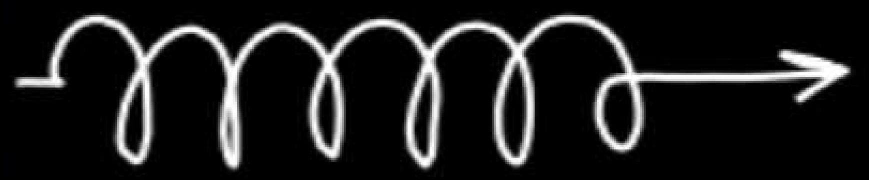
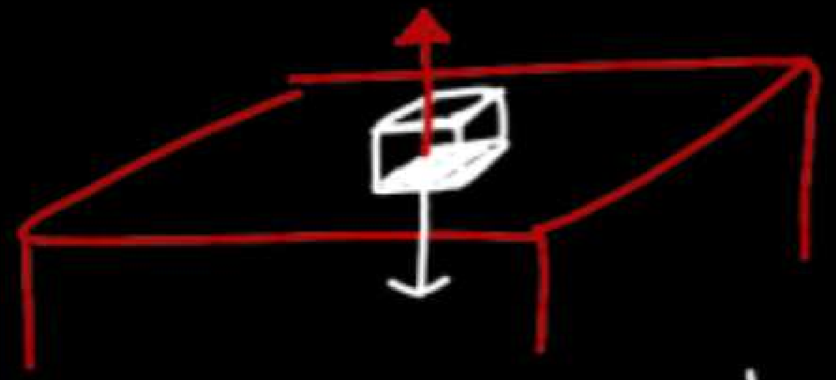
Type of Force

Contact Forces

* **Applied force** Human (Push/Pull)
* **Spring Force**

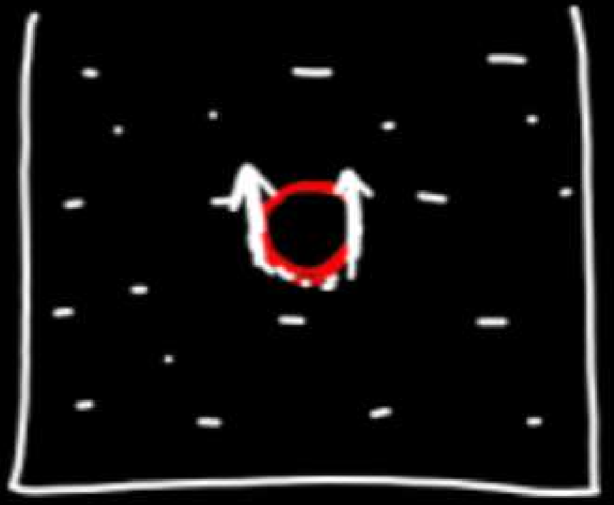


* **Normal**



* **Tension** in rope/thread/wire . . .
* **Friction** opposes relative motion b/w two solid surfaces

Drag force in Fluid < Gas, Liquid



Non-Contact Forces

* **Gravitational Force**

Magnetic Force

Electrostatic Force

} class 12th

Newton's First Law of Motion

It states that a body continues to be in state of rest or of uniform velocity until and unless an external unbalanced force is acted on the body.

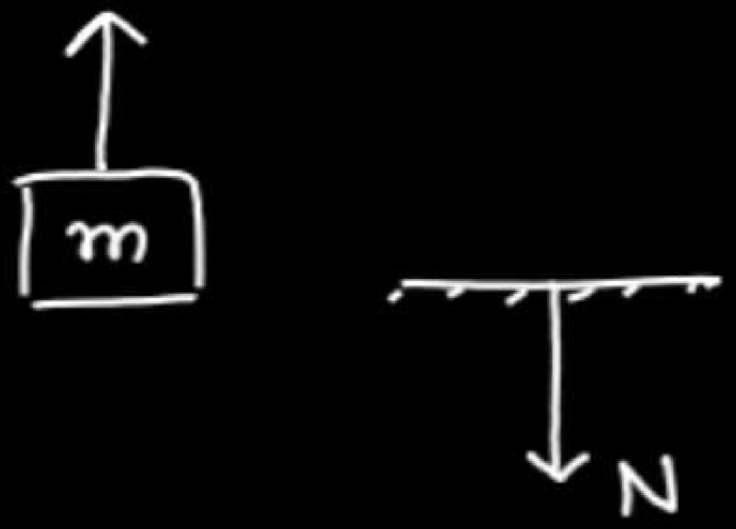
- If $F_{ext} = 0 \Rightarrow$ Body will remain in its state
  - → Rest . . . Rest
  - uniform velocity ($a = 0$)

- It is also known as law of Inertia
  - → Prop. of mass that resist the change in its state
  - → more mass ⇒ more inertia

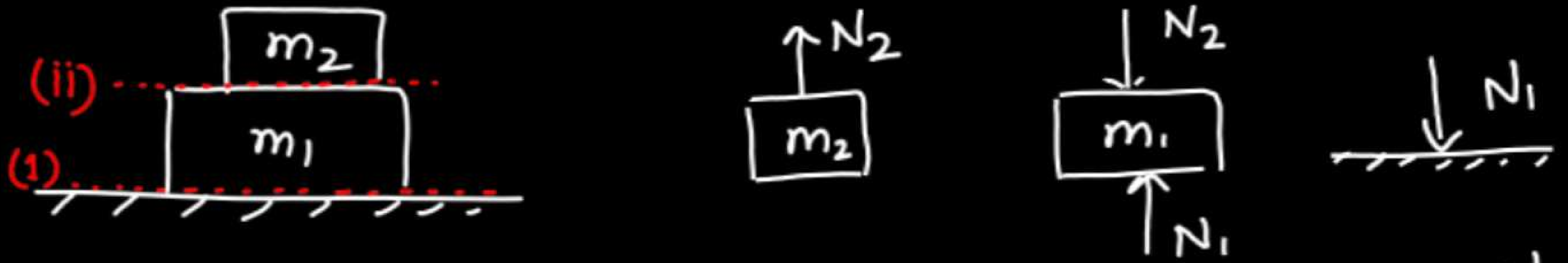
Marking / identification of forces acting on a body

Ex

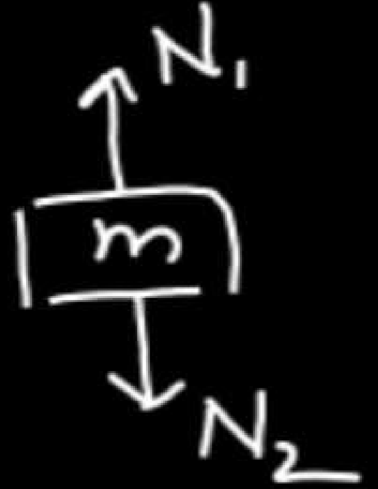
Numerical :



Ex



or



⊛ Free body digm (FBD)

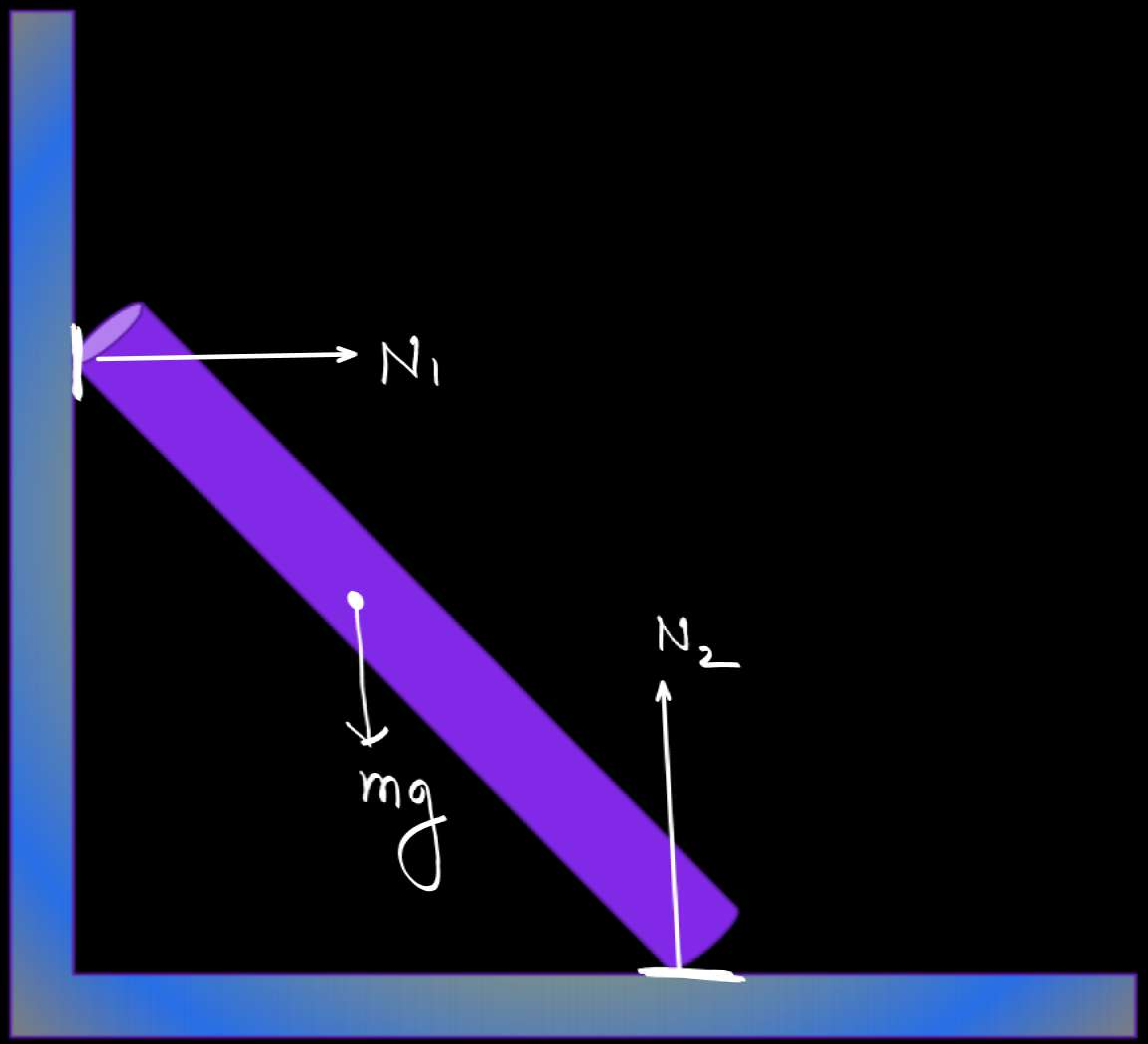
digm showing all the forces acting on object

Normal Force (N)

- contact Force acts b/w surfaces of two solid objects in contact
- It acts ⊥r to the line of contact and through body
- It value = self adjusting
- Both object apply equal and opposite normal force

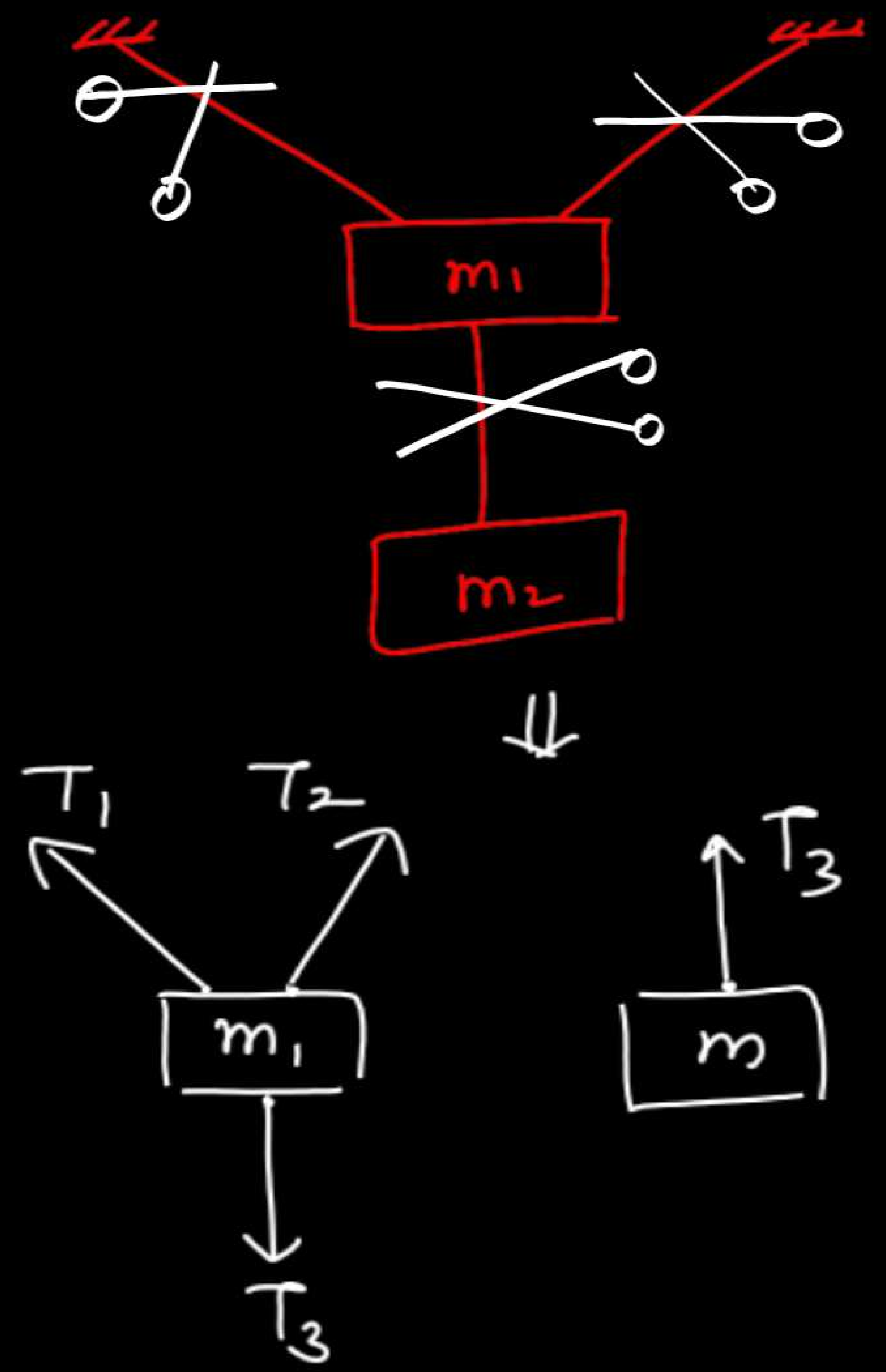
Marking / identification of forces acting on a body

Normal Force



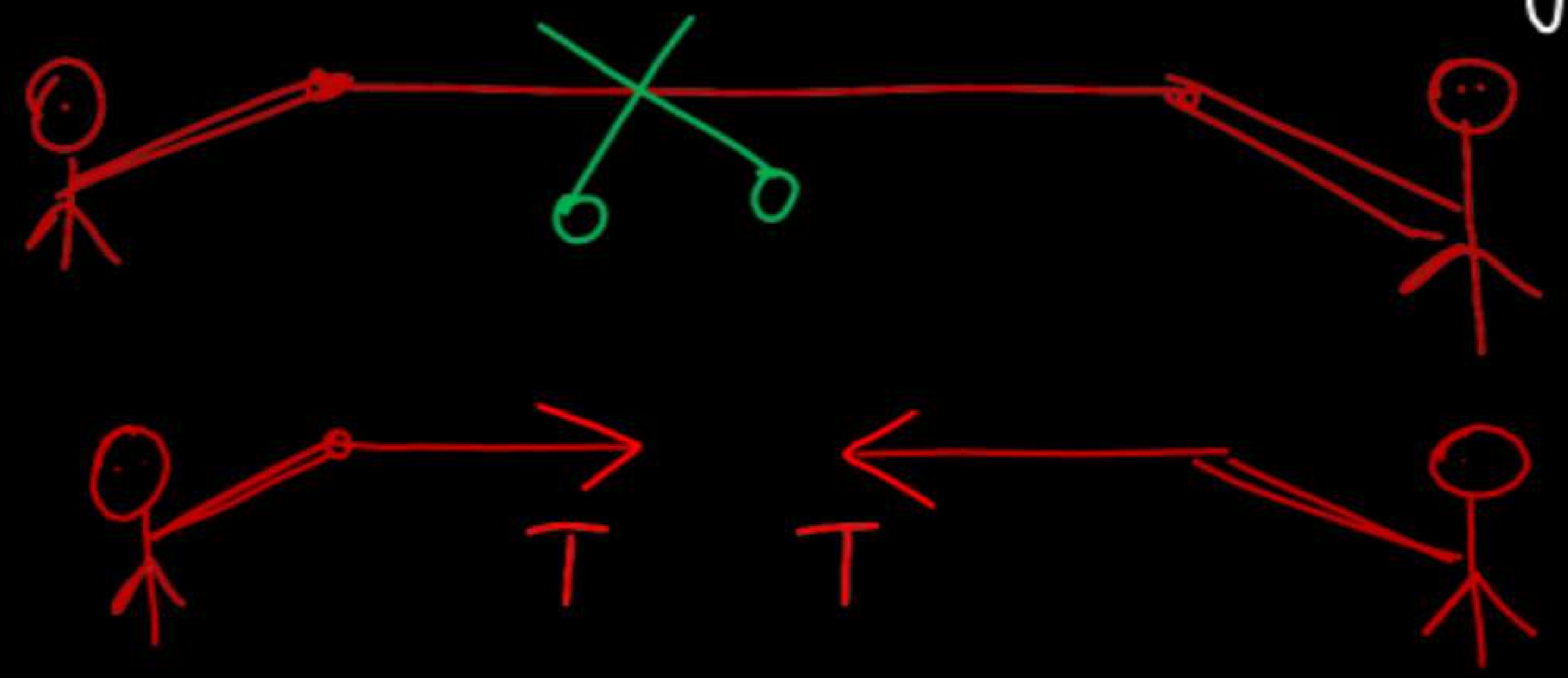
Marking / identification of forces acting on a body

Tension



Force due to a thread, string, wire, rope etc.

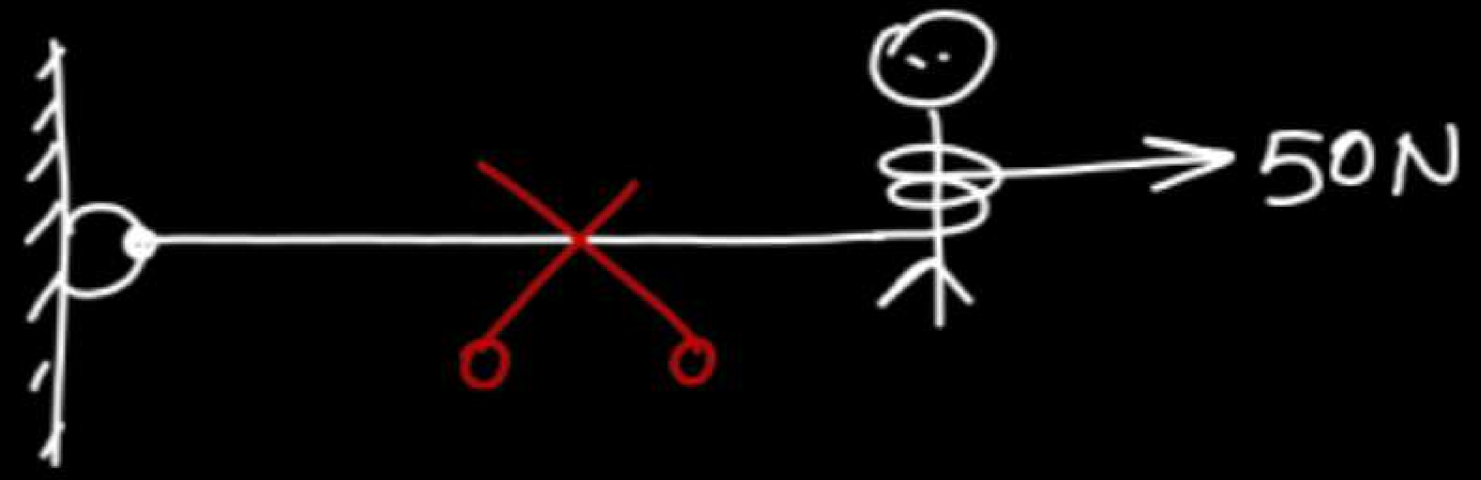
- considering them massless and inextensible
- direction: Away from the cut point
- Same thread / rope $\Rightarrow$ Tension force is same everywhere

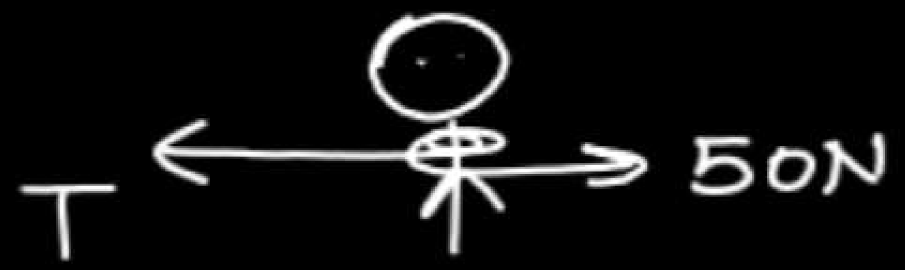


Marking / identification of forces acting on a body

Tension

Ideal Massless thread has same tension throughout.

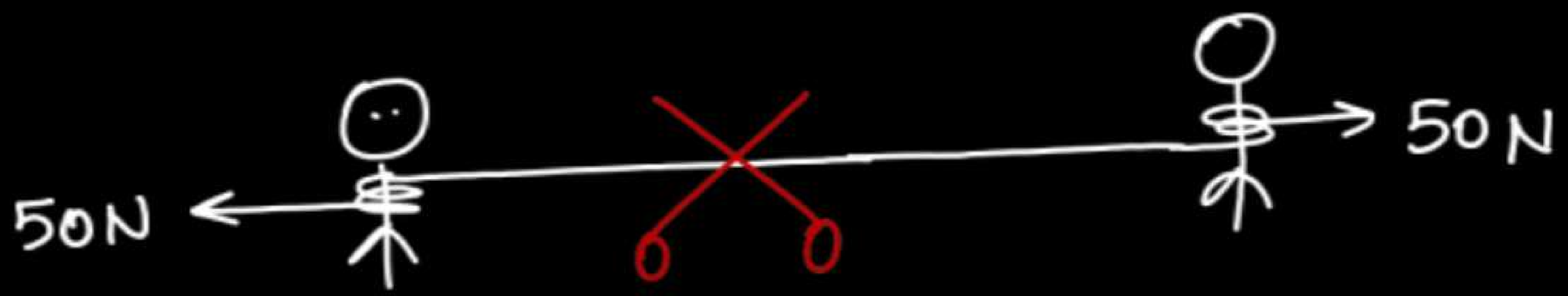




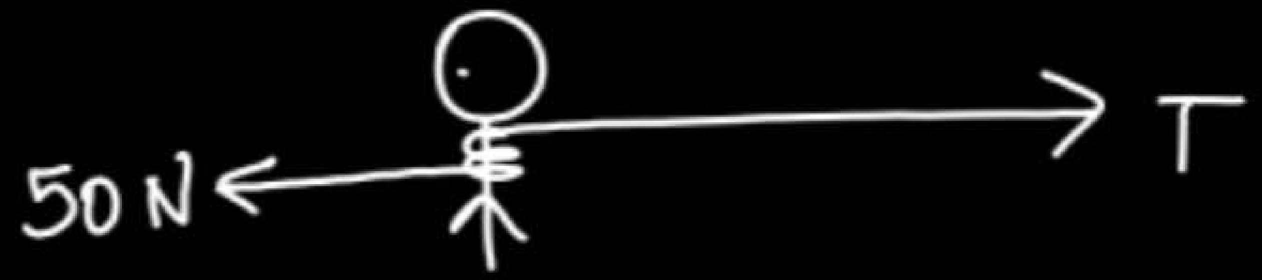
$F_{net} = 0$

$50 - T = 0$

$50 = T$

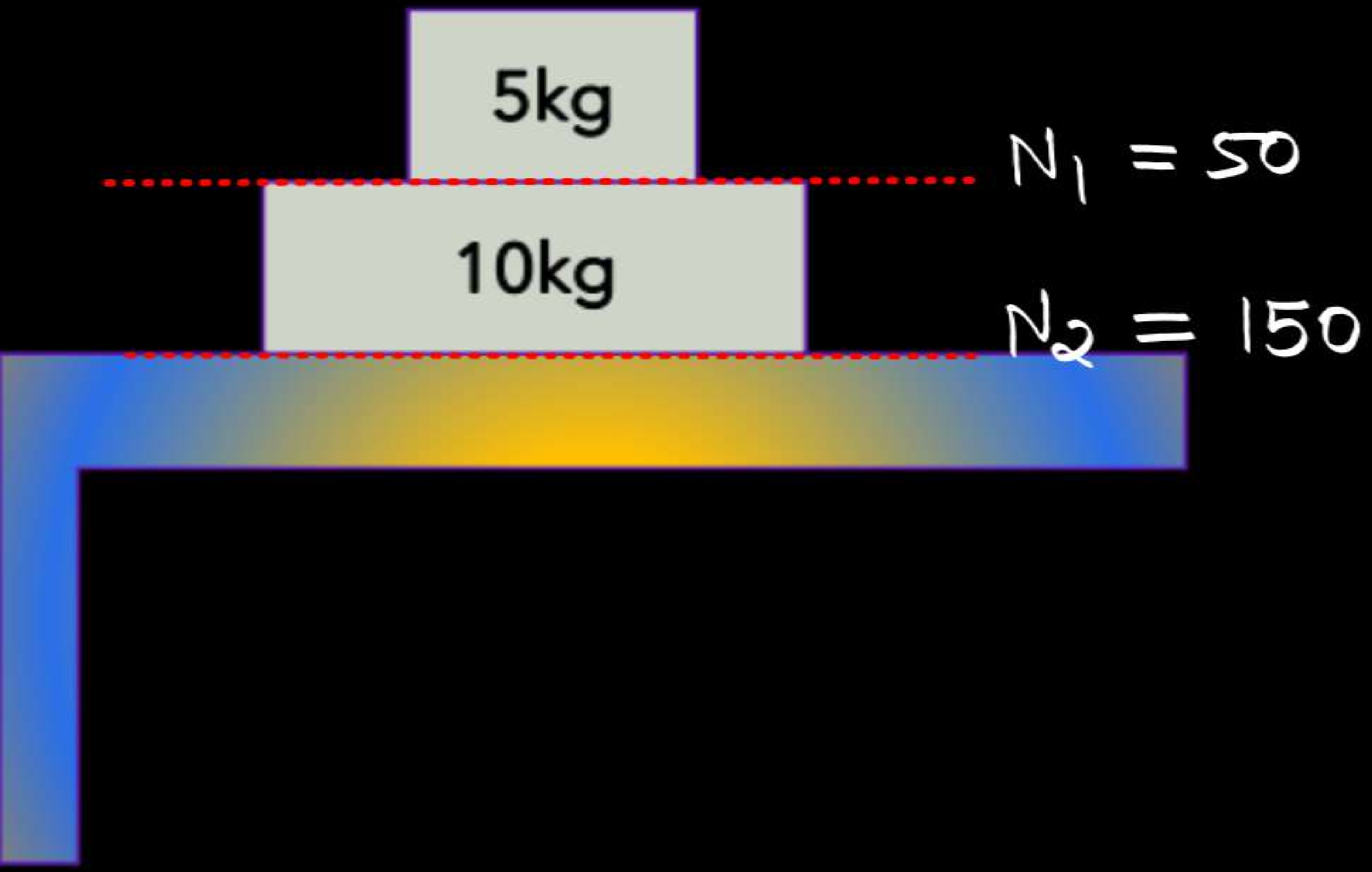


find tension:

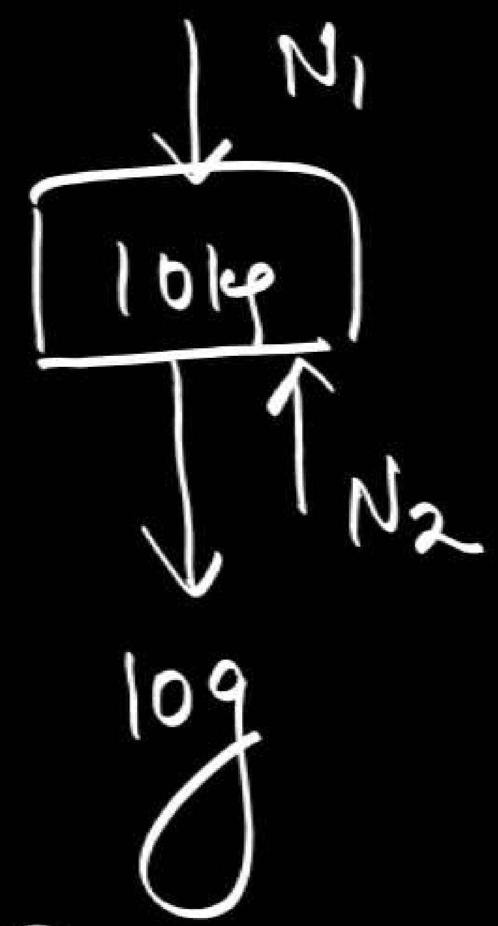


$T = 50$

Find Normal force acting on both blocks



Concept



$f_{net} = 0$

$N_1 - 5g = 0$

$N_1 = 50$

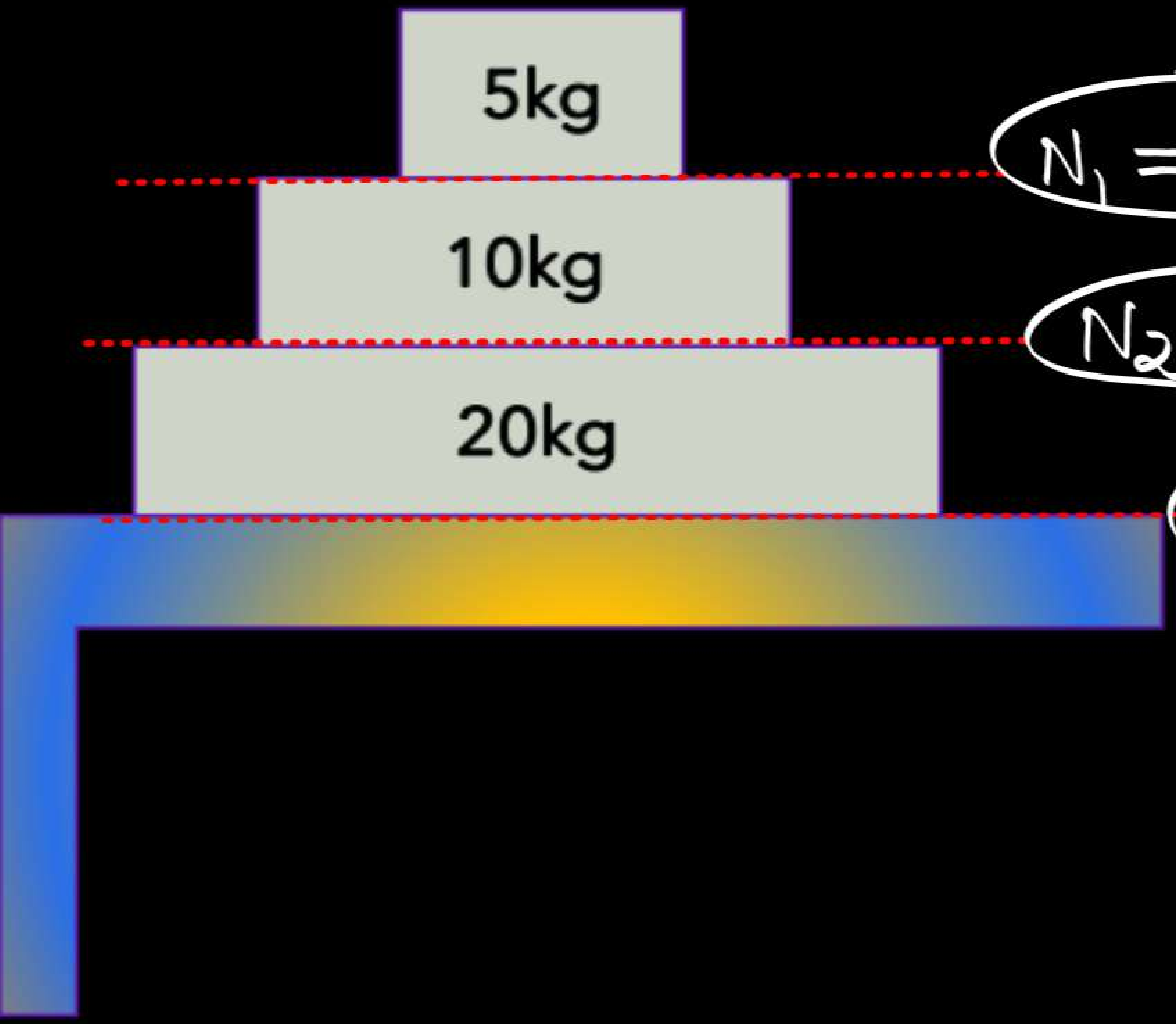
$f_{net} = 0$

$N_2 - N_1 - 10g = 0$

$N_2 - 5g - 10g = 0$

$N_2 = 150$

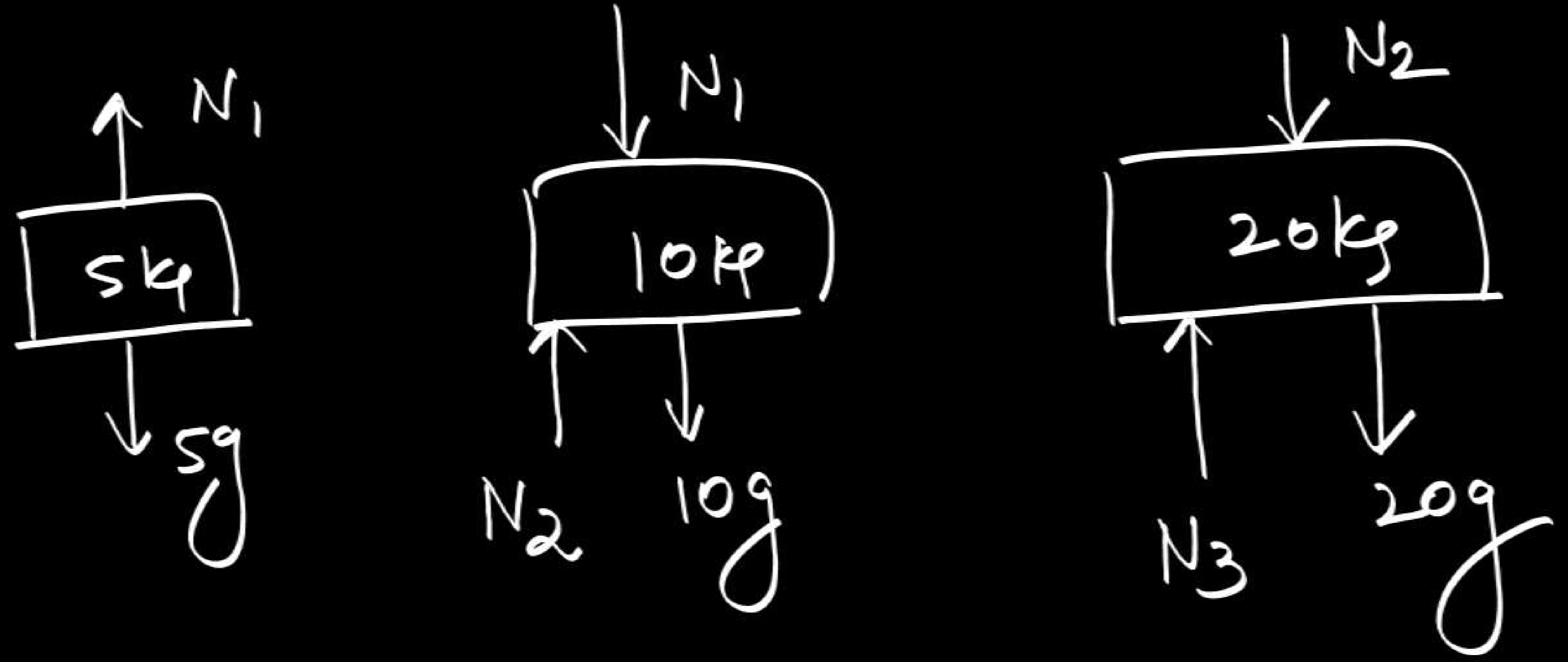
Find Normal force acting on blocks



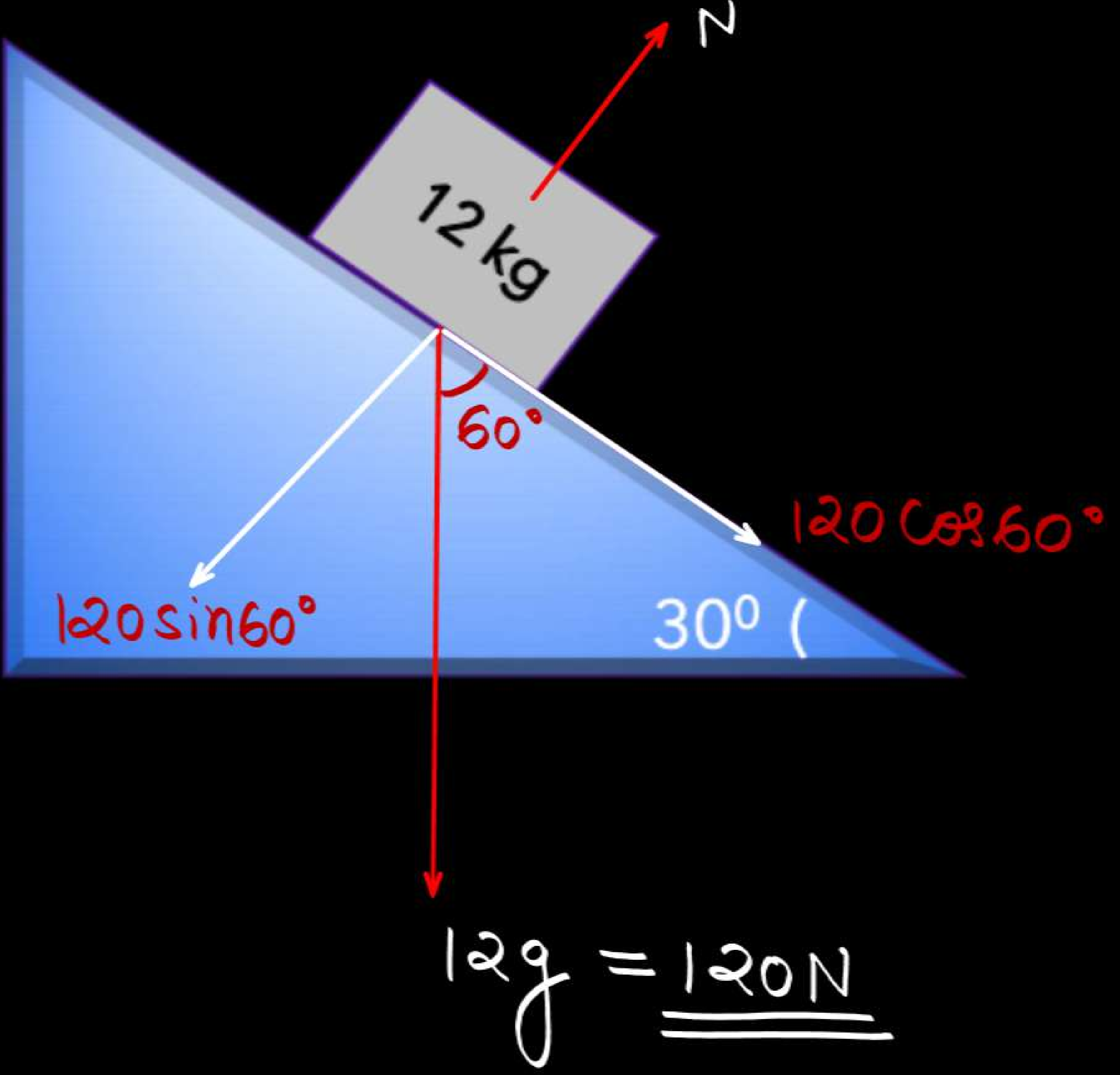
$N_1 = 50$

$N_2 = 150$

$N_3 = 350$



Find Normal force acting on block



$$f_{net} = 0$$

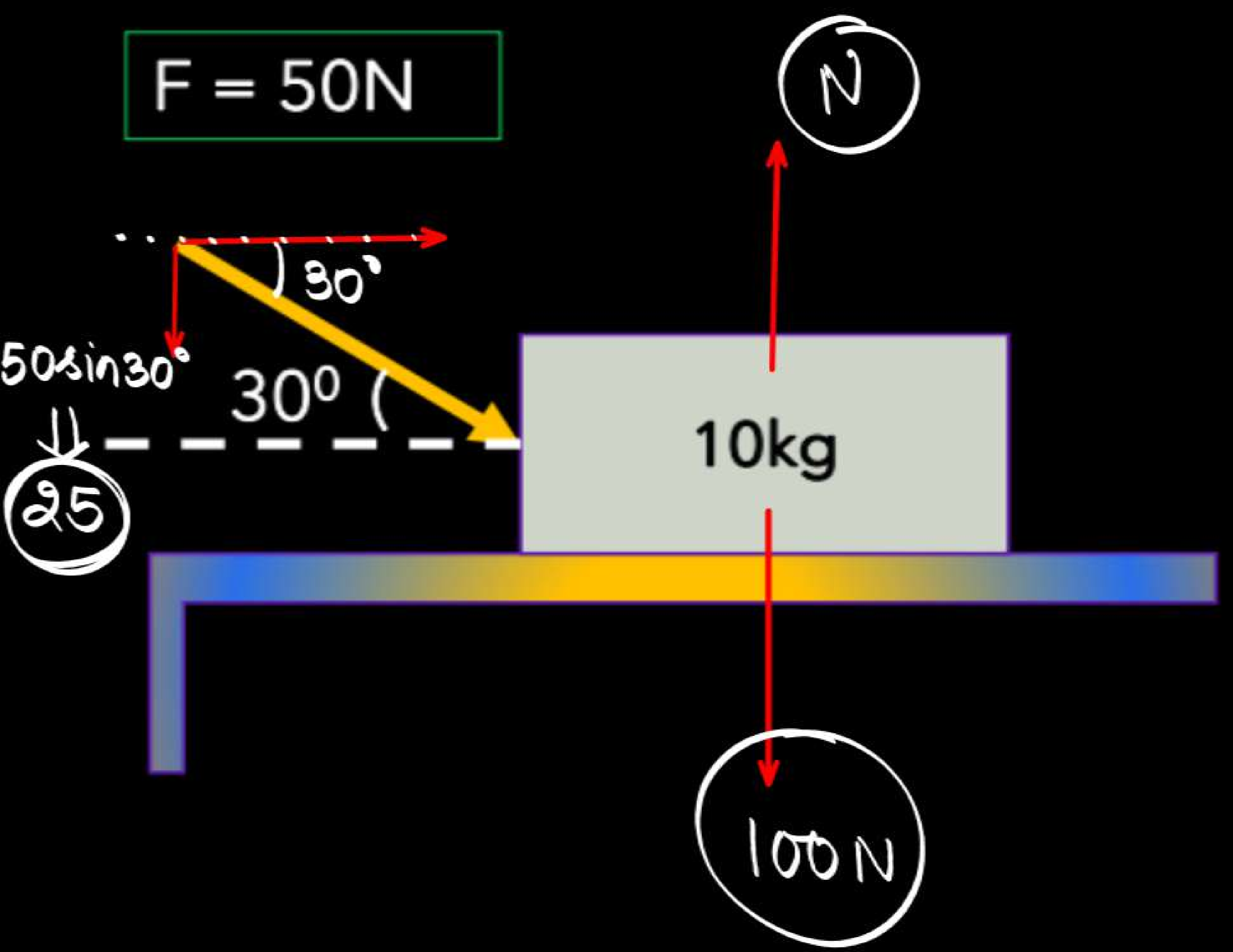
from fig :

$$N - 120\sin 60^\circ = 0$$

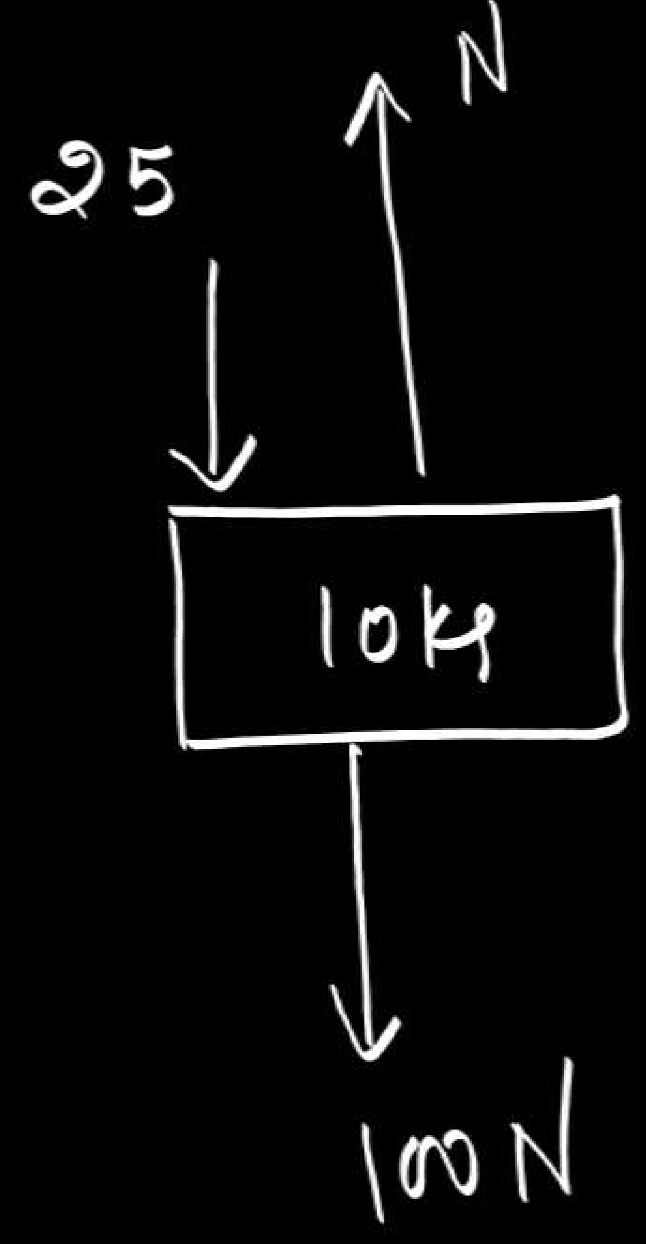
$$N - 120 \times \frac{\sqrt{3}}{2} = 0$$

$$\boxed{N = 60\sqrt{3}}$$

Find Normal force acting on block

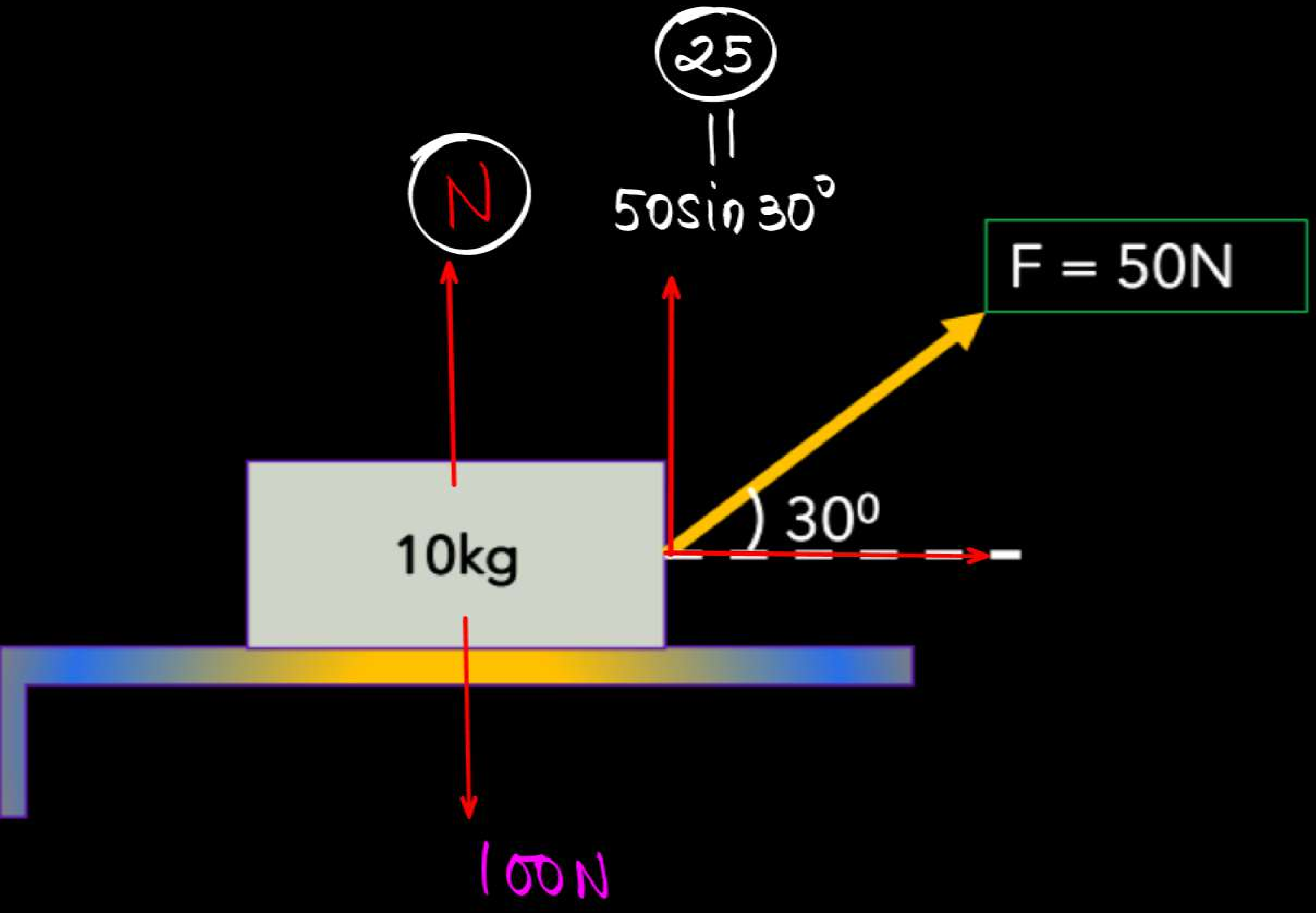


$\Rightarrow$



$$\Rightarrow N = 25 + 100$$
$$= 125N$$

Find Normal force acting on block

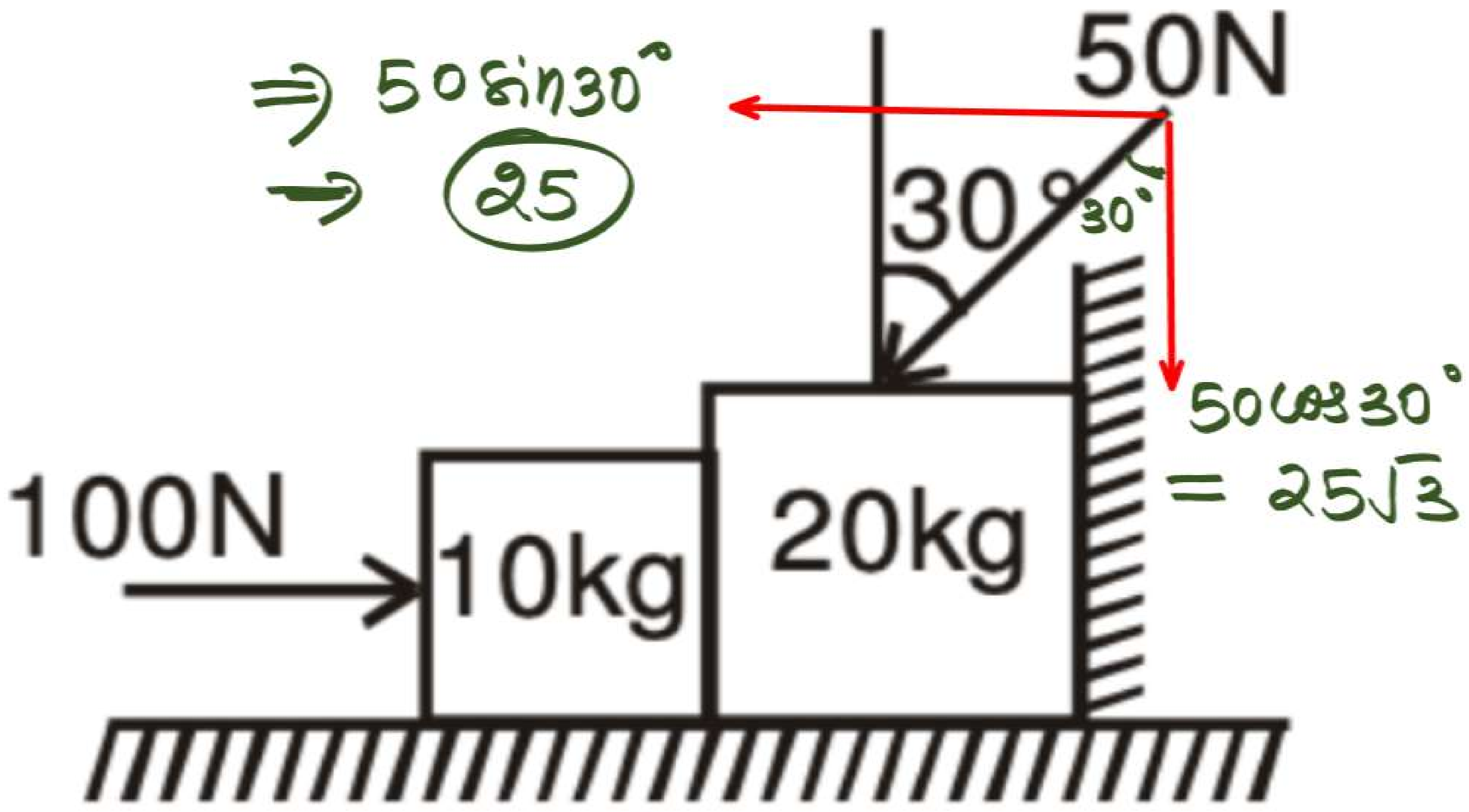


In equilib.

$$N + 25 = 100$$

$$N = 75$$

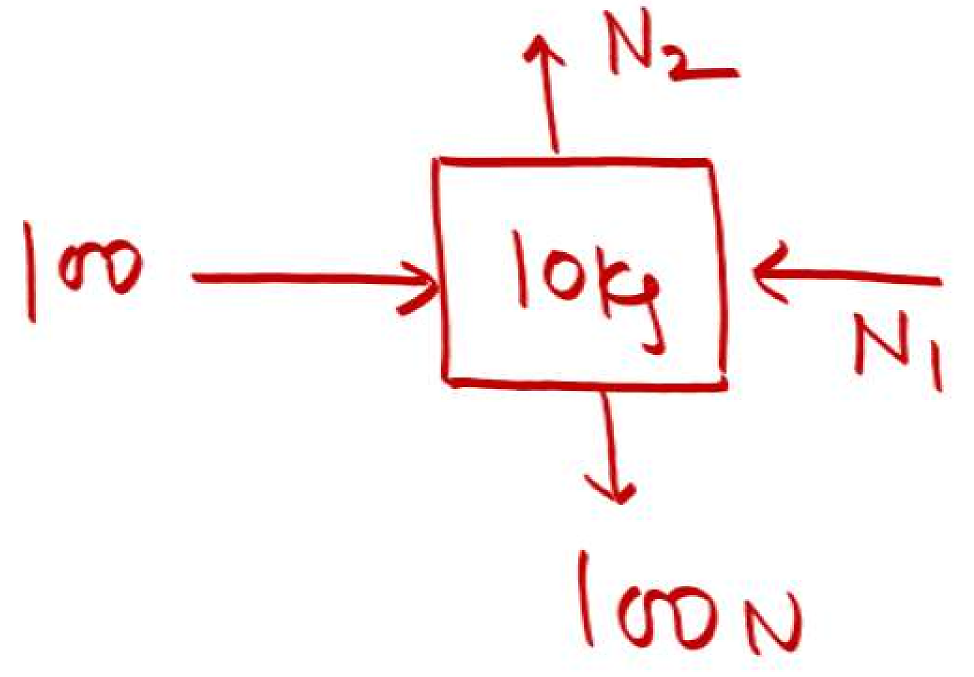
Find Normal force acting on both blocks Given all are stationary



$\Rightarrow 50\sin 30^\circ$

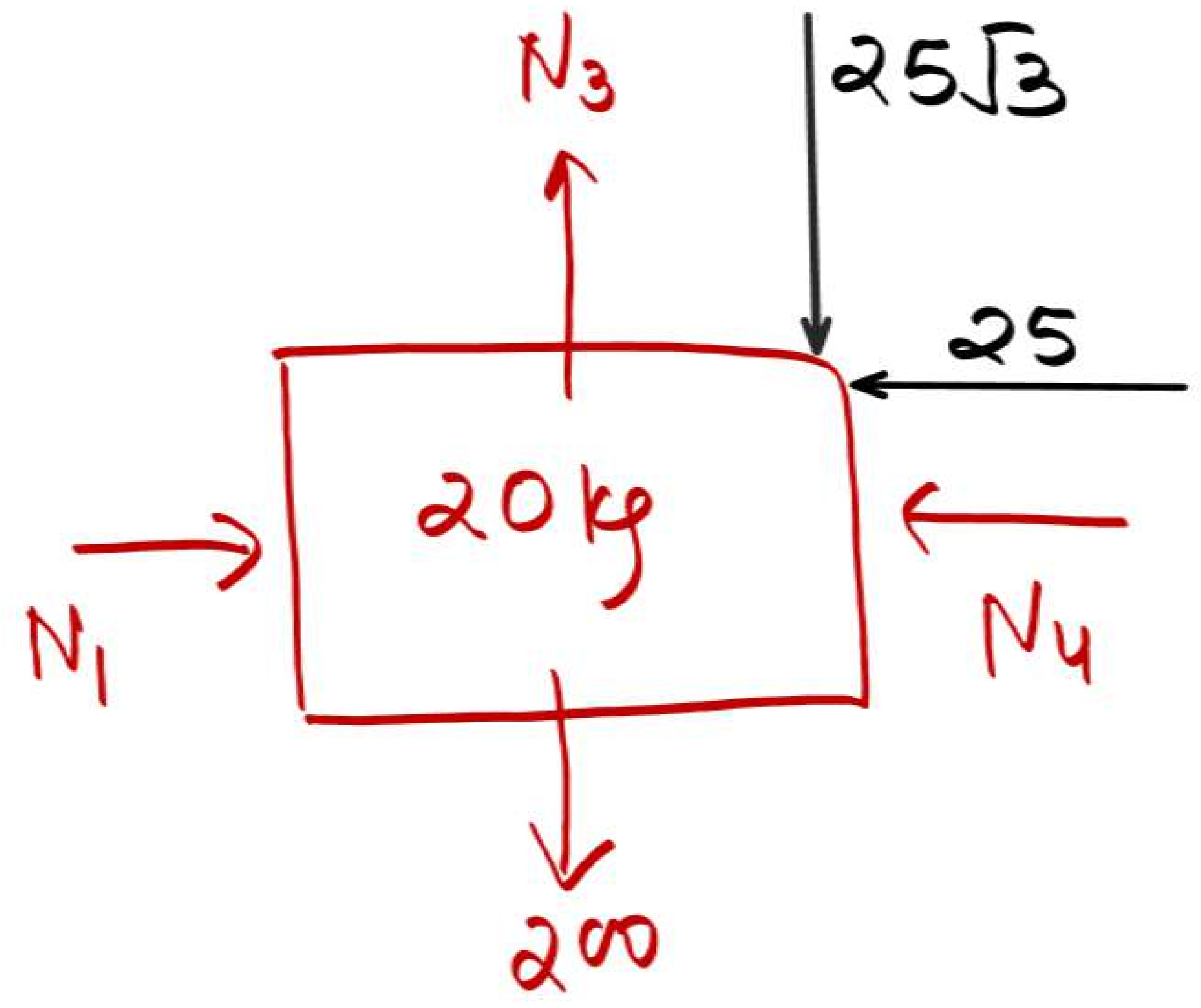
$\Rightarrow 25$

$50\cos 30^\circ = 25\sqrt{3}$



$N_1 = 100$

$N_2 = 100$

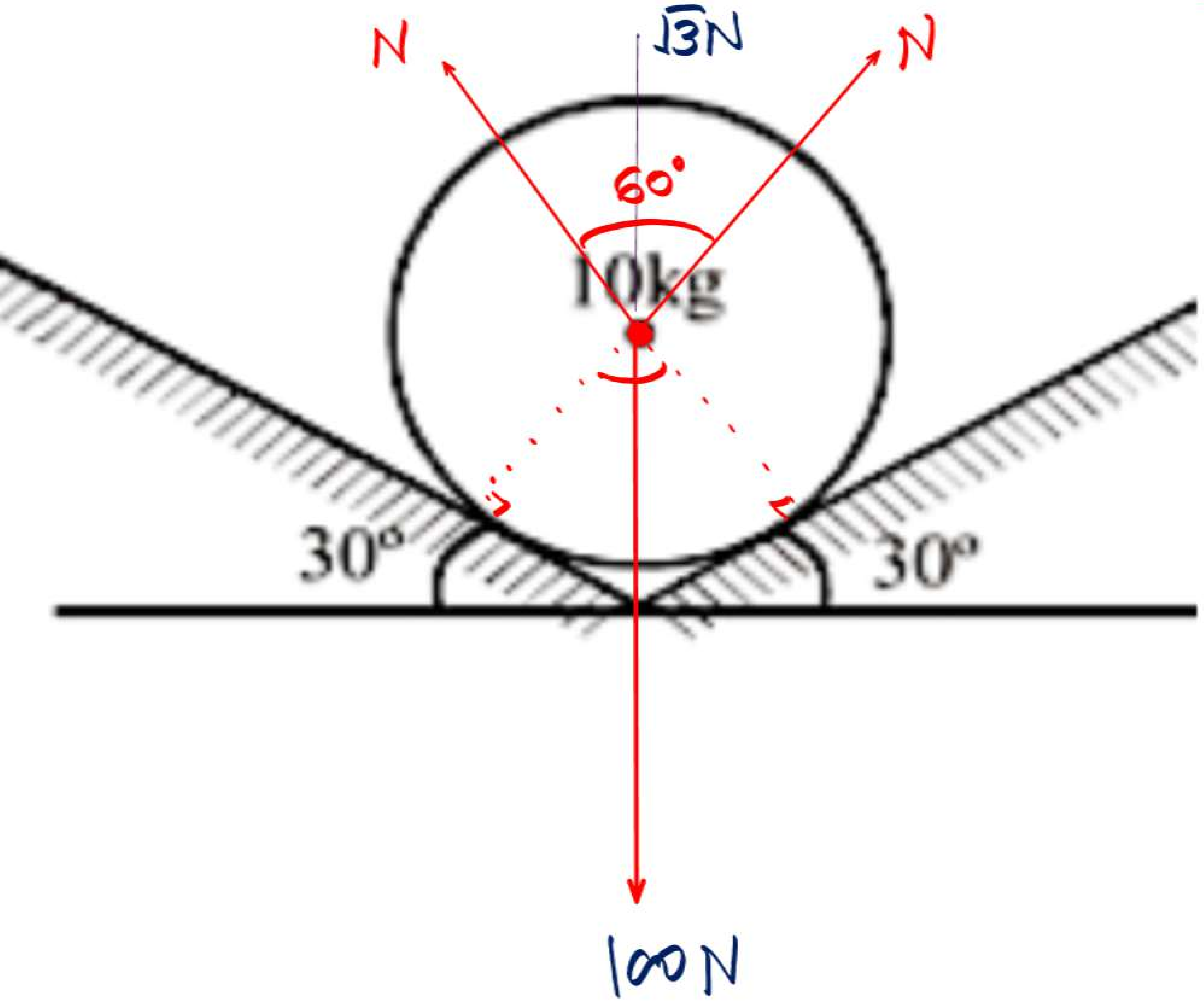


Horizontal: $25 + N_4 = N_1$

$N_4 = 75$

Vertical: $N_3 = 200 + 25\sqrt{3}$

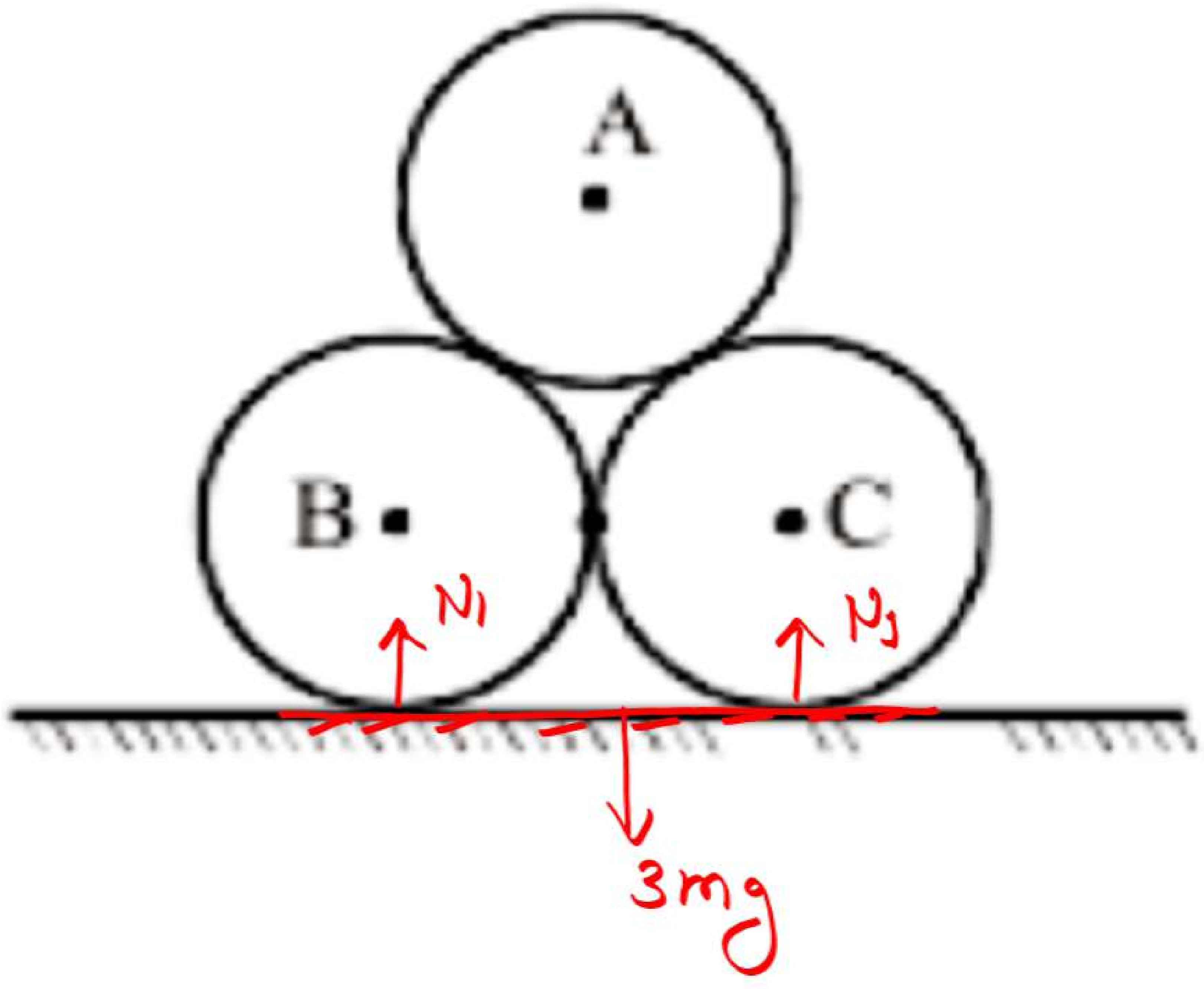
Find Normal force acting b/w sphere and surface



$$\Rightarrow \sqrt{3}N = 100$$

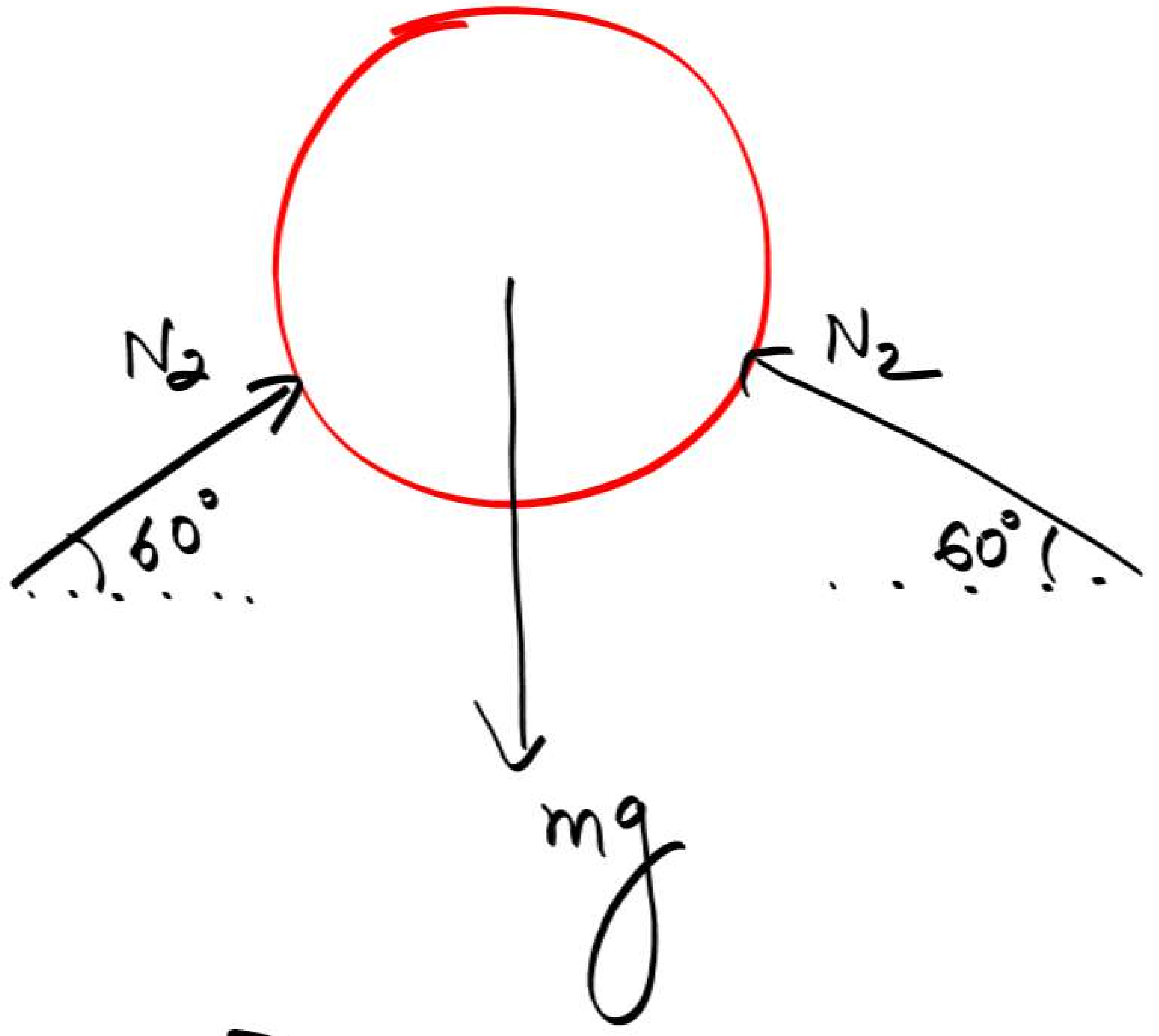
$$N = \frac{100}{\sqrt{3}}$$

Find Normal force acting b/w spheres



$$2N_1 = 3mg$$

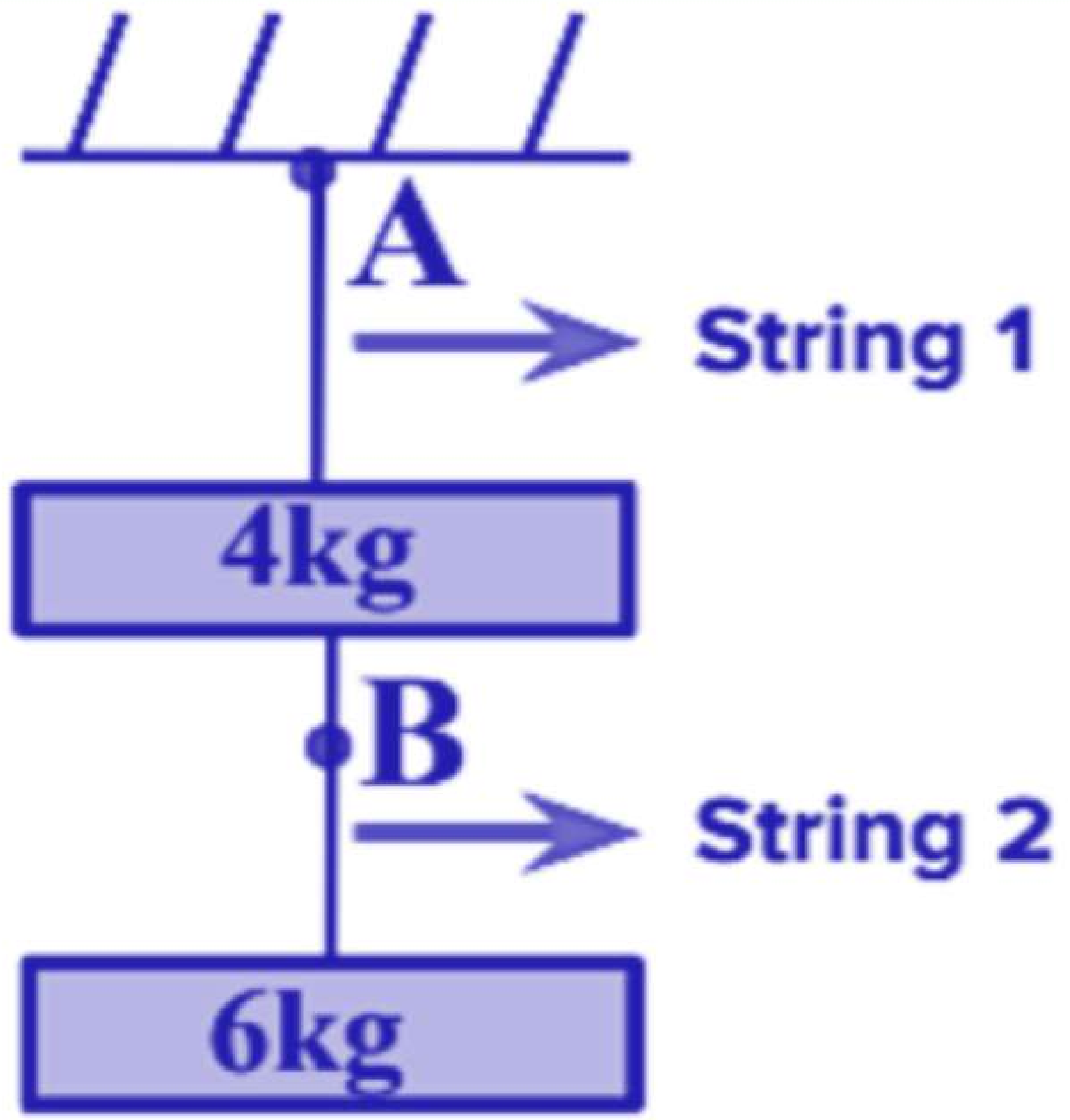
$$N_1 = \frac{3}{2}mg$$



$$2\left[N_2 \sin 60^\circ\right] = mg$$

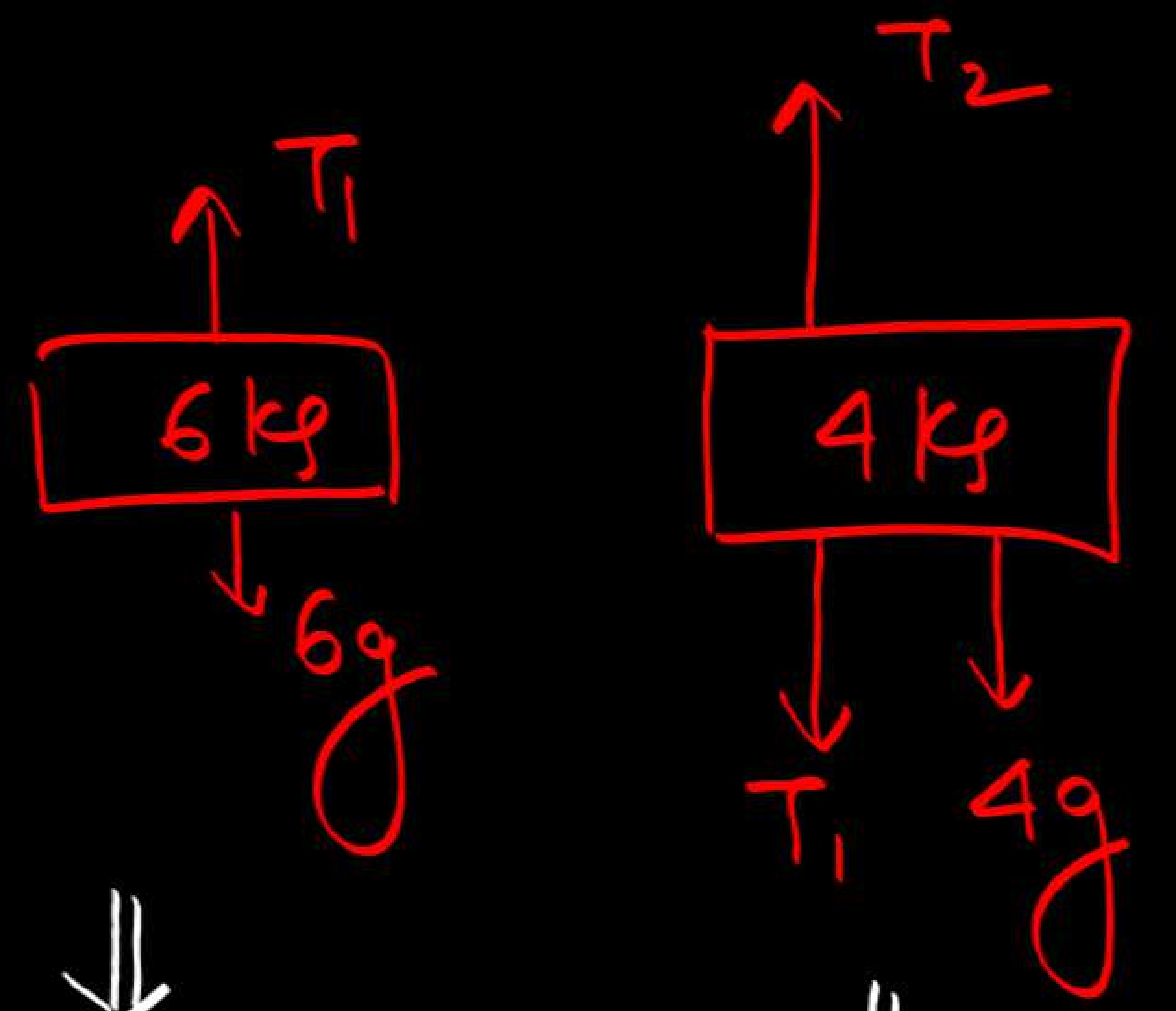
$$N_2 = \frac{mg}{\sqrt{3}}$$

Two blocks of mass 4kg and 6kg are attached in a vertical plane with the help of ideal strings. Find the tension at points (i) A and (ii) B



Concept : equilibrium of Hanging mass

$$\boxed{T = \text{weight}}$$



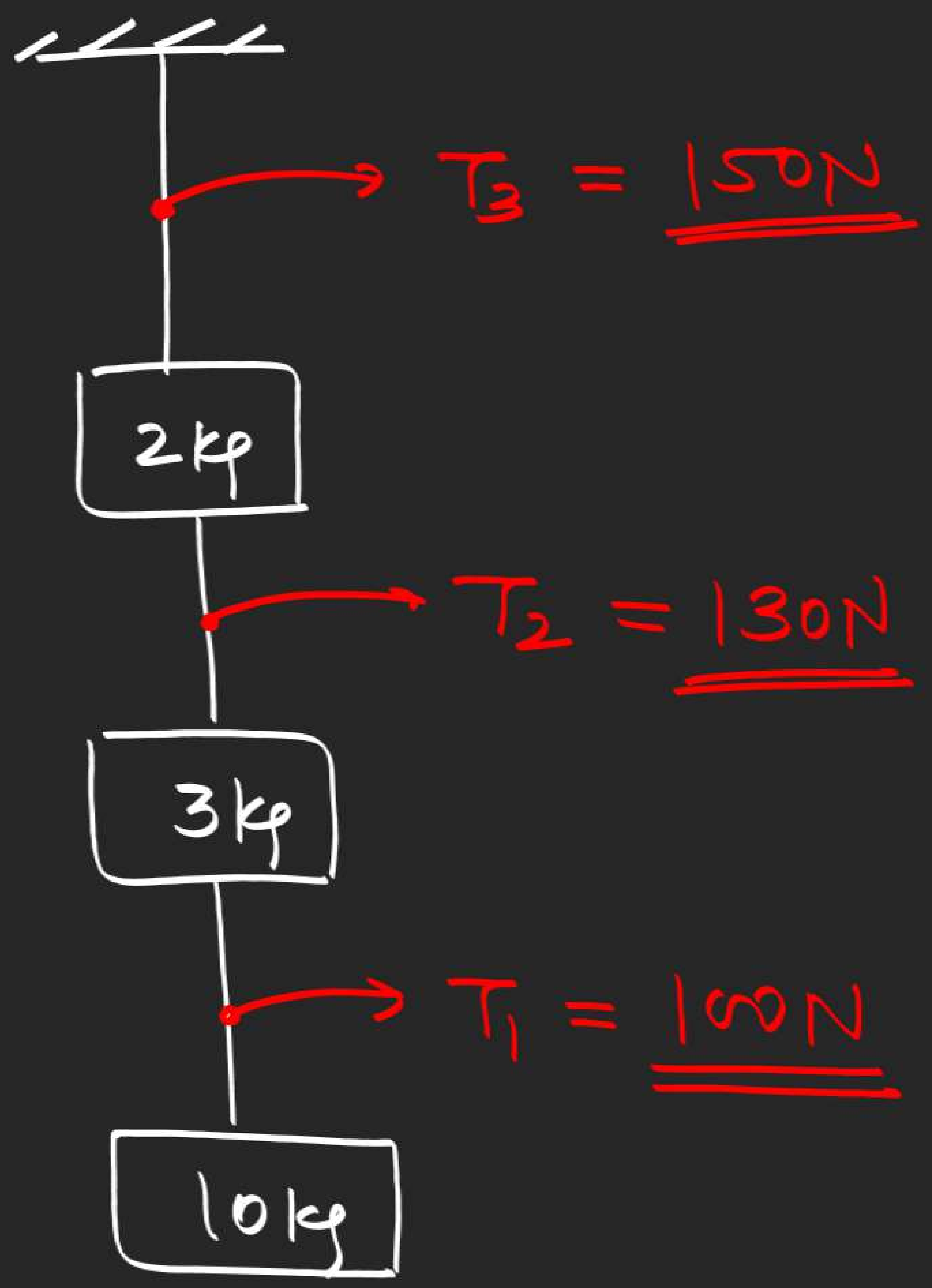
$T_1 = 6g$

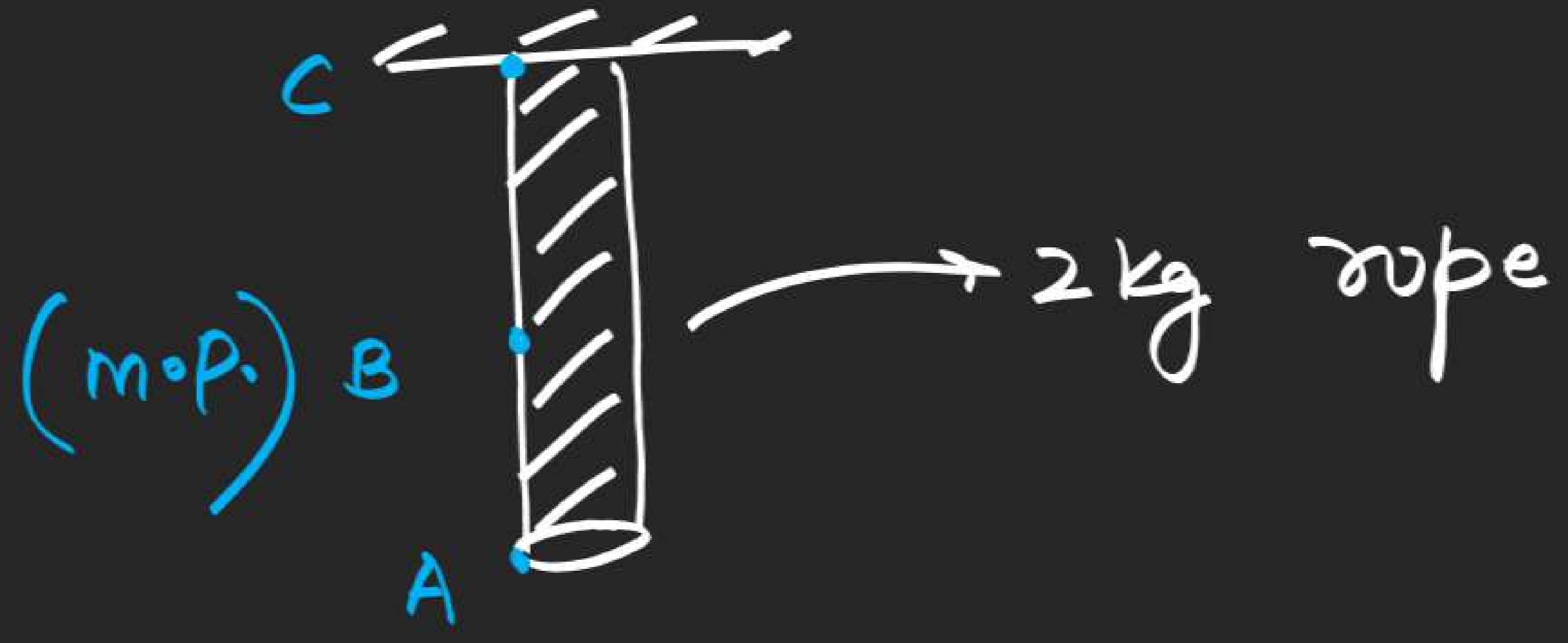
$T_2 = T_1 + 4g$
$= 10g$

$T_1 = 60\,N$

$T_2 = (4+6)g = 100\,N$

100,60

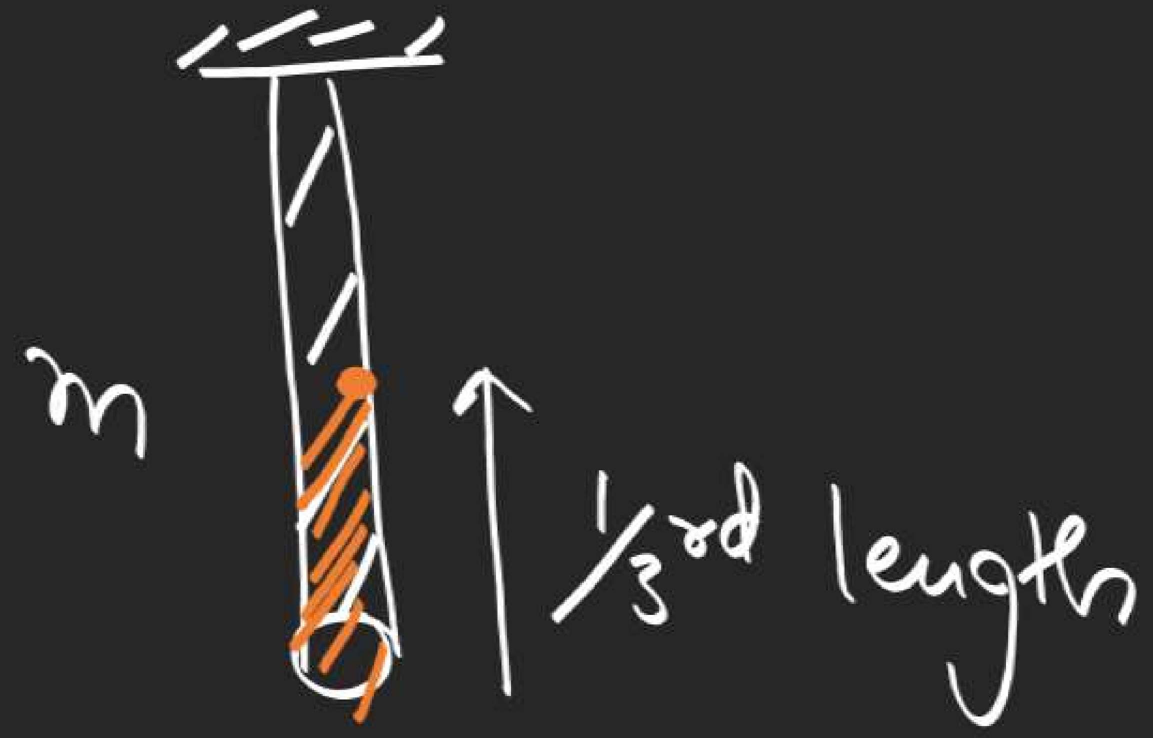




T_A = zero

$T_B = 1g = 10N$

$T_C = 2g = 20N$

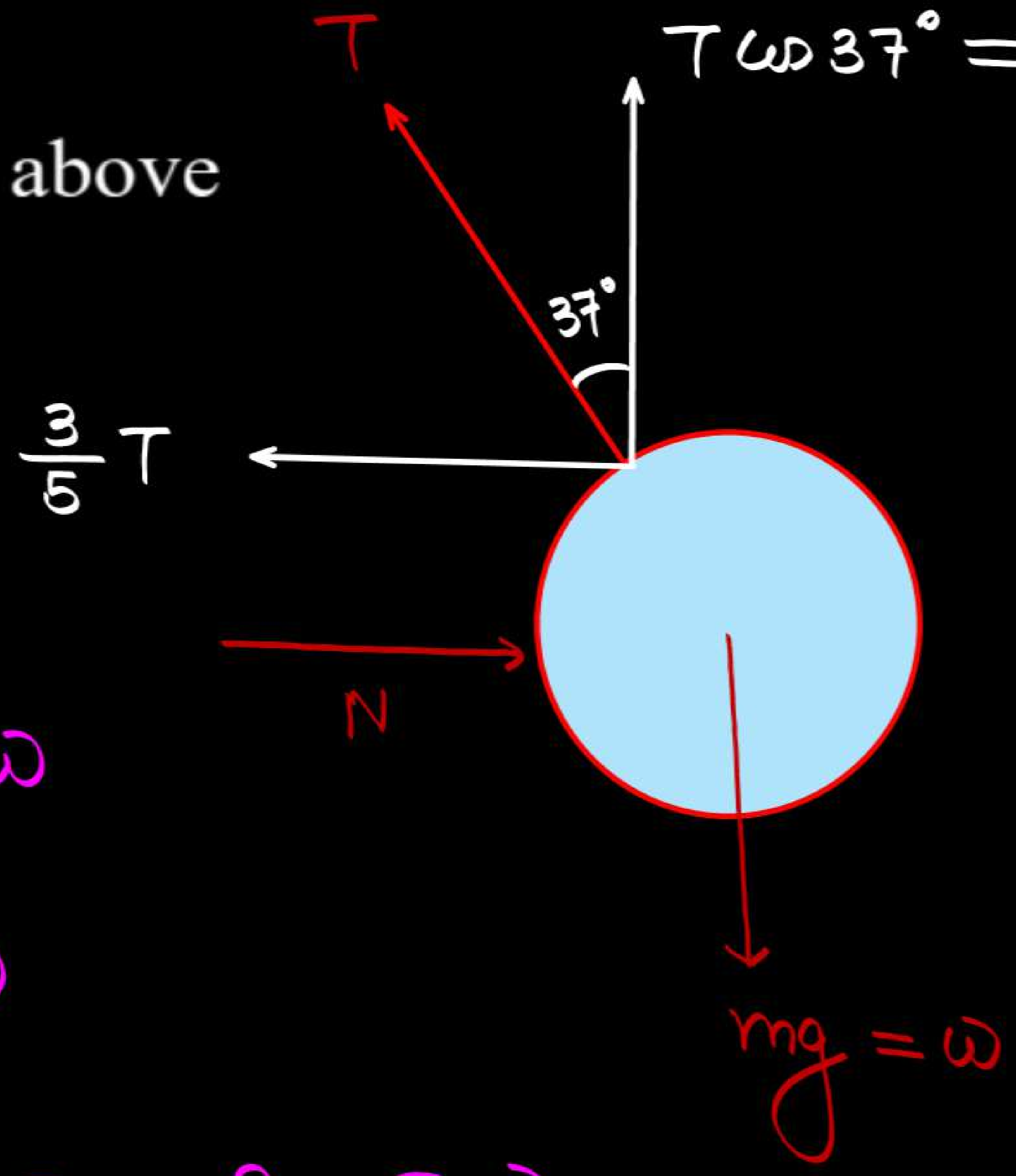


$T = \frac{m}{3} g$

A uniform sphere of weight w and radius 3m is being held by a string of length 5m attached to a frictionless wall as shown in the figure. The tension in the string will be:

A. 5w/4
B. 15w/4
C. 15w/16
D. None of the above

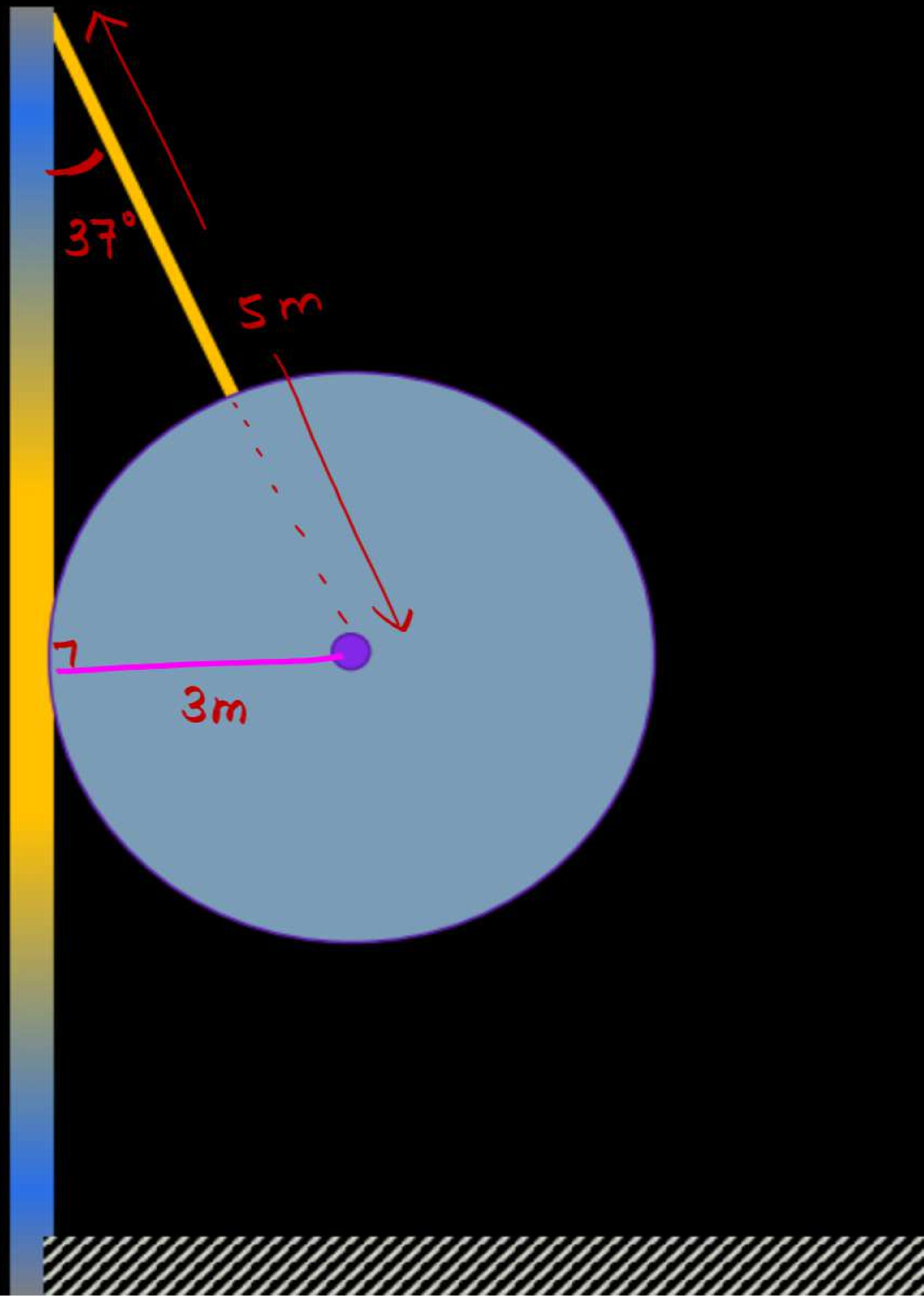
$$T\cos 37^\circ = \frac{4}{5}T$$



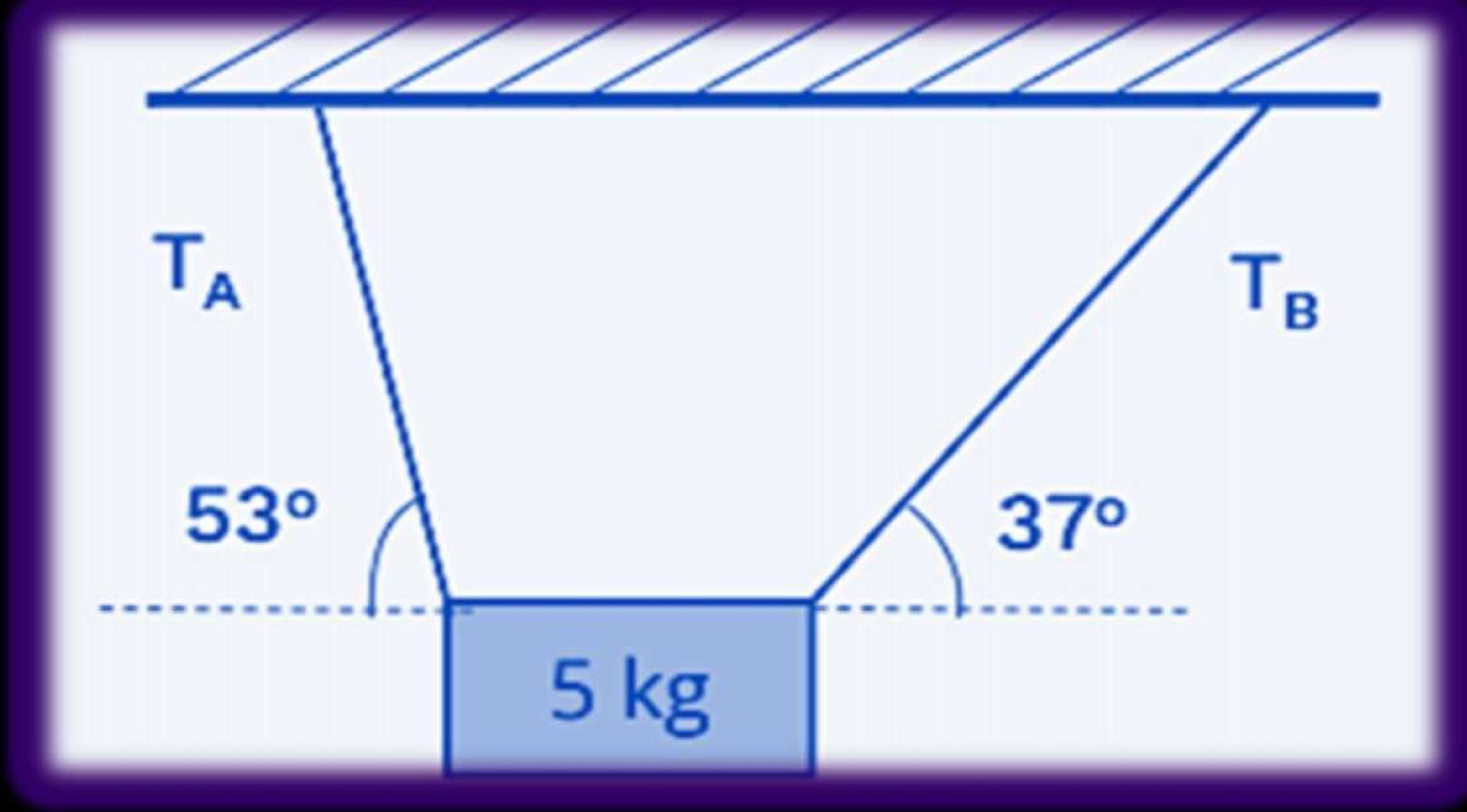
(i) $\frac{4}{5}T = \omega$

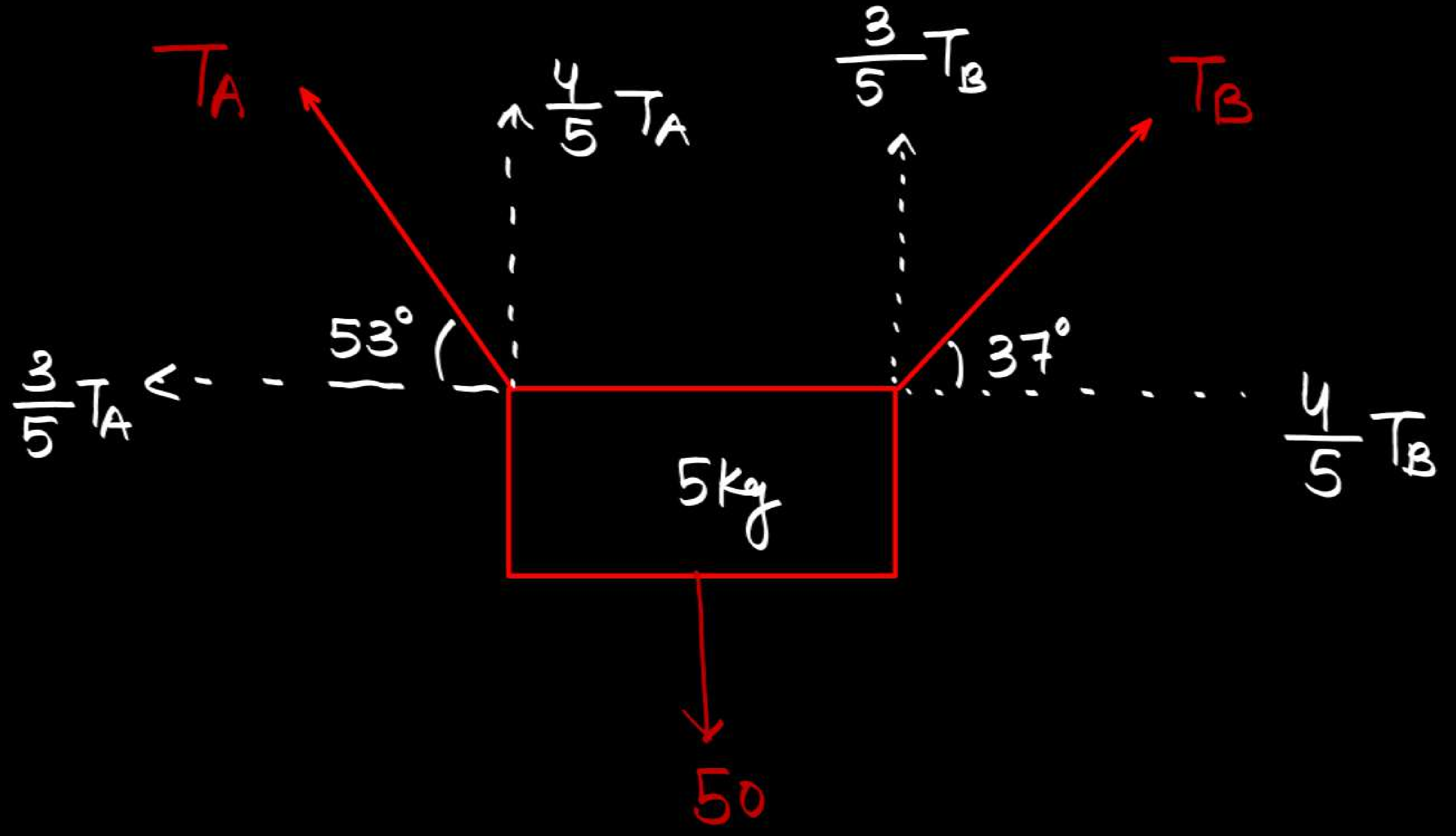
$T = \frac{5}{4}\omega$

(ii) $N = \frac{3}{5}T = \frac{3}{5} \times \frac{5}{4}\omega = \left(\frac{3}{4}\omega\right)$



find tension in each thread:





i) Horizontal : $\frac{3}{5}T_A = \frac{4}{5}T_B$

$$\boxed{3T_A = 4T_B}$$

$$T_A = 40N$$

Vertical : $\frac{4}{5}T_A + \frac{3}{5}T_B = 50$

$$4\left(\frac{4}{3}T_B\right) + 3T_B = 250$$

$$T_B = 30N$$

Newton's Second Law of Motion

The rate of change of linear momentum of a body is directly proportional to the external force applied on the body and this change takes place always in the direction of the applied force.

$$F_{ext.} \propto \frac{d\vec{p}}{dt}$$

$$F_{ext} = \frac{d}{dt}(mv)$$

$$F_{ext} = m\left(\frac{dv}{dt}\right)$$

$$\boxed{F = ma}$$

JEE/NEET

(i) $F_{net} = ma \Rightarrow \boxed{a = \frac{F_{net}}{m}}$

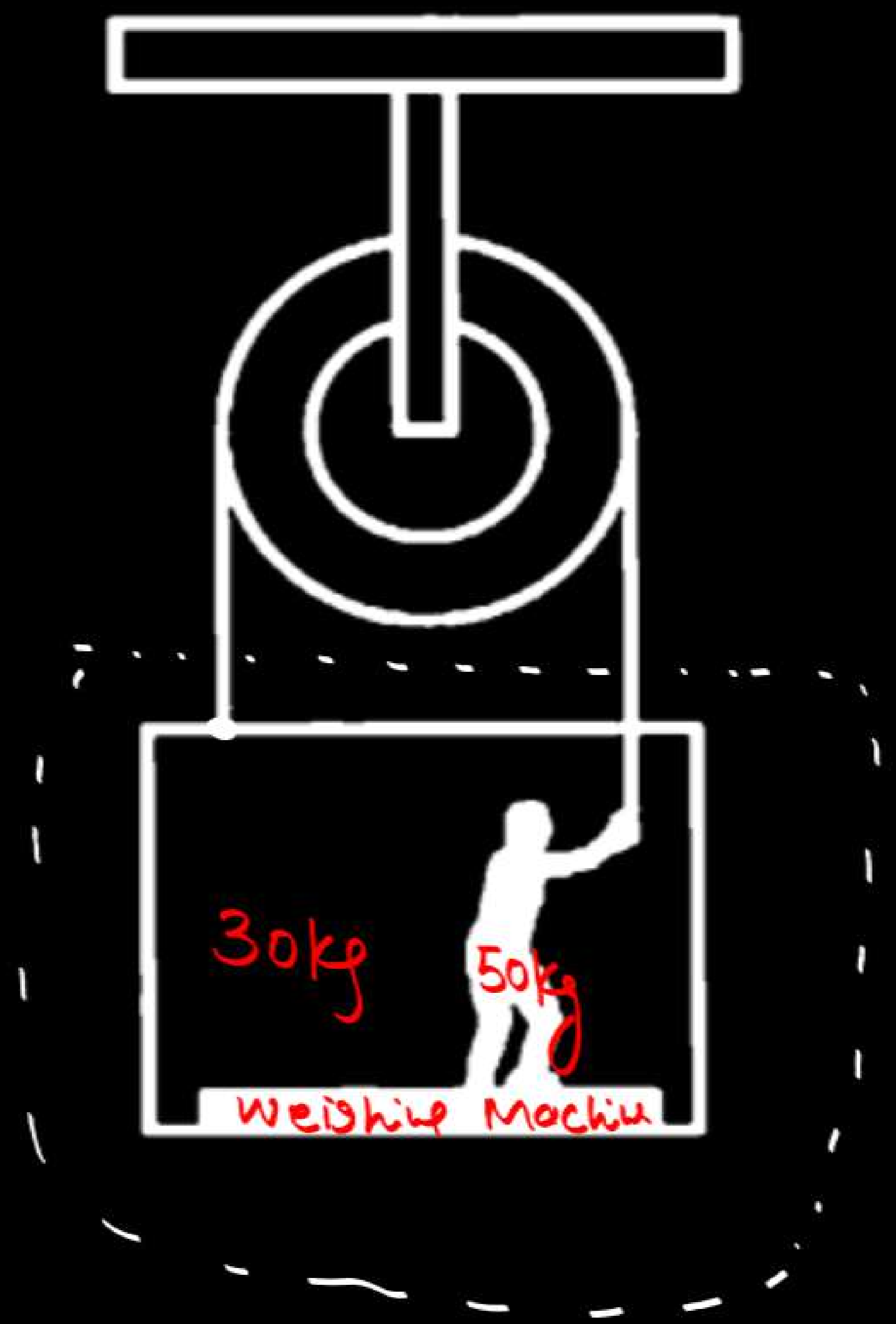
(ii) $F = m\left(\frac{dv}{dt}\right) = m\left(v\frac{dv}{dx}\right)$

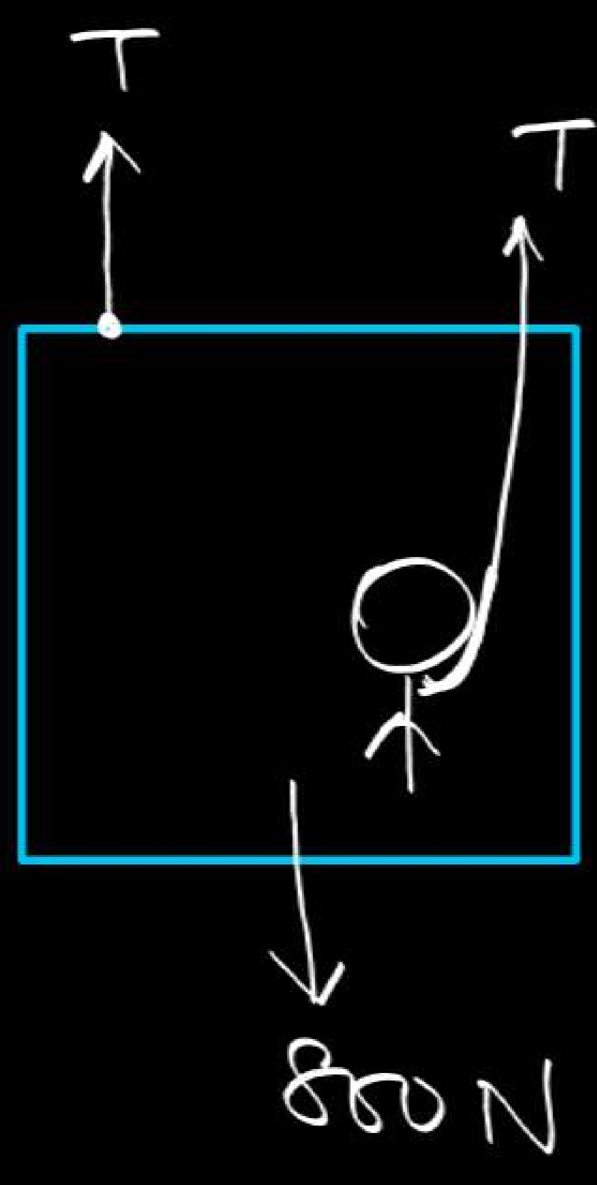
(iii) $F_{avg} = \frac{\Delta p}{\Delta t} = \frac{p_f - p_i}{\Delta t}$

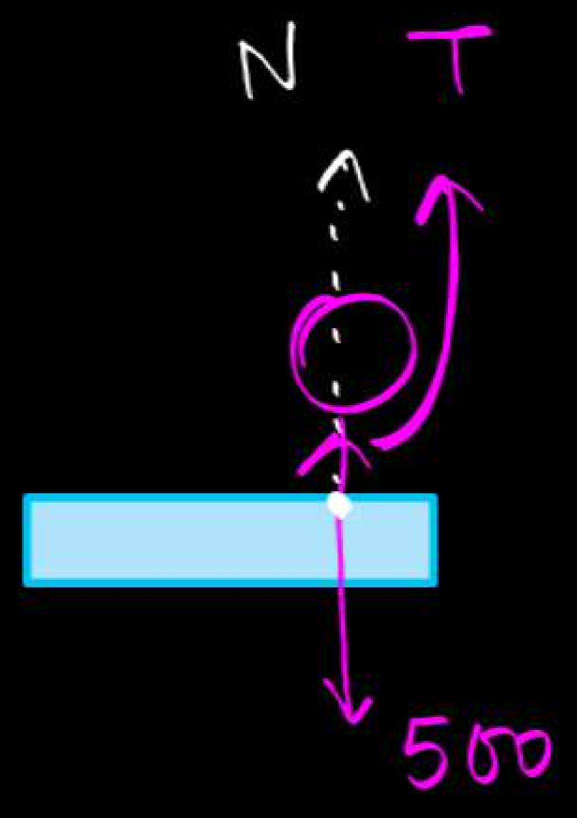
(iv) $F_{inst.} = \frac{dp}{dt}$ or $v\frac{dm}{dt}$

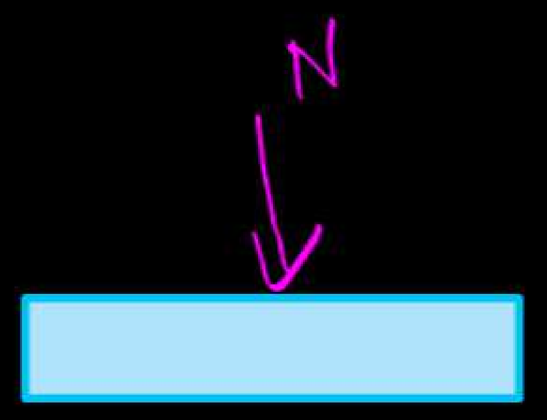
(vi) $F = m\frac{dv}{dt} + v\frac{dm}{dt}$

Figure shows a man of mass 50 kg standing on a light weighing machine kept in a box of mass 30 kg. The box is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself. If the man manages to keep the box at rest, the weight shown by the machine is









$2T = 800$

$T = 400$

$N + T = 500$

$N = 100 \rightarrow 10\text{kg}$

It is observed, a CAR of mass m, moves with a velocity V=2t as shown. Find the force applied by boy to do so (where, t represents time).

A. 2m
B. 3m
C. 4m
D. 8m

$$F = m\frac{dv}{dt}$$

$$= m\left(2\right)$$

A truck of mass 'm' is going with constant velocity v . Due to rain, water is getting collected at rate r kg/s in the trolley. Find Force applied on the trolley.

A. 2vr

B. vr

C. 1/2vr

D. 3vr

$$F = v\frac{dm}{dt}$$

$$= v(r)$$

A machine gun fires a bullet of mass 40 g with a velocity 1200 m/s. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?

A. One
B. Four
C. Two
D. Three

$$F_{\text{one bullet}} = \frac{P_f - P_i}{\text{time}}$$

$$= \frac{(0.04 \times 1200) - 0}{1}$$

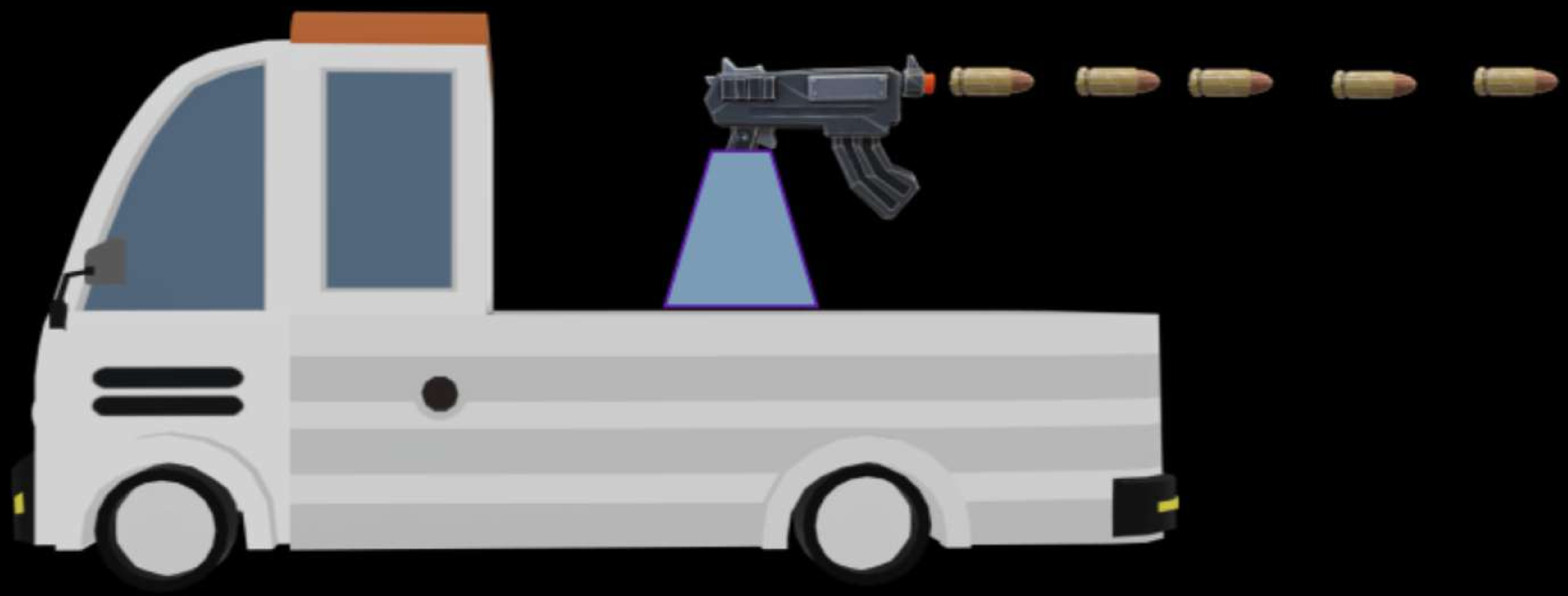
$$= 48\,N$$

$$\text{No. of bullets} = \frac{\text{Capacity}}{F_{\text{one bullet}}} = \frac{144}{48}$$

$$= 3$$

A machine gun is mounted on a 2000 kg car on a horizontal frictionless surface. At some instant the gun fires bullets of mass 10 gm with a velocity of 500 m/sec with respect to the car. The number of bullets fired per second is 10. The average thrust on the system is

A. 550 N
B. 50 N
C. 250 N
D. 150 N



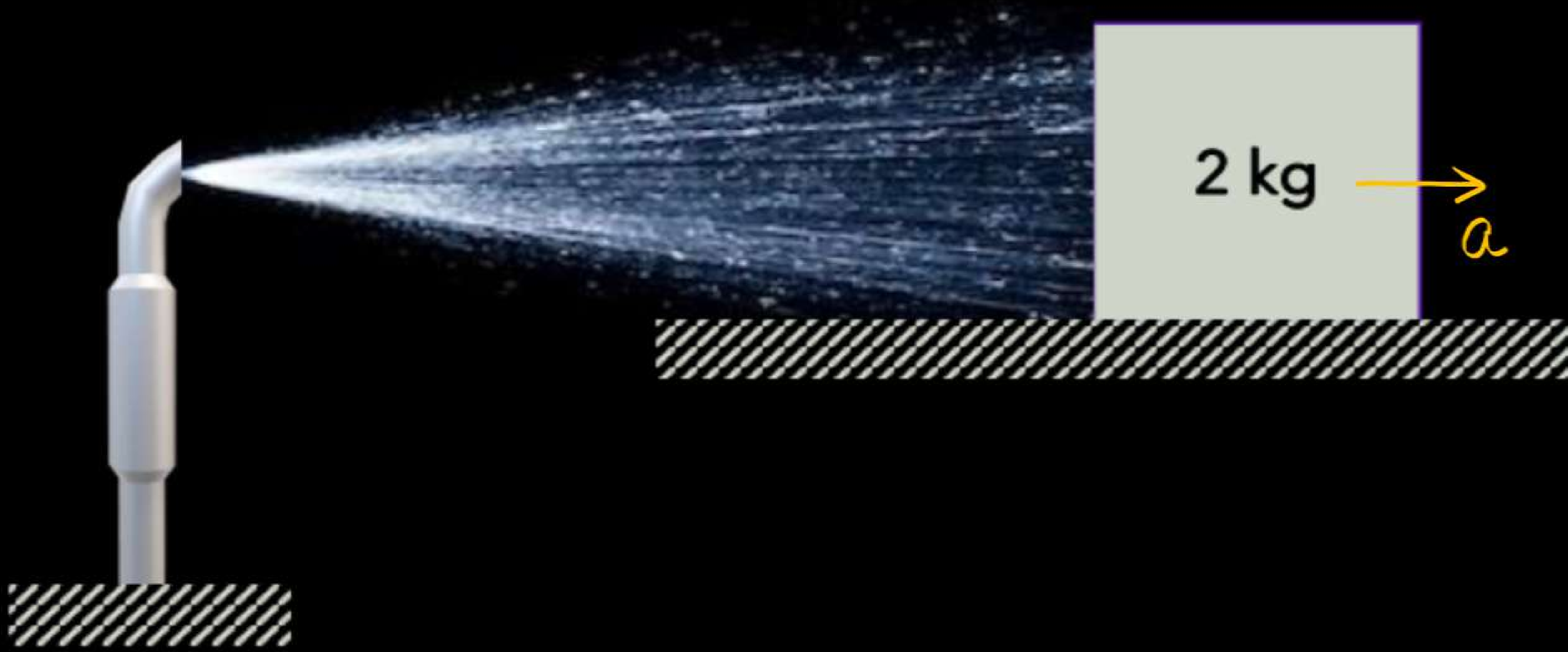
A block of metal weighing 2 kg is resting on a frictionless plane. It is struck by a jet releasing water at a rate of 1 kg/s and at a speed of 5 m/s. The initial acceleration of the block will be :

A. 2.5 m/s^2

B. 5 m/s^2

C. 10 m/s^2

D. 5 m/s^2



$$F = v\frac{dm}{dt} = ma$$

block

$$5 \times 1 = 2 \times a$$

(i) $F = ma$

(ii) $F = m\frac{dv}{dt} = (ma)$ body

(iii) $F = m\left(v\frac{dv}{dx}\right) =$ " "

iv) $F = v\left(\frac{dm}{dt}\right) =$ " "

v) $\boxed{F = \frac{\Delta p}{\Delta t} = \frac{dp}{dt}} \Rightarrow$ slope of P v/s time

$\Rightarrow \underline{\Delta p} = \int F \cdot dt$

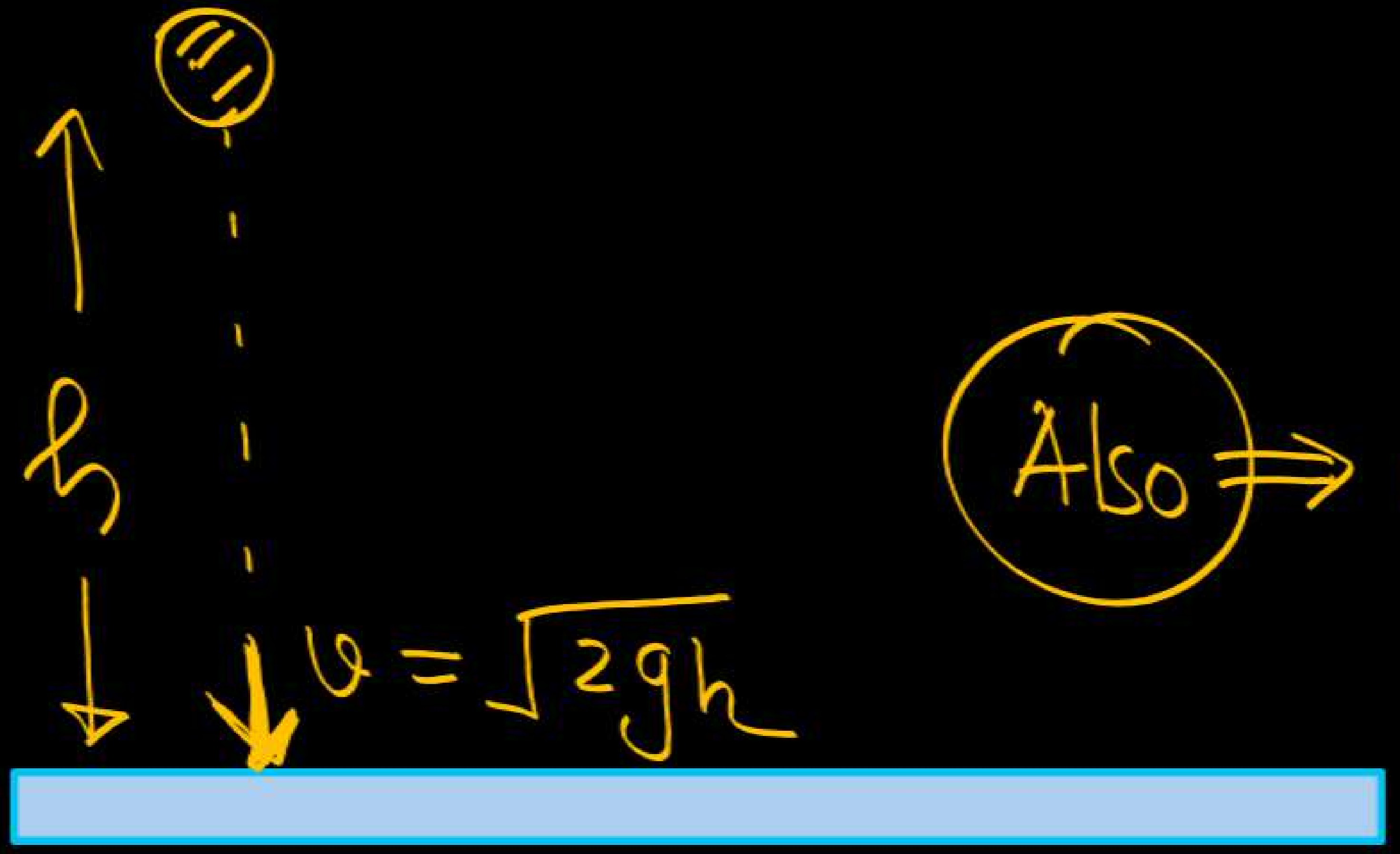
= area of F-t graph

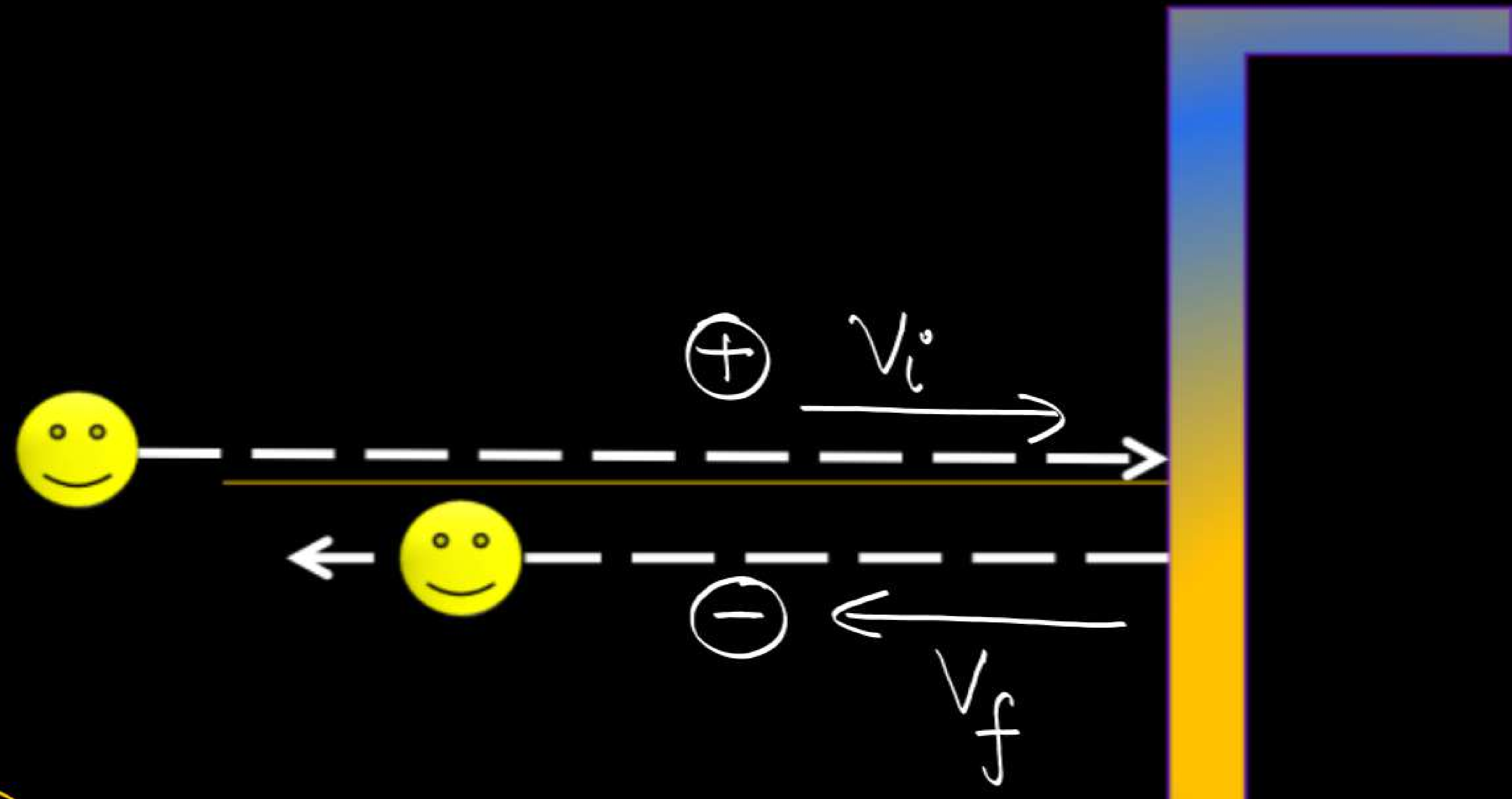
Collision with wall

$$\Delta p = m(v_f - v_i)$$

$$\text{time} = \Delta t$$

$$F_{avg} = \frac{\Delta p}{\Delta t}$$





Also ⟹ elastic collission

$$|v_i| = |v_f|$$

$$\Delta p = 2mv$$

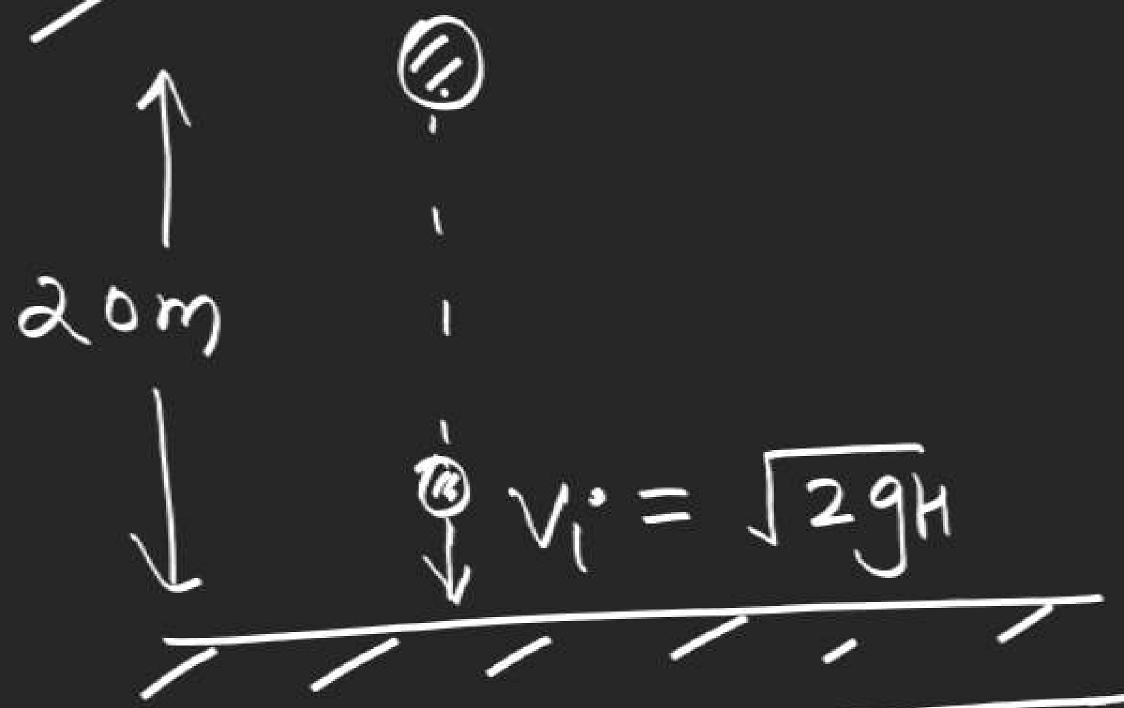
Question 100gm Ball dropped From 20m Height. find thrust on Ground.

If a) Rebounds with same speed

b) ——,—— Half speed

If contact time is 0.05 sec

a)



$$v_i = \sqrt{2gH}$$

$$= \sqrt{2 \times 10 \times 20}$$

$$= 20\,m/s$$

$$\frac{\Delta p}{\Delta t} = \frac{2mv}{0.05}$$

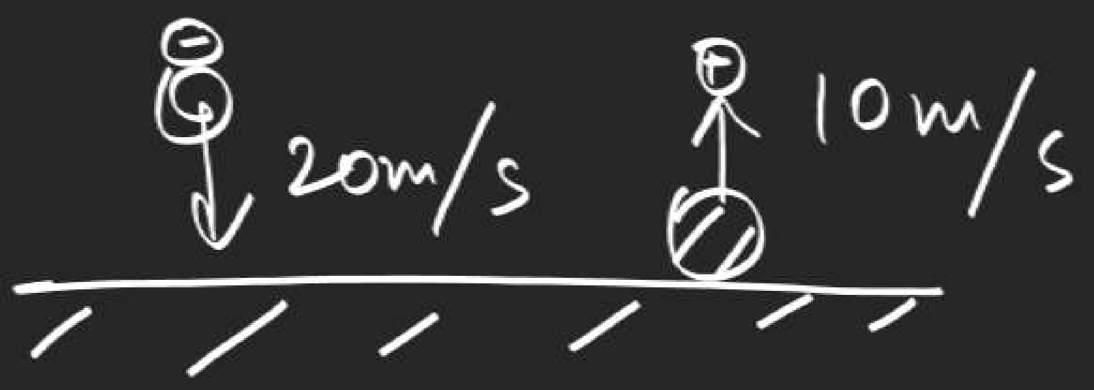
$$= \frac{2 \times 0.1 \times 20}{0.05}$$

$$= \underline{80\,N}$$

b) Rebound with Half speed

$\Downarrow$

10m/s



$$\frac{\Delta P}{\Delta t} = \frac{m(v_f - v_i)}{0.05}$$

$$= \frac{0.1\left(10 - (-20)\right)}{0.05}$$

$$= \underline{60\,N}$$

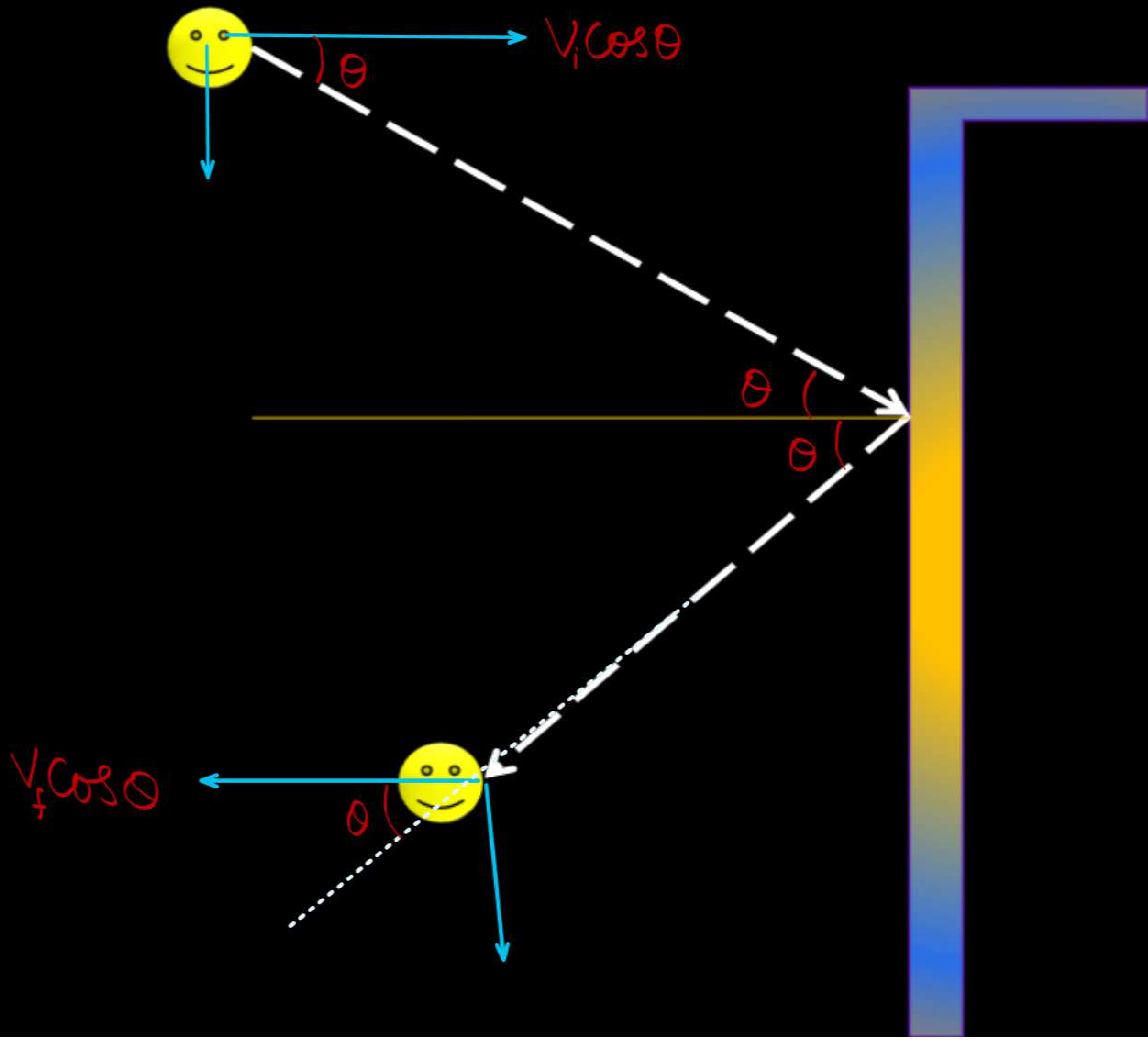
Collision with wall

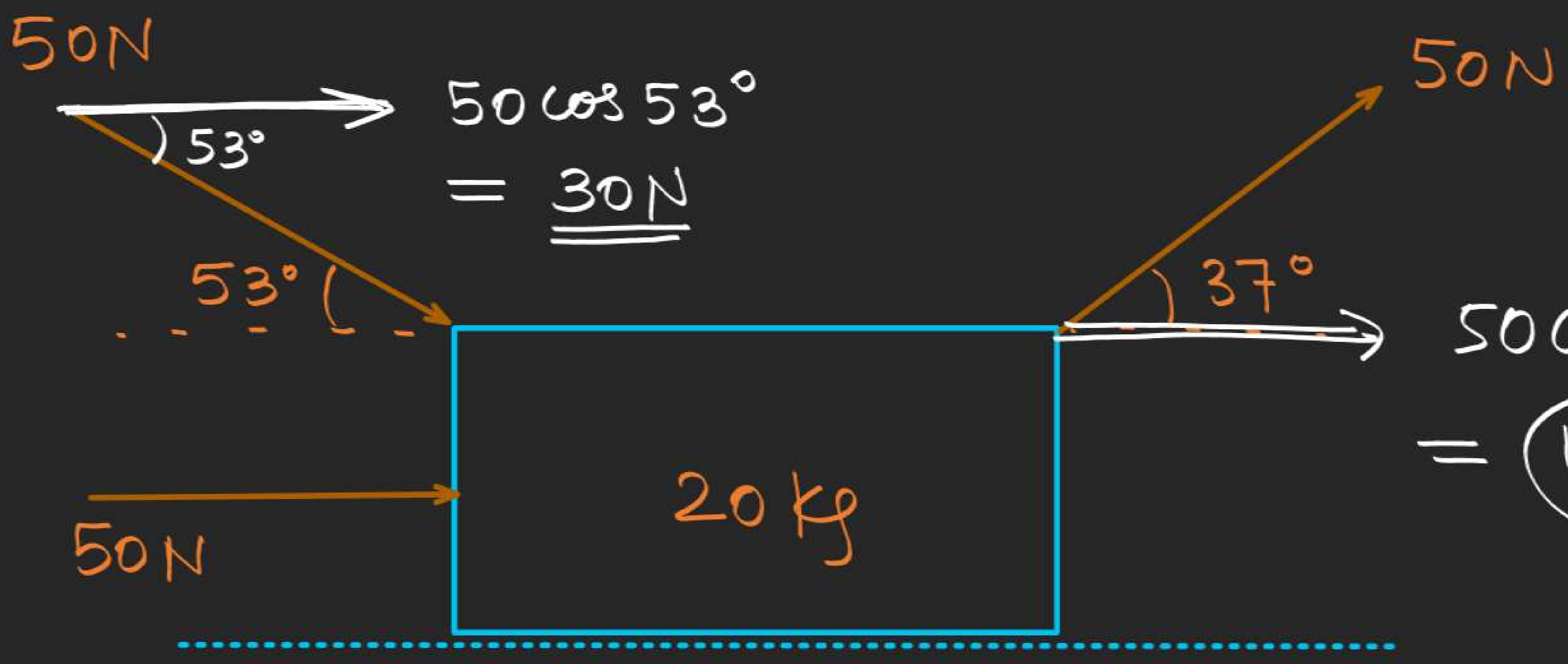
At an angle

here $\Delta p = m\left(V_f \cos\theta - V_i \cos\theta\right)$

Elastic collission

$$\Delta p = 2mv\cos\theta$$





$50\cos 53° = \underline{\underline{30N}}$

$50\cos 37° = 40N$

find acc^n

$\Rightarrow$ 

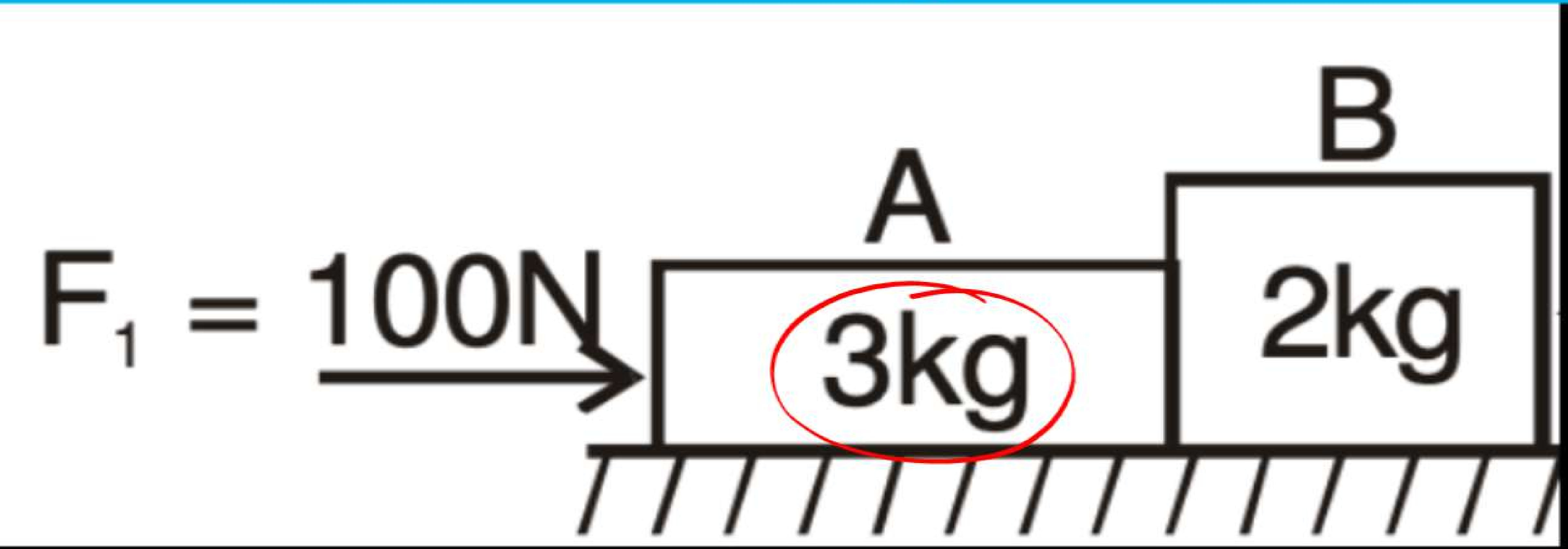
$$f_{net} = ma$$

$$30 + 50 + 40 = 20a$$

$$120 = 20a$$

$$6\,m/s^2 = a$$

Find Normal force acting on blocks and it's acceleration



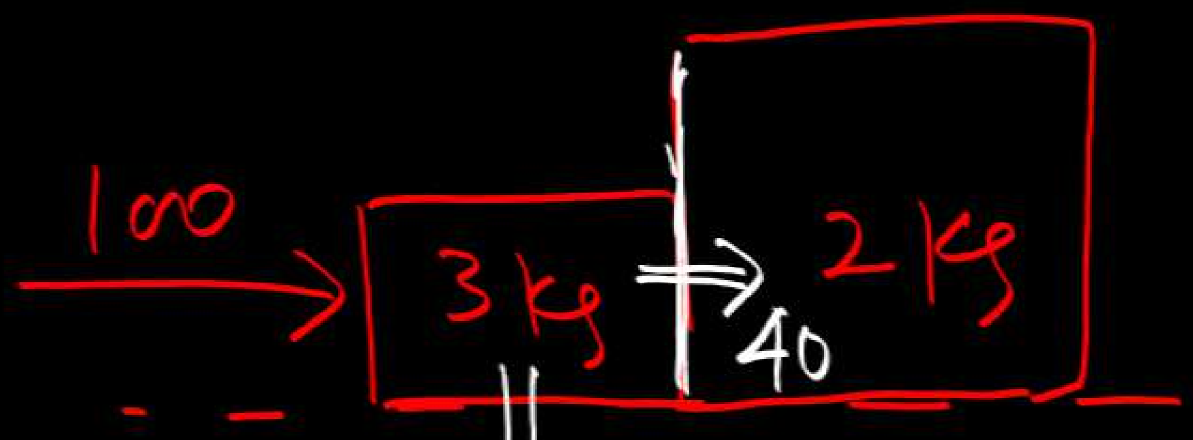
(i) All move together

$$f_{net} = (m_{Total})a$$

$$100 = (3+2)a$$

$$\boxed{20\, m/s^2 = a}$$

oral method

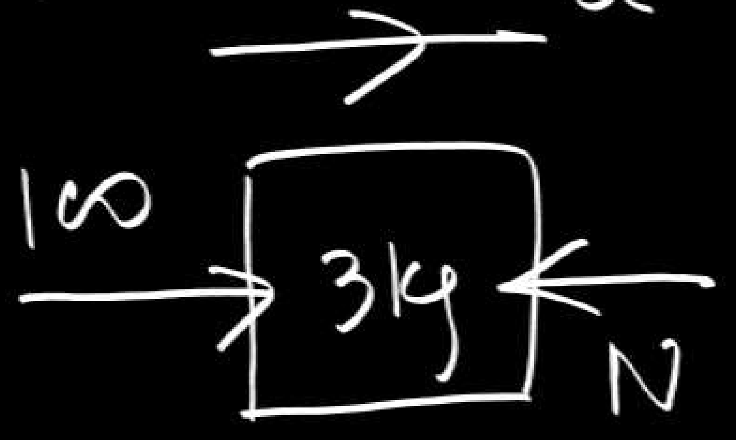


eat

(ma)

$3 \times 20 = 60$

Concept



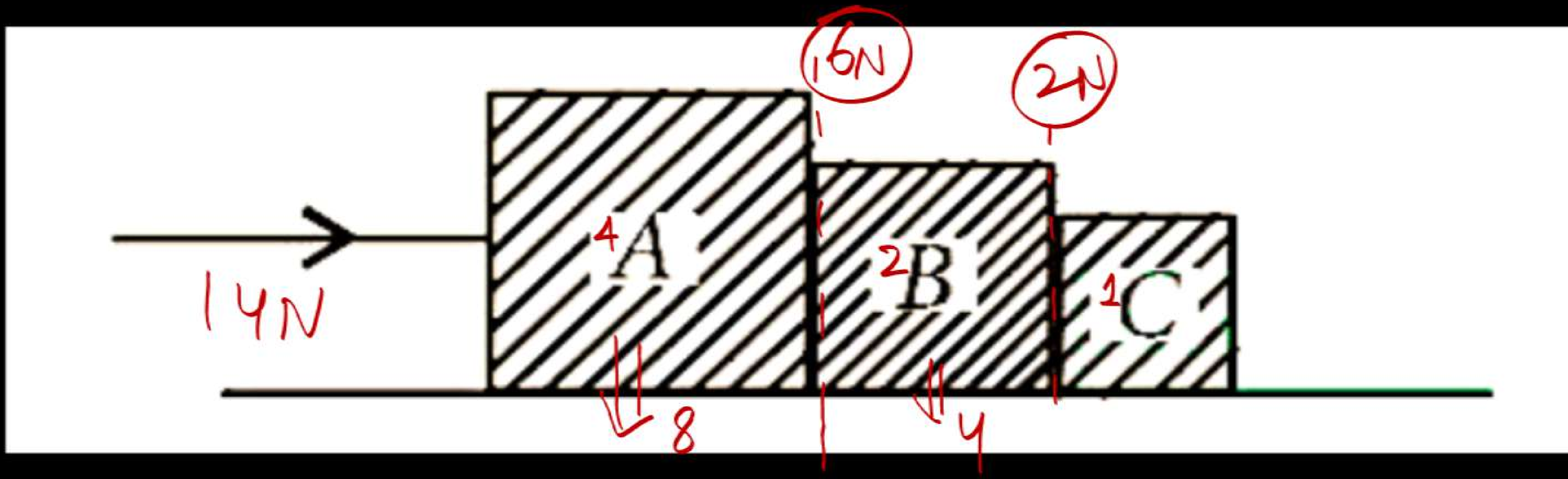
$$f_{net} = ma$$

$$100 - N = 3 \times 20$$

$$100 - 60 = N$$

$$40 = N$$

Three blocks A, B and C, of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is



$$a = \frac{14}{7} = 2$$

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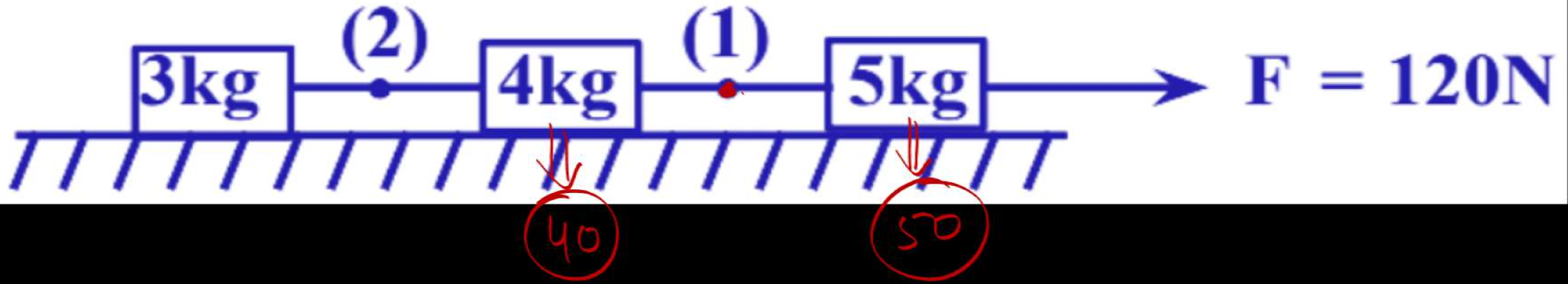
Find acceleration of blocks, also find tension in string (1) &(2)



$T_1 = 70$

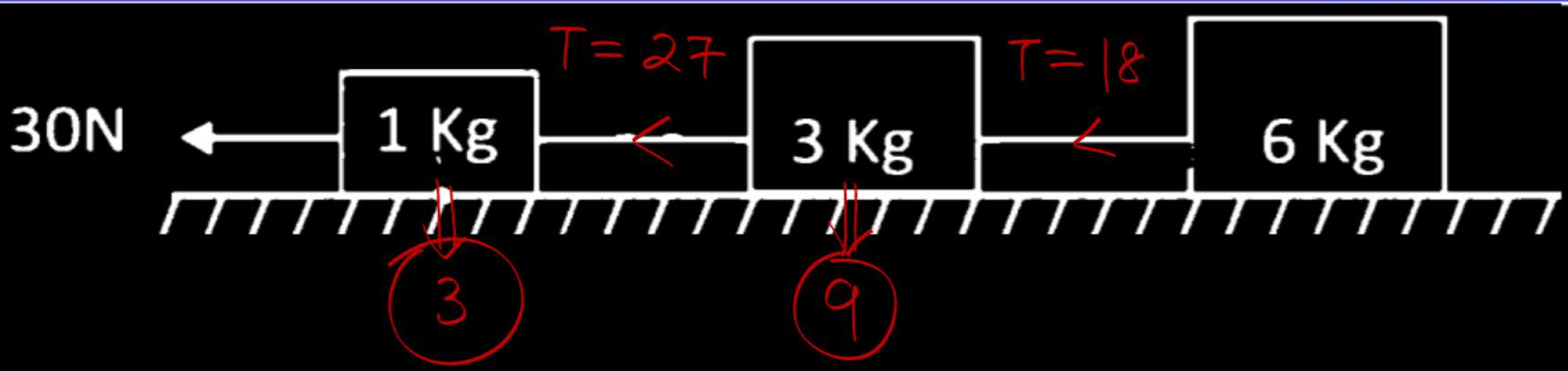
$T_2 = 30$

(i) $a = \frac{120}{12}$

$= 10\,m/s^2$

$a = 10\ m/s^2$
$T_1 = 70\ N$
$T_2 = 30\ N$

Find acceleration of blocks, also find tension in string (1) &(2)



$$a = \frac{30}{10}$$

$$= 3 \, m/s^2$$

a= 10 m/s²

T_1= 70 N

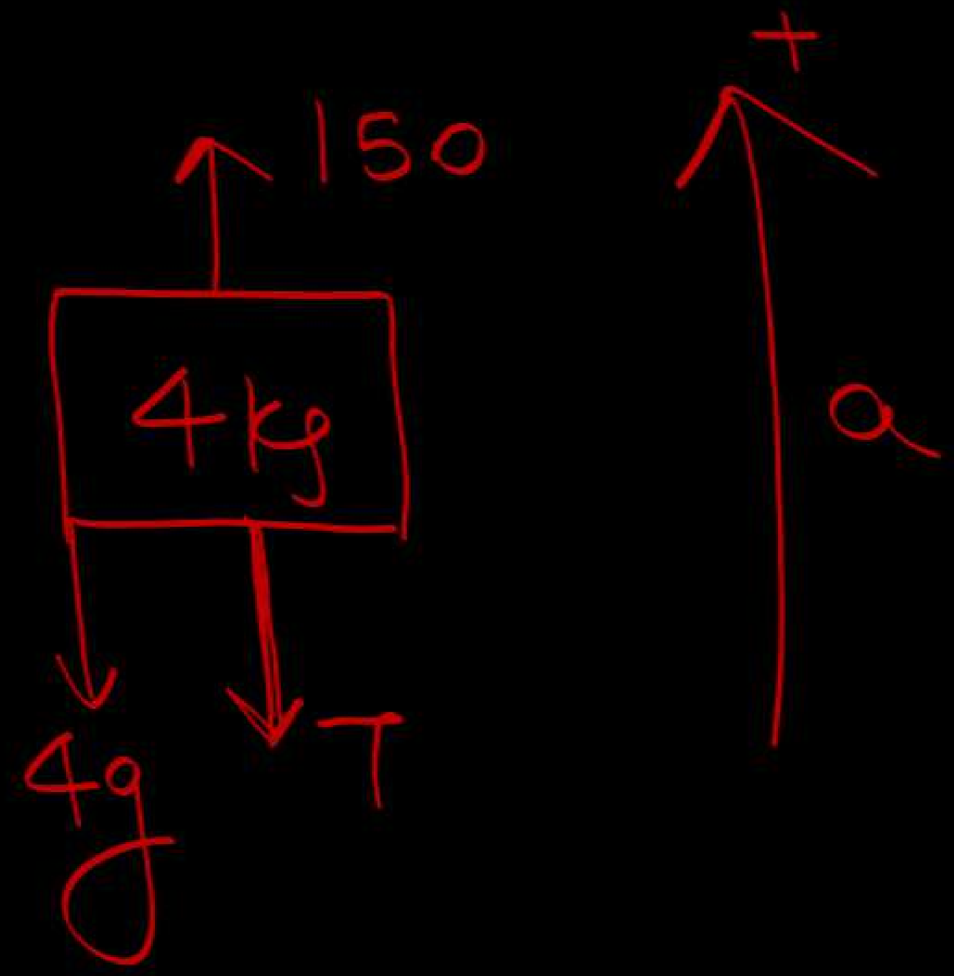
T_2= 30 N

Find the acceleration of each block and tension in the strings.

1) $a = \dfrac{150 - 10g}{10}$

$= 5\ m/s^2$

2)



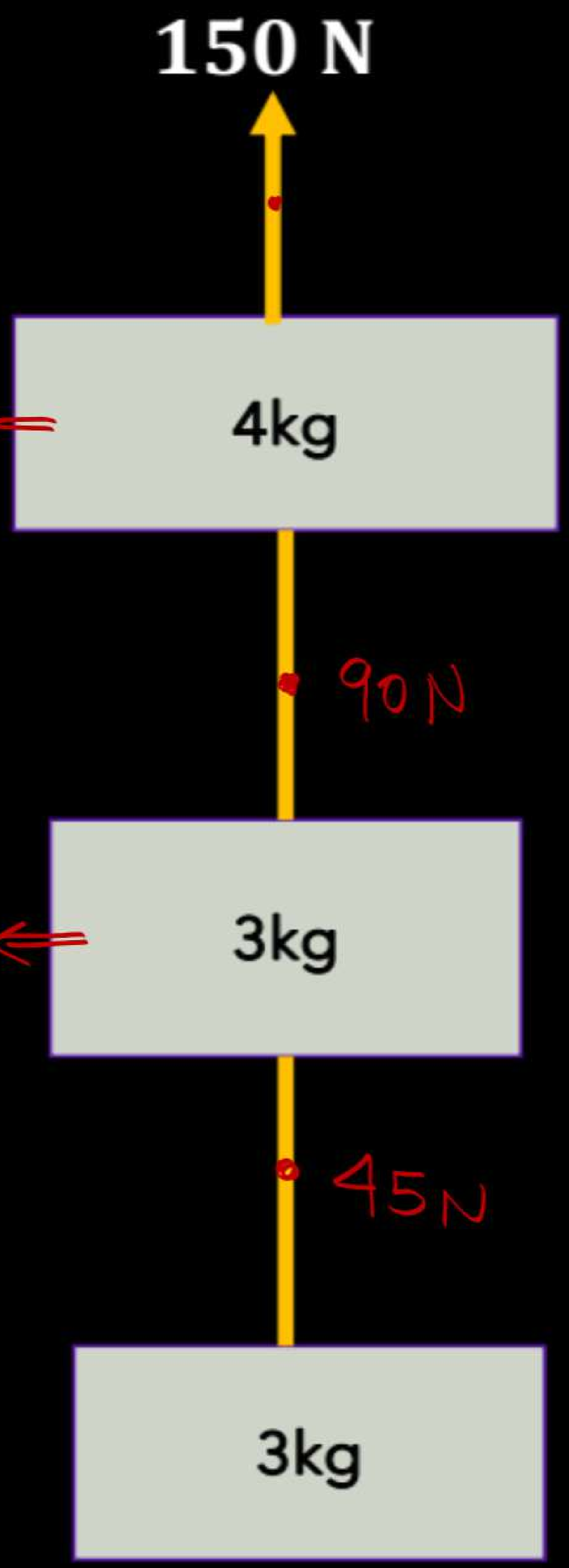
$150 - 40 - T = 4a$

$110 - T = 4 \times 5 \Rightarrow 90 = T$

40 + 20 ⟸

weight खायेगा

30 + 15 ⟸



$a = 5\ m/s^2$

$T_1 = 150\ N$

$T_2 = 90\ N$

$T_3 = 45\ N$

find tension in each thread:

$$a = \frac{30}{6}$$

$$\underline{a = 5\, m/s^2}$$

Breaking Tension of string = 350N. Find the maximum acceleration of boy without breaking the string. (mass of boy = 20 kg)

A. 10 m/s^2

B. 7.5 m/s^2

C. 17.5 m/s^2

D. None of these

$$F_{net} = ma$$

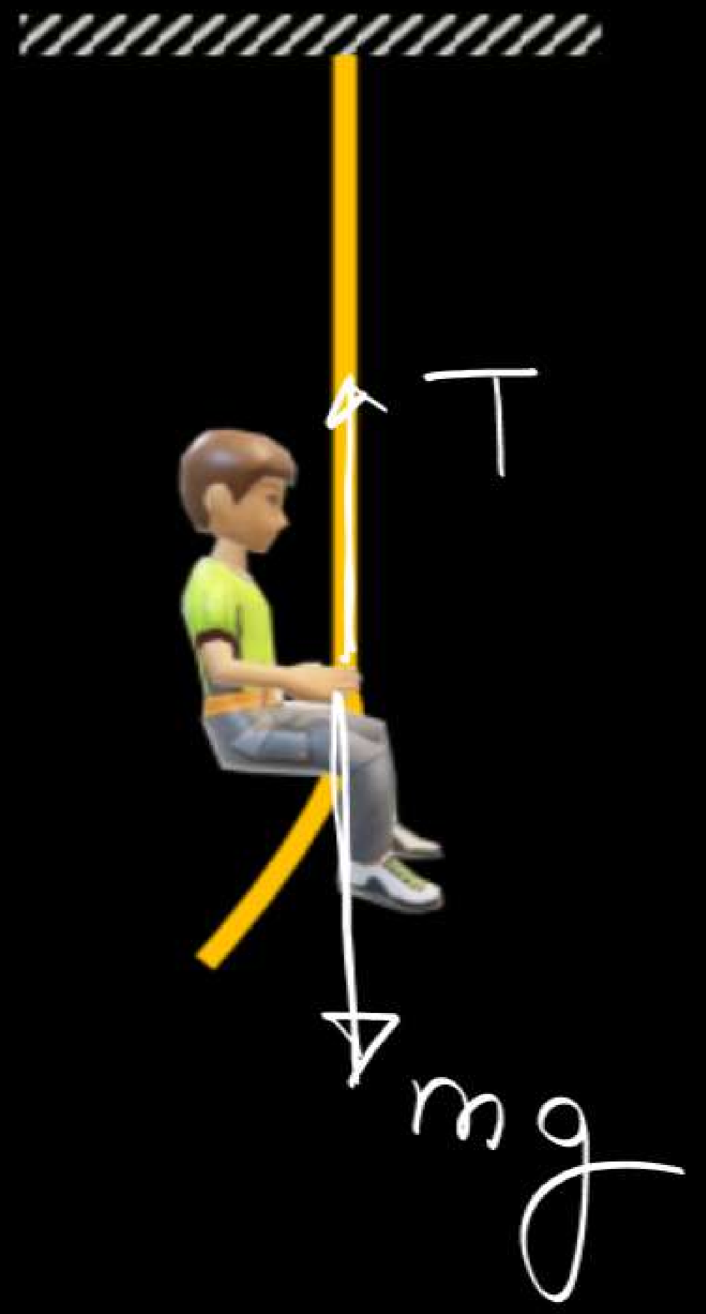
$$T - mg = ma$$

max

$$350 - 200 = 20a$$

$$\frac{150}{20} = a_{max}$$

$$7.5 = a_{max}$$



A monkey of mass 20 kg. is holding a vertical rope. The rope will not break when a mass of 25 kg. Is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration it which the monkey can climb up along the rope ?

Breaking : 250N

A. 5 m/s²
B. 10 m/s²
C. 25 m/s²
D. 2.5 m/s²

$F_{net} = ma$

$250 - 200 = 20a$

$50 = 20a$

Breaking Tension of string = 150N. Find the maximum acceleration of boy without breaking the string. (mass of boy = 20 kg)

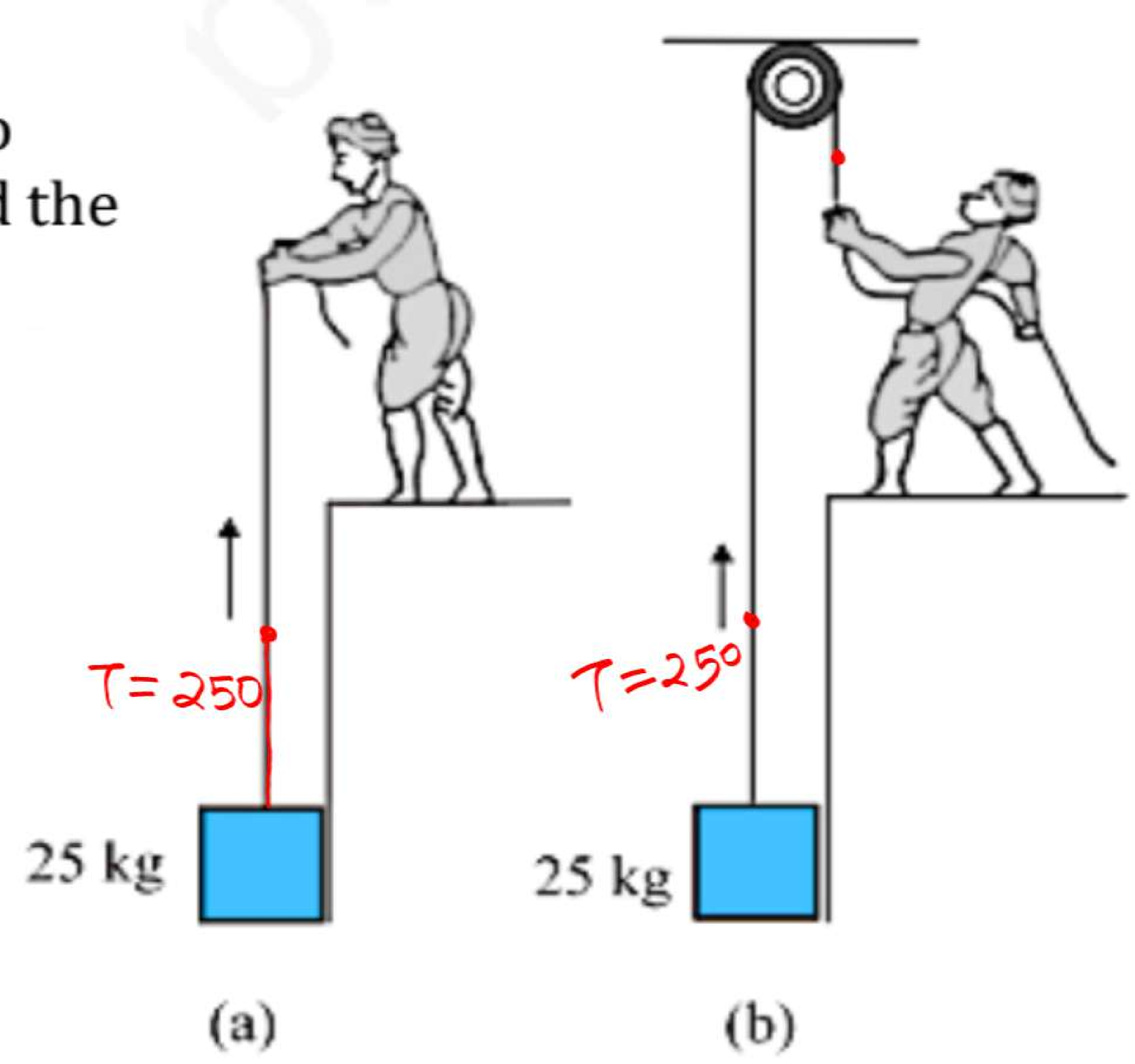
A. 2.5 m/s^2 [downward]

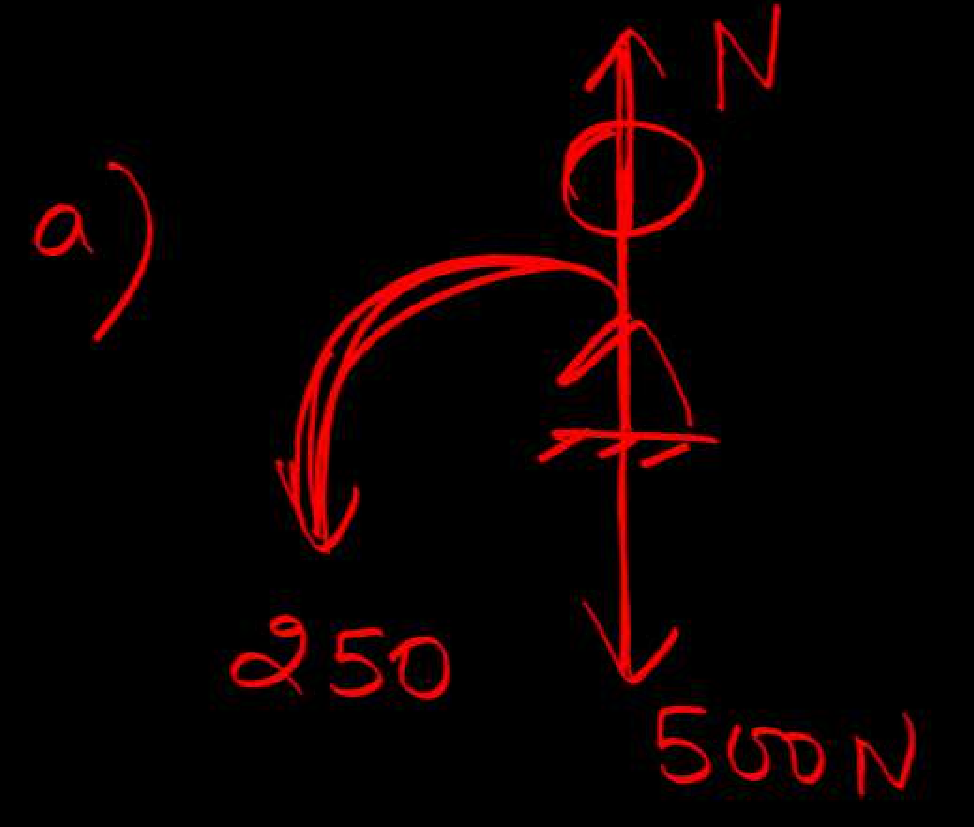
B. 2.5 m/s^2 [upward]

C. 7.5 m/s^2

D. Boy can't climb up

A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in Fig. 5.19. What is the action on the floor by the man in the two cases ? If the floor yields to a normal force of 700 N, which mode should the man adopt to lift the block without the floor yielding ?

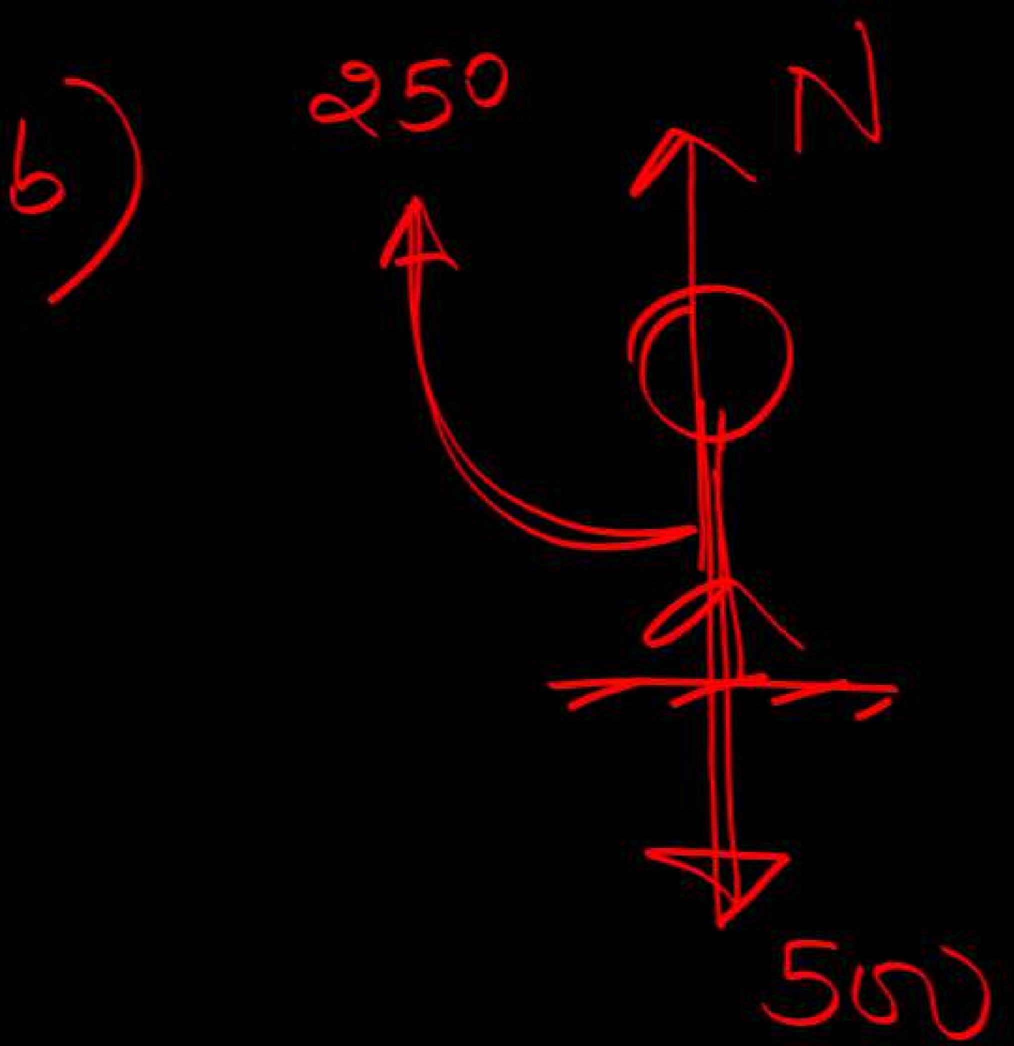




$N = 250 + 500$

$= 750$

XX



$N + 250 = 500$

$N = 250$

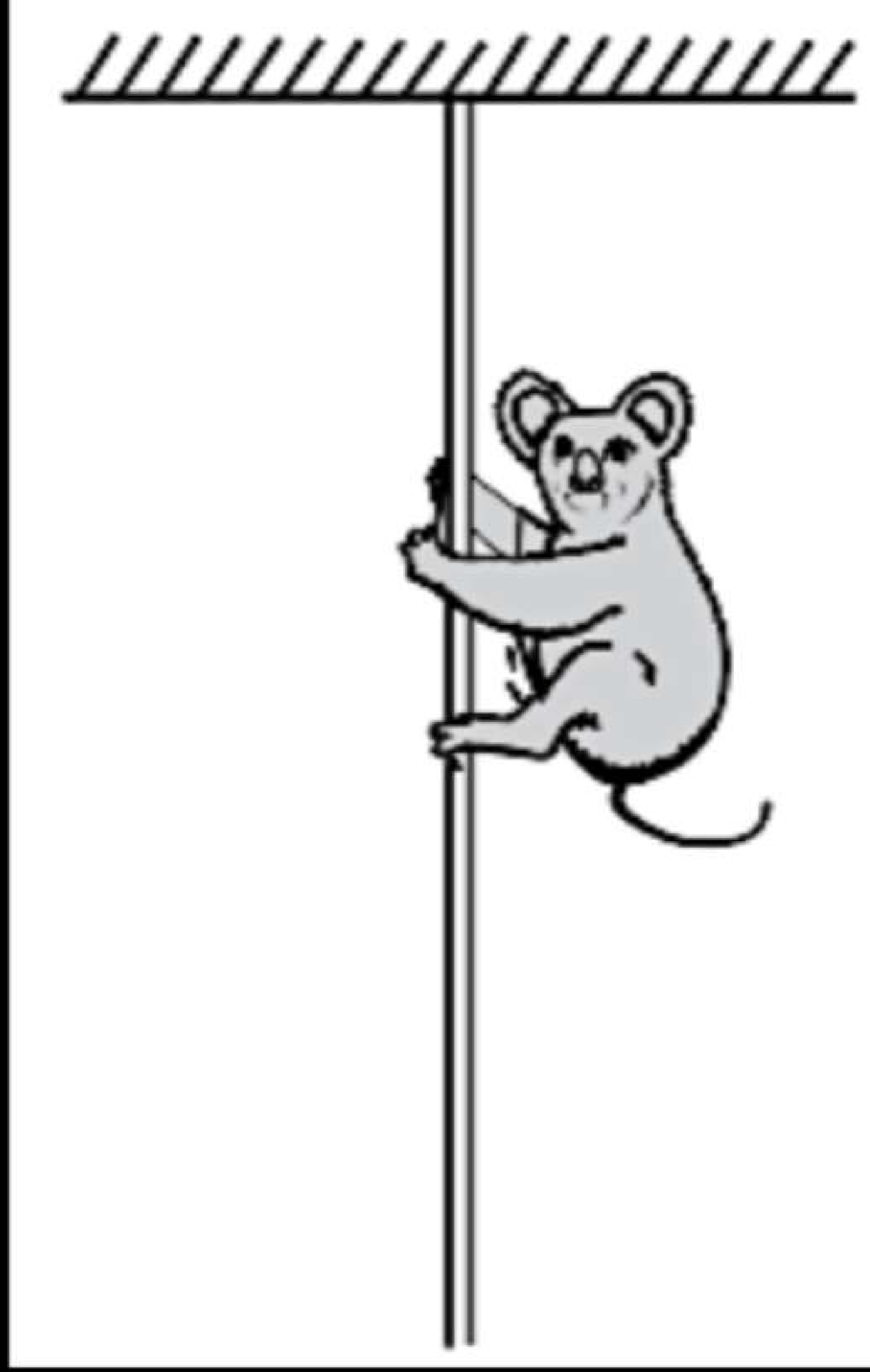
A monkey of mass 40 kg climbs on a rope (Fig. 5.20) which can stand a maximum tension of 600 N. In which of the following cases will the rope break: the monkey

(a) climbs up with an acceleration of 6 m s^{-2}

(b) climbs down with an acceleration of 4 m s^{-2}

(c) climbs up with a uniform speed of 5 m s^{-1}

(d) falls down the rope nearly freely under gravity?



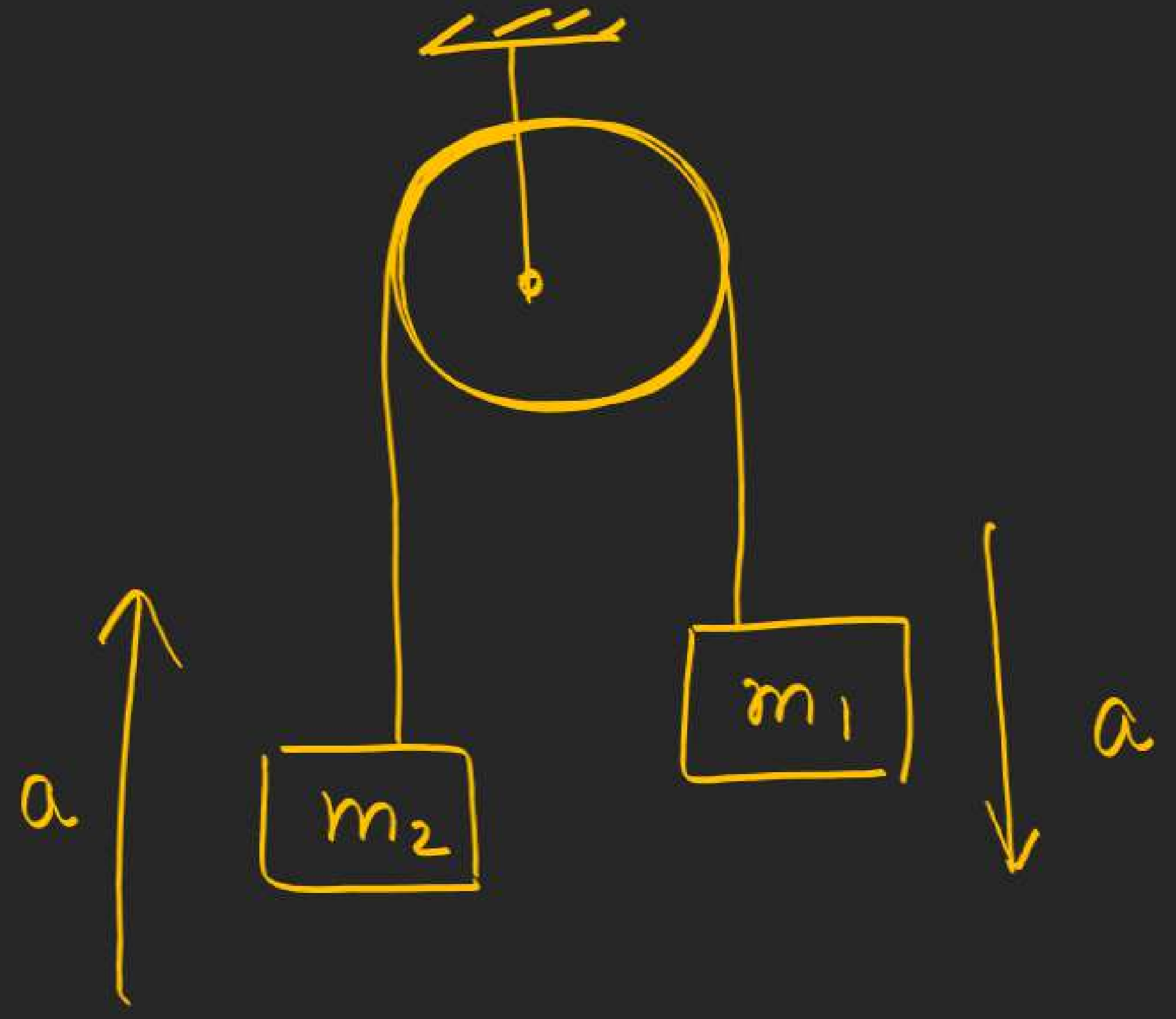
$$F_{net} = ma$$

$$600 - 400 = ma$$

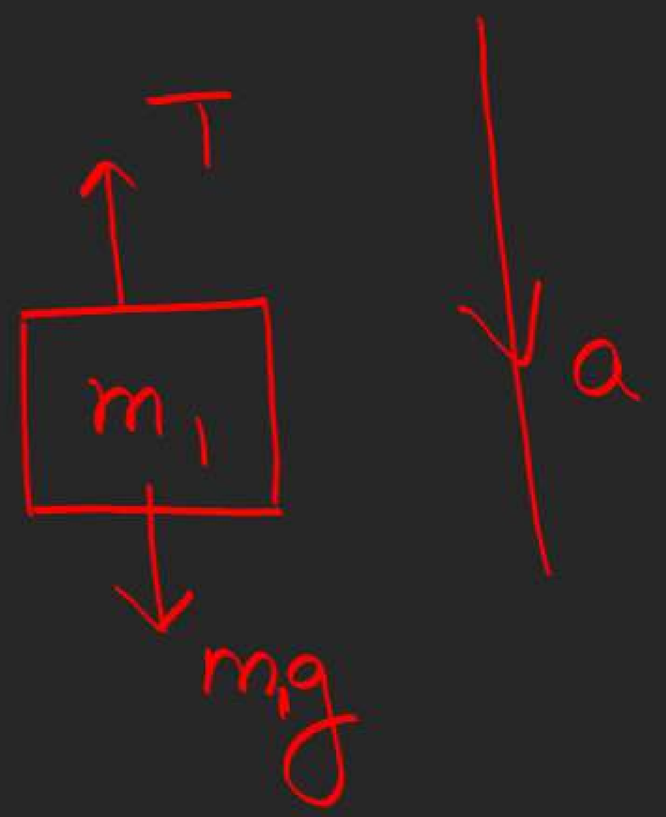
$$200 = 40a$$

$$5 = a$$

Pulley Problems



$$\xrightarrow{m_1 > m_2} \quad \boxed{a = \frac{(m_1 - m_2)g}{m_1 + m_2}}$$

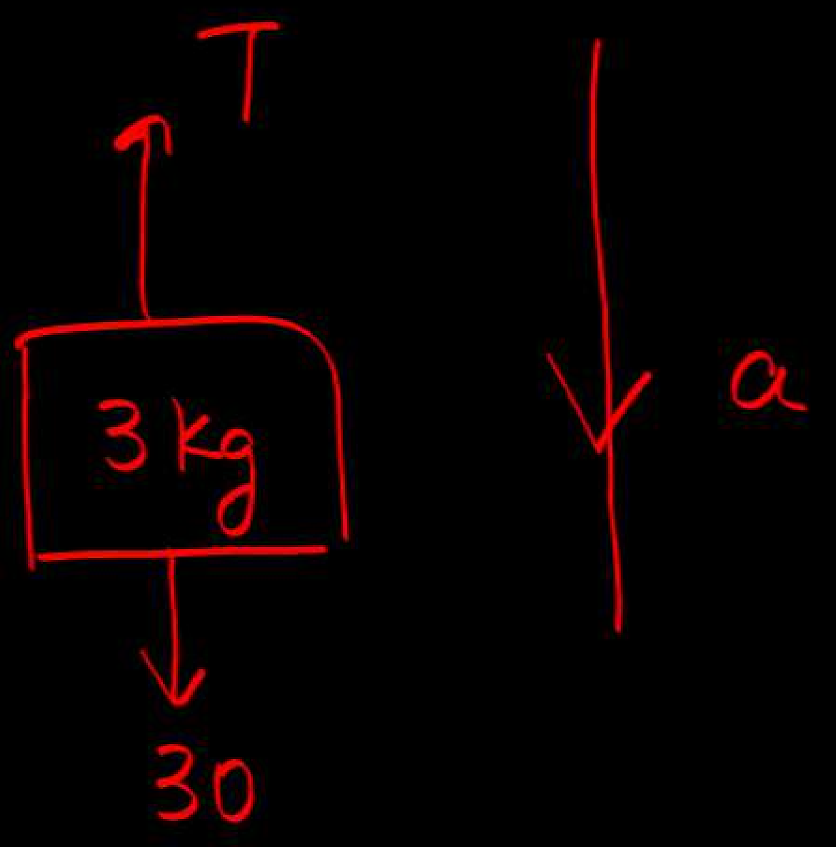


$$m_1 g - T = m_1 a$$

Find Acceleration and the tension in the string connecting the masses

$$a = \frac{(3-1)g}{(3+1)}$$

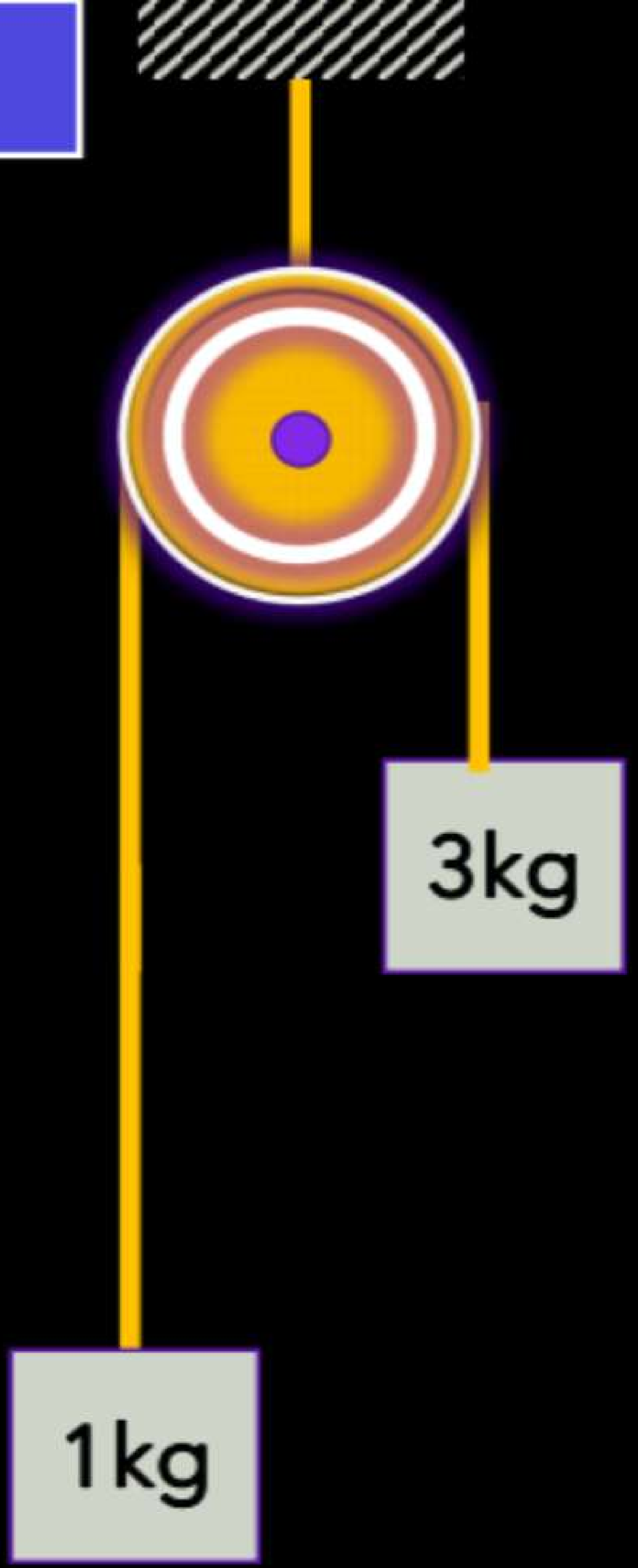
$$a = g/2 = 5\,m/s^2$$

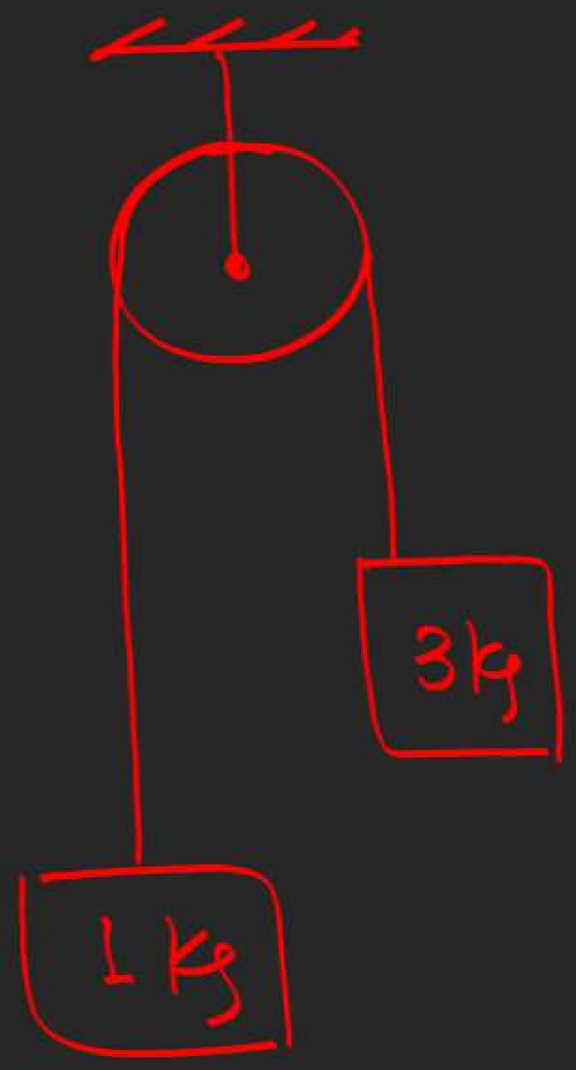


$$30 - T = 3a$$

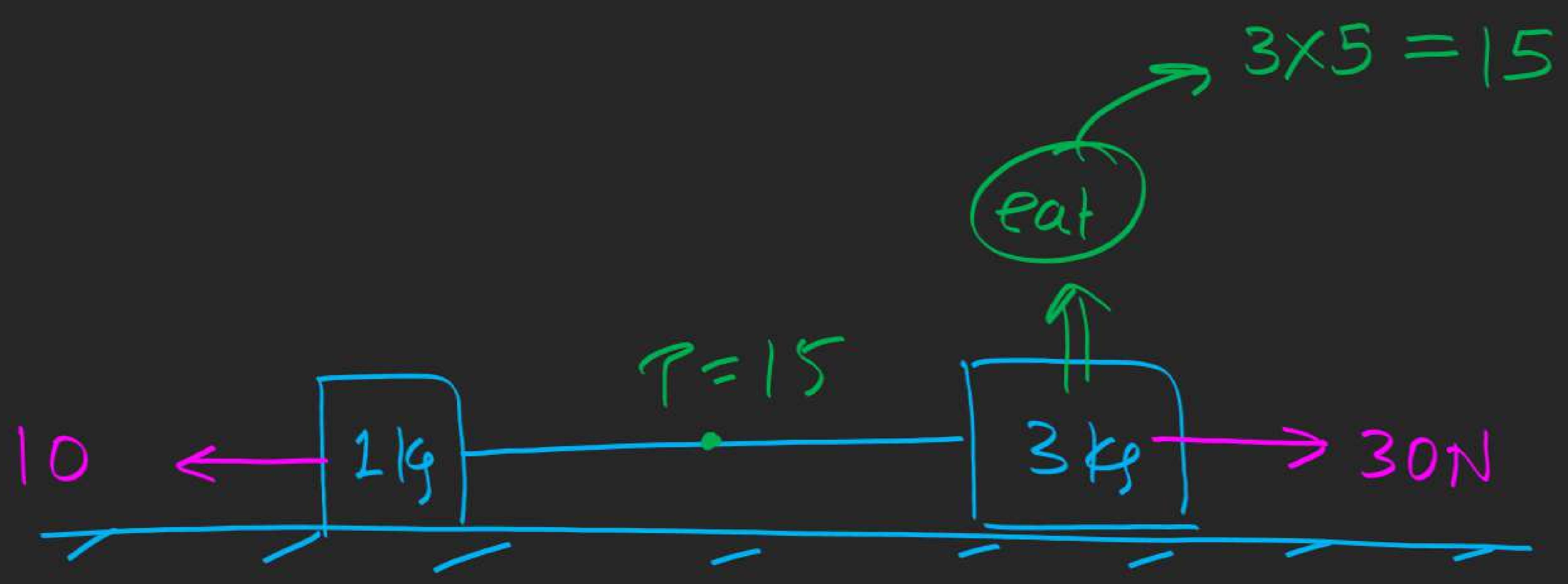
$$30 - T = 3 \times 5$$

$$15 = T$$





$\Rightarrow$



$$a = \frac{30 - 10}{4} = 5\ m/s^2$$

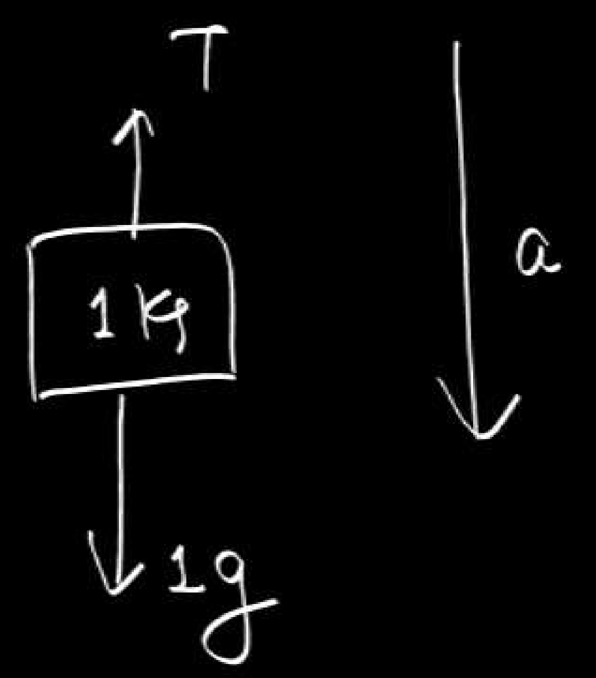
$$\underline{T = 15N}$$

Acceleration of the 1 kg mass and the tension in the string connecting A and B is

A. g/4 downwards, 8g/7
B. g/4 upwards, g/7
C. g/2 upwards, g
D. g/7 downwards, 6g/7

$$a = \frac{(4-3)g}{7}$$

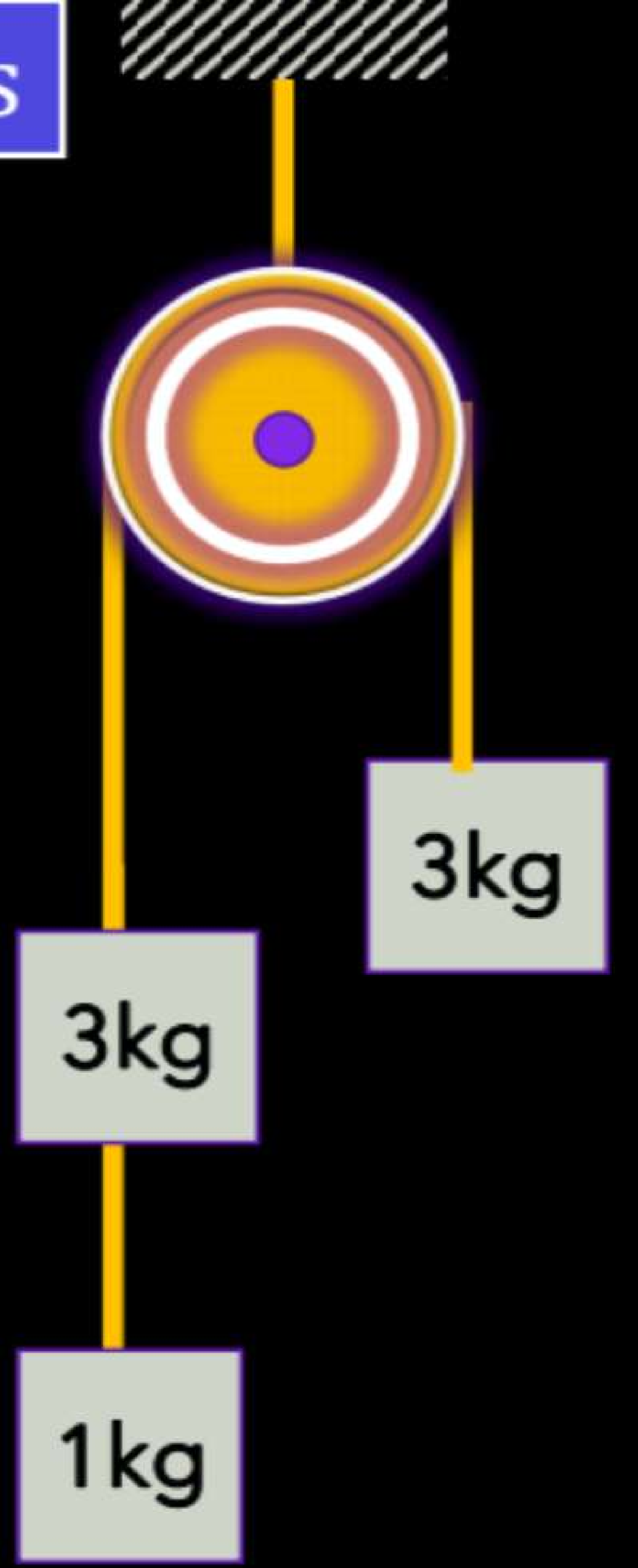
$$a = g/7$$

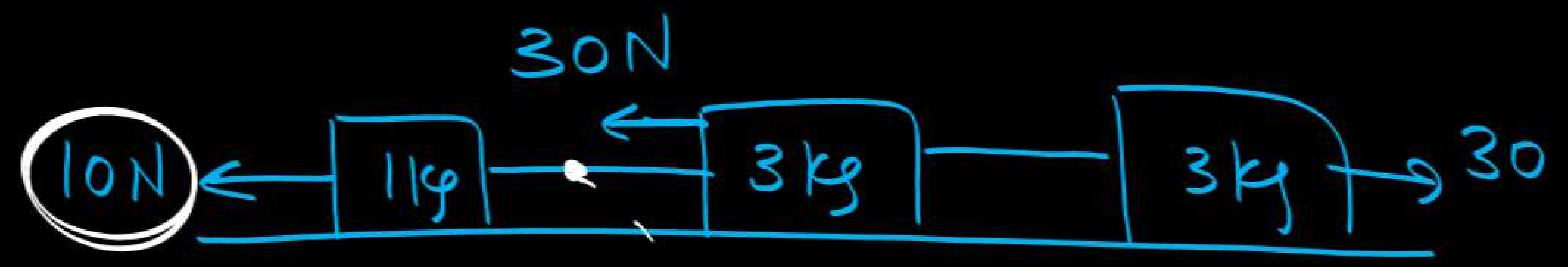


$$g - T = 1 \times a$$

$$g - T = \frac{g}{7}$$

$$6g/7 = T$$





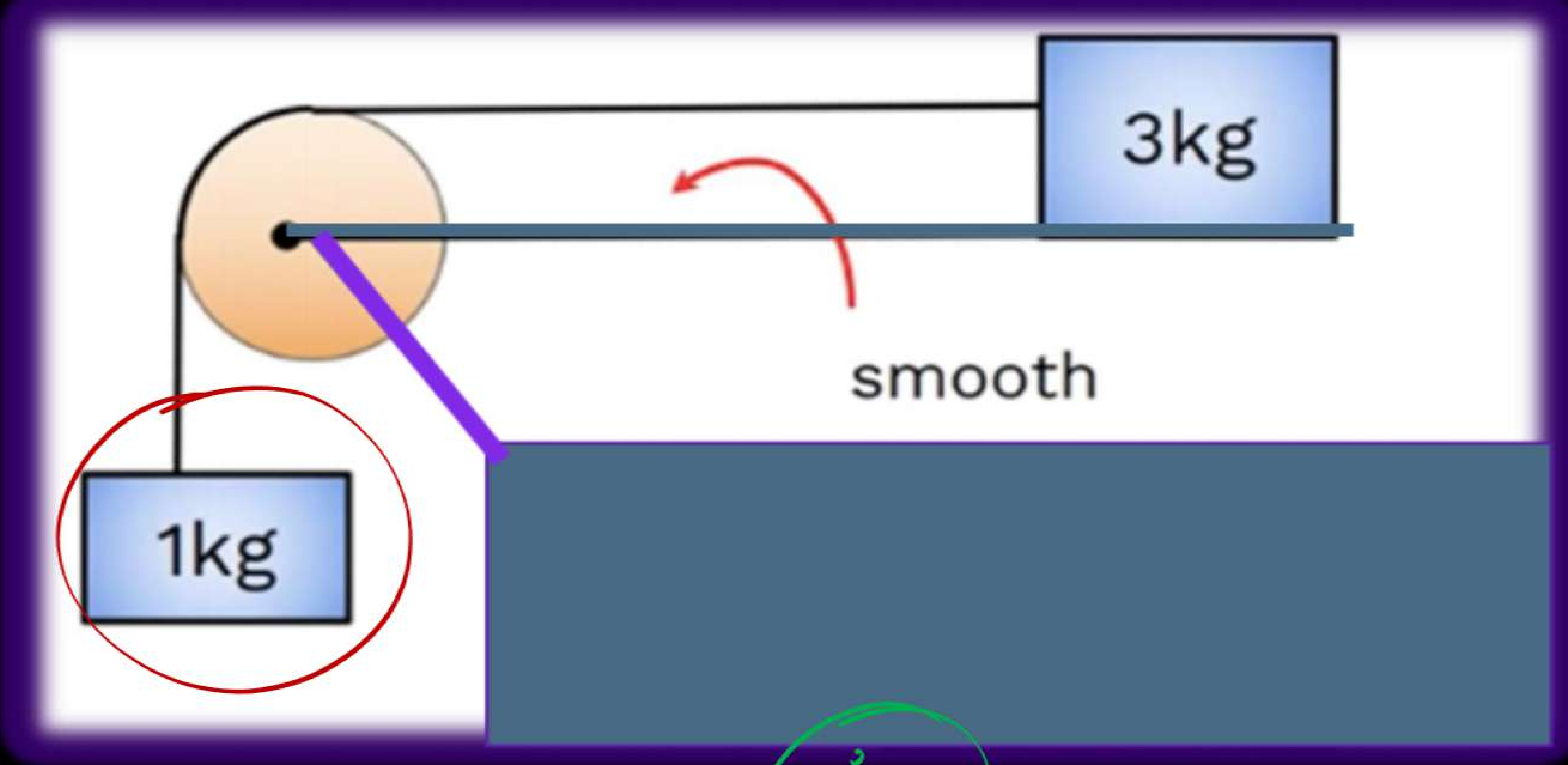
$$a = \frac{40-30}{7}$$

$$= \frac{10}{7} = g/7$$

$$g - g/7$$

$$\Rightarrow 6g/7$$

find Tension and acceleration of the block



$$a = \frac{(1 - \text{कोई नहीं})\, g}{(1+3)}$$

$$a = \frac{1g}{4} = 2.5\, m/s^2$$

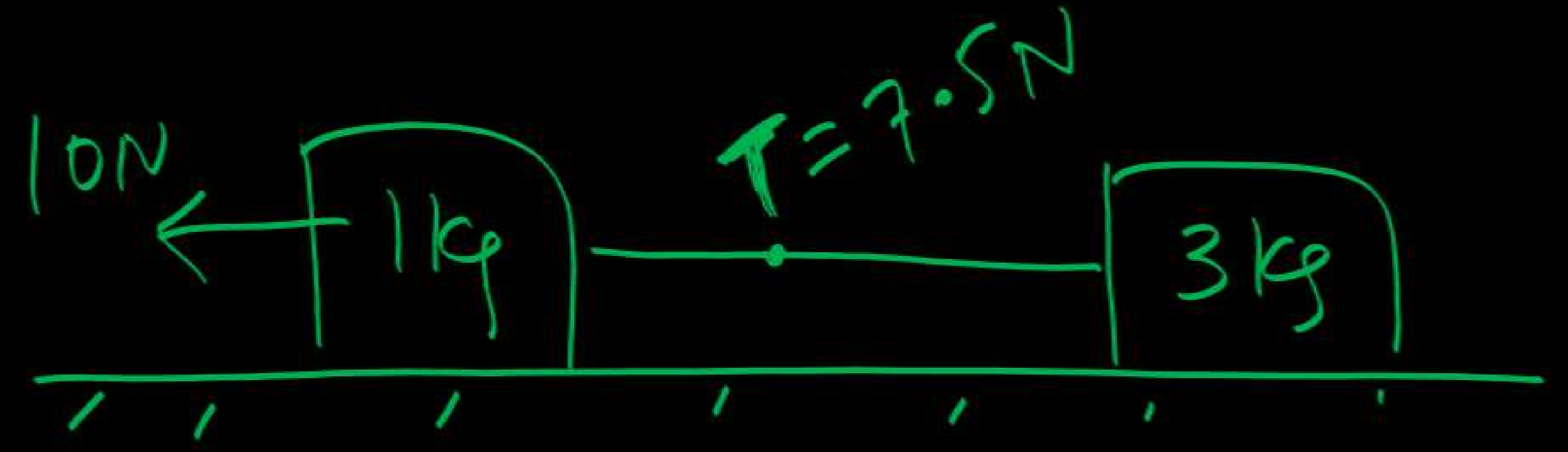
$$\xleftarrow{a}$$

$$T \leftarrow \boxed{3kg}$$

$$T = ma$$

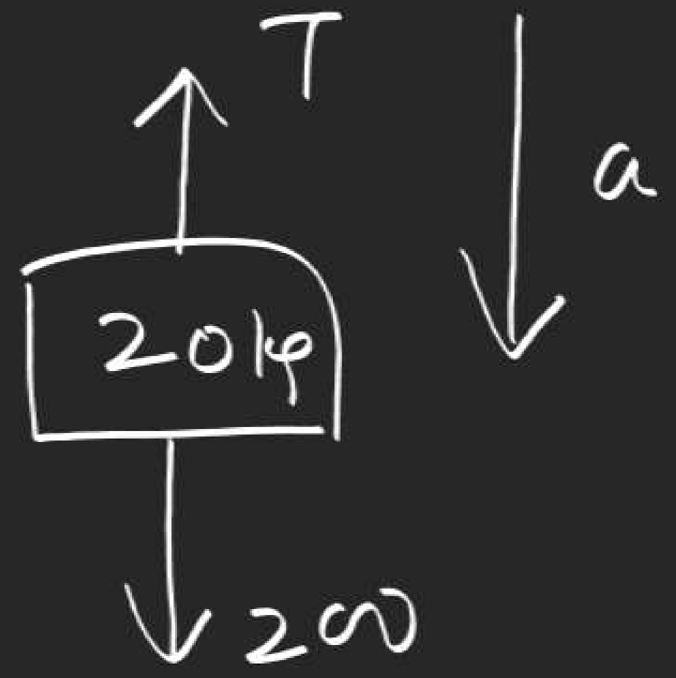
$$T = 3 \times 2.5 = 7.5N$$

ninja



$$a = \frac{10}{4} = 2.5\, m/s^2$$

$\Longrightarrow$



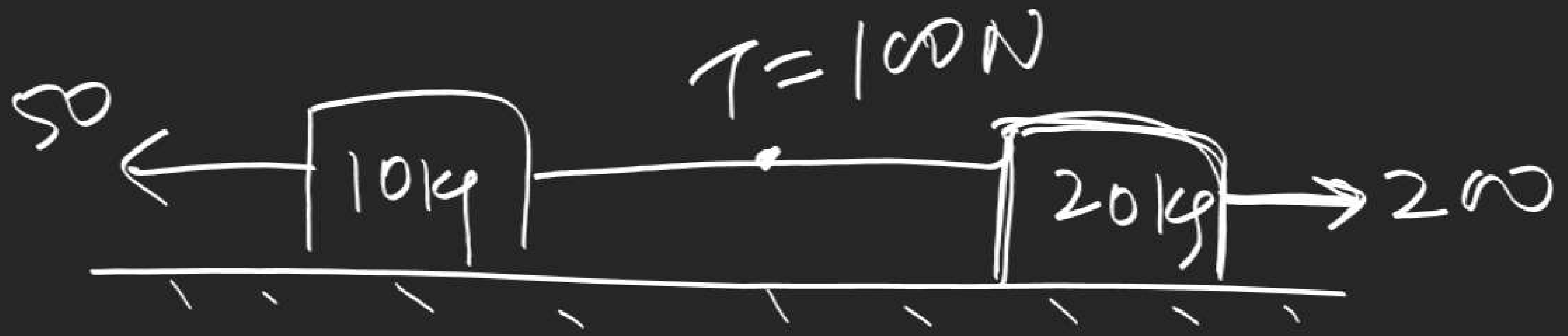
$$\Rightarrow 200 - T = 20a$$

$$200 - T = 20 \times 5$$

$$\boxed{T = 100}$$

$$a = \frac{200 - 50}{30}$$

$$= \underline{\underline{5\,m/s^2}}$$



$$a = \frac{200-50}{30} = 5\,m/s^2$$

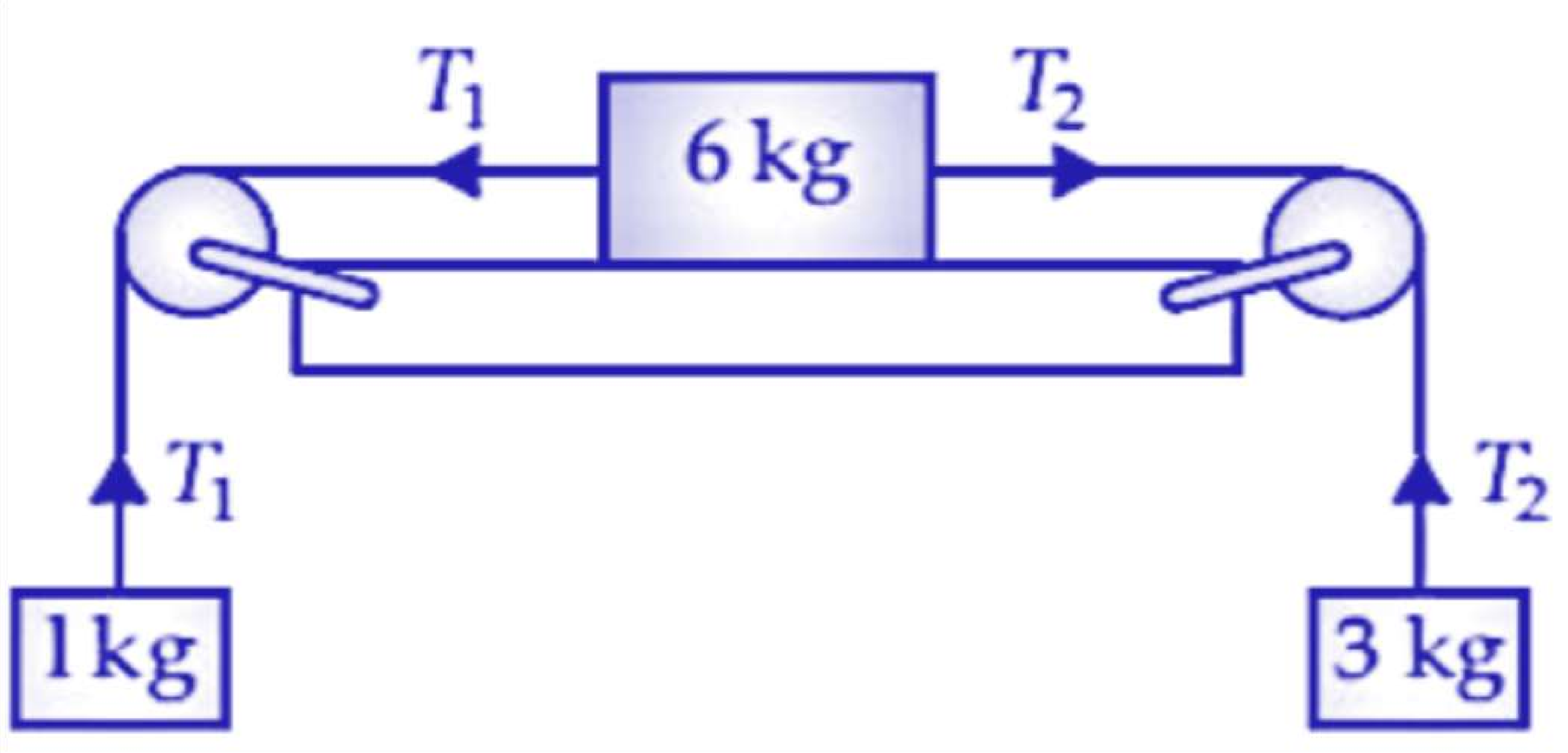
Three masses of 1 kg, 6 kg and 3 kg are connected to each other with threads and are placed on table as shown in figure. What is the acceleration with which the system is moving ?

A. Zero

B. 1 m s^{-2}

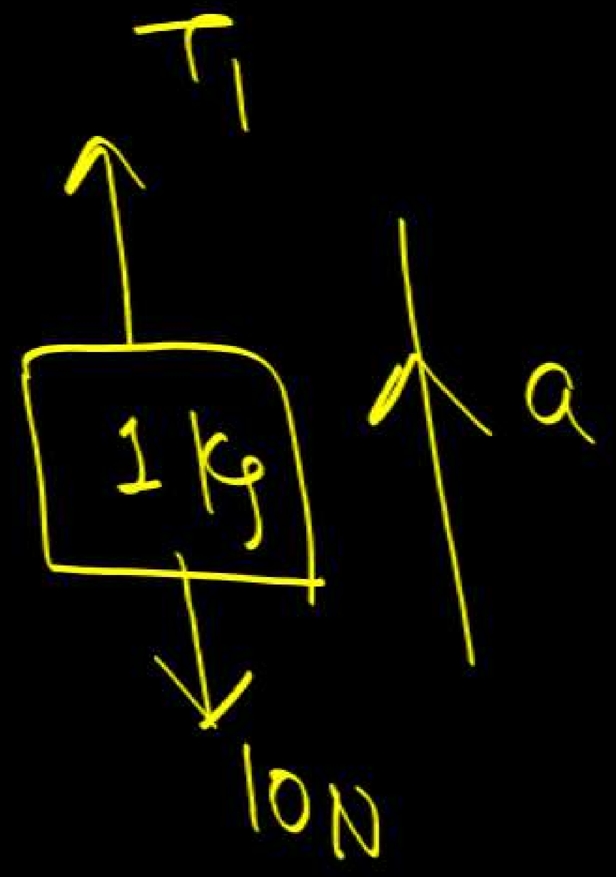
C. 3 m s^{-2}

D. 2 m s^{-2}



$$a = \frac{(3g - 1g)}{(1+6+3)}$$

$$= \frac{20}{10} = 2 m/s^2$$

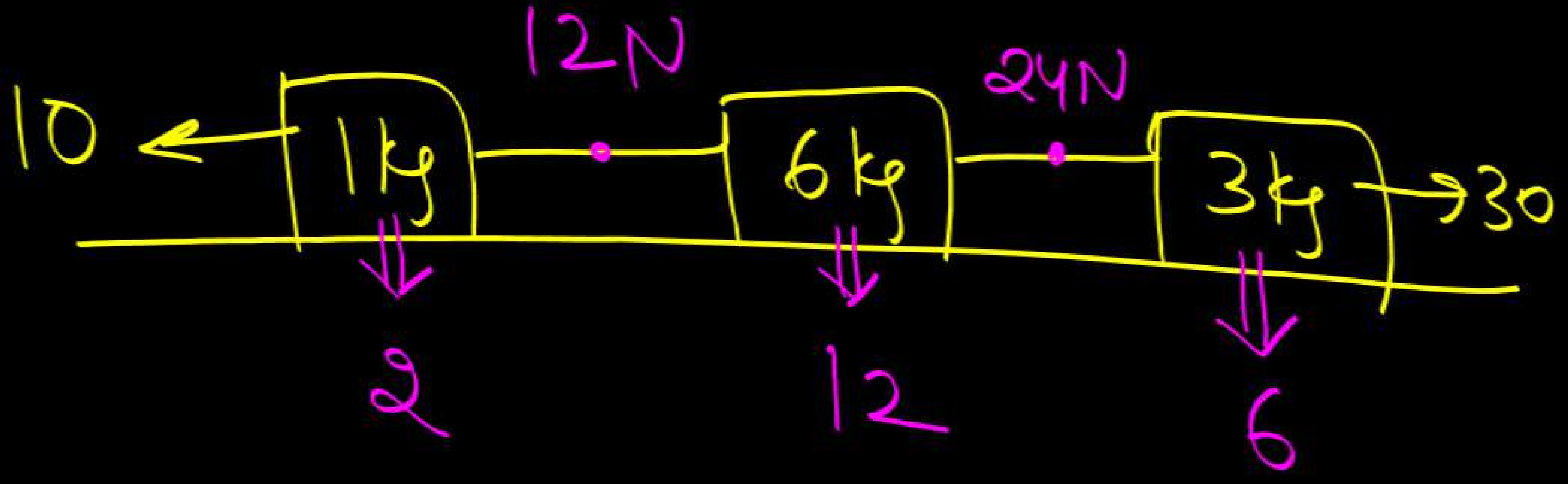


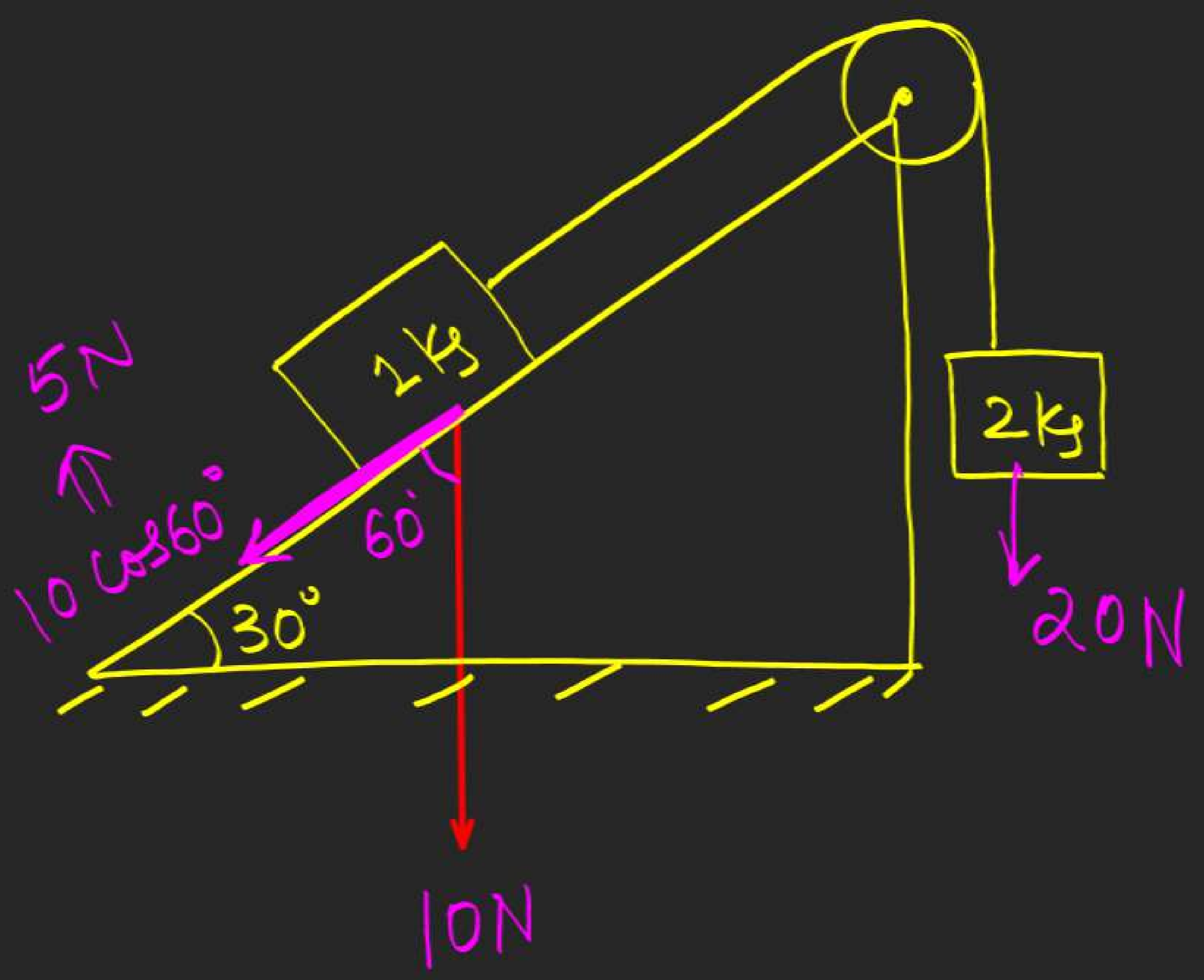
$f_{net} = ma$

$T - 10 = 1 \times a$

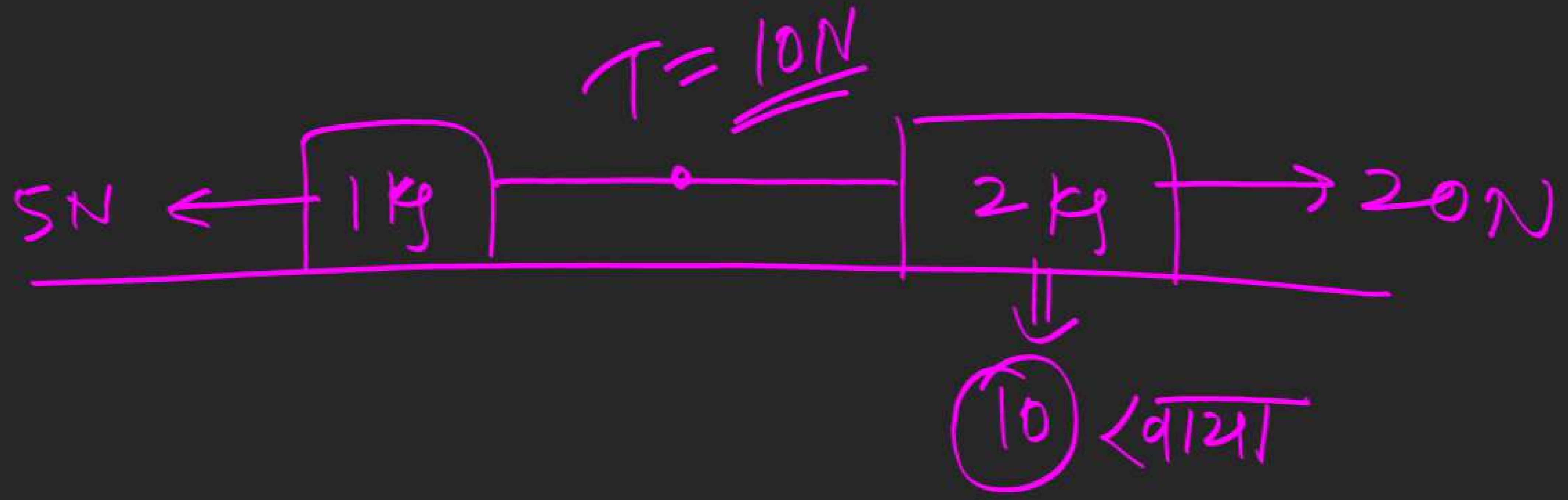
$T_1 = 10 + 2$

$= 12 N$





$$a = \left(\frac{20-5}{1+2}\right) = \frac{15}{3} = 5\,m/s^2$$



$$a = \frac{20-5}{3}$$

$$= 5\,m/s^2$$

Two blocks, each having mass M, rest on frictionless surface as shown in figure. If the pulleys are light and frictionless, and M on the incline is allowed to move down, then the tension in the string will be :

A. ⅔ Mg sinθ

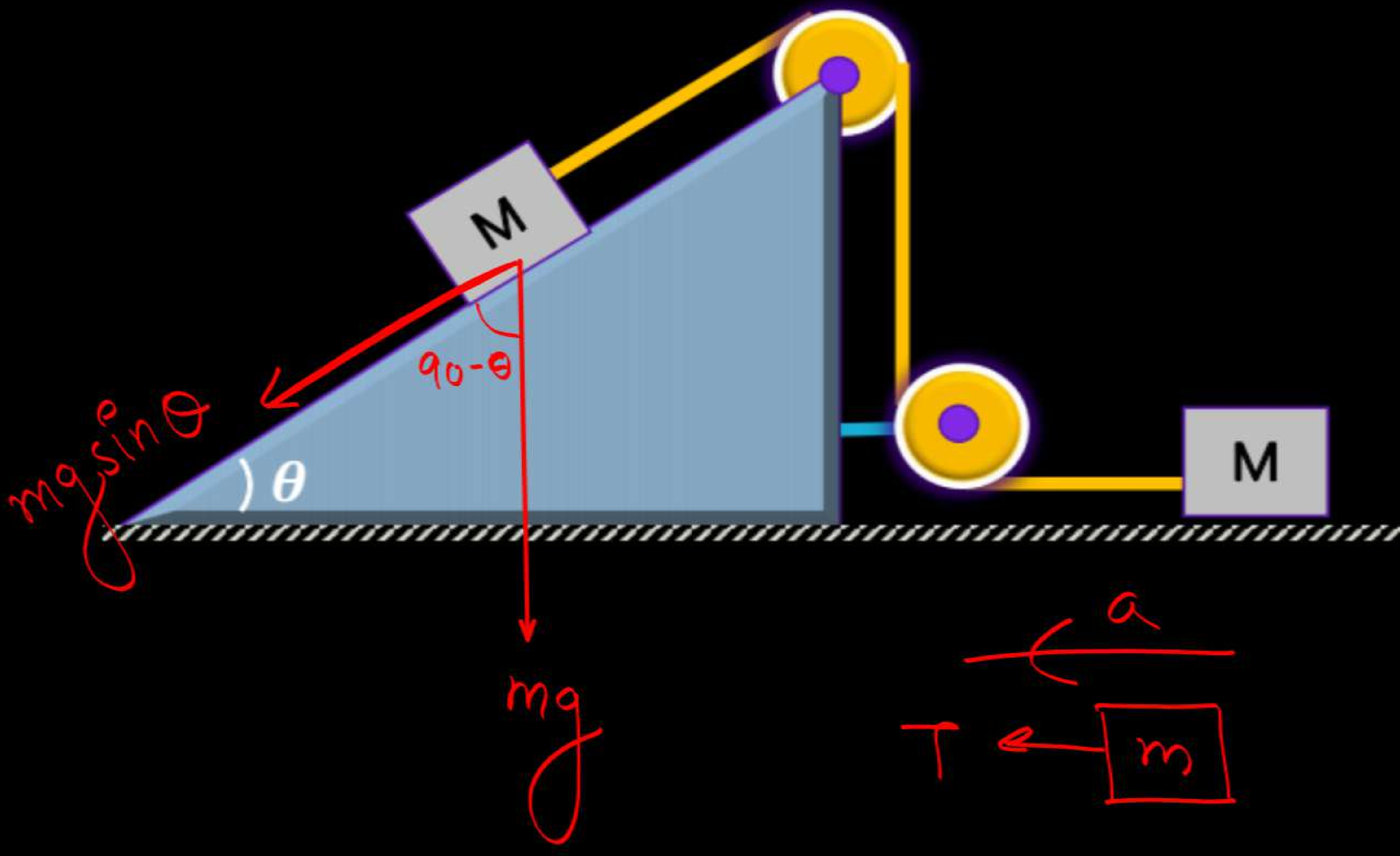
B. 3/2 Mg sinθ

C. 2 Mg sinθ

D. ½ Mg sinθ

$$a = \frac{mg\sin\theta}{2m}$$

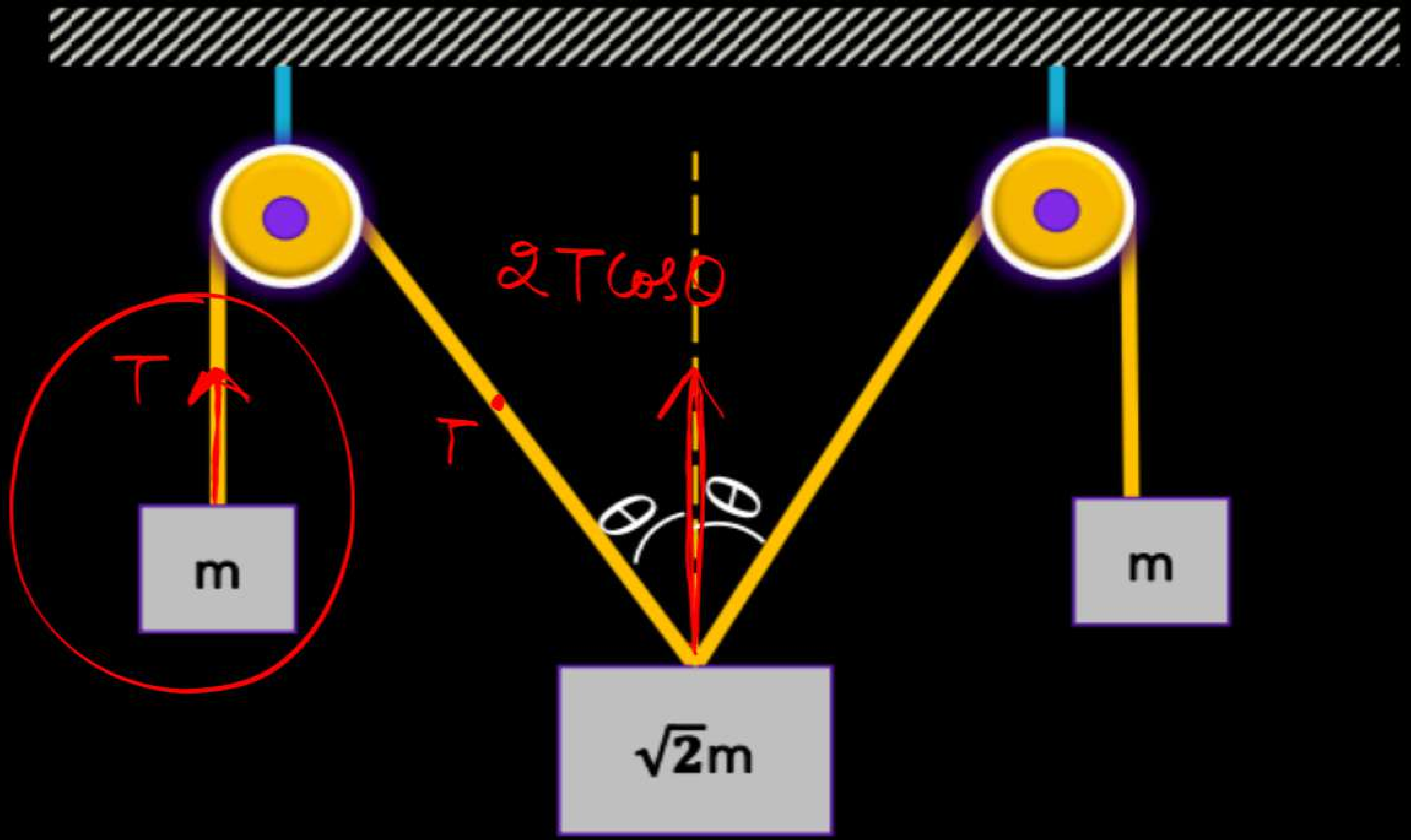
$$a = \frac{g\sin\theta}{2}$$



$$T = ma$$

$$= m\left(\frac{g\sin\theta}{2}\right)$$

The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be



$$2T\cos\theta = \sqrt{2}\,mg$$

$$2(mg)\cos\theta = \sqrt{2}\,mg$$

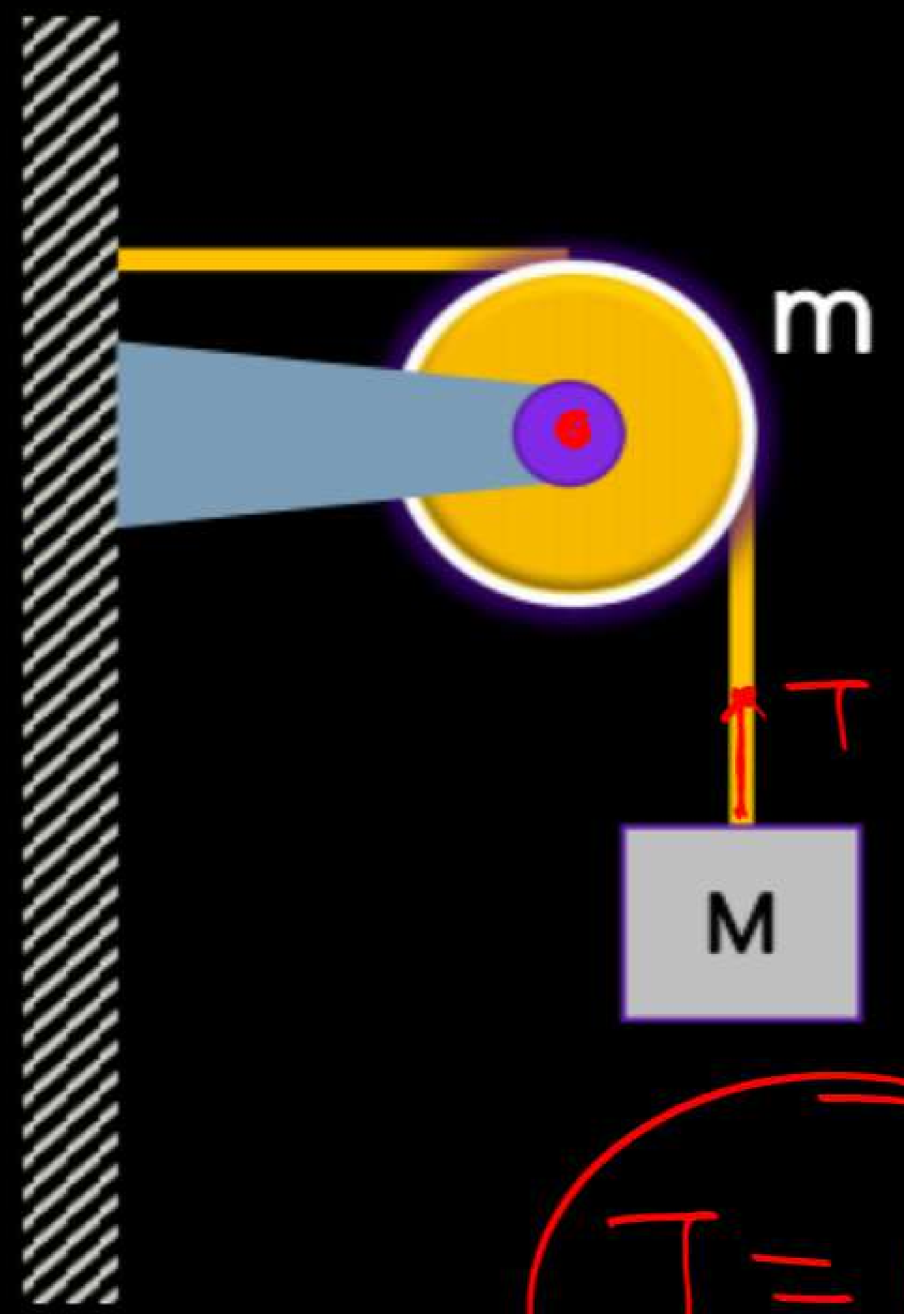
$$2\cos\theta = \sqrt{2}$$

$$\theta = 45^\circ$$

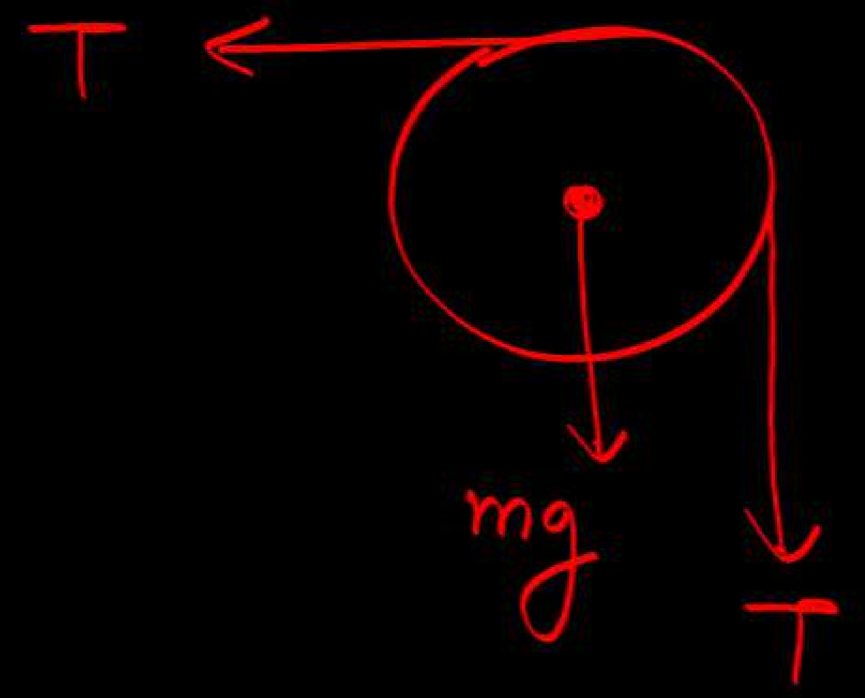
JEE - (2001, 2M

A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by

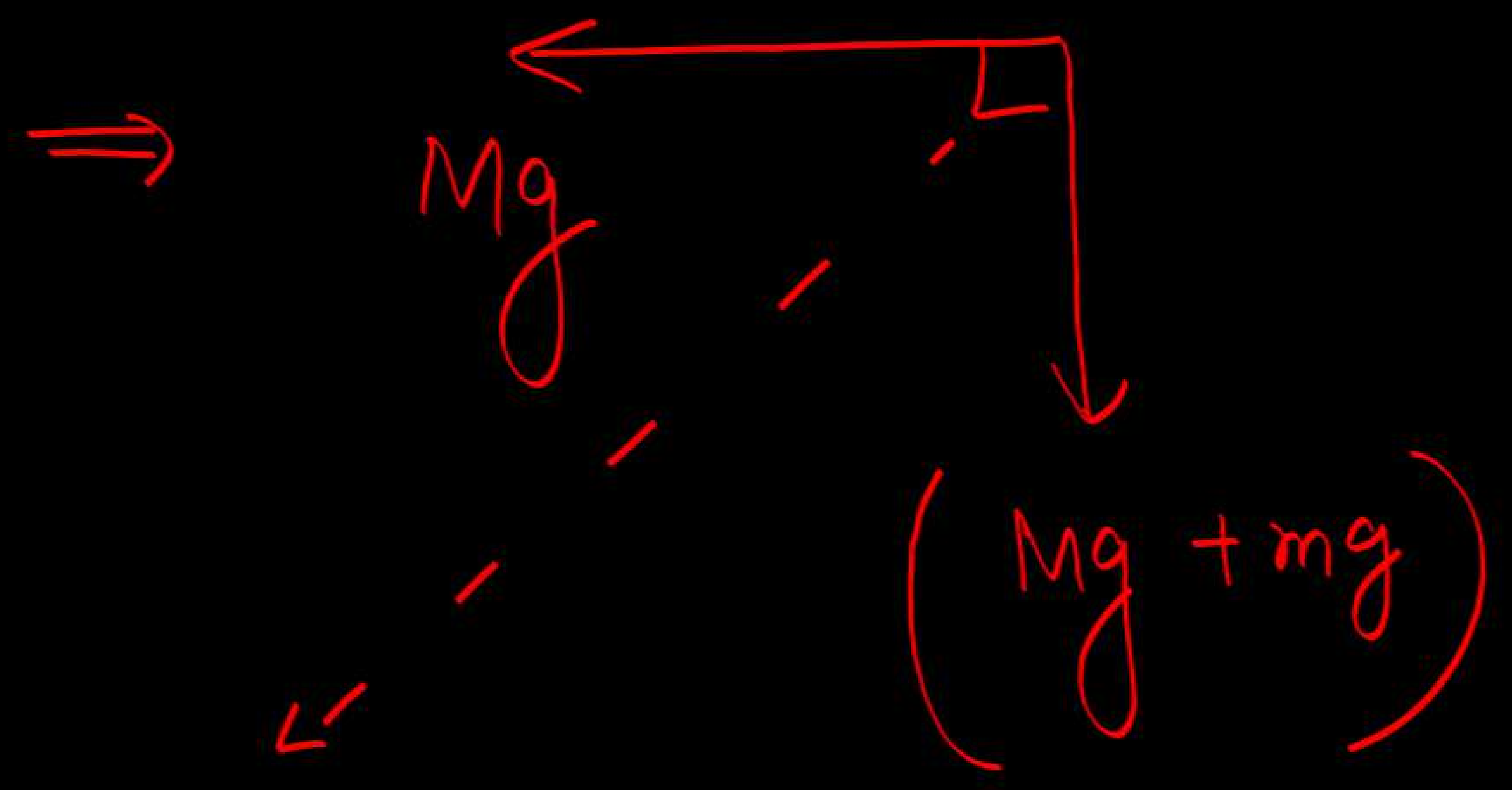
JEE- (2001, 2M)



$$T = Mg$$

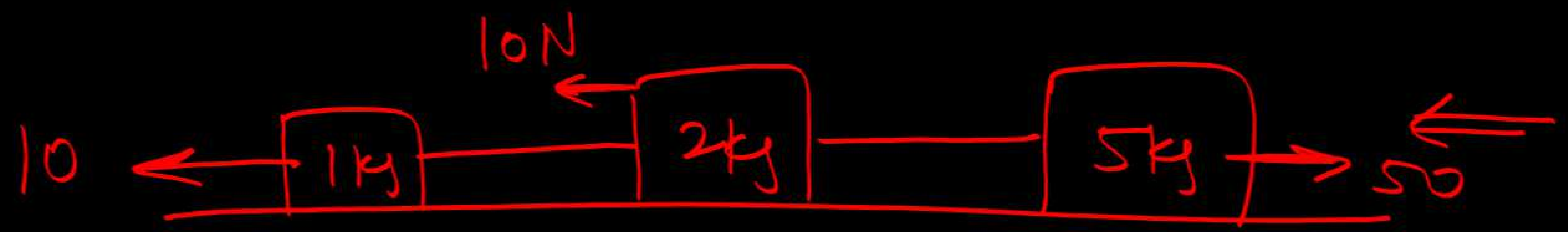


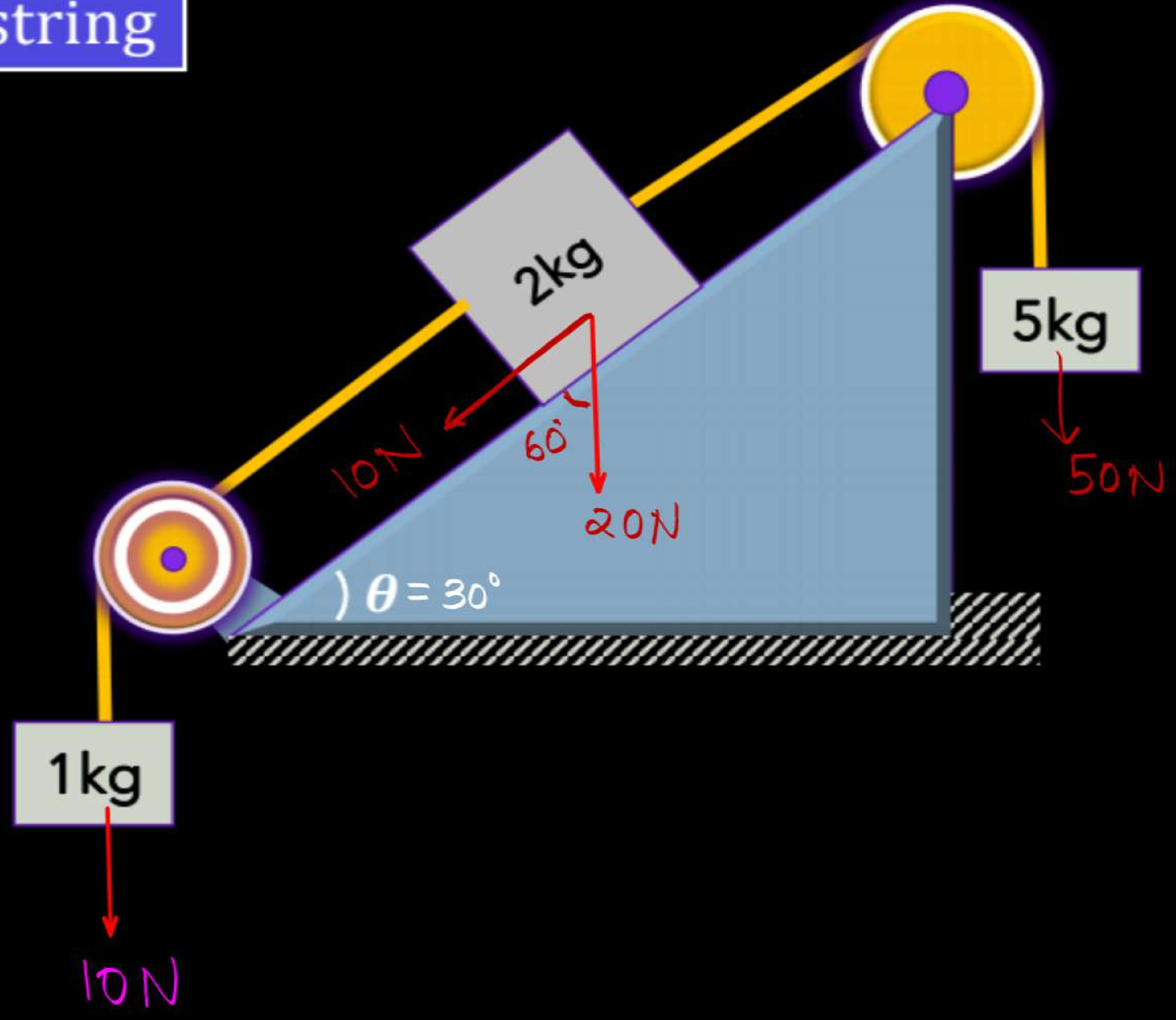
$\Longrightarrow$



$$F_{net} = g\sqrt{M^2 + (M+m)^2}$$

Find acceleration of 5kg block and tension in each string



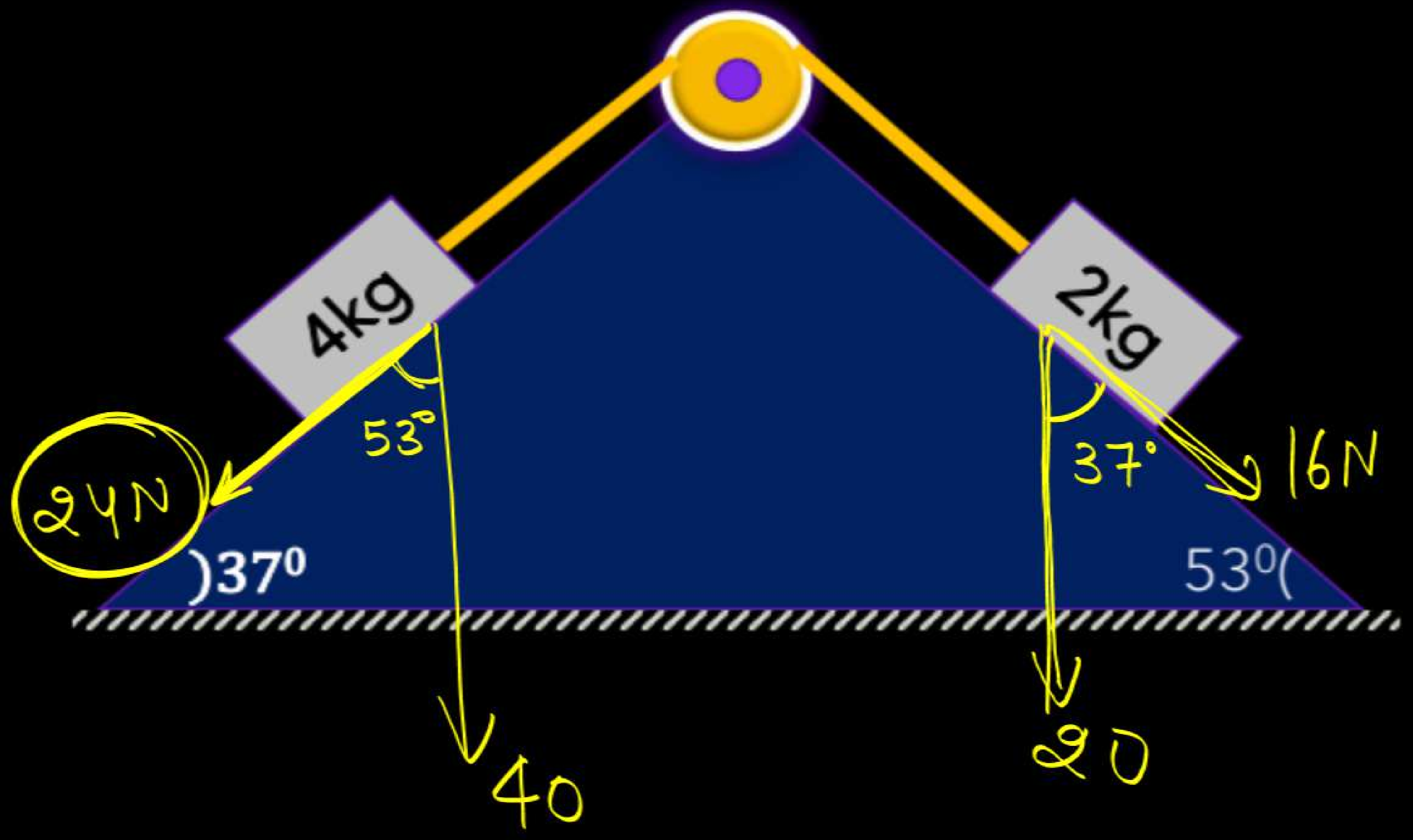


$$a = \frac{50-10-10}{8}$$

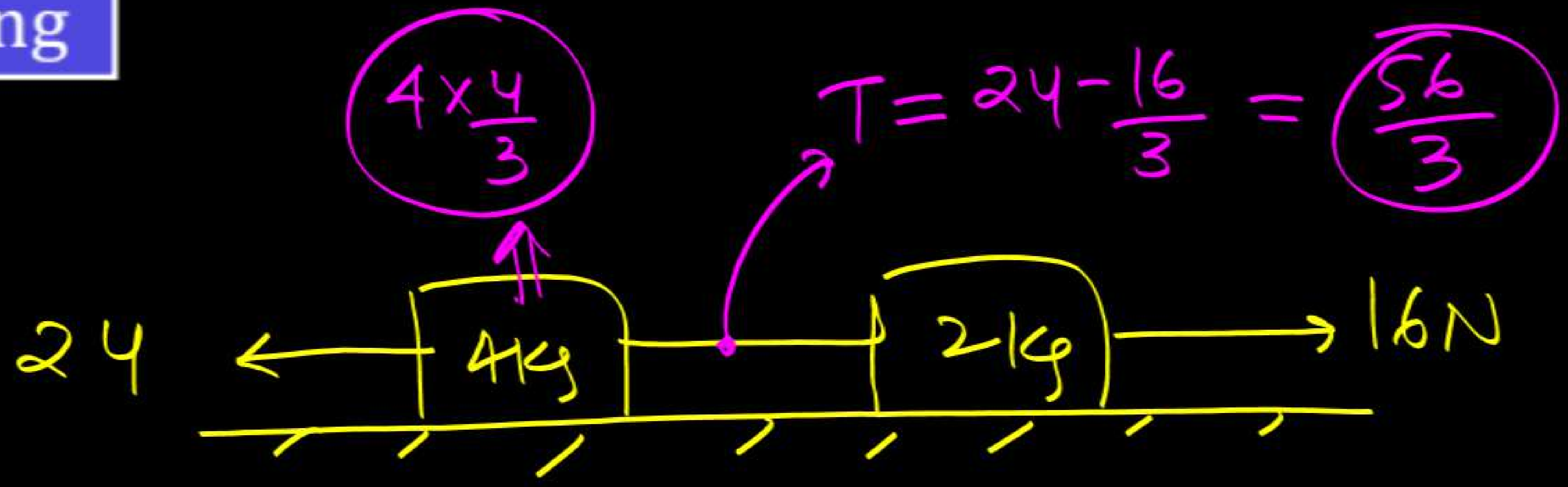
$$= \frac{30}{8}$$

$$= 3.75\, m/s^2$$

Find acceleration of each block and also tension in each string



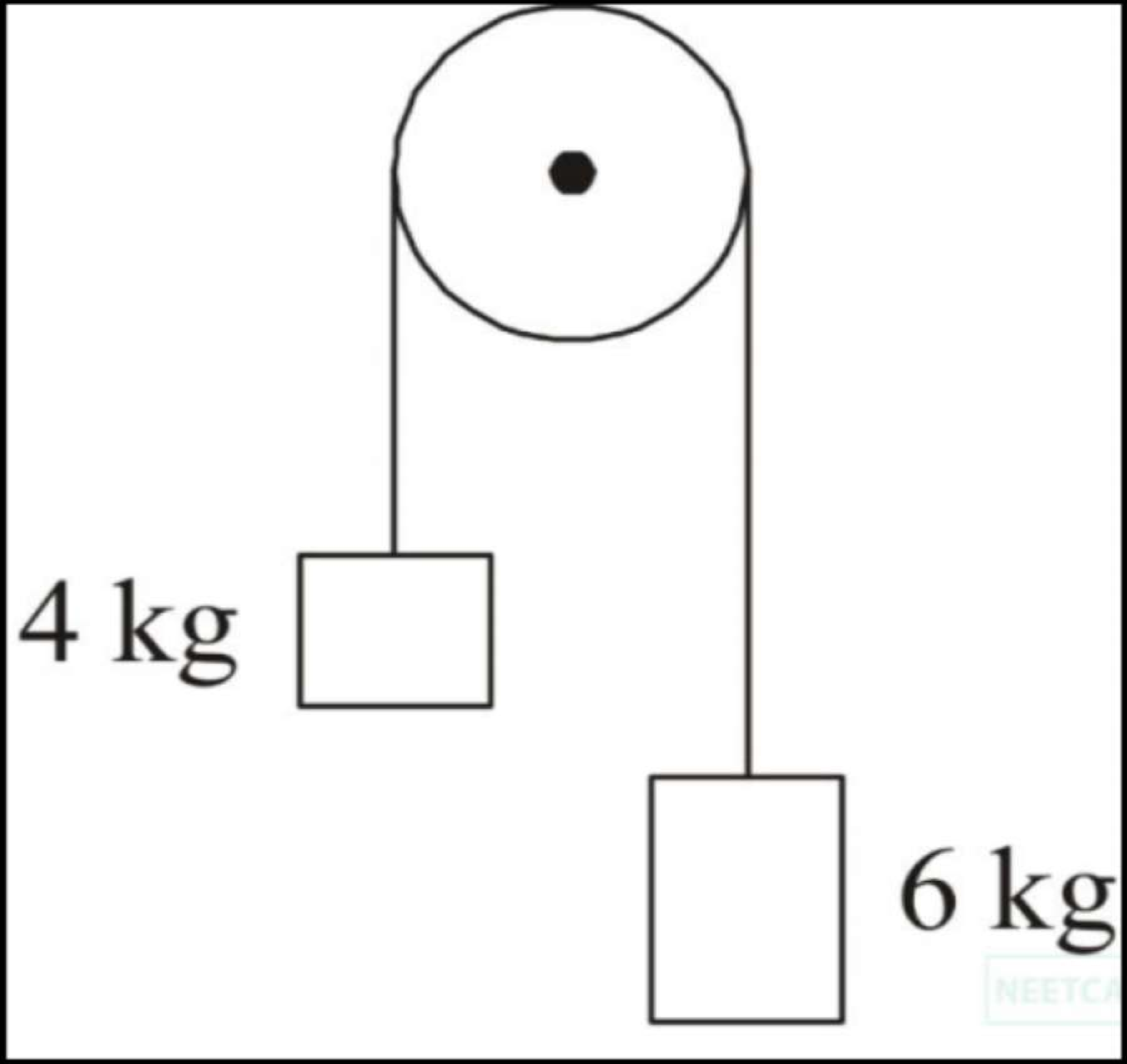
$\Longrightarrow$



$$a = \frac{24-16}{6}$$

$$= 8/6 = 4/3 \ m/s^2$$

Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is :



$$a = \frac{(6-4)g}{10}$$

$$= g/5$$

Ⓐ g/2

Ⓑ g/5

Ⓒ g/10

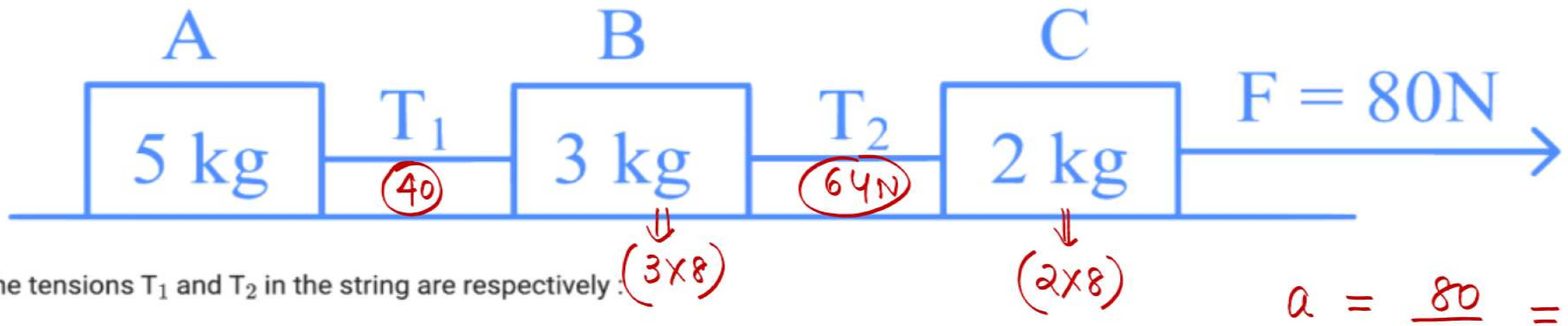
Ⓓ g

NEET 2020

JEE Main 2024 (Online) 30th January Evening Shift

MCQ (Single Correct Answer) +4 -1

Three blocks A, B and C are pulled on a horizontal smooth surface by a force of $80\ \mathrm{N}$ as shown in figure



The tensions T_1 and T_2 in the string are respectively :

$a = \frac{80}{10} = 8 m/s^2$

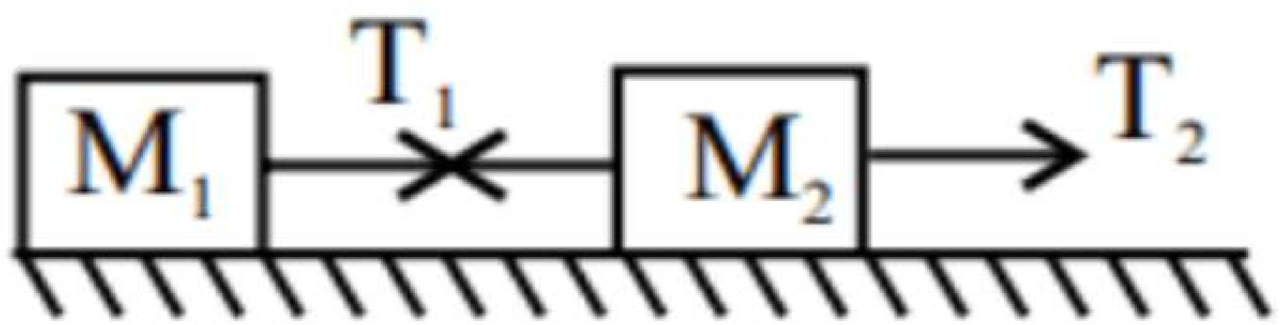
A. 40N, 64N

B. 60N, 80N

C. 80N, 100N

D. 88N, 96N

Two masses M_1 and M_2 are accelerated uniformly on a frictionless surface. The ratio of the tensions T_1/T_2 is



(a) $\frac{M_1}{M_1+M_2}$ ✓

(b) $\frac{M_2}{M_1+M_2}$

(c) $\frac{M_2}{M_1}$

(d) $\frac{M_1 M_2}{M_1+M_2}$

$\Rightarrow a = \frac{T_2}{M_1+M_2} \Rightarrow \boxed{T_2 = (M_1+M_2)a}$

$\boxed{M_1} \rightarrow T_1 \Rightarrow \boxed{T_1 = M_1 a}$

Divide $\frac{T_1}{T_2} = \frac{M_1 \cancel{a}}{(M_1+M_2)\cancel{a}}$

A

A block of mass m is pulled by a uniform chain of mass m tied to it by applying a force F at the other end of the chain. The tension at a point which is at a distance of quarter of the length of the chain from the free end, will be

$\frac{3m}{4}$

a. $\frac{3F}{4}$

b. $\frac{7F}{8}$

c. $\frac{6F}{7}$

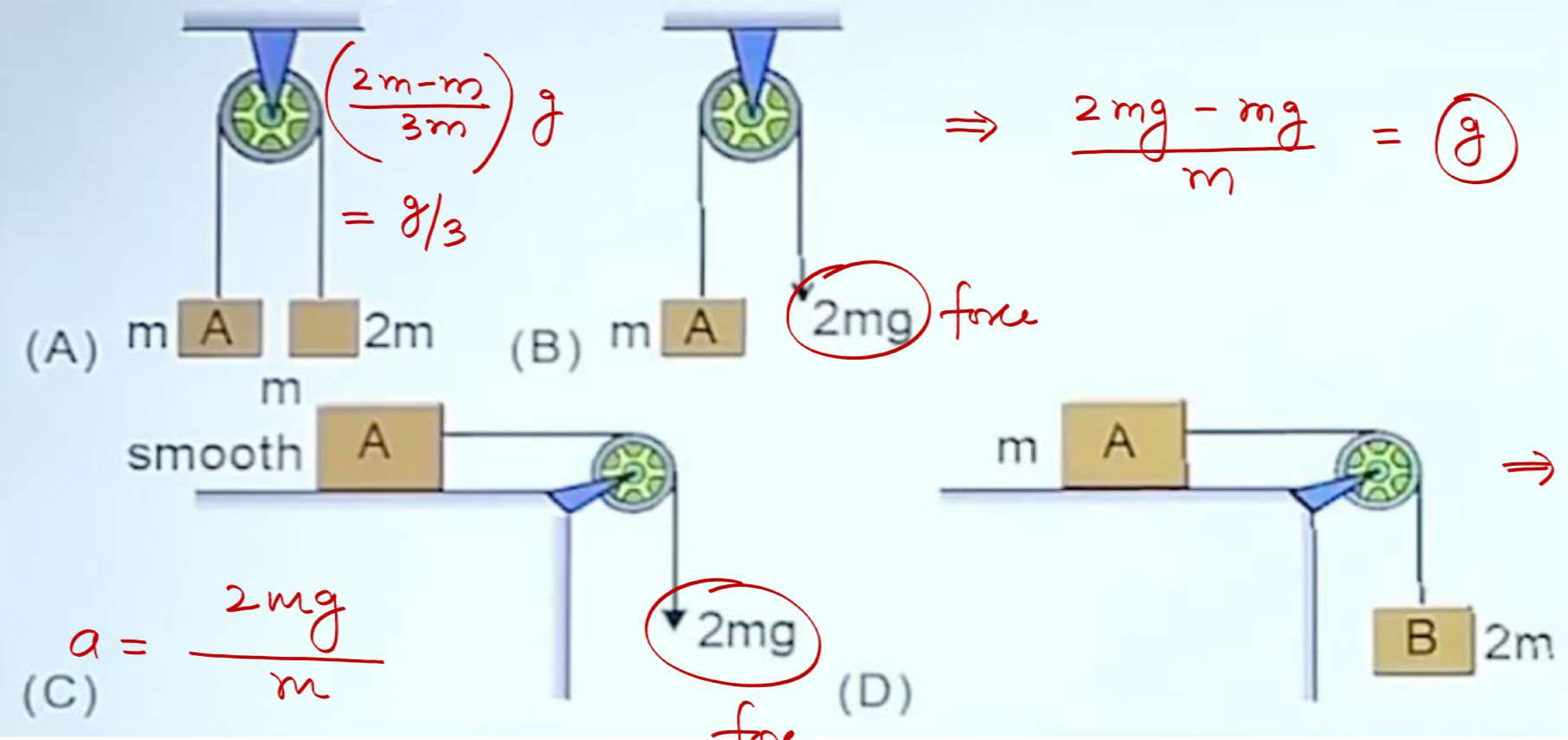
d. $\frac{4F}{5}$

$$\boxed{a = \frac{F}{2m}}$$

$$T = \left(m + \frac{3m}{4}\right) a$$

$$= \frac{7m}{4}\left(\frac{f}{2m}\right)$$

B



(A): $\left(\frac{2m-m}{3m}\right)g = g/3$

(B): 2mg force $\Rightarrow \frac{2mg - mg}{m} = g$

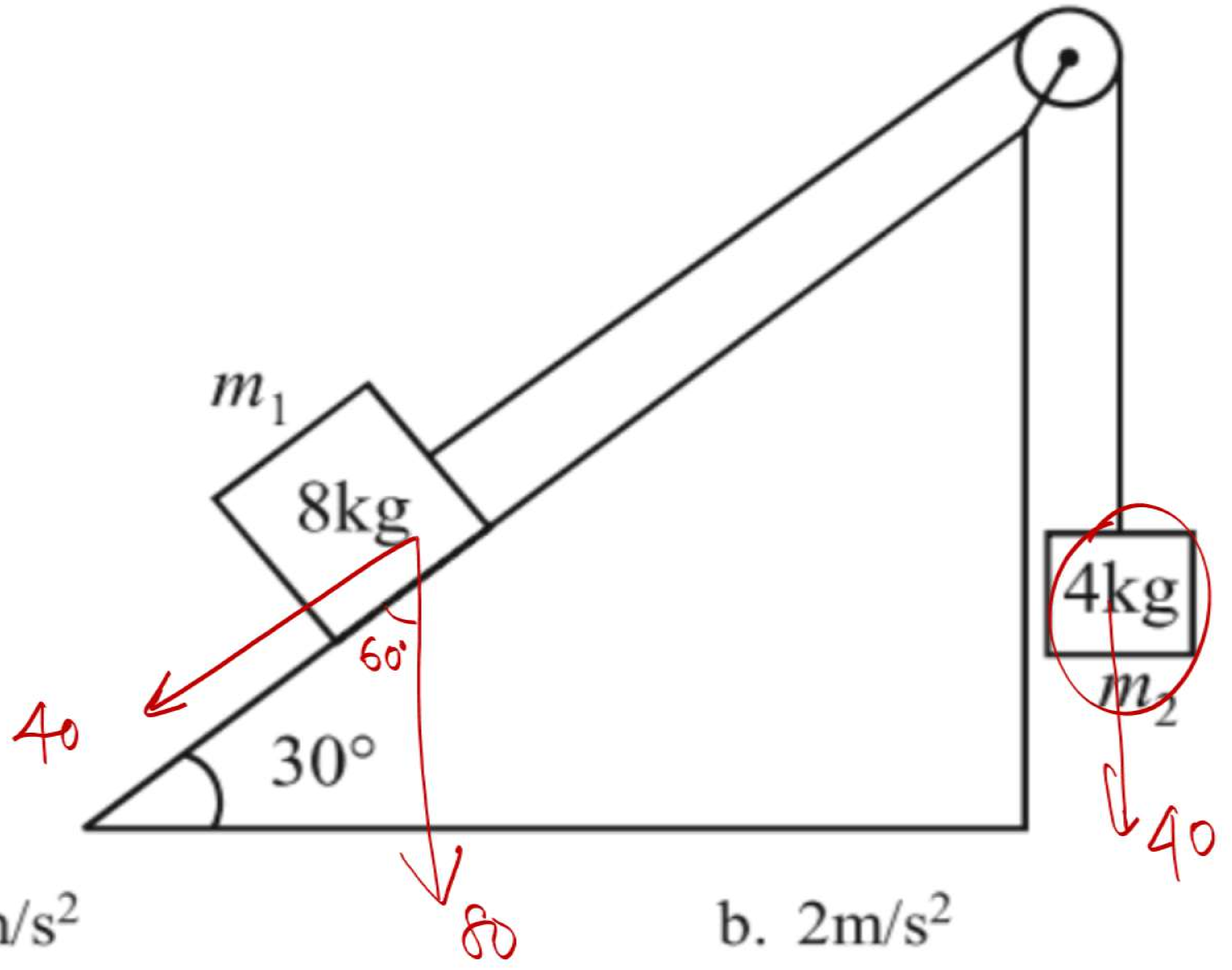
(C): 2mg force

$a = \frac{2mg}{m}$

$a = 2g$

(D): $\Rightarrow \frac{2mg}{3m} = 2g/3$

. Two masses of 8 kg and 4 kg are connected by a string as shown in figure over a frictionless pulley. The acceleration of the system is



$$a = \frac{40 - 40}{12} = \text{zero}$$

a. $4 m/s^2$

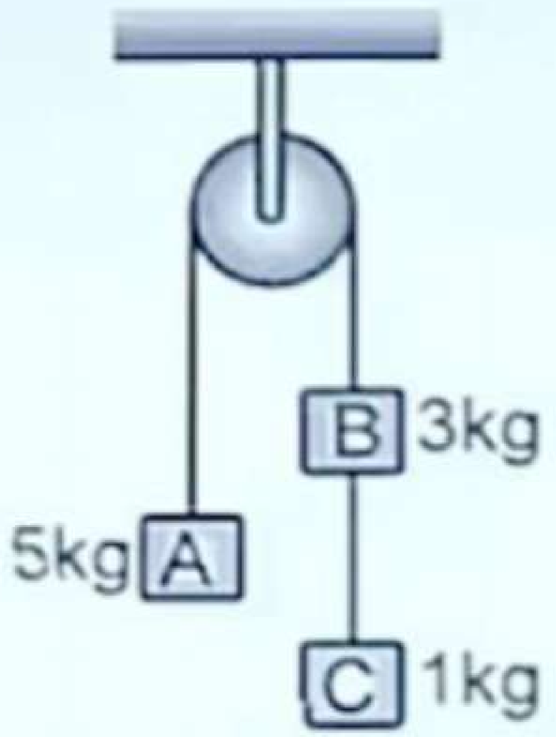
b. $2 m/s^2$

c. Zero

d. $9.8\ m/s^2$

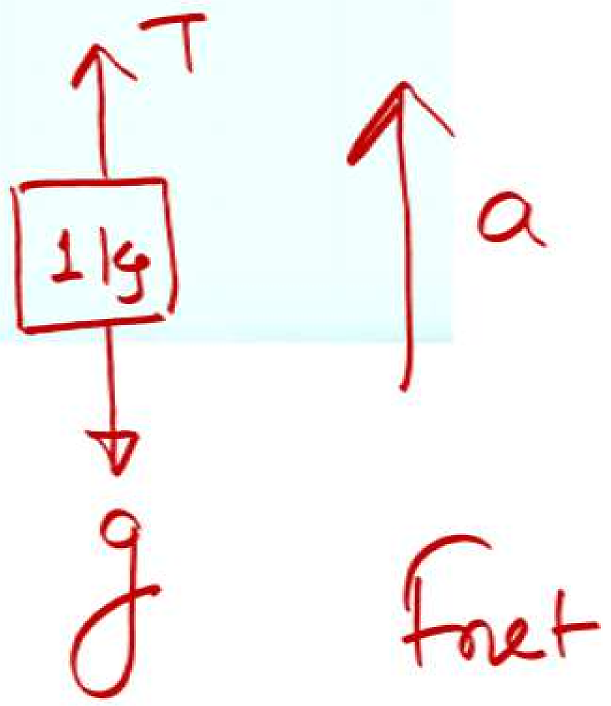
C

Three weights are hanging over a smooth fixed pulley as shown in the figure. What is the tension in the string connecting weights B and C?



(A) g (B) g/9 (C) 8g/9 (D) 10g/9

$$a = \left(\frac{5-4}{9}\right) g = g/9$$

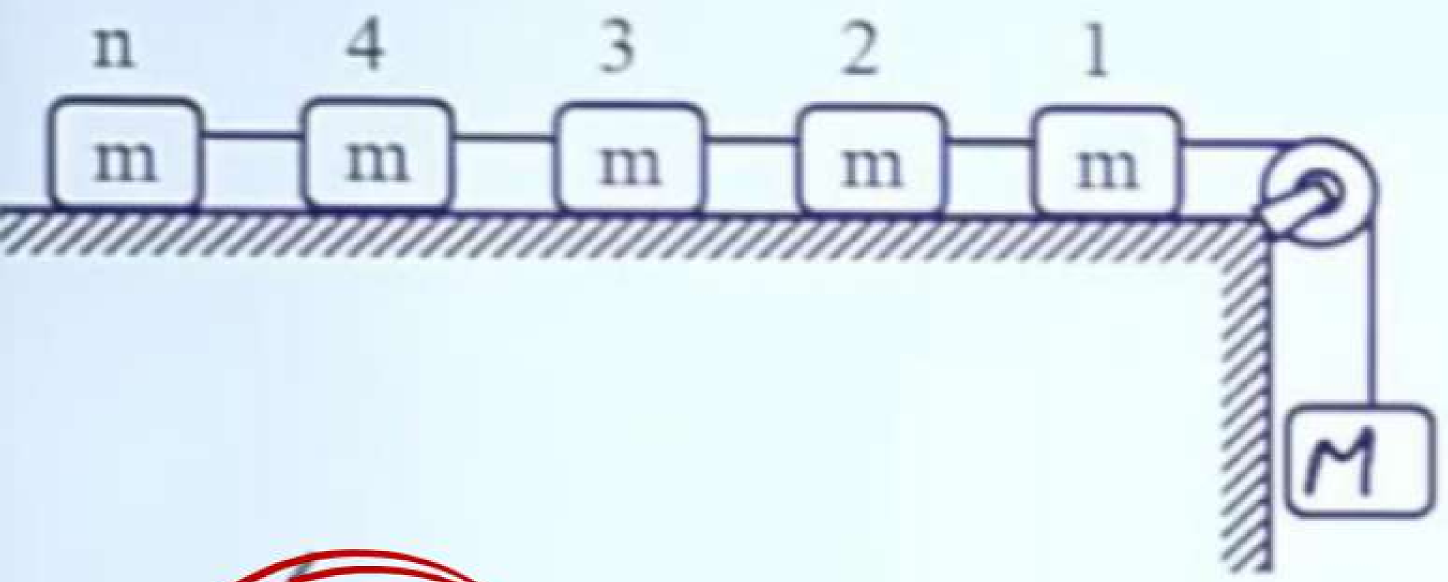


$F_{net} = ma$

$$T - g = 1 \times \frac{g}{9}$$

$$T = \frac{10g}{9}$$

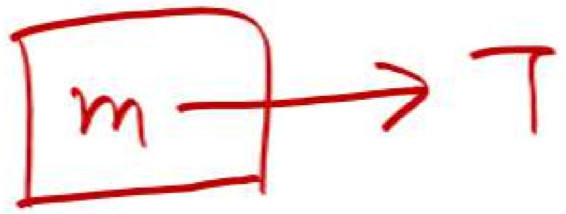
In the given arrangement, n number of equal masses are connected by strings of negligible masses. The tension in the string connected to n^{th} mass is -



(A) $\dfrac{mMg}{nm + M}$ (B) $\dfrac{mMg}{nmM}$

(C) mg (D) mng [A]

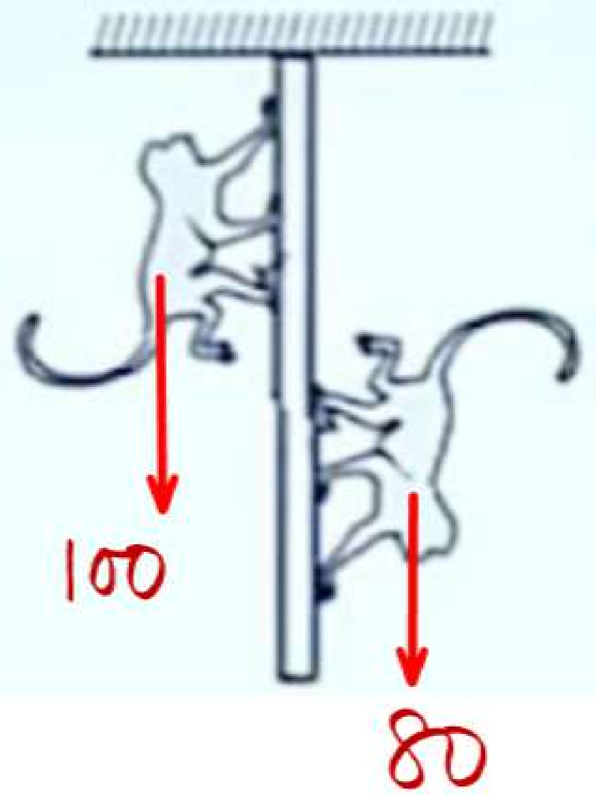
$$a = \frac{M}{M + nm} g$$



$$T = ma$$

$$= m\left(\frac{M}{M + nm}\right) g$$

Two monkeys of masses 10 kg and 8 kg are moving along a vertical light rope, the former climbing up with an acceleration of $2 m/s^2$ while the latter coming down with a uniform velocity of 2 m/s. Find the tension in the rope at the fixed support.



1st monkey

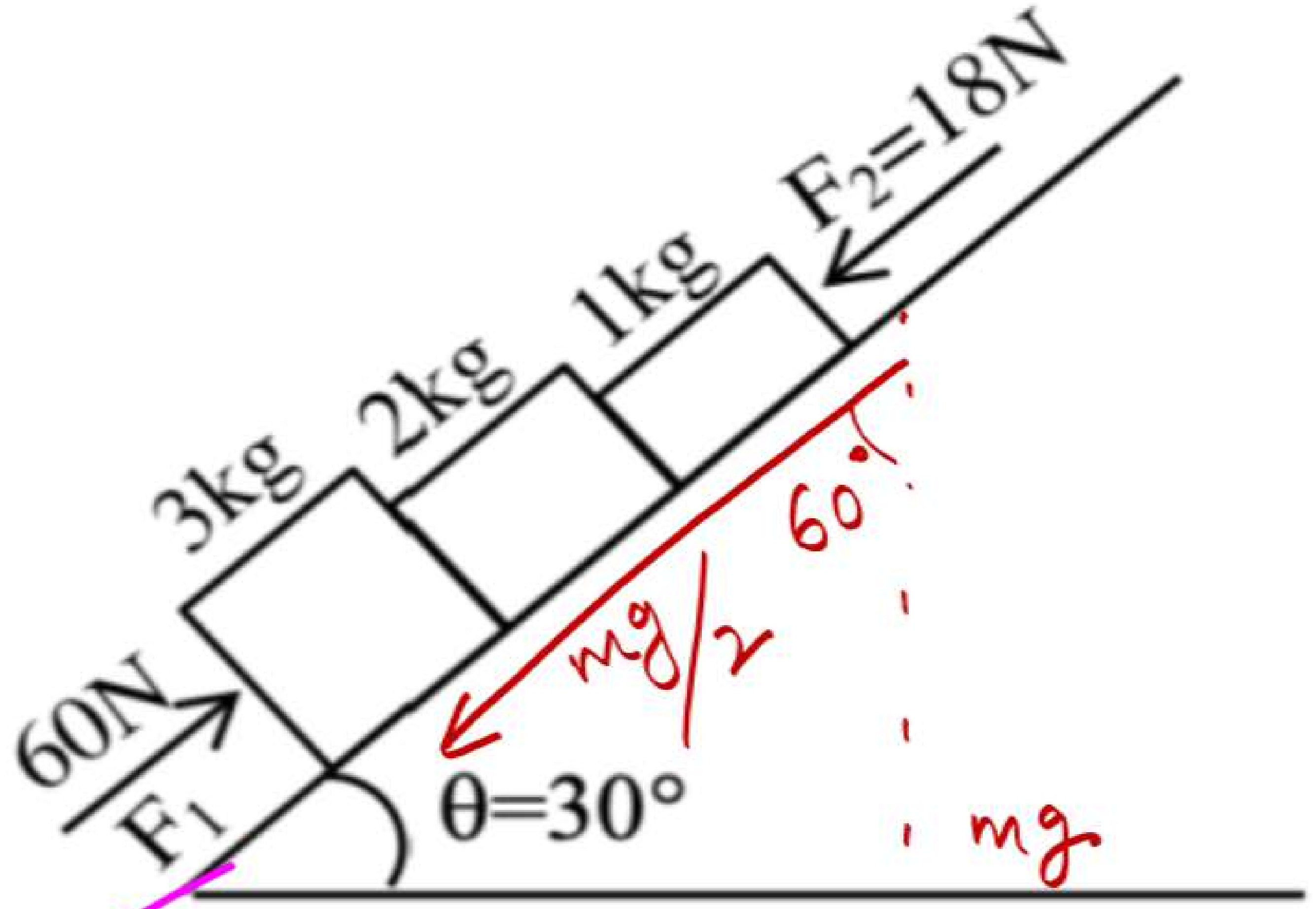
$$\boxed{\begin{aligned} T_1 - 100 &= 10 \times 2 \\ T_1 &= 120 \end{aligned}}$$

2nd monkey

$$\boxed{\begin{aligned} T_2 - 80 &= m \times 0 \\ T_2 &= 80 \end{aligned}}$$

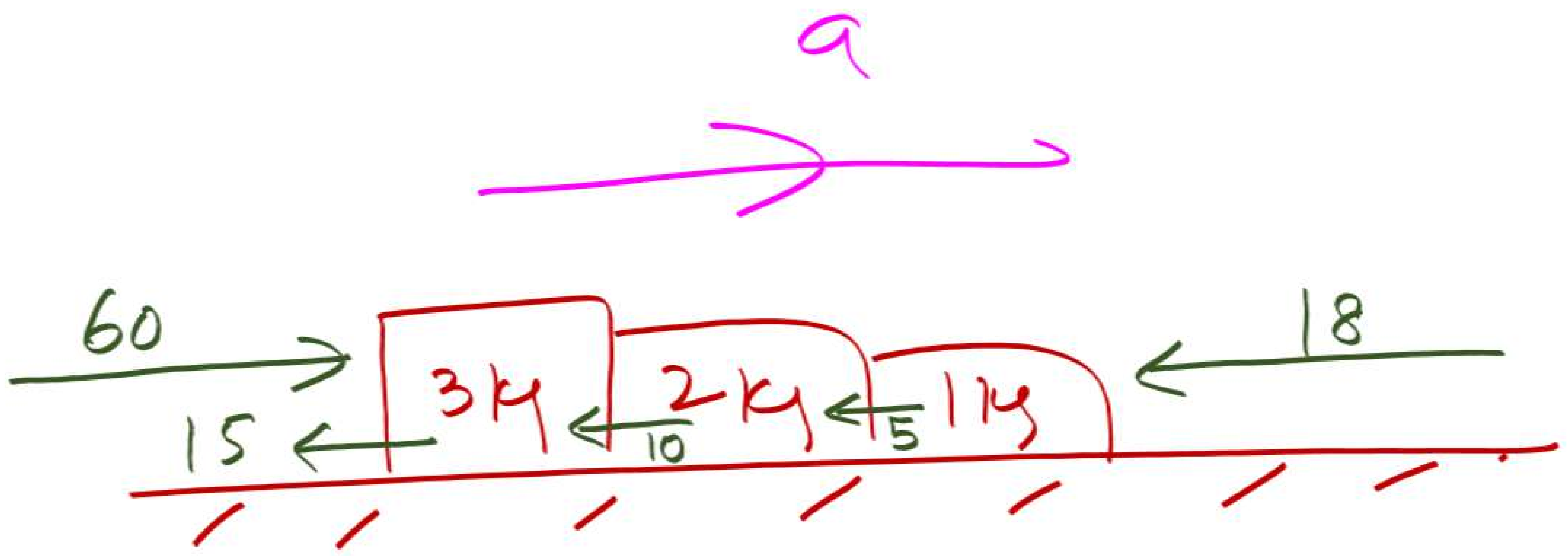
$$\begin{aligned} \text{Total tension} &= T_1 + T_2 \\ &= 120 + 80 \\ &= \underline{200} \end{aligned}$$

26. 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}

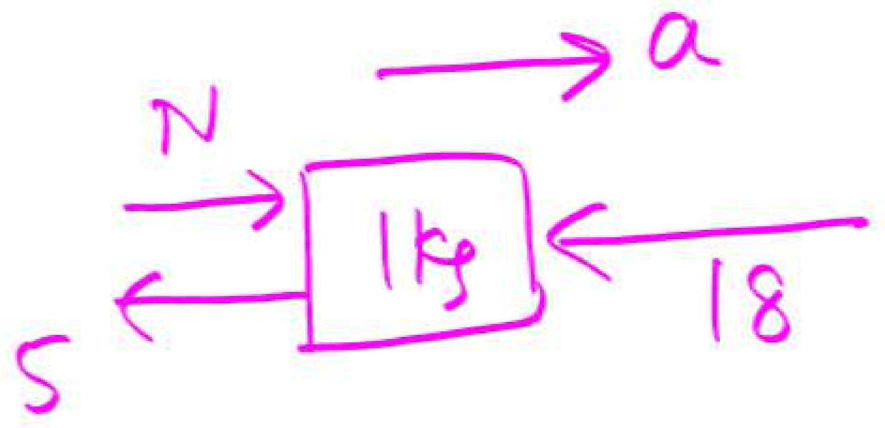


(1) 25 N (2) 39 N

(3) 6 N (4) 10 N



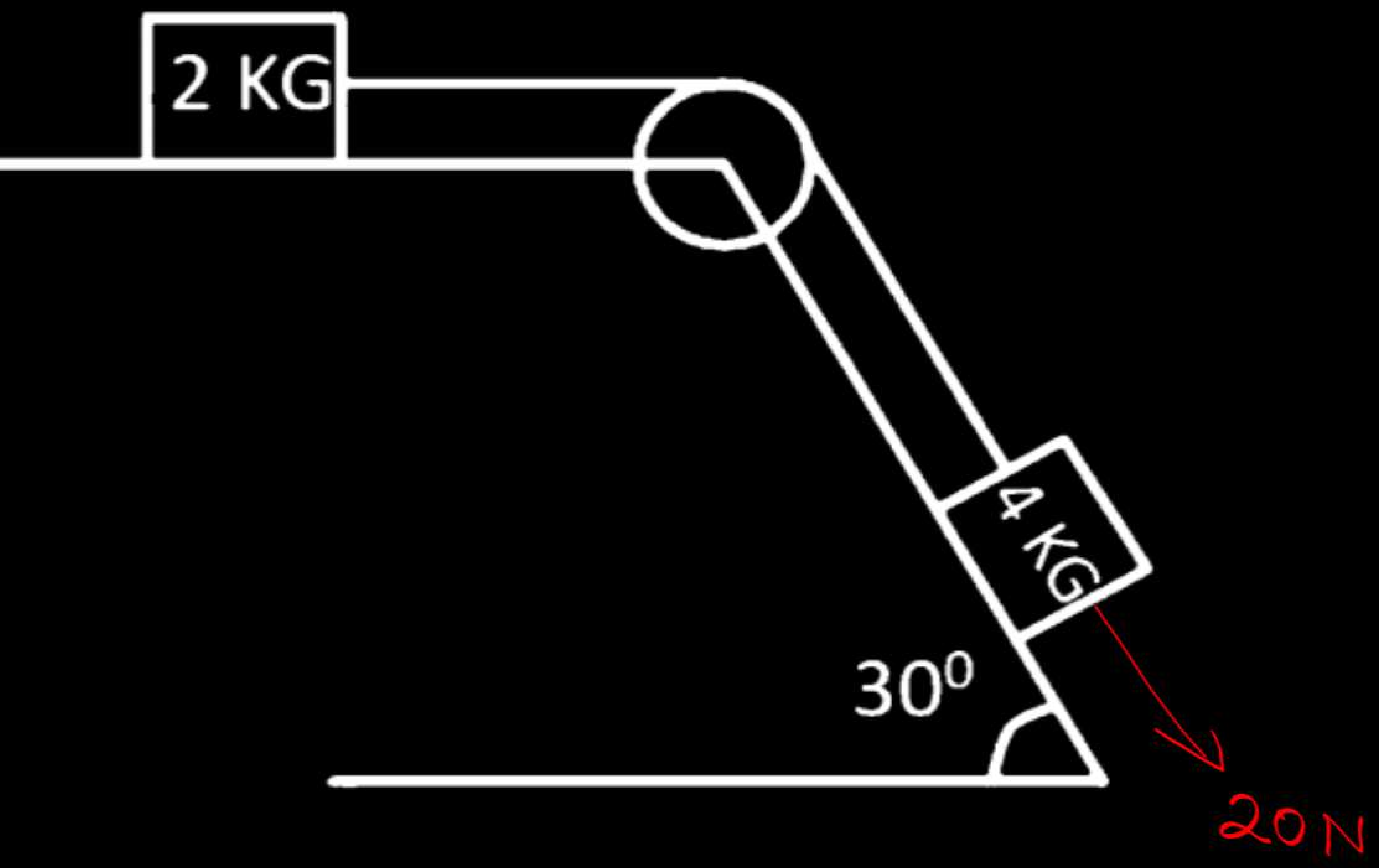
$$a = \frac{60-48}{6} = (2)\ m/s^2$$



$$N - 5 - 18 = 1 \times 2$$

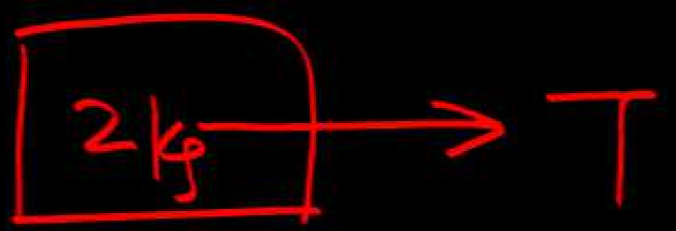
$$N = 25$$

Find acceleration & tension



$$a = \frac{20-0}{6}$$

$$= \frac{10}{3}\, m/s^2$$

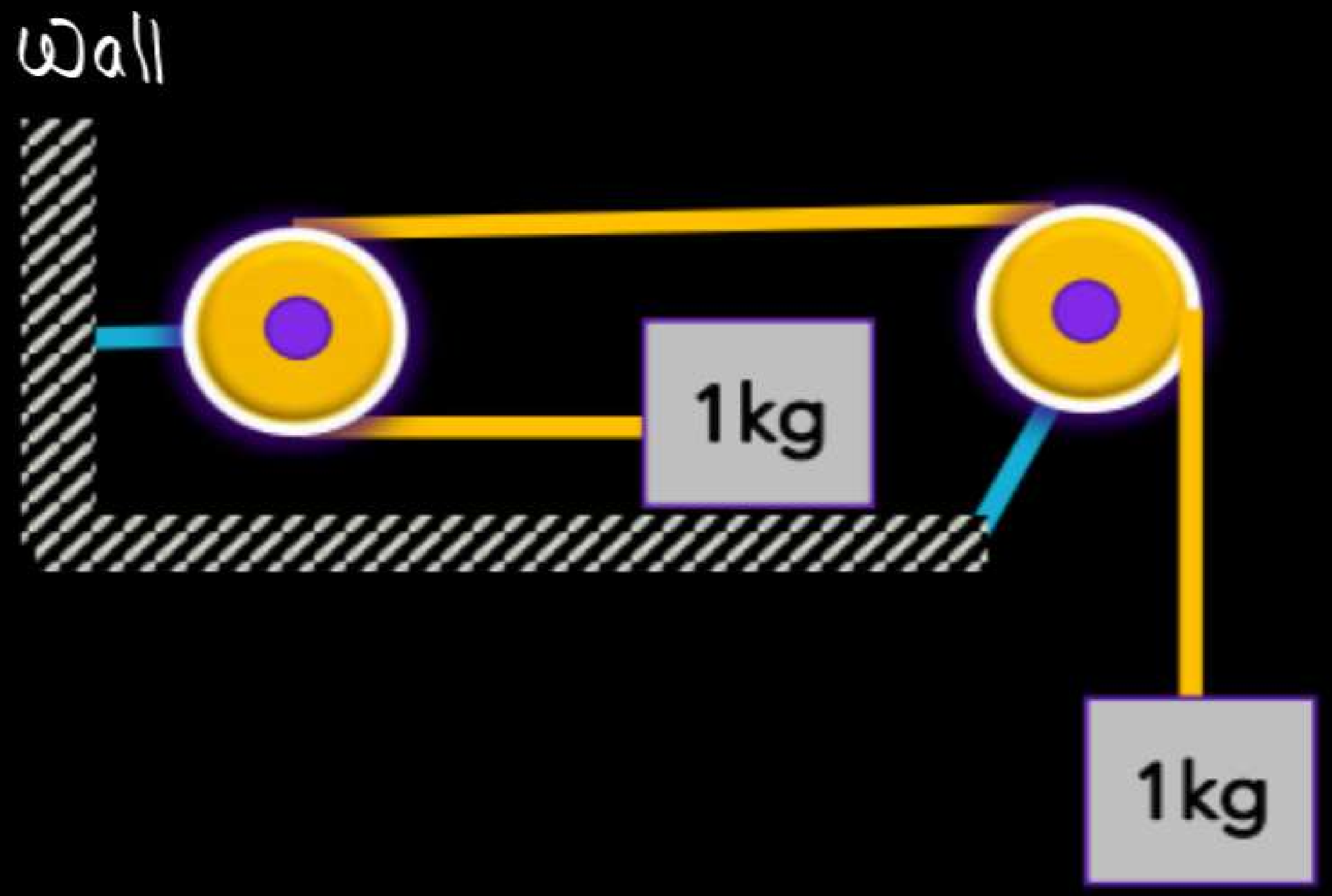


$$T = ma$$

$$T = 2 \times \frac{10}{3} = \frac{20}{3} \text{ Newton}$$

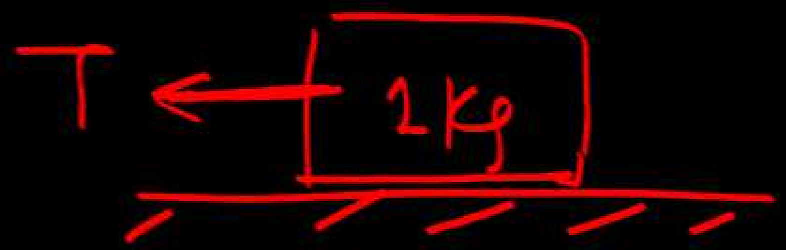
Consider the system as shown in the figure. The pulley and the string are light and all the surfaces are frictionless. The tension in the string ($g = 10\ m/s^2$).

A. 5 N
B. 0 N
C. 1 N
D. 2 N



(i) $a = \left(\frac{10}{2}\right) = 5\ m/s^2$

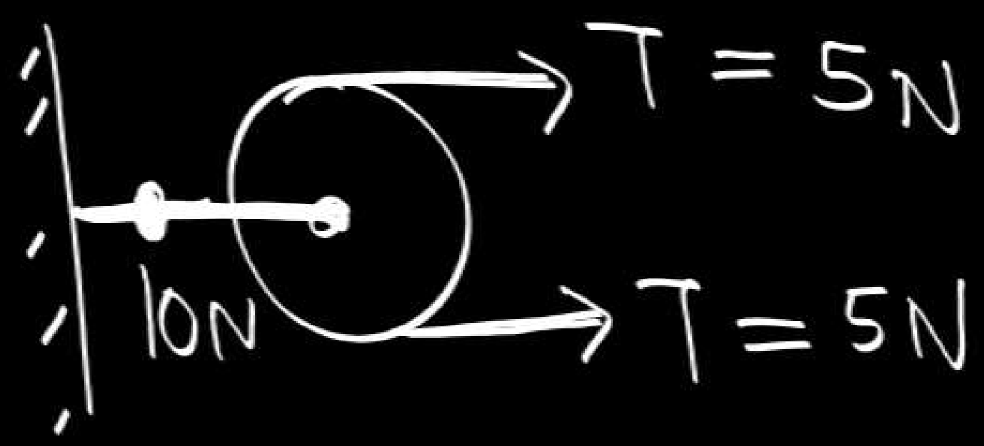
(ii)



$T = ma$

$T = 1 \times 5 = \underline{\underline{5N}}$

(III) force on wall



CONSTRAINED MOTION

$$V_0 = V\cos\theta$$

Along the thread speed of each point same

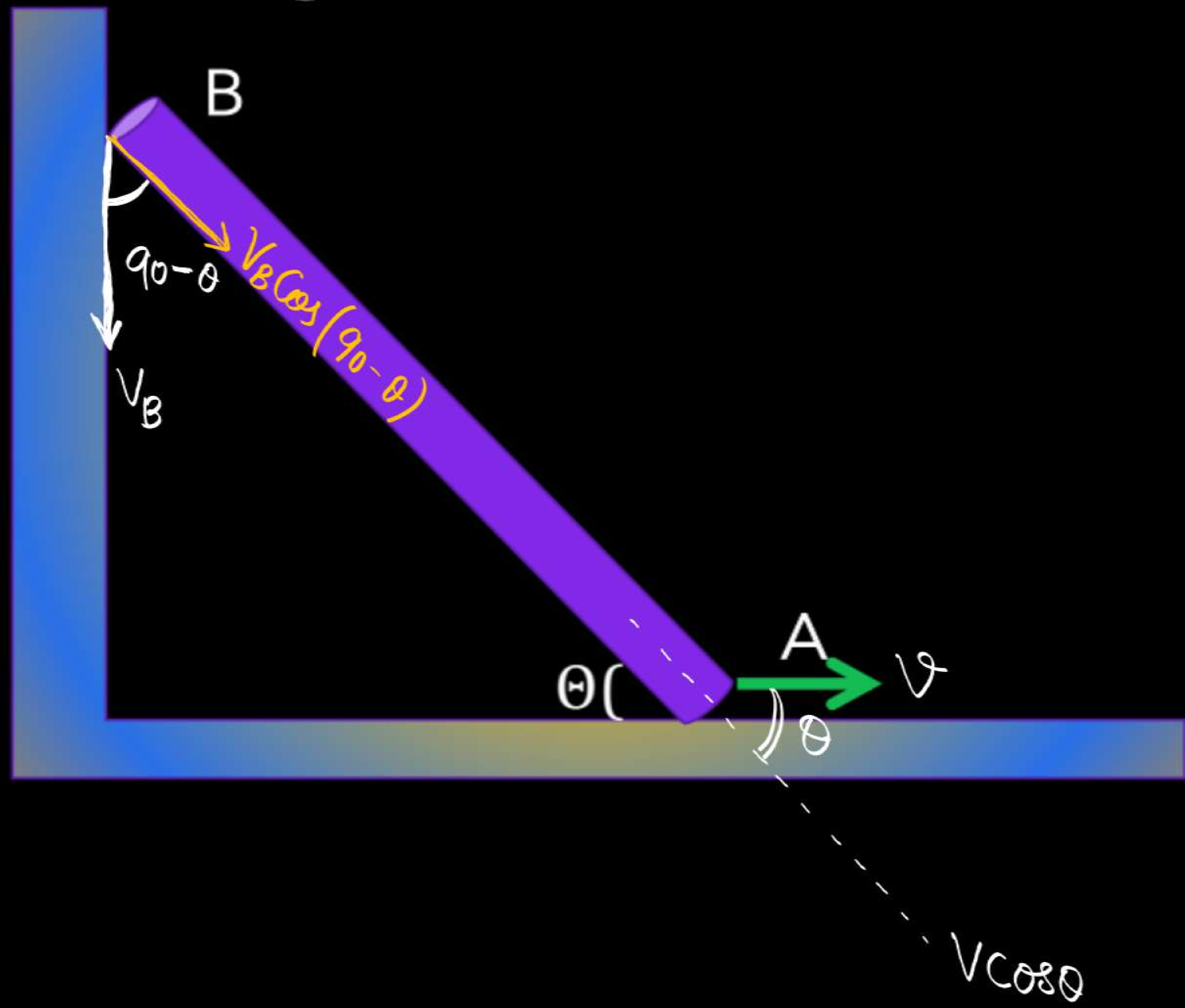
As shown this rod's lower end A is pulled towards right with a constant velocity v. Find the velocity of the other end B downward when rod makes an angle θ with the horizontal.

A. v tanθ

B. v cotθ

C. v cosθ

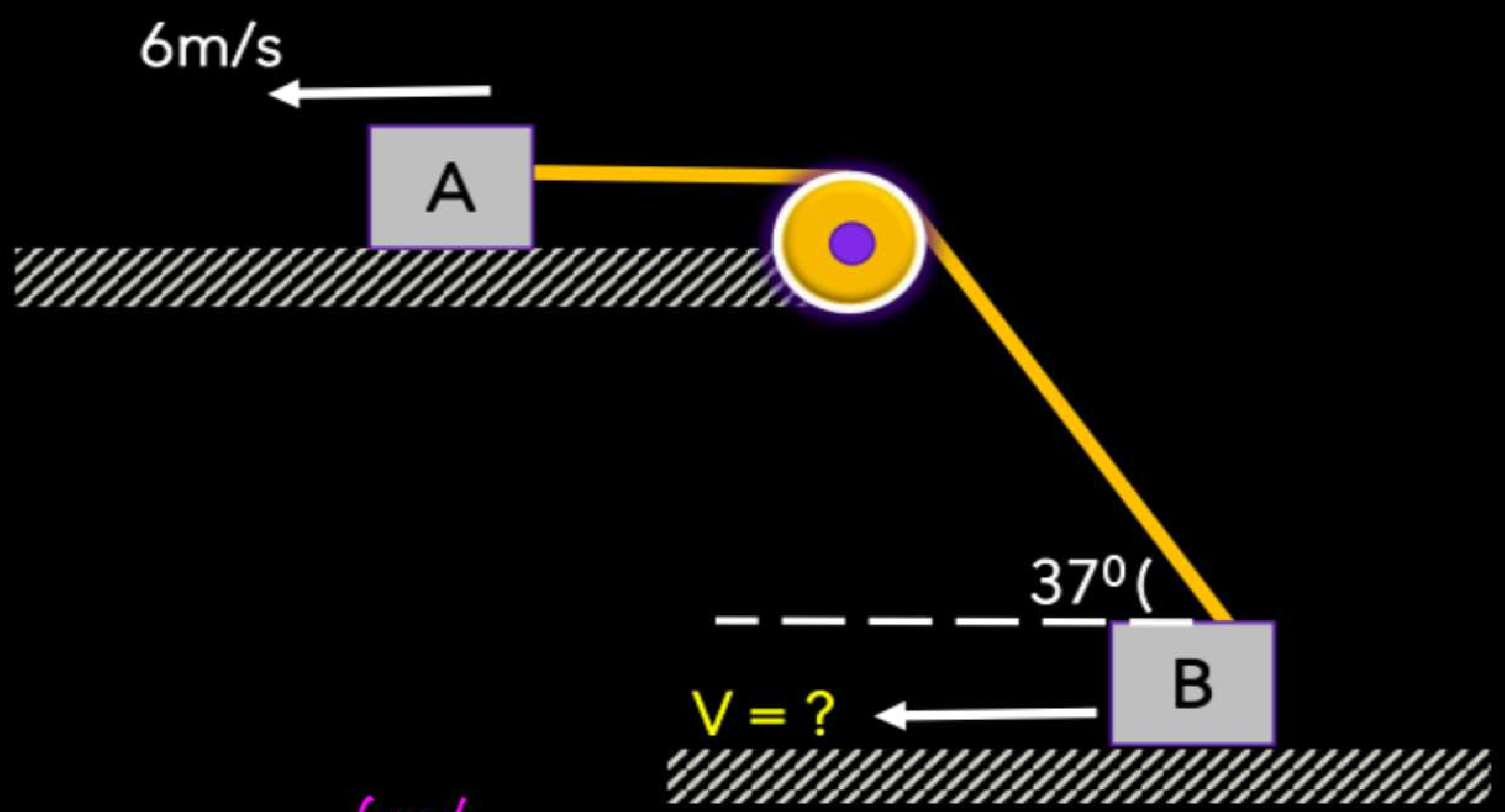
D. None of these

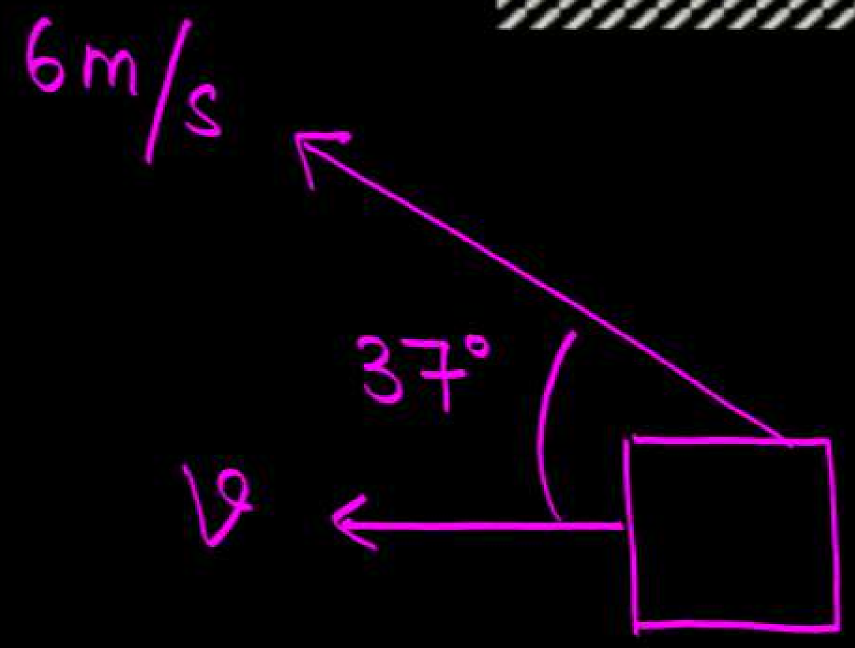


$$V_B \cos(90-\theta) = V\cos\theta$$

$$V_B \sin\theta = V\cos\theta$$

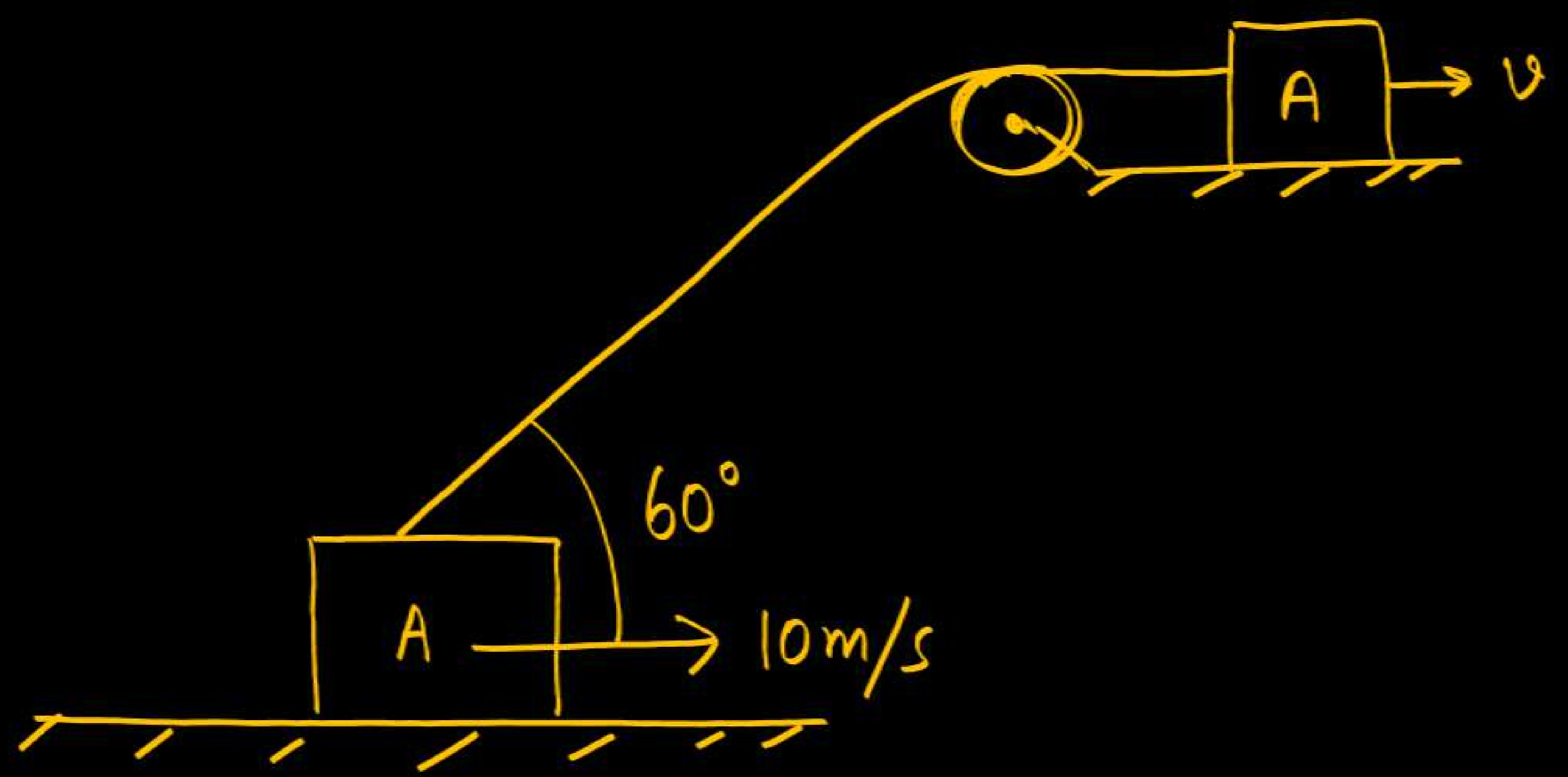
$$\underline{V_B = V\cot\theta}$$

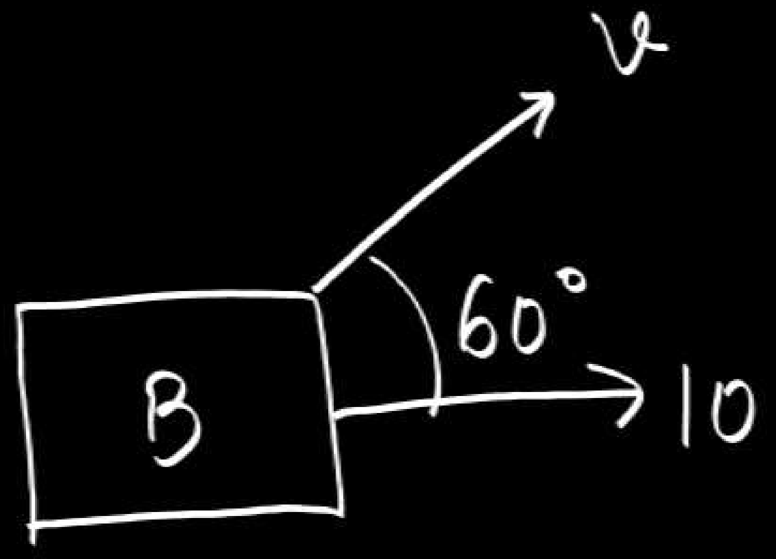




$$v\cos 37^\circ = 6$$

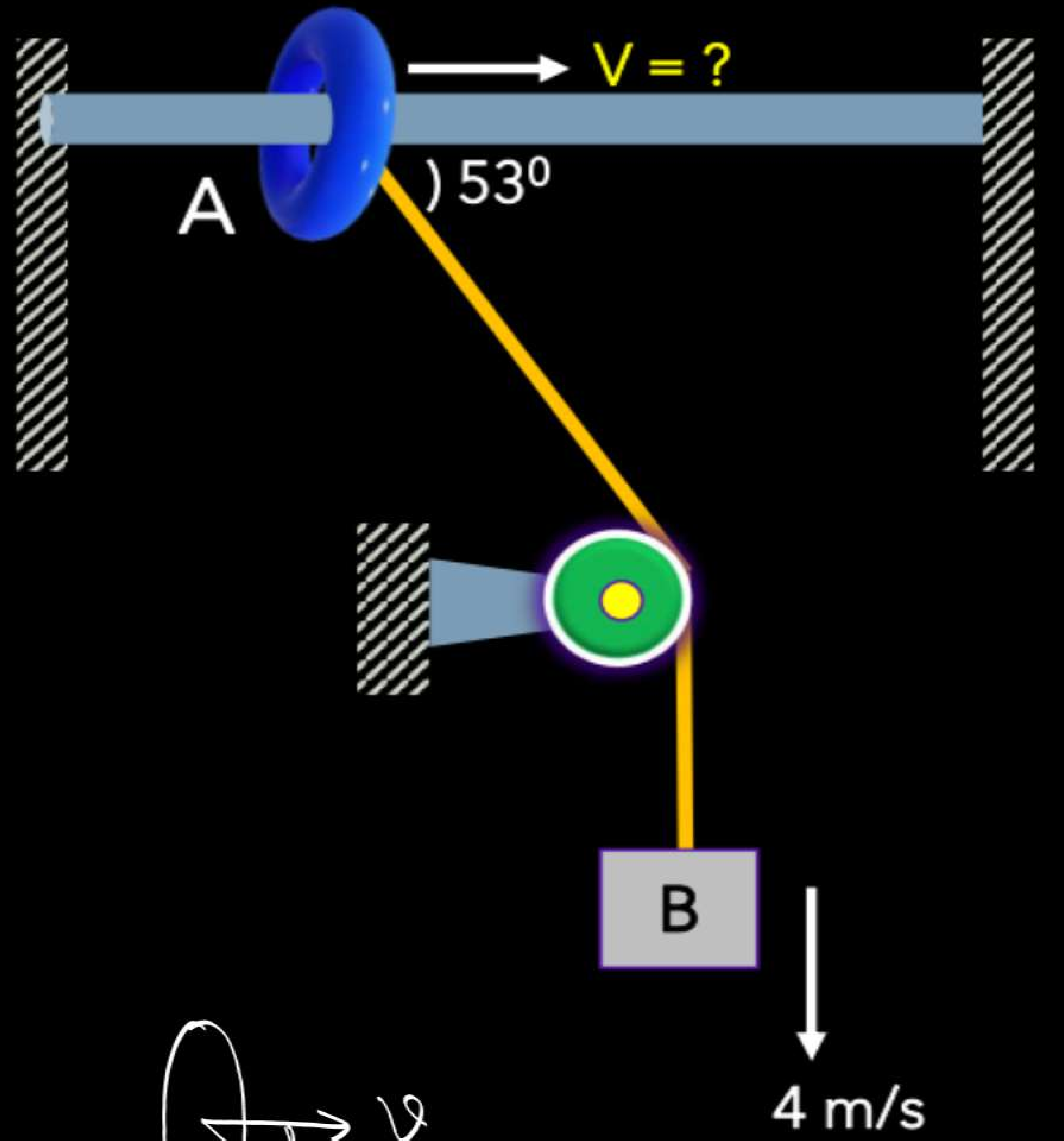
$$v \times \frac{4}{5} = 6 \Rightarrow v = 7.5\ m/s$$

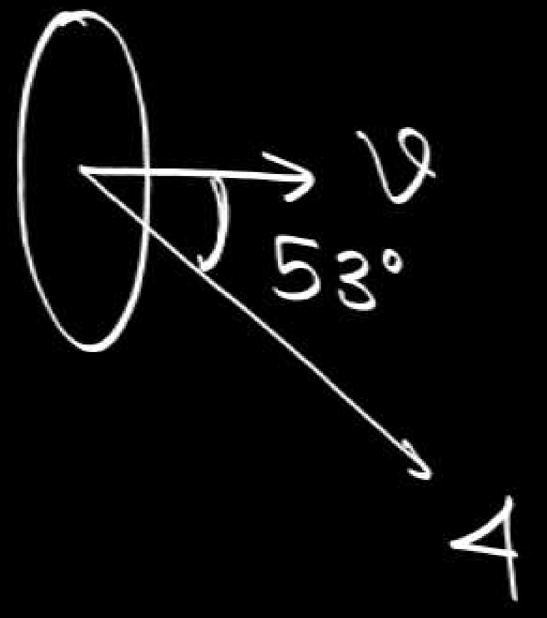




$$10\cos 60^\circ = v$$

$$5\ m/s = v$$

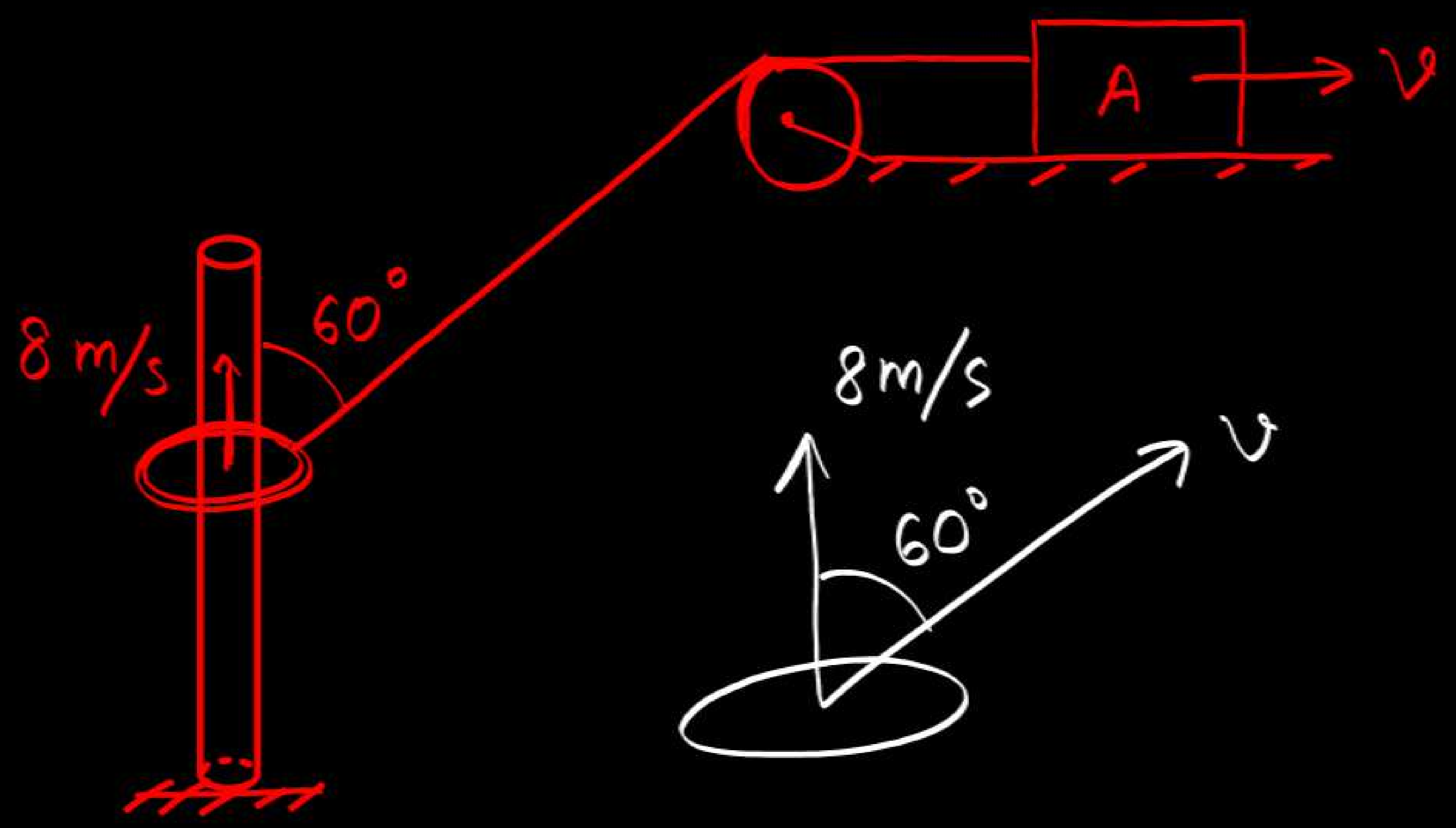




$$v\cos 53^\circ = 4$$

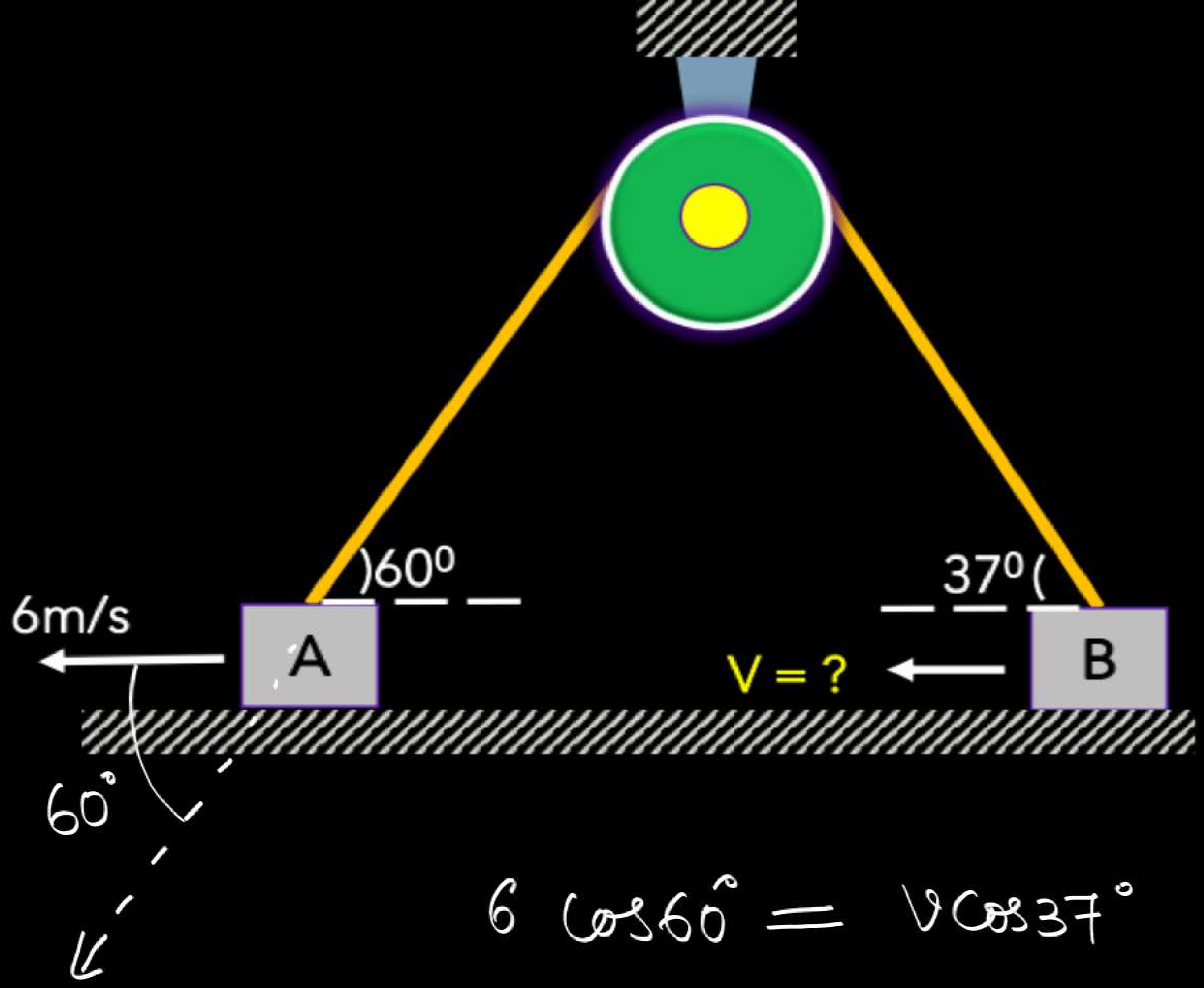
$$v\left(\frac{3}{5}\right) = 4$$

$$v = \left(20/3\right)\ m/s$$



$$8\cos 60^\circ = v$$

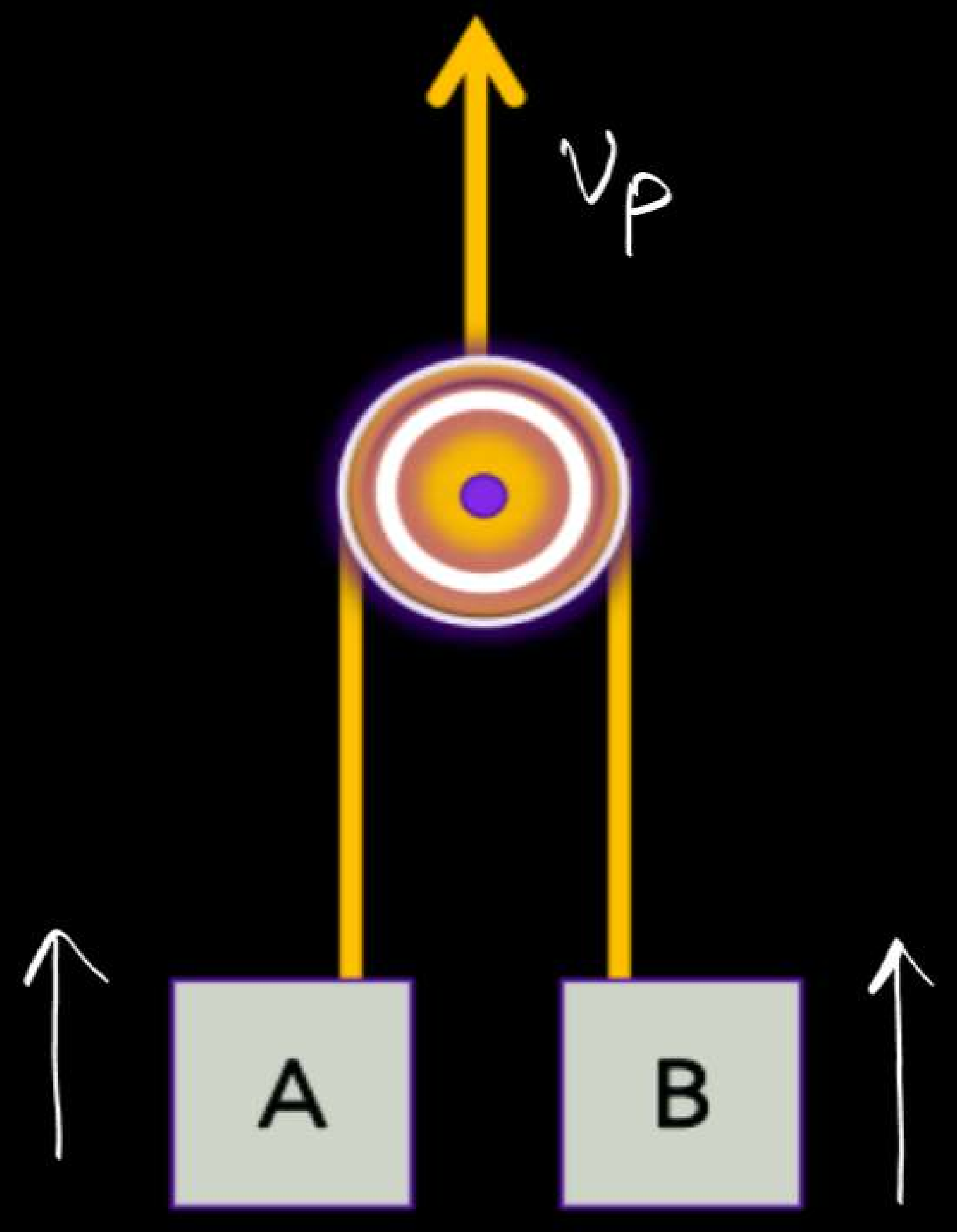
$$4\ m/s = v$$



$$6\cos 60^\circ = v\cos 37^\circ$$

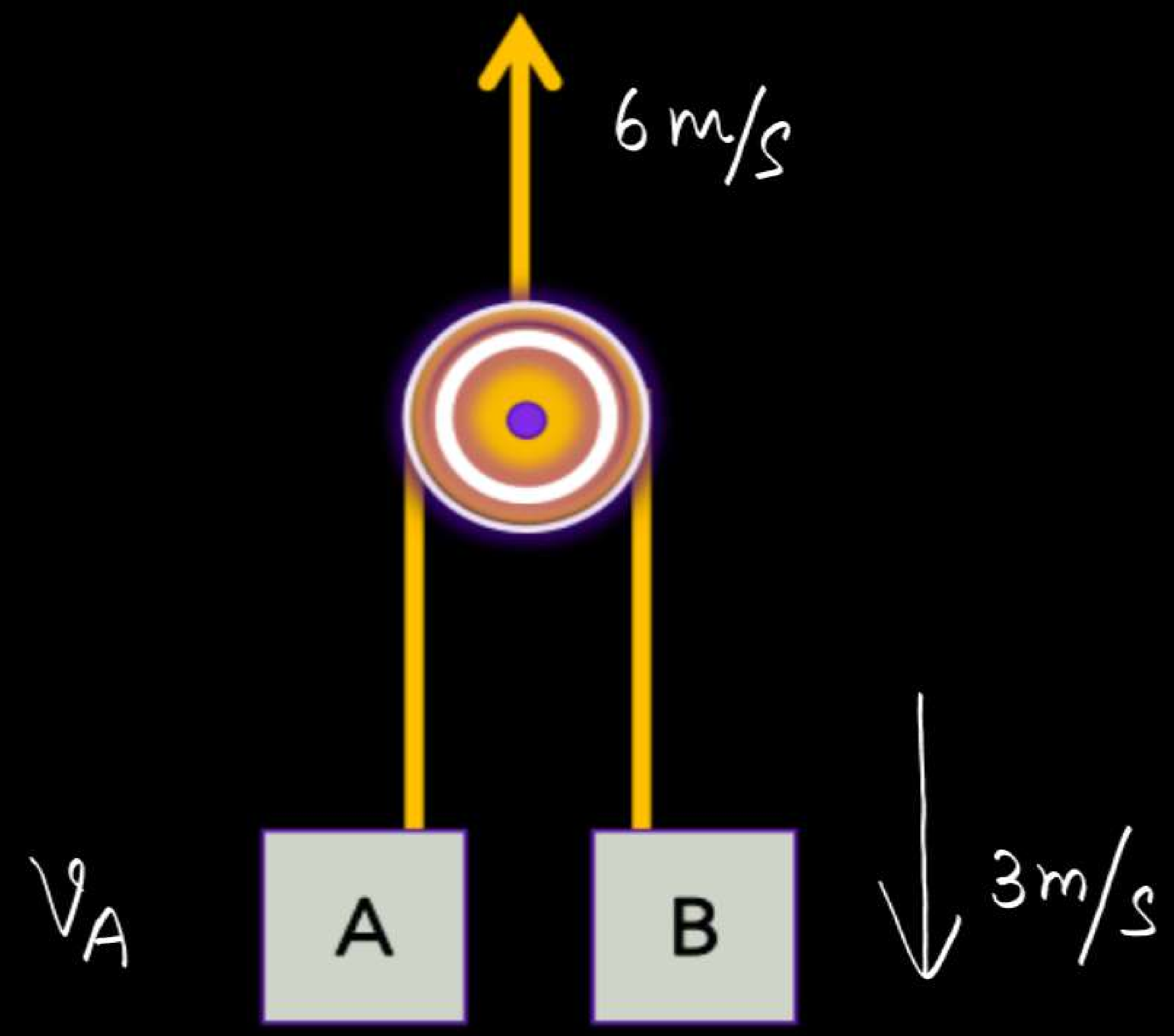
$$3 = v \times \frac{4}{5}$$

$$\frac{15}{4} = v$$



$$\boxed{V_p = \frac{V_A + V_B}{2}}$$

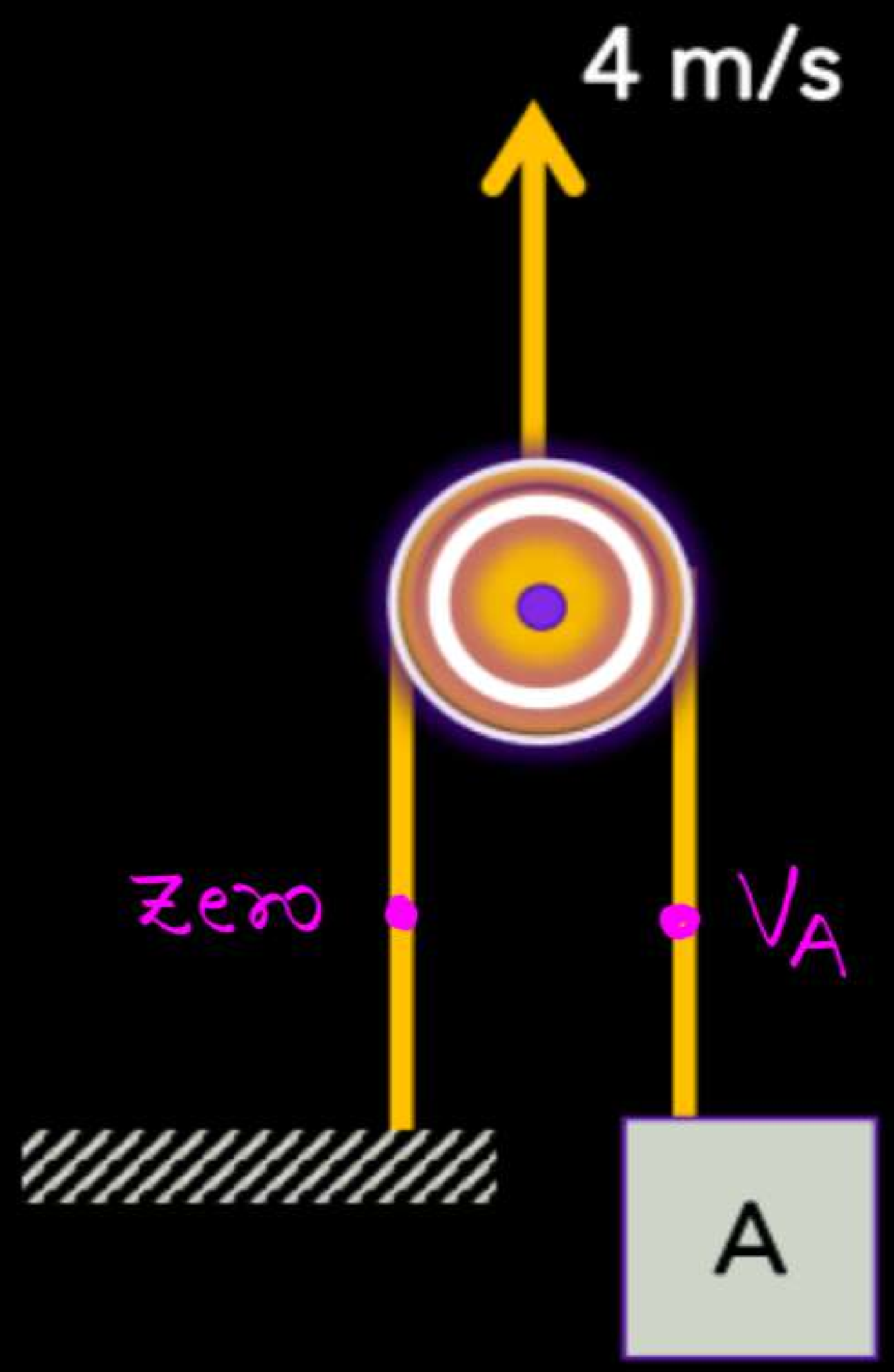
with sign



$$\Rightarrow \quad 6 = \frac{V_A - 3}{2}$$

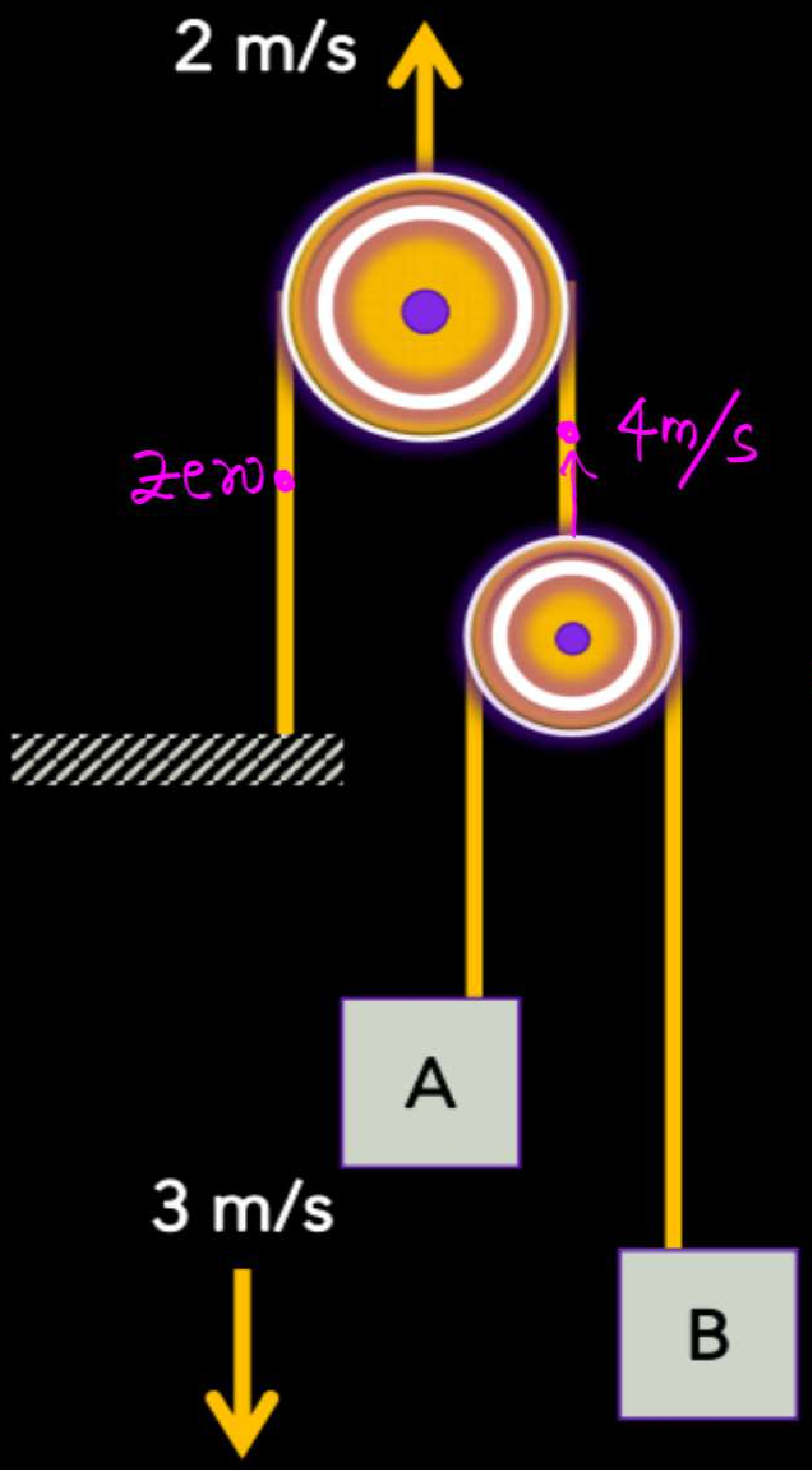
$$12 = V_A - 3$$

$$15 = V_A$$



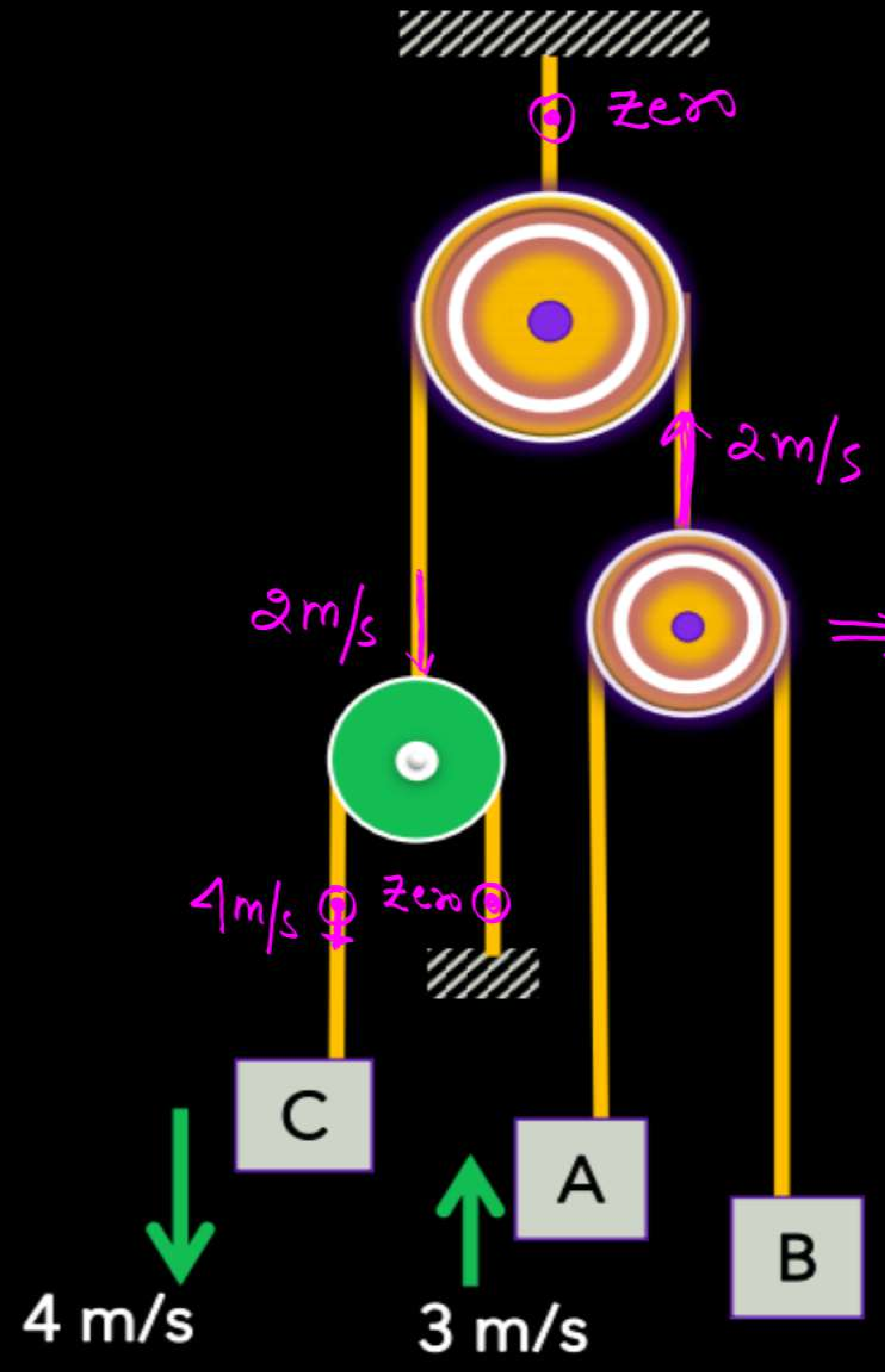
$$4 = \frac{0 + V_A}{2}$$

$$\underline{\underline{8 = V_A}}$$



$$\Rightarrow \quad 4 = \frac{-3 + V_B}{2}$$

$$\boxed{11 = V_B}$$

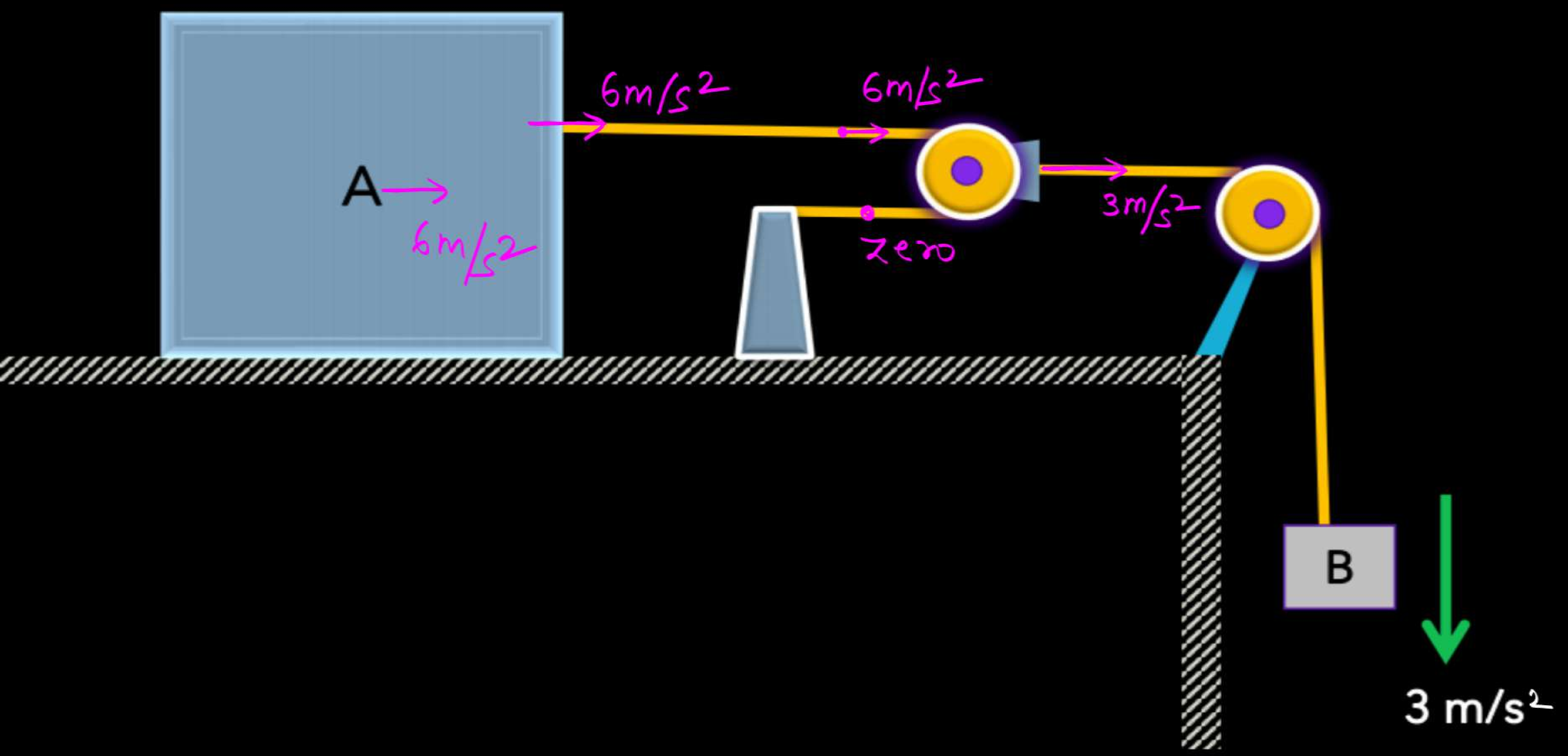


$$\Rightarrow 2 = \frac{3 + V_B}{2}$$

$$4 = 3 + V_B$$

$$\underline{1\ m/s = V_B}$$

If block B moves downward with acceleration $3 m/s^2$, find acceleration of block A.

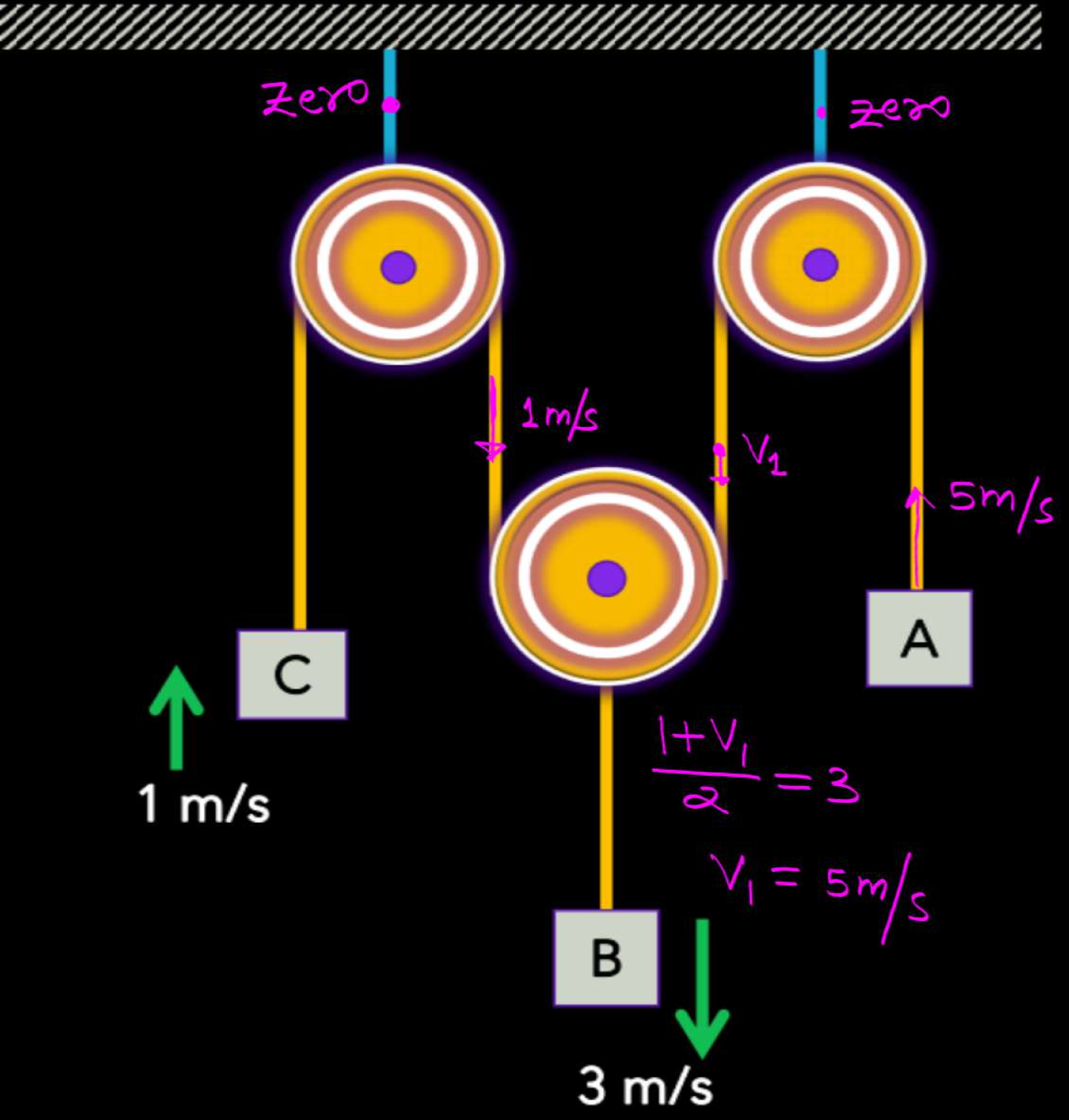


A. $2\ m/s^2$

B. $4\ m/s^2$

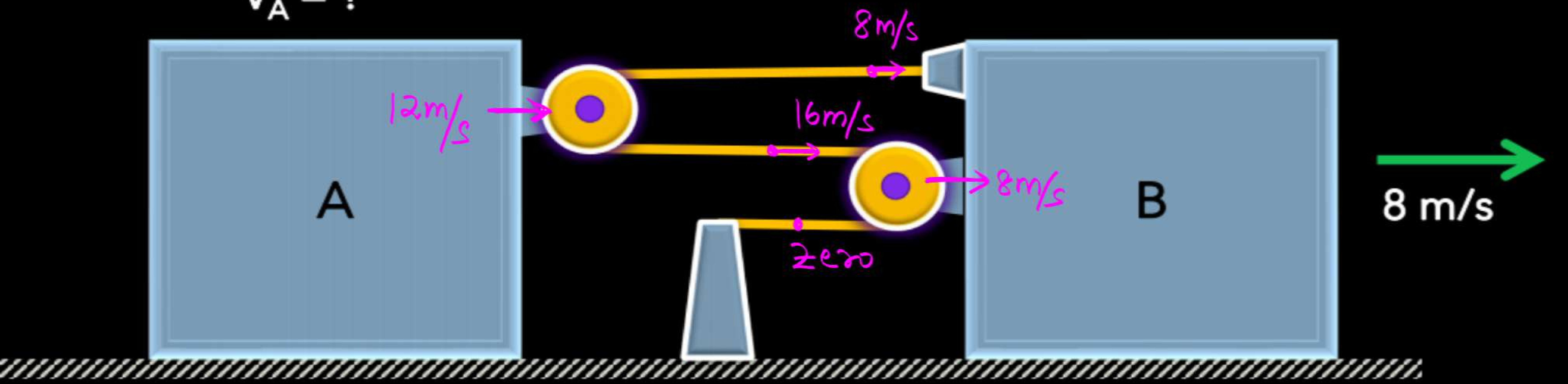
C. $6\ m/s^2$

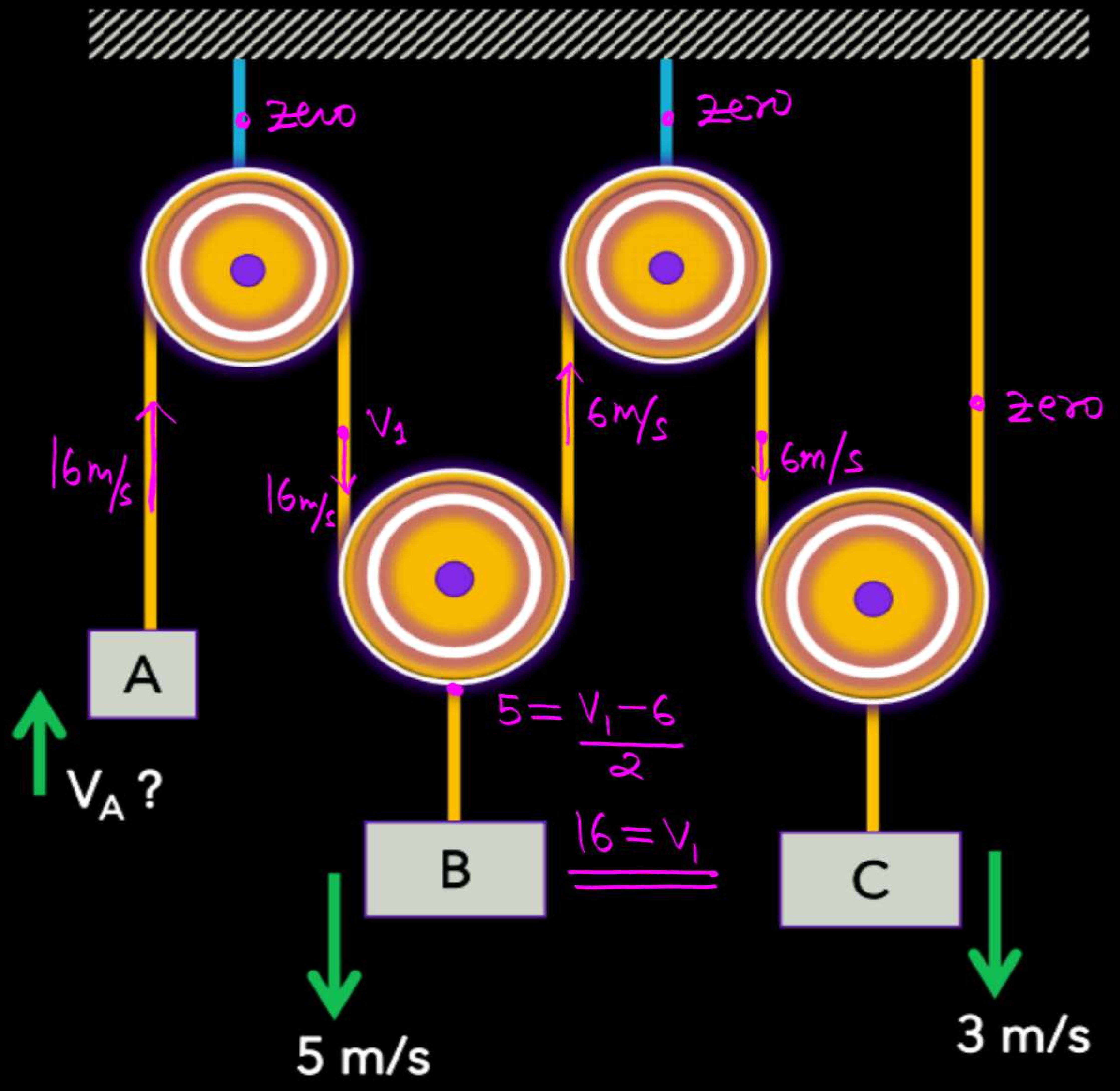
D. $8\ m/s^2$



zero
zero
1 m/s
V_1
5m/s
C
A
B
1 m/s
3 m/s
$\frac{1+V_1}{2} = 3$
$V_1 = 5\,m/s$

$V_A = ?$



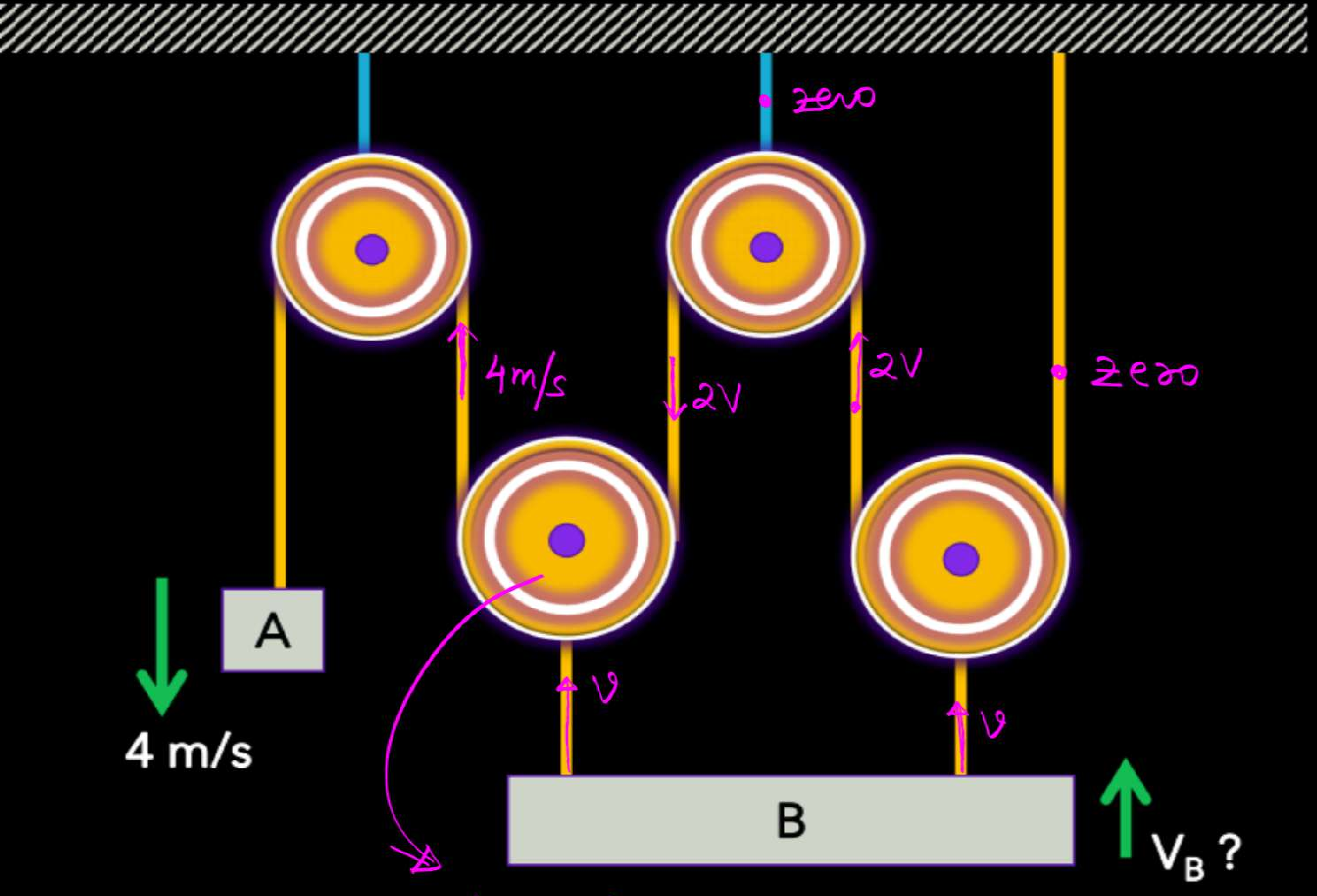


In the system shown in figure find the speed of block A ?

A. 4 m/s
B. 8 m/s
C. 16 m/s
D. 32 m/s

Two block Problems

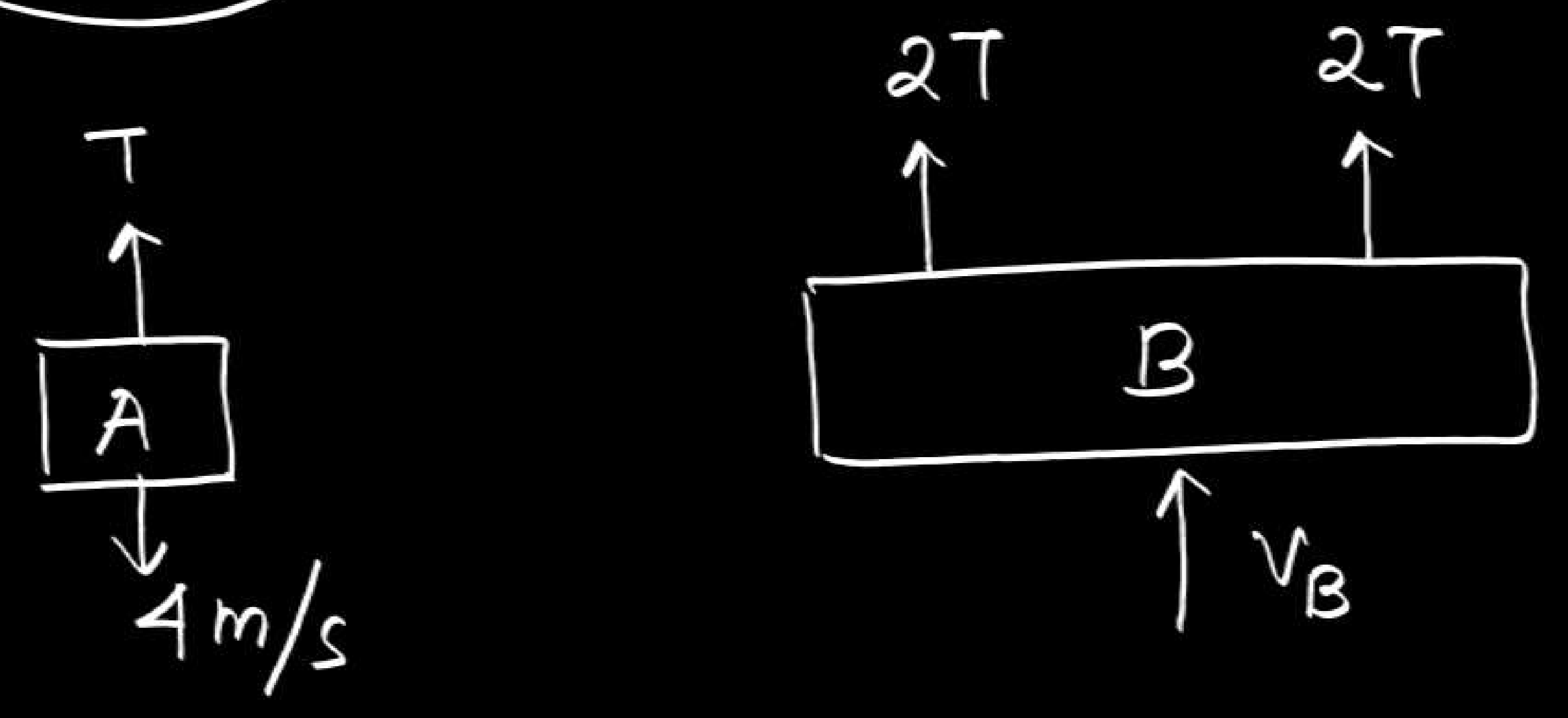
m-2



$$v = \frac{4-2v}{2}$$

$$2v = 4-2v$$

$$4v = 4 \Rightarrow 1\,m/s$$

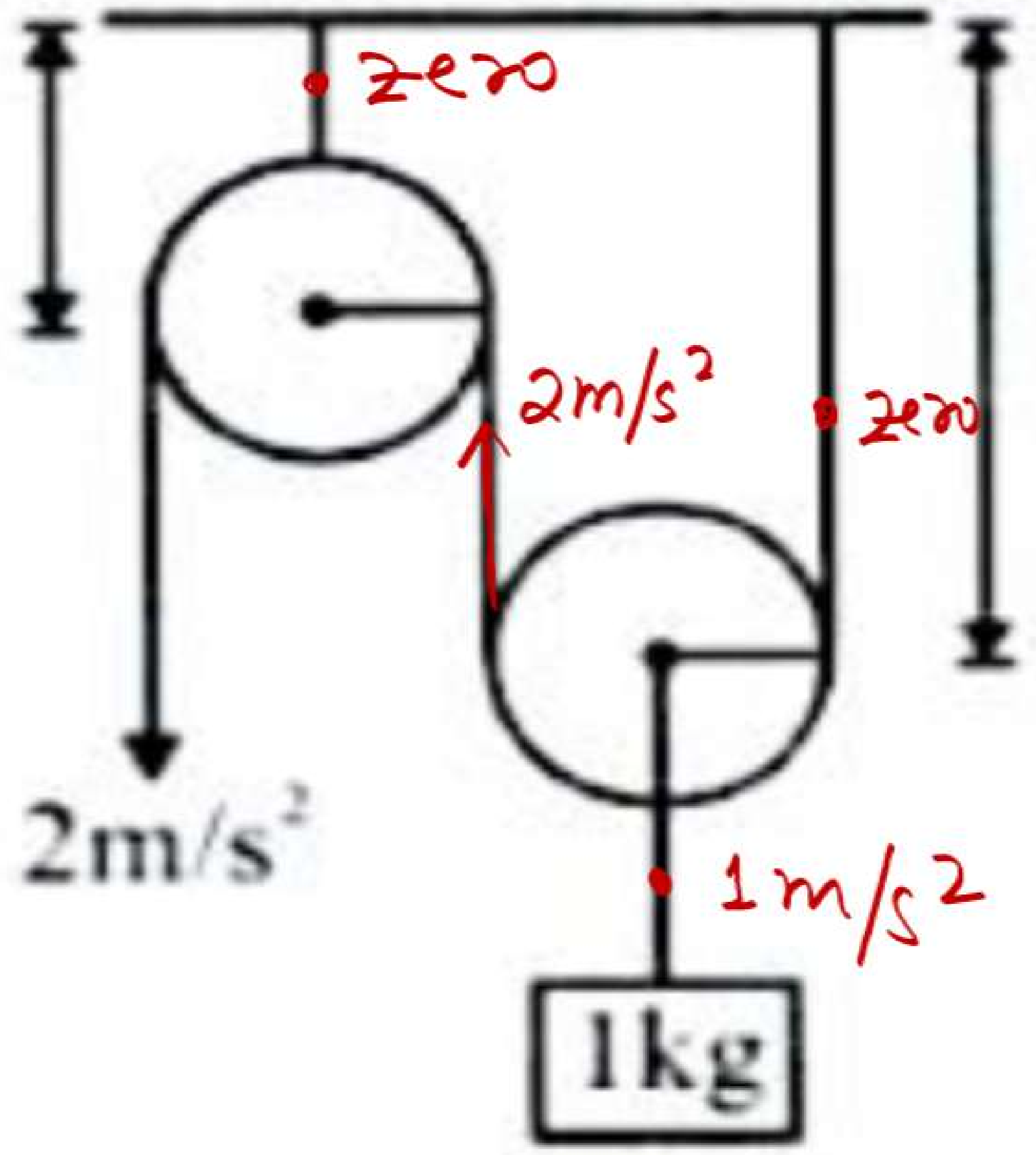


$$T(4) - 4T(V_B) = 0$$

$$4 - 4V_B = 0$$

$$V_B = 1\,m/s$$

If string is pulled with acceleration of 2 m/s^2 then acceleration of block is. **[AIIMS 2017]**



(1) 4 m/s^2 (2) 2 m/s^2 (3) 1 m/s^2 (4) 8 m/s^2

JEE Main 2021 (Online)

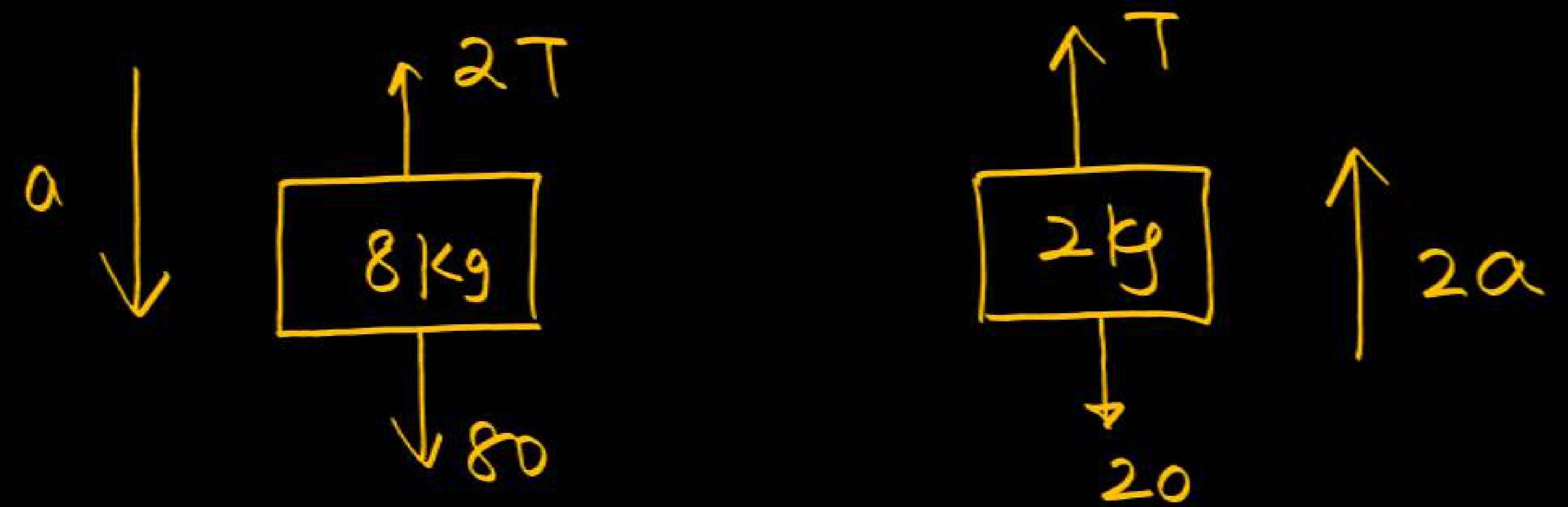
The boxes of masse 2 kg and 8 kg are connected by a massless string passing over smooth pulleys. Calculate the time taken by box of mass 8 kg to strike the ground starting from rest.

(A) 0.34 s

(B) 0.2 s

(C) 0.25 s

(D) 0.4 s



$$80 - 2T = 8a$$

$$2 \times \left[T - 20 = 2(2a) \right]$$

add

$$40 = 16a$$

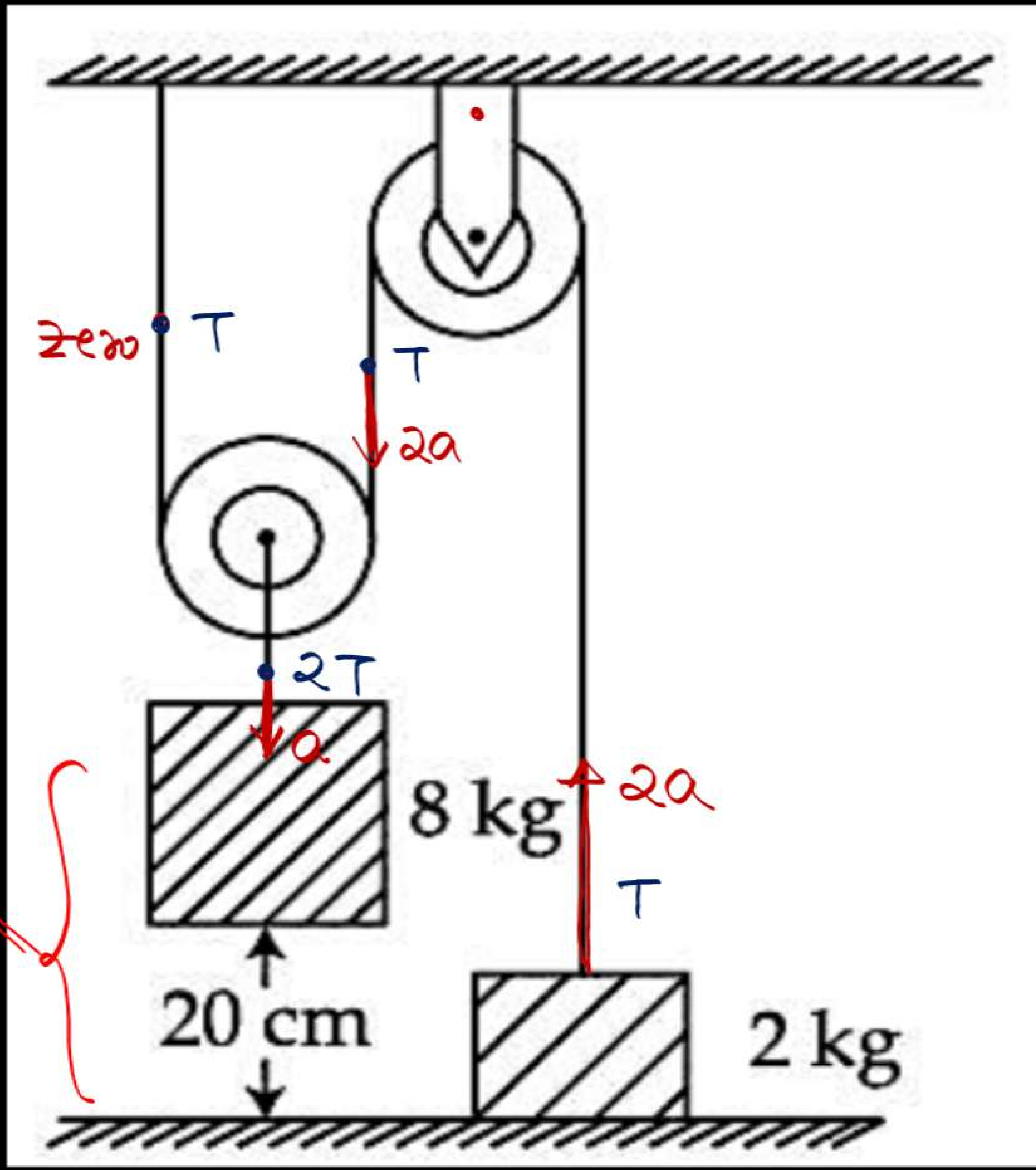
$$2.5\ m/s^2 = a$$

$$s = ut + \frac{1}{2}at^2$$

$$0.2 = 0 + \frac{1}{2}(2.5)t^2$$

$$0.2 = \frac{5}{4}t^2$$

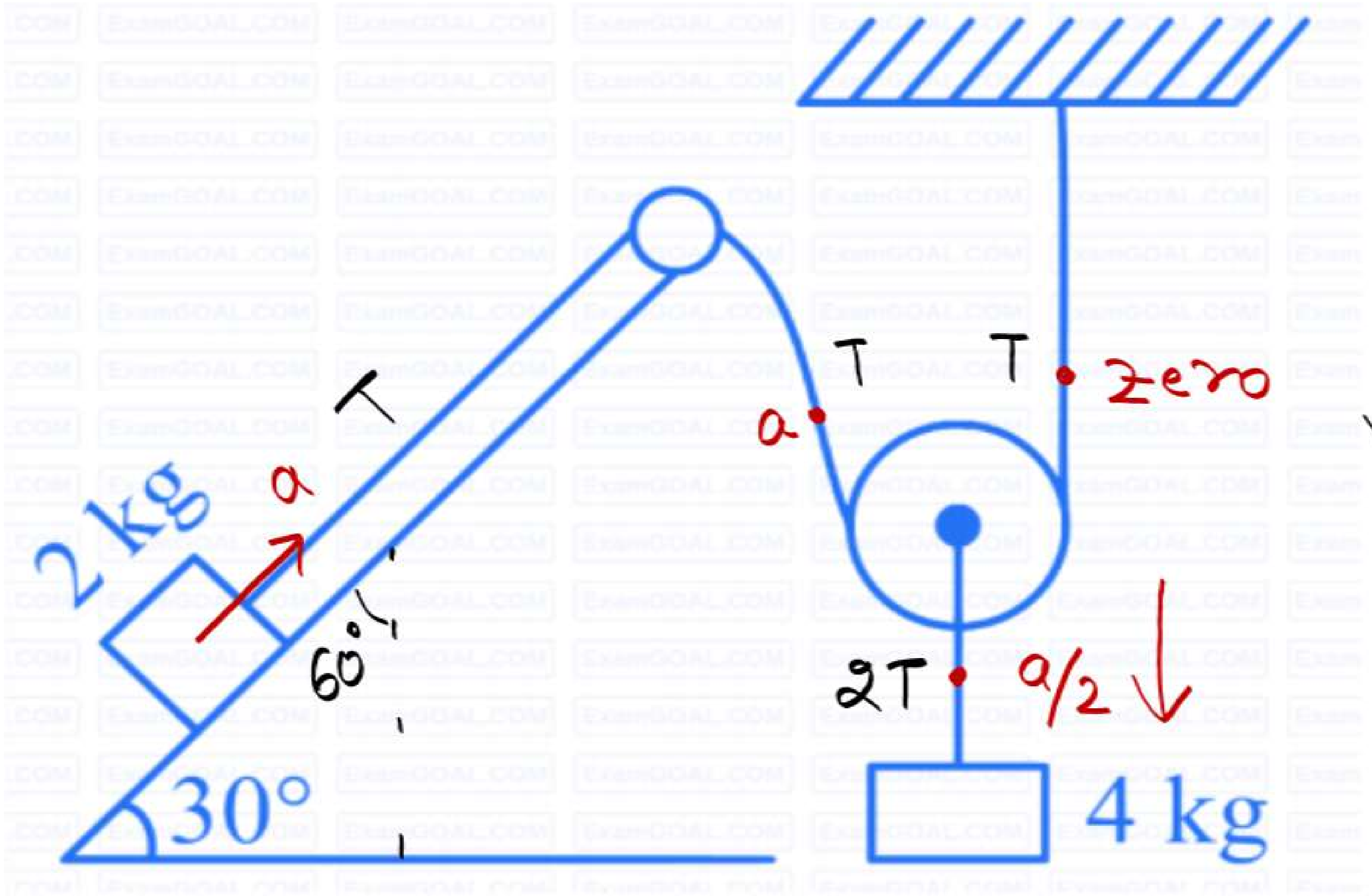
$$0.16 = t^2$$

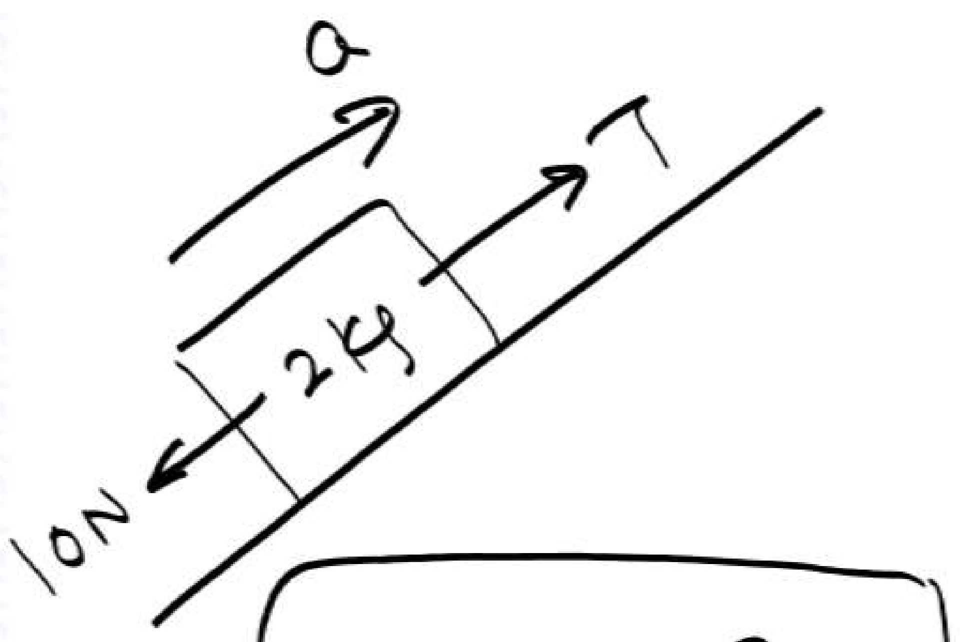


JEE Main 2024 (Online) 30th January Morning Shift

MCQ (Single Correct Answer) +4 -1

All surfaces shown in figure are assumed to be frictionless and the pulleys and the string are light. The acceleration of the block of mass $2 \ \mathrm{kg}$ is :

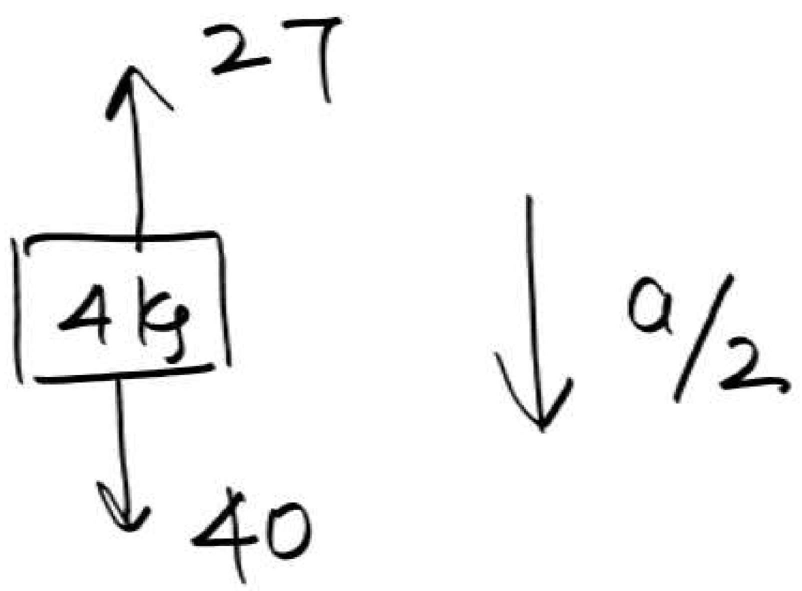




$$\boxed{T - 10 = 2a}$$

$$\Downarrow$$

$$2T = 20 + 4a$$



$$40 - 2T = 4 \times \frac{a}{2}$$

$$40 - (20 + 4a) = 2a$$

$$20 = 6a$$

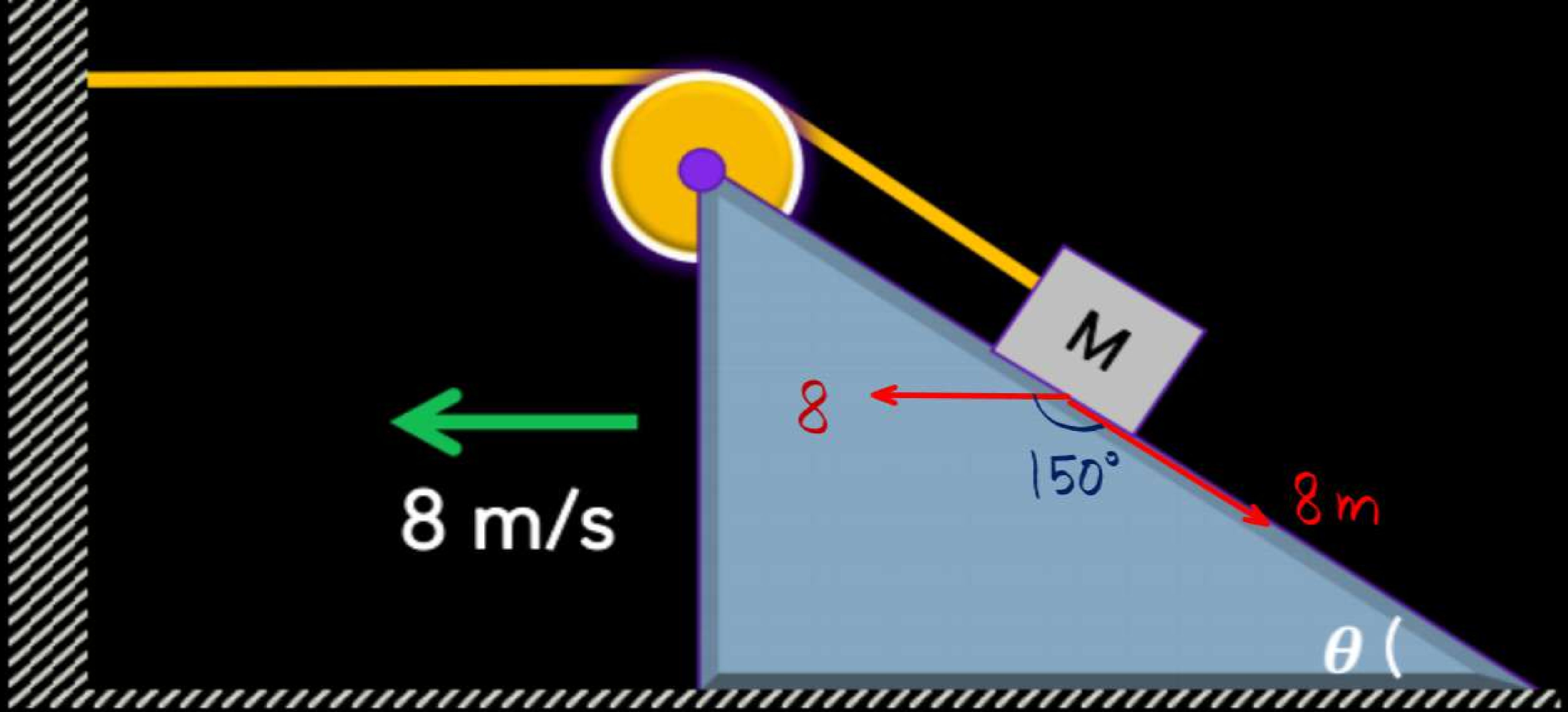
$$\frac{10}{3} = a$$

A. $\frac{g}{2}$

B. $\frac{g}{4}$

C. g

D. $\frac{g}{3}$



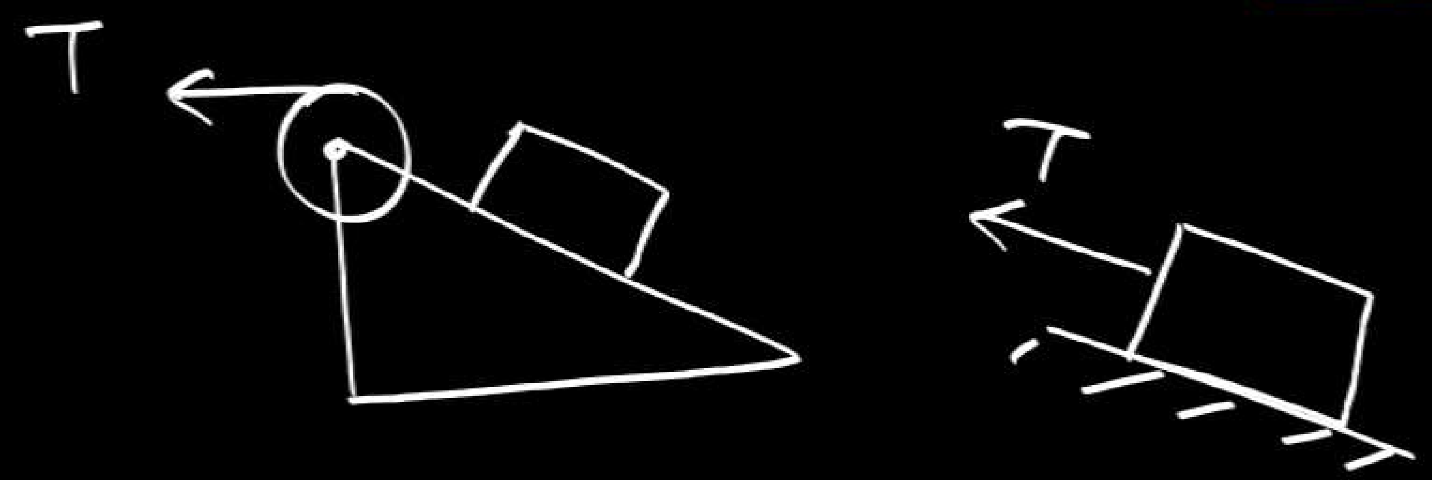
let $\theta = 30°$

i) Velocity of block wrt wedge

Ans : 8 m/s

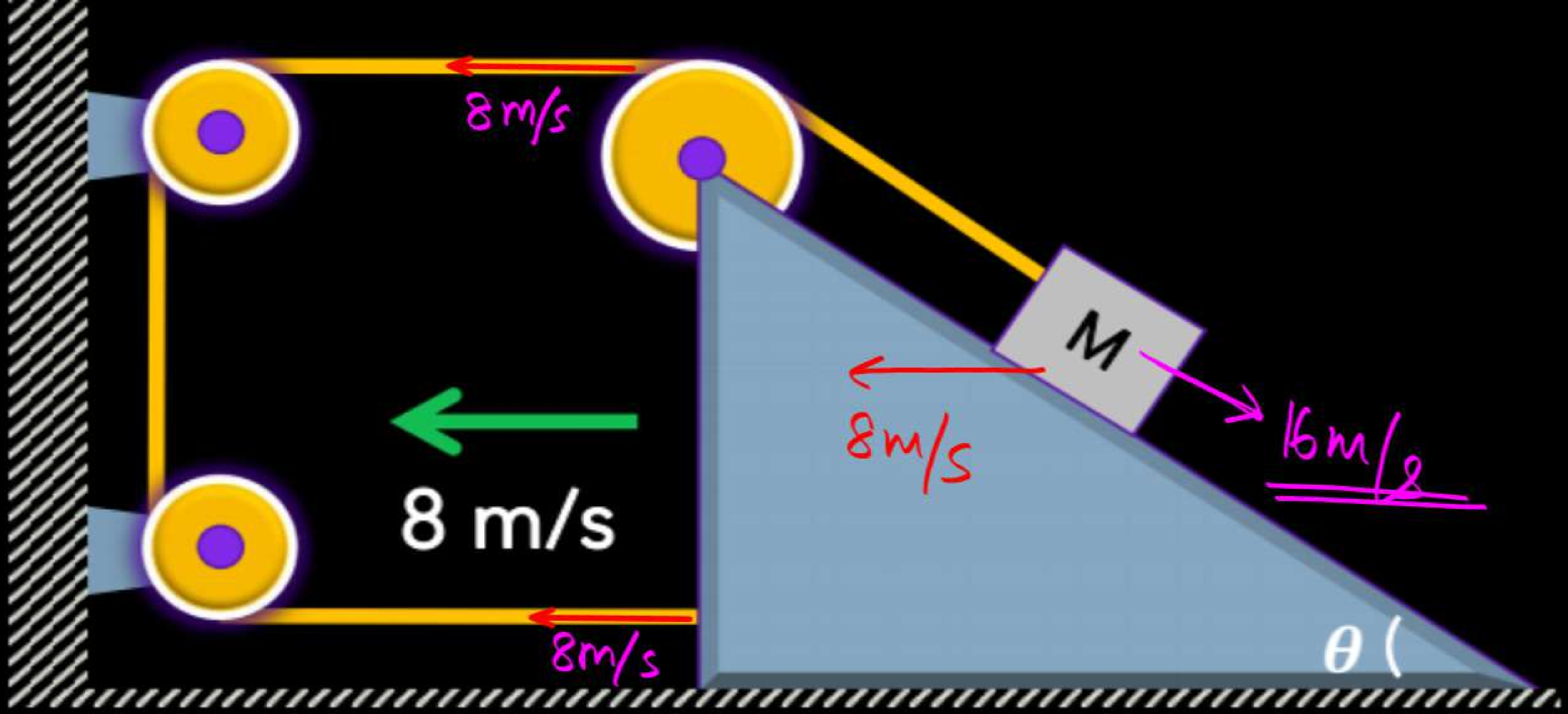
ii) $V_{net} = \sqrt{8^2 + 8^2 + 2 \times 64 \cos 150°}$

M-2

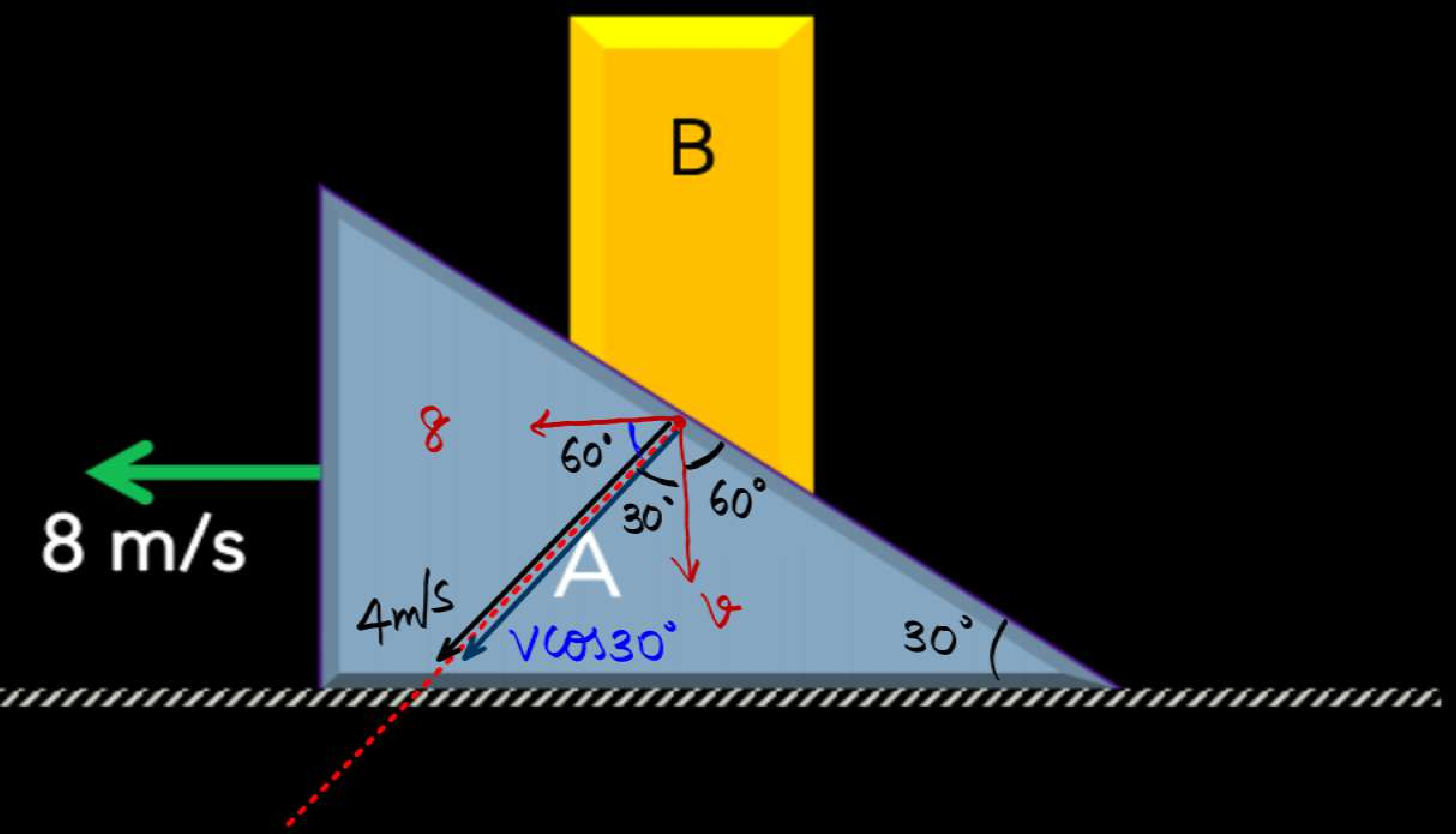


$$-T(8) - T(v) = 0$$

$$v = -8 \text{ m/s}$$



8 m/s
M
8m/s
16m/s
8 m/s
8m/s
θ



Find velocity of (B) moving down

$$4 = V\cos 30^\circ$$

$$4 = V\frac{\sqrt{3}}{2}$$

$$\frac{8}{\sqrt{3}}\,m/s = v$$

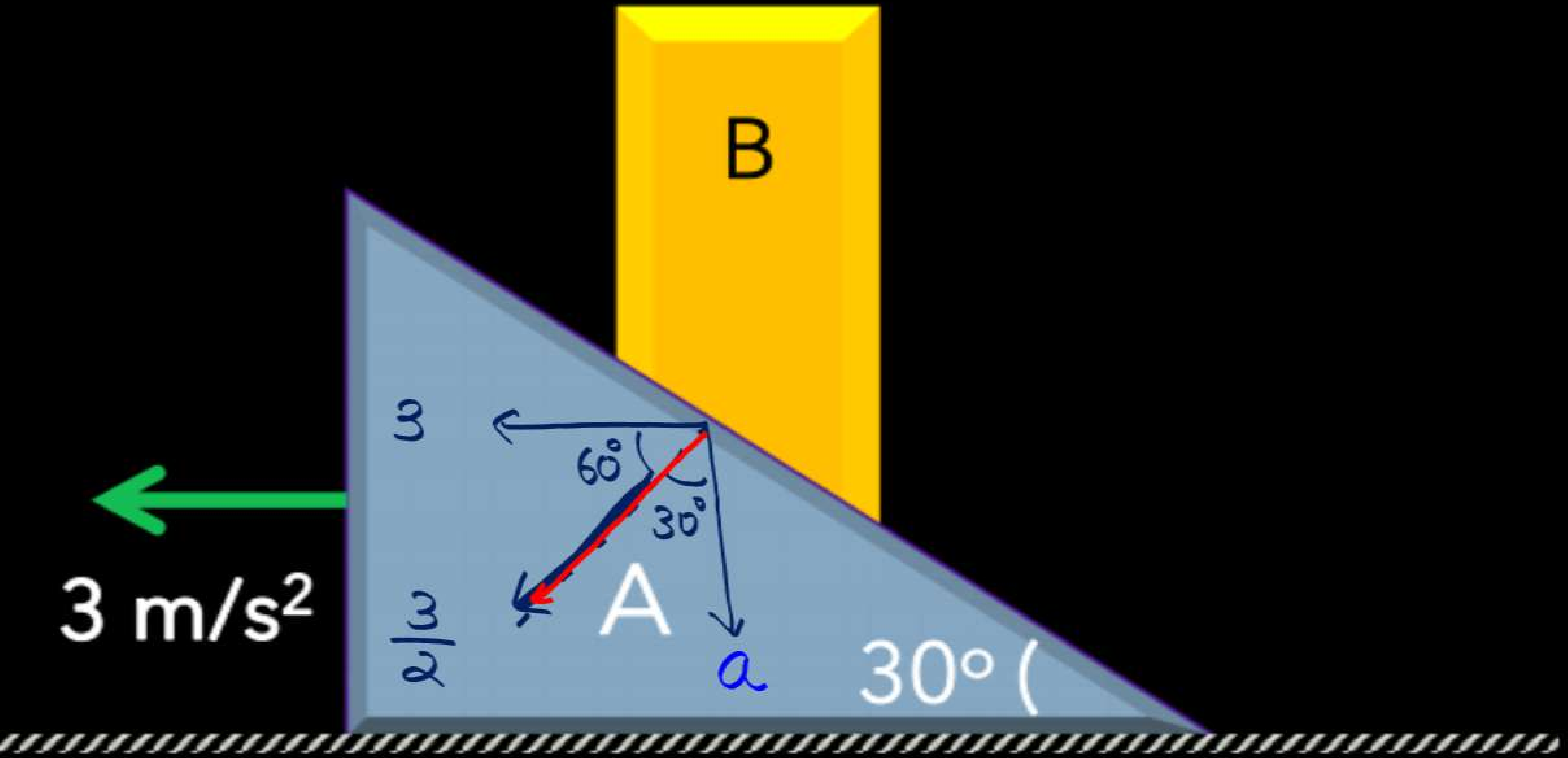
In the system shown, the block A moves towards left at acceleration of 3 m/s^2 .Find acceleration of rod B which is constrained to move vertically over the wedge.

A. $\sqrt{3}$ m/s^2

B. 3 m/s^2

C. $1/\sqrt{3}$ m/s^2

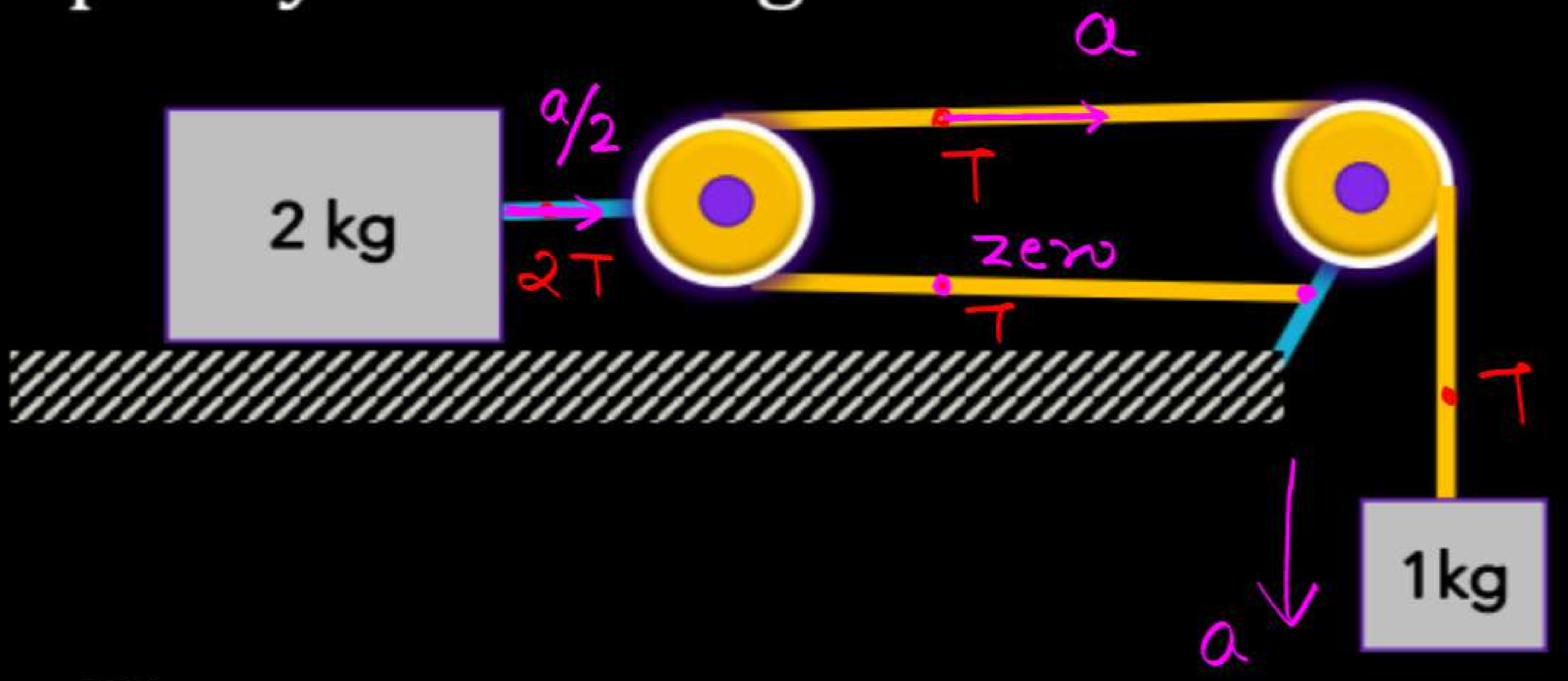
D. 1 m/s^2



$$\frac{3}{2} = a\cos 30^\circ$$

$$\sqrt{3} = a$$

Consider the situation shown in figure. 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



$\xrightarrow{a/2}$

$\boxed{2kg} \rightarrow 2T$

$\uparrow T$

$\boxed{1\,kg}$

$\downarrow 10$

$$2T = 2\left(\frac{a}{2}\right)$$

$$\boxed{2T = a}$$

$$\Downarrow$$

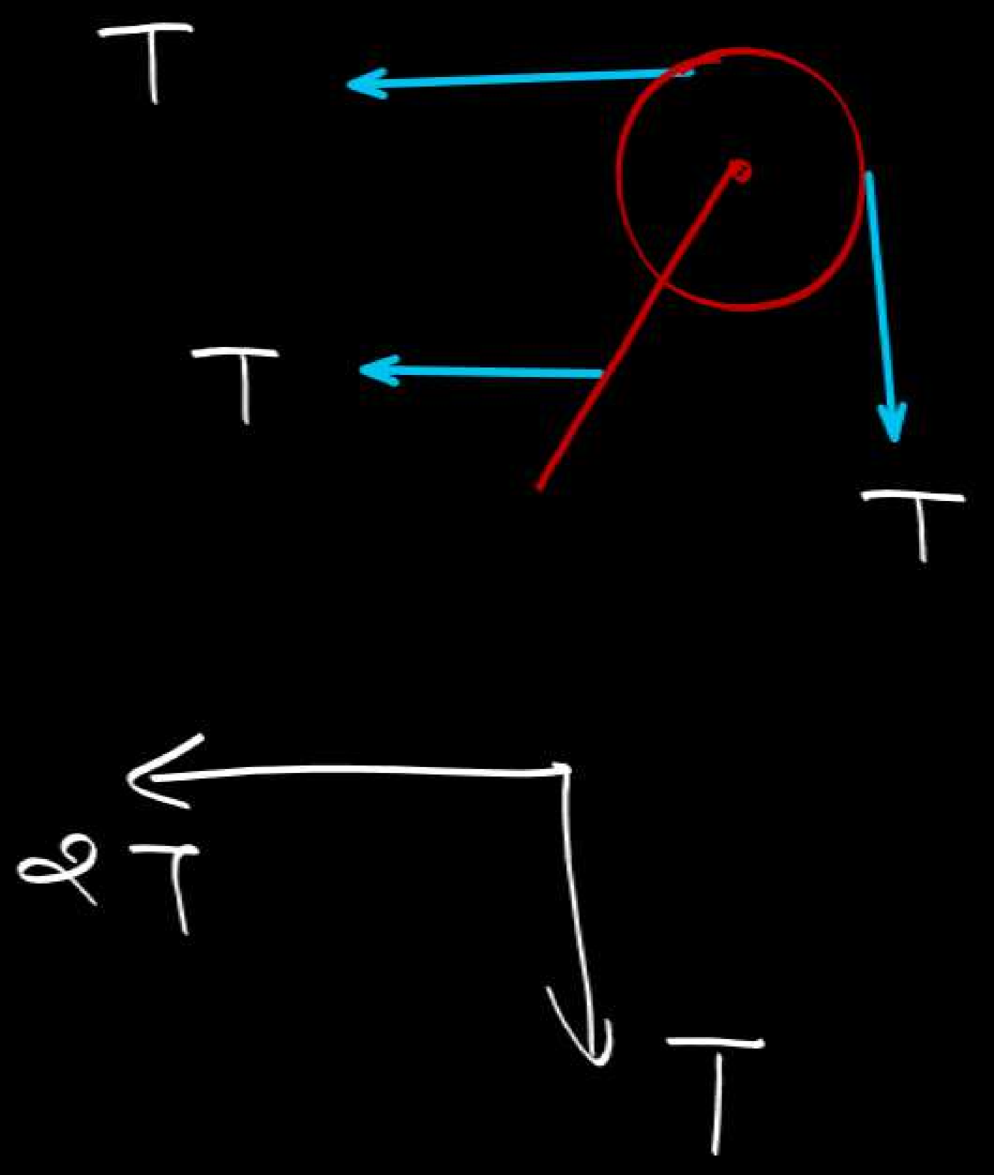
$$T = \frac{10}{3}\,N$$

$$10 - T = 1 \times a$$

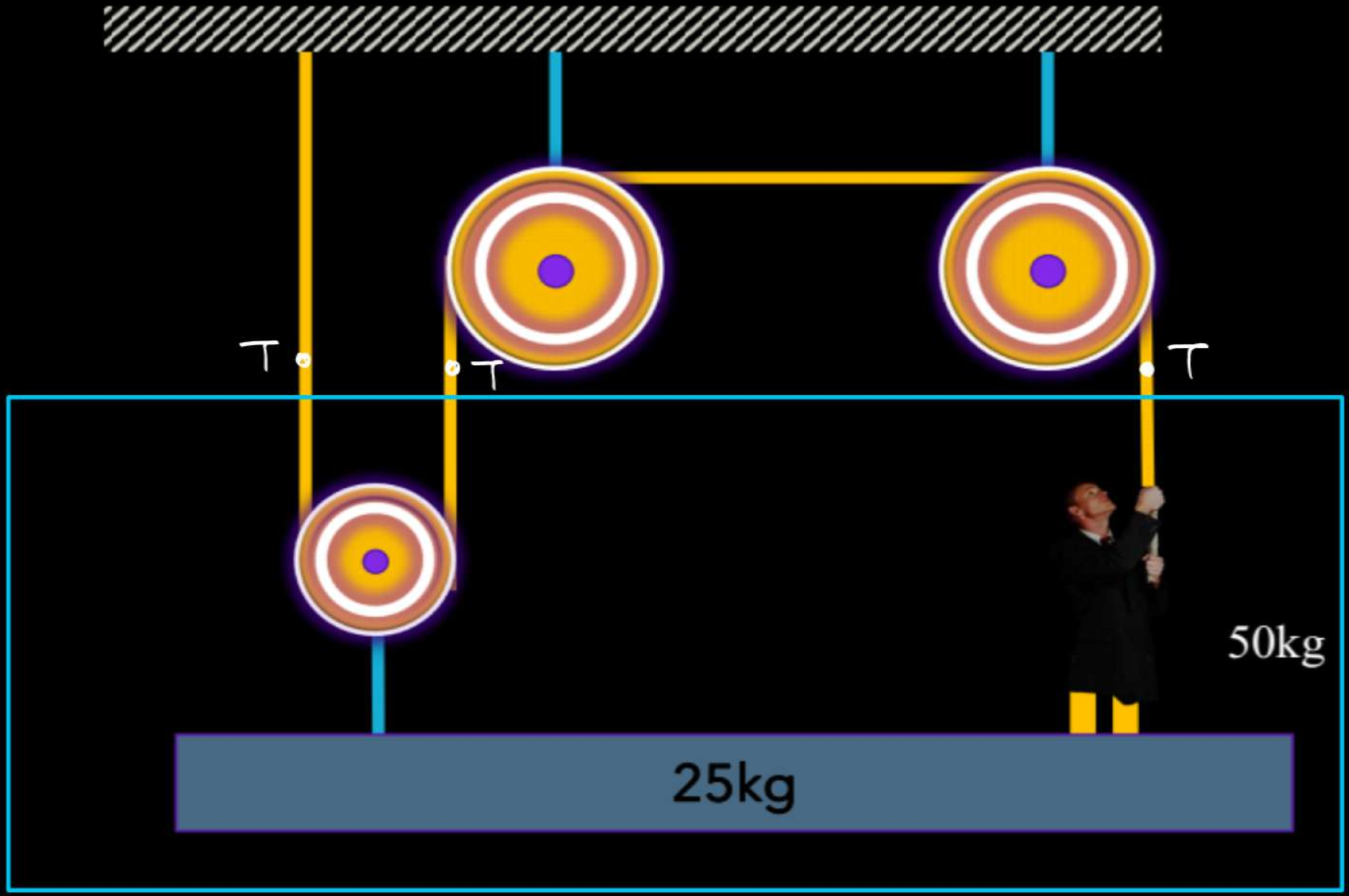
$$10 - \frac{a}{2} = a$$

$$10 = \frac{3}{2}a$$

$$\left(\frac{20}{3} = a\right)$$



A 50kg person stands on a 25kg platform. He pulls on the rope via frictionless pulleys as shown in the figure. The platform moves upwards at a steady rate if the force with which the person pulls the rope is ?

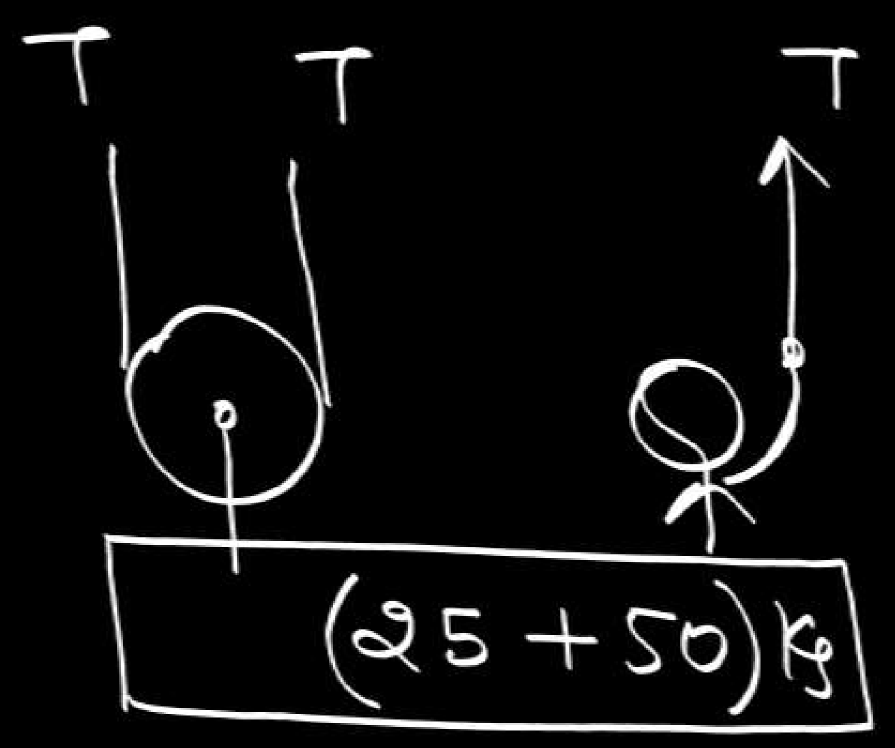


A. 500 N

B. 250 N

C. 125 N

D. None of these



$3T = 750$

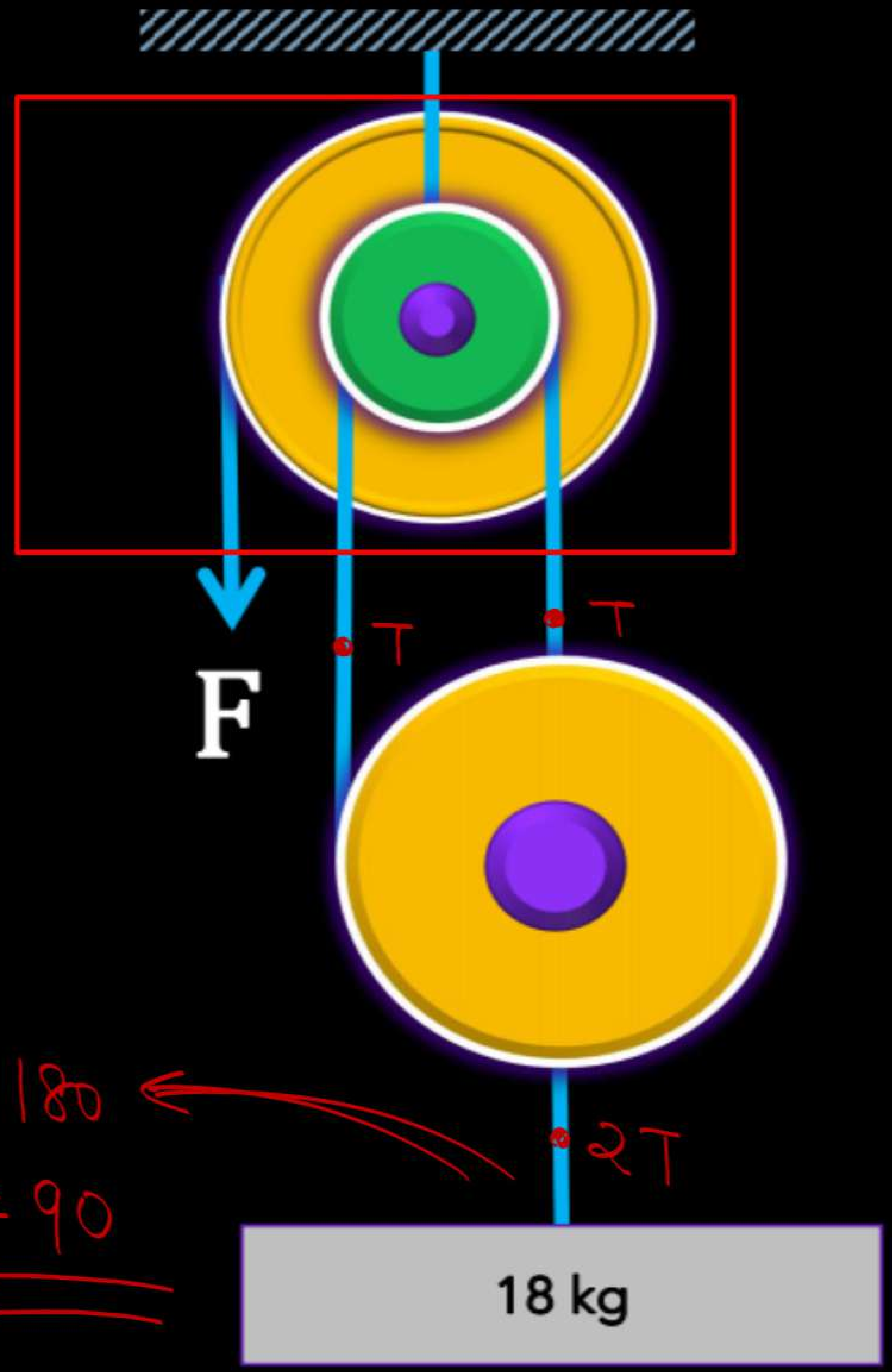
In the figure, at the free end of the light string, a force F is applied to keep the suspended mass of 18 kg at rest. Then the force exerted by the ceiling on the system (assume that the string segments are vertical and the pulleys are light and smooth) is: ($g = 10\ m/s^2$)

A. 60 N
B. 120 N
C. 180 N
D. 240 N

$F + T + T = 0$

$F + 180 = 0$

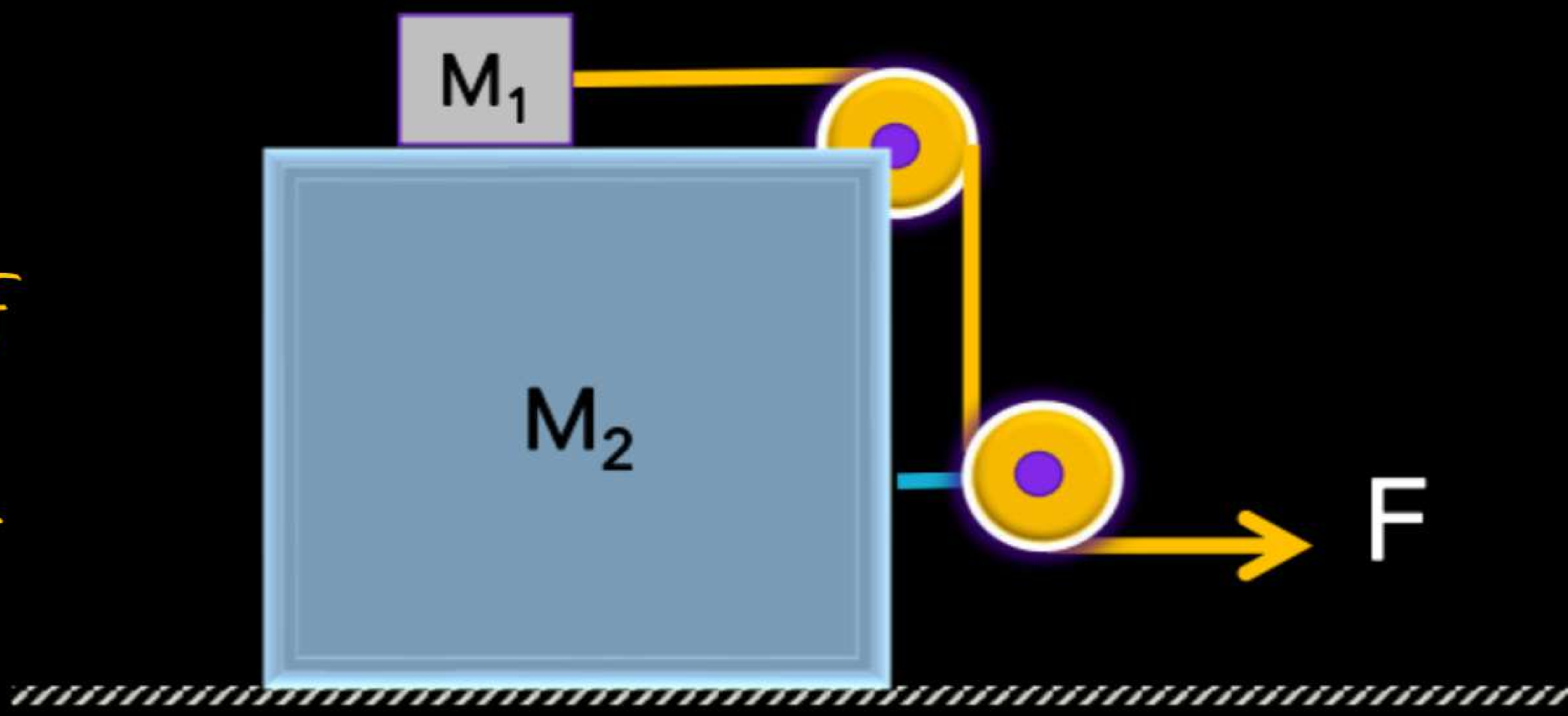
$\underline{F = -180}$

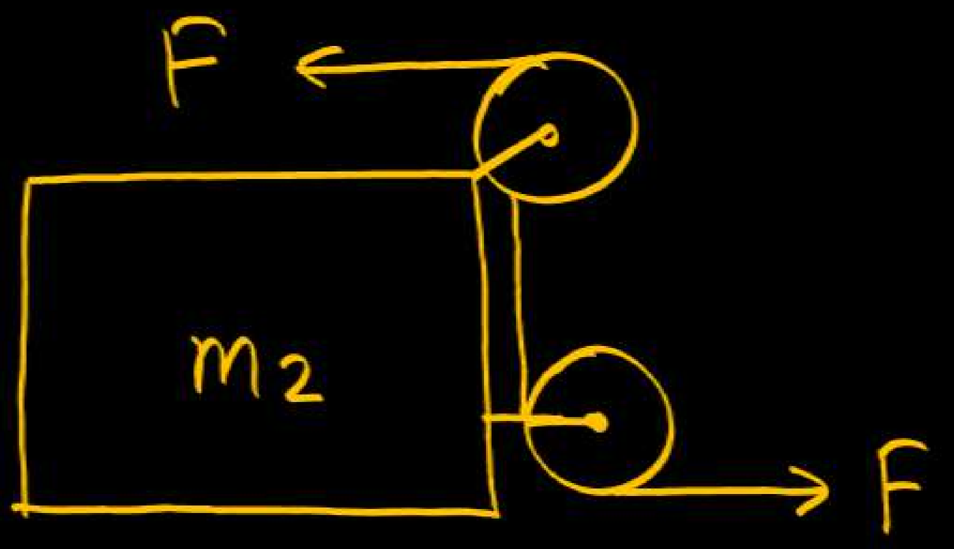


$2T = 180$

$\underline{T = 90}$

The masses of the block are $m_1 = 20$ kg and $m_2 = 30$ kg. The acceleration of masses m_1 and m_2 will be if $F = 180$ N is applied according to figure.

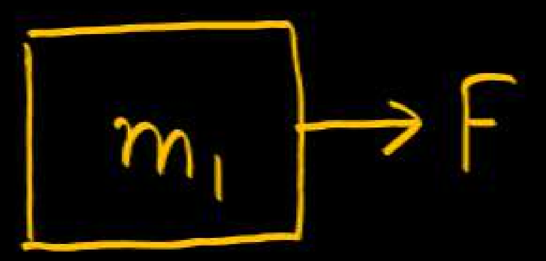




$F_{net} = m_2 a$

$0 = m_2 a$

$\boxed{0 = a}$



$F = m_1 a$

$\frac{F}{m_1} = a$

$\frac{180}{20} = a$

A $a_{m_1} = 9 m/s^2, a_{m_2} = 0$

B $a_{m_1} = 9 m/s^2, a_{m_2} = 9 m/s^2$

C $a_{m_1} = 0, a_{m_2} = 9 m/s^2$

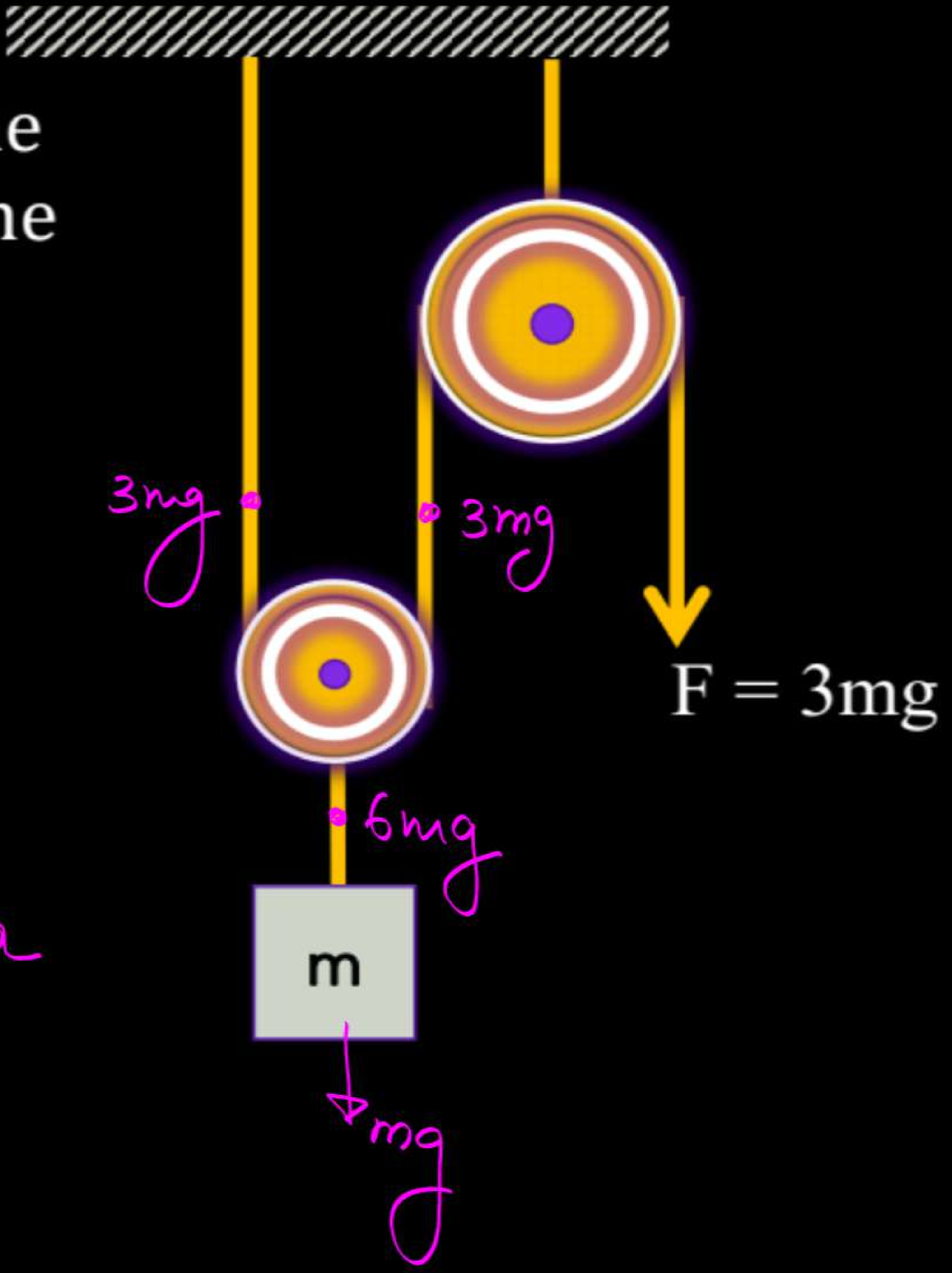
D None of these

In the shown mass pulley system, pulleys and string are massless. The one end of the string is pulled by the force F = 3mg. The acceleration of the block will be

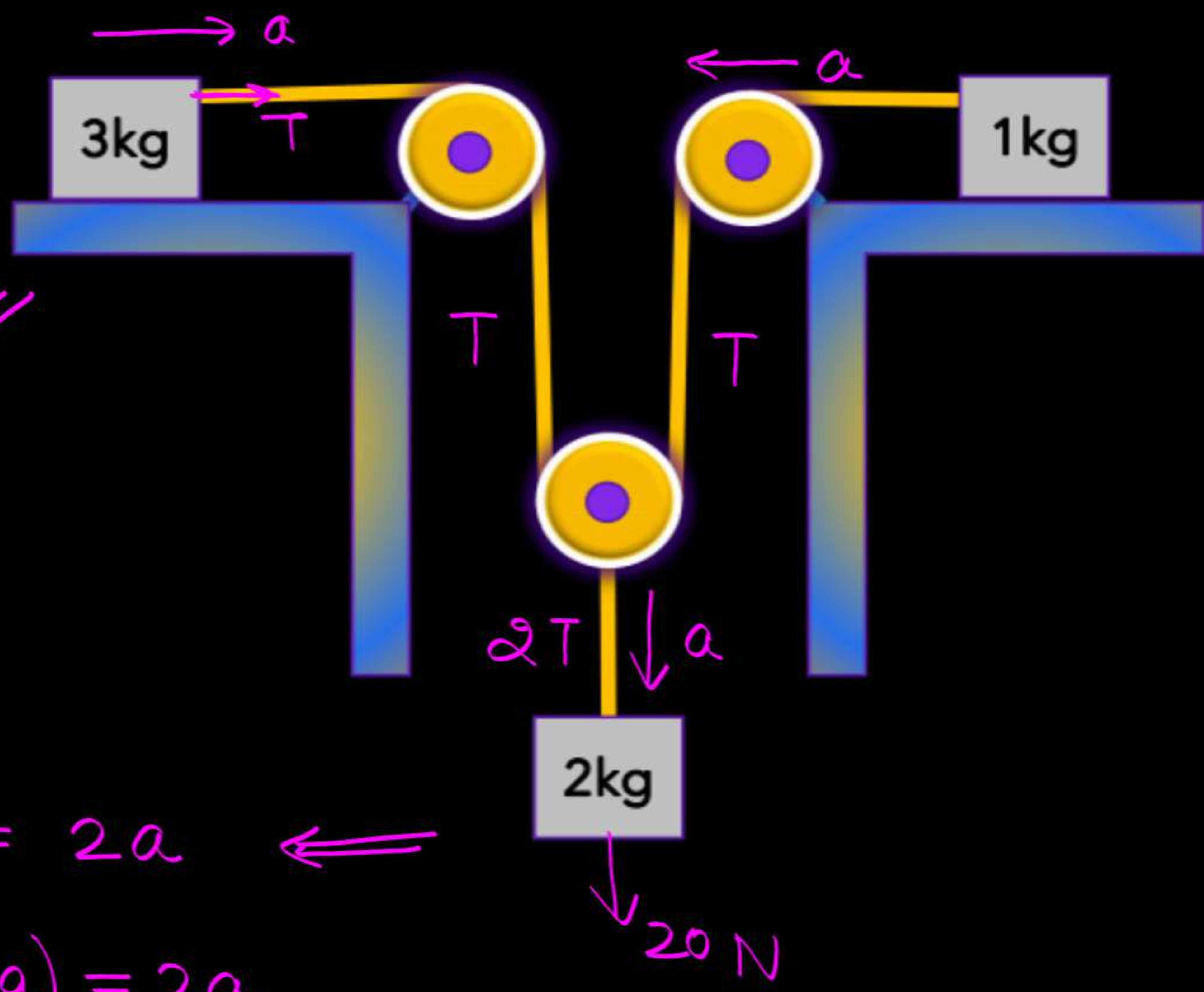
A. 3g
B. 5g/2
C. 4G
D. 5g

$$6mg - mg = ma$$

$$5g = a$$



In the shown mass pulley system, pulleys and string are massless. Find acceleration of each block



$$T = 3a$$

$$20 - 2T = 2a$$

$$20 - 2(3a) = 2a$$

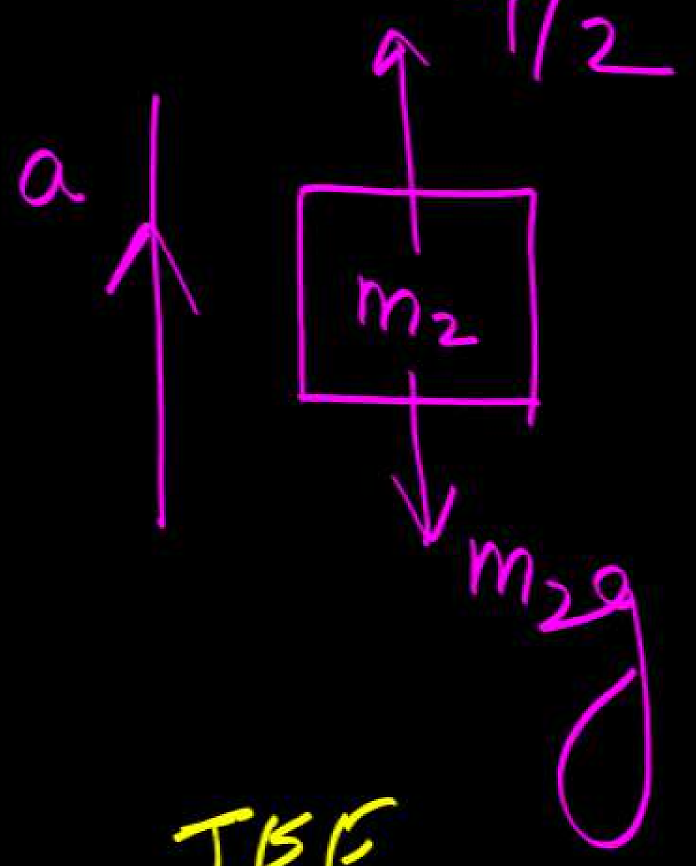
$$20 = 8a$$

$$2.5\ m/s^2 = a$$

Block of mass m_1 will remain at rest if :

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

$$\boxed{a = \frac{m_3 - m_2}{m_3 + m_2} g}$$



$$\frac{T}{2} - m_2 g = m_2 a$$

$$\Rightarrow \frac{m_1 \cancel{g}}{2} - m_2 \cancel{g} = m_2 \left(\frac{m_3 - m_2}{m_2 + m_3}\right) \cancel{g}$$

$$\frac{m_1}{2} - m_2 = \frac{m_2 m_3 - m_2^2}{m_2 + m_3}$$

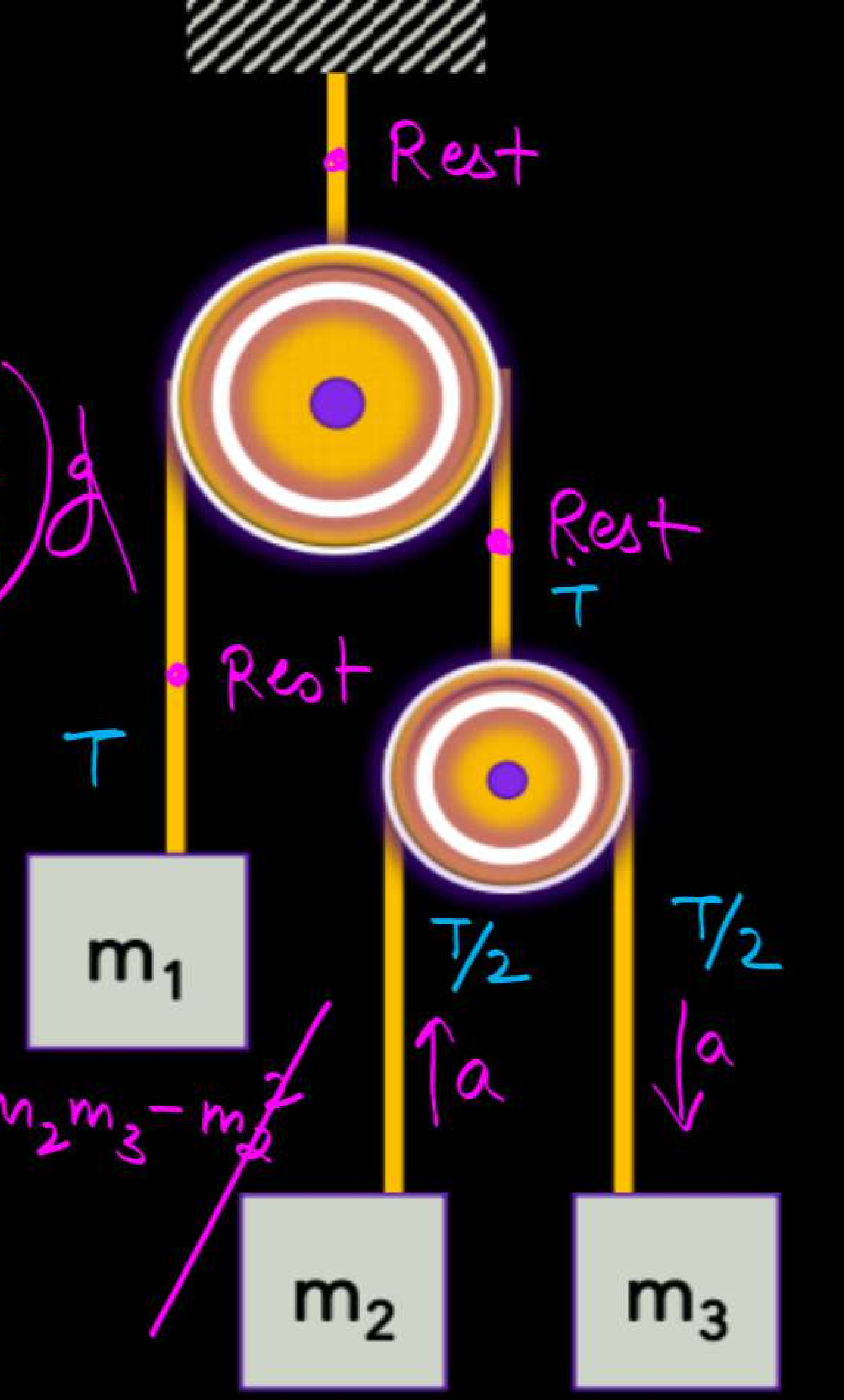
$$\frac{m_1 m_2}{2} - \cancel{m_2^2} + \frac{m_1 m_3}{2} - m_2 m_3 = m_2 m_3 - \cancel{m_2^2}$$

$$\frac{m_1 m_2}{2} + \frac{m_1 m_3}{2} = 2 m_2 m_3$$

$\div m_1 m_2 m_3$

$$\Rightarrow \frac{1}{m_3} + \frac{1}{m_2} = \frac{4}{m_1}$$

JEE



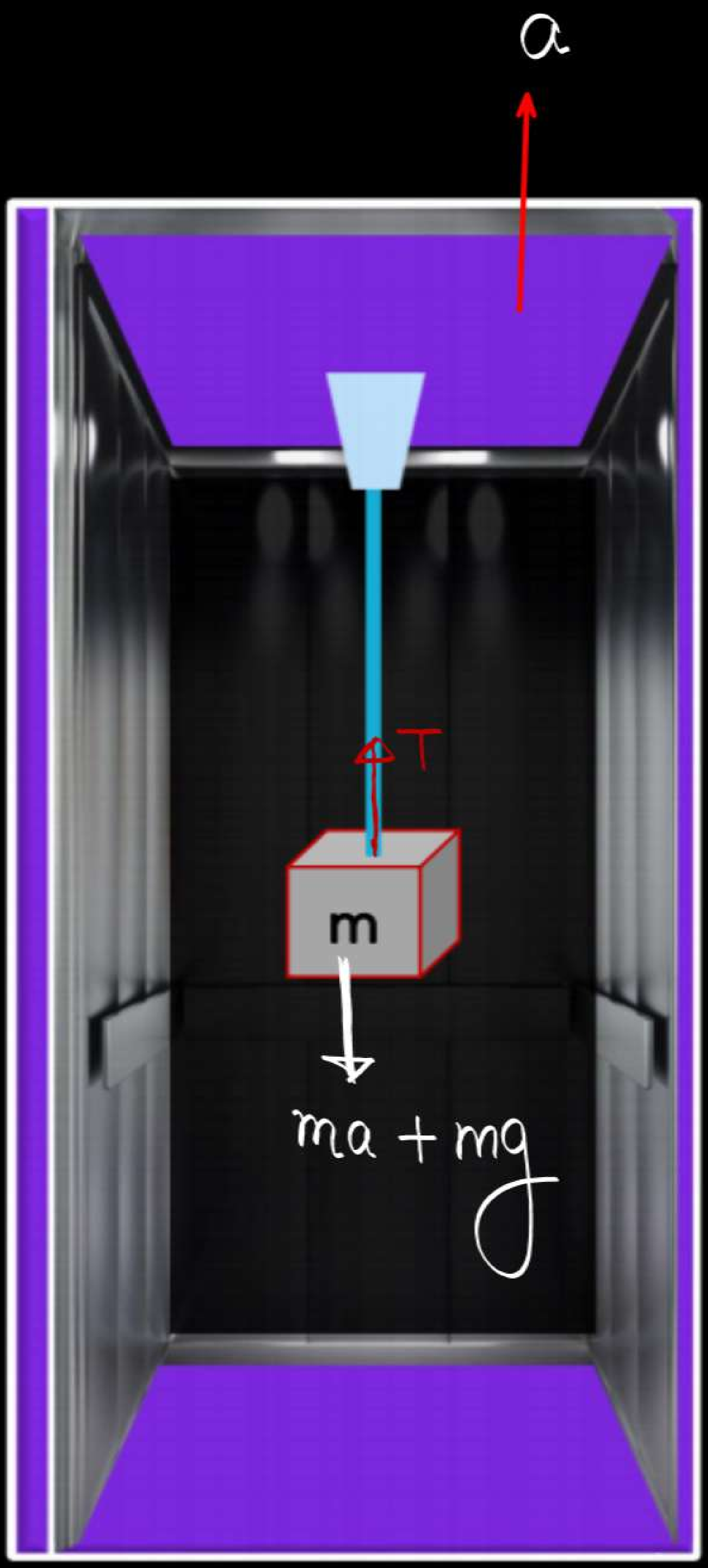
A $\frac{1}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$

B $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$

C $m_1 = m_2 + m_3$

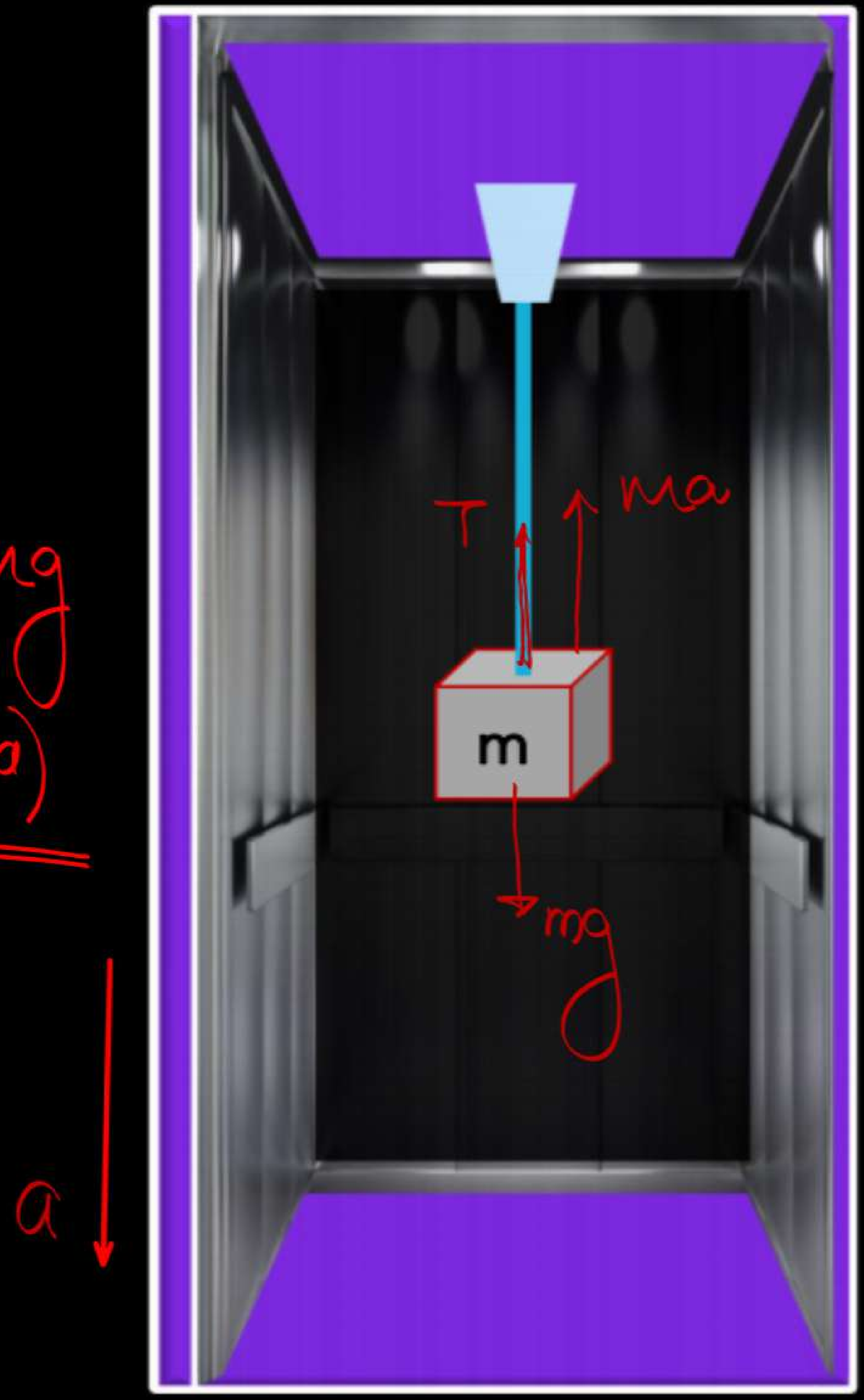
D $\frac{1}{m_3} = \frac{2}{m_2} + \frac{3}{m_1}$

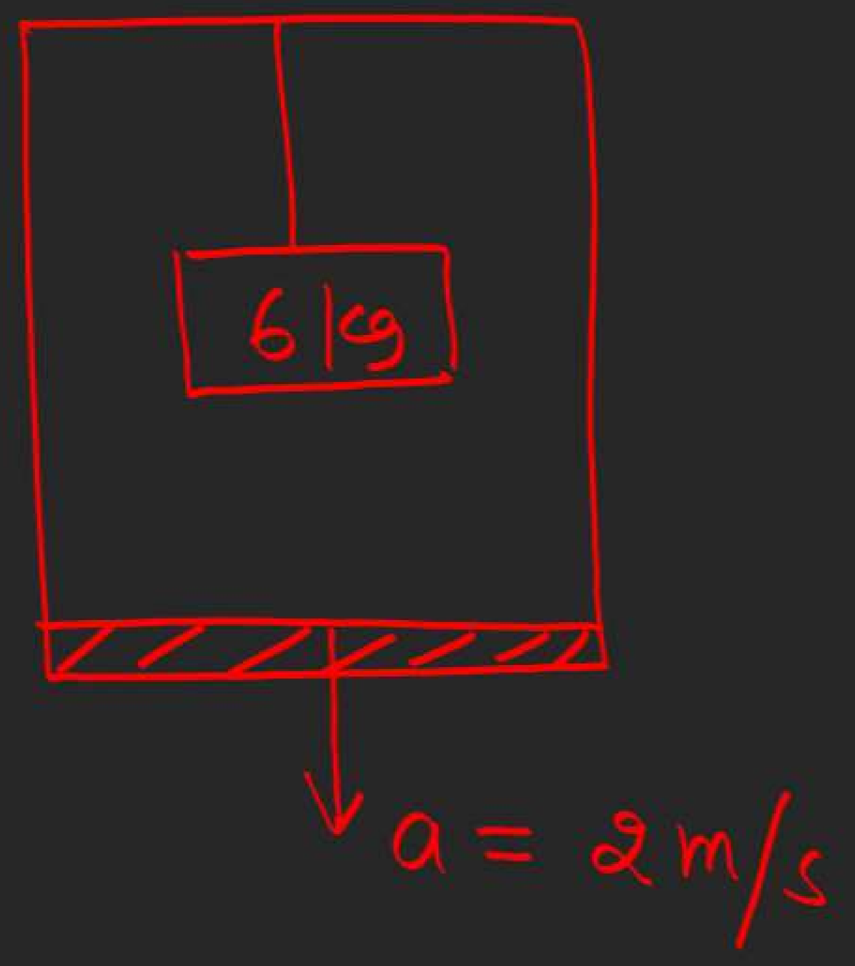
Pseudo Force



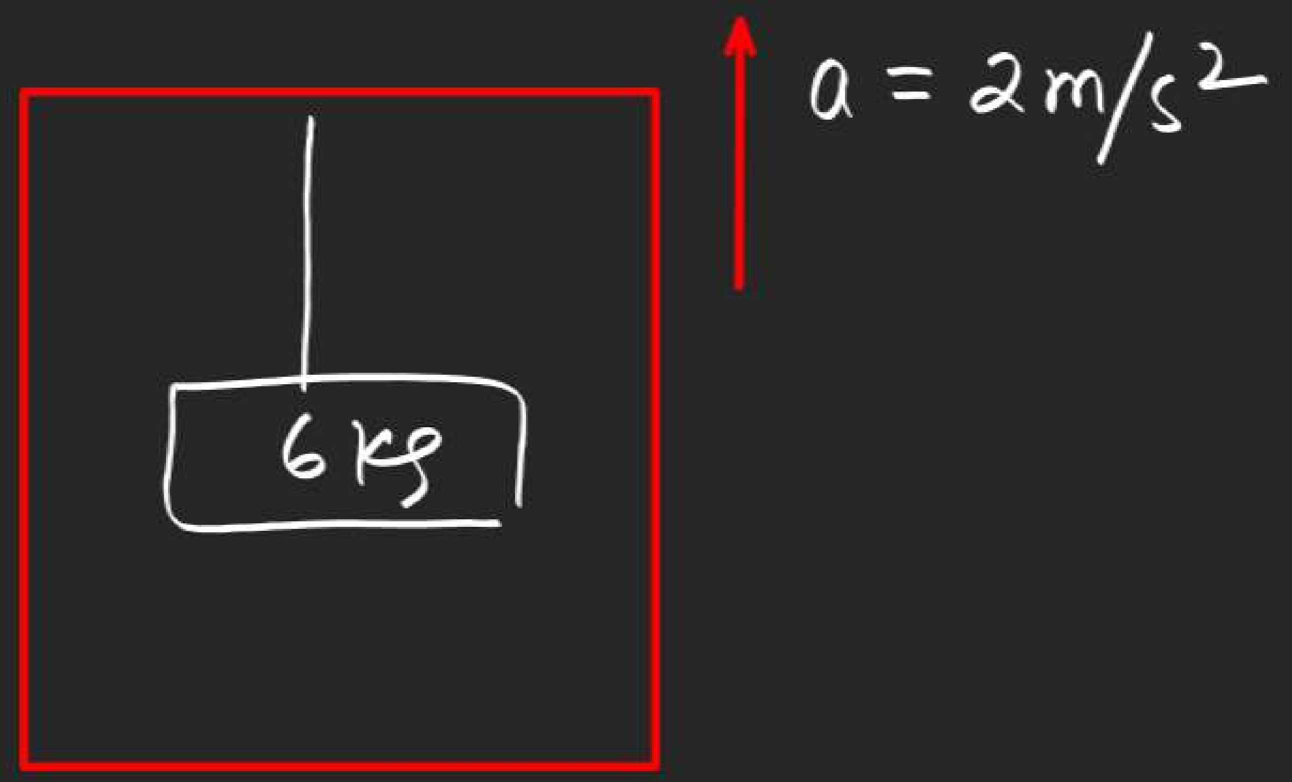
$$T = ma + mg$$
$$= m(g+a)$$

$$T + ma = mg$$
$$T = m(g-a)$$

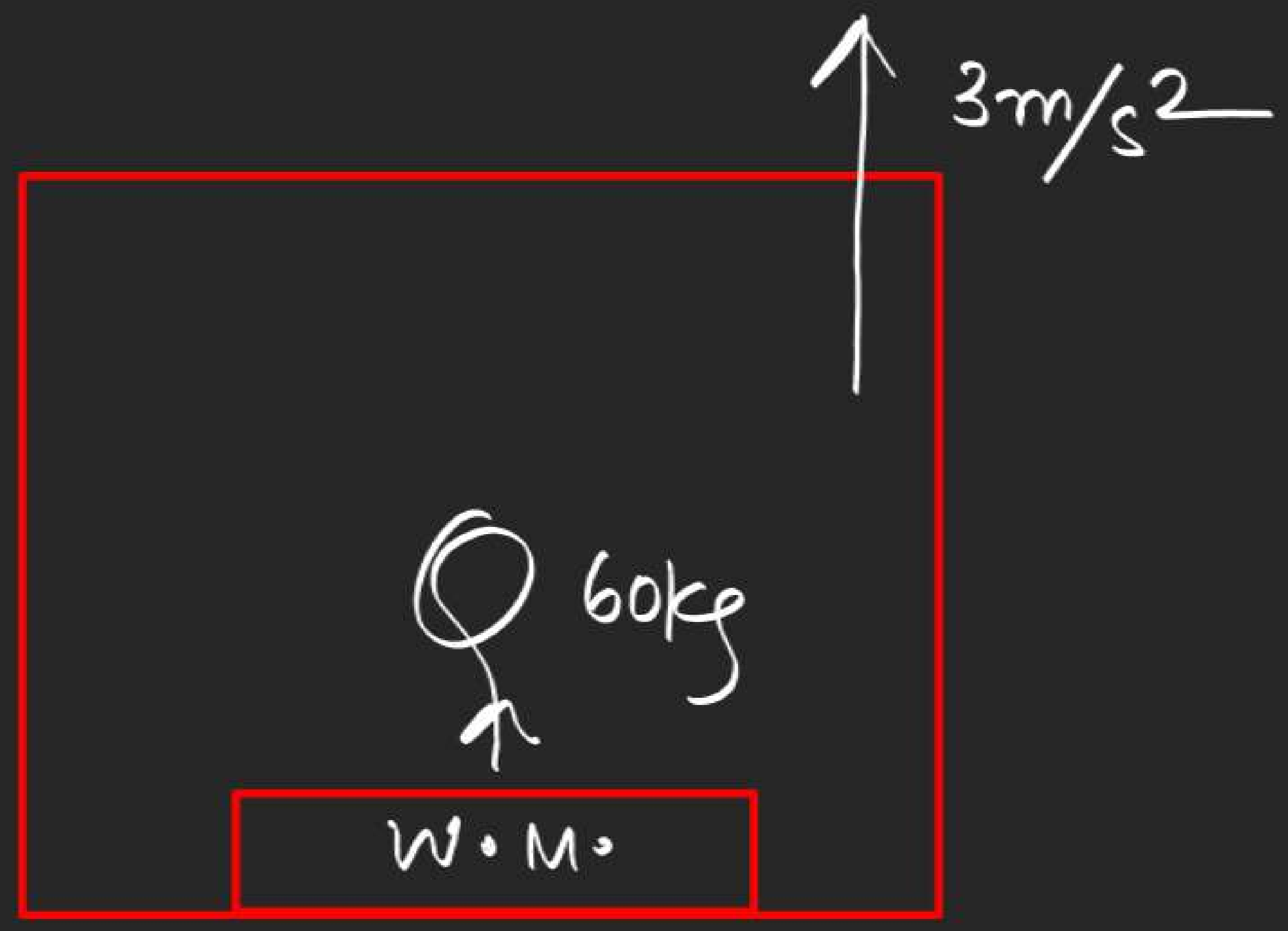




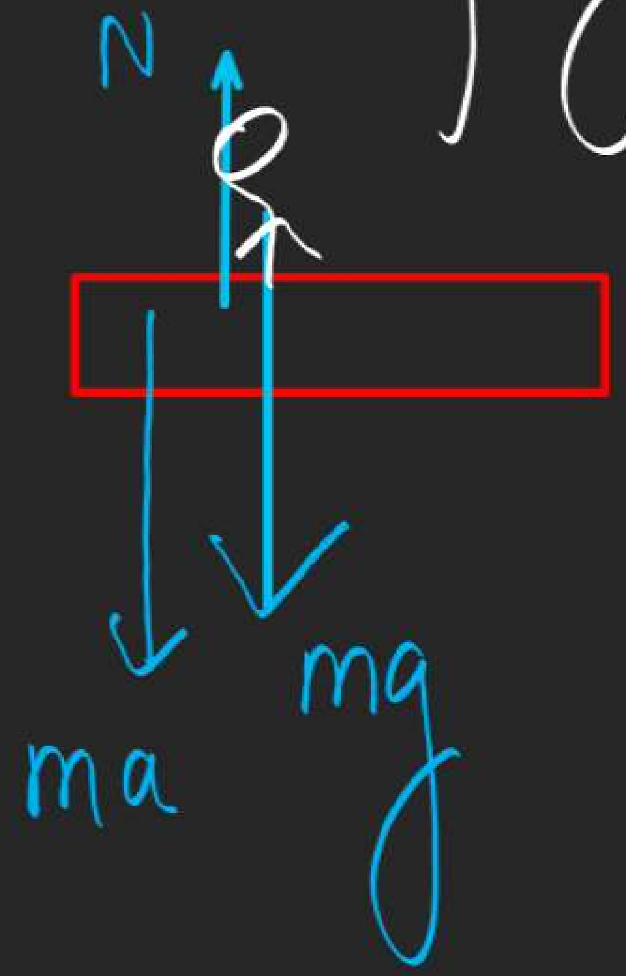
$$T = m(g-a)$$
$$= 6(10-2)$$
$$= \underline{\underline{48\,N}}$$



$$T = m(g+a)$$
$$T = 6 \times 12$$
$$= \underline{\underline{72\,N}}$$



Reading of machine = N



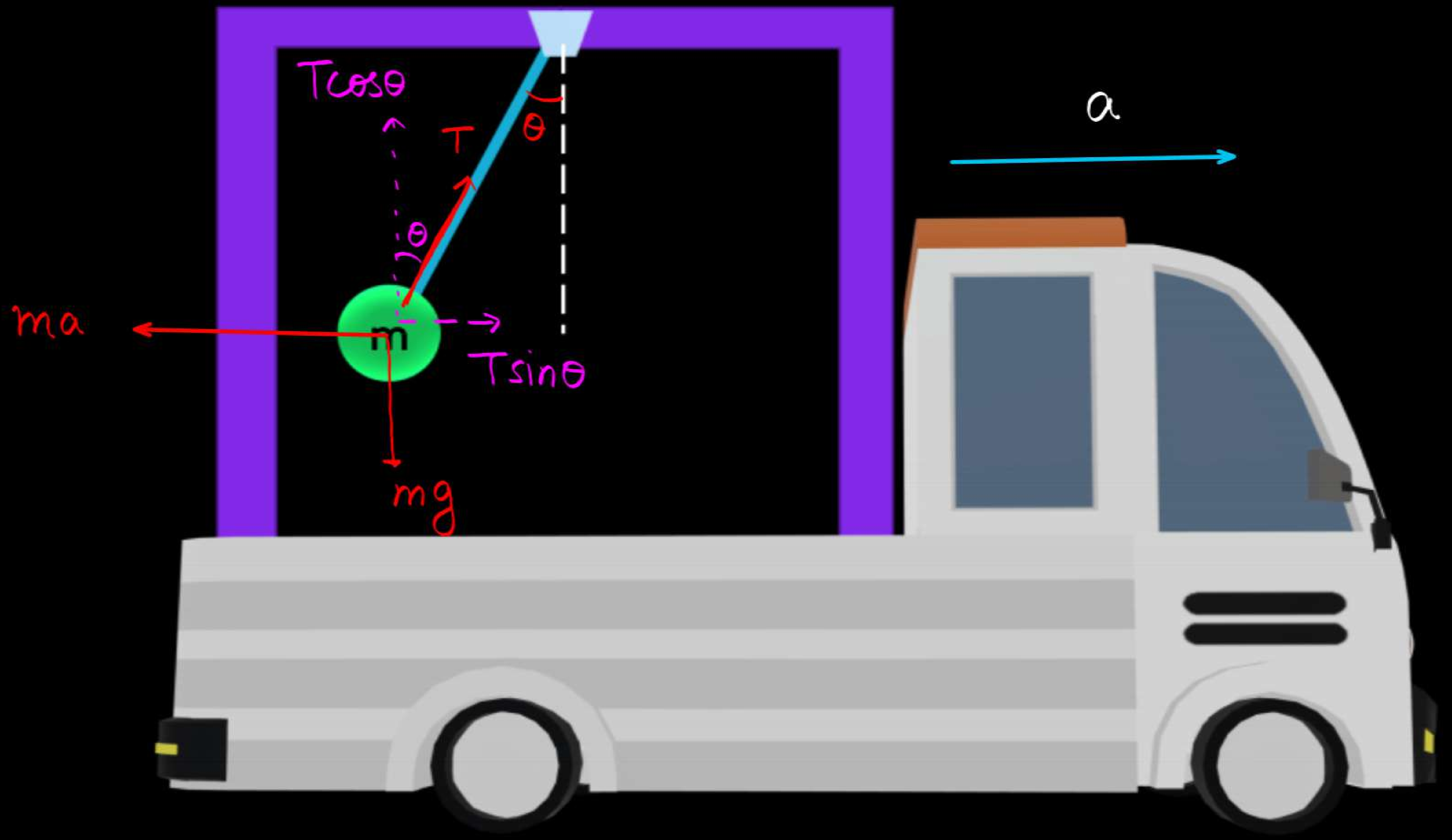
$$N = m(g+a)$$
$$N = 60 \times 13$$
$$= \underline{780N}$$

Pseudo Force

$$T\sin\theta = ma$$

$$T\cos\theta = mg$$

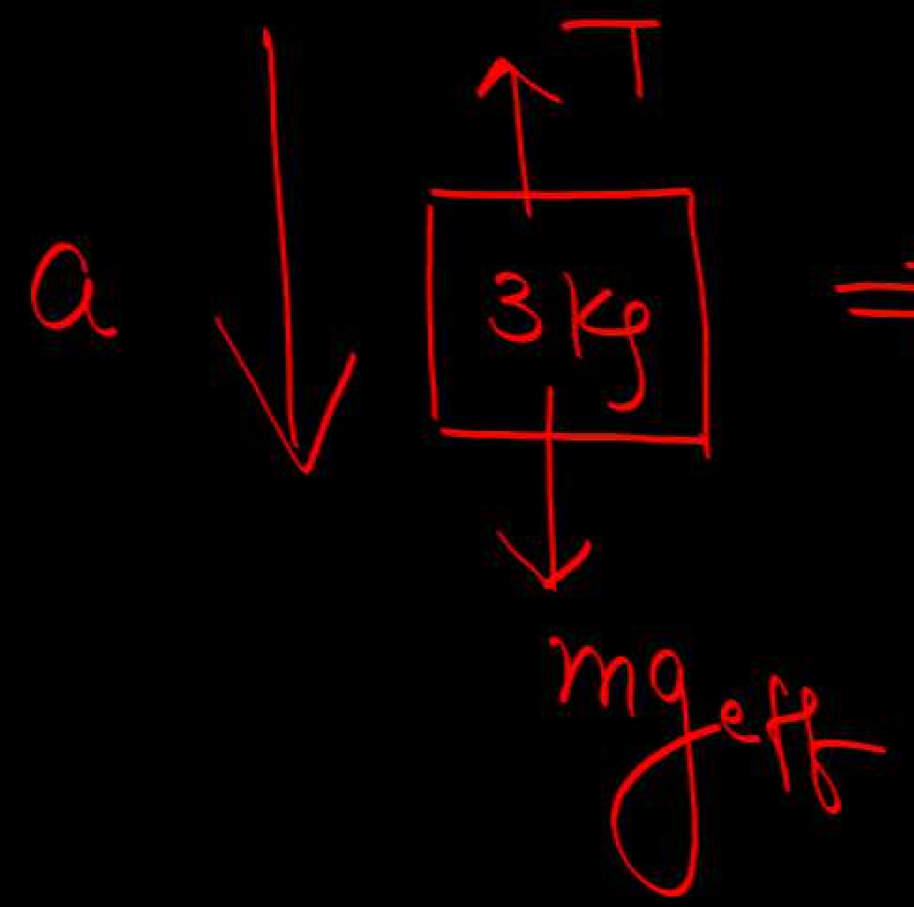
$$\tan\theta = \frac{a}{g}$$



Find acceleration and Tension in string

Ninja Tech : $g \rightarrow g_{eff}$ — ↑up: $g+a$; ↓down: $g-a$

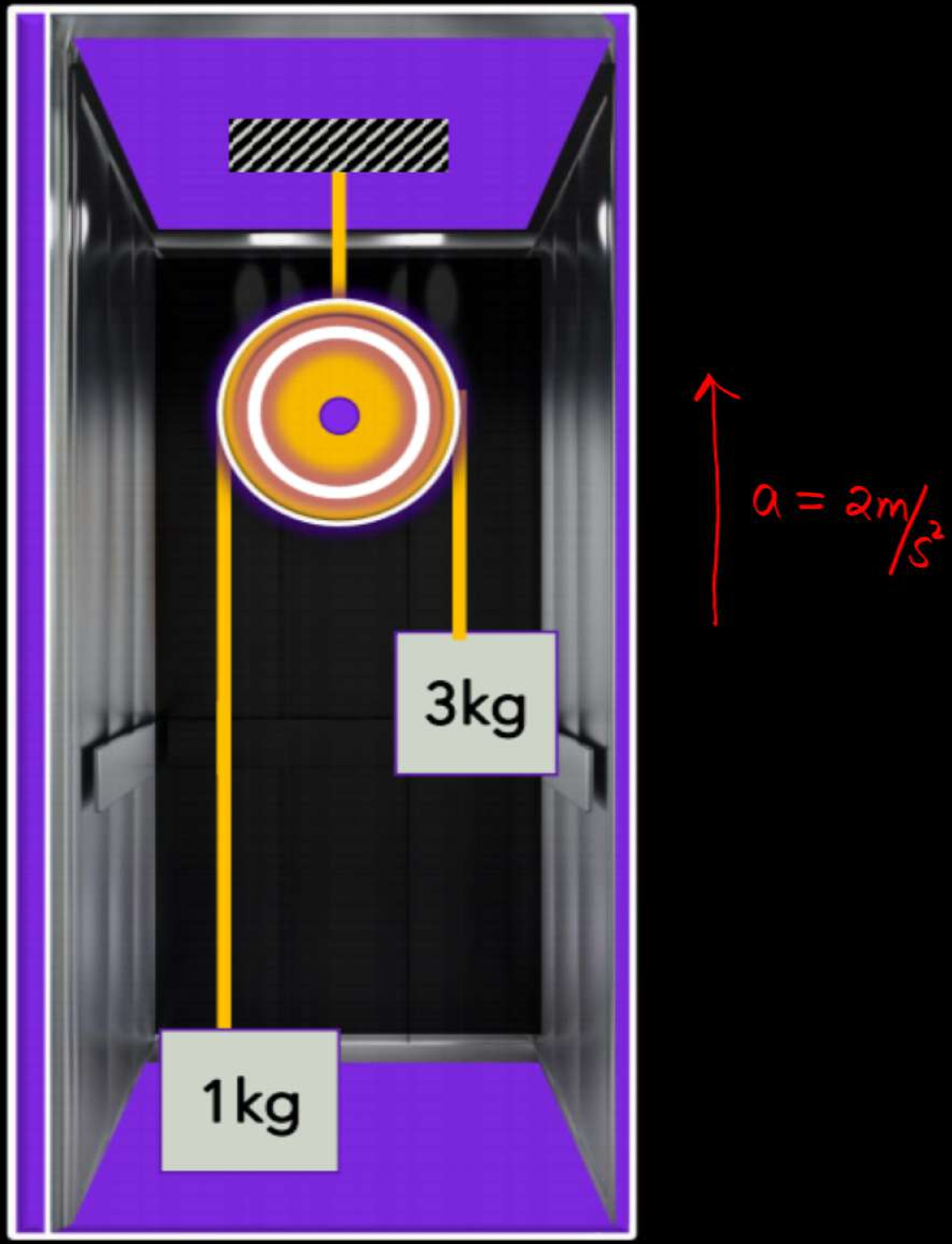
$$a = \left(\frac{3-1}{4}\right) g_{eff} = \frac{1}{2}(10+2) = 6\ m/s^2$$



$$\Rightarrow mg_{eff} - T = ma$$

$$3\times 12 - T = 3\times 6$$

$$18 = T$$



A box of mass m is placed on a wedge of mass 'M' on a smooth surface. How much force F is required to be applied on wedge M so that during motion mass m remains at rest relative to wedge.

A. $(M + m)g \cos\theta$
B. $(M + m)g \sin\theta$
C. $(M + m)g \tan\theta$
D. None of these

(i) $a = \frac{F}{M+m}$

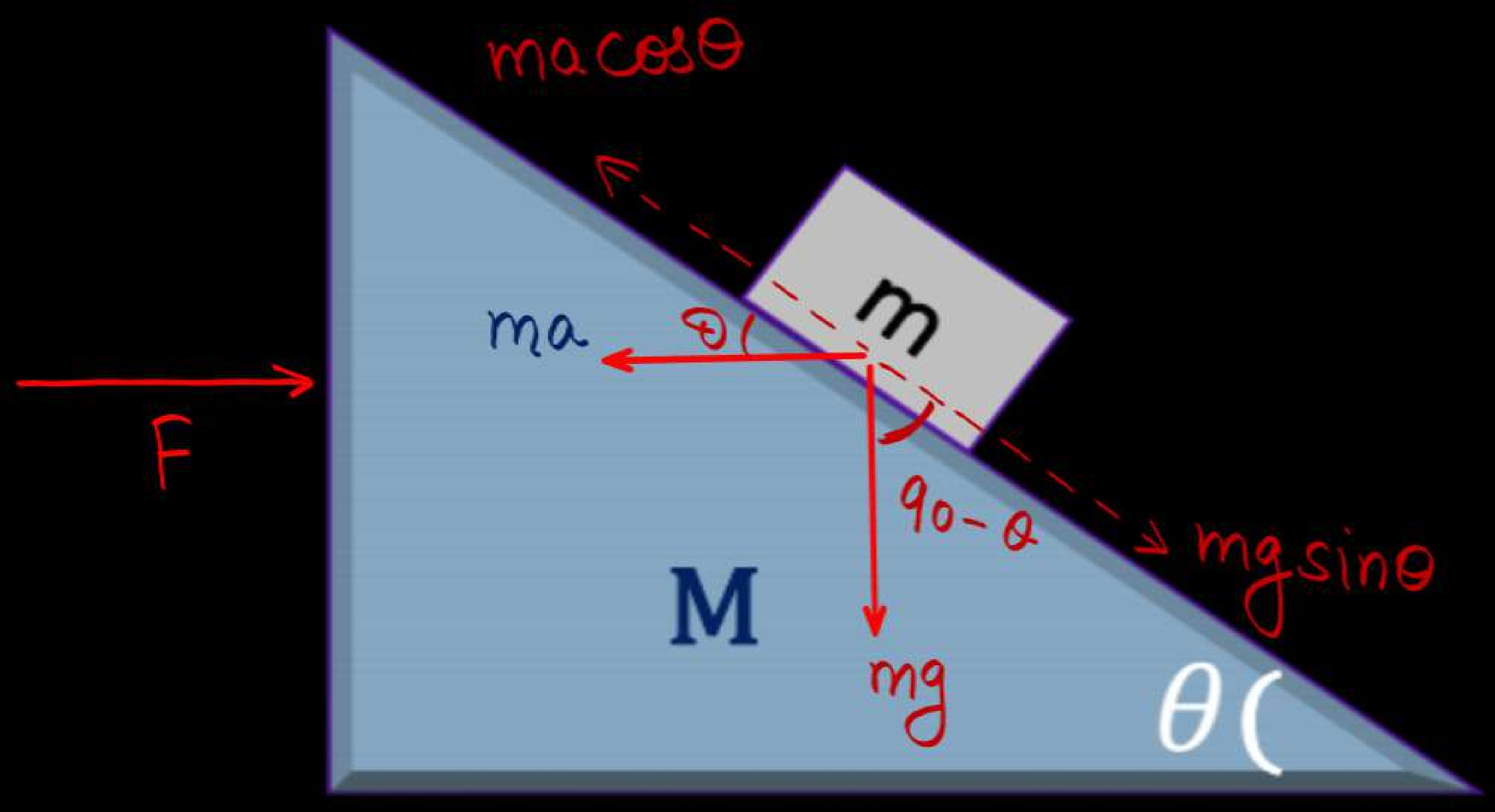
(ii) $ma \cos\theta = mg \sin\theta$

$a = g \tan\theta$

$\frac{F}{M+m} = g \tan\theta$

$F = (M+m) g \tan\theta$

$$\boxed{\begin{aligned} a &= g \tan\theta \\ F &= M_T a \\ &= (M+m) g \tan\theta \end{aligned}}$$



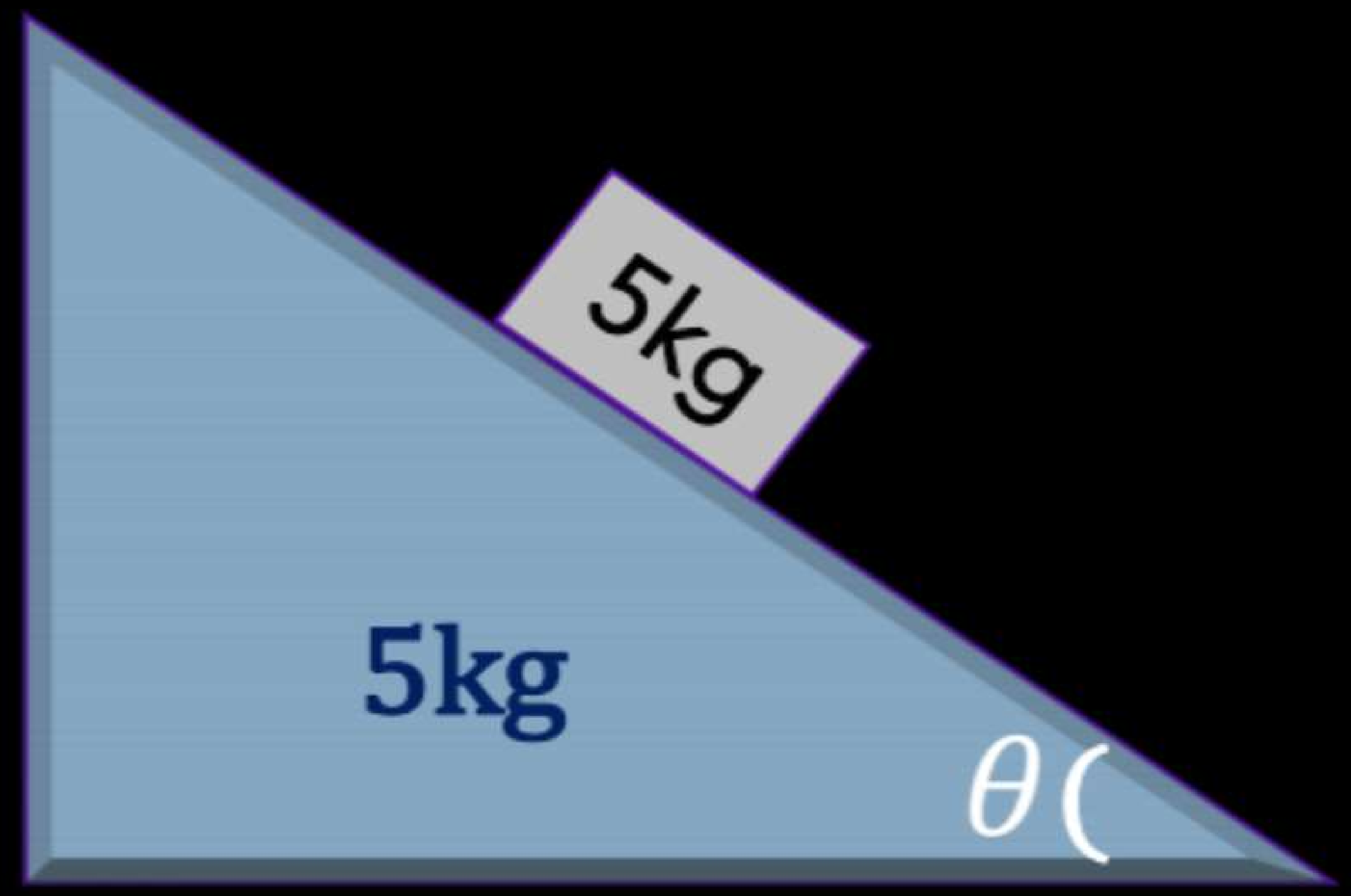
A box of mass m is placed on a wedge of mass 'M' on a smooth surface. How much force F is required to be applied on wedge M so that during motion mass m remains at rest relative to wedge.

$$F = m_T a$$

$$= 10 \times g \tan\theta$$

$$= 10 \times 10 \times 1$$

$$= \underline{100\ N}$$



$\theta = 45°$

How much force F is required to be applied on wedge so that there is no slipping

(i) $a = \frac{F}{10}$ - - - (1)

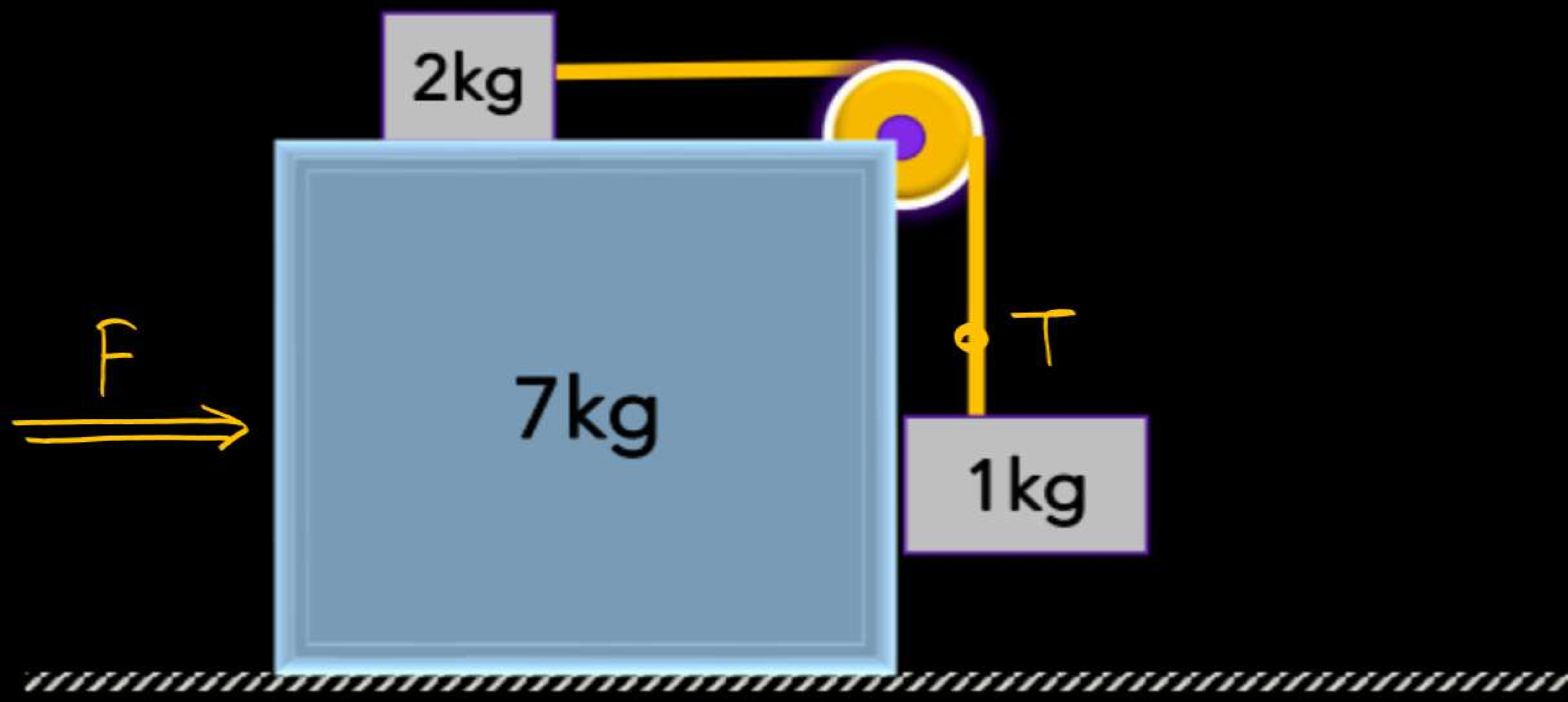
$ma \leftarrow \boxed{2\,kg} \rightarrow T$

no slipping

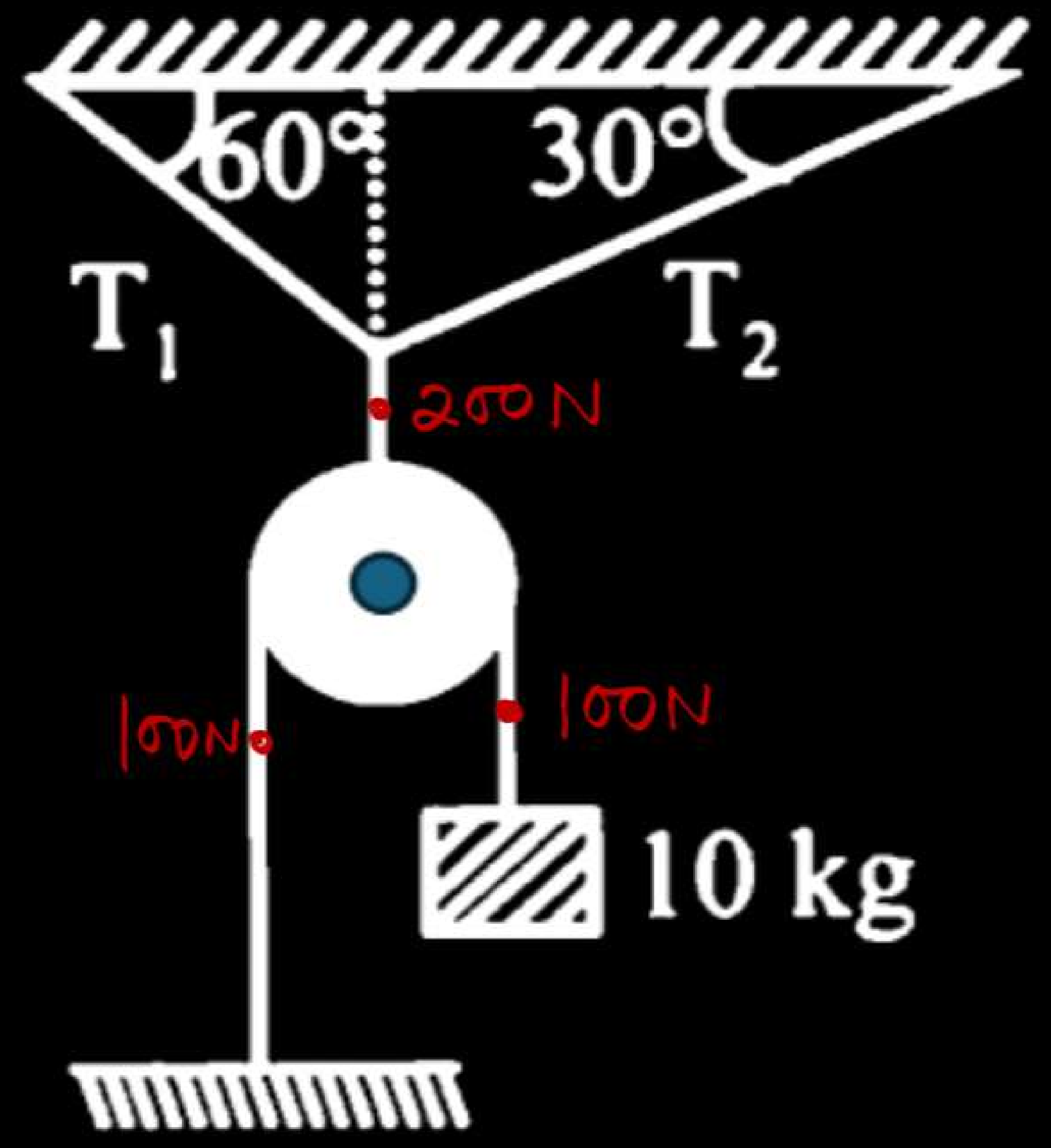
$ma = T$

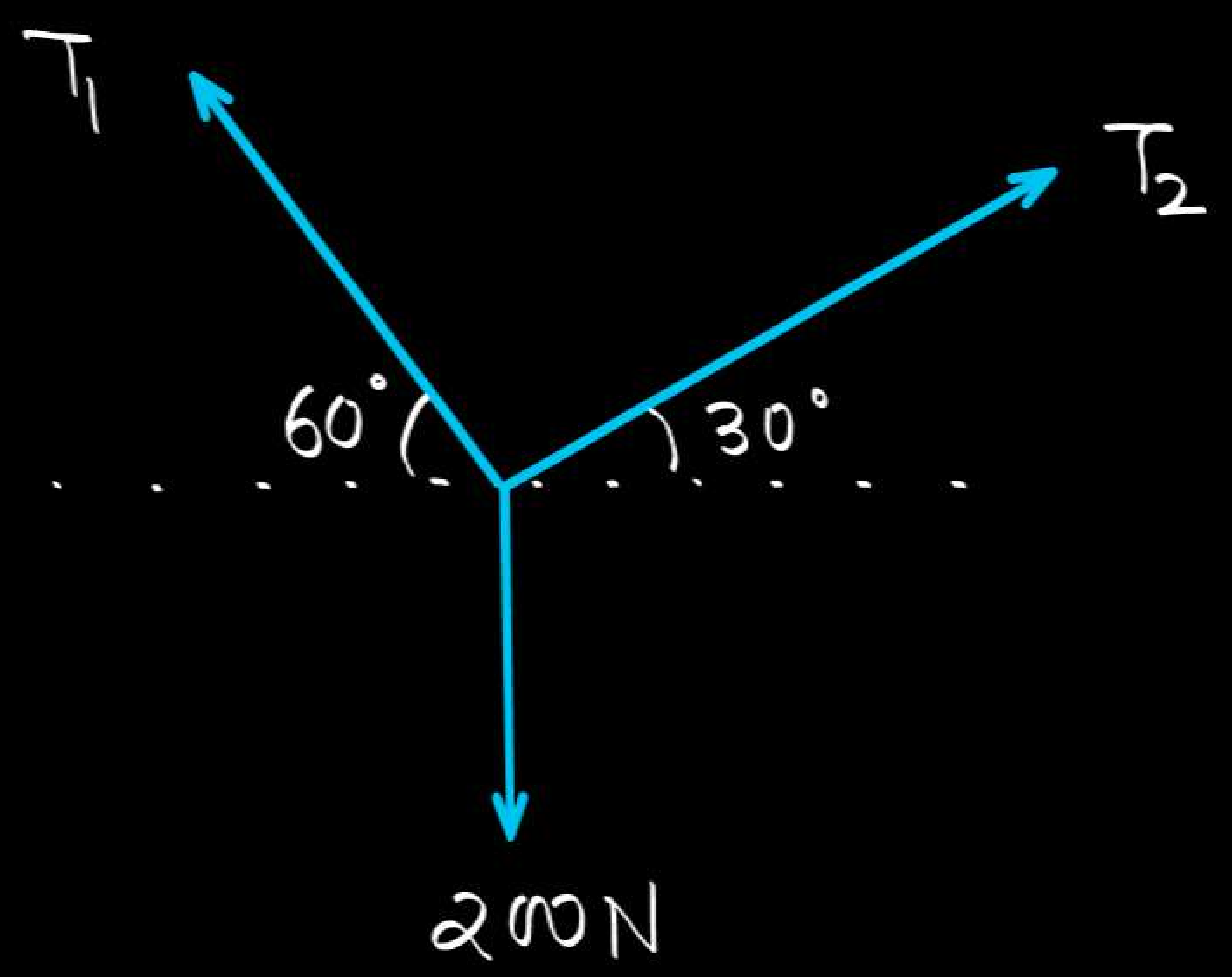
$2\left(\frac{F}{10}\right) = 10$

$F = 50N$



No slipping $T = 10N$



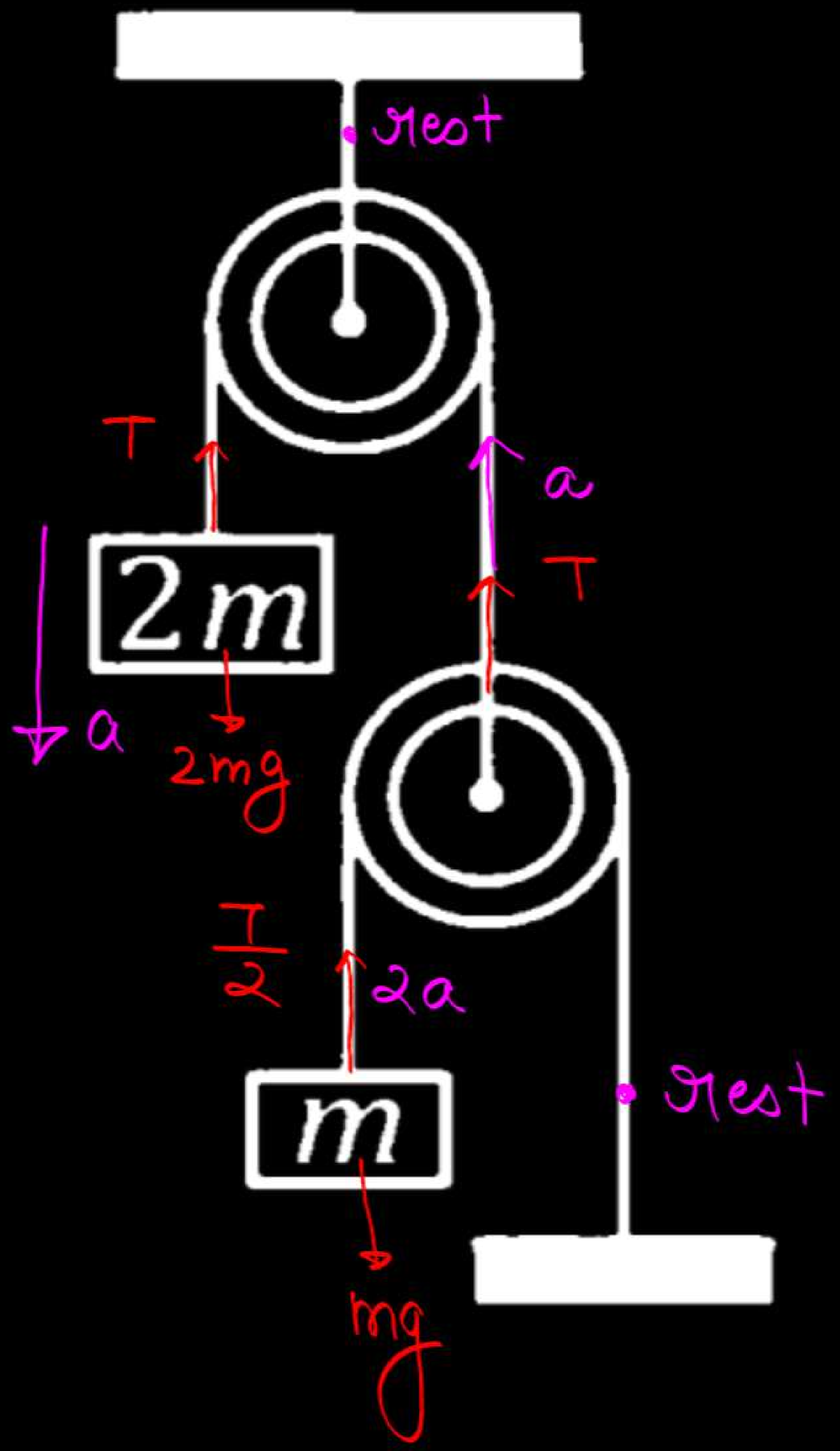


find T_1 and T_2

Vertical $\quad T_1 \frac{\sqrt{3}}{2} + \frac{T_2}{2} = 200$

Horizontal $\quad \frac{T_1}{2} = \frac{T_2 \sqrt{3}}{2}$

In the system shown in the figure, the friction and mass of rope is negligible then acceleration of the block of mass 2m is:



$$2mg - \cancel{T} = 2ma$$

$$\cancel{\frac{T}{2}} - mg = m(2a) \qquad \times 2$$

add

$$2mg - 2mg = 6ma$$

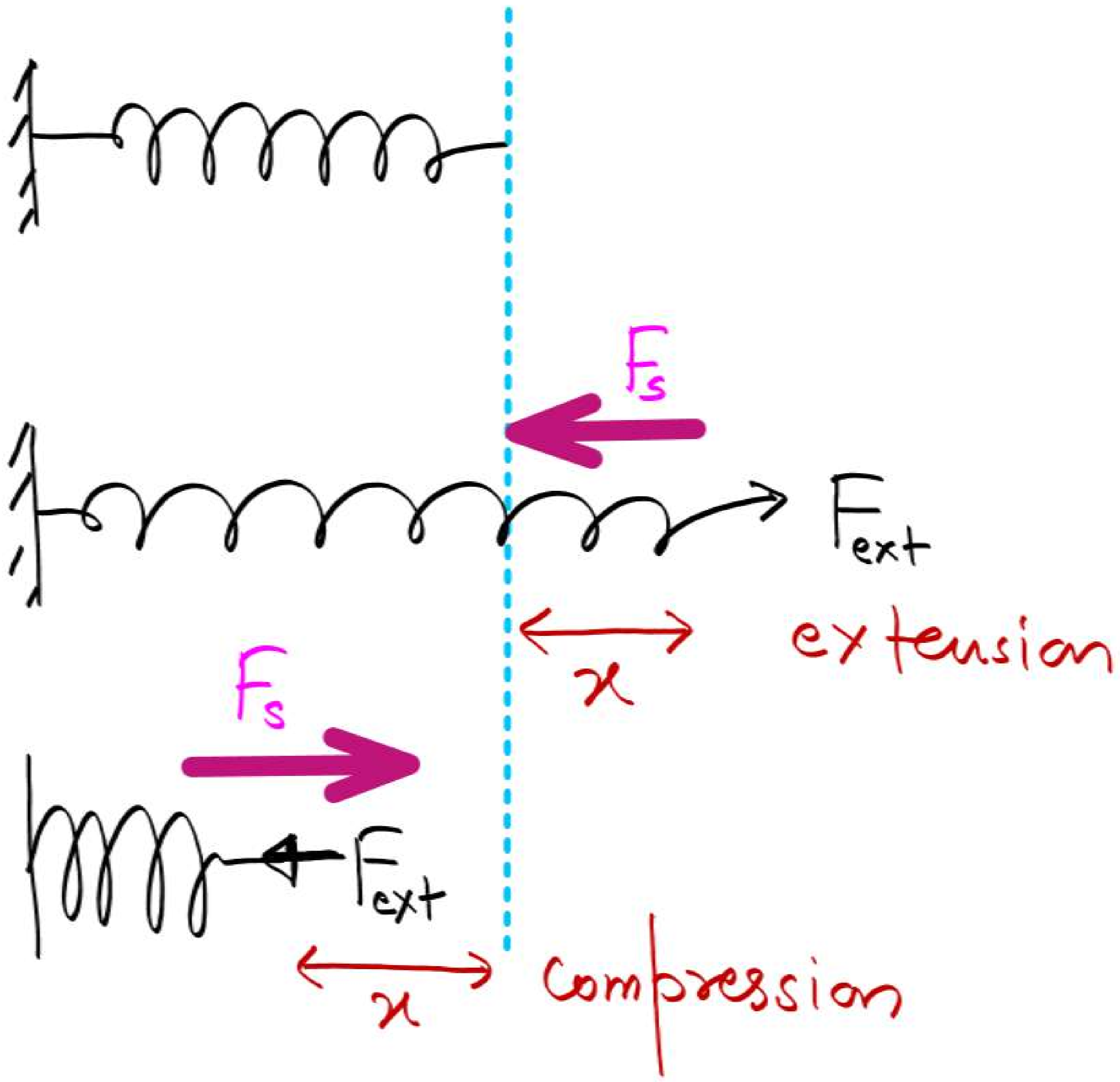
$$0 = 6ma$$

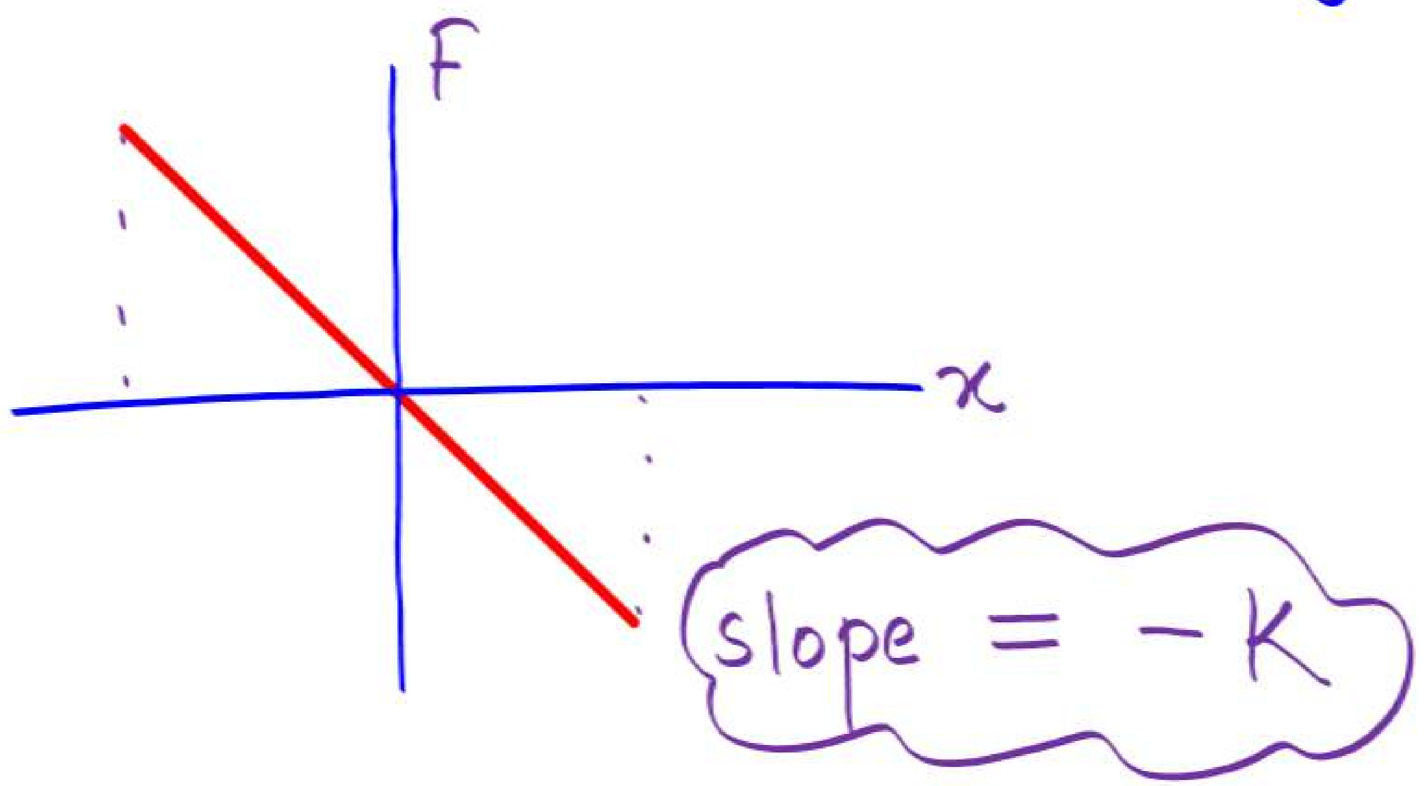
$$0 = a$$

Spring Force

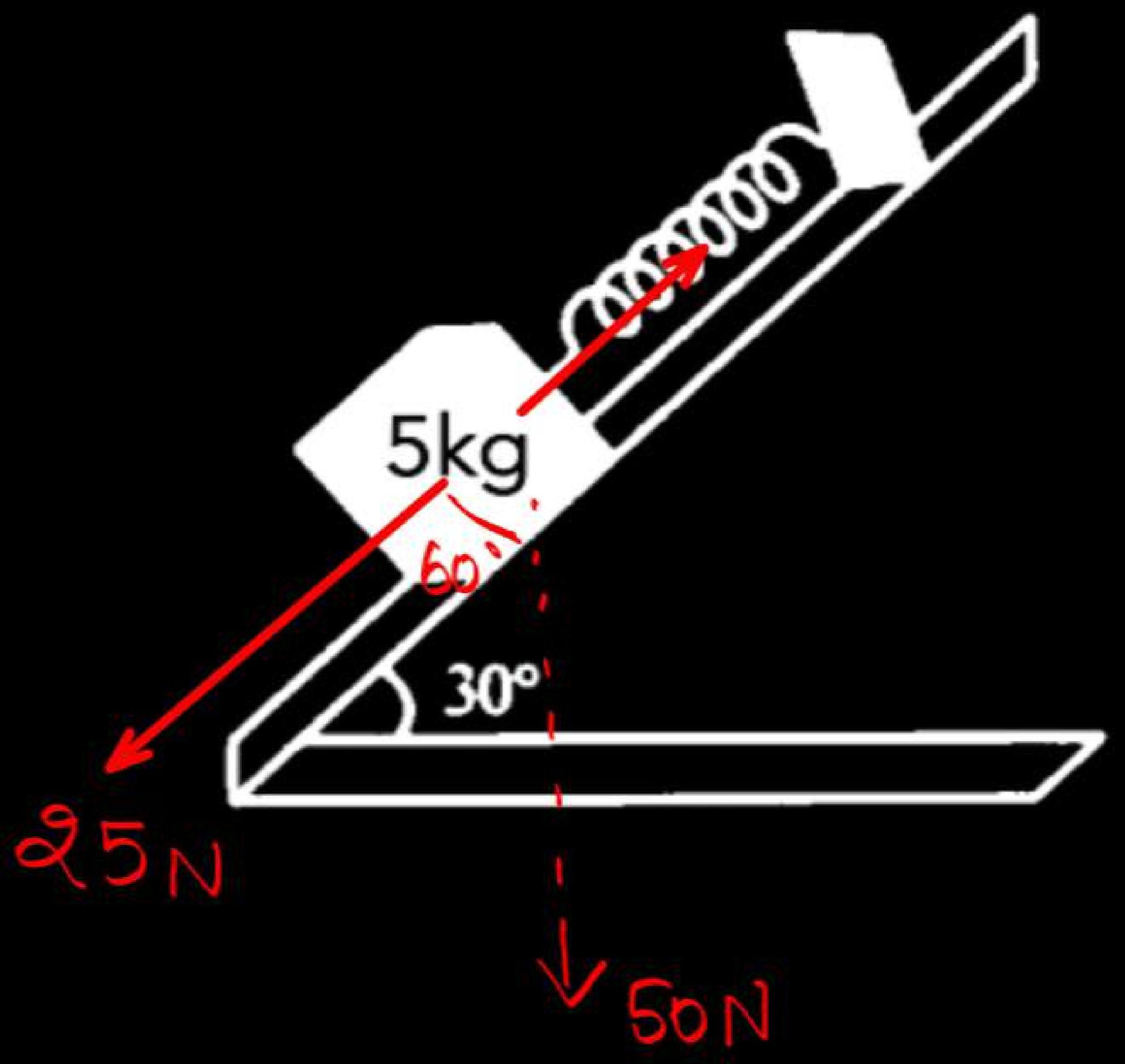
$$\vec{F_s} = -kx$$ $\Longrightarrow$ $(-)$ is for direction

$$\boxed{F_s = kx}$$ where K = spring const. (N/m)





The tension in the spring is



$Kx = 25$ = Tension in spring (Kx)

Q If $K = 100\,N/m$ then extension

Ans $Kx = 25$

$100x = 25$

$x = \frac{1}{4}\,m$

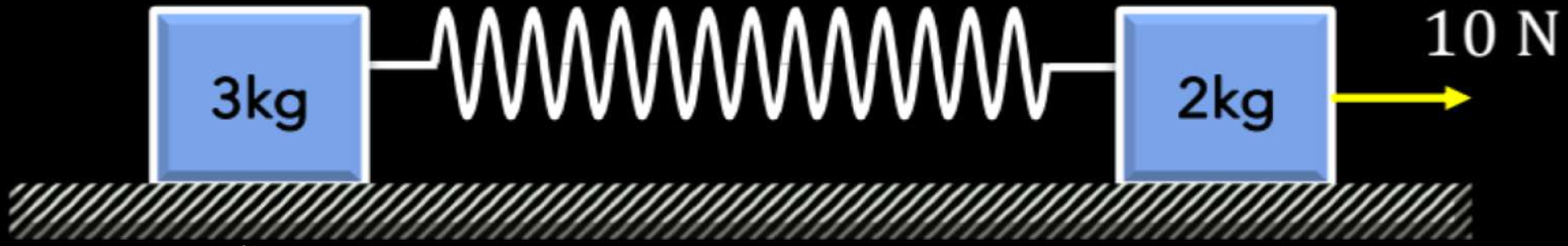
Find the acceleration of 3 kg mass when acceleration of 2kg mass is $2ms^{-2}$ as shown in fig.

(A) $3\ ms^{-2}$

(B) $2\ ms^{-2}$

(C) $0.5\ ms^{-2}$

(D) zero



$\rightarrow a_2$

$3kg \rightarrow kx$

$Kx = 3a_2$

$6 = 3a_2$

$\boxed{2\ m/s^2 = a_2}$

$a_1 = 2\ m/s^2$

$kx \leftarrow 2kg \rightarrow 10$

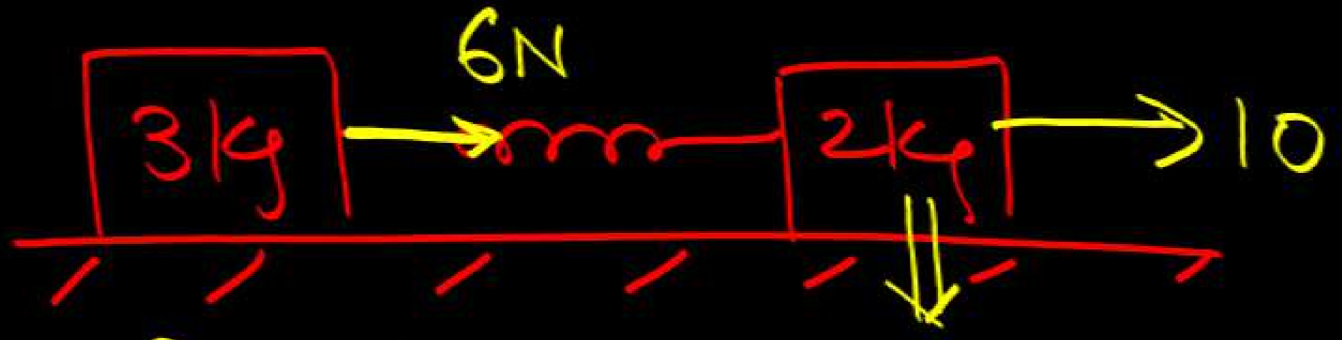
$10 - Kx = 2a_1$

$10 - 2a_1 = Kx$

$10 - 4 = Kx$

$\boxed{6 = Kx}$

Ninja Tech



$3a = 6$

$a = 2m/s^2$

2×2

$\Downarrow$

4

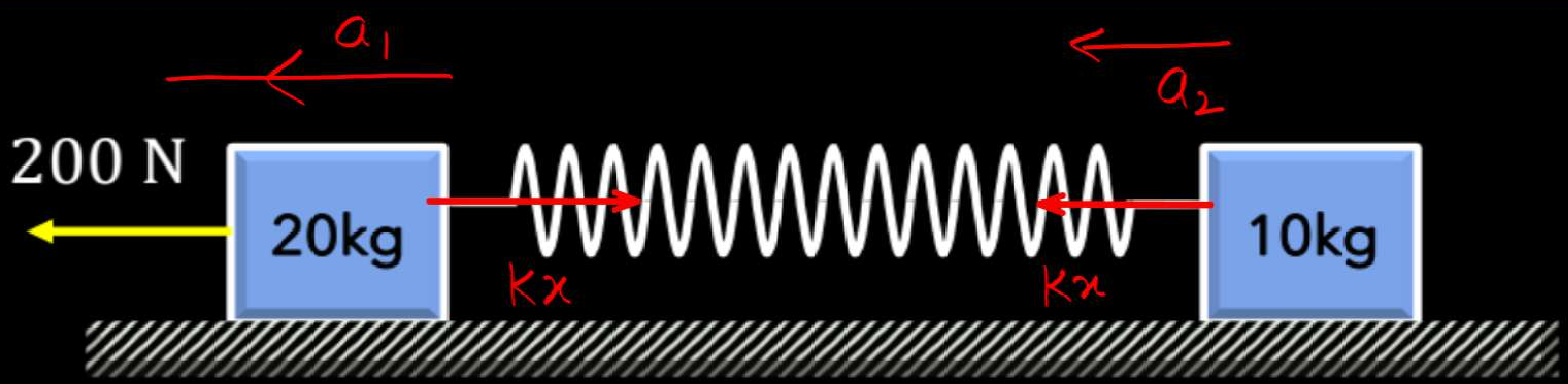
Find the acceleration of 20kg block if acceleration of 10kg is $12 m/s^2$ and if $k = 50 N/m$

A. $12\ m/s^2$

B. $4\ m/s^2$

C. $10\ m/s^2$

D. zero



$200 - kx = 20a_1$

$200 - 120 = 20a_1$

$80 = 20a_1$

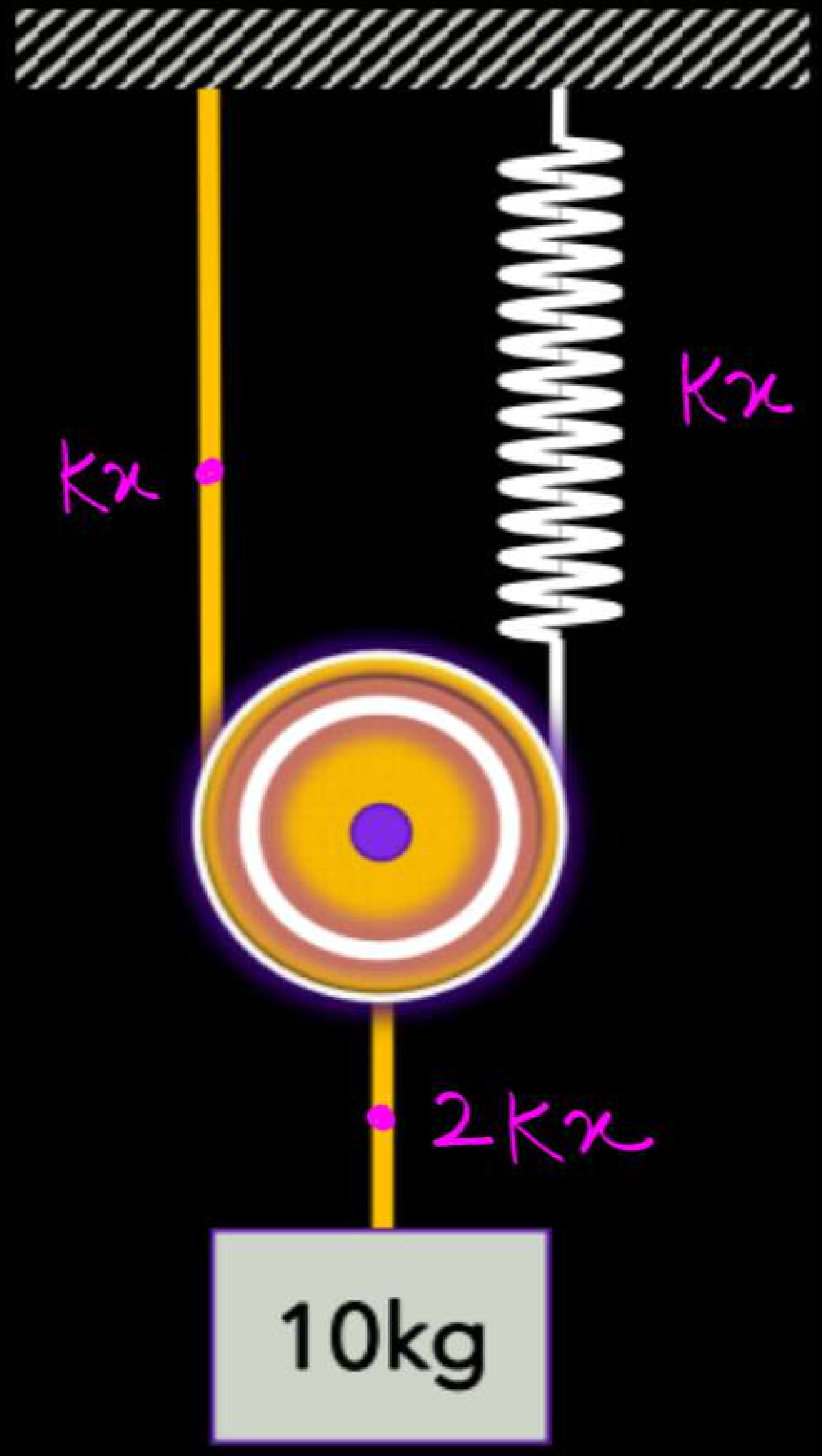
$4\ m/s^2 = a_1$

$kx = 10a_2$

$kx = 10 \times 12$

$= 120$

Find elongation in spring if spring constant $k = 40N/m$
The system is in equilibrium

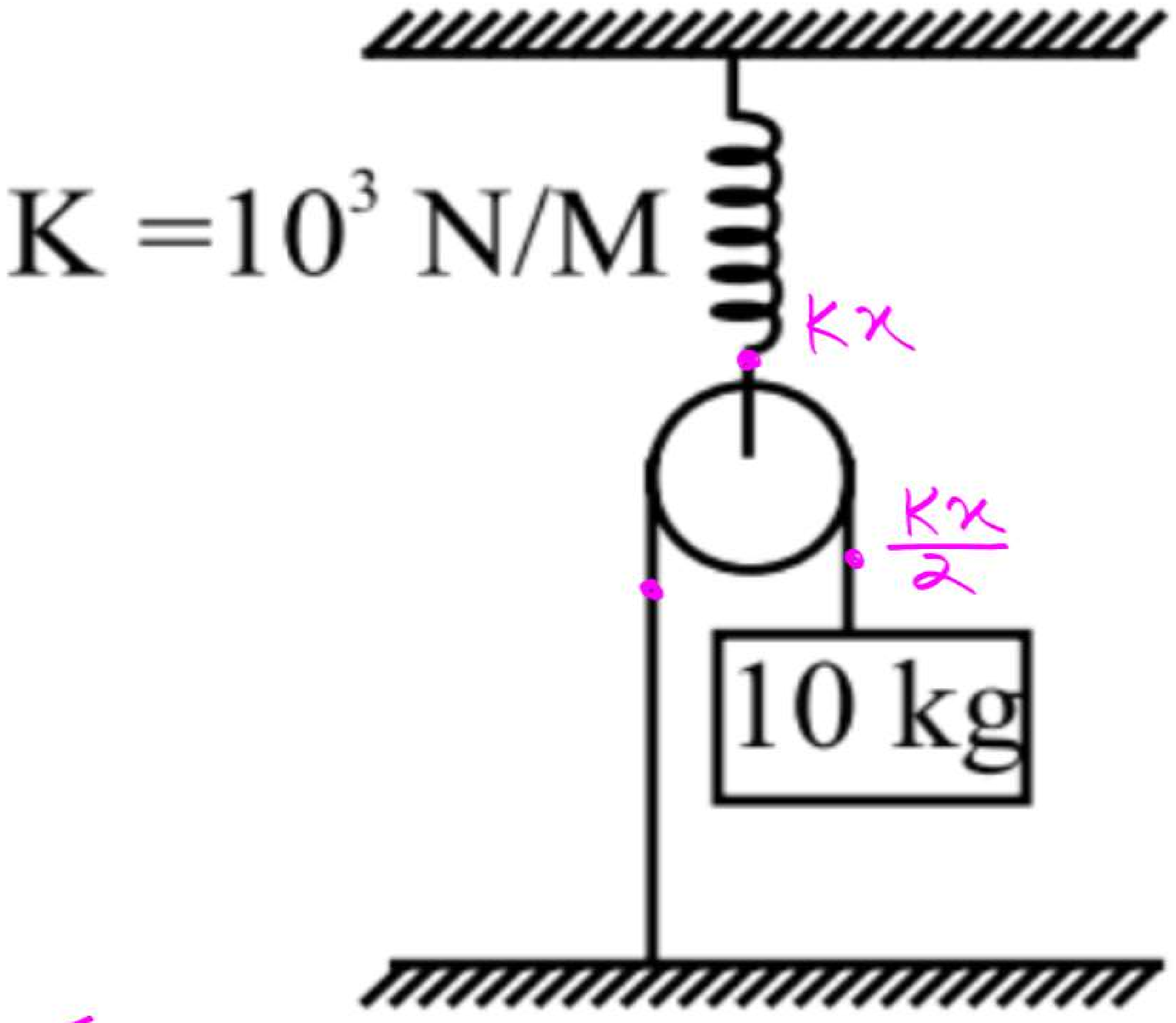


$$2kx = 100$$

$$x = \frac{100}{80}$$

$$= 1.25$$

For the arrangement shown in the figure. The extension in the spring, for which the block remains at rest is ($g = 10$ m/s^2)



$$\frac{Kx}{2} = 100$$

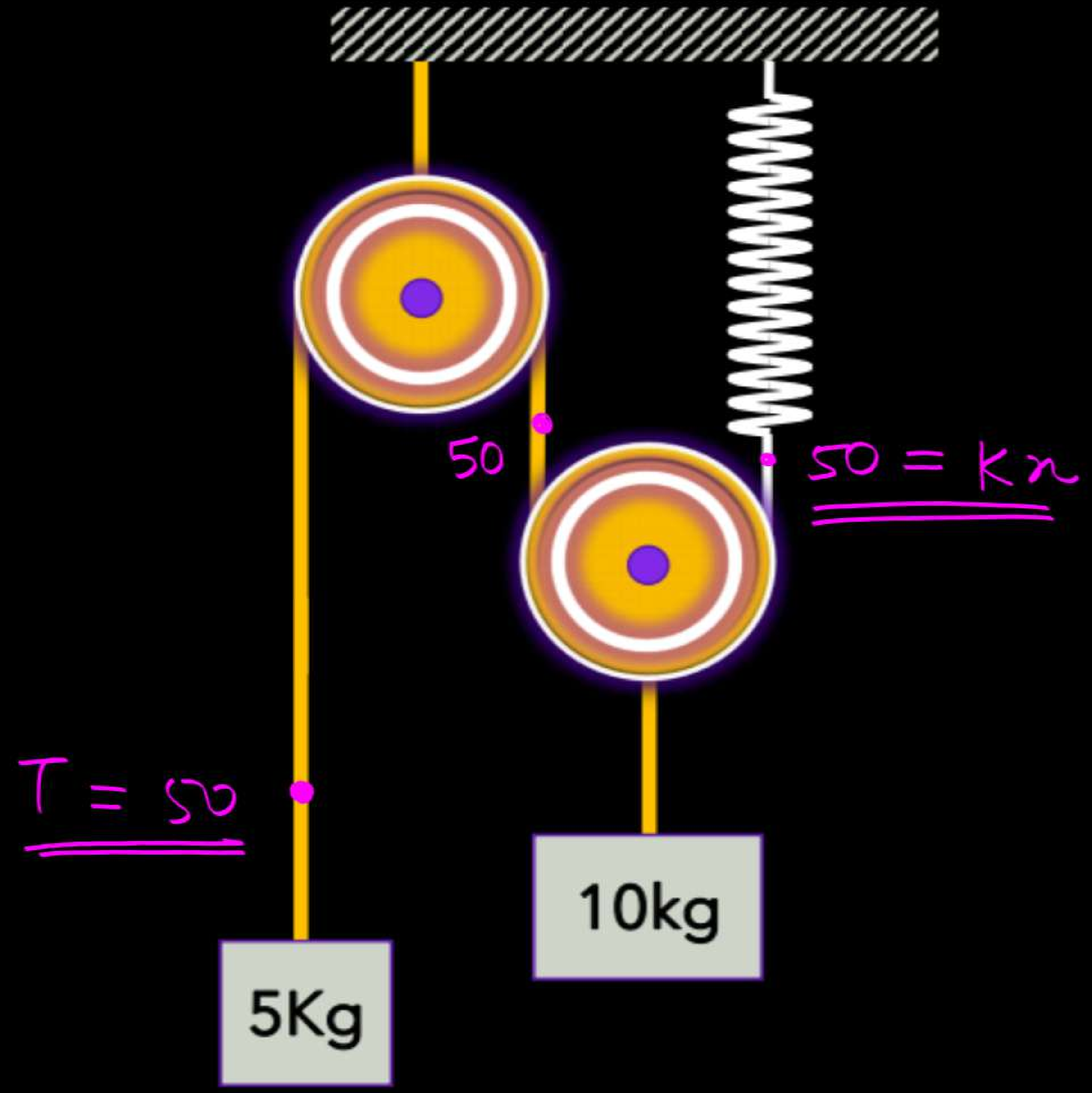
$$x = \frac{200}{K} = \frac{200}{1000} = 0.2\,m$$

(*a*) 20 cm ✓ | (*b*) 25 cm

(*c*) 15 cm | (*d*) 30 cm

A

Find elongation in spring if spring constant $k = 40N/m$
The system is in equilibrium

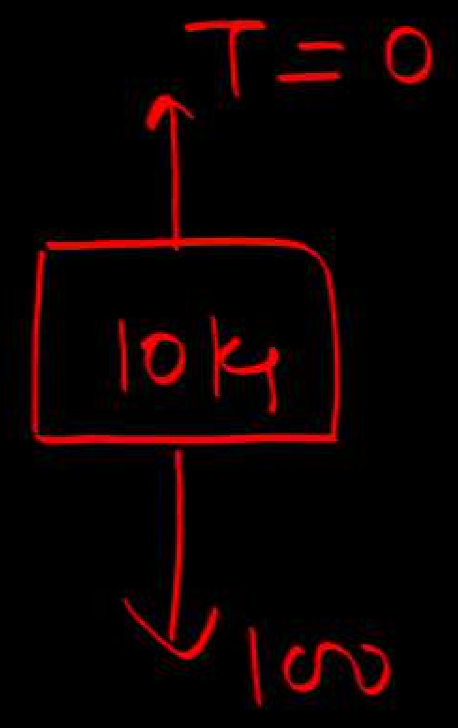


Find acceleration of both blocks just after string is cut.
K of spring is 50 N/m

Thread cut : $T = 0$

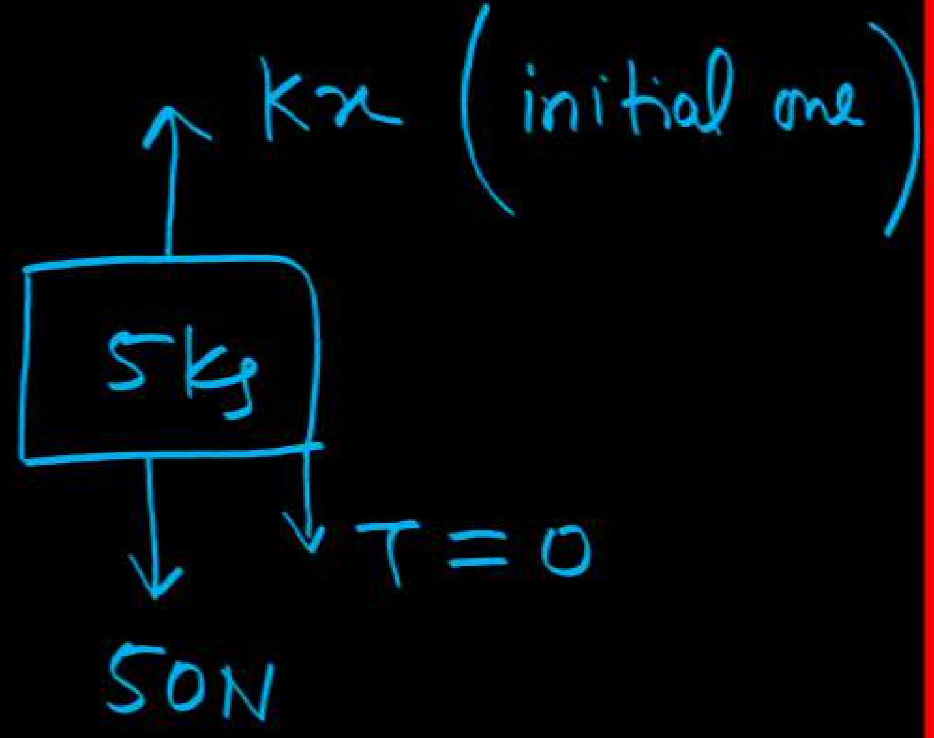
spring cut : Kx remains

At the time of cut



free fall

$a = g$

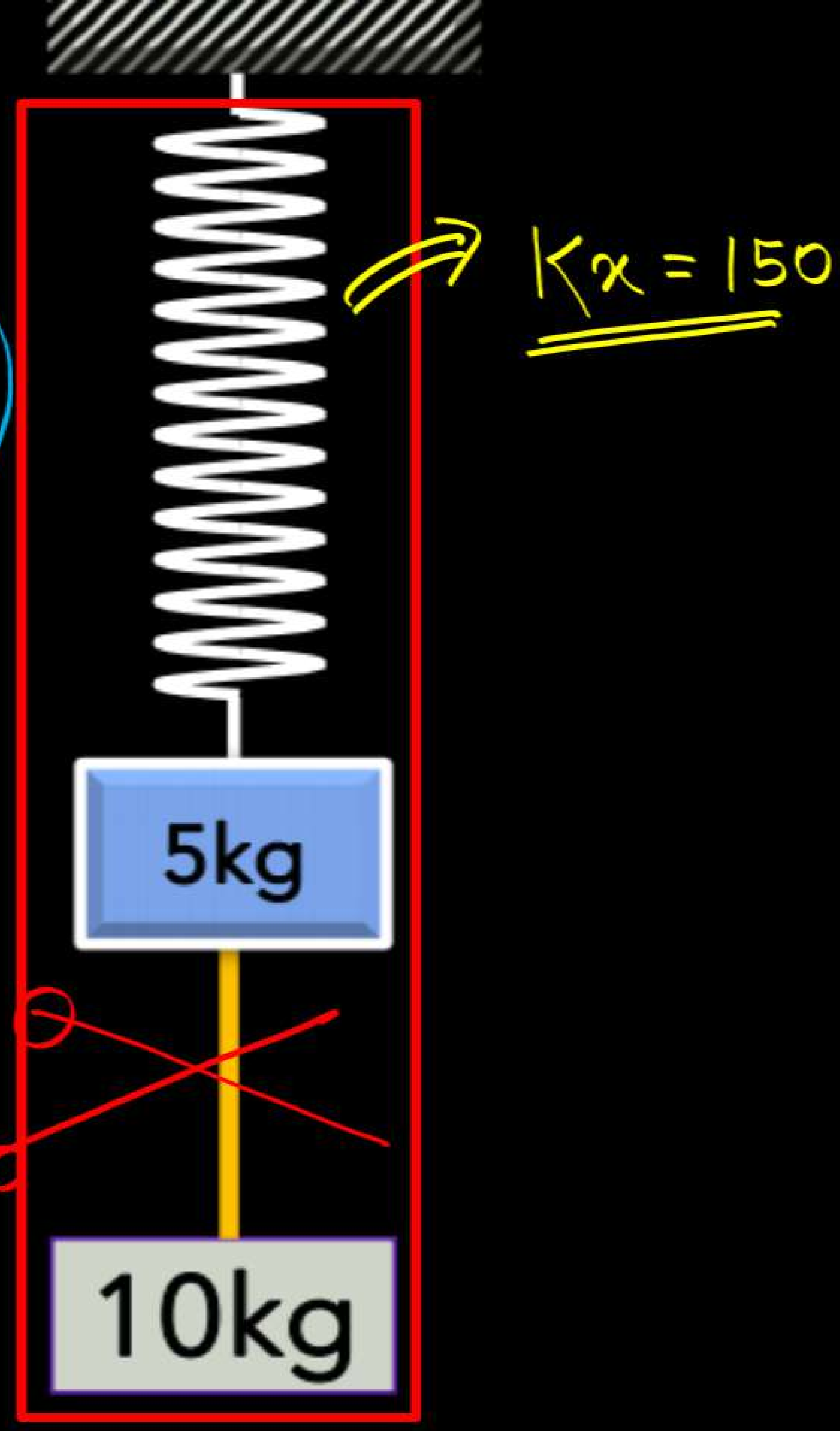


$Kx - 50 = 5a$

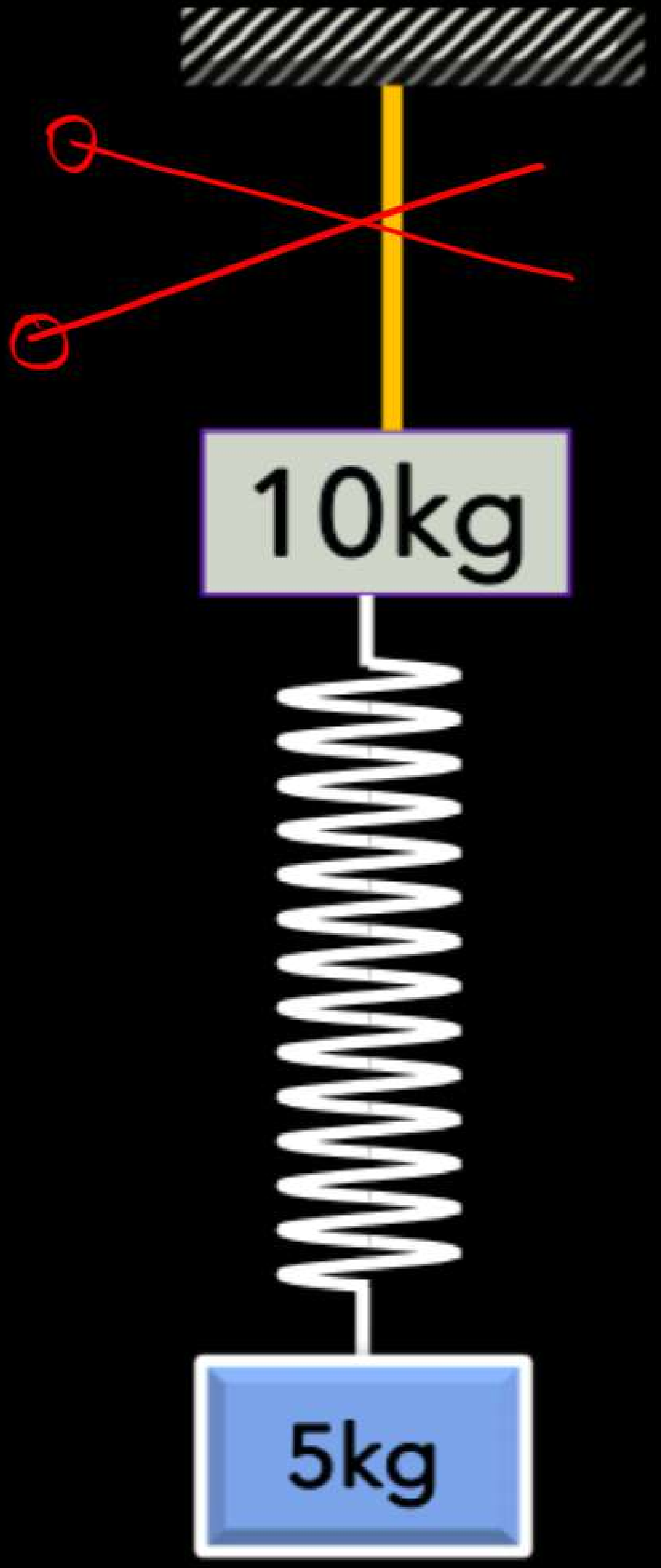
$150 - 50 = 5a$

$20\,m/s^2 = a$

upward

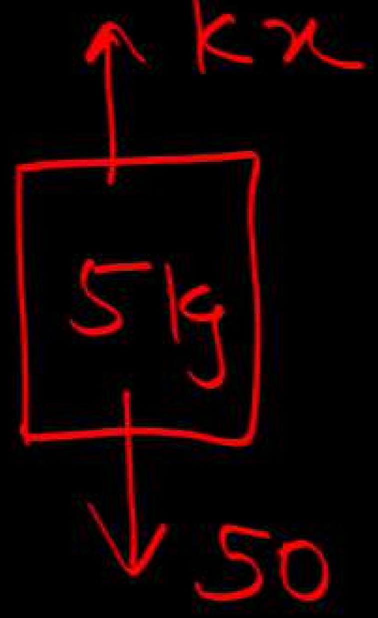


Find acceleration of both blocks just after string is cut.
K of spring is 50 N/m

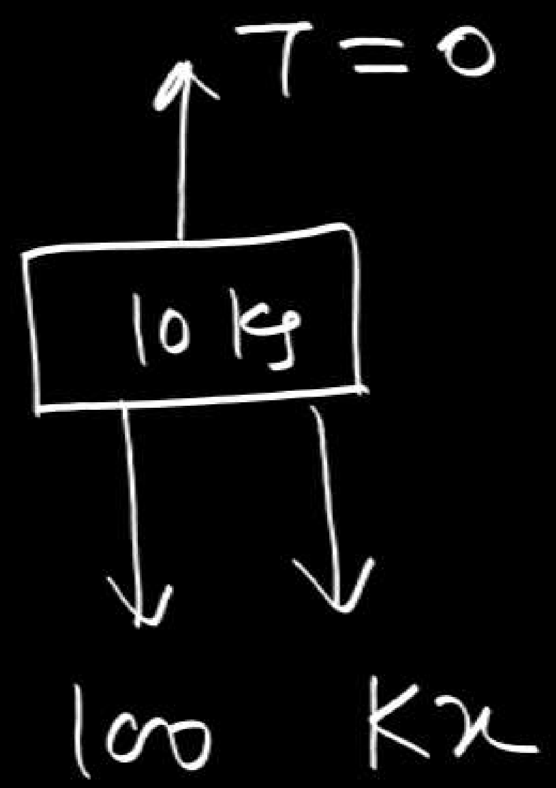


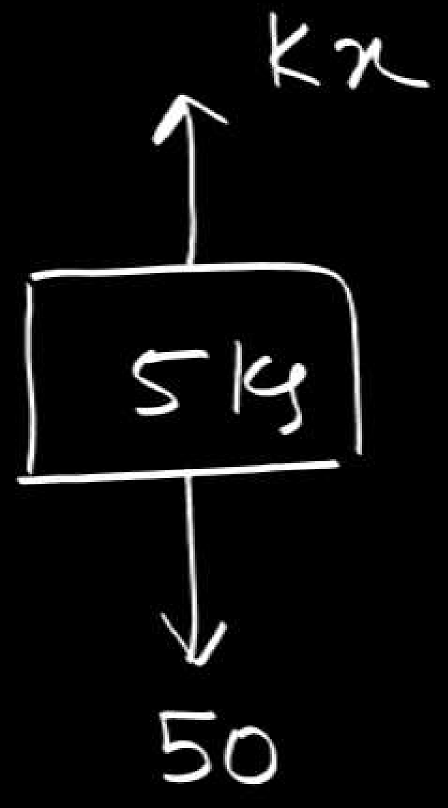
initially

$kx = 50N$



After cut





$$100 + kx = 10a$$

$$100 + 50 = 10a$$

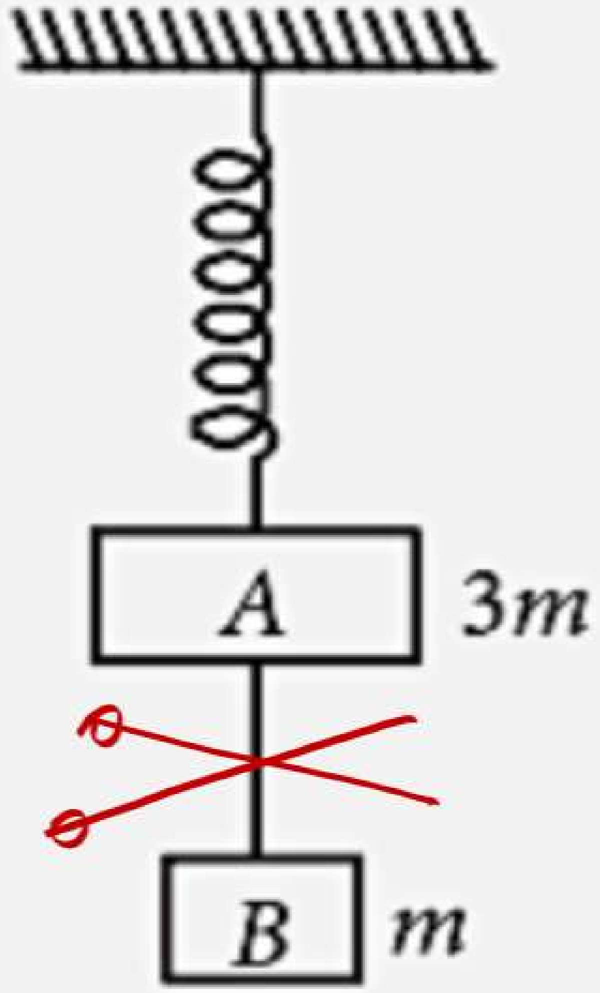
$$15\ m/s^2 = a$$

$$50 - kx = 5a$$

$$50 - 50 = 5a$$

$$0 = a$$

Two blocks A and B of masses $3m$ and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively



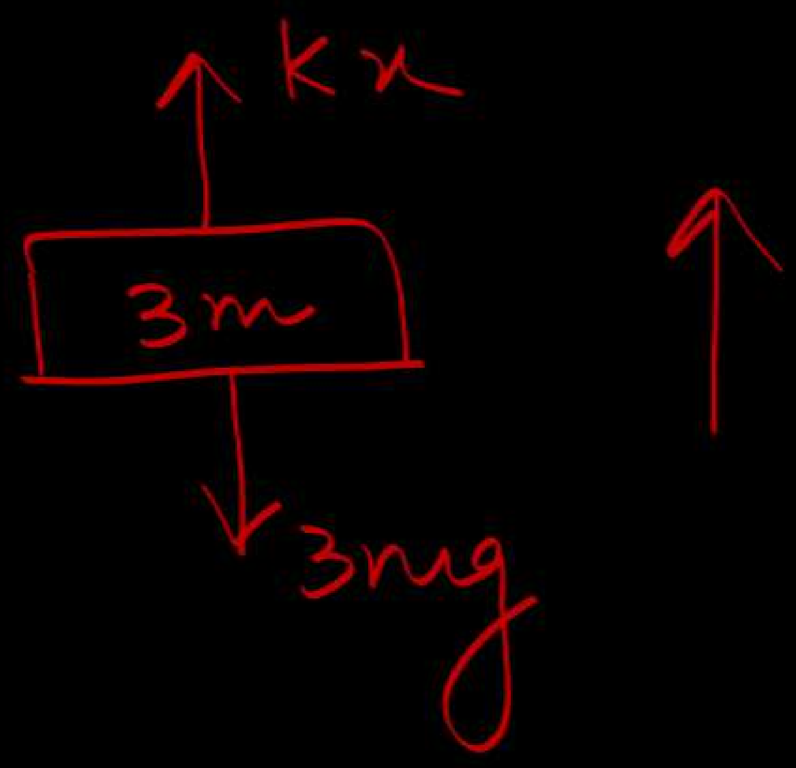
(a) $\frac{g}{3}, g$ (b) g, g

(c) $\frac{g}{3}, \frac{g}{3}$ (d) $g, \frac{g}{3}$

(NEET 2017)

Initially → spring $kx = 4mg$

After cut

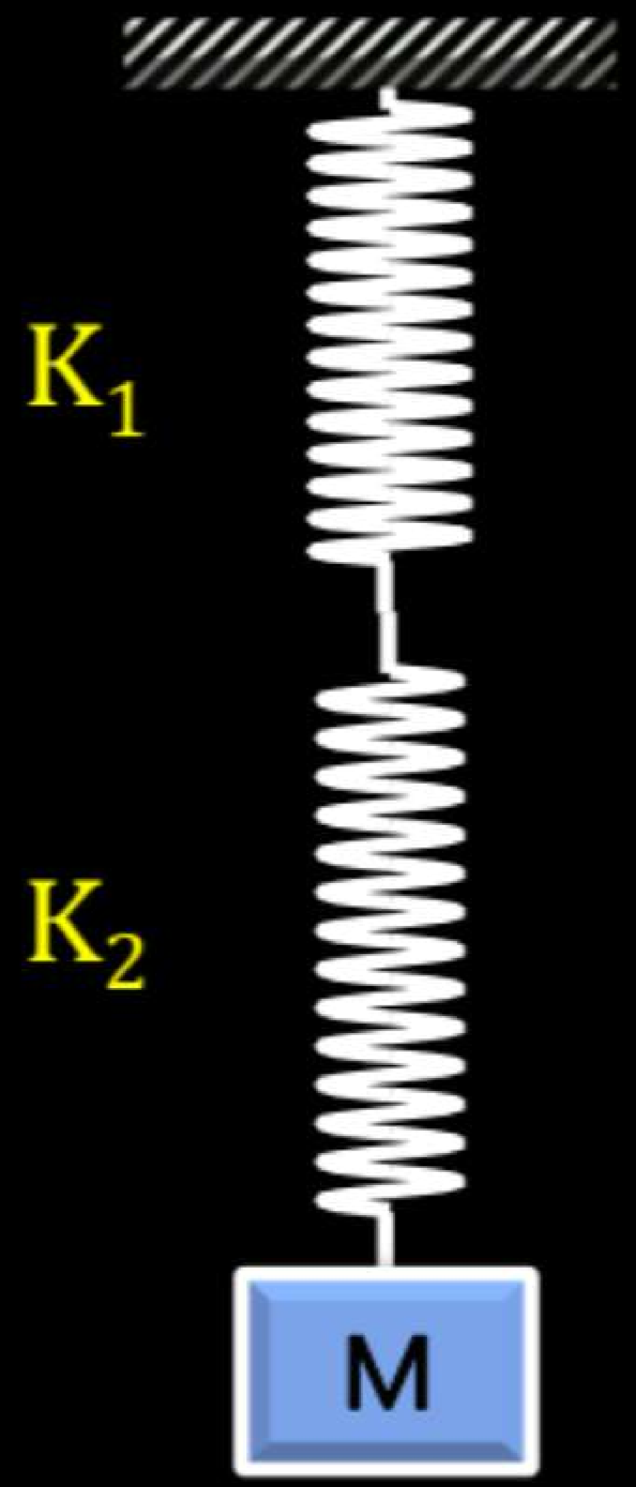


$kx - 3mg = 3ma$

$4mg - 3mg = 3ma$

$g/3 = a$

Combination of spring



Series Combination

a) Each spring force equal

Here : $K_1 x_1 = K_2 x_2 = Mg$

b) $\dfrac{x_1}{x_2} = \dfrac{K_2}{K_1}$

c) $\boxed{\dfrac{1}{K_{eq}} = \dfrac{1}{K_1} + \dfrac{1}{K_2}} + \cdots \Rightarrow \boxed{K_{eq} = \dfrac{K_1 K_2}{K_1 + K_2}}$

Example

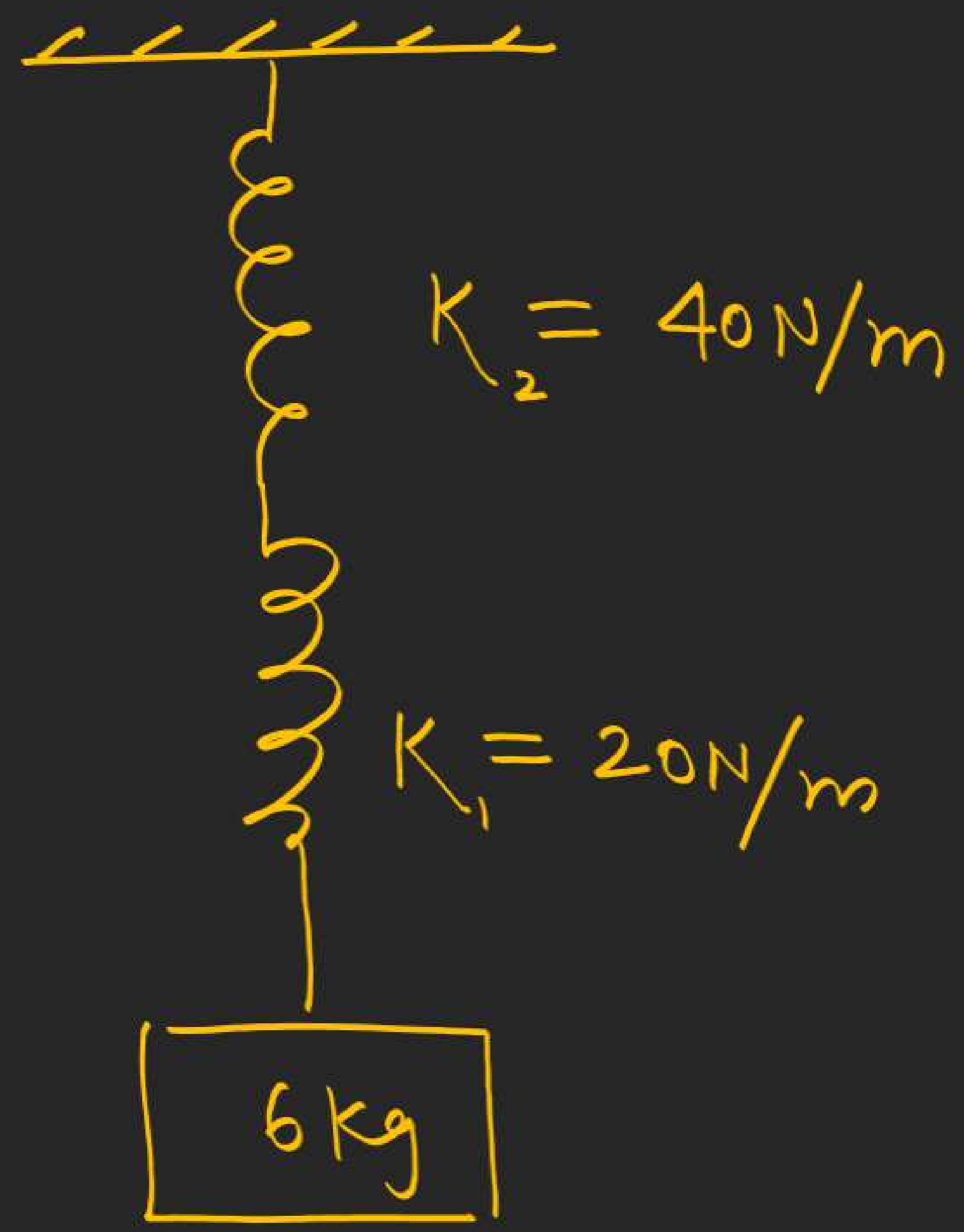
K, K: $K_{eq} = \dfrac{K}{2}$

K, K, K: $K_{eq} = \dfrac{K}{3}$

3K, 6K: $K_{eq} = 2K$

Ex: 10 N/m, 20 N/m, 30 N/m

Ans $\dfrac{1}{K_{eq}} = \dfrac{1}{10} + \dfrac{1}{20} + \dfrac{1}{30} \Rightarrow K_{eq} = \dfrac{60}{11}$ N/m



find a) Force in each spring

b) find ext. in each spring

c) find K_{eq}

Ans a) $K_1 x_1 = K_2 x_2 = 60\,N$

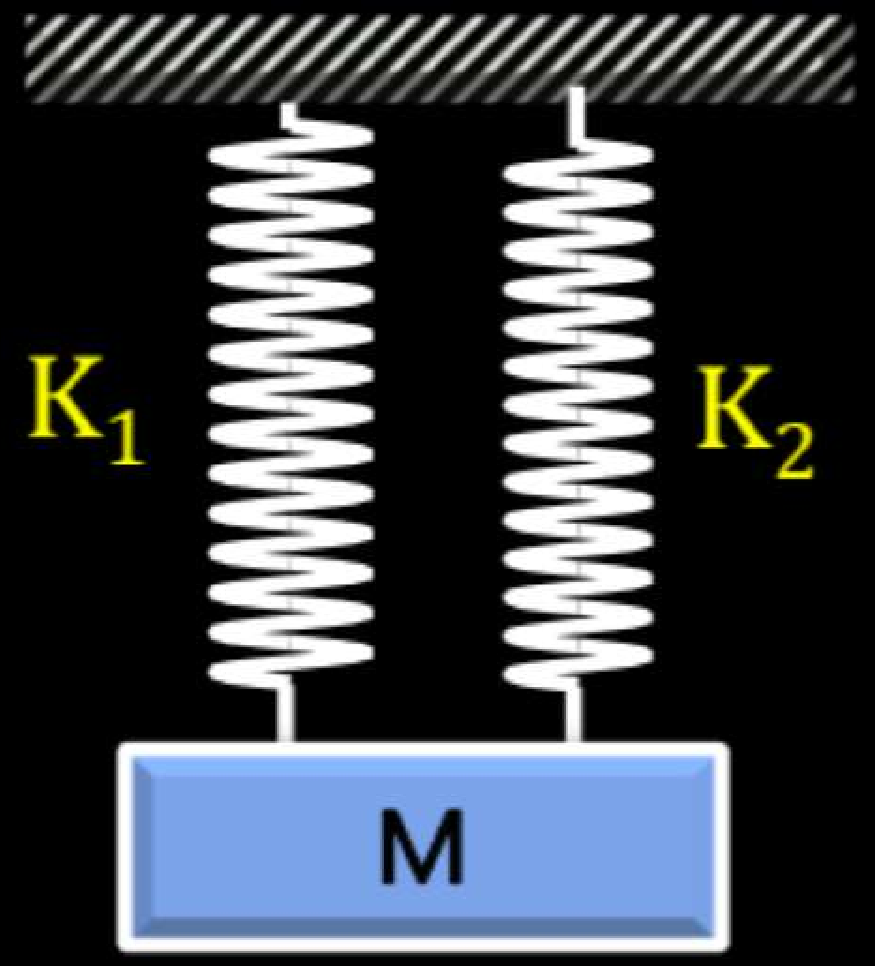
b) $K_1 x_1 = 60$ and $K_2 x_2 = 60$

$20 x_1 = 60 \qquad 40 x_2 = 60$

$x_1 = 3 \qquad x_2 = 3/2$

c) $K_{eq} = \dfrac{20 \times 40}{60} = \dfrac{40}{3}\,N/m$

Combination of spring



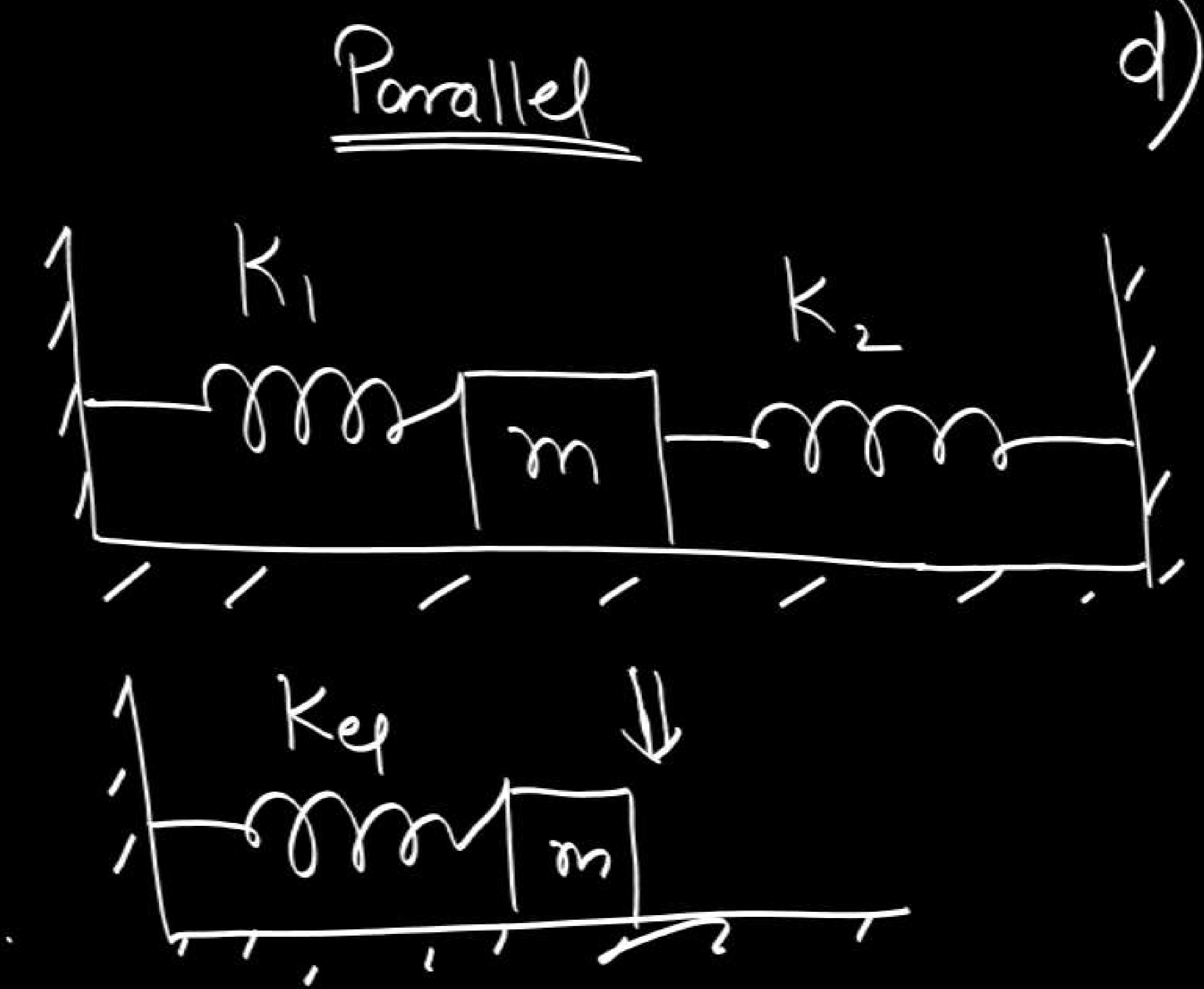
Parallel combination

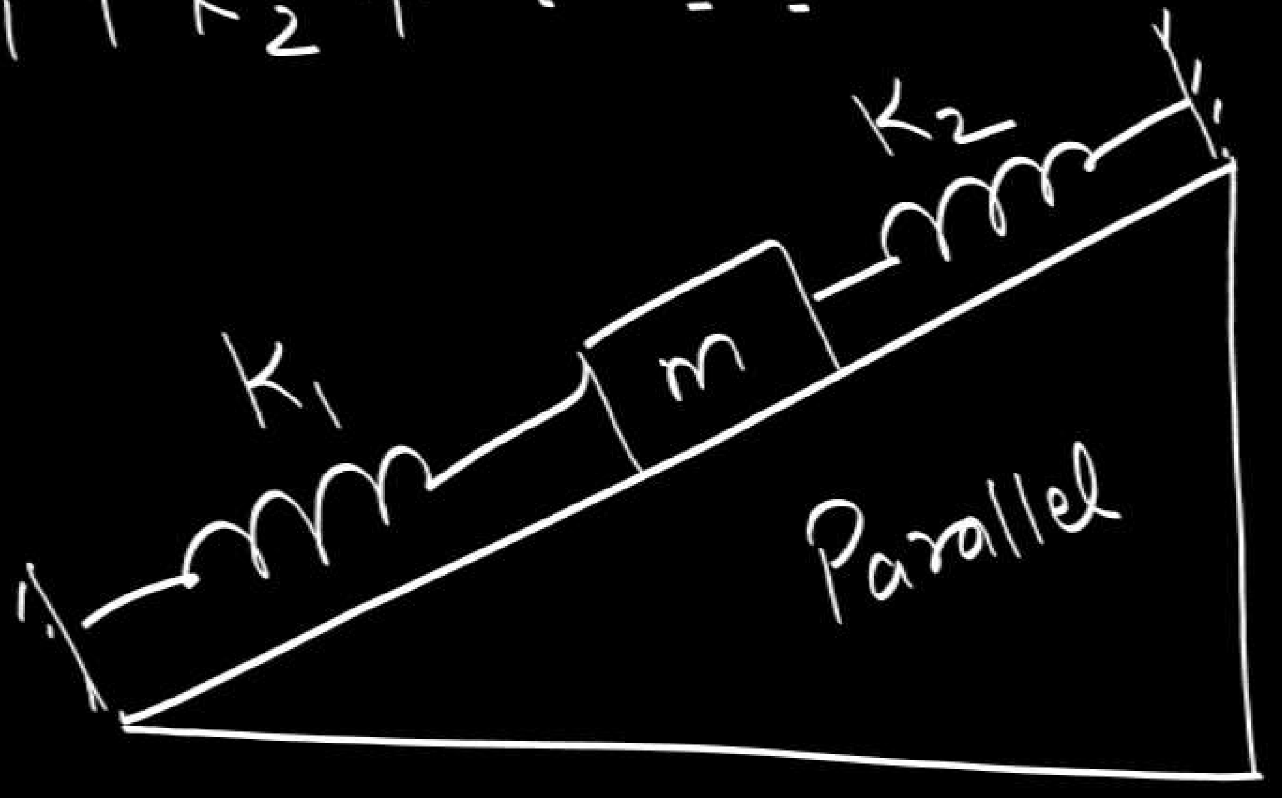
a) extension / compression is same $(x_1 = x_2 = x)$

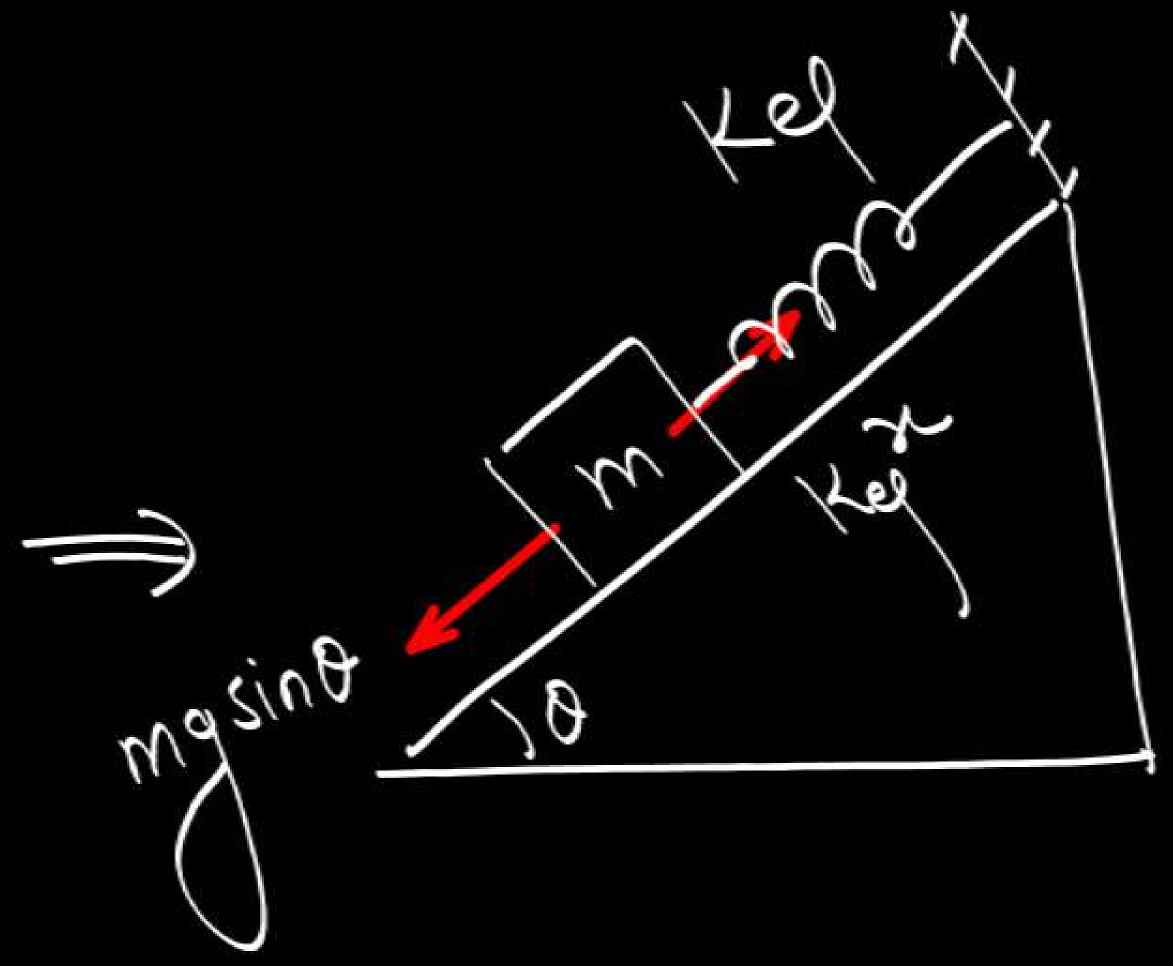
b) force is not same (Generally)

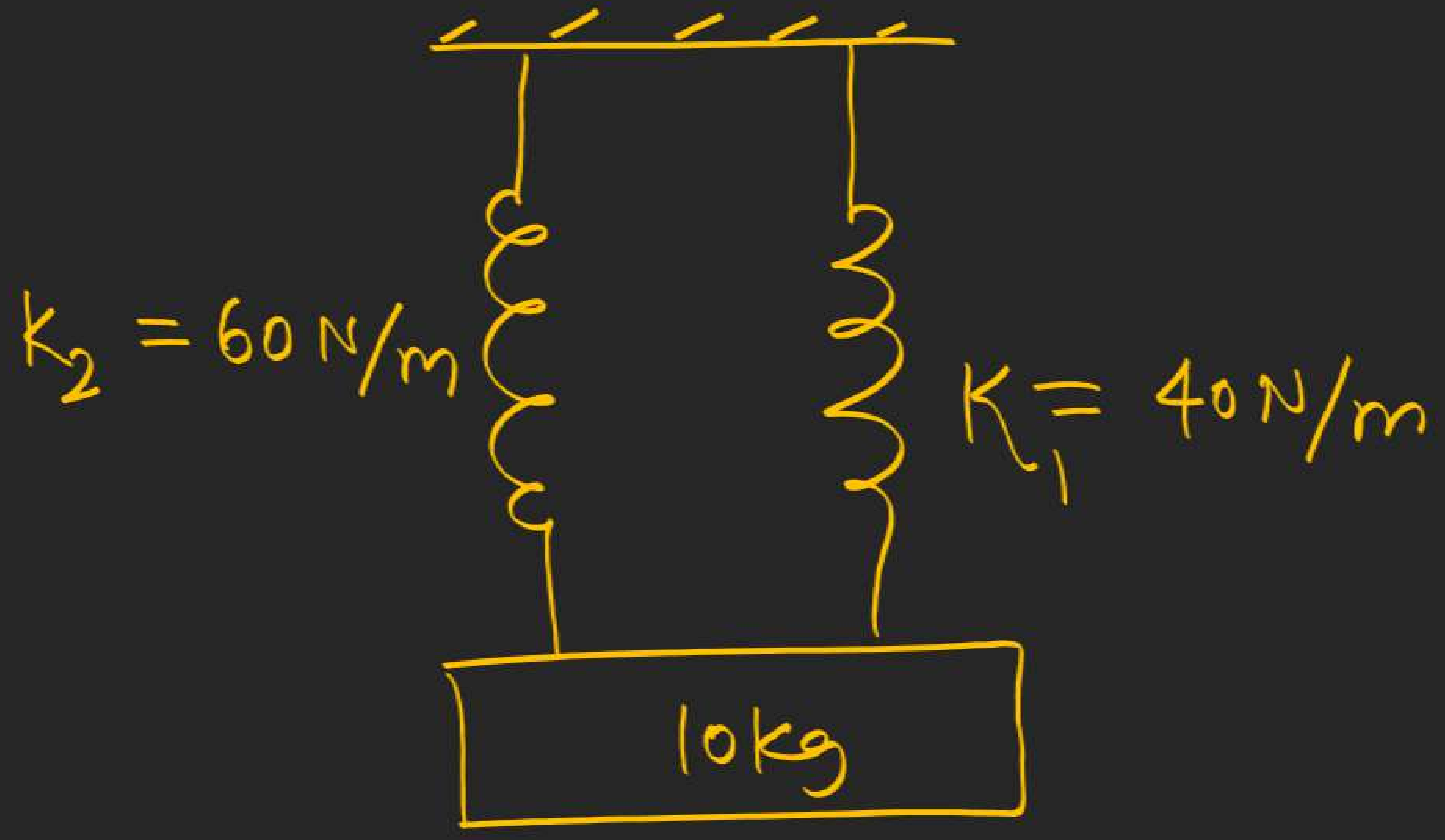
c) $F_1 = K_1 x$, $F_2 = K_2 x$ $\Bigg\}$ $\dfrac{f_1}{f_2} = \dfrac{K_1}{K_2}$

d) $K_{eq} = K_1 + K_2 + \ldots$





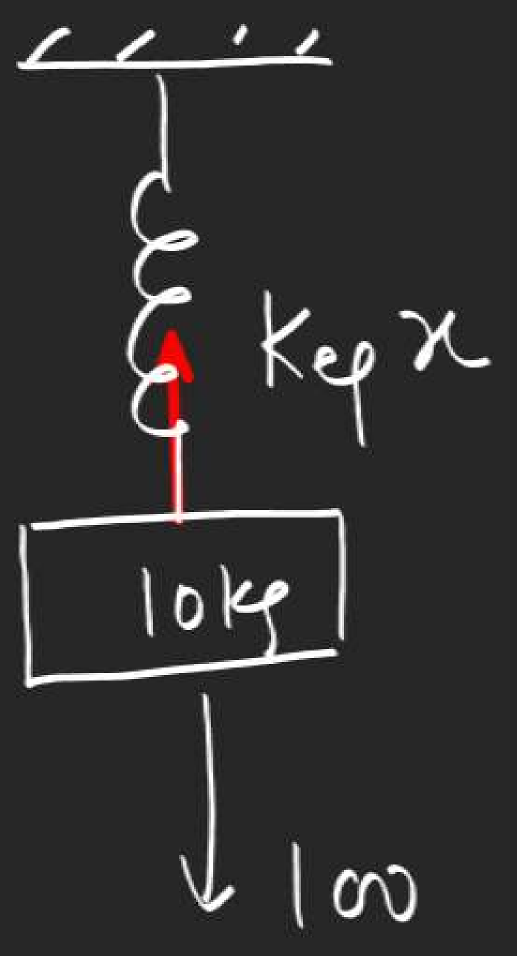




Find a) K_{eq} b) x c) Force on each

Ans: a) $K_{eq} = 100\ N/m$

b)

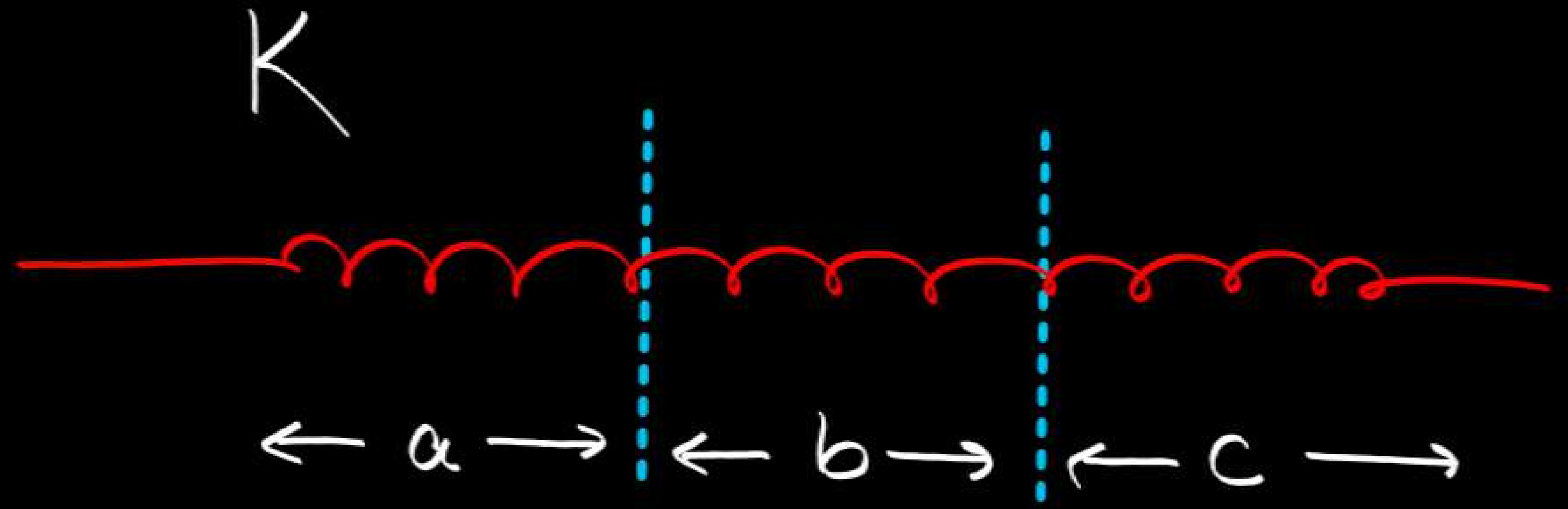


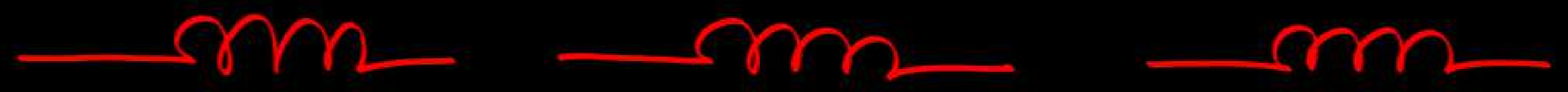
$$K_{eq}x = 100$$
$$100x = 100$$
$$x = 1m$$

c) $F_1 = K_1 x$
$= 40(1) = \underline{\underline{40N}}$

$F_2 = K_2 x$
$= 60 \times 1$
$= \underline{\underline{60N}}$

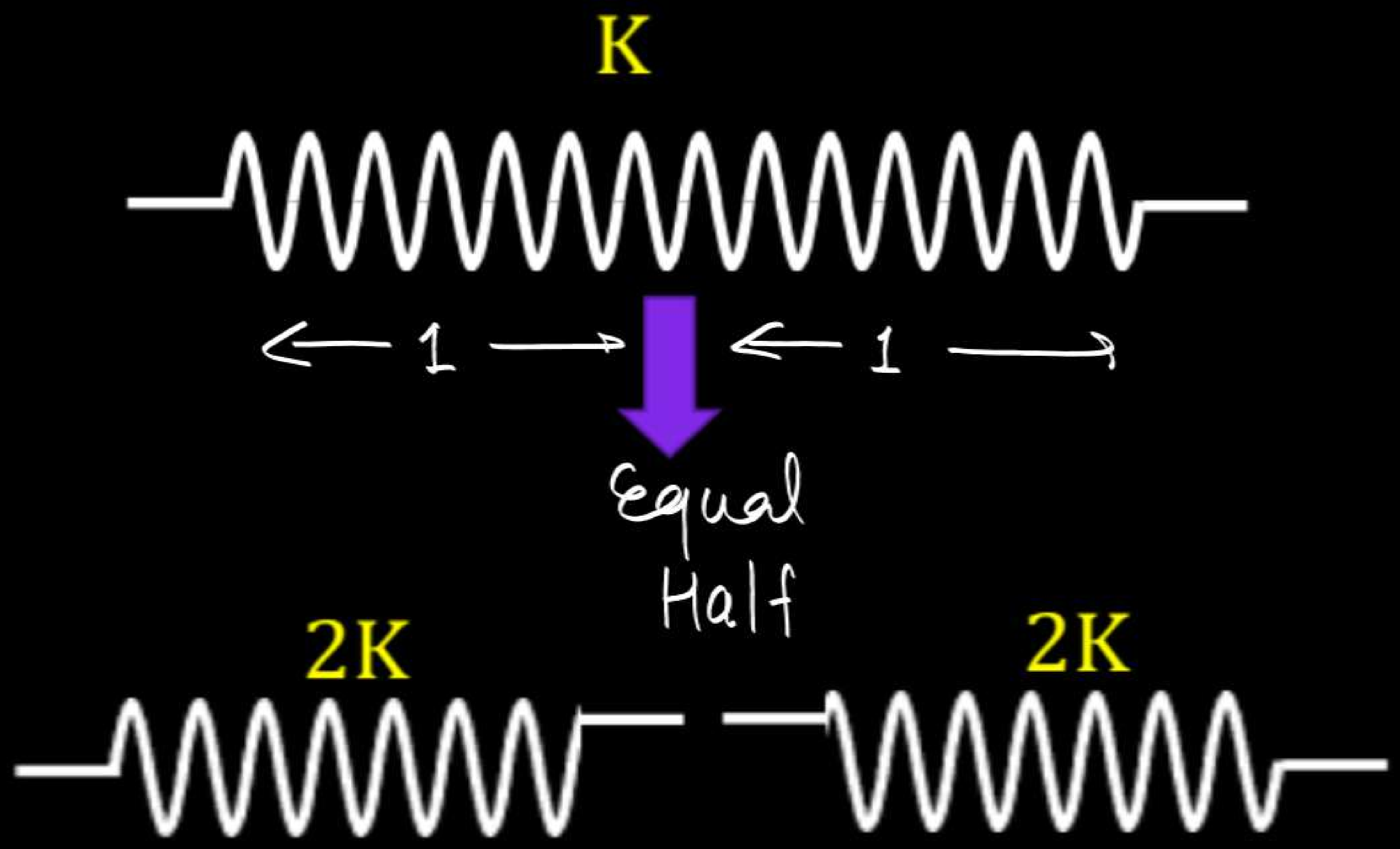
Cutting of spring in pieces



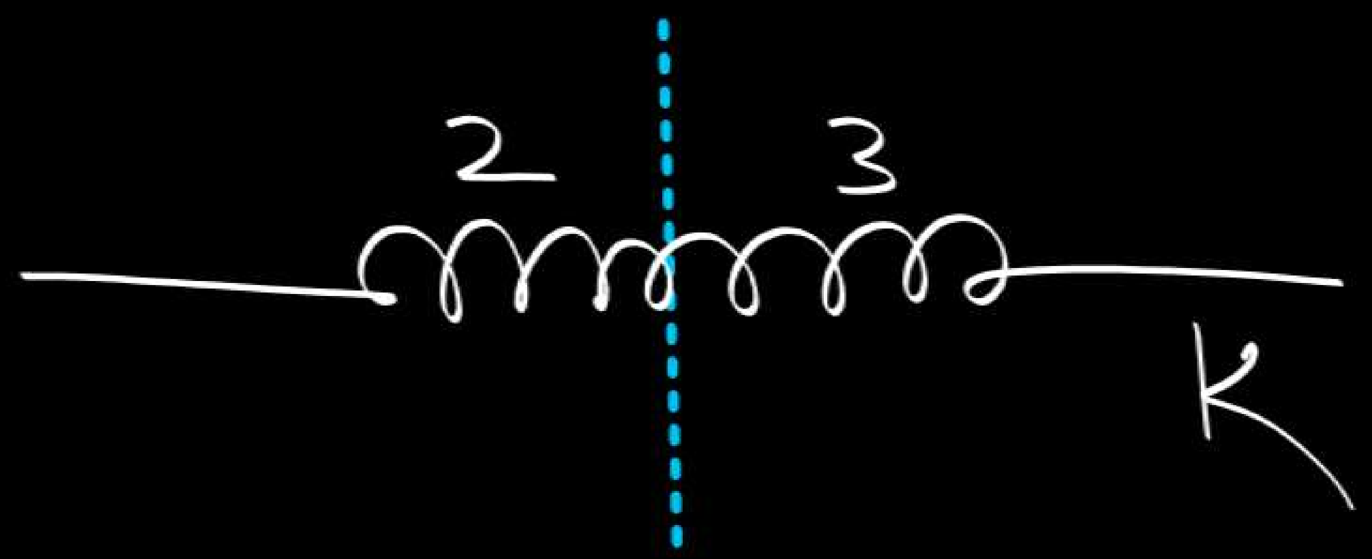


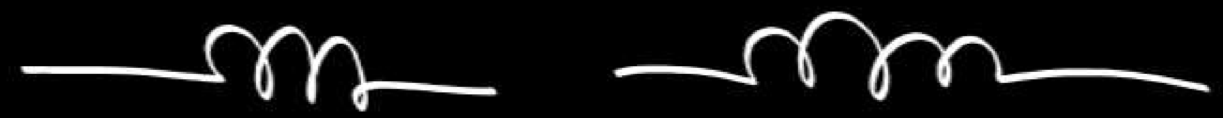
$$\frac{(a+b+c)K}{a} \qquad \frac{(a+b+c)K}{b} \qquad \frac{(a+b+c)K}{c}$$

ex

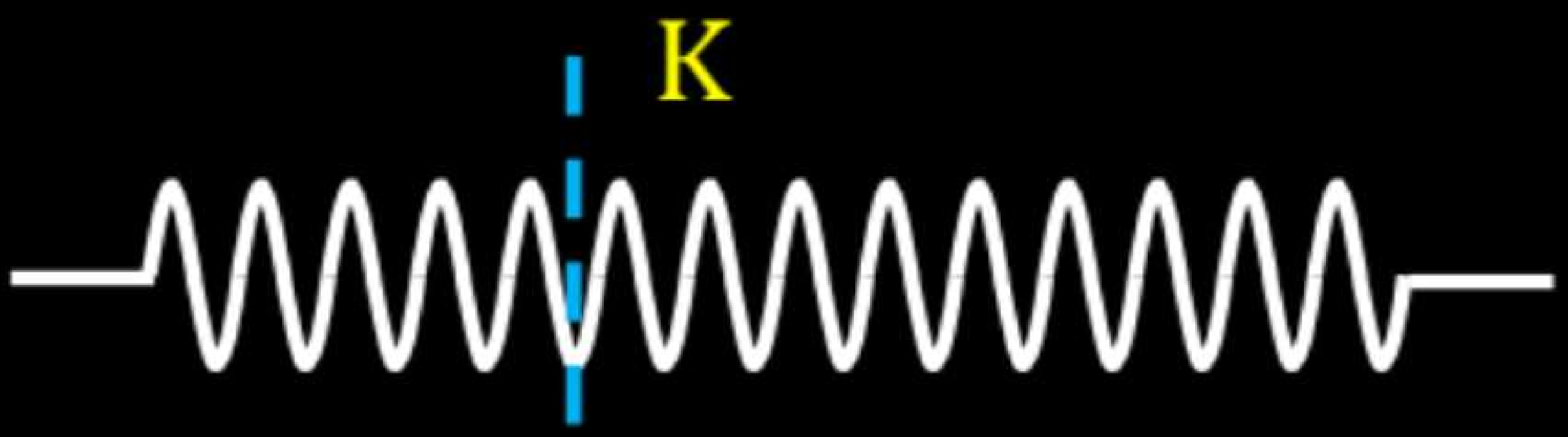


ex

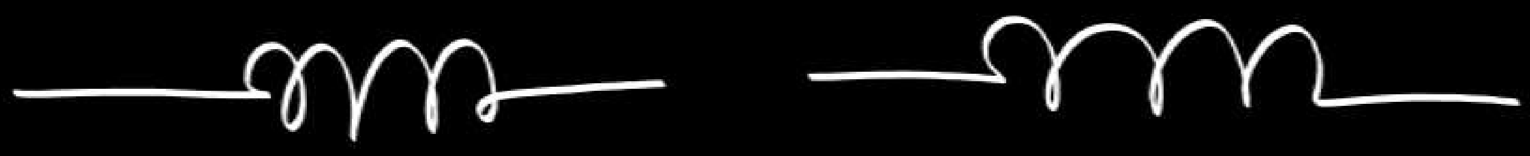




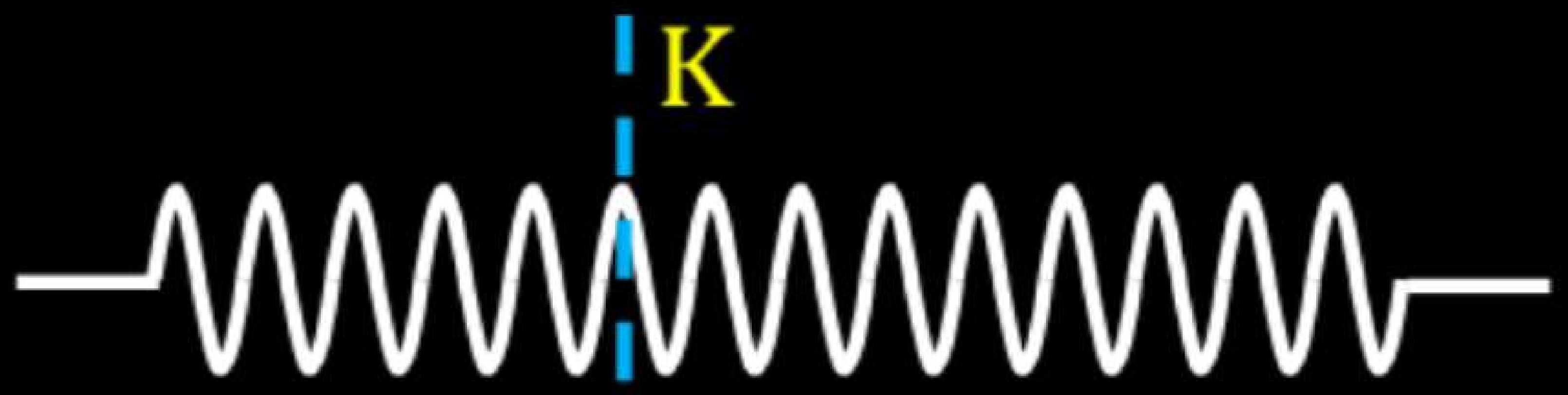
$$\frac{5K}{2} \qquad \frac{5K}{3}$$



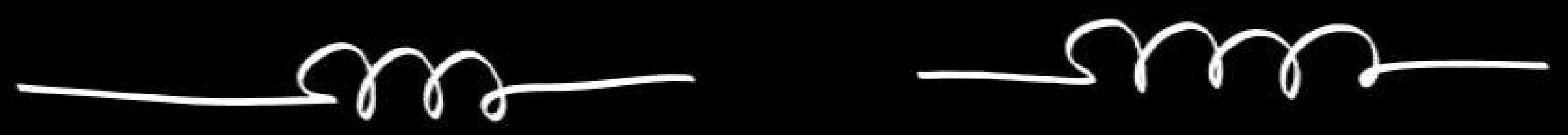
2 : 3



$\frac{5}{2}K$ $\frac{5}{3}K$

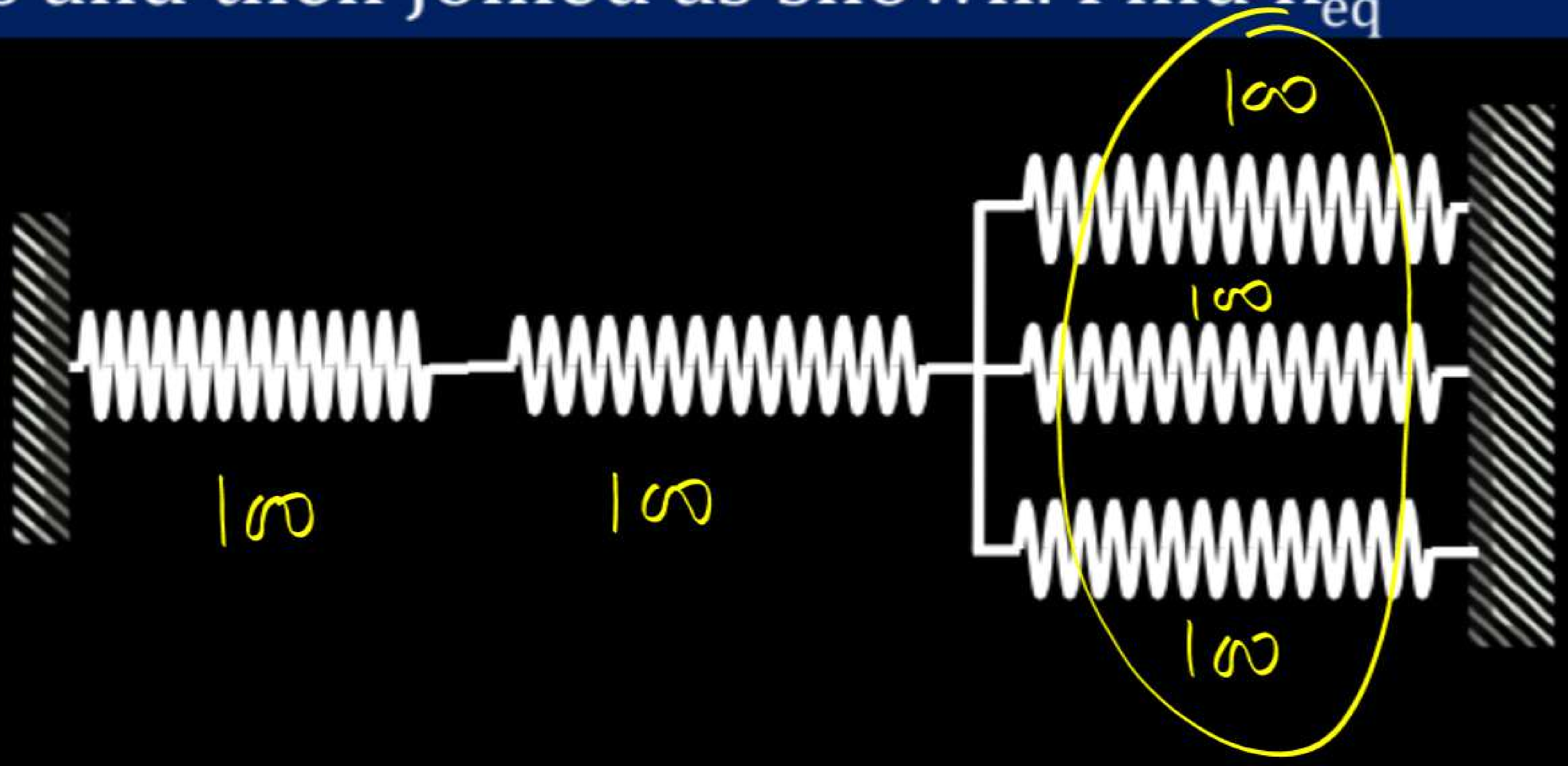


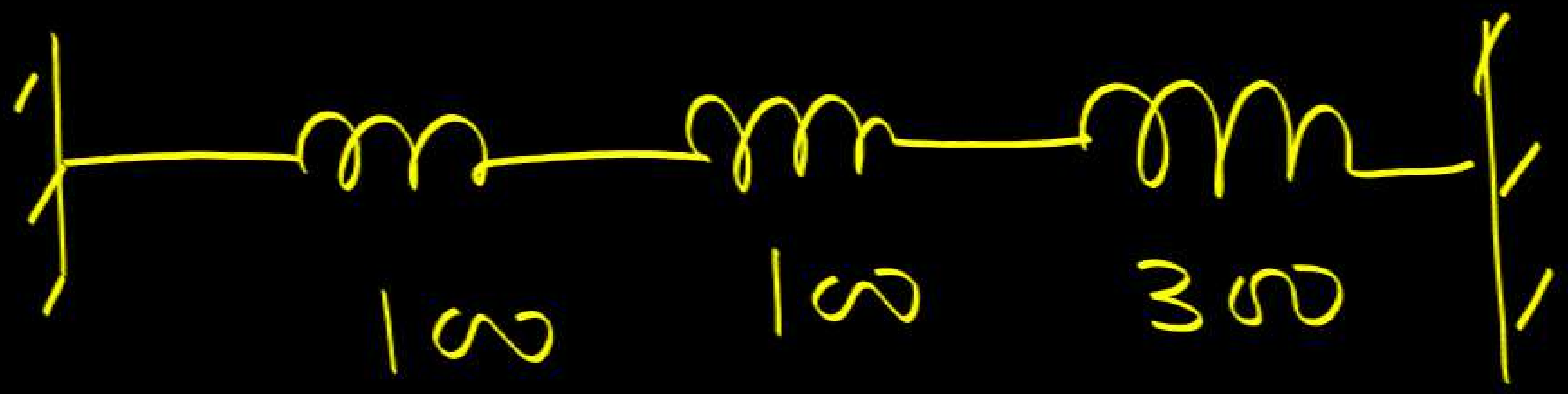
4 : 7



$\frac{11}{4}K$ $\frac{11}{7}K$

If a spring of constant k=20N/m is cut in 5 pieces and then joined as shown. Find k_{eq}



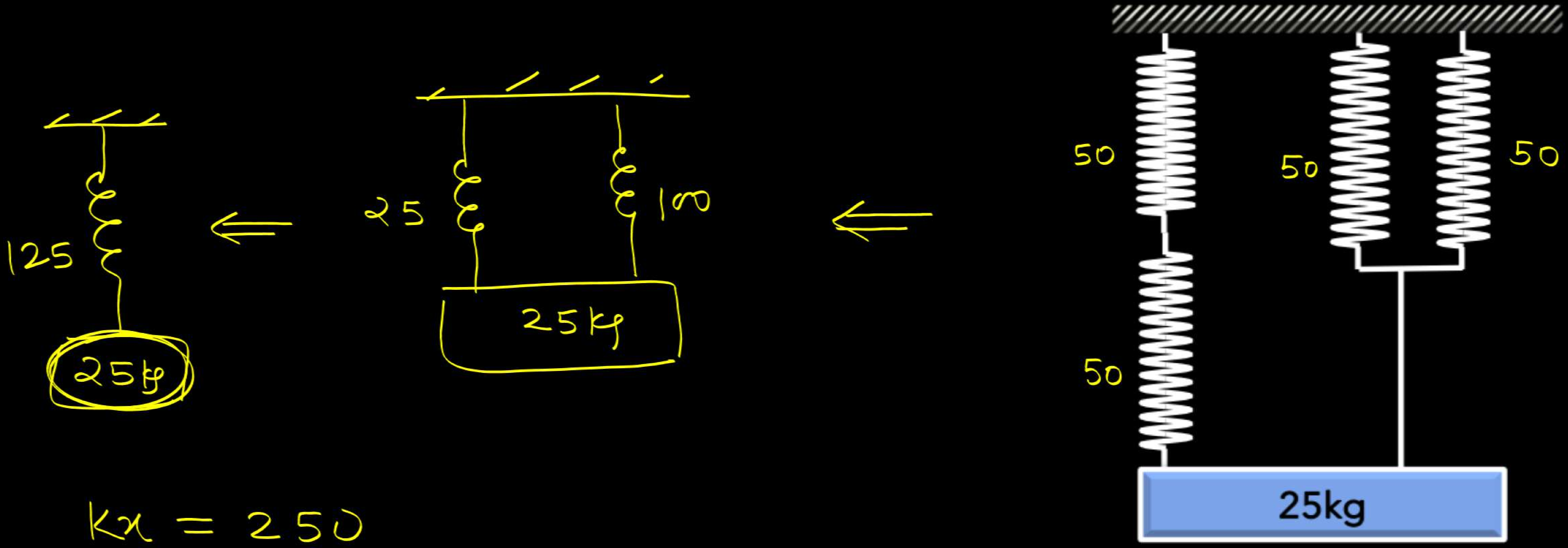


$$\frac{1}{k_{eq}} = \frac{1}{100} + \frac{1}{100} + \frac{1}{300}$$

$$k_{eq} = 300/7$$

4 identical springs are connected as shown each spring has a spring constant of 50 N/m. Find the net extension of the spring system on attaching a 25 kg mass

A. 5m
B. 2.5m
C. 2m
D. 10m



$$Kx = 250$$

$$125x = 250$$

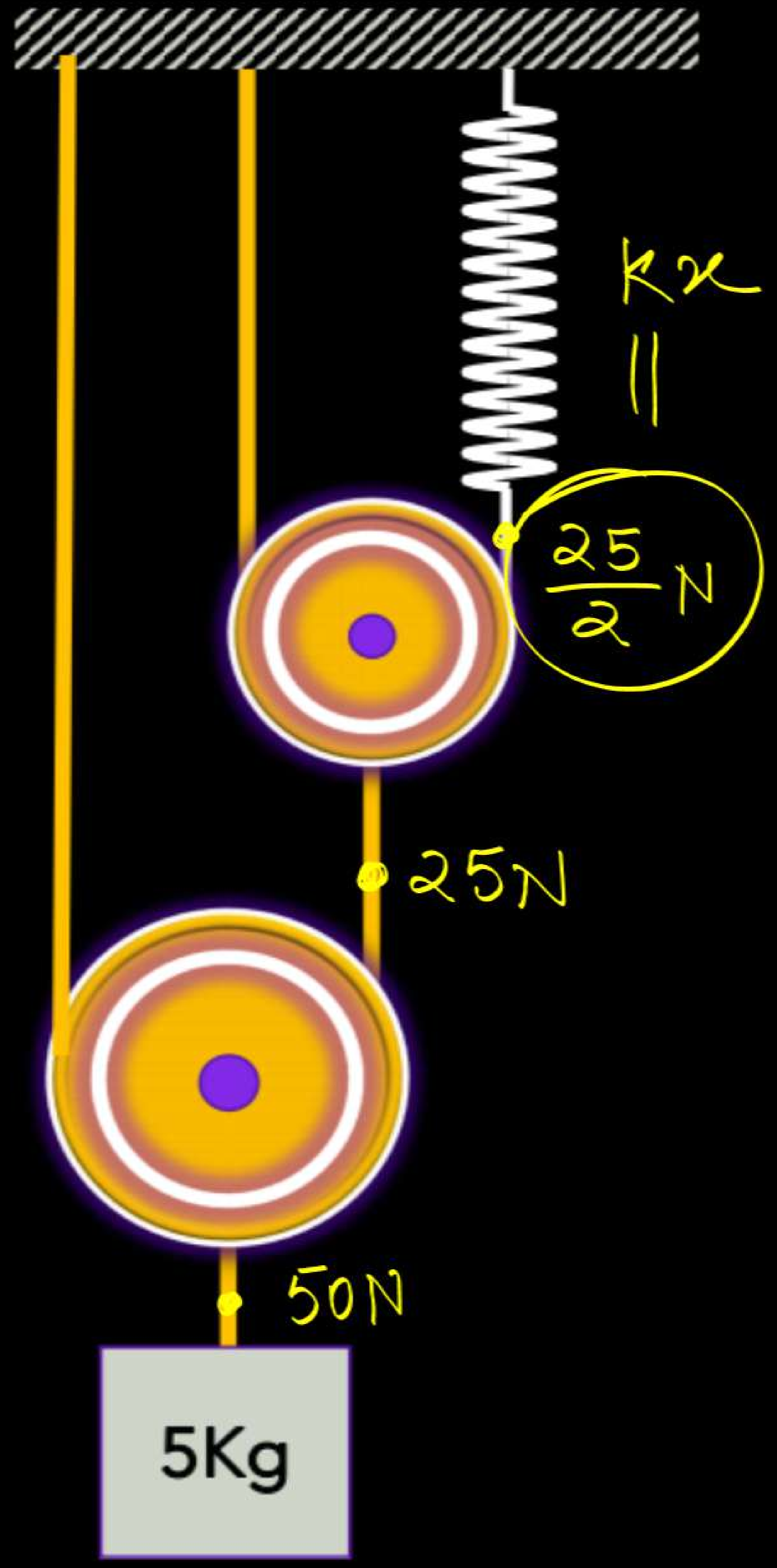
$$\underline{x = 2}$$

Find elongation in spring if spring constant $k = 40N/m$
The system is in equilibrium

$$kx = \frac{25}{2}$$

$$40x = \frac{25}{2}$$

$$x = \frac{25}{80}$$

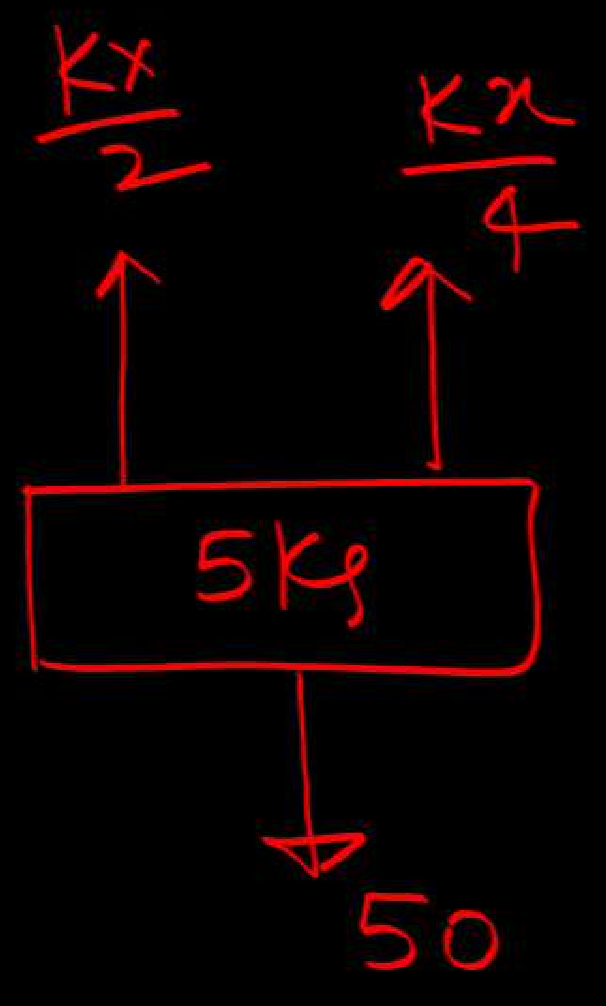


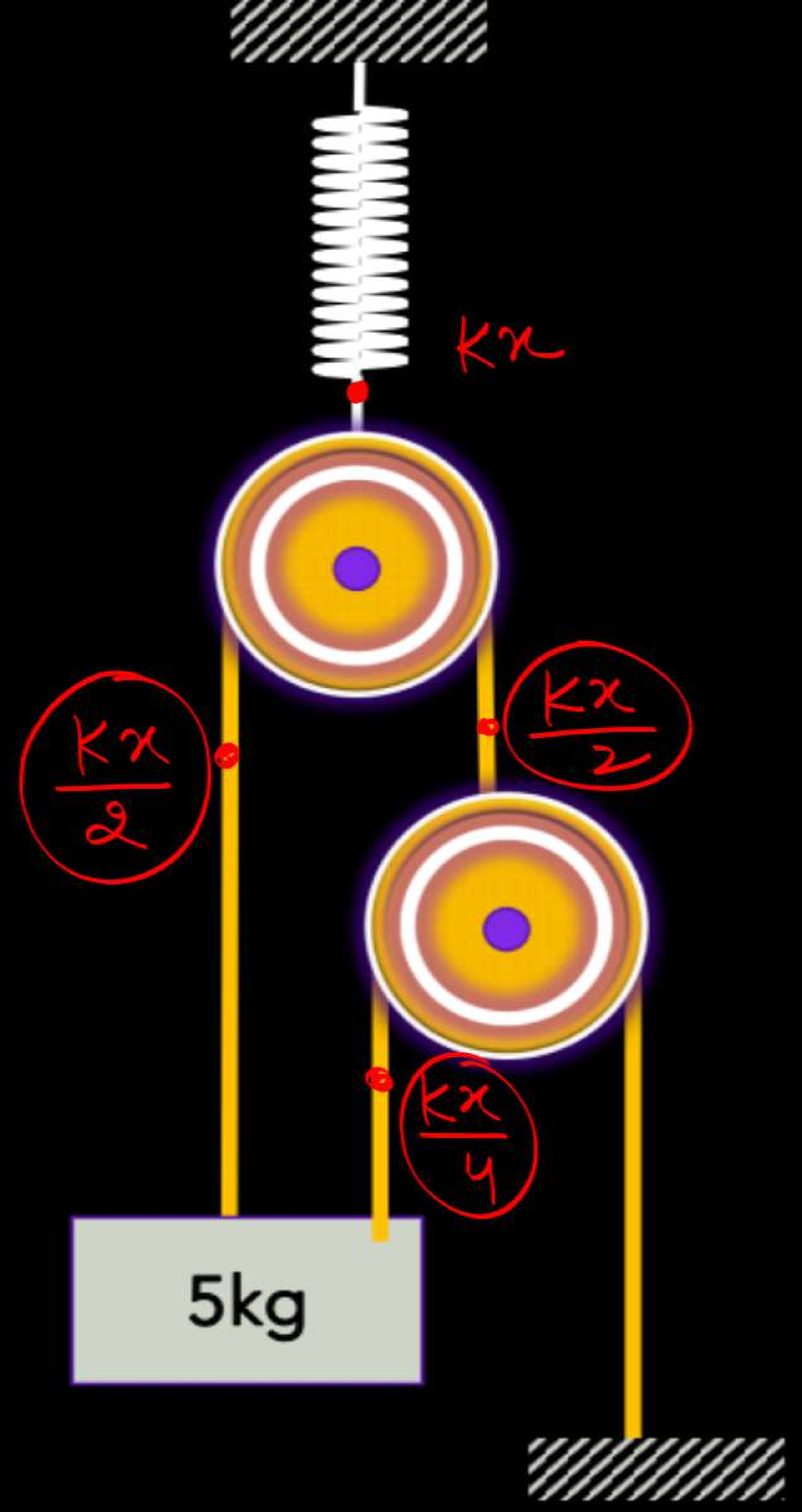
Find elongation in spring if spring constant $k = 40 N/m$
The system is in equilibrium

$$\frac{kx}{2} + \frac{kx}{4} = 50$$

$$\frac{3}{4} \times 40x = 50$$

$$x = 5/3$$

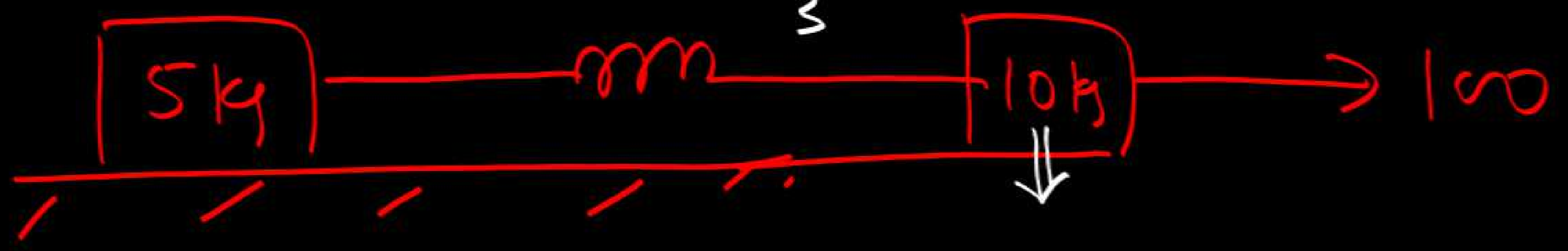




Find acceleration of both block and elongation in spring if spring constant $k = 40 N/m$

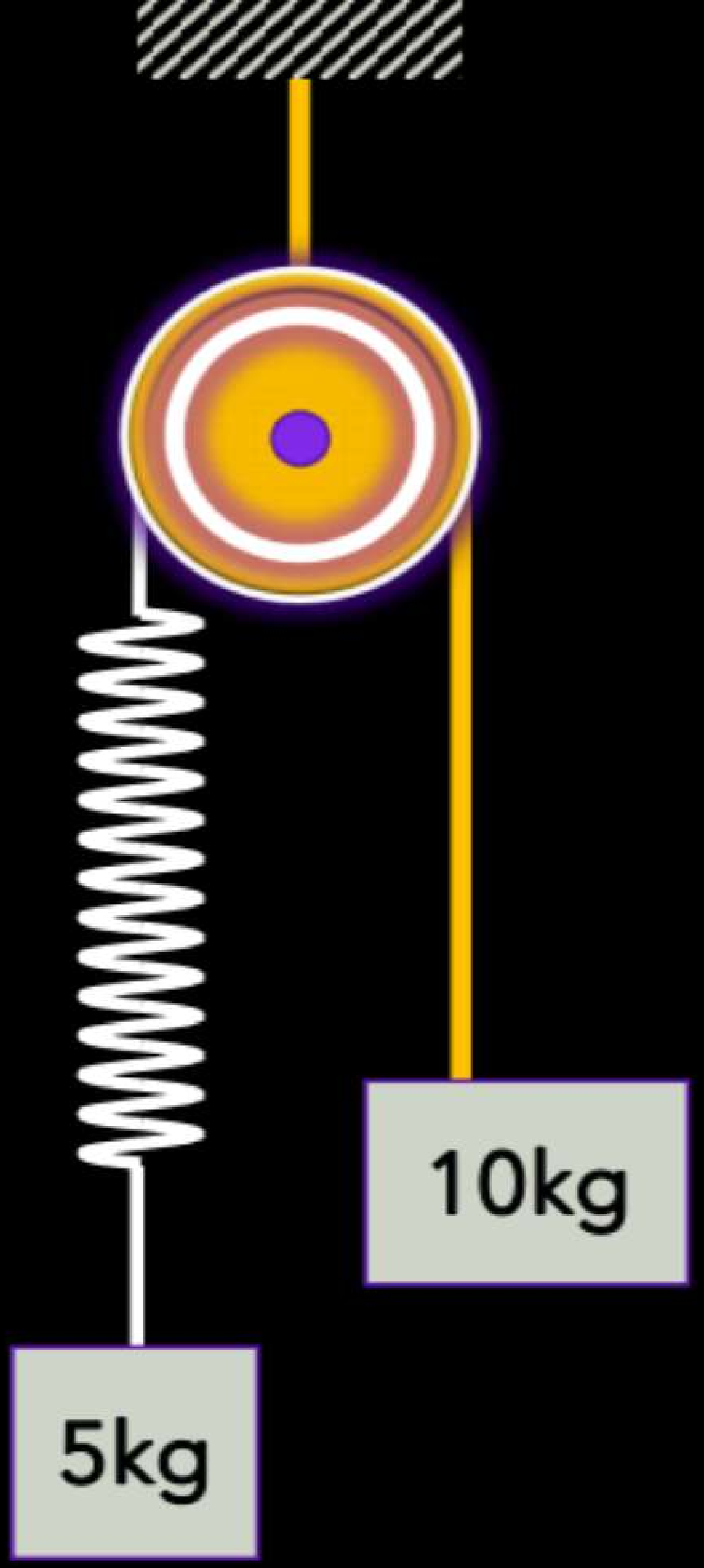
$$a = \left(\frac{10-5}{15}\right) g = g/3$$

$$kx = \frac{200}{3}$$



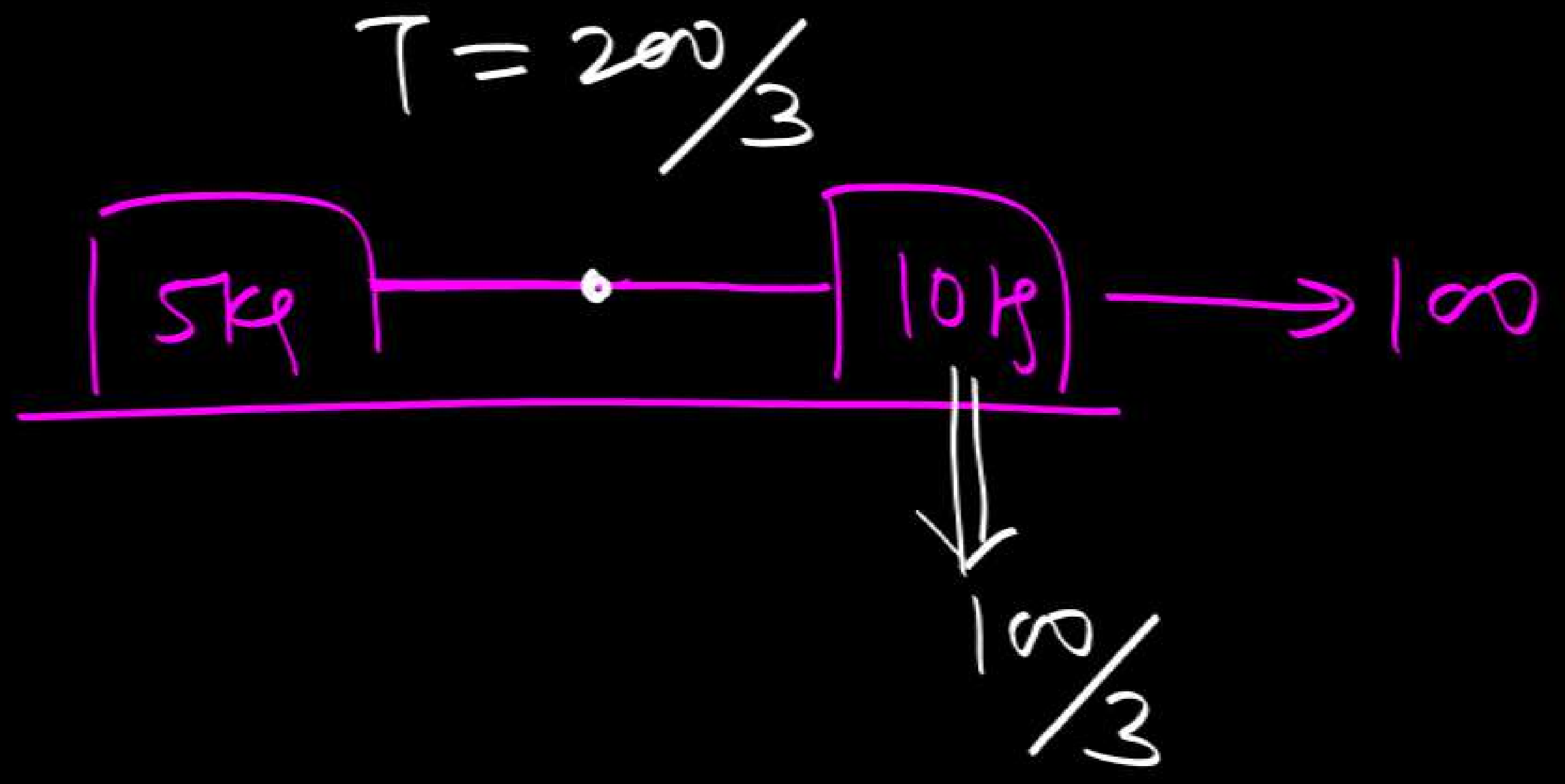
$$10 \times g/3$$

$$= 100/3$$



Find acceleration elongation in spring if spring constant $k = 250$ N/m

$$a = g/3$$

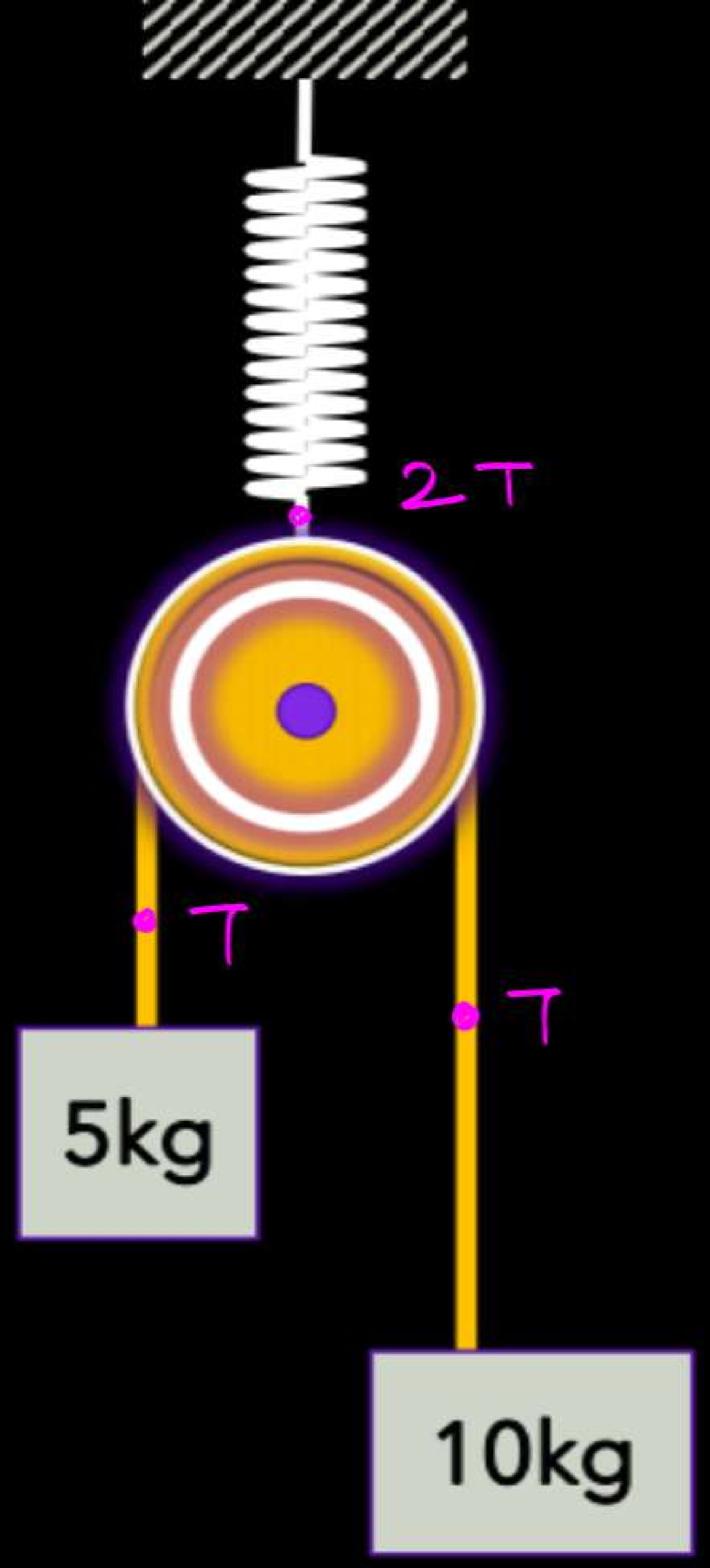


$$kx = 2T$$

$$kx = 2\left(\frac{200}{3}\right)$$

$$250x = \frac{400}{3}$$

$$x = \frac{8}{15}\ \text{m}$$



A mass M is suspended as shown in figure. The system is in equilibrium. Assume pulleys to be massless. k is the force constant of the spring. The extension produced in the spring is given by

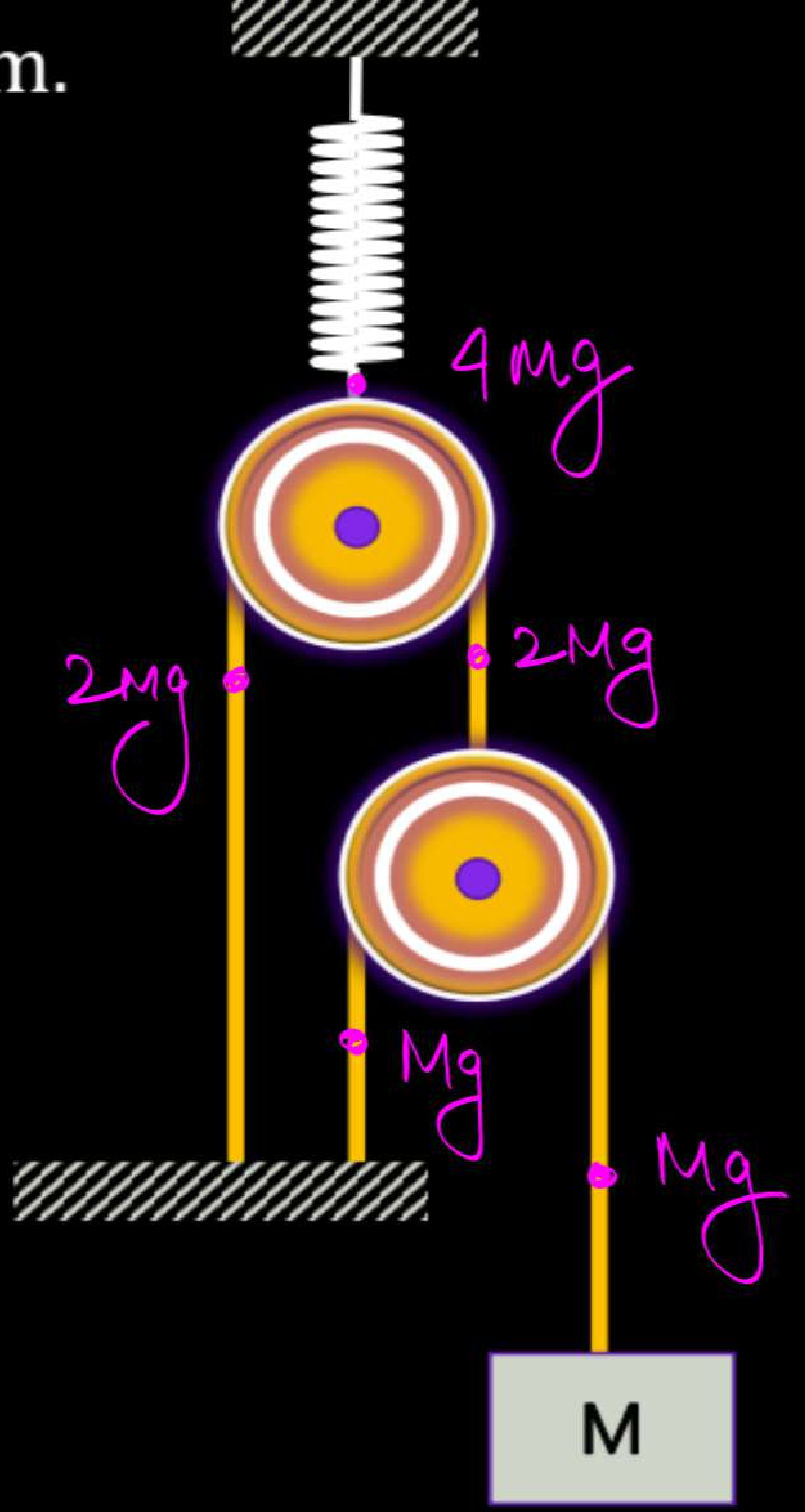
A. 4Mg/k

B. Mg/k

C. 2Mg/k

D. 3Mg/k

$kx = 4mg$



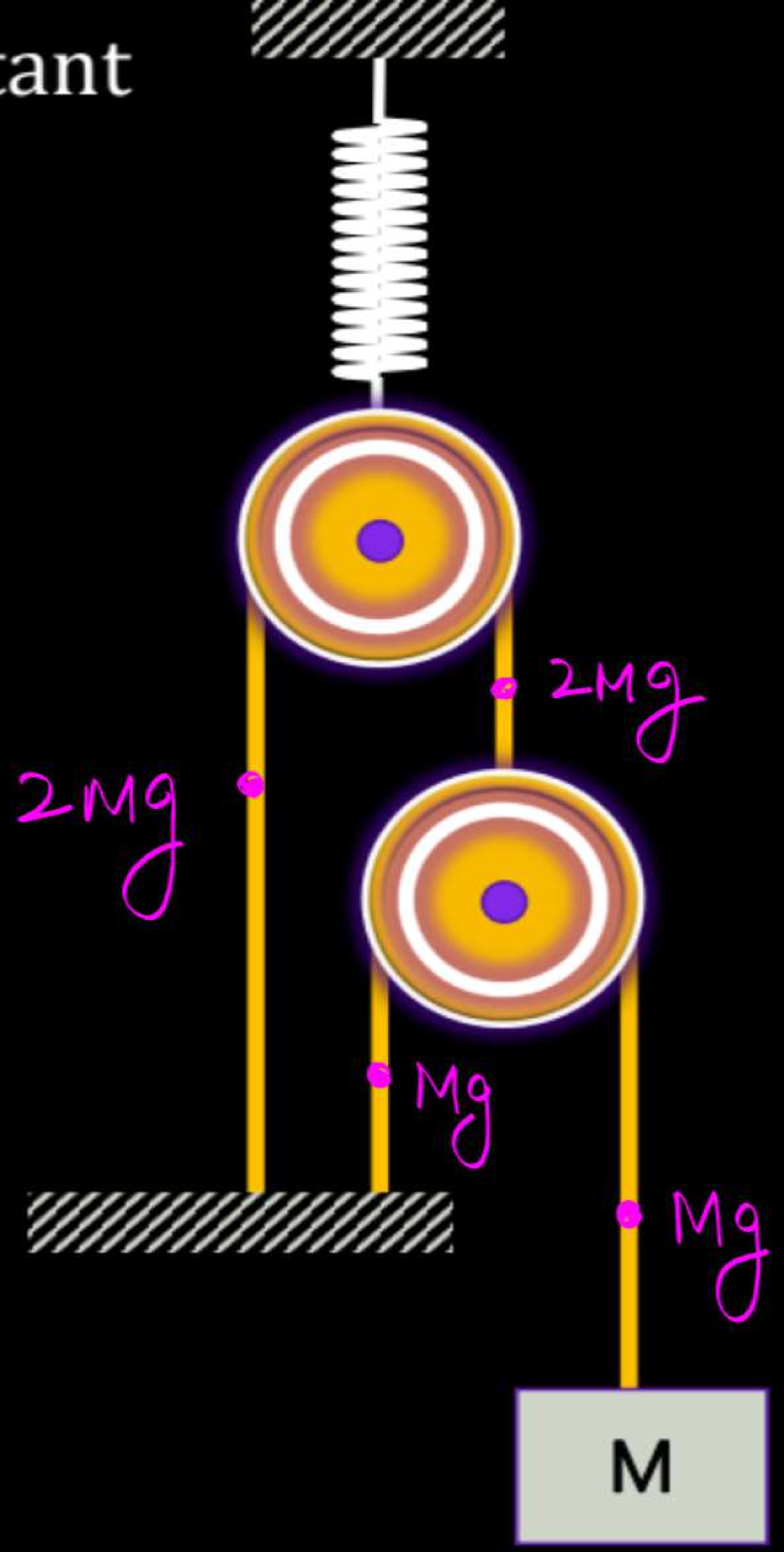
The system is in equilibrium. Pulleys are massless. K is the force constant of the spring. Find the net tension force acting on the lower support.

A. Mg

B. 2Mg

C. 3Mg ✓

D. 4Mg



A mass M is suspended as shown in figure. The system is in equilibrium. k is the force constant of the spring. The extension produced in the spring is given by

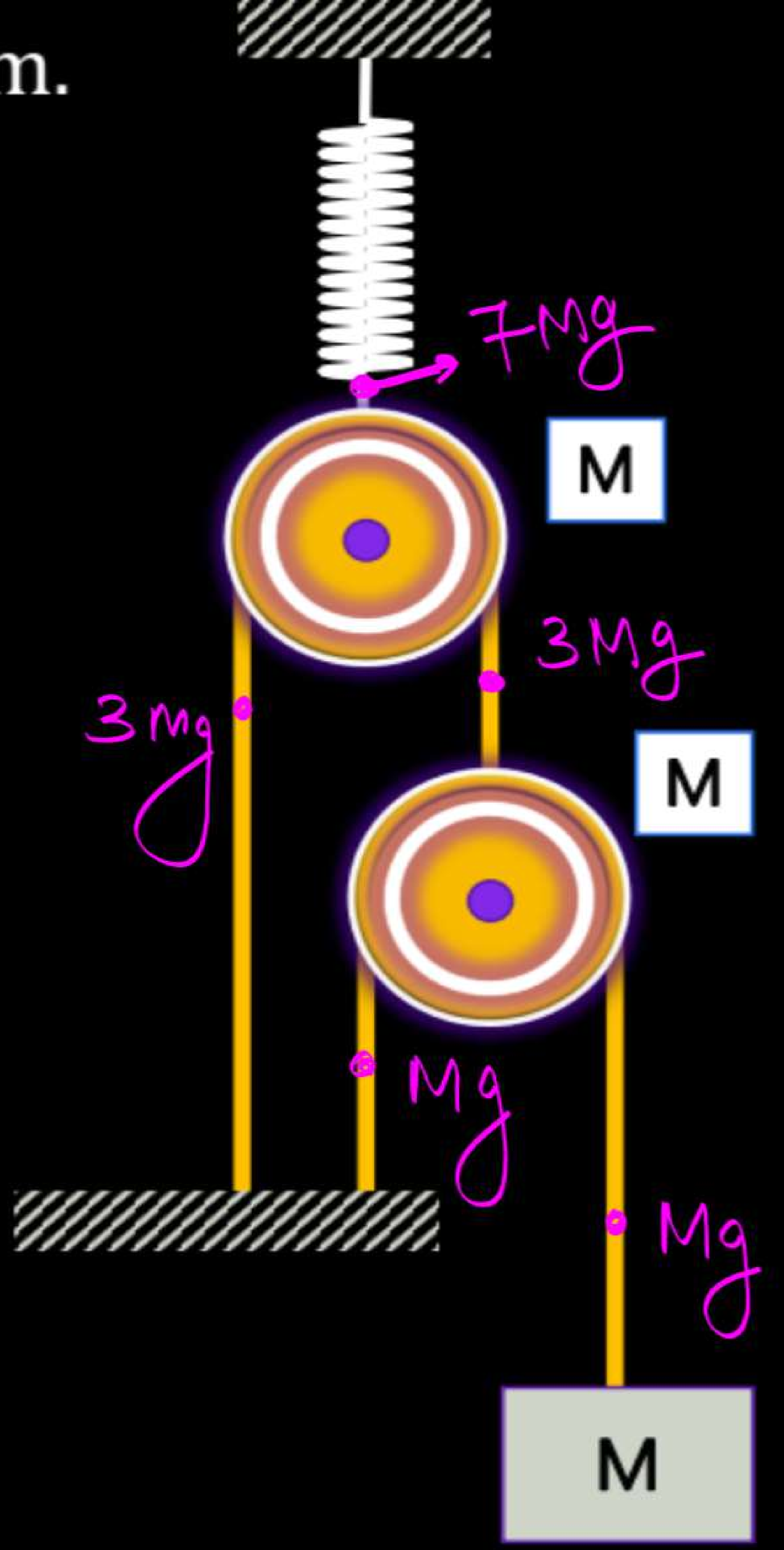
A. 4Mg/k

B. 7Mg/k

C. 5Mg/k

D. 3Mg/k

$kx = 7Mg$



The system is in equilibrium. K is the force constant of the spring. Find the net tension force acting on the lower support.

A. Mg

B. 2Mg

C. 3Mg

D. 4Mg