YAKEEN NEET 2.0

2026

Laws of Motion

Physics | Lecture - 06

By- Manish Raj (MR Sir)

Todays Goal

→ Connected body Motion with spring & Pulley

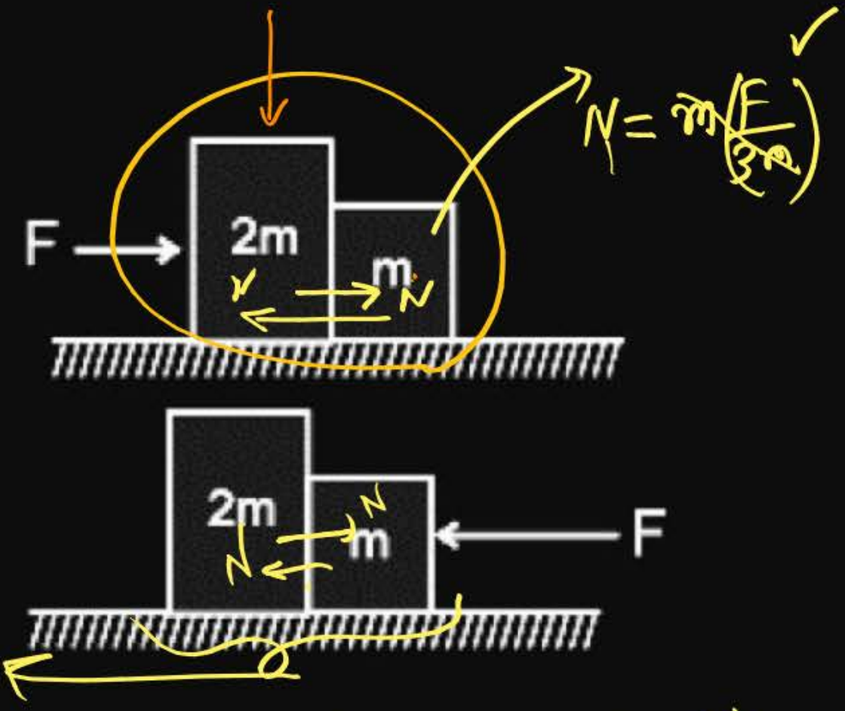
Question 3

Two blocks are in contact on a frictionless table. One has mass *m* and the other 2m. A force F is applied on 2m as shown in the figure. Now the same force F is applied from the right on m. In the two cases respectively, the ratio of force of contact between the two blocks will be:

1. Same
2. 1 : 2
3. 2 : 1
4. 1 : 3

$\frac{N_1}{N_2} = \frac{\frac{F}{3}}{\frac{2F}{3}} = \frac{1}{2}$

$a = \frac{F}{3m}$



$N = m\left(\frac{F}{3m}\right)$

$a = \frac{f}{3m}$

$N = 2m(a)$

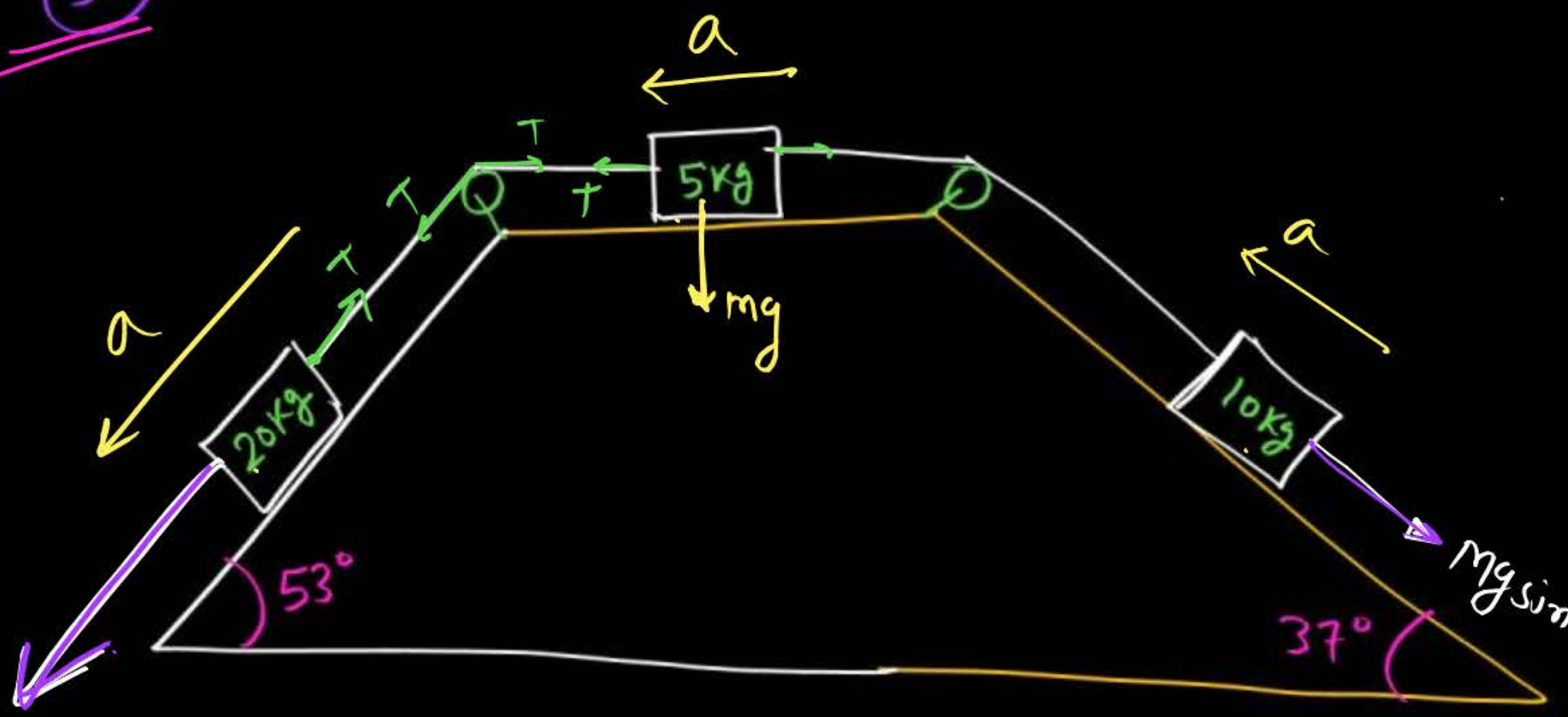
$N_2 = 2m\left(\frac{f}{3m}\right) = \frac{2F}{3}$

find acc^{n}.

50

$\sin 37^\circ = \frac{3}{5}$

$\sin 53^\circ = \frac{4}{5}$



$20 \times 10 \times \sin 35^\circ$

$20 \times 10 \times \frac{4}{5} = 160N$

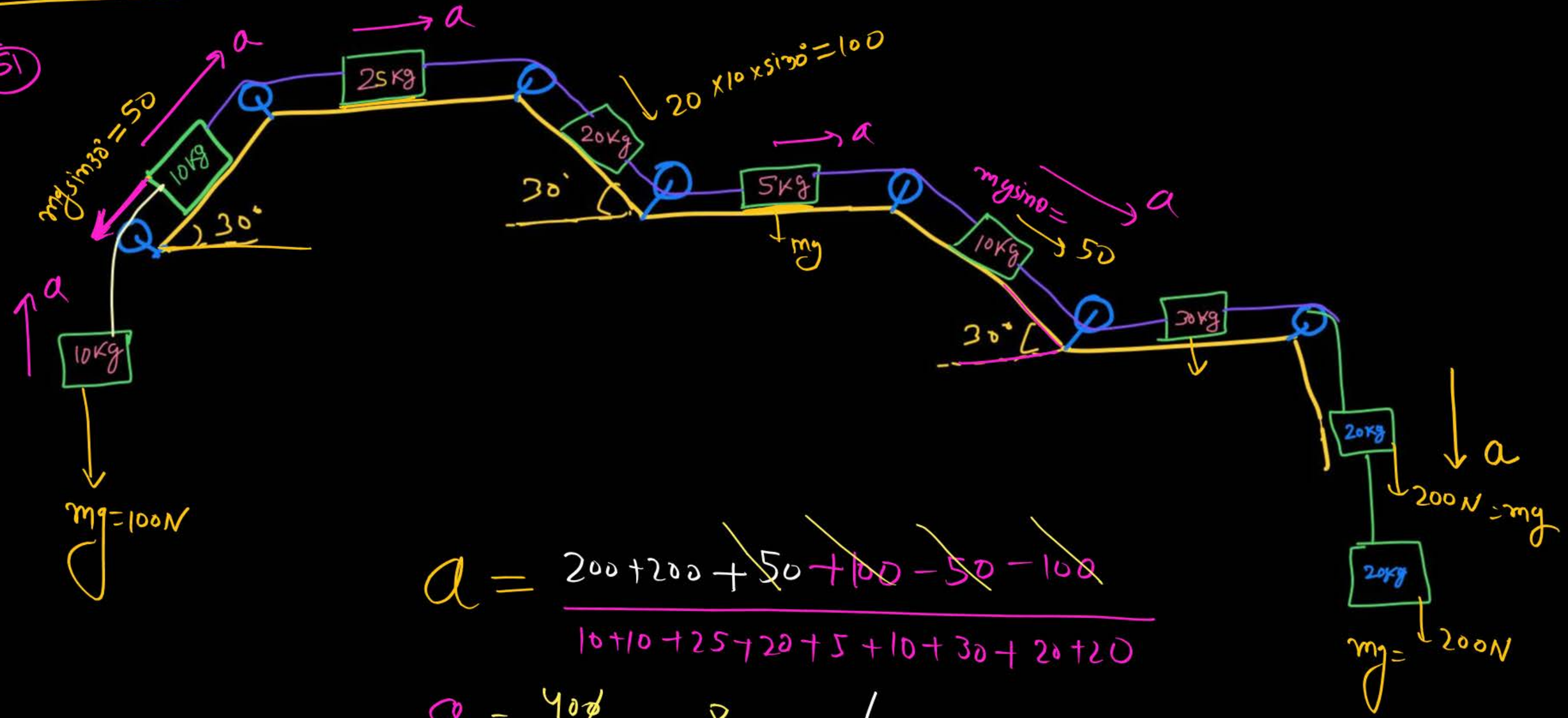
$mg\sin\theta = 10 \times 10 \sin 37^\circ$

$= 10 \times 10 \times \frac{3}{5} = 60N$

$$a = \frac{160 - 60}{20 + 5 + 10} = \frac{100}{35}\ m/s^2$$

find acc^n of all block:-

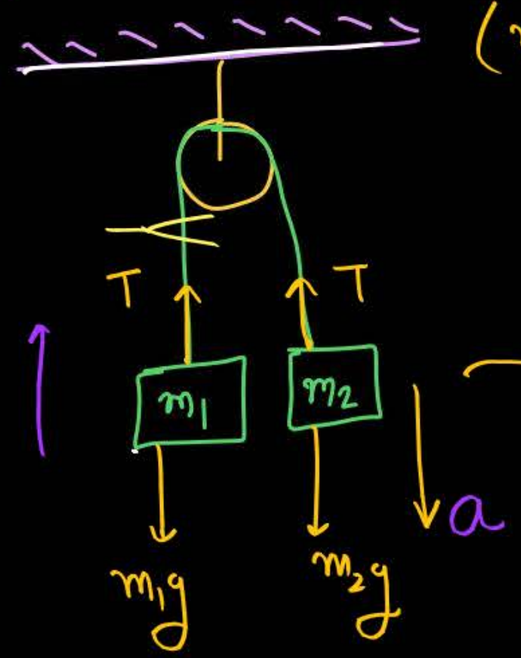
(51)



$$a = \frac{200 + 200 + \cancel{50} + \cancel{100} - \cancel{50} - \cancel{100}}{10+10+25+20+5+10+30+20+20}$$

$$a = \frac{400}{150} = \frac{8}{3}\ m/s^2$$

(52) If find acceleration and Tension in string :-



($m_2 > m_1$)

$$a = \frac{m_2g - m_1g}{m_1 + m_2}$$

$m_2g - T = m_2a$

Puting value of (a)

$T = m_2g - m_2(a)$

$= m_2g - m_2\left[\frac{m_2g - m_1g}{m_1+m_2}\right]$

after solving

$$T = \left(\frac{2m_1m_2}{m_1+m_2}\right)g$$

(dimensionally)

$m_1g < T < m_2g$

MR* If string is cut (Tension will be) zero.

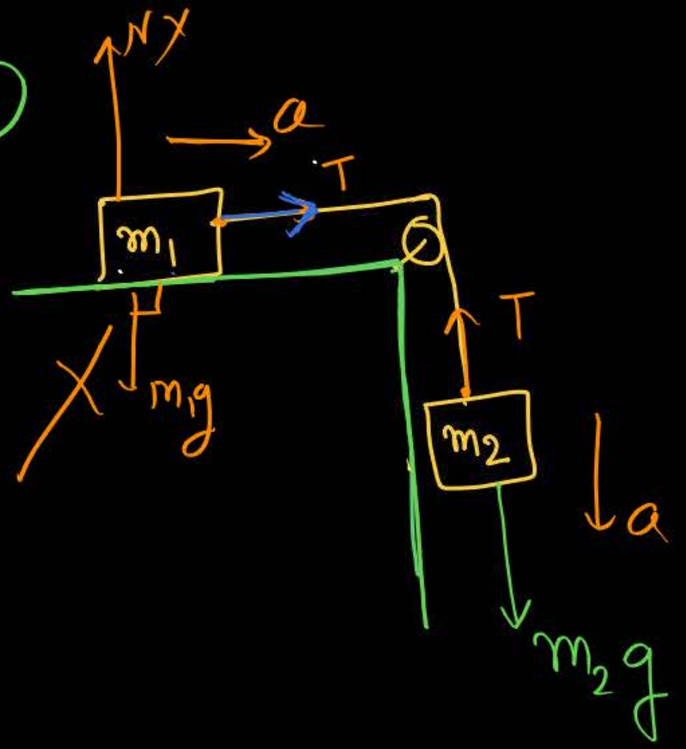
hence for m_2 → value of $m_1 = 0$

$T = 0$

$a = g$

(53)

find Tension in string:- and acceleration.



$$a = \frac{m_2 g}{m_1 + m_2}$$

dimensionally correct

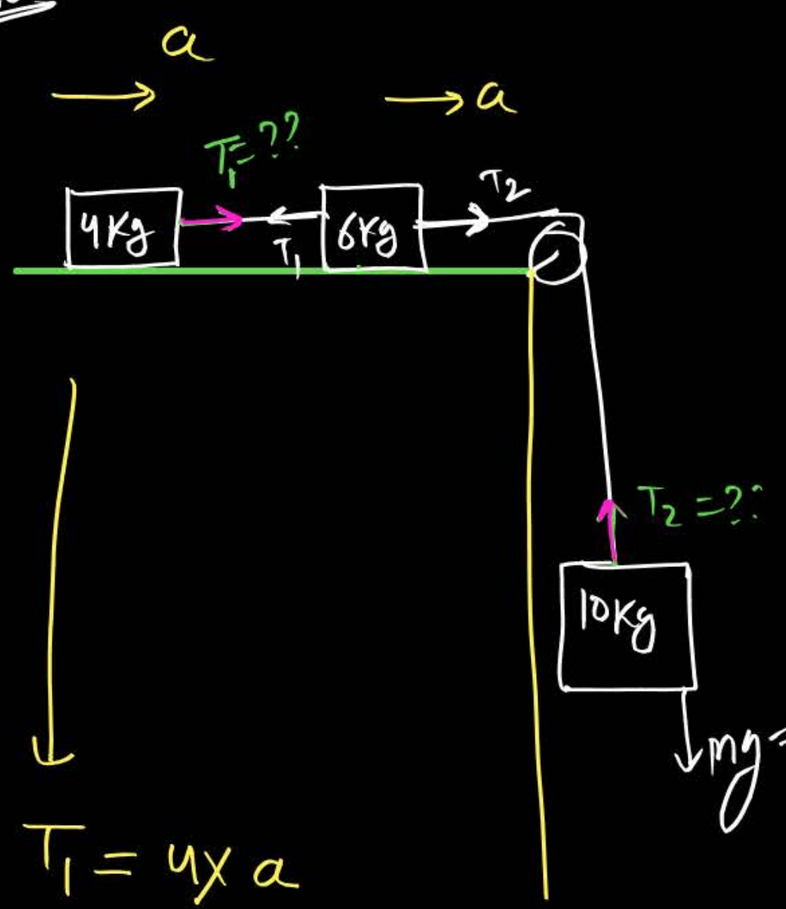
FBD of m_1 for Tension

$$T = m_1 a = \frac{m_1 m_2 g}{m_1 + m_2}$$ ✓

@ Likho

54

find T_1 & T_2 = ??



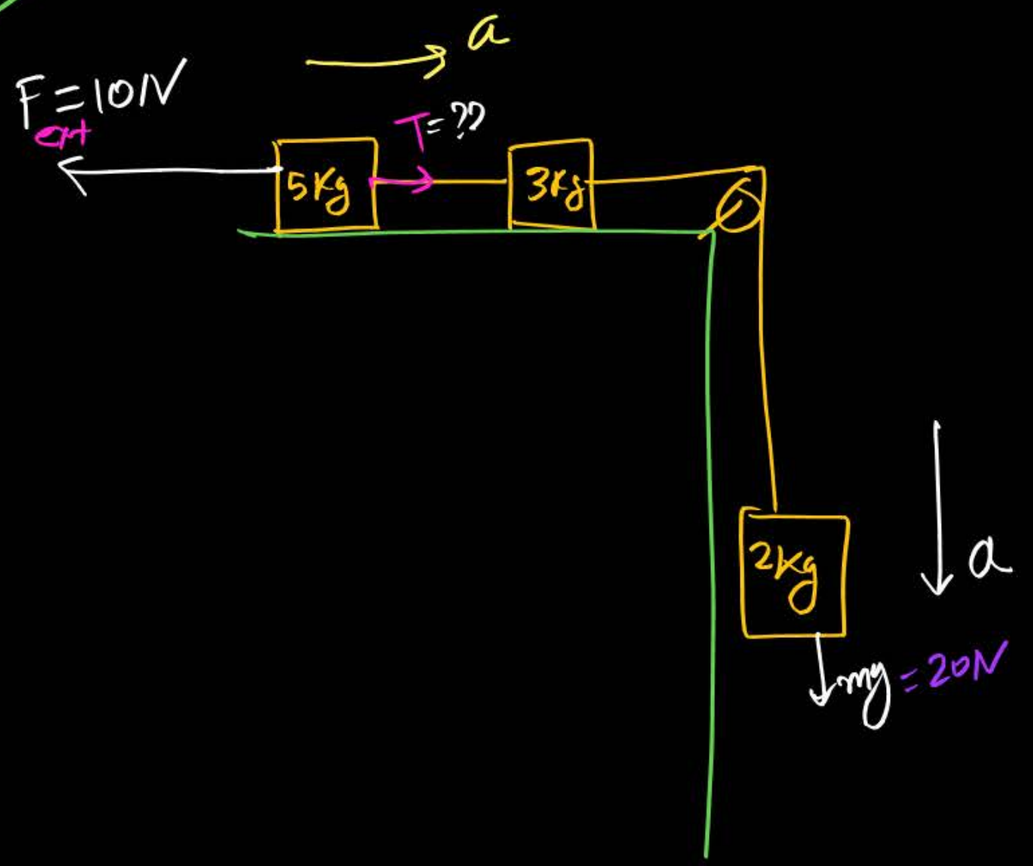
$$\# \quad a = \frac{100}{10+6+4} = \frac{100}{20} = 5\,m/s^2$$

$$100 - T_2 = 10 \times 5$$

$$T_2 = 100 - 50 = 50N$$

$$T_1 = 4 \times a$$
$$= 4 \times 5$$
$$T_1 = 20N$$

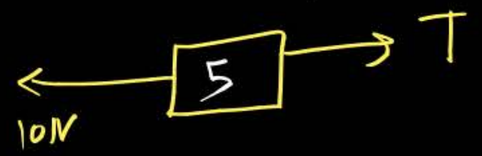
55



find Tension & acc^{n}:

$$a = \frac{20-10}{5+3+2} = \frac{10}{10} = 1\ m/s^2$$

F BD of 5kg

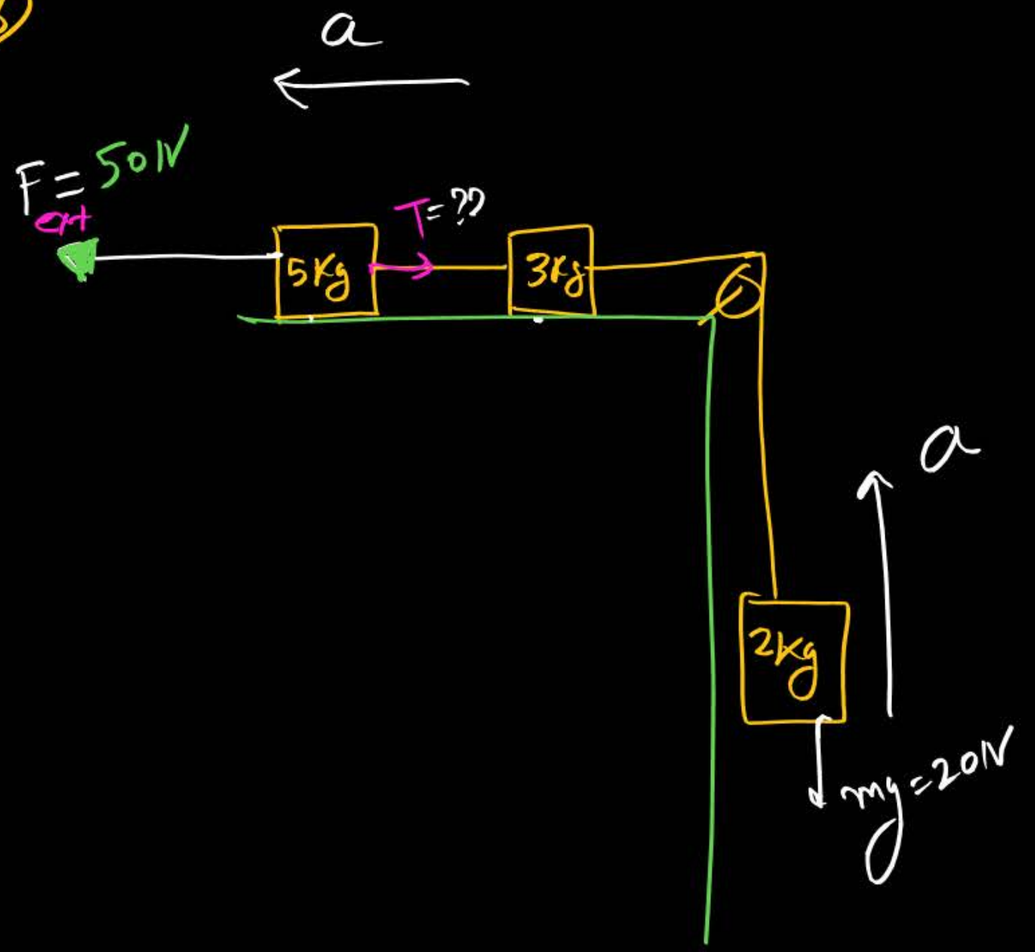


$$T - 10 = 5 \times a$$

$$T = 10 + 5 \times 1 = 15\ N$$

Ans

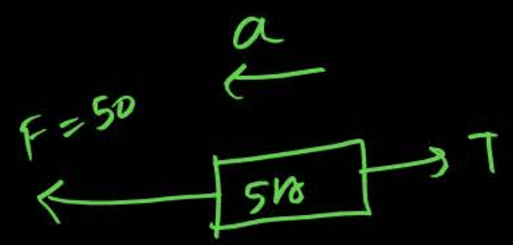
56



find Tension & acc^{n}:

$$a = \frac{50 - 20}{5+3+2} = \frac{30}{10}$$

$$= 3 m/s^2$$

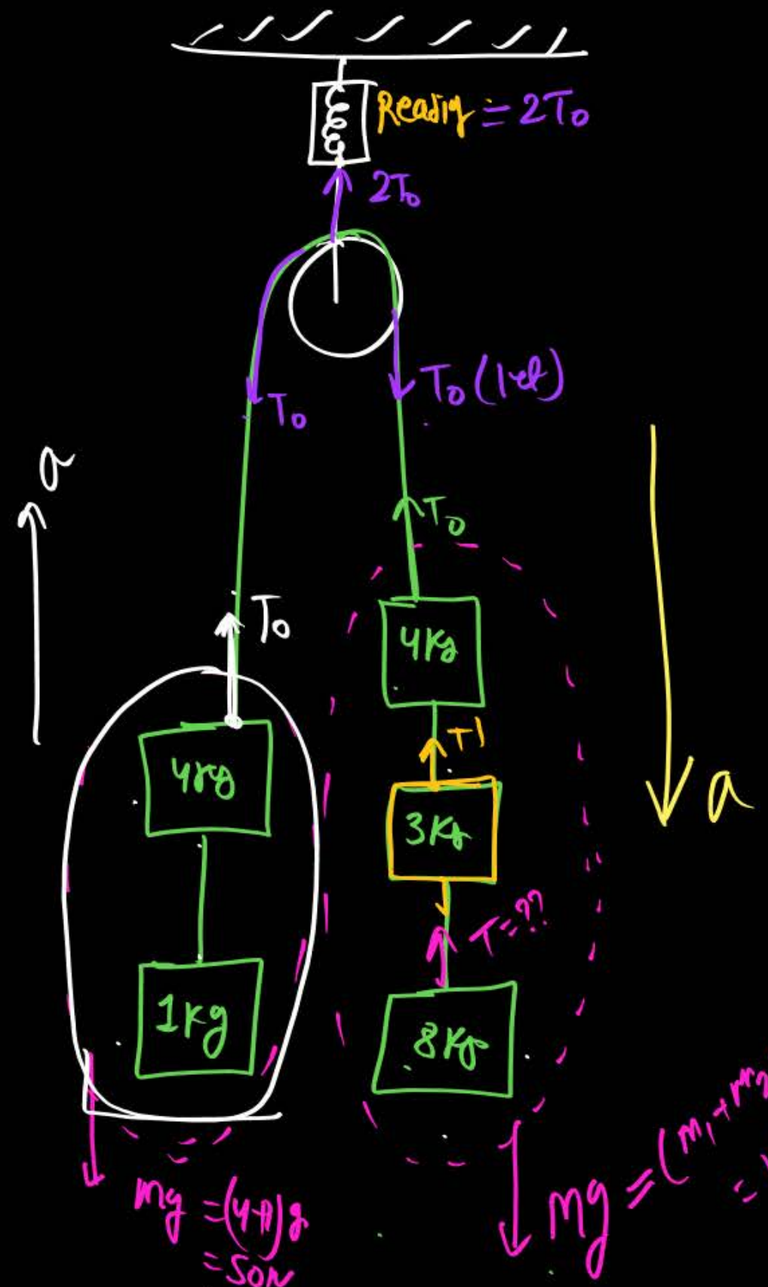


$$50 - T = 5 \times a$$

$$T = 50 - 5 \times 3 = 35N$$

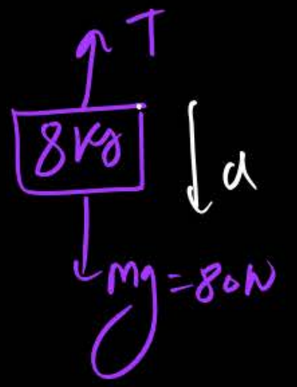
Ans

57



Soln

$$a = \frac{150-50}{8+4+3+4+1} = \frac{100}{20} = 5\,m/s^2$$

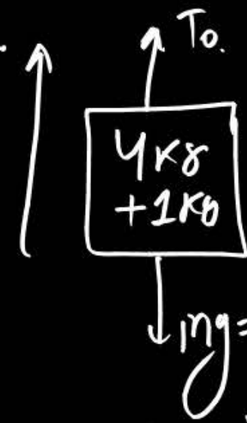


$80 - T = 8 \times a$

$T = 80 - 8 \times 5$

$T = 40N$ Ans

for T_0 FBD of (4kg+1kg)

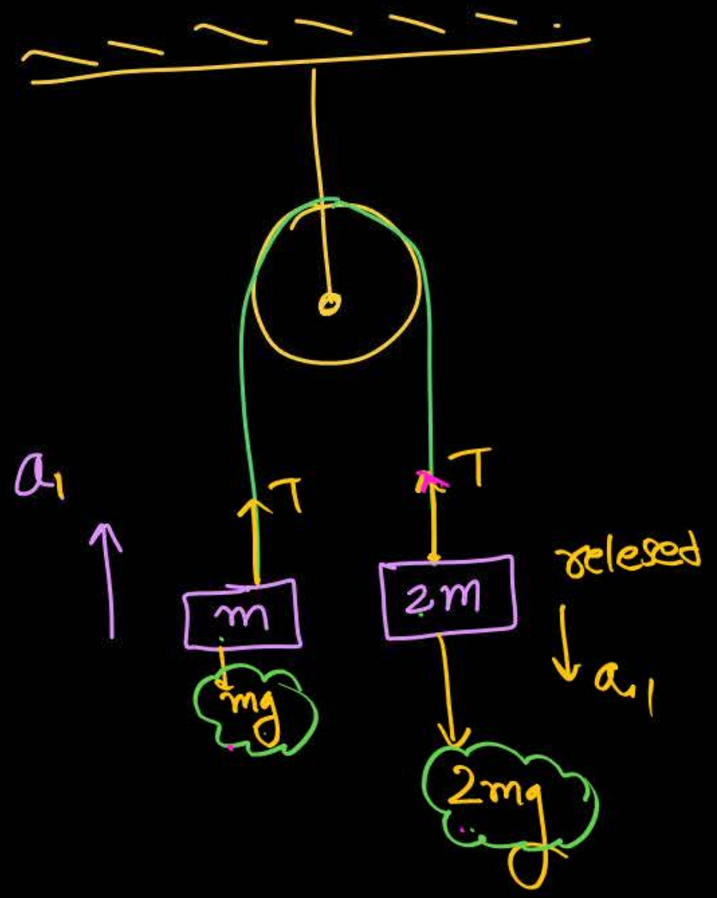


$T_0 - 50 = 5a$

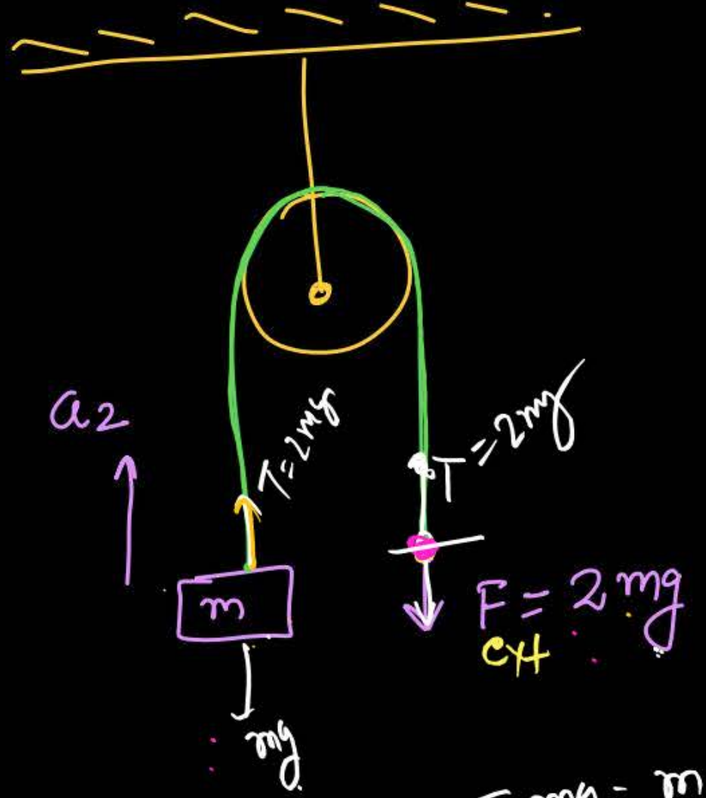
$T_0 = 50 + 5 \times 5 = 75N$

$Reading = 2T_0 = 2 \times 75 = 150$

(58)



$$+\quad 2mg - T = 2ma_1$$
$$+\quad T - mg = ma_1$$
$$mg = 3ma_1$$
$$a_1 = g/3$$



$$T - mg = ma_2$$
$$2mg - mg = ma_2$$
$$g = a_2$$

Rel^n B/w a_1 & a_2

MR Scam

~~(a) $a_1 = a_2$ (62%)~~

(b) $a_1 > a_2$

~~(c)~~ $a_1 < a_2$

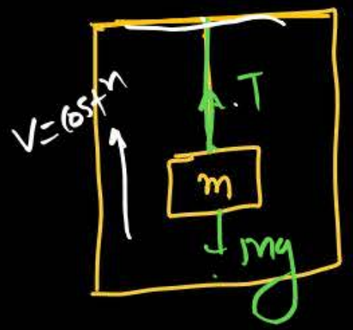
MR*

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

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

$$a = g$$

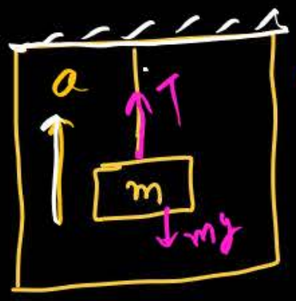
Case-2



lift ↑ V=const^n

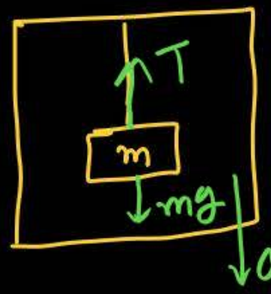
T=mg

Case-3



lift

acc^n ↑ a



lift

acc ↓ = a

T − mg = ma

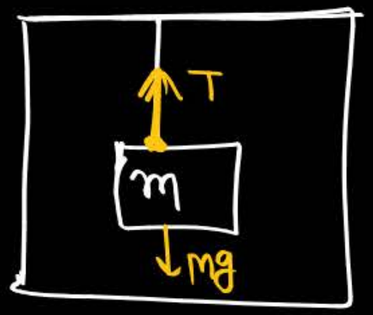
T = mg + ma

mg − T = ma

T = mg − ma

T = m(g − a)

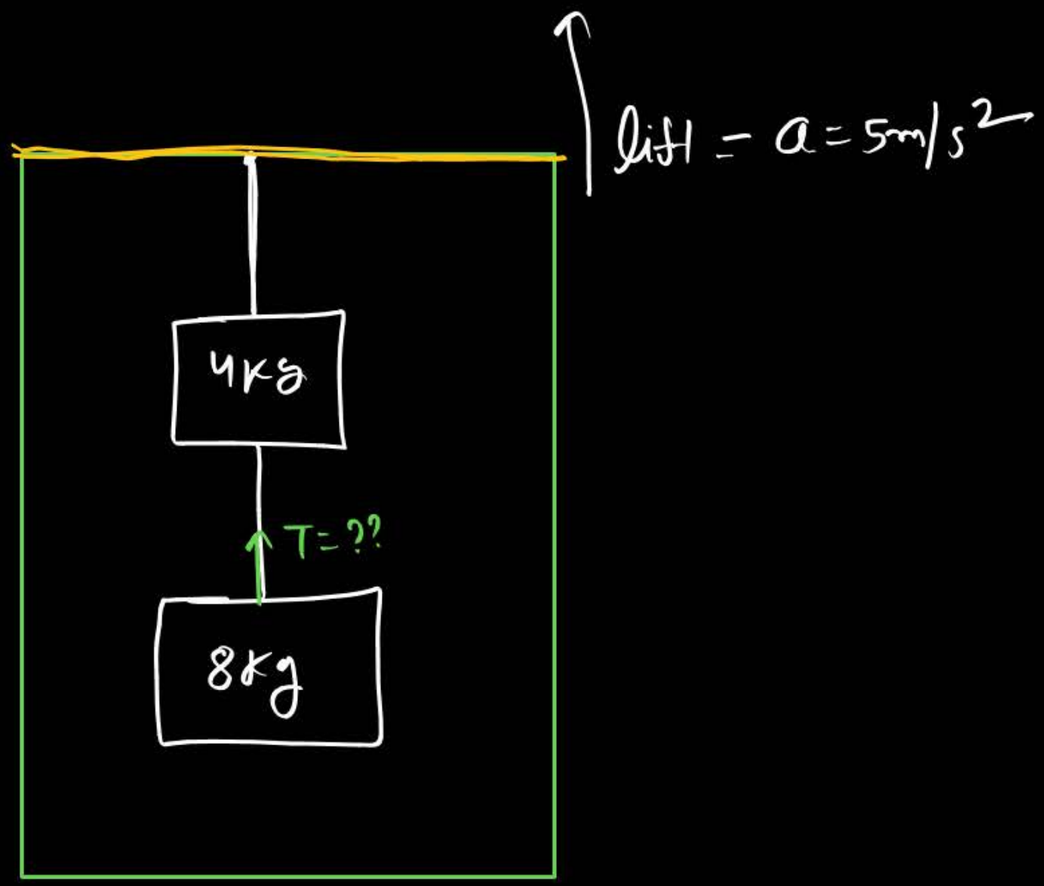
Case-1

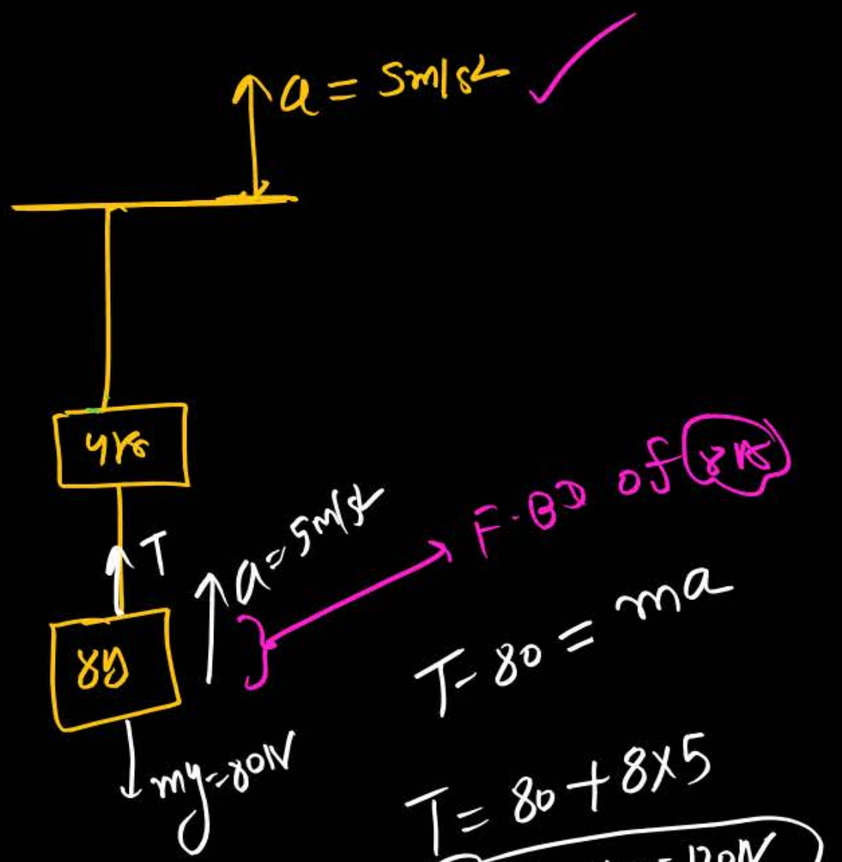


lift is at rest.

T = mg − ①

Q





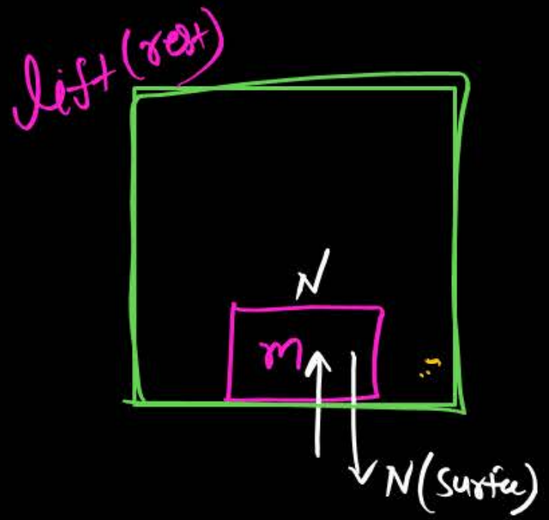
$T - 80 = ma$

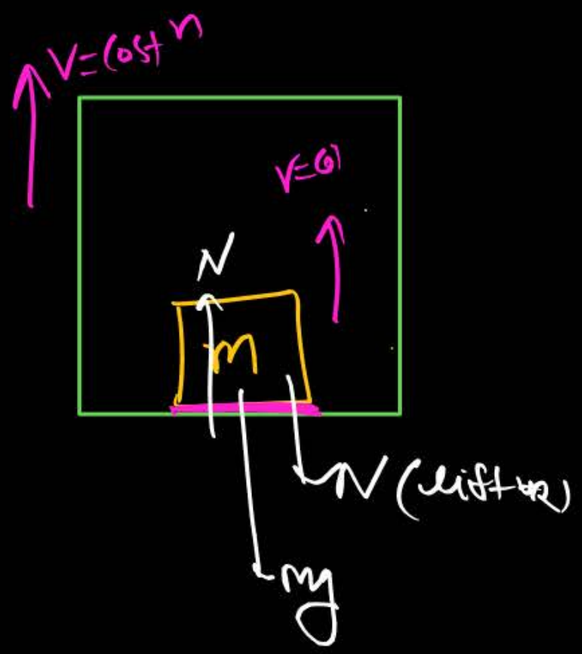
$T = 80 + 8 \times 5$

$T = 80 + 40 = 120N$

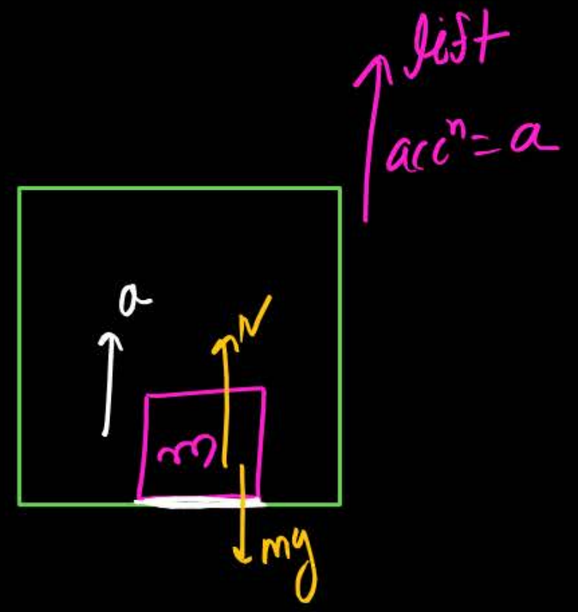
Ans

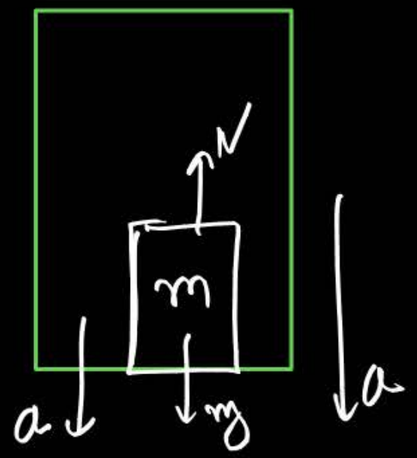
Find Normal reaction Between lift and block

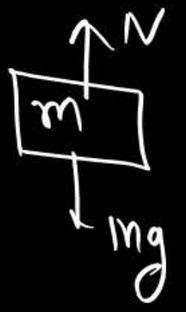




$N = mg$







(i) $N = mg$

$N - mg = ma$

$N = mg + ma$

$N = m(g+a)$

$mg - N = ma$

$N = mg - ma$

$N = m(g-a)$

(a)

lift is moving up with retardation $a = 4 m/s^2$ then find contact force b/w Block & lift.

$F_{net} = ma$

$mg - N = ma$

$50 - N = 5 \times 4$

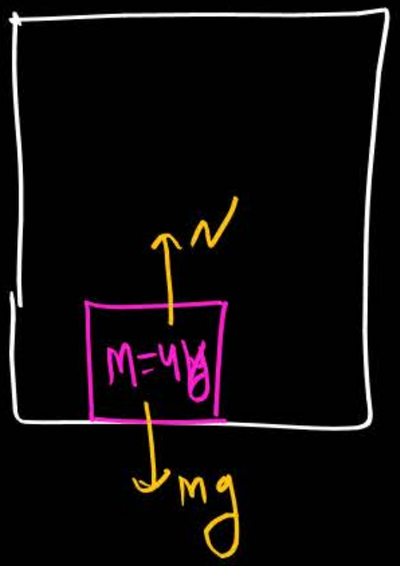
$N = 50 - 20$

$N = 30$ Newt

$N = 70$ Newt

(a)

force by 4kg on surface of lift :—



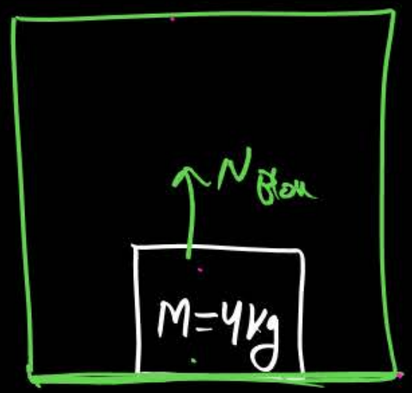
$a = 6\,m/s^2$ (Moving down)

$Mg - N = ma$

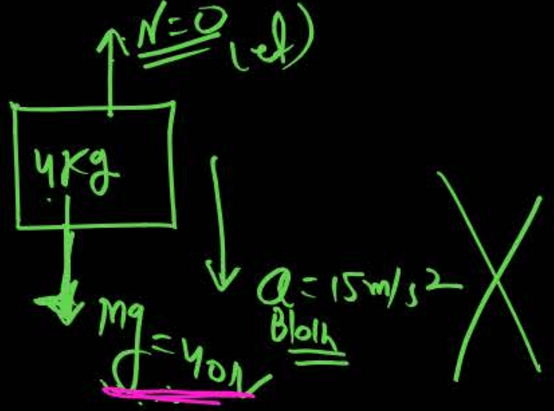
$40 - N = 4 \times 6$

$N = 40 - 24 = 16$ newton

Q.



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



$F_{net} = mg$

$ma = 40$

$4a = 40$

$a = 10\ m$ Maximum.

Mab

find Contact force on 4kg by surface of lift ??

MR Scam

Avg $N = 20$

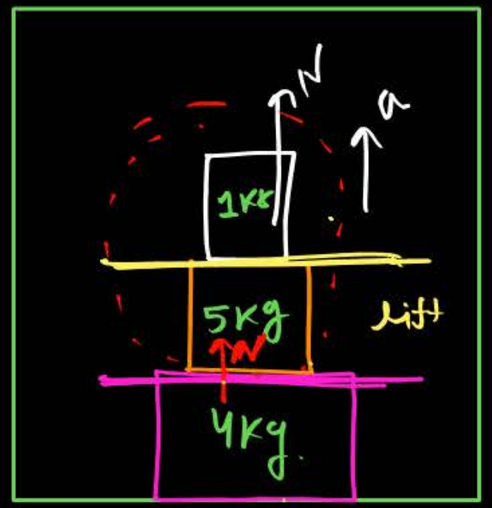
$N = -20$

No Contact
No Normal

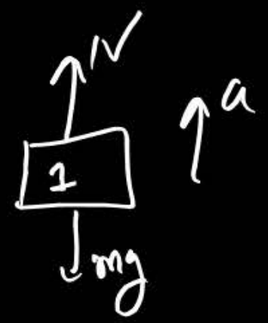
Avg $N = 0$

Normal can't be negative

likho



lift
acc^n = 5 m/s^2



find contact force b/w
5kg & 1kg

$N - mg = ma$

$N = mg + ma$

$= 1 \times 10 + 1 \times 5$

$= 15$ Newt

MR* Box
Jaha Normal nikalna hai, uske upar wale saare object ko ek sath Man ke FBD Bnao

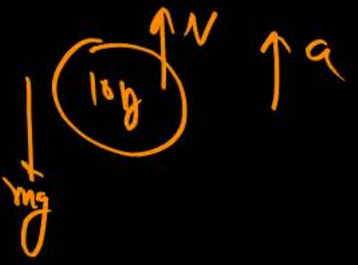
find force on 4kg by lift

$N = m(g+a)$

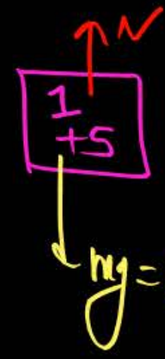
$= 10(10+5)$

$= 150N$

Combined FBD of



find Normal b/w 5kg & 4kg

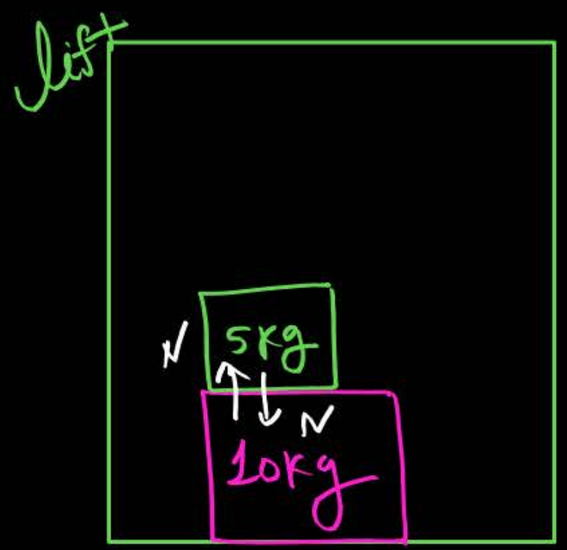


$N - 60 = ma$

$N = 60 + 6 \times 5$

$= 90\ N$

Q)



Q)

find Normal B/w 5kg & 10kg ✓

FBD of 5kg

$mg - N = ma$

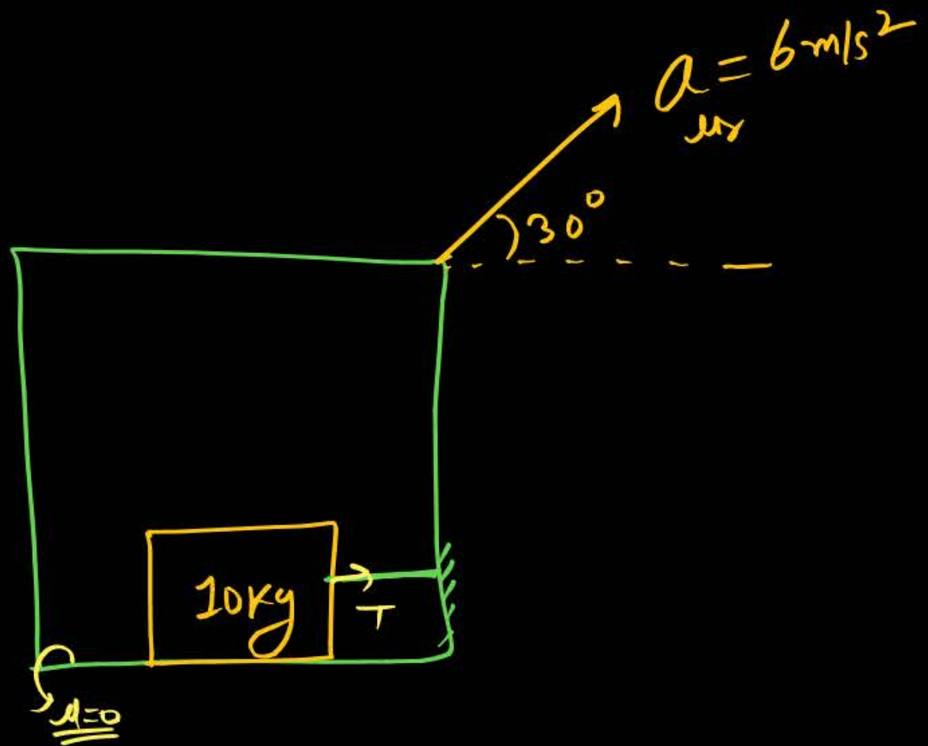
$N = mg - ma$

$= 5(10-4)$

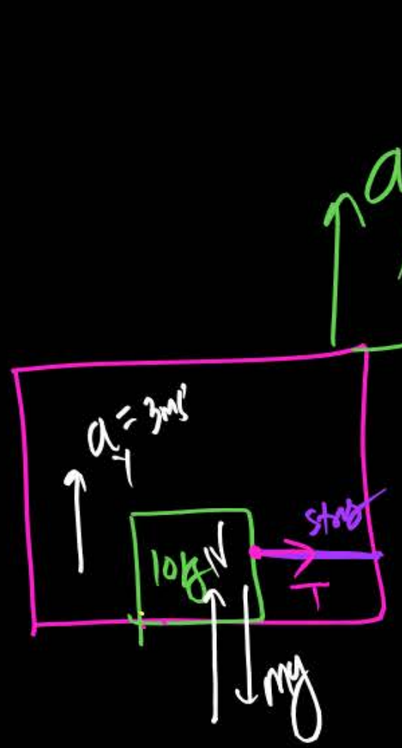
$= 5 \times 6$

$= 30N$

Q)



find Normal rexn B/w Block & lift :-



$N - mg = ma$] y-axis

$N = mg + ma$

$= m(g+a)$

$= 10(10+3)$

$= 10\times 13 = 130\ N$

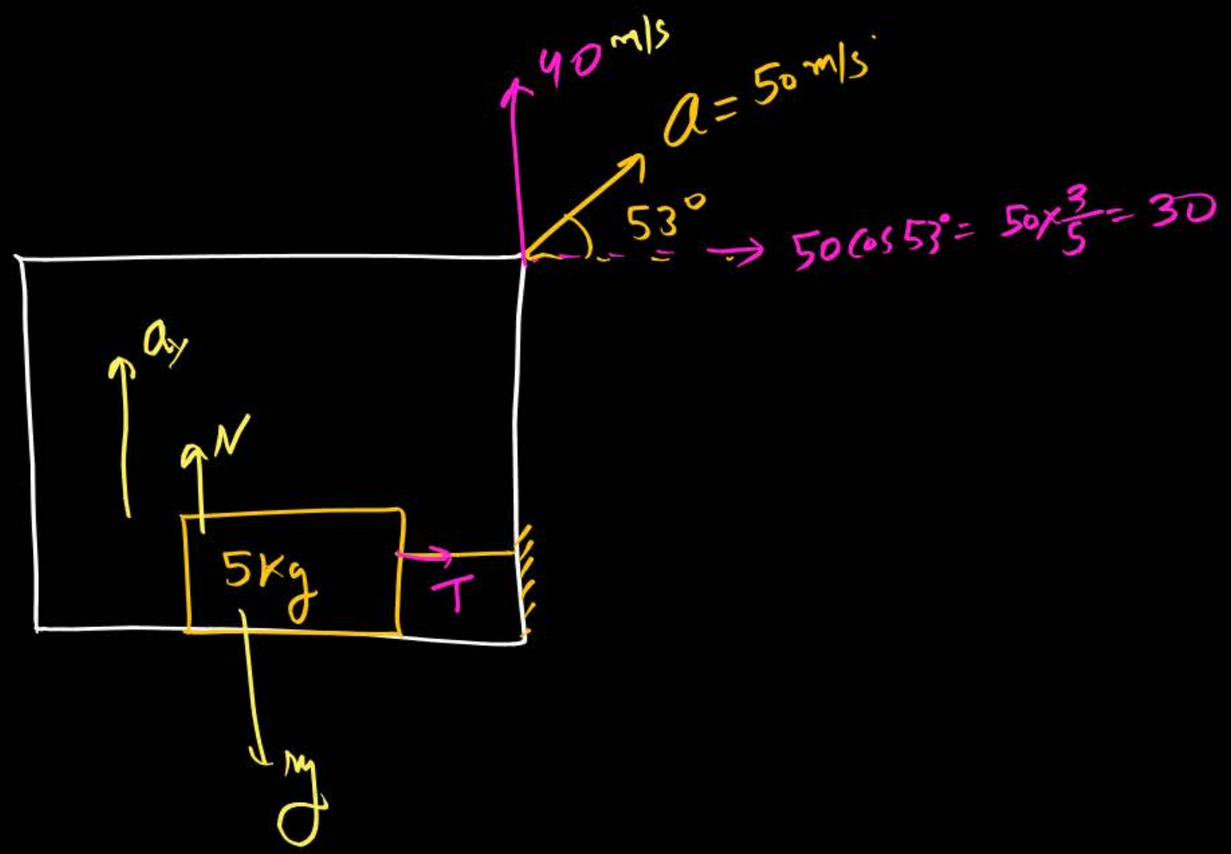
x-axis

$T = ma$

$= 10\times 6\cos 30° = 10\times 6\times\frac{\sqrt{3}}{2}$

$= 30\sqrt{3}$

⑩



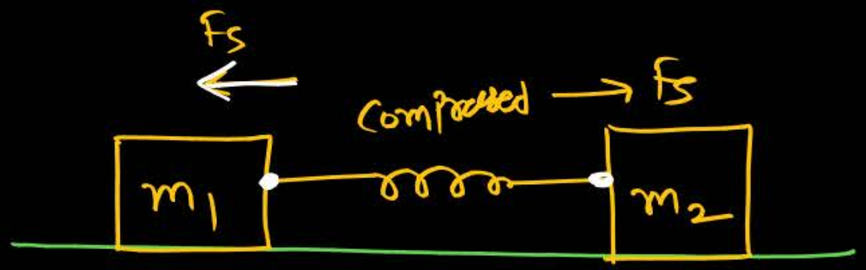
find Normal rexn & Tension in string :-

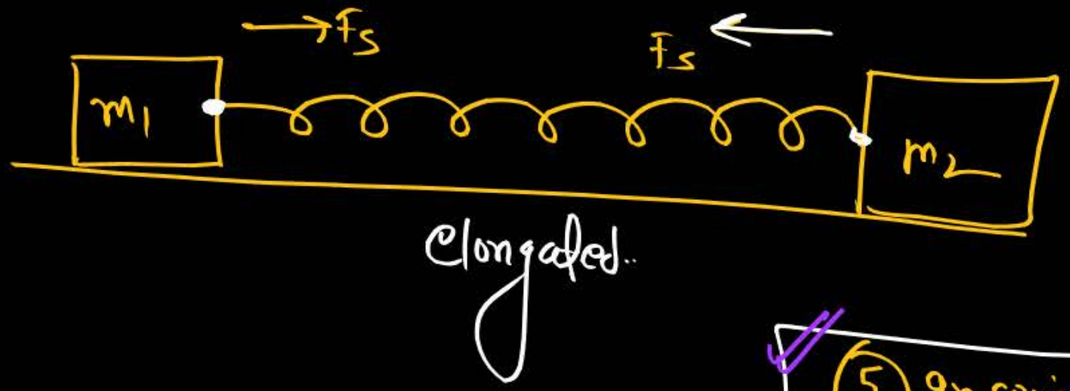
$N = 5 \times 50 = 250$ New

$T = 5 \times 30 = 150$ New

Connected body motion with spring

#





Elongated..

MR*

① spring se connected dono mass ka acc^n same ho bhi skta hai or nahi bhi ✓

② spring force, spring ke length ke along or opposite bhi ho skta hai ✓

③ $\vec{F}_{ext} = m_1\vec{a}_1 + m_2\vec{a}_2$

(As discussed in Connected body motion with string ✓✓)

④ In string $a_1 = a_2 = a$

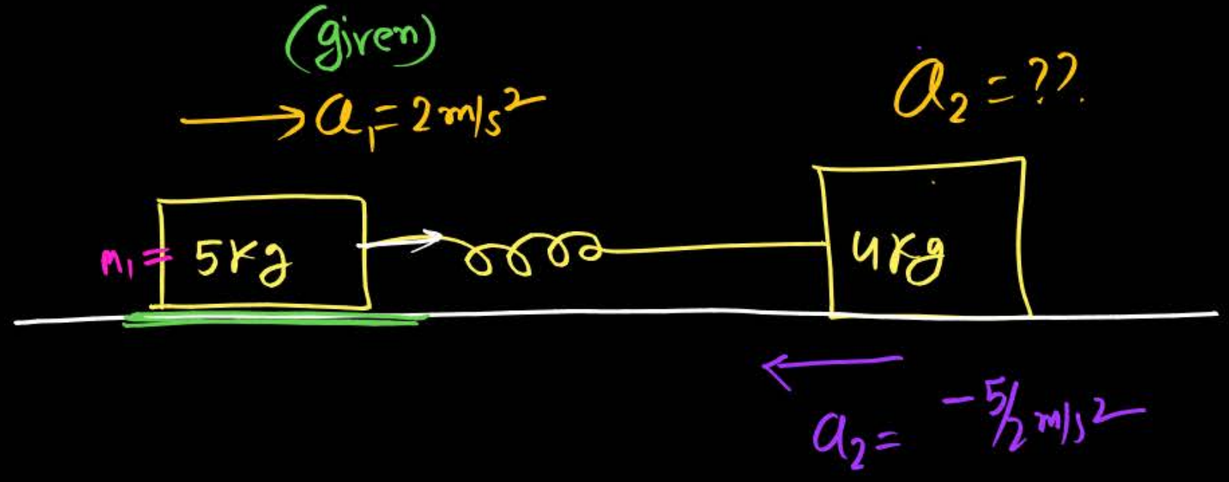
$F_{ex} = (m_1 + m_2)\, a$

$a = \dfrac{F_{ext}}{m_1 + m_2}$

⑤ In spring if $\vec{F}_{ext} = 0$

$m_1\vec{a}_1 + m_2\vec{a}_2 = 0$

Q)



No external force = 0

Sum

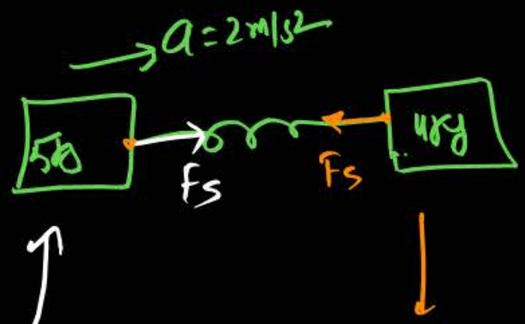
(#) $m_1\vec{a} + m_2\vec{a}_2 = 0$

$5 \times 2 + 4 \times \vec{a}_2 = 0$

$4a_2 = -10$

$\vec{a}_2 = -\frac{10}{4} = -5/2\ m/s^2$

2nd method



FBD

$F_s = ma$

$F_s = 5 \times 2$

$F_s = 10N$ *

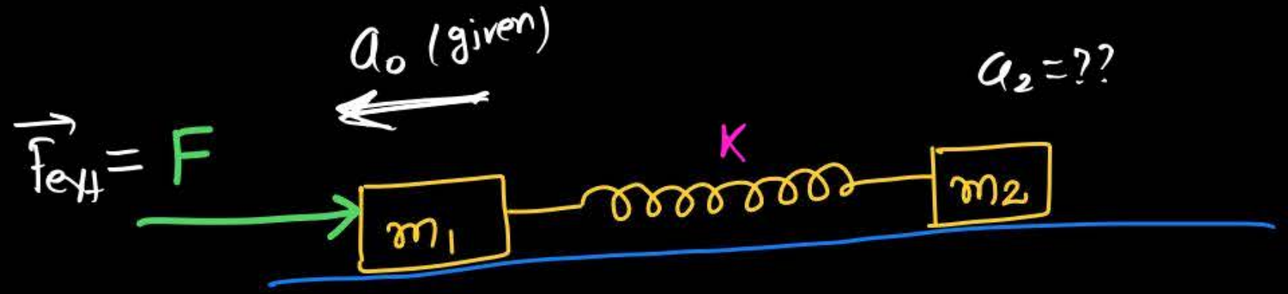
$\vec{F}_s = ma$

$10 = 4a$

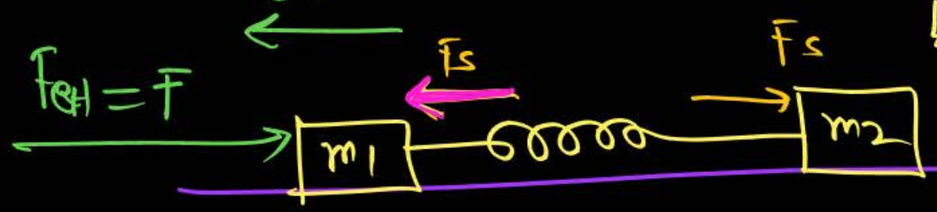
$a = \frac{10}{4}$

Back sub

ⓐ If acceleration of m_1 is a_0 in left then find, acc^n of m_2



Sol^n



FBD of m_1

$F_s - f = m_1 a_0$

$F_s = f + m_1 a_0$ — ①

FBD of m_2

$F_s = m_2 a_2$

$F + m_1 a_0 = m_2 a_2$

$$a_2 = \frac{F + m_1 a_0}{m_2}$$

Ans

ⓐ

$\vec{F}_{ext} = m_1 \vec{a}_1 + m_2 \vec{a}_2$

$F = -m_1 a_0 + m_2 \vec{a}_2$

$F + m_1 \vec{a}_0 = m_2 a_2$

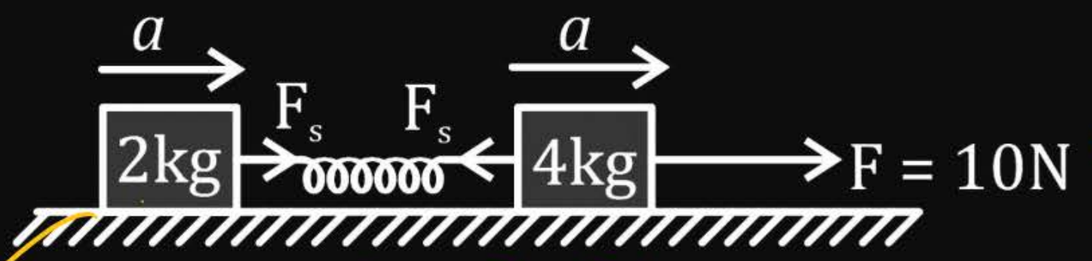
$$a_2 = \frac{F + m_1 \vec{a}_0}{m_2}$$

Ans

Question

Two blocks of mass 2 kg and 4 kg are accelerated with same acceleration by a force 10 N as shown in figure on a smooth horizontal surface. Then the spring force between the two blocks will be (spring is massless)

1. 5 N
2. 10 N
3. $\frac{10}{3}$ N
4. $\frac{5}{3}$ N



$m_1\vec{a}_1 + m_2\vec{a}_2 = F_{ext}$

$2 \times a + 4 \times a = 10$

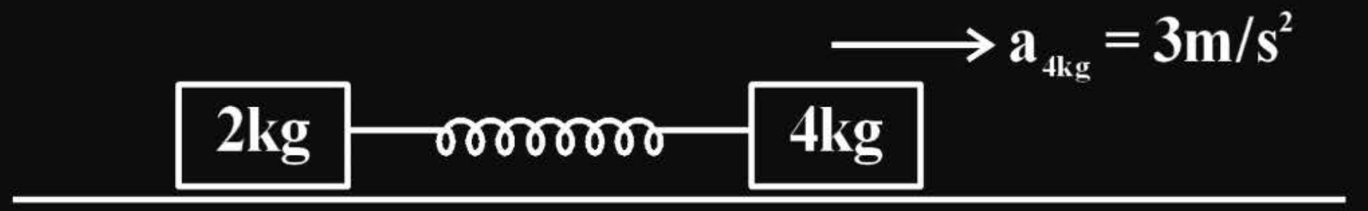
$6a = 10$

$a = \frac{10}{6}$ m/s²

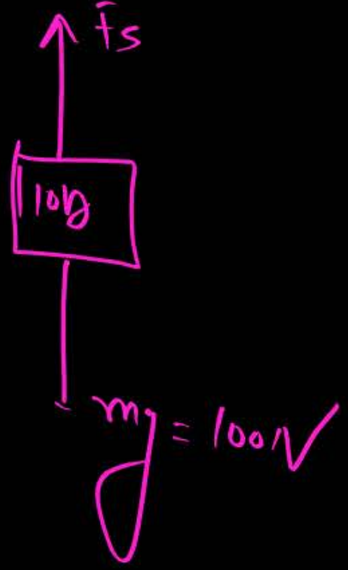
$F_s = 2 \times \frac{10}{6} = \frac{10}{3}$ newton

Question

Find acceleration of 2 kg.

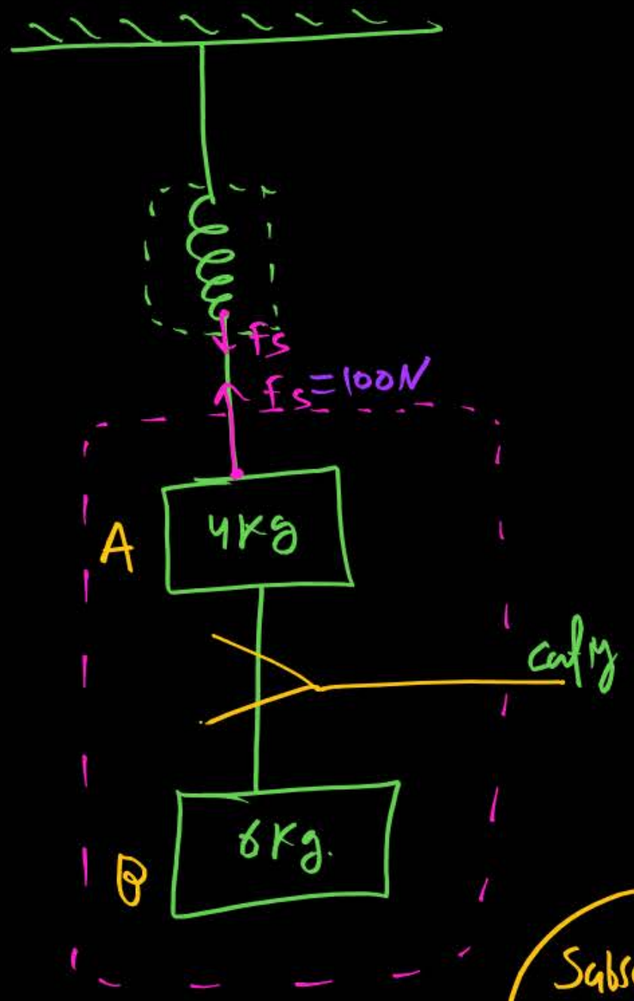


find spring force in equilibrium = ??

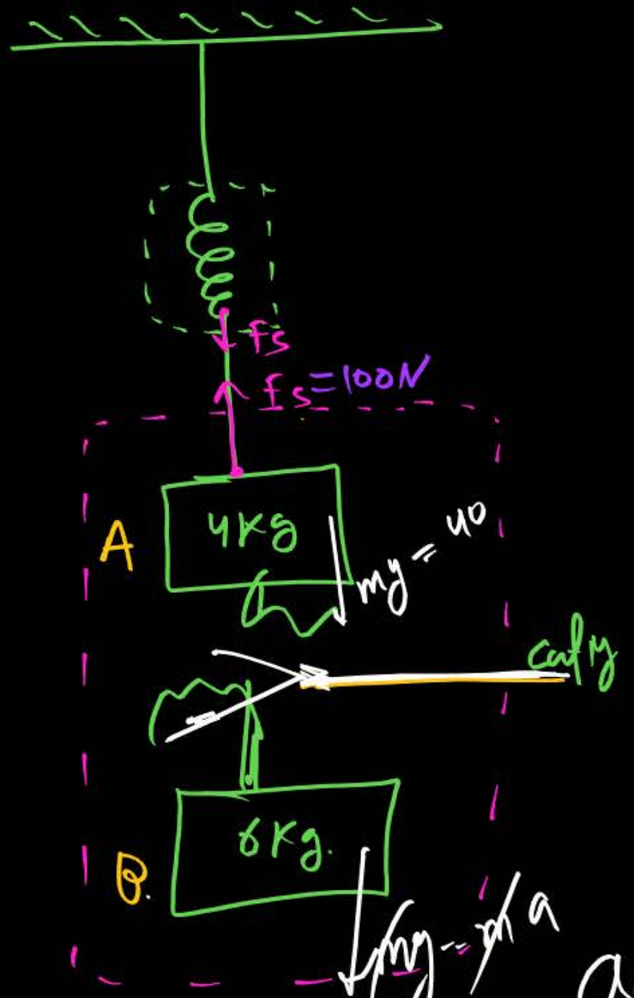


$F_S = 100N$

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



Sabse Pahle equilibrium ki Fs/T calculate



$T = ma$

$a_B = g$ (down)

MR. BOX

Just after cutting the string → T → become zero

but spring force remain same just after cutting →

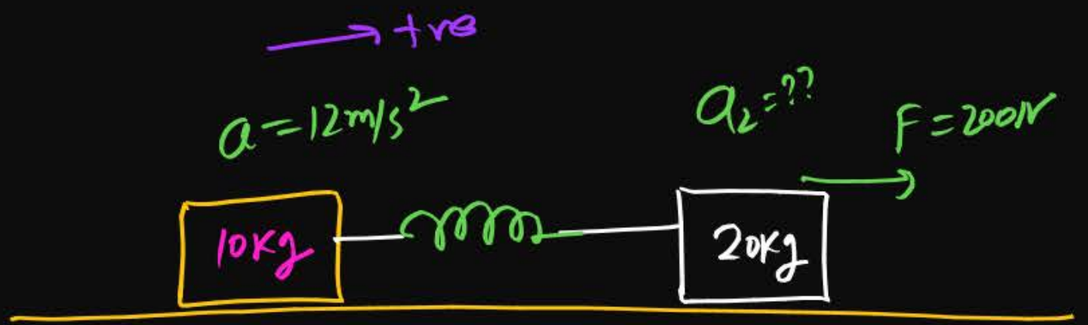
$$a_A = \frac{100-40}{4}$$

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

Question

Two masses of 10 kg and 20 kg respectively are connected by a massless spring as shown in figure. A force of 200 N acts on the 20 kg mass. At the instant shown the 10 kg mass has acceleration 12 m/s^2 towards right. The acceleration of 20 kg mass at this instant is:

1. 12 m/s^2
2. 4 m/s^2
3. 10 m/s^2
4. zero



$10 \times 12 + 20 \times a_2 = 200$

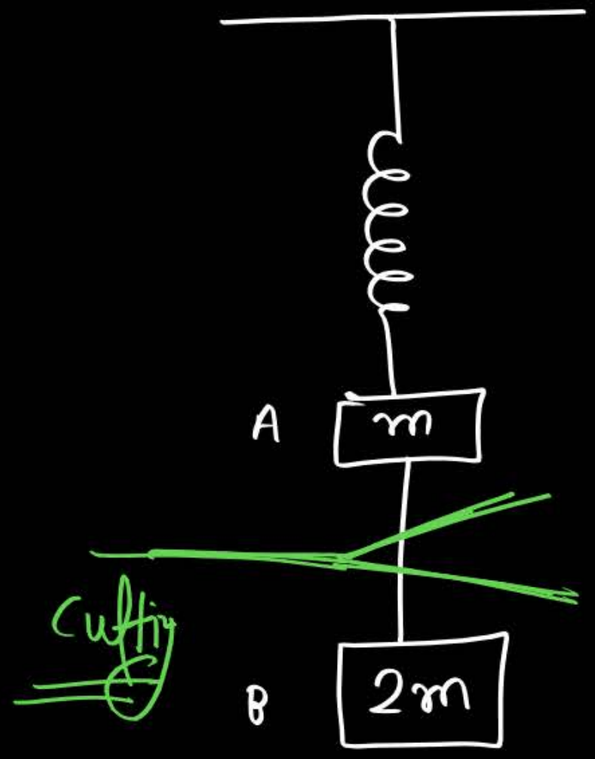
$120 + 20a_2 = 200$

$20a_2 = 200 - 120$

$20a_2 = 80$

$a_2 = \frac{80}{20} = 4 \text{ m/s}^2$ Ans

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



$a_A = 2g$ (upwards)

$a_B = g$ downwards.

H/W

THANK YOU