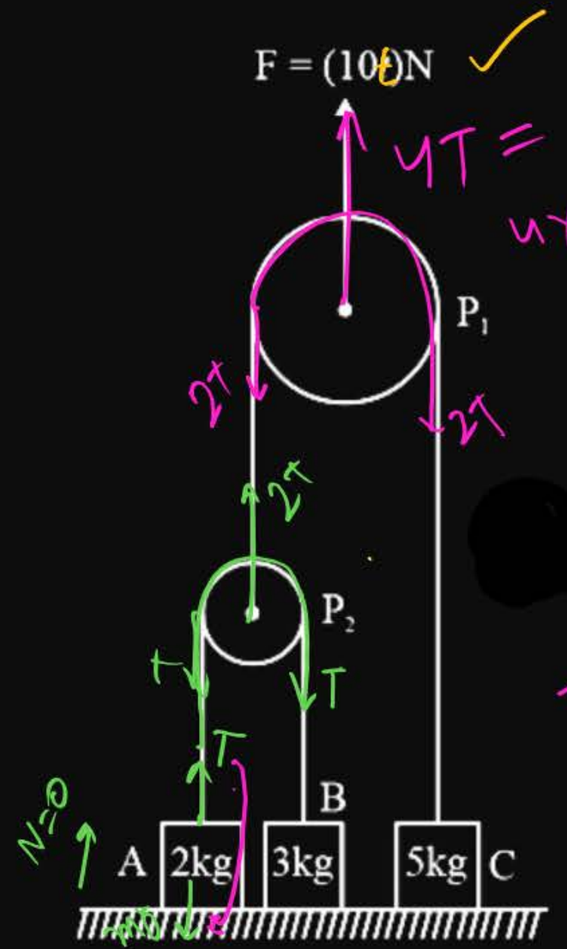
7

A force $F = (10t)N$ is applied on pulley P_1 as shown in the figure, where t is time in seconds. Find the time when block A loses contact with floor. [Assume pulleys and strings to be massless]

(a) 10 sec

(b) 8 sec

(c) 4 sec



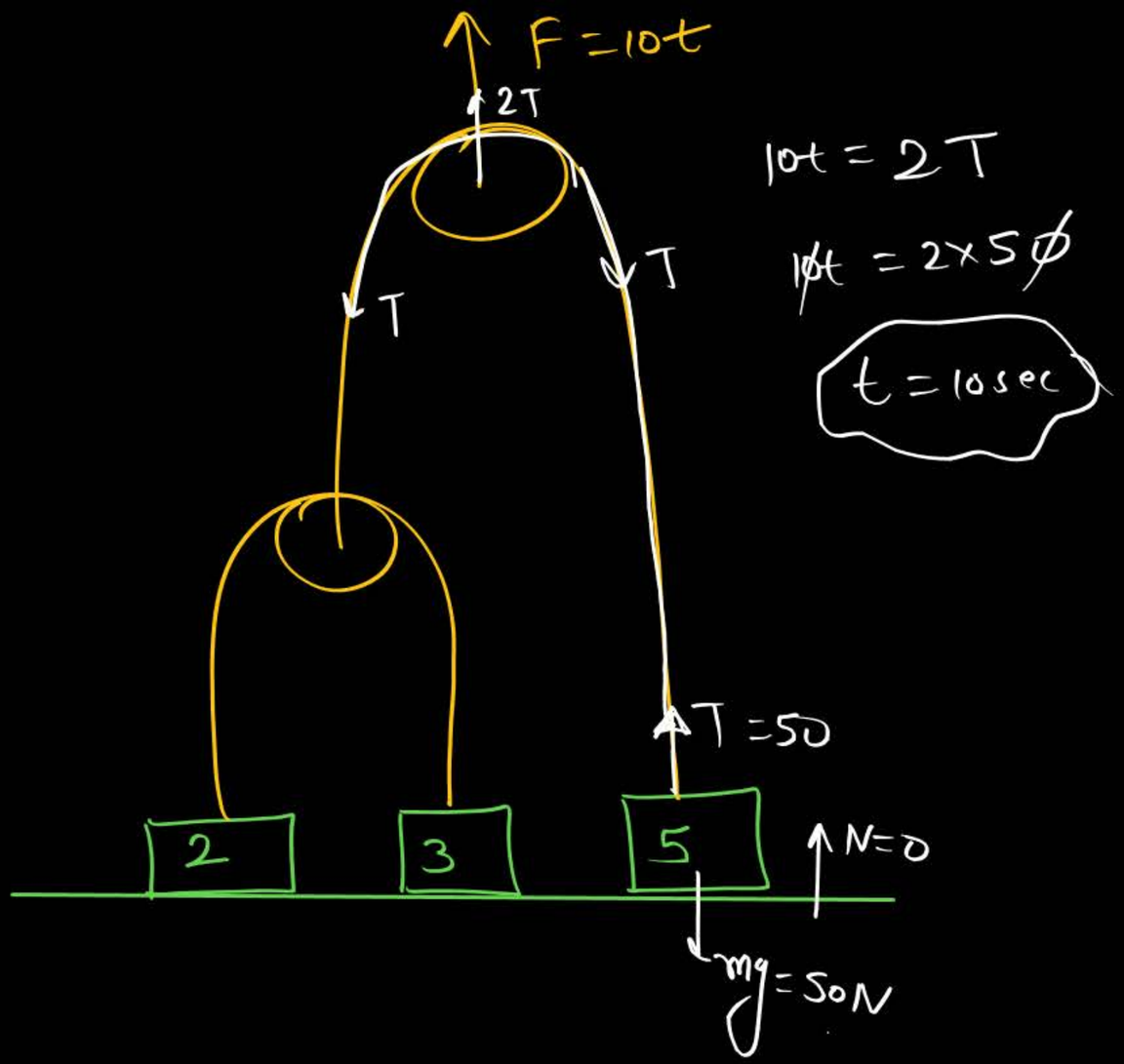
4T = 10t

4 × 2ϕ = 10t

t = 8 sec

T = mg = 2 × 10 = 20

(8)



$10t = 2T$

$10t = 2 \times 50$

$t = 10\,sec$

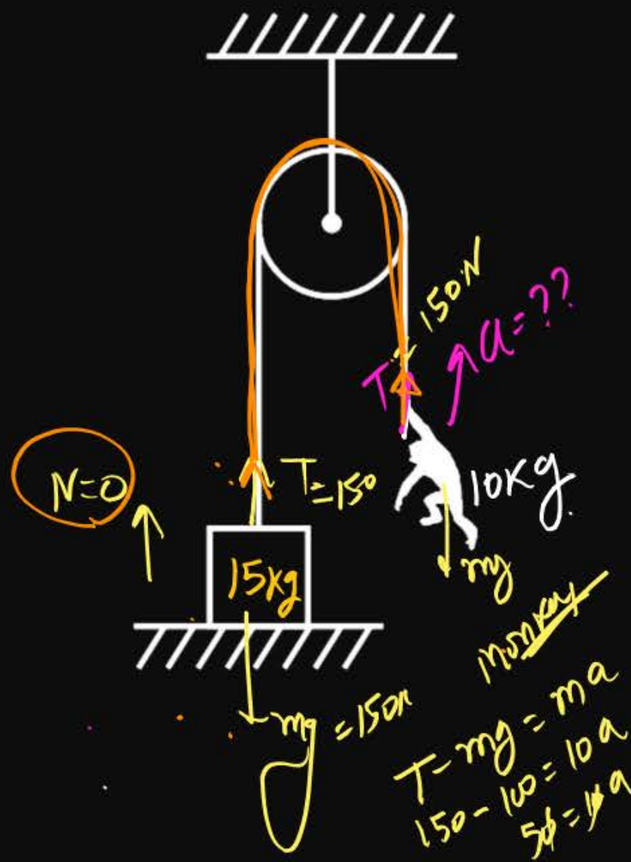
(a) find time when 5 kg will lift ??

Question

(9)

A monkey weighing 10 kg is climbing up a light rope which passes over an ideal pulley. The other end of the rope is attached a 15 kg mass as shown in the figure. In order to raise the 15 kg mass of the ground the monkey should climb up

1. with constant acceleration $g/3$.
2. with an acceleration greater than $g/2$
3. with an acceleration equal to $g/4$
4. It is not possible because weight of monkey is lesser than the block.

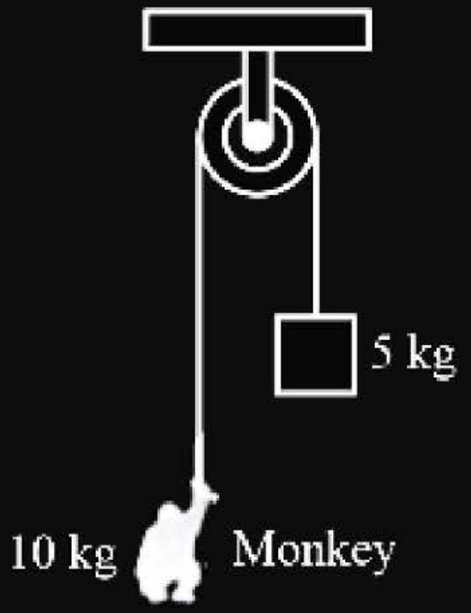


Question

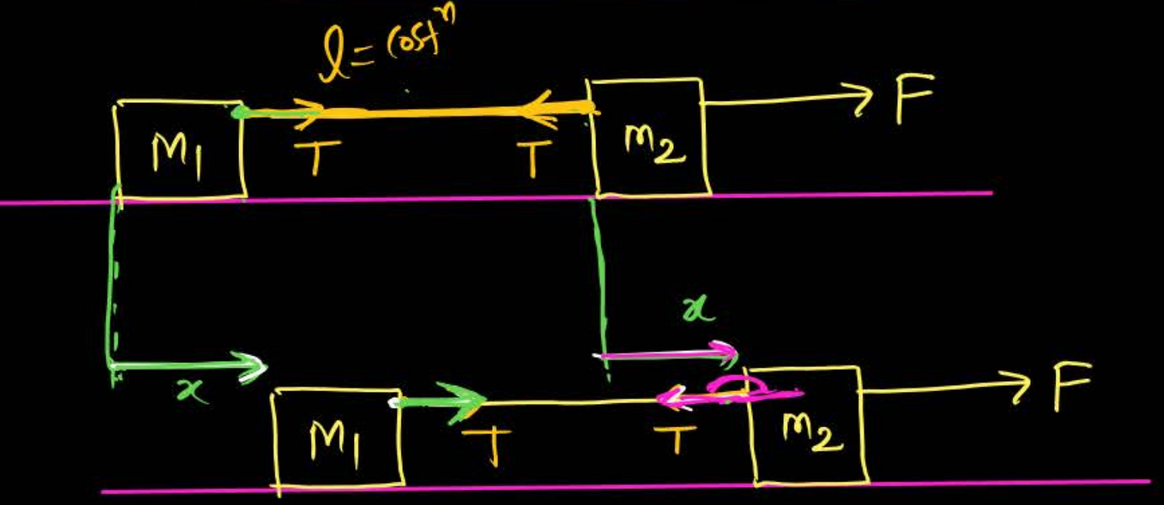
H/W challenge नहीं हो कोई Problem next class

In the figure shown acceleration of monkey relative to the rope if the exerts a force of 80 N on string will be:

1. 2 m/s^2 downwards
2. 4 m/s^2 upwards
3. 4 m/s^2 downwards
4. 8 m/s^2 downwards



Constrain Motion



done by Tension force on system:-

$W = T x \cos 0^\circ + T x \cos 180^\circ$

$W = Tx - Tx = 0$

Work done by Tension force or internal force is zero on system

$\text{work} = \vec{F} \cdot \vec{s}$

$= FS\cos\theta$

Angle b/w Force & disp^m

$W_{\text{Total work by Tension}} = 0$

$\vec{T_1} \cdot \vec{x_1} + \vec{T_2} \cdot \vec{x_2} + \vec{T_3} \cdot \vec{x_3} + \vec{T_4} \cdot \vec{x_4} + \dots = 0$

diff^n w.r.t. time :-

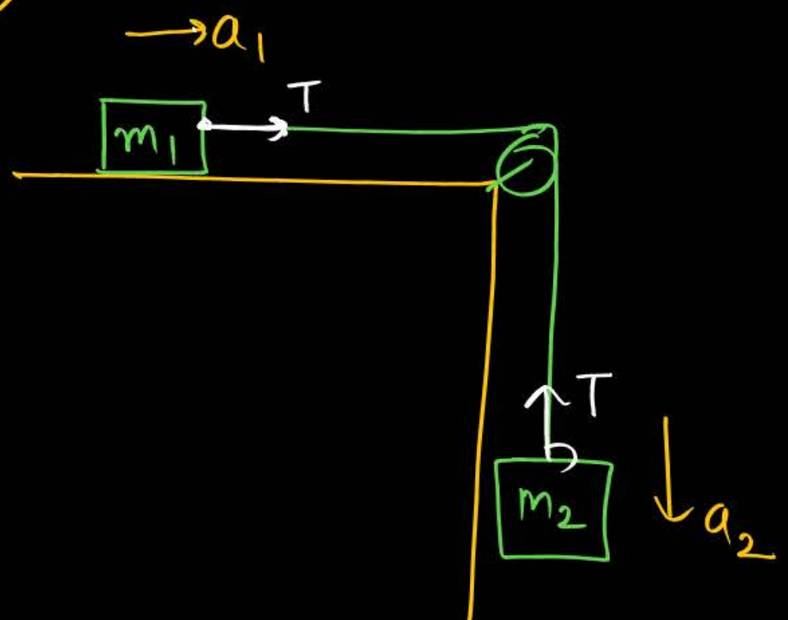
$\vec{T_1} \cdot \vec{v_1} + \vec{T_2} \cdot \vec{v_2} + \vec{T_3} \cdot \vec{v_3} + \dots = 0$

diff^n w.r.t. time

$\vec{T_1} \cdot \vec{a_1} + \vec{T_2} \cdot \vec{a_2} + \vec{T_3} \cdot \vec{a_3} + \dots = 0$

find Rel^n b/w $\vec{a_1}$ & $\vec{a_2}$

(1)



$$T_1 a_1 + T_2 a_2 = 0$$

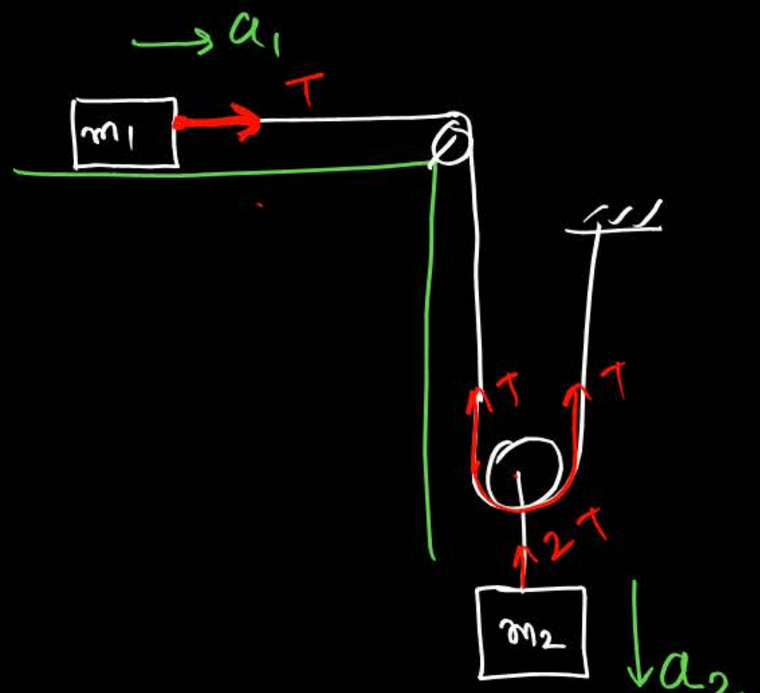
$$T a_1 \cos 0^\circ + T a_2 \cos 180^\circ = 0$$

$$T a_1 - T a_2 = 0$$

$$T a_1 = T a_2$$

$$\boxed{a_1 = a_2}$$

(2)



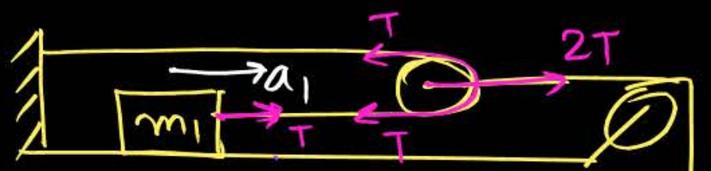
$$T a_1 - 2T a_2 = 0$$

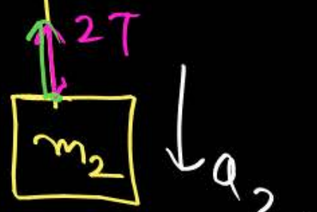
$$T a_1 = 2T a_2$$

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

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

(3)



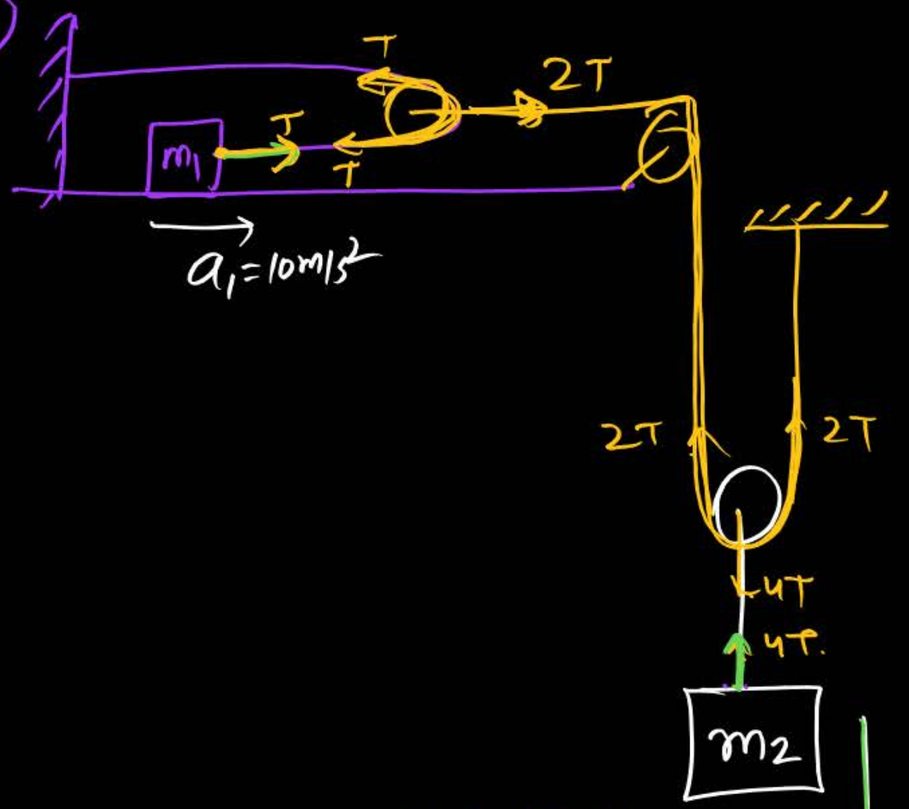


$$Ta_1 - 2Ta_2 = 0$$

$$\cancel{T}a_1 = 2\cancel{T}a_2$$

(#) $\boxed{a_1 = 2a_2}$

(4)



$$Ta_1 - 4Ta_2 = 0$$

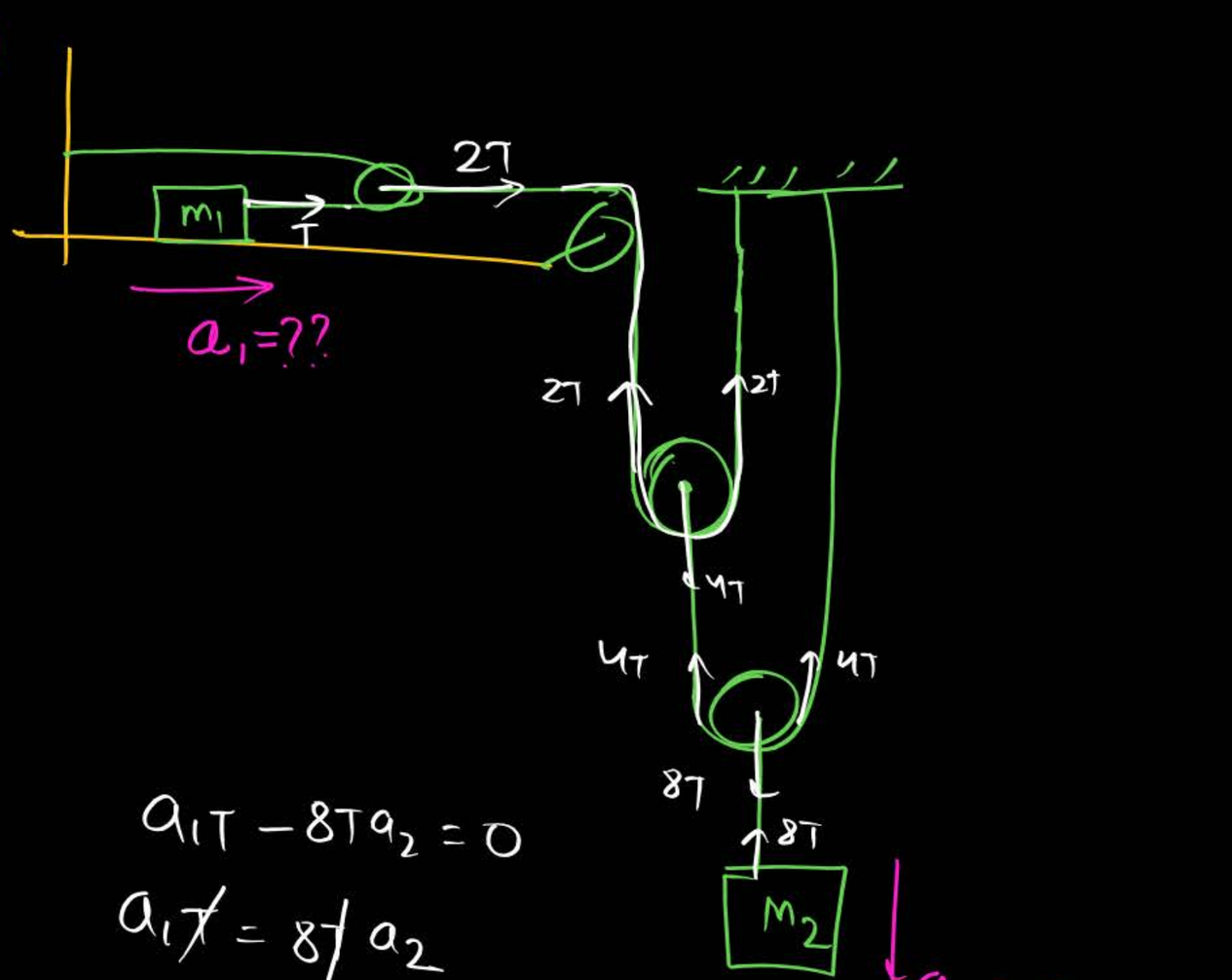
$$\cancel{T}a_1 = 4\cancel{T}a_2$$

$a_2 = ??$

$$a_1 = 4a_2$$

$$a_2 = \frac{a_1}{4} = \frac{10}{4} = 2.5\ m/s^2$$

(5)



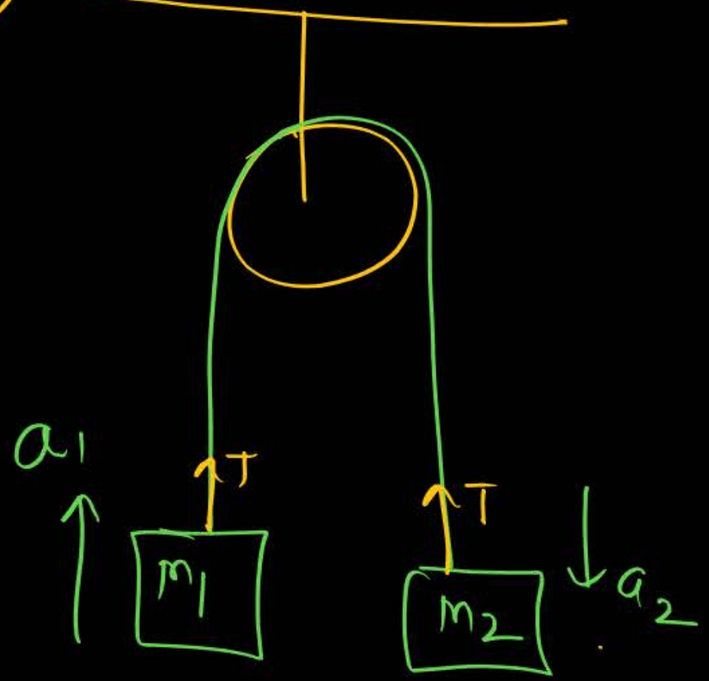
$a_1 T - 8T a_2 = 0$

$a_1 T = 8T a_2$

$a_1 = 8 \times 5$

$= 40 m/s^2$.

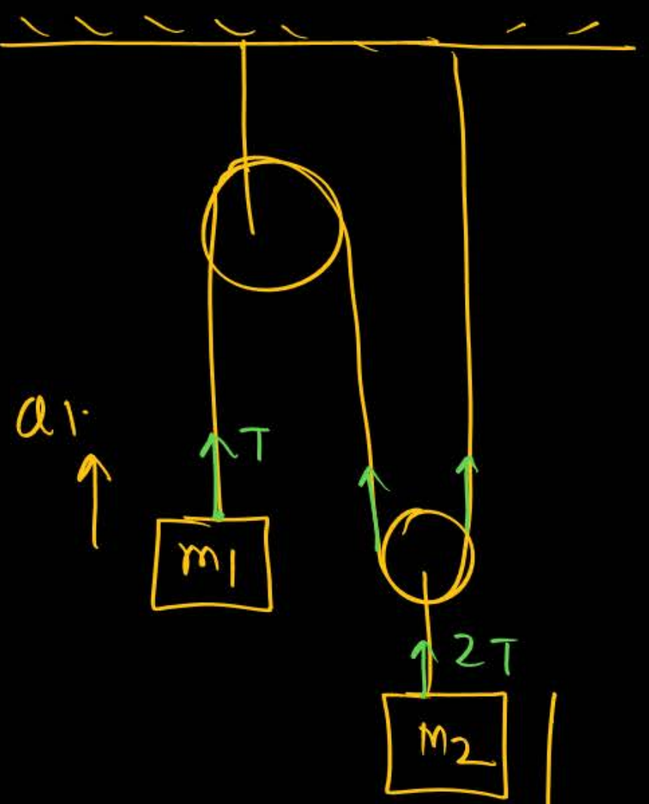
(6)



$$a_1 T - a_2 T = 0$$

$$\boxed{a_1 = a_2}$$

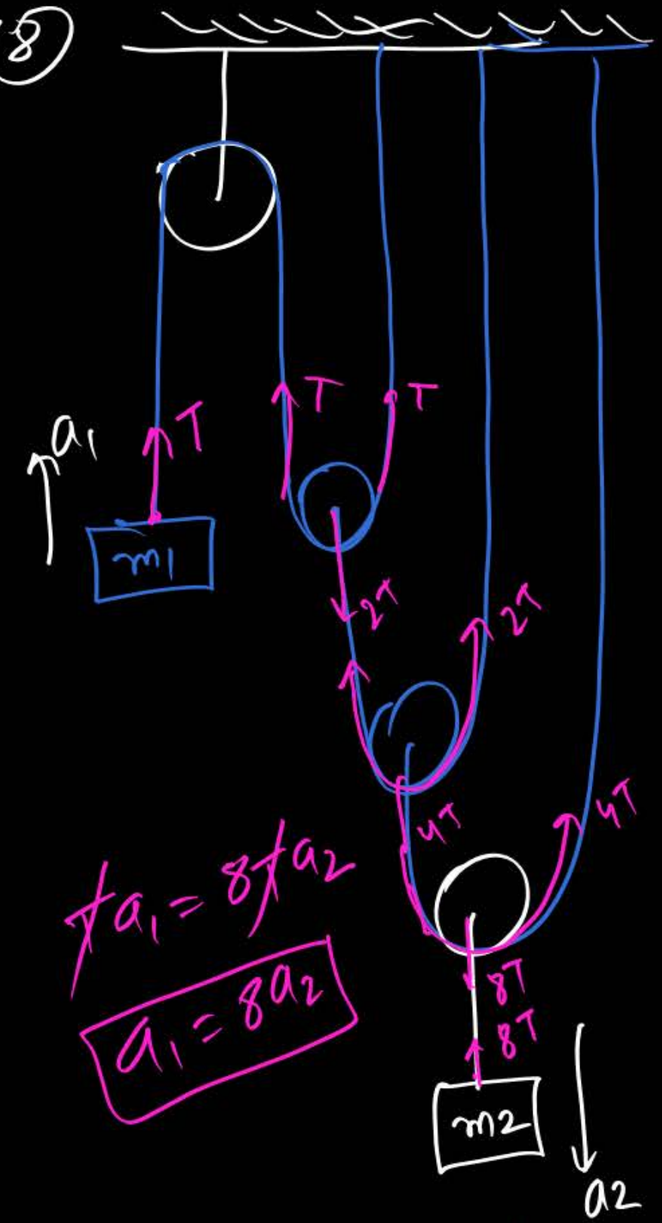
(7)



$$a_1 T = 2T a_2$$

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

(8)

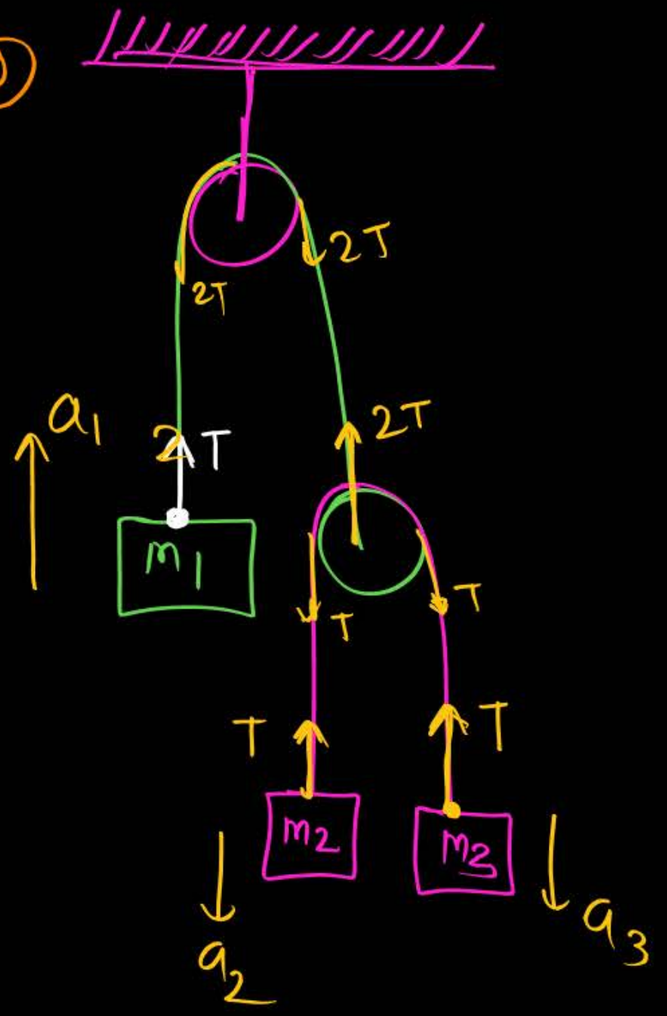


$$8T a_1 = 8T a_2$$

$$\boxed{a_1 = 8a_2}$$

find Relⁿ B/w a_1, a_2 & a_3 ??

(9)

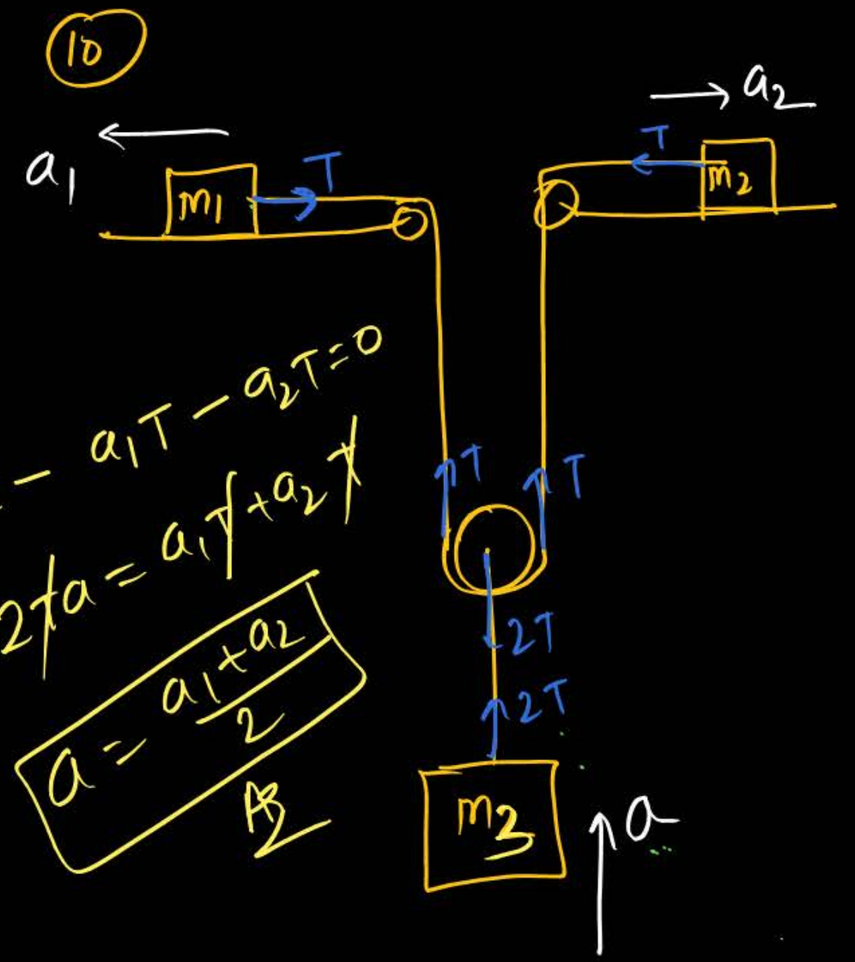


$$2Ta_1 - Ta_2 - Ta_3 = 0$$

$$2Ta_1 = Ta_2 + Ta_3$$

$$\boxed{a_1 = \frac{a_2 + a_3}{2}} \quad *$$

(10)



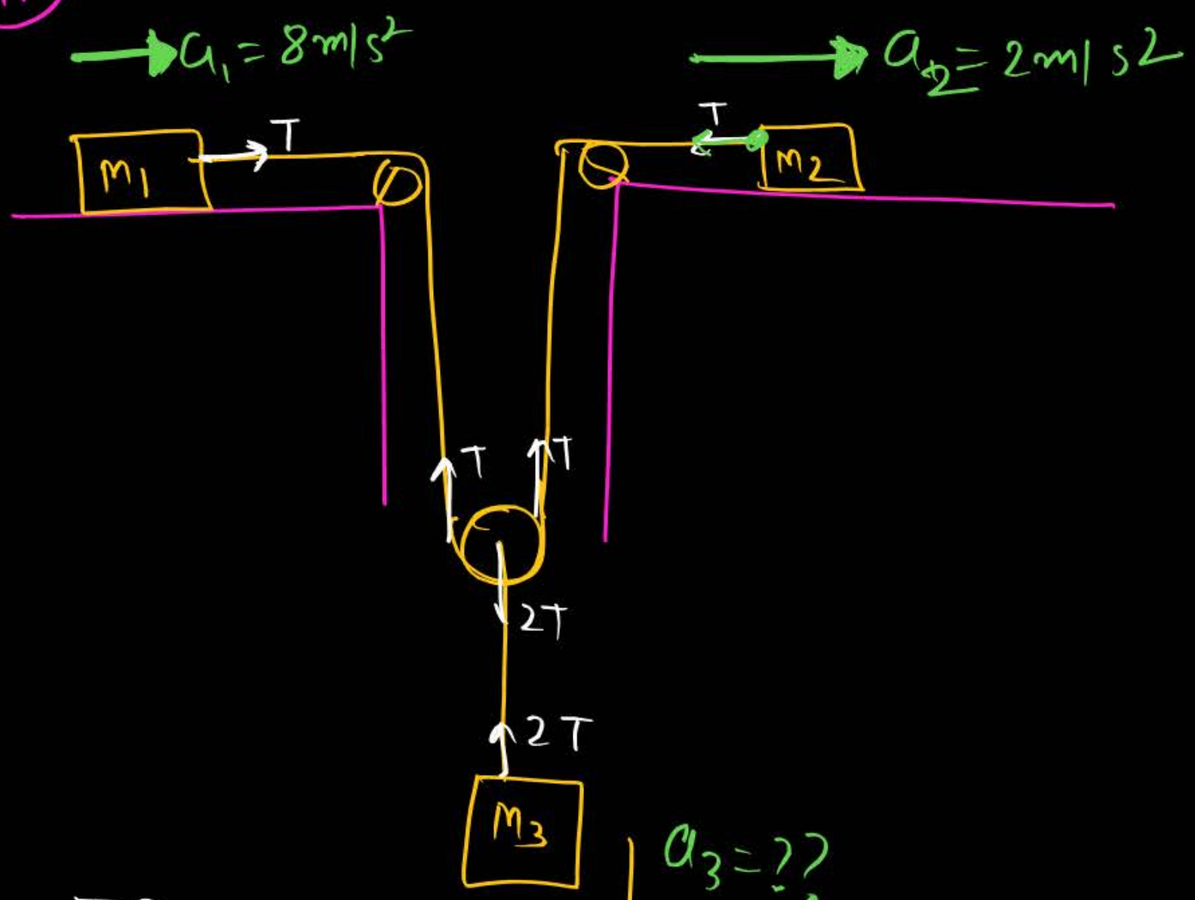
$$2Ta - a_1T - a_2T = 0$$

$$2Ta = a_1T + a_2T$$

$$\boxed{a = \frac{a_1 + a_2}{2}}$$

AP

(11)



$T8 - T\times2 - 2Ta_3 = 0$

$T(8-2) = 2Ta_3$

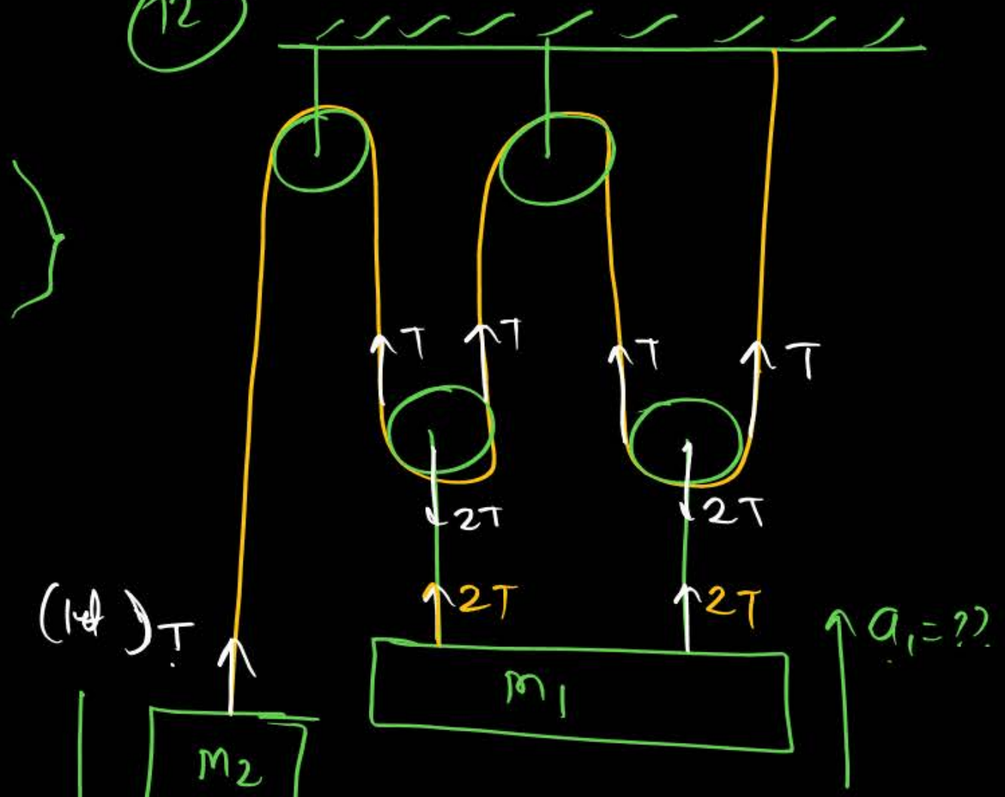
$\frac{6}{2} = a_3$

$\boxed{a_3 = 3\,m/s^2}$

$acc^n = 5\,m/s^2$ ye scam hai

$\boxed{a_3 = 3\,m/s^2}$

(12)

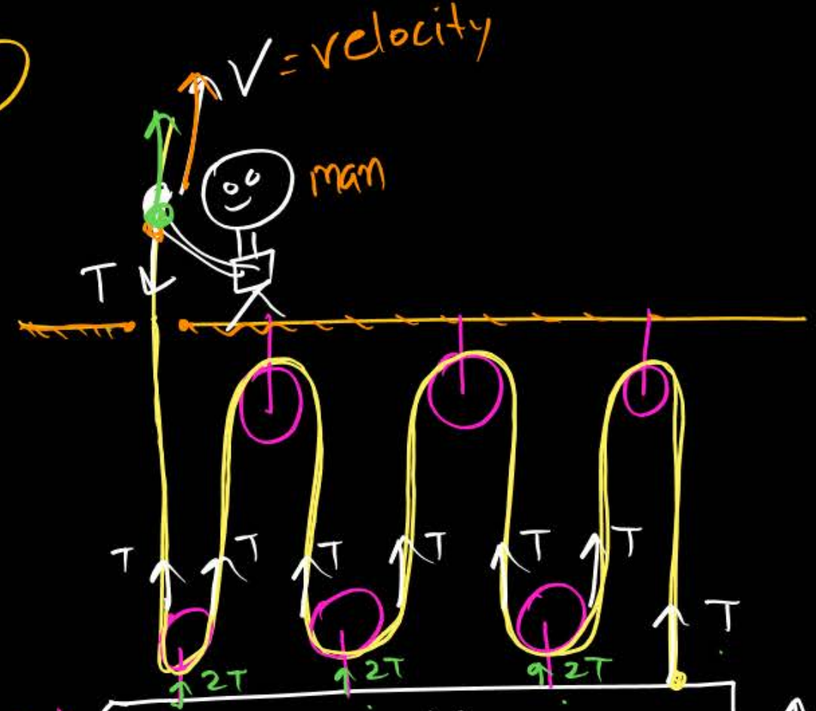


$$4Ta_1 - 4T = 0$$

$$4Ta_1 = 4T$$

$$a_1 = 1\ m/s^2$$

(13)



$$M.A = \frac{(\text{Resulting force})_{plank}}{(\text{Applied force})_{man}}$$

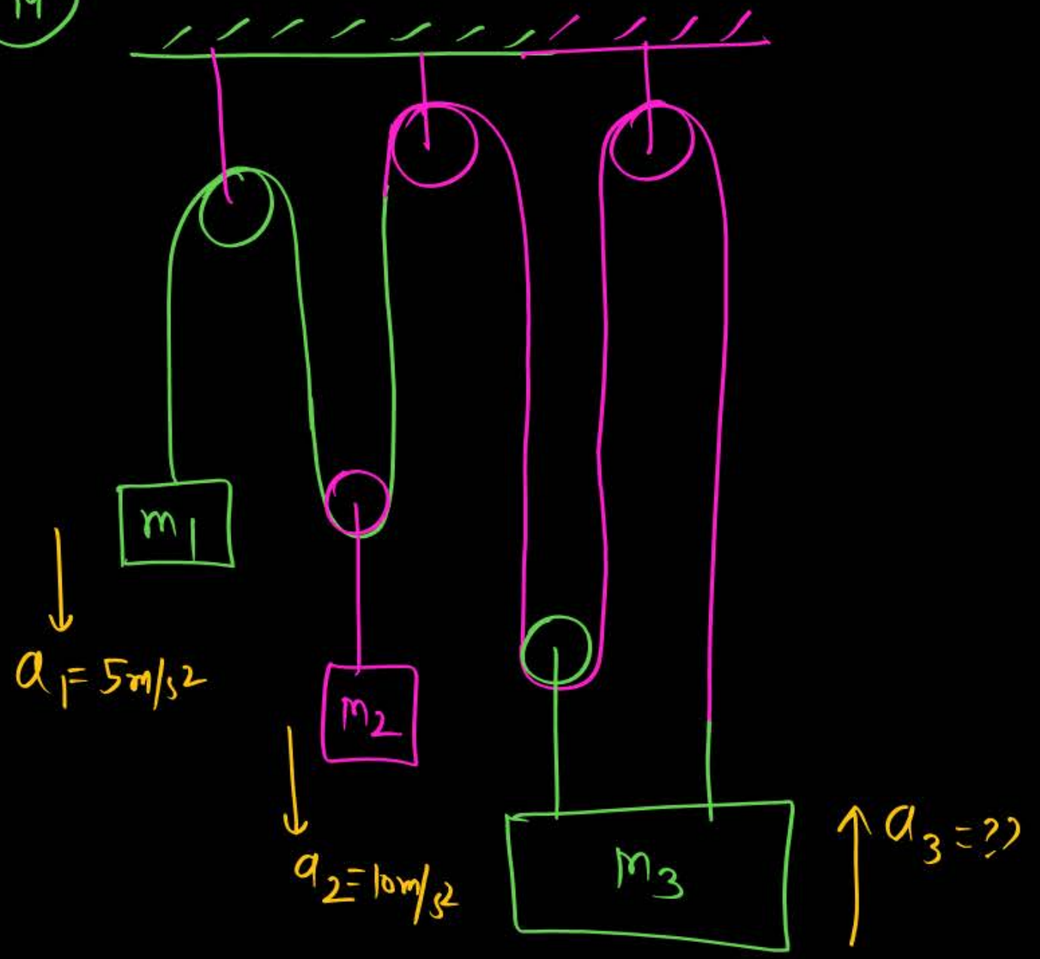
Mechanical Advantage $= \frac{7T}{T}$

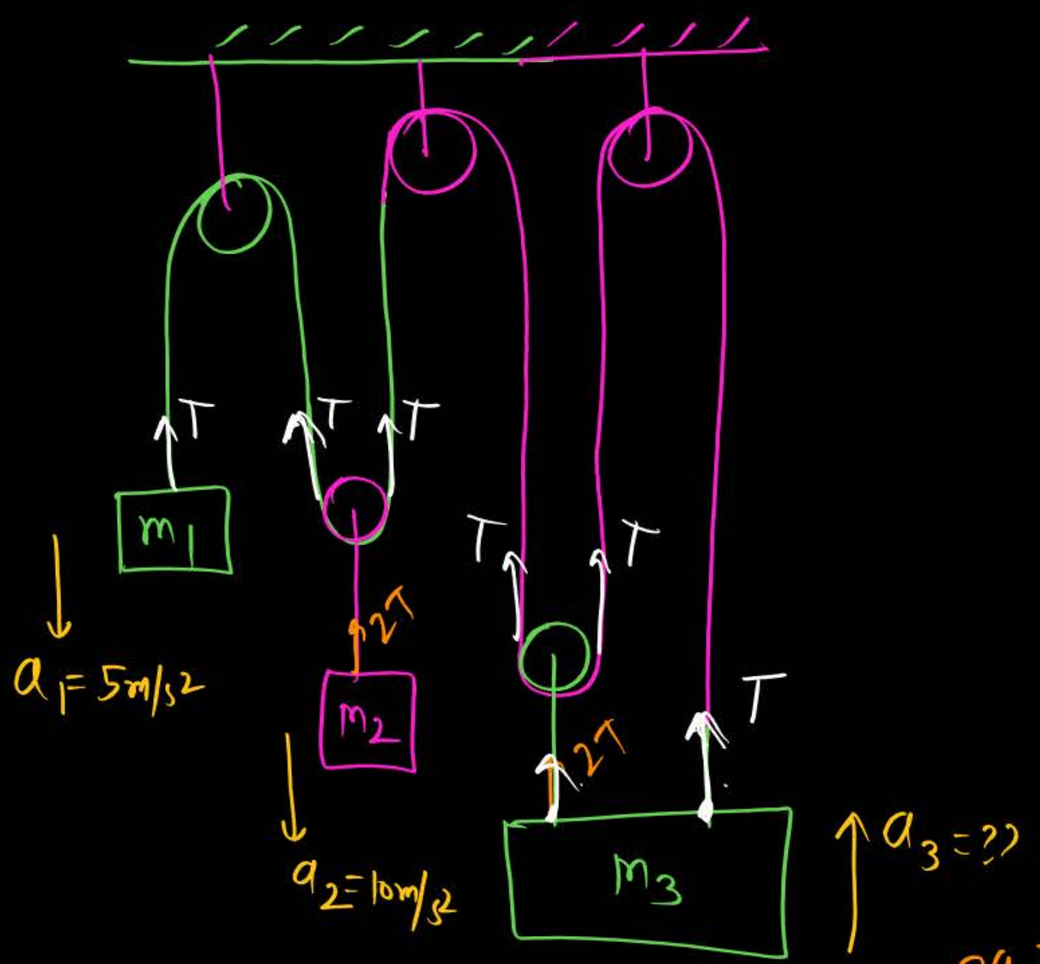
$M.A = 7$

$7T \quad V_p = V\ T$

$V_p = V/7$

(14)





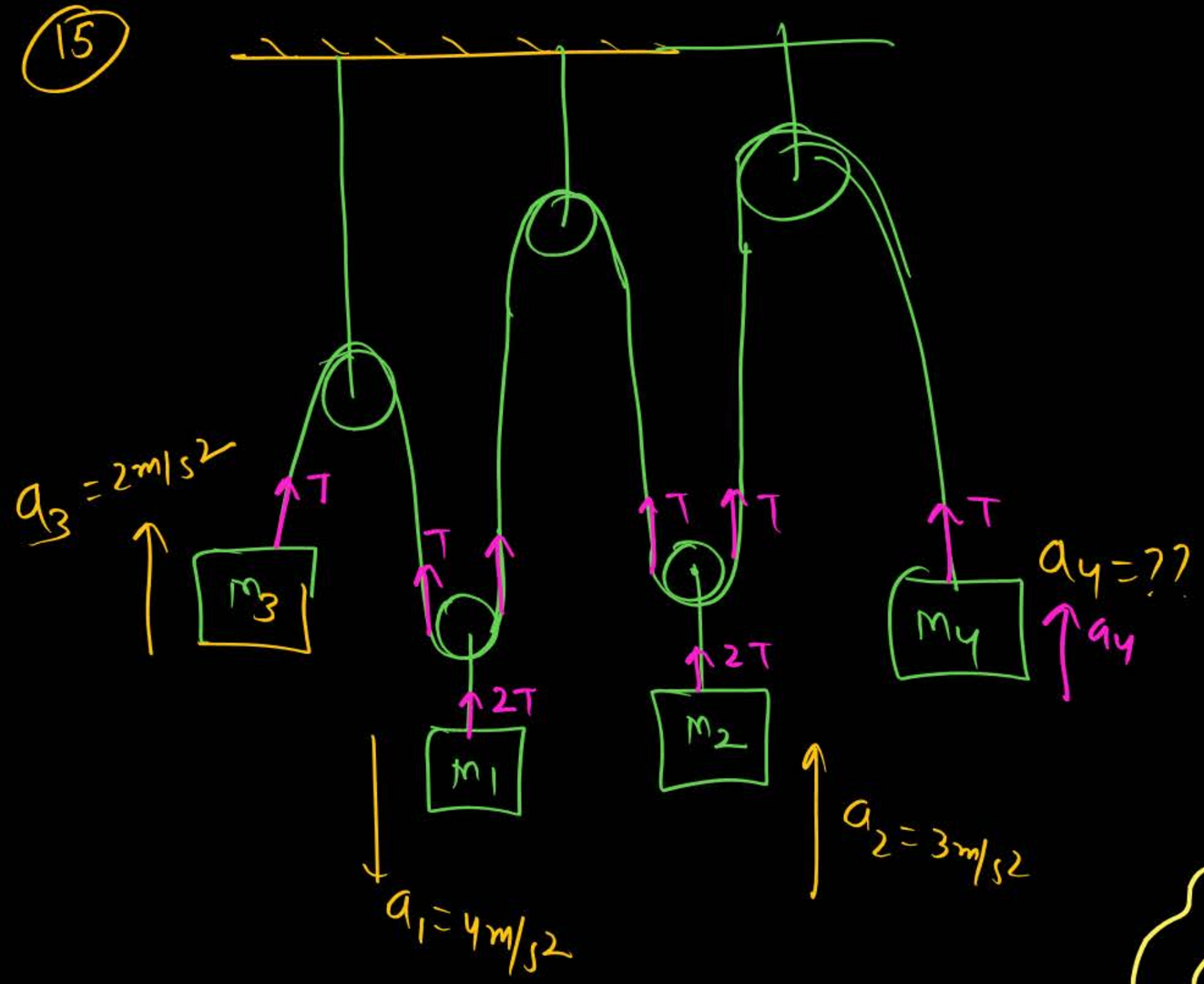
$3T\,a_3 - 2T a_2 - T a_1 = 0$

$3T a_3 = 2T a_2 + T a_1$

$3a_3 = 20 + 5$

$a_3 = \frac{25}{3}\ m/s^2$

15



find $a_4 = ??$

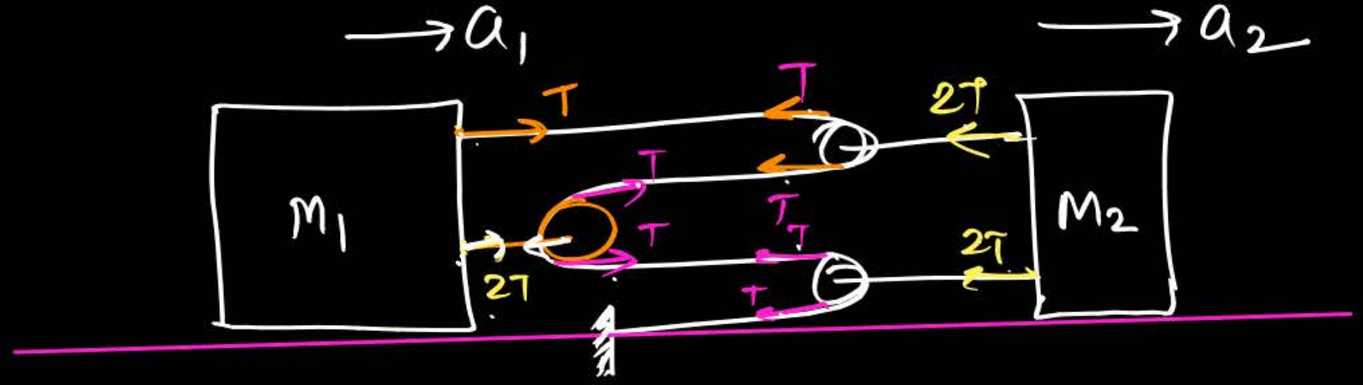
$2T - 2T \times 4 + 2T \times 3 + T a_4 = 0$

$2 - 8 + 6 + a_4 = 0$

$a_4 = 0$

(16) IIT.

find Rel^n B/w a_1 & a_2.



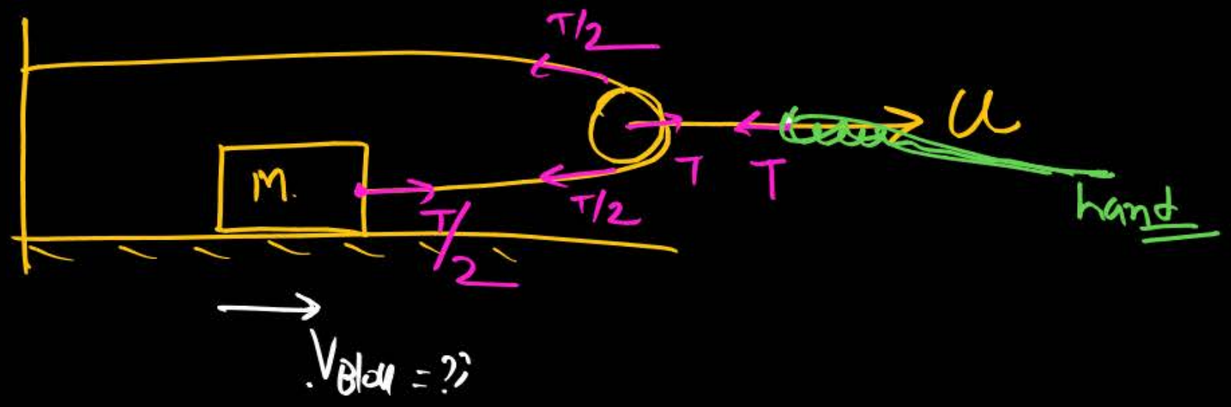
$3 \not| a_1 = 4 \not| a_2$

$$\boxed{3a_1 = 4a_2} \quad A_1$$

$$a_1 = \frac{4}{3} a_2$$

(17)

Velocity of Block ??

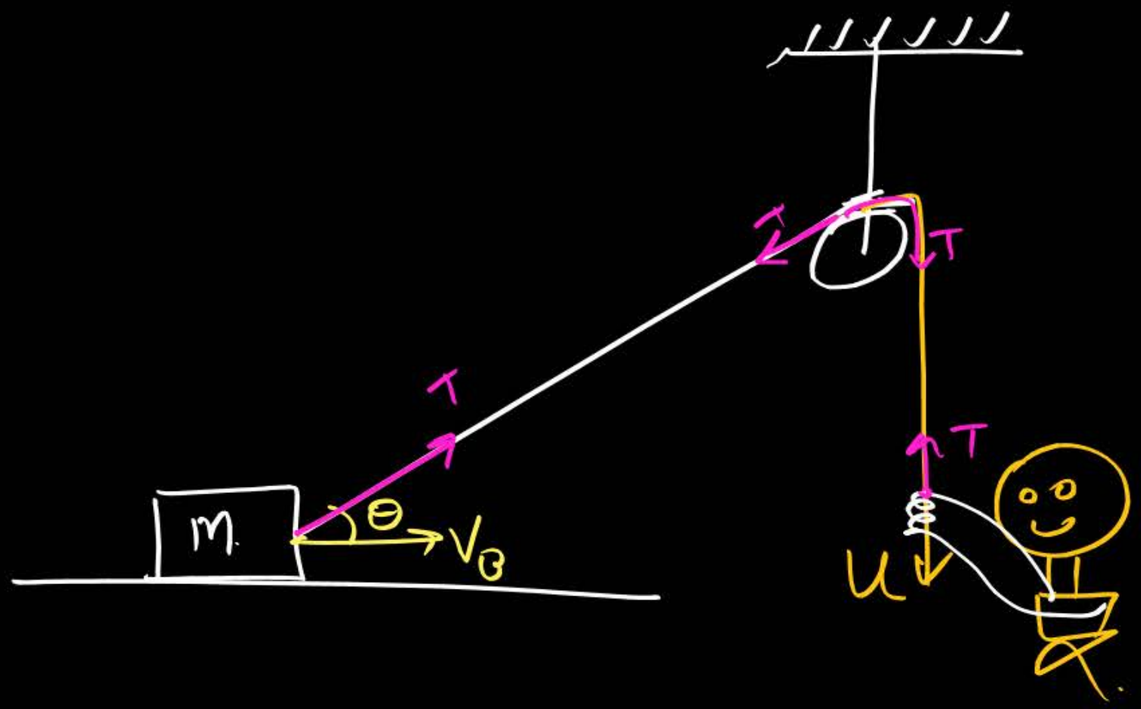


$$\frac{T}{2} V_B = T u$$

$$\boxed{V_B = 2u}$$

V_B = Velocity of Block

(18)



find velocity of Block ??

$$T V_B \cos\theta - T u = 0$$

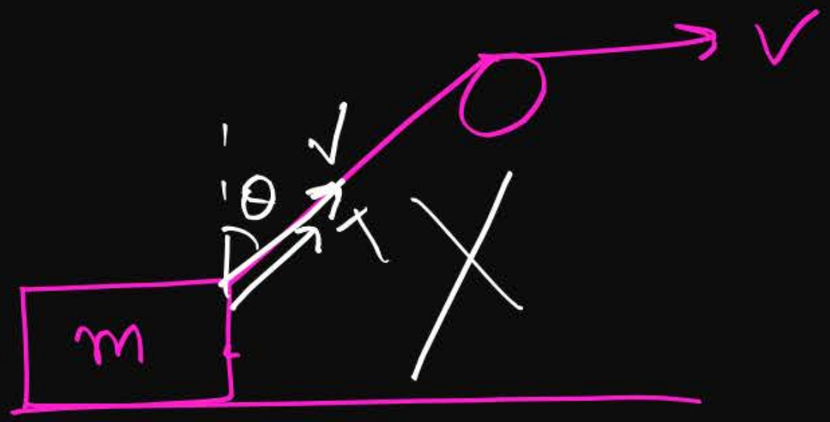
$$V_B \cos\theta = u$$

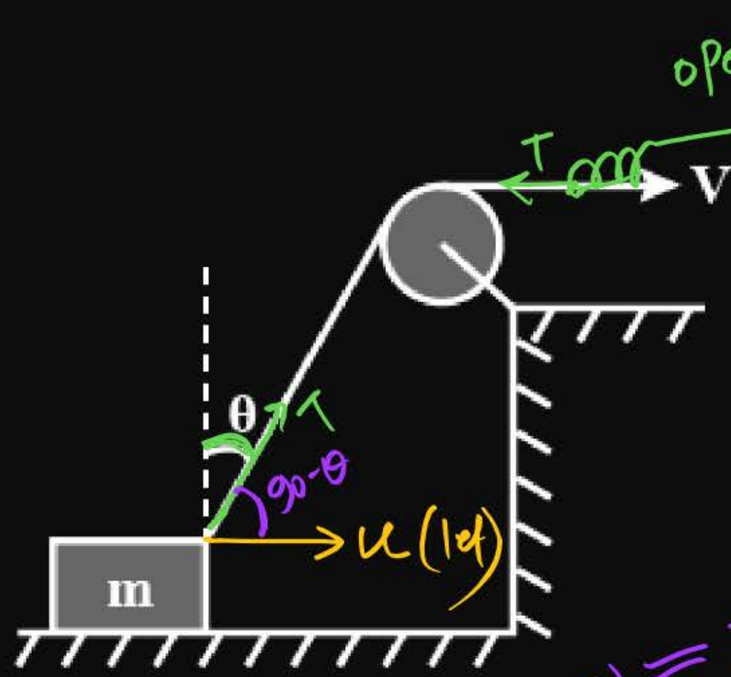
$$V_B = \frac{u}{\cos\theta} = u \sec\theta$$

Question 19

A block is dragged on smooth plane with the help of a rope which moves with velocity v. The horizontal velocity of the block is :

1. v
2. $\frac{v}{\sin\theta}$
3. $v\sin\theta$
4. $\frac{v}{\cos\theta}$





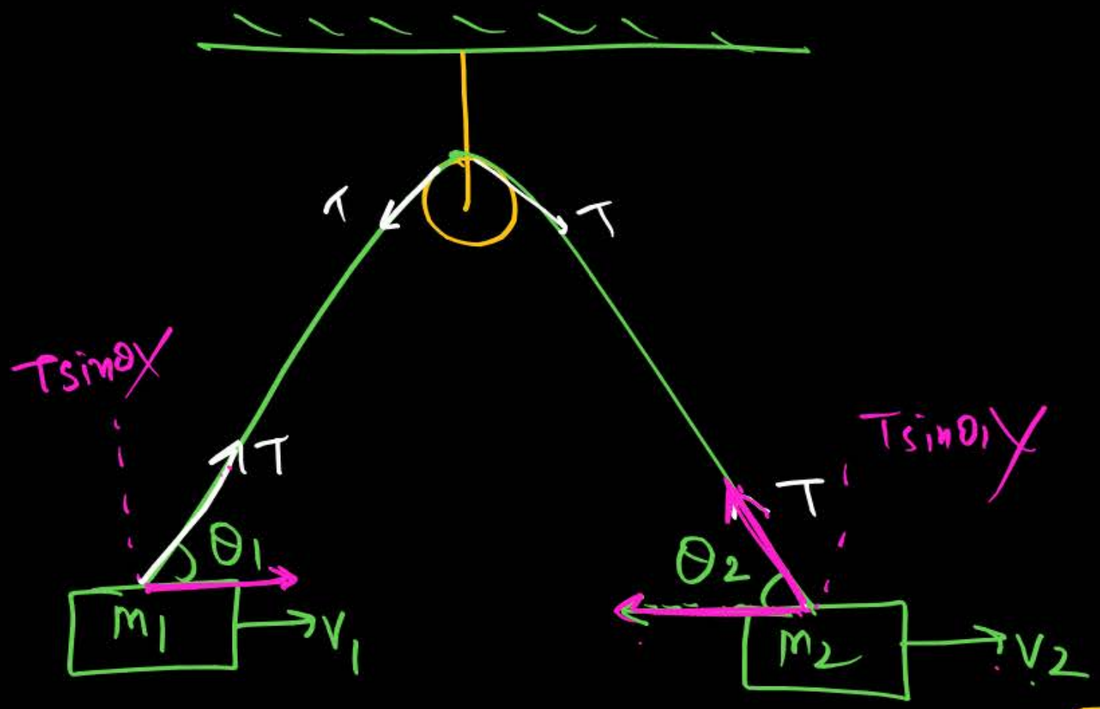
$T u\cos(90-\theta) = TV$

$u\sin\theta = V$

$u = \frac{V}{\sin\theta}$

(20)

at this instant find rel^n B/w V_1 & V_2.

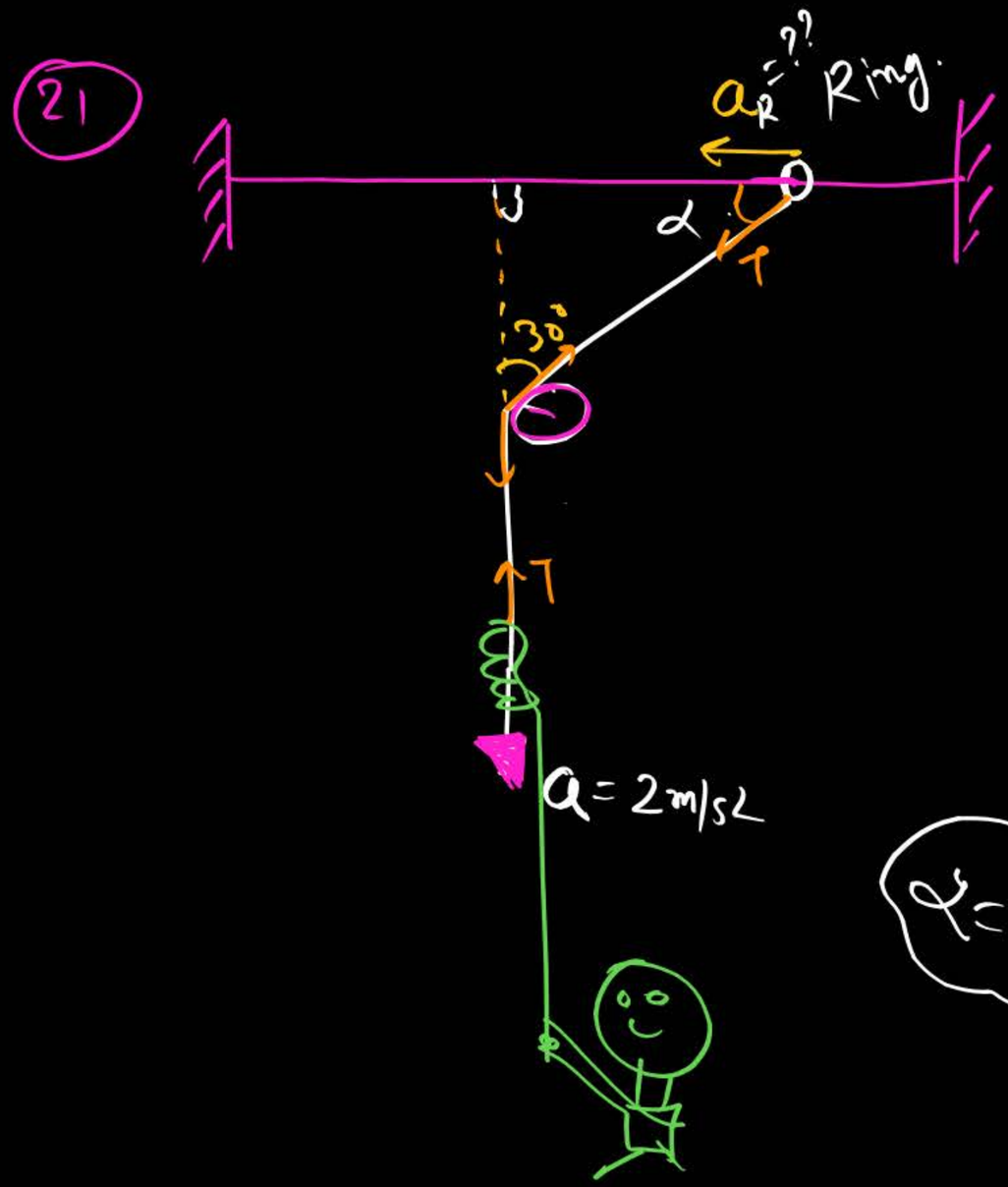


$V_1 \cancel{T} \cos\theta_1 = \cancel{T} \cos\theta_2 V_2$

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

$$\frac{V_1}{V_2} = \frac{\cos\theta_2}{\cos\theta_1}$$

Find acc^n of Rig..



$\theta = 60$

$2 \times T = T \cos 60 \times a_R$

$2 = \frac{1}{2} a_R$

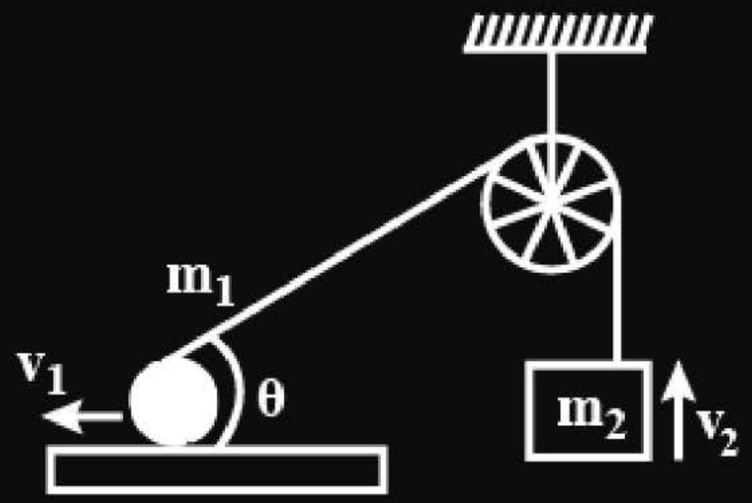
$a_R = 4 m/s^2$

Q

Question 22

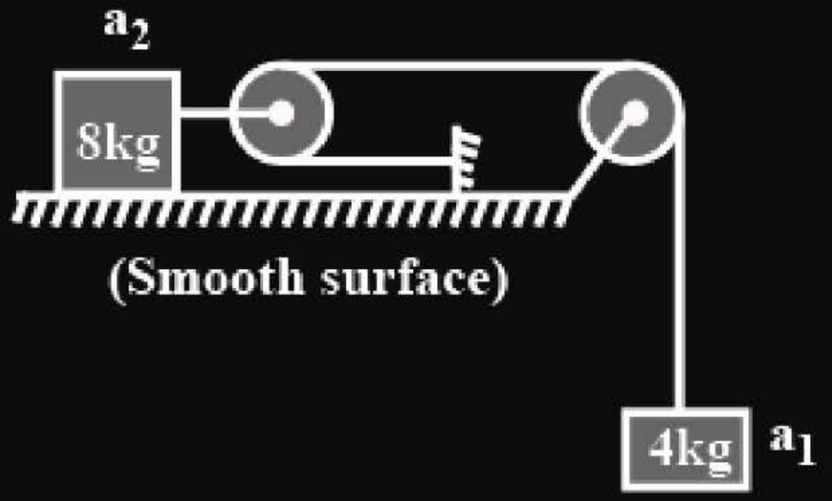
In figure, a ball of mass m_1 and a block of mass m_2 are joined together with an inextensible string. The ball can slide on a smooth horizontal surface. If v_1 and v_2 are the respective speeds of the ball and the block, Find $\frac{v_1}{v_2}$.

1. $\cos\theta$
2. $\sec\theta$
3. $\tan\theta$
4. $\sin\theta$



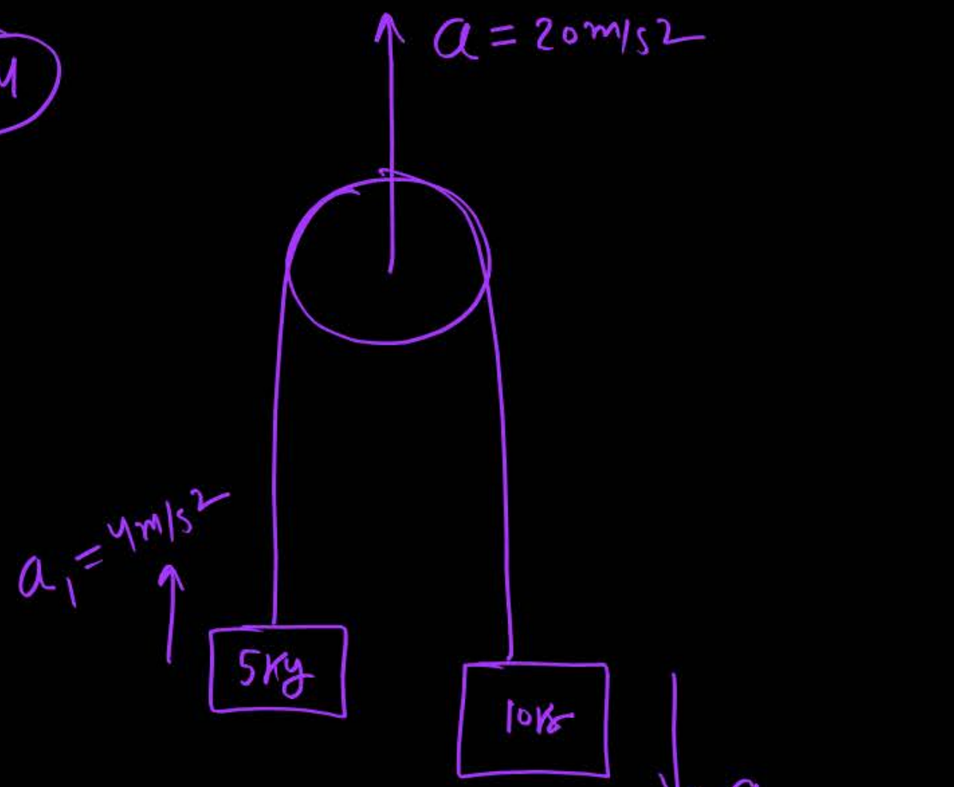
Question 23

If pulleys shown in the diagram are smooth and massless and a_1 and a_2 are acceleration of blocks of mass 4 kg and 8 kg respectively, then

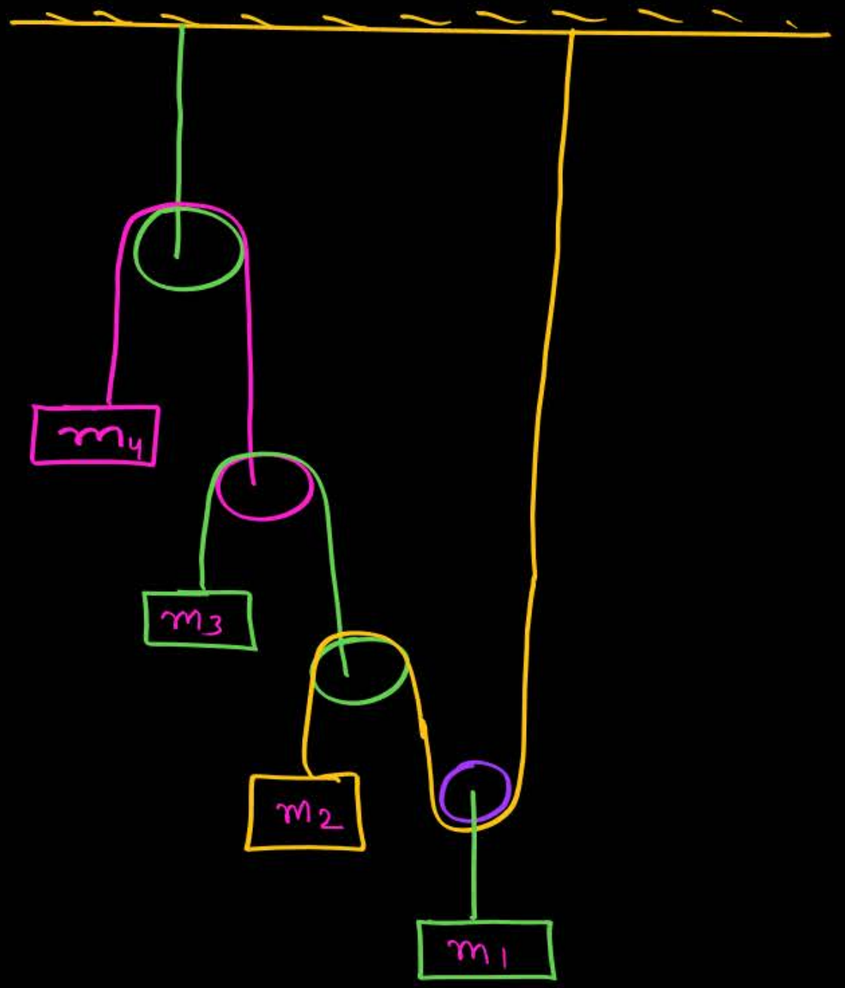


1. $a_1 = a_2$
2. $a_1 = 2a_2$
3. $2a_1 = a_2$
4. $a_1 = 4a_2$

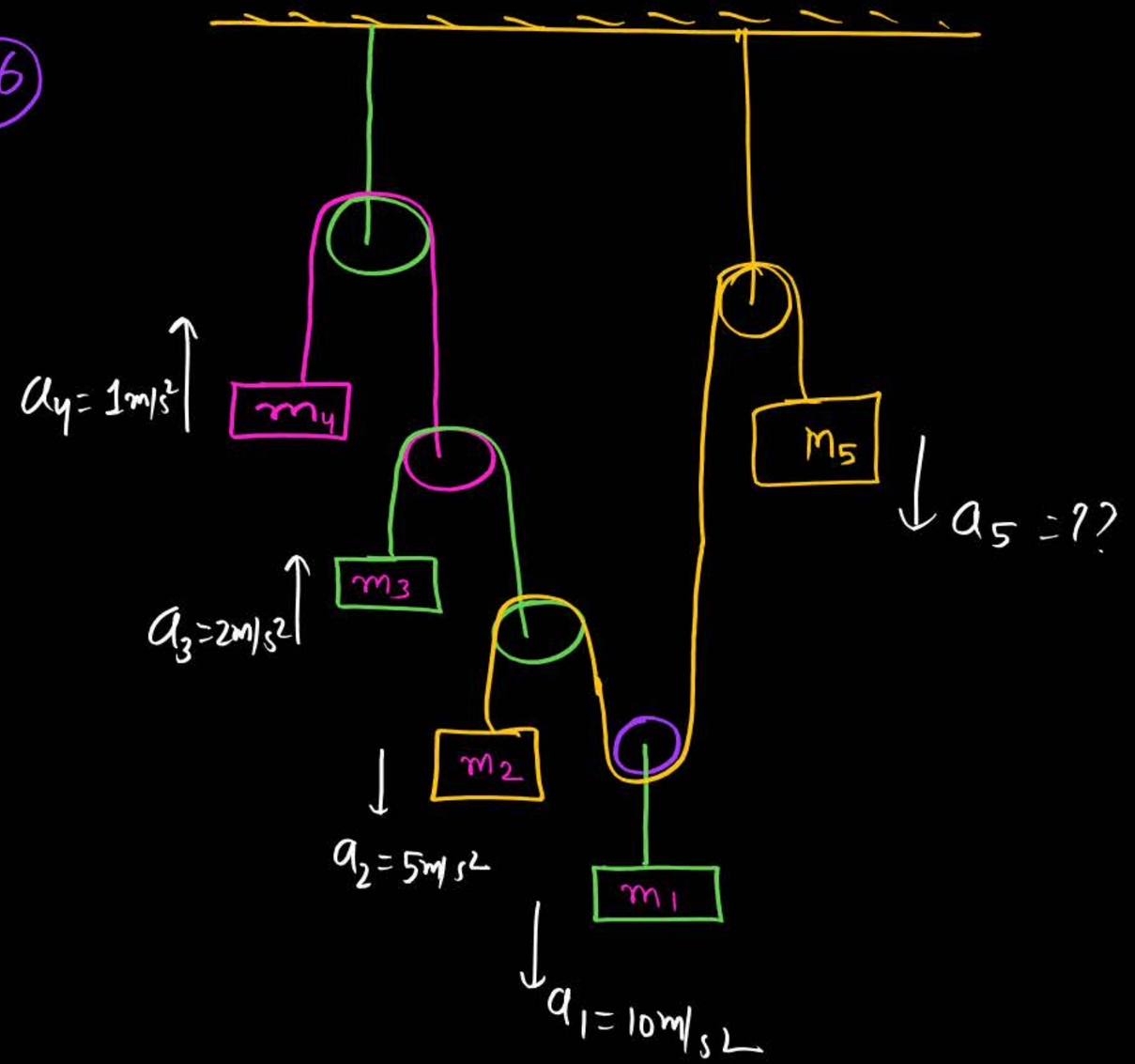
24



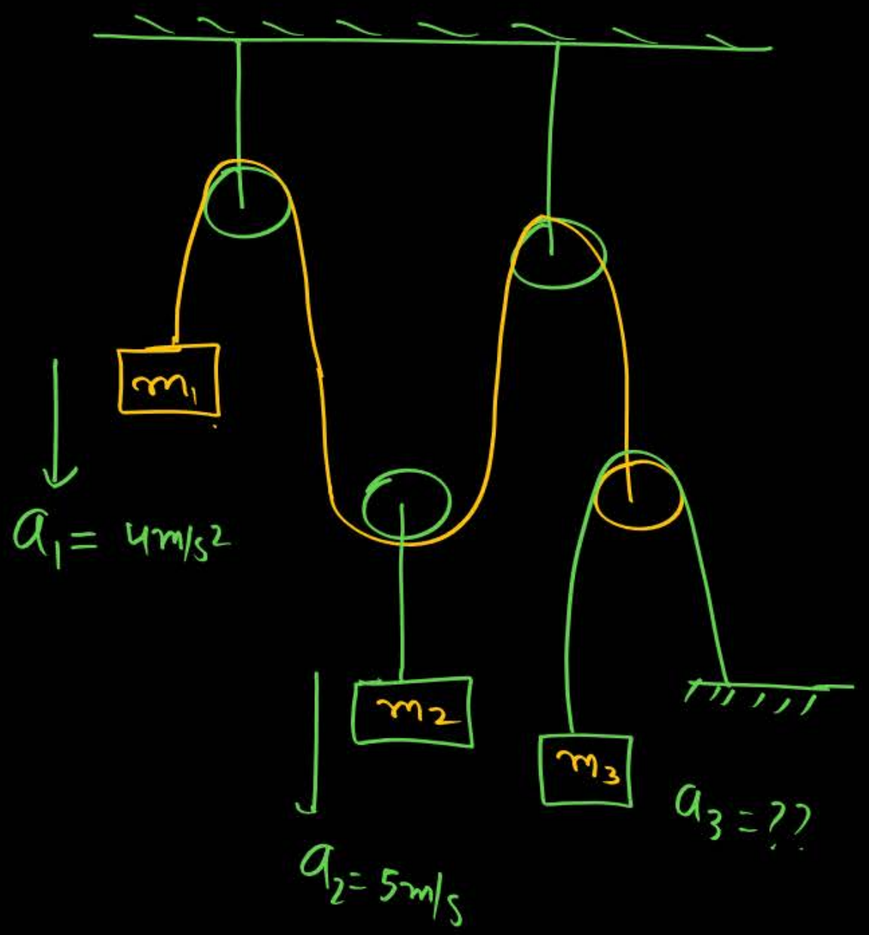
25



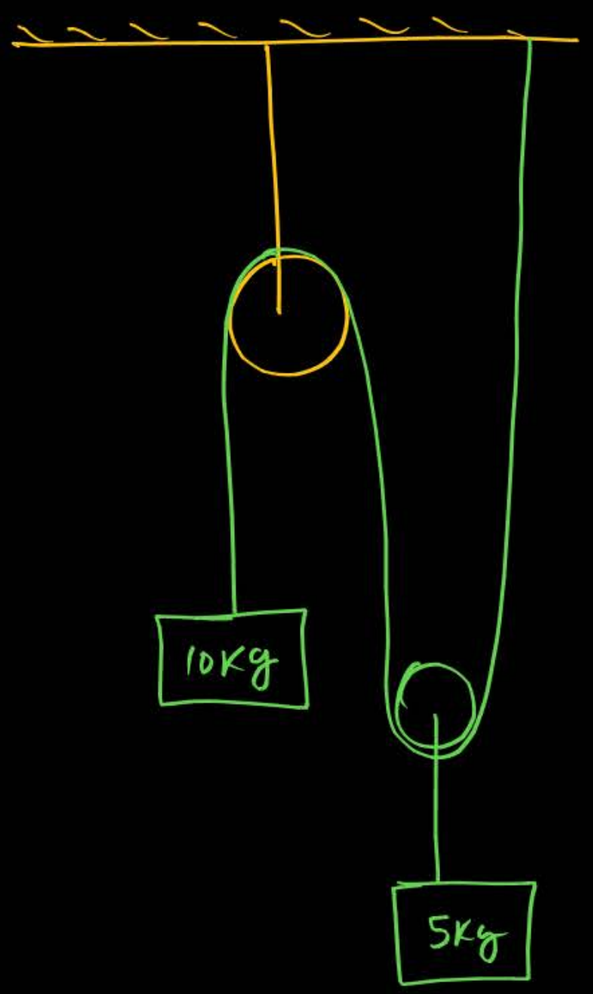
(26)



27



(28)



find value of a_1 and a_2 of 10kg & 5kg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THANK YOU