YAKEEN NEET 2.0

2026

Laws of Motion

PHYSICS | Lecture 15

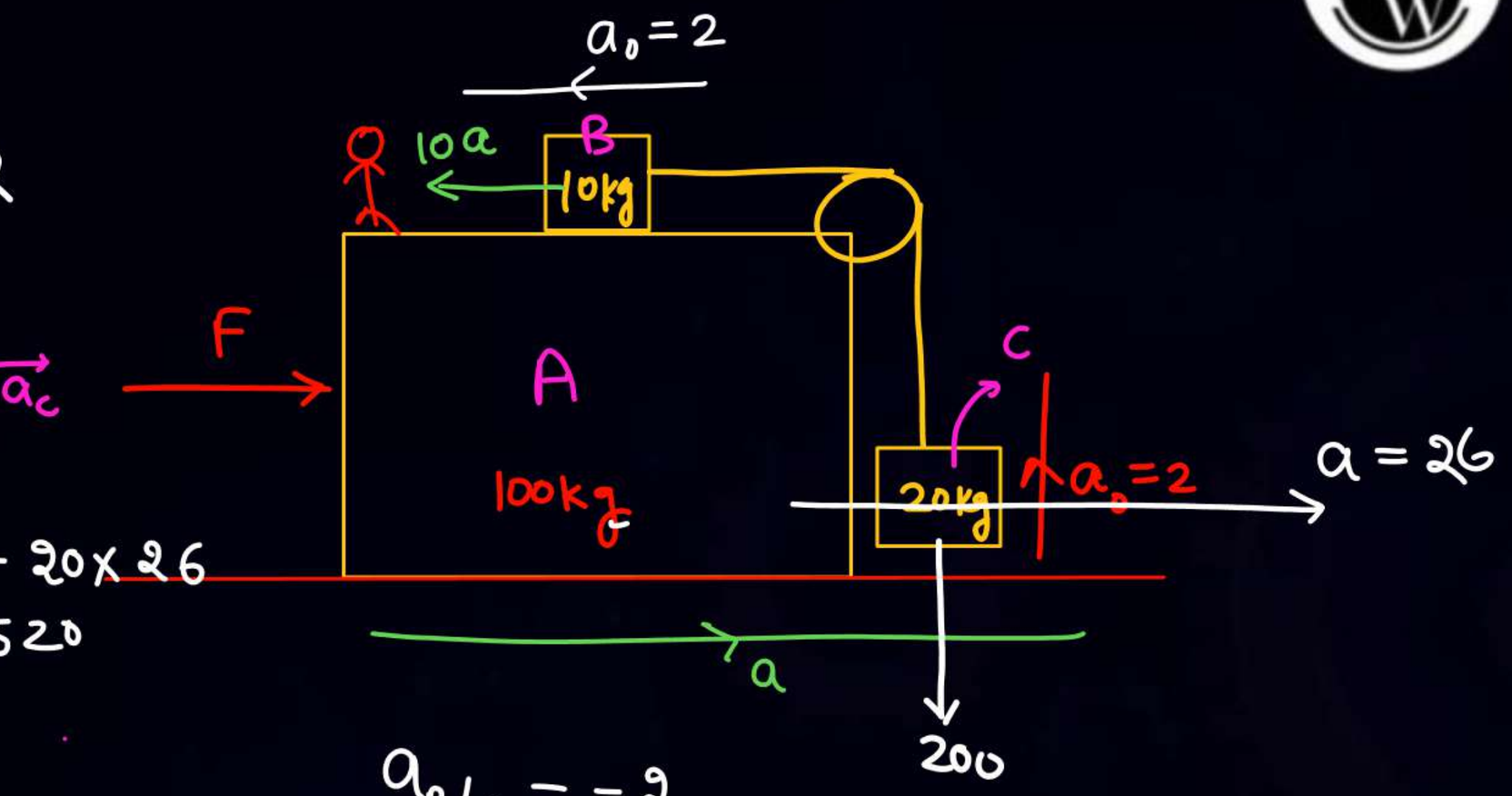
By - Saleem Ahmed Sir

Todays Goal

Questions on Friction (part 02)

F = ?

(68)



$10a - 200 = (10+20) \times 2$

$a = 26$

$\vec{F} = m_A\vec{a}_A + m_B\vec{a}_B + m_C\vec{a}_C$

$= 100 \times 26 + 10 \times 24 + 20 \times 26$

$= 2600 + 240 + 520$

(wrt ground) $= \underline{3360}$

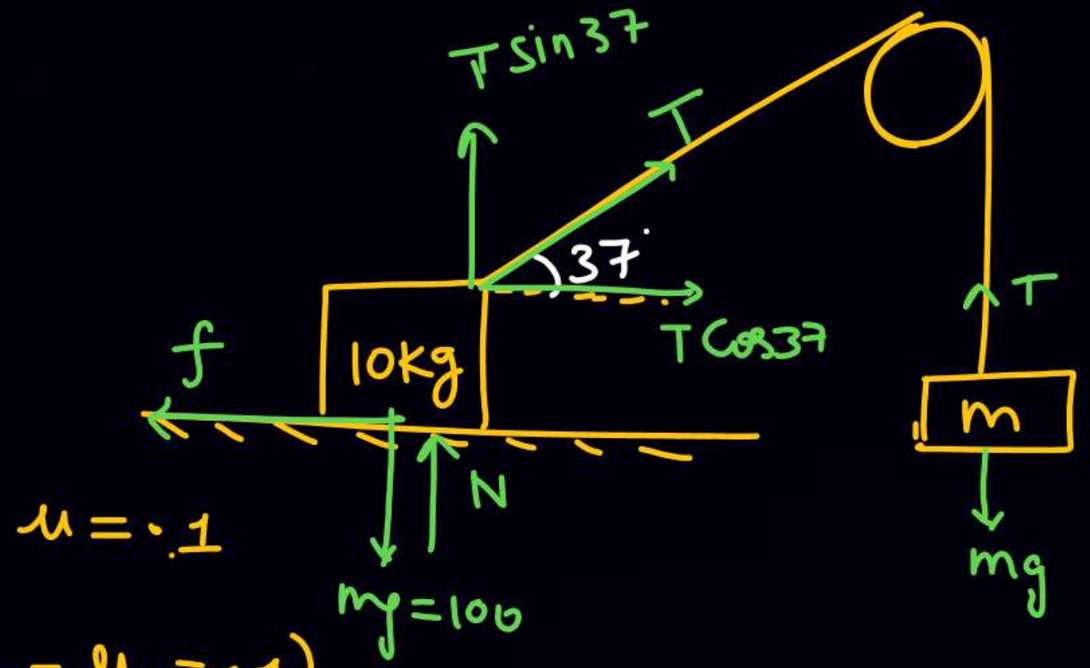
$a_{B/A} = -2$

$a_B - a_A = -2$

$a_B - 26 = -2$

$a_B = 24$

Q



$(\mu_s = \mu_k = \cdot 1)$

$N = 100 - T\sin 37^\circ$

$m = \frac{50}{43}$

(min value)

find the value of m so that 10kg block move.

Soln $T\cos 37^\circ = (f_s)_{max}$ (limiting case)

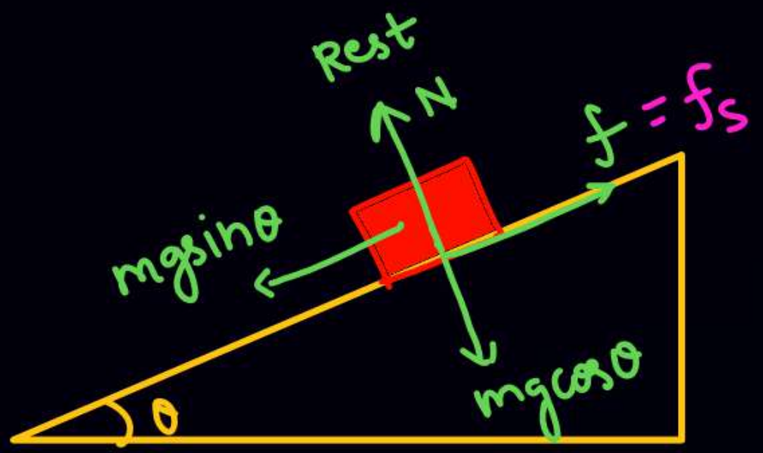
$$T\frac{4}{5} = \mu N = \cdot 1\,(100 - T\sin 37^\circ)$$

$$\frac{4T}{5} = 10 - T\times\frac{3}{50}$$

$$\frac{4T}{5} + \frac{3T}{50} = 10$$

$$\frac{43T}{50} = 10 \Rightarrow T = \frac{500}{43} = mg$$

Angle of repose / Angle of sliding



Equil. ⇒ $N = mg\cos\theta$

$f = mg\sin\theta$ (static)

If we increase θ gradually from 0.

$\theta \uparrow \Rightarrow (mg\sin\theta) \uparrow \Rightarrow f \uparrow$

when block is just about to slide

$mg\sin\theta = (f_s)_{max} = \mu_s N$

$mg\sin\theta = \mu_s \cdot mg\cos\theta$

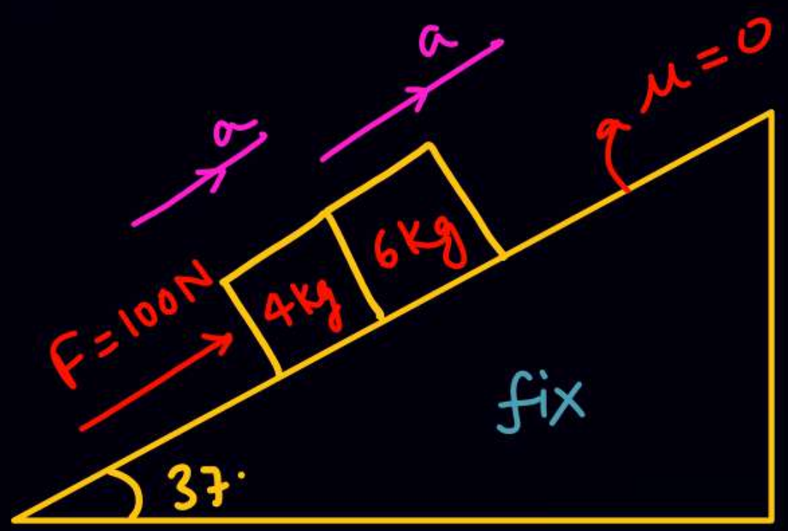
$$\boxed{\tan\theta = \mu_s}$$

Q If $\mu_s = \frac{1}{\sqrt{3}}$

$\tan\theta = \mu_s$

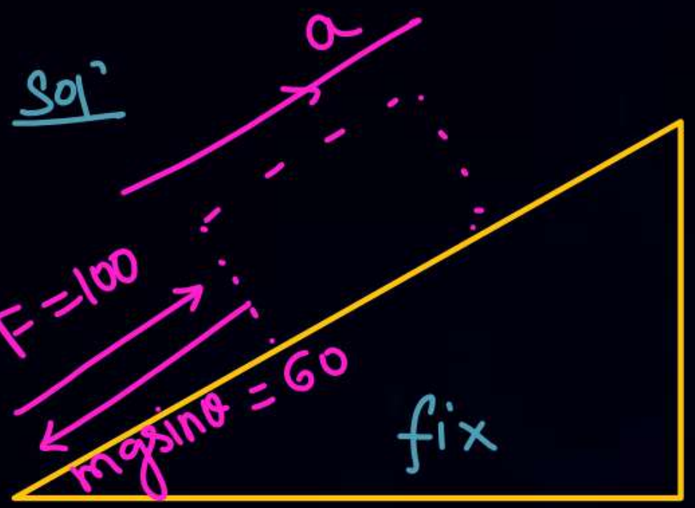
$\theta = 30^\circ$

Q

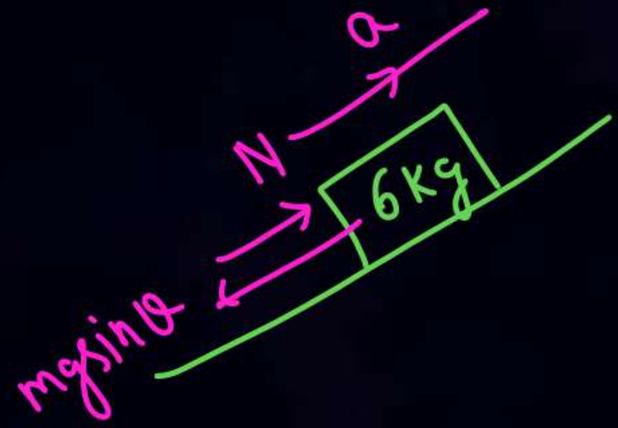


find acc. of each block & Normal force b/w them.

Sol^n

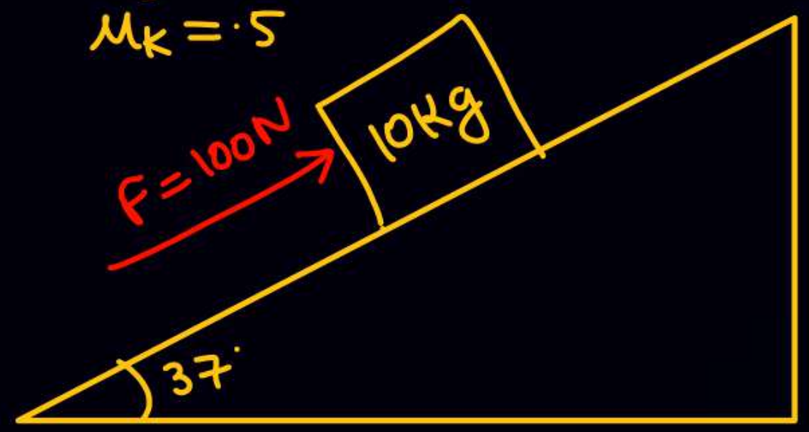


$$a = \frac{100 - 60}{10} = 4$$



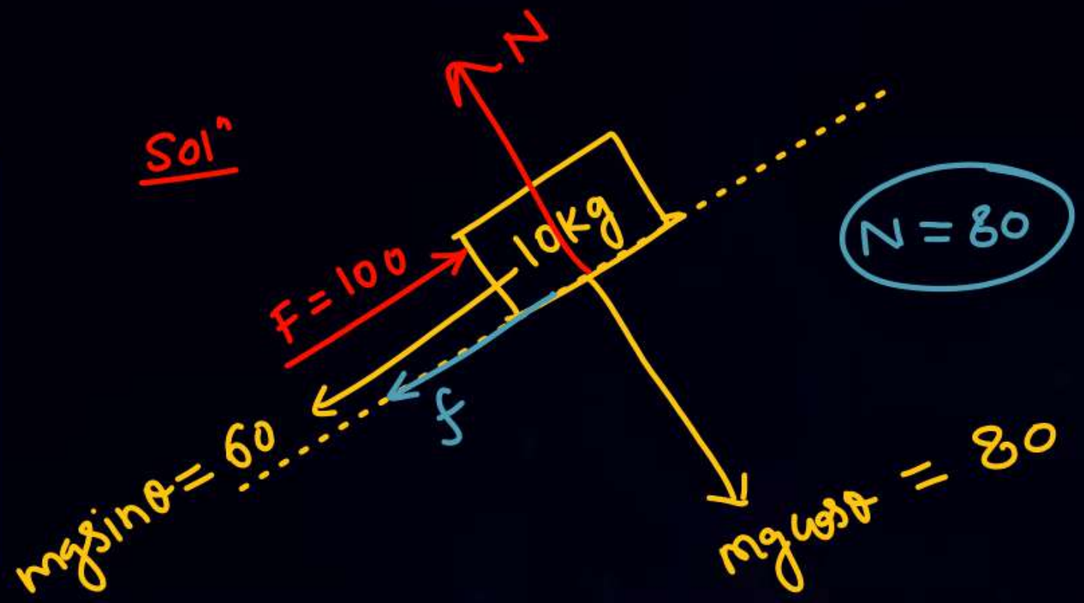
$$N - 60\sin 37 = 6 \times 4$$

Q



find the a, f

Soln



$$(f_s)_{max} = \mu_s N = .6 \times 80 = 48$$

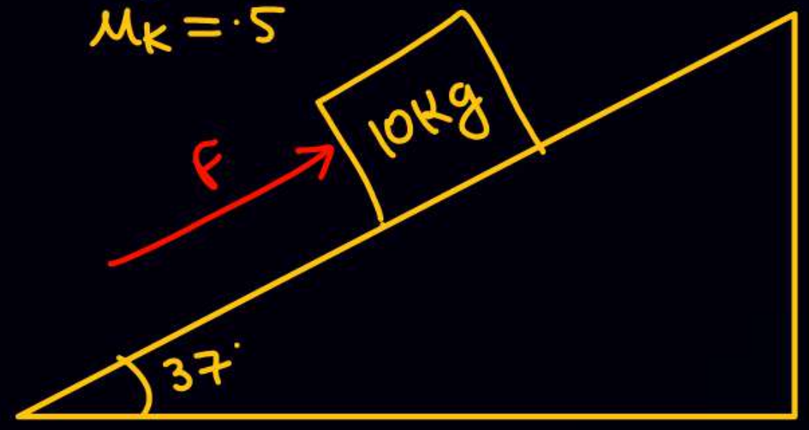
$$a = 0, \quad f = 40 = f_s$$

find the a, f

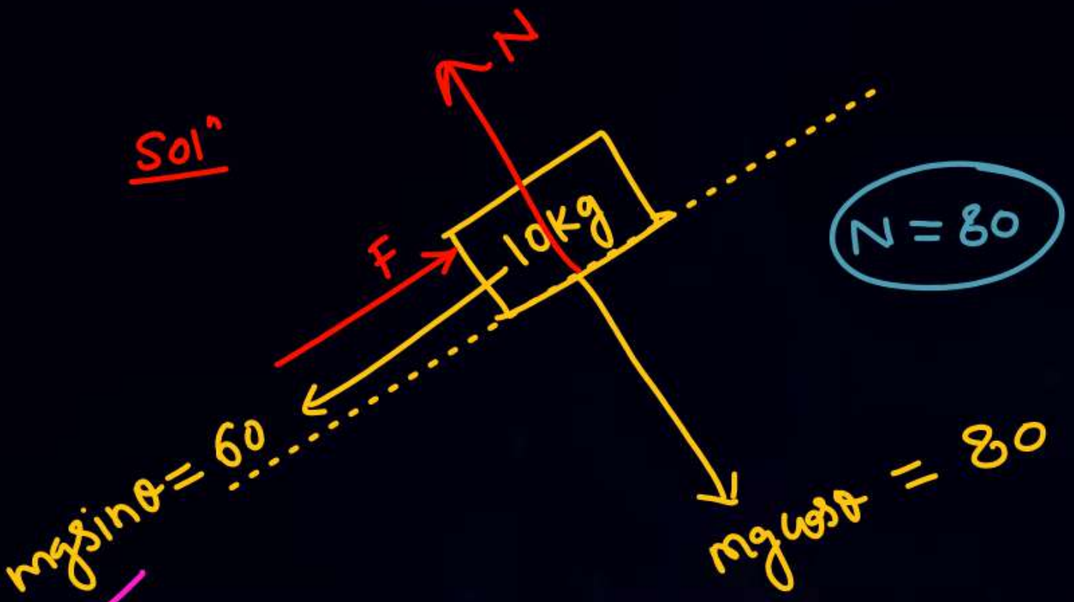
$\mu_s = 0.6$

$\mu_k = 0.5$

Q



Sol^n



① If $F = 50N \Rightarrow a = 0 \Rightarrow f = 10$

② If $F = 60N \Rightarrow a = 0,\ f = 0$

③ If $F = 80N \Rightarrow a = 0,\ f = 20$ ✗

④ If $F = 100N \Rightarrow a = 0,\ f = 40$ ✗

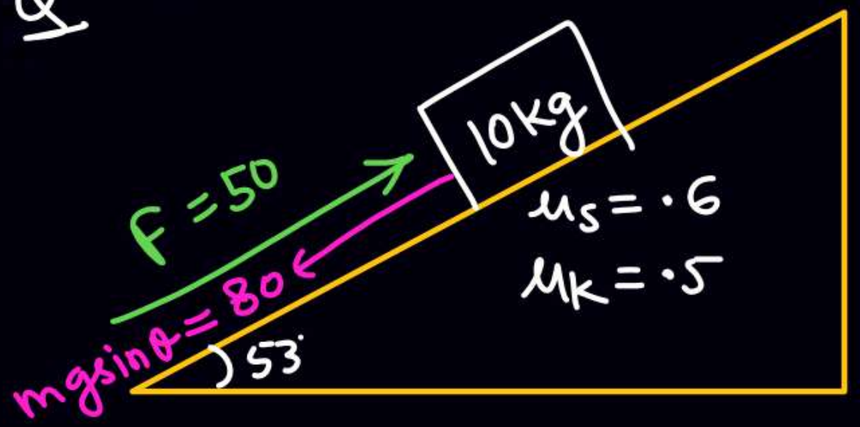
⑤ If $F = 120N \Rightarrow a = \frac{120 - 60 - 40}{10} = 2,\ f = 40$

f_k

$(f_s)_{max} = \mu_s N = 0.6 \times 80 = 48$

$f_k = 0.5 \times 80 = 40$

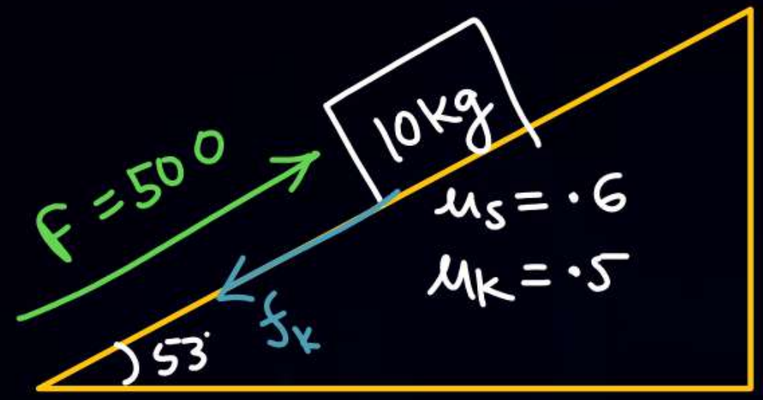
Q



$(f_s)_{max} = .6 \times 60 = 36$

$a = 0, \quad f = 30$

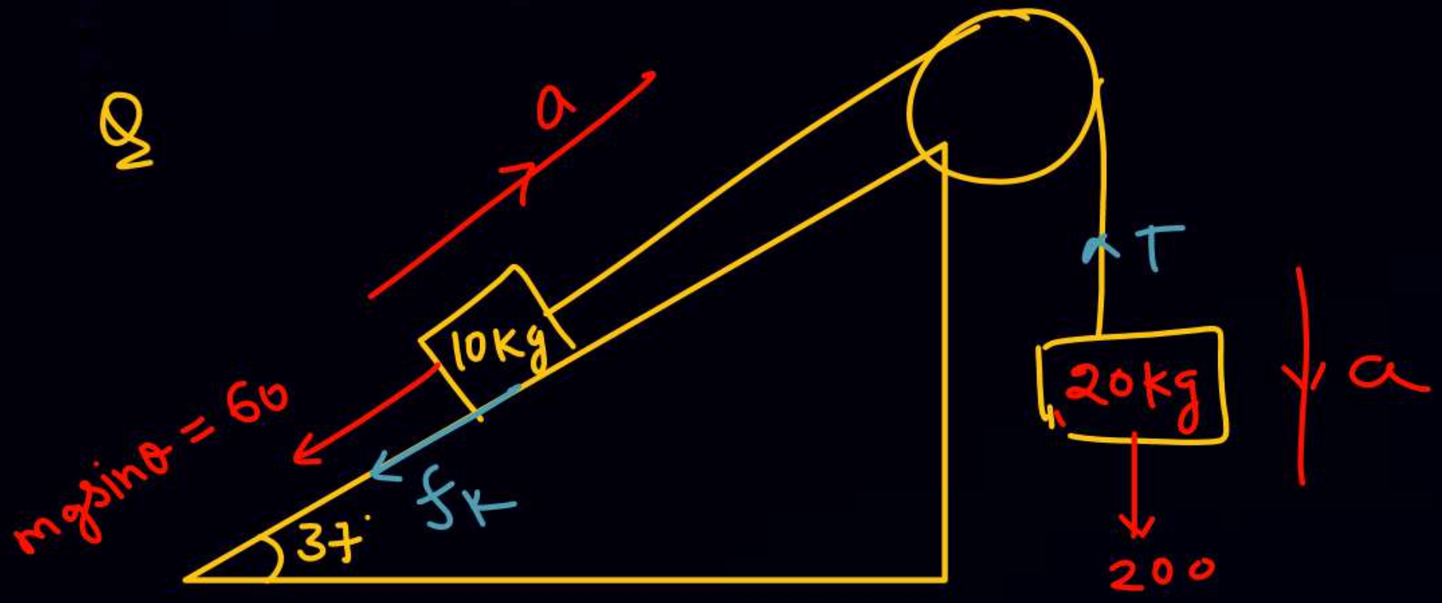
Q



$$a = \frac{500 - 80 - .5 \times 60}{10}$$

$a = 39$

Q



$\mu_s = \cdot 6$

$\mu_k = \cdot 5$

$(f_s)_{max} = 48$

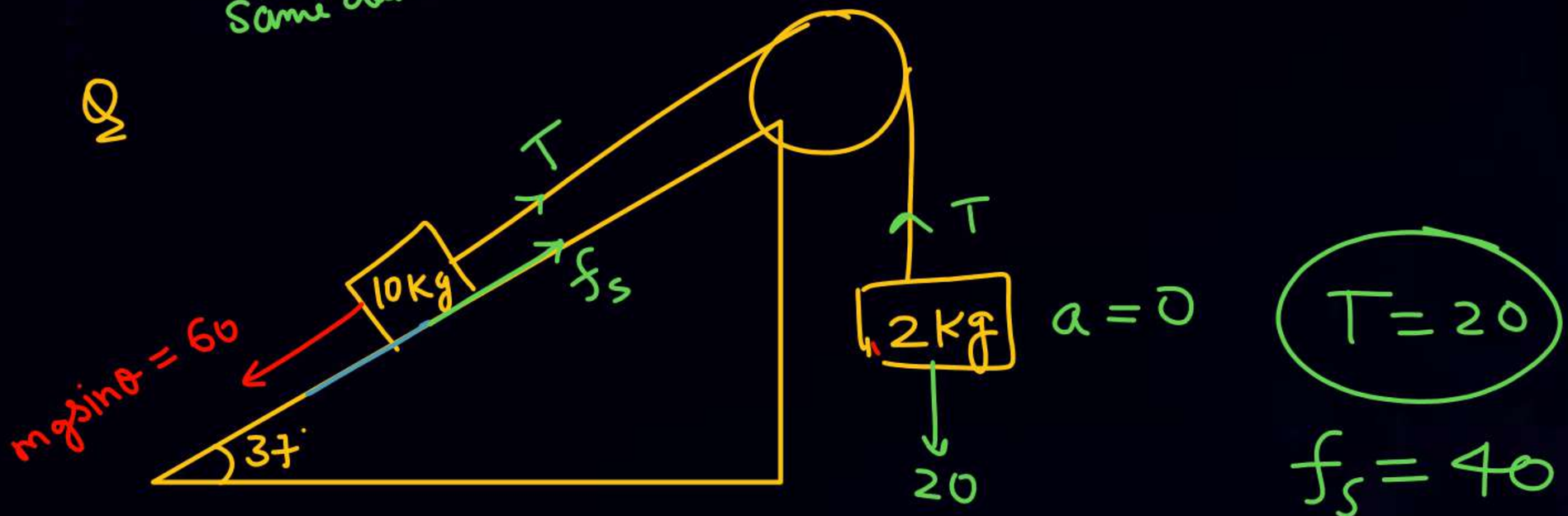
$f_k = 40$

$$a = \frac{200 - 60 - 40}{10 + 20}$$

$$200 - T = 20a$$

Same data

Q



$a = 0$

$T = 20$

$f_s = 40$

$\mu_s = 0.6$

$\mu_k = 0.5$

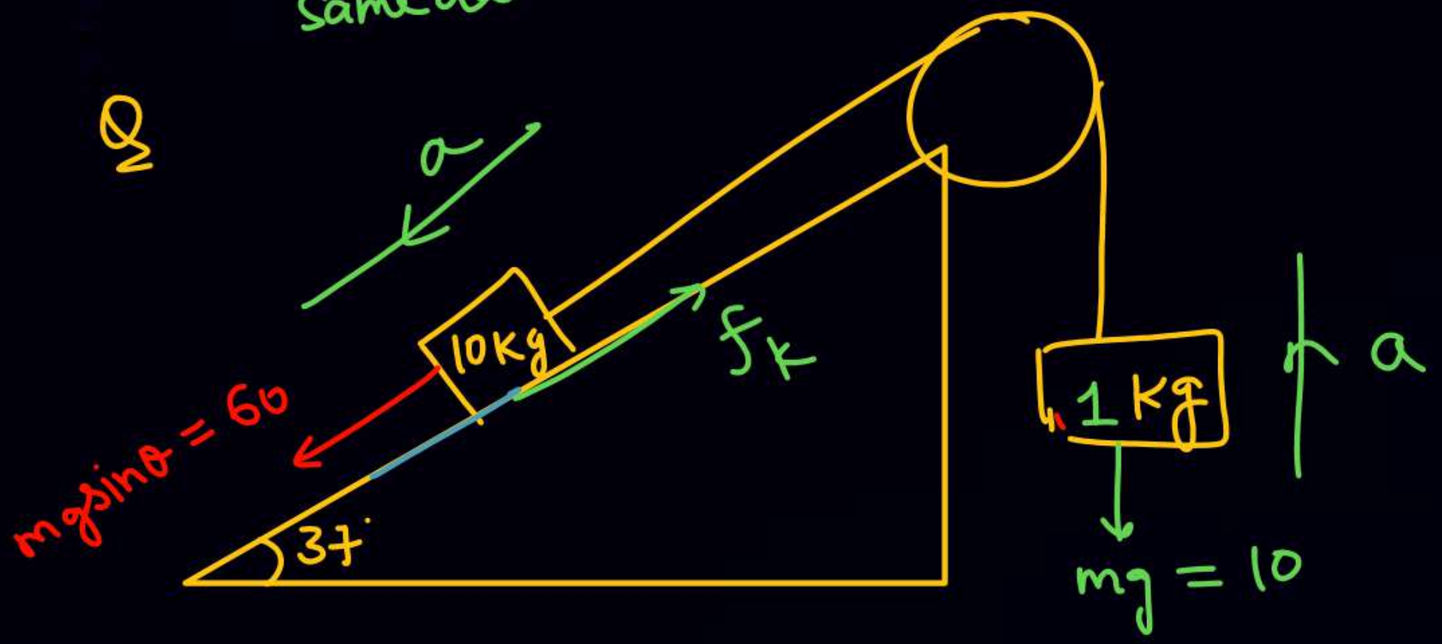
$(f_s)_{max} = 48$

$f_k = 40$

So

Same data

Q



$\mu_s = 0.6$

$\mu_k = 0.5$

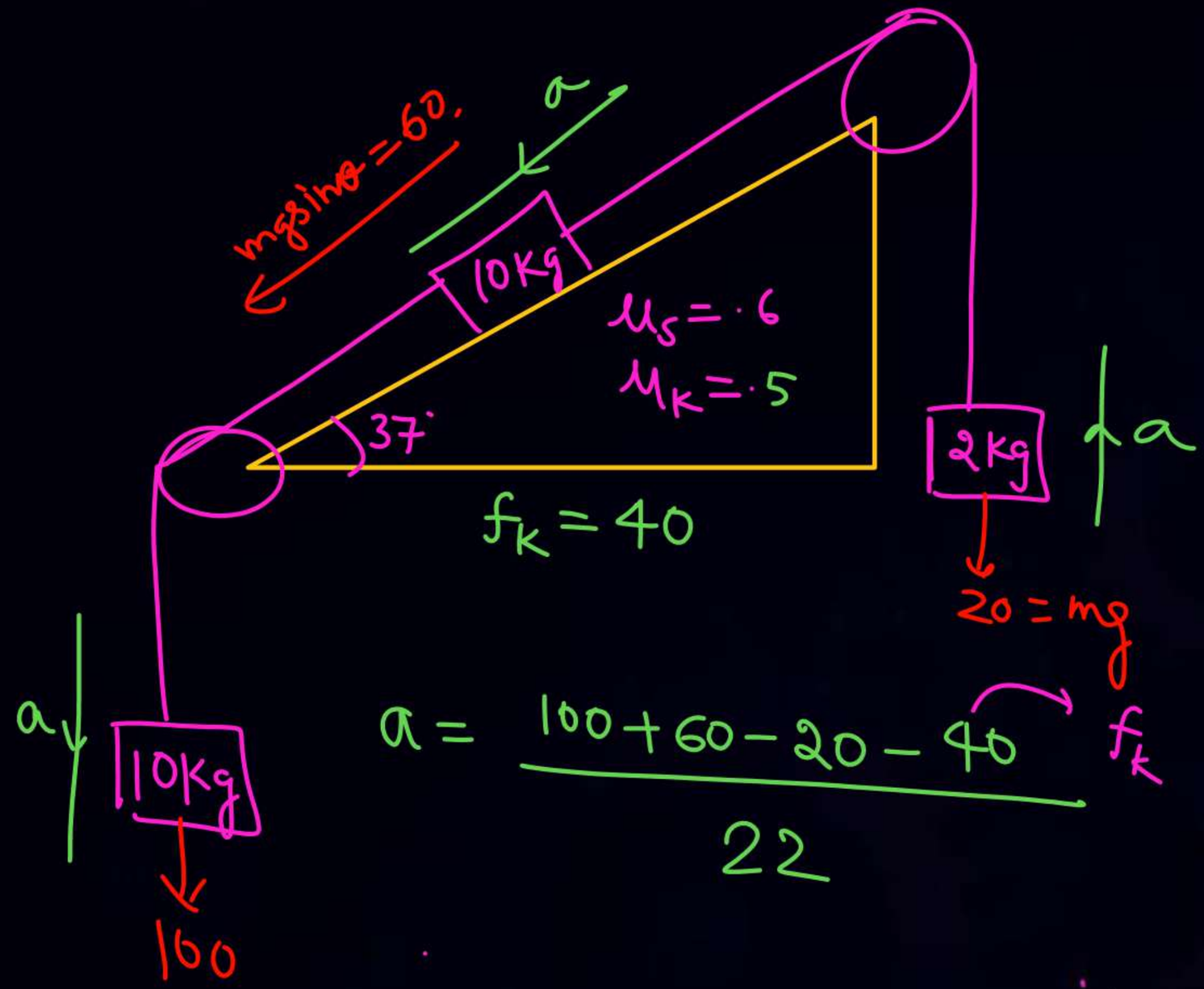
$(f_s)_{max} = 48$

$f_k = 40$

$$a = \frac{60 - 10 - 40}{11}$$

$$a = \frac{10}{11}$$

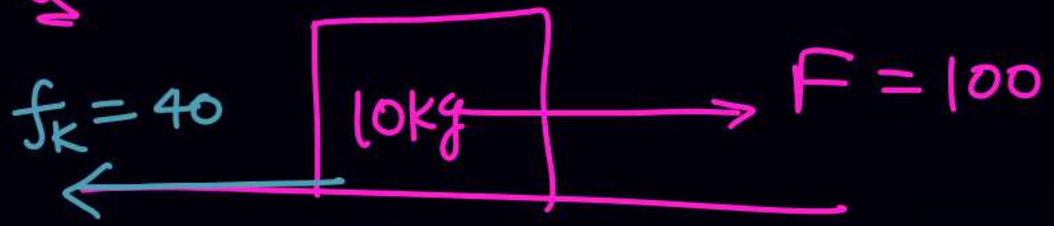
Q



$$a = \frac{100 + 60 - 20 - 40}{22}$$

f_k

Q



$\mu = \cdot 4$

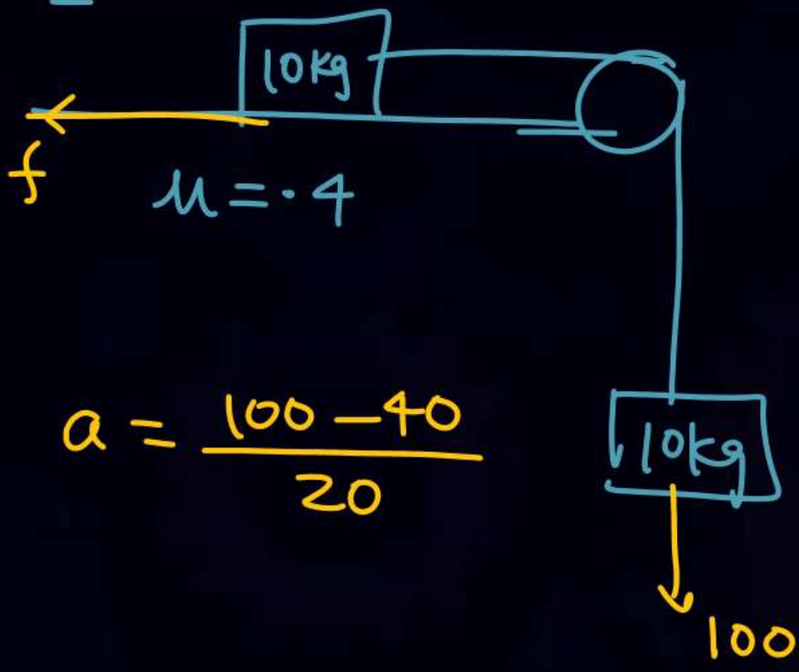
→ इसका matlab $\mu_s = \mu_k = \cdot 4$

$(f_s)_{max} = 40$

$f_k = 40$

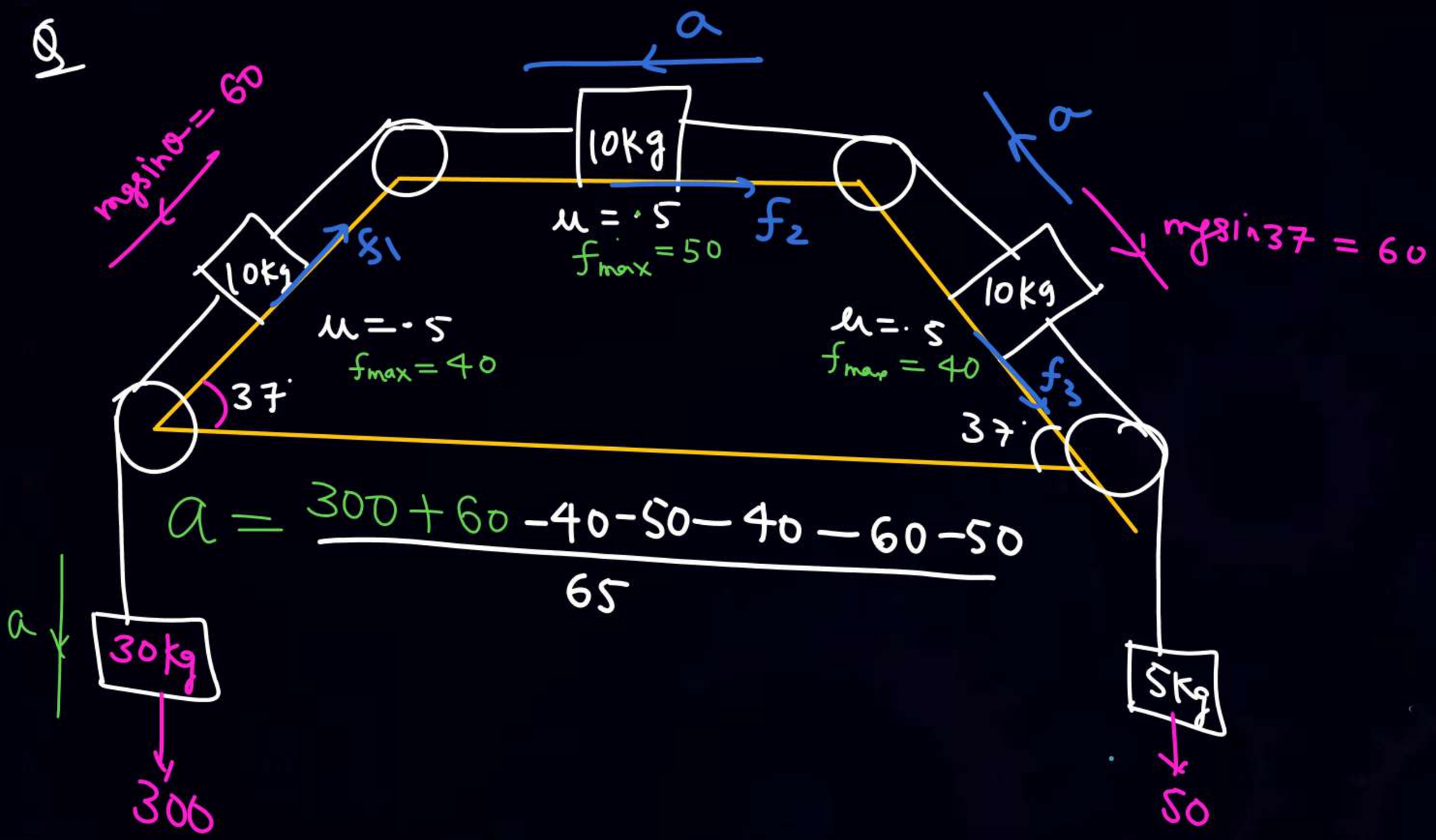
$$a = \frac{100 - 40}{10} = 6$$

Q

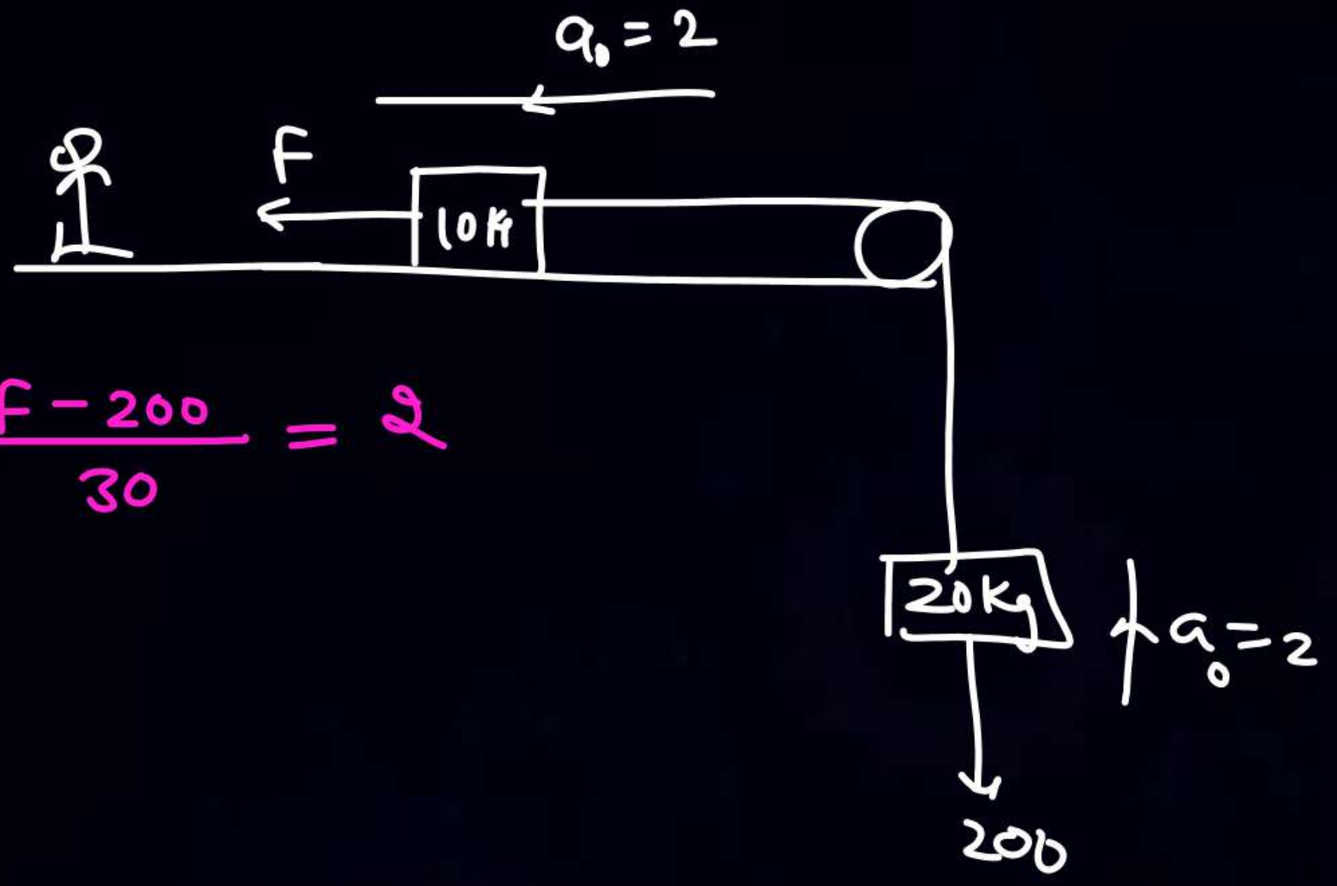


$$a = \frac{100 - 40}{20}$$

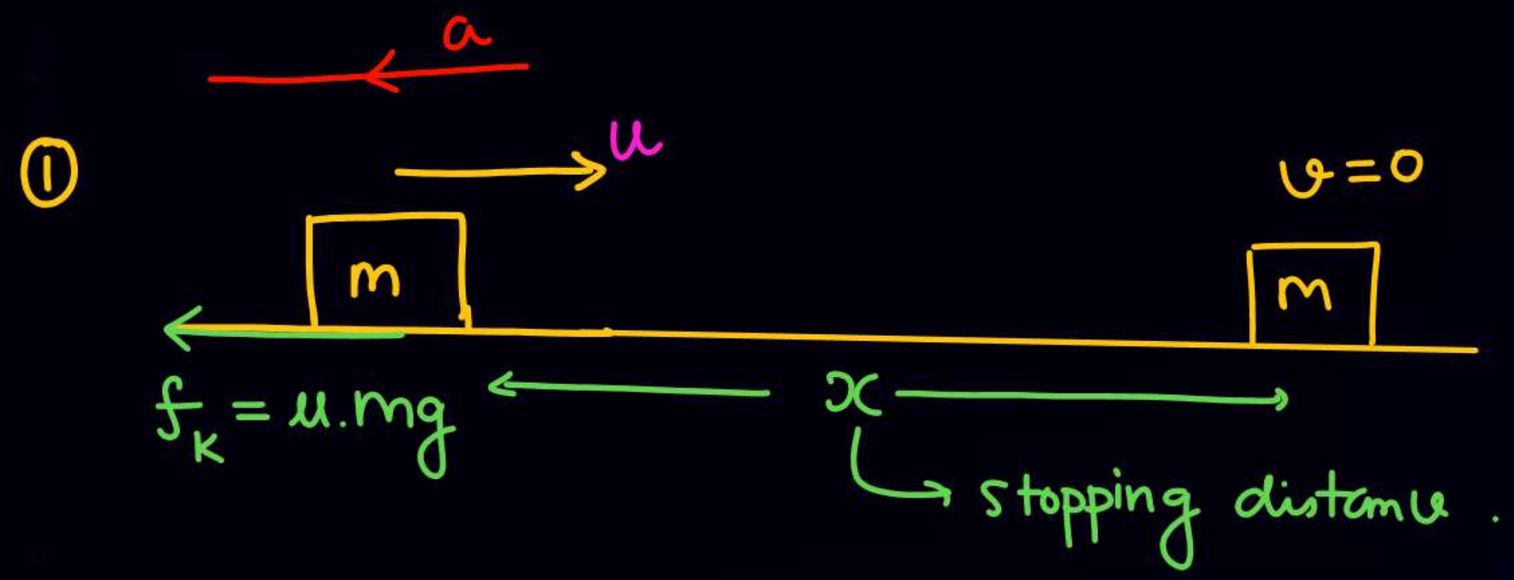
Q



$$a = \frac{300 + 60 - 40 - 50 - 40 - 60 - 50}{65}$$



$$\frac{F - 200}{30} = 2$$



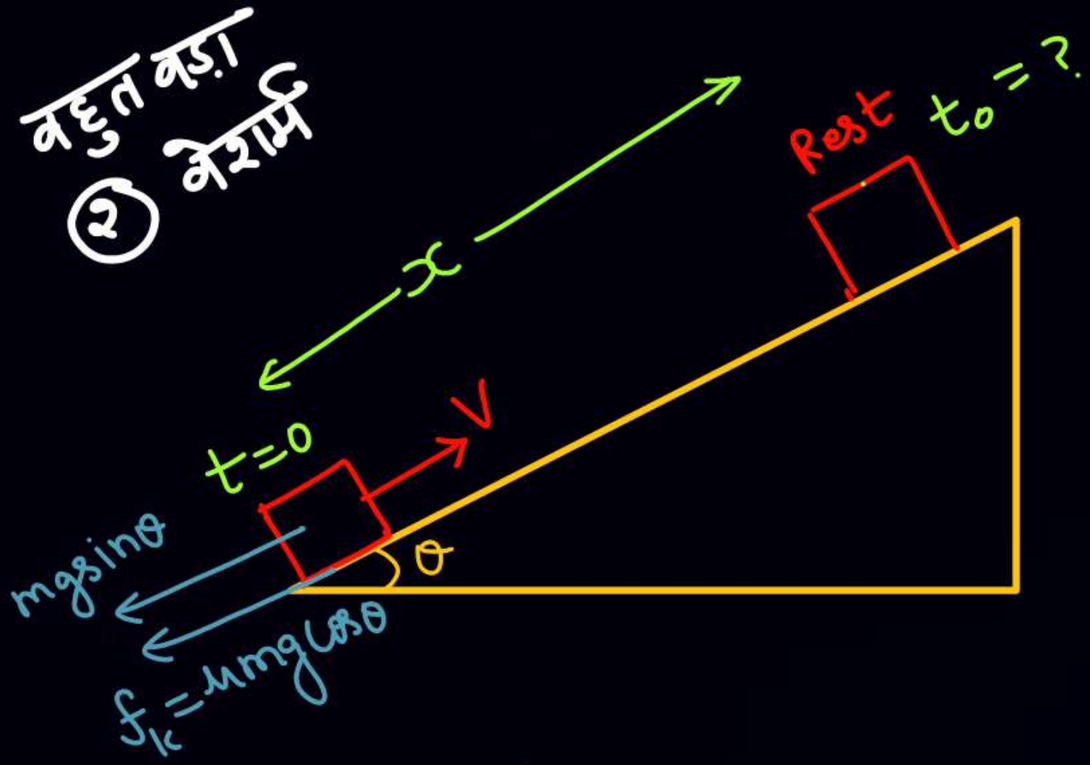
* $a = \frac{f}{m} = \frac{\mu mg}{m} = \mu g$.

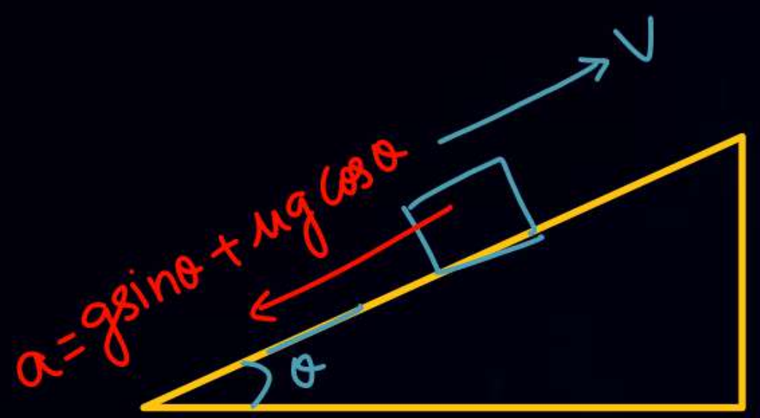
* $x = \frac{u^2}{2a} = \frac{u^2}{2\mu g}$

* $v^2 = u^2 + 2as$

$0 = u^2 - 2\mu g x$

बहुत बड़ा ② नेहर्मी





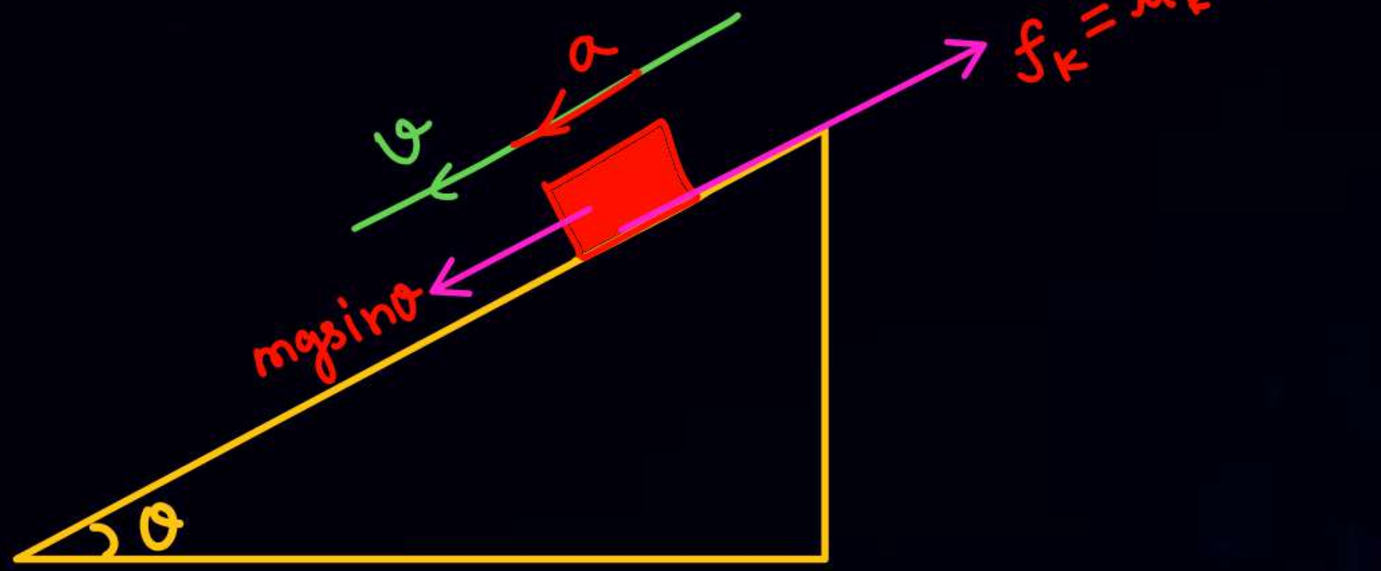
$$a = \frac{mg\sin\theta + \mu mg\cos\theta}{m}$$

$$\boxed{a = g\sin\theta + \mu_k g\cos\theta}$$

$$x = \frac{v^2}{2a}, \qquad 0 = v - at_0$$

$$t_0 = \frac{v}{a}$$

③

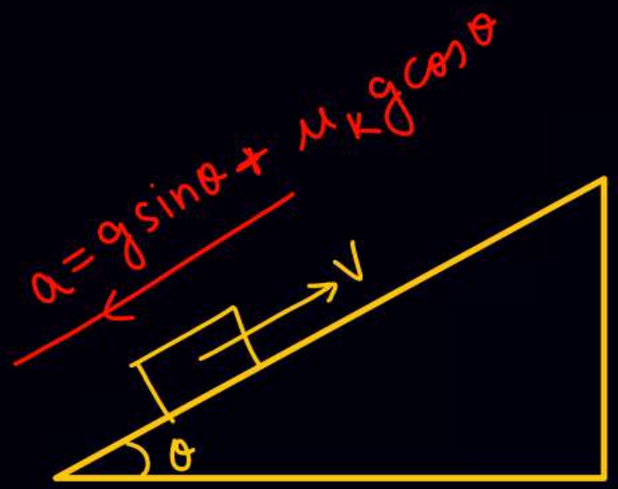


$$a = \frac{mg\sin\theta - \mu_K mg\cos\theta}{m}$$

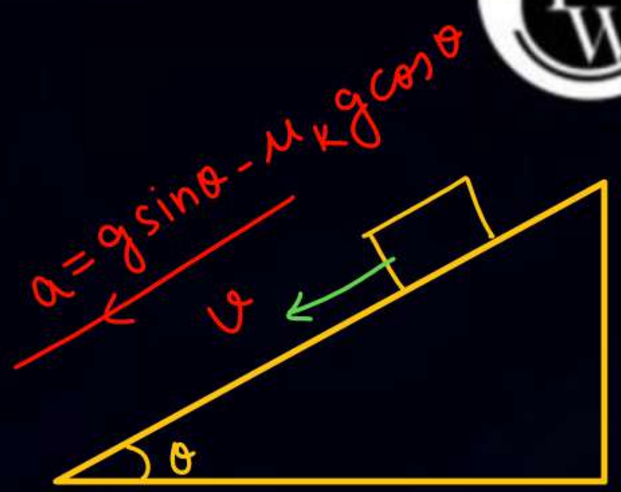
$$a = g\sin\theta - \mu_K g\cos\theta$$

① $a = \mu g$

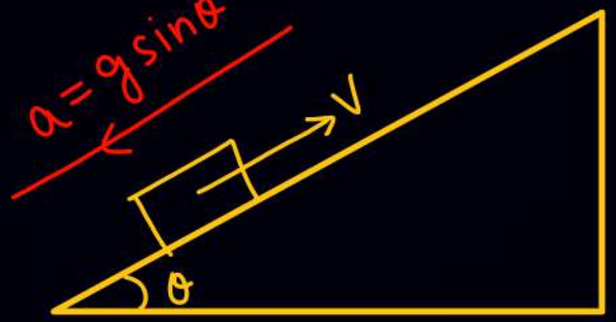
②



③



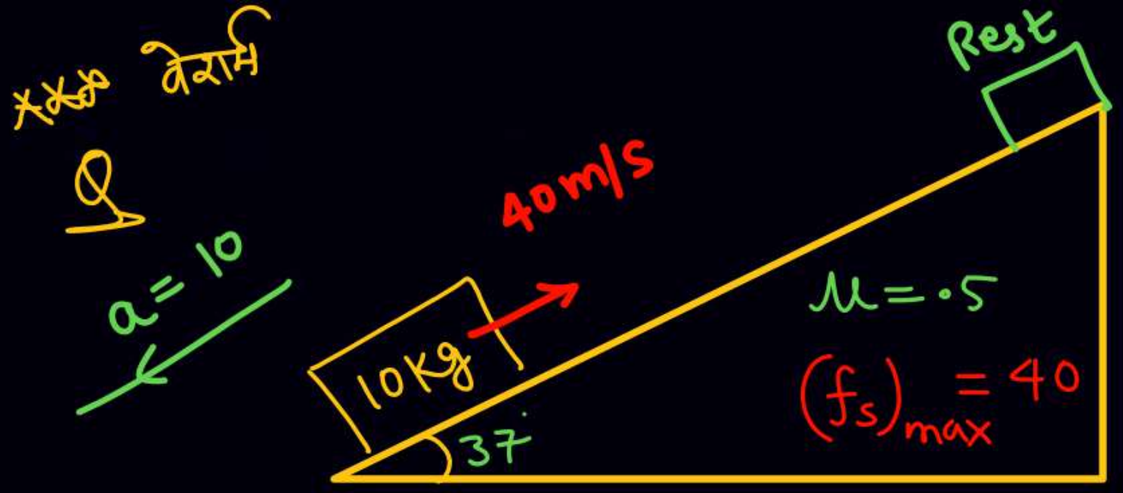
④



$\mu = 0$

xxx वेगार्थ

Q



① $a_{\text{जाते वक्त}} = a_{up} = g\sin\theta + \mu g\cos\theta$

$= 6 + .5 \times 8 = 10$

② Stopping distance, where it will come to at rest $\Rightarrow x = \frac{(40)^2}{2\times 10} = 80$

③ $t_{\text{आने}} = ?$

④ $a_{\text{आते वक्त}} = g\sin\theta - \mu g\cos\theta$

$= 6 - .5\times 8 = 2$

⑤ $t_{\text{आते}} = ?$

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

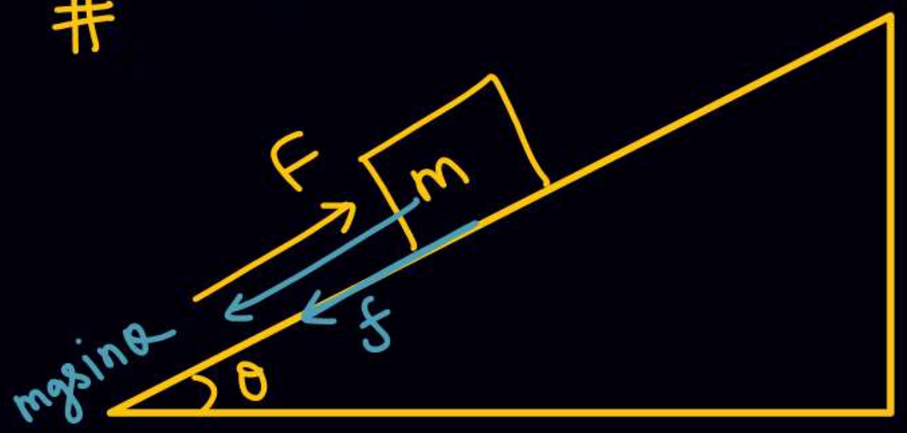
$80 = 0 + \frac{1}{2}\times 2\times t^2$

$t_{\text{आने}} = 4\sqrt{5}$.

⑥ $V_f^2 = 0^2 + 2\times 2\times 80$

$v_f = \sqrt{320}$

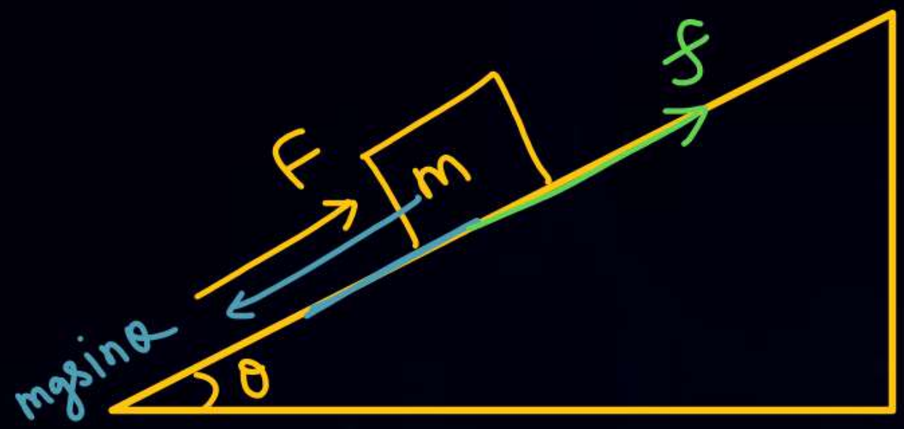
#



F_{min} so that block slide up

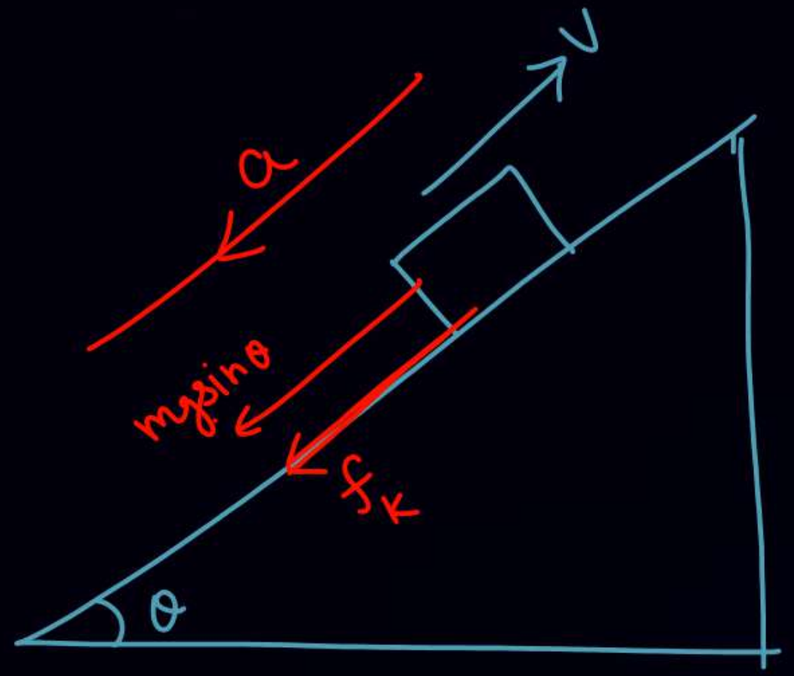
$$F_{min} = mg\sin\theta + \mu_s mg\cos\theta$$

Sol^n



F_{min} to prevent the block sliding down.

$$F_{min} = mg\sin\theta - \mu_s mg\cos\theta$$



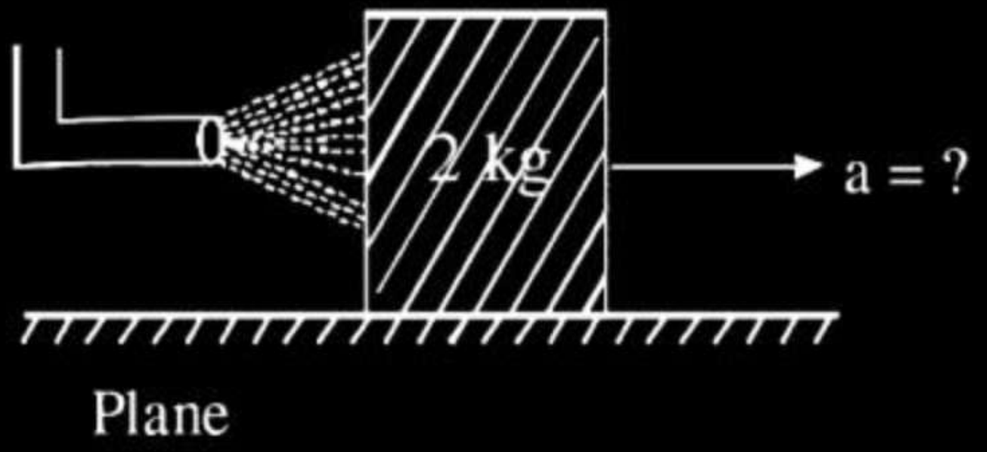
$$a = g\sin\theta + \mu_k g\cos\theta$$

QUESTION

A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of 1 kg s^{-1} and at a speed of 10 ms^{-1}. Then, the initial acceleration of the block in ms^{-2}, will be _____.

[Jan 29, 2023 (I)]

1. 3
2. 6
3. 5
4. 4



Ans : (3)

QUESTION

An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to: [Use $g = 10\ ms^{-2}$] **[June 24, 2022 (II)]**

1. 1 : 1
2. $\sqrt{2} : \sqrt{3}$
3. $\sqrt{3} : \sqrt{2}$
4. 2 : 3

Ans: (2)

QUESTION

The initial mass of a rocket is 1000 kg. Calculate at what rate the fuel should be burnt so that the rocket is given an acceleration of 20 ms^{-2}. The gases come out at a relative speed of 500 ms^{-1} with respect to the rocket: [Use $g = 10\ m/s^2$] **[Aug. 26, 2021 (I)]**

1. $6.0 \times 10^2\ kg\ s^{-1}$
2. $500\ kg\ s^{-1}$
3. $10\ kg\ s^{-1}$
4. $60\ kg\ s^{-1}$

Ans: (4)

QUESTION

A massless spring gets elongated by amount x_1 under a tension of 5N. Its elongation is x_2 under the tension of 7N. For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be:

[Jan. 23, 2025 (II)]

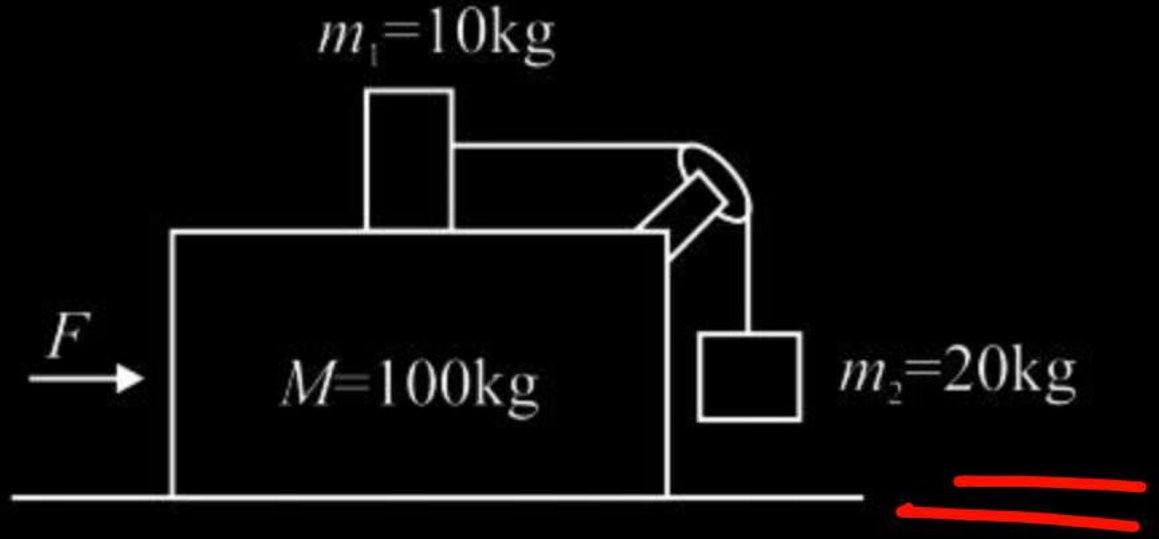
1. 15 N
2. 20 N
3. 11 N
4. 39 N

Ans: (3)

QUESTION

Three masses $M = 100$ kg, $m_1 = 10$ kg and $m_2 = 20$ kg are arranged in a system as shown in figure. All the surface are frictionless and strings are inextensible and weightless. The pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration of 2 ms^{-2}. The value of F is: (Take $g = 10$ ms^{-2}).

[July 26, 2022 (I)]



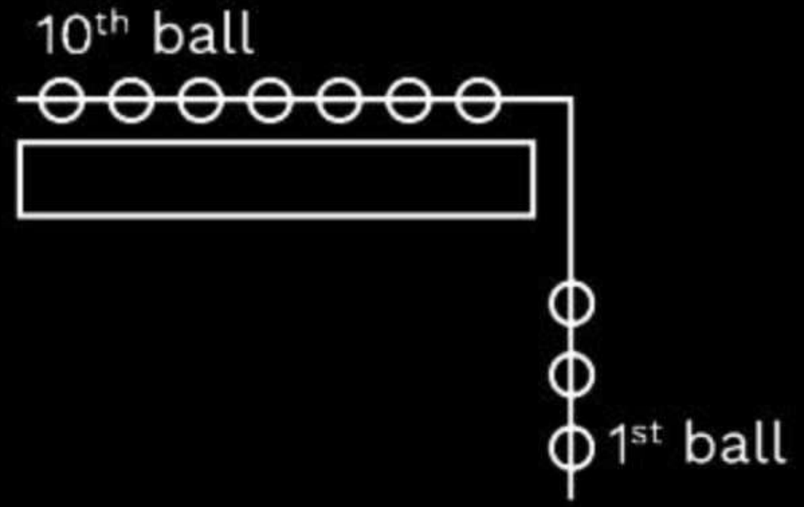
1. 3360 N
2. 3380 N
3. 3120 N
4. 3240 N

Ans : (1)

QUESTION

A system of 10 balls each of mass 2 kg are connected via massless and un-stretchable string. The system is allowed to slip over the edge of a smooth table as shown in figure. Tension on the string between the 7^{th} and 8^{th} ball is _____ N when 6^{th} ball just leaves the table.

[June 26, 2022 (II)]



Ans : (36)

QUESTION

A body of mass 10 kg is moving with an initial speed of 20 m/s. The body stops after 5 s due to friction between body and the floor. The value of the coefficient of friction is: (Take acceleration due to gravity $g = 10\ ms^{-2}$)

[Jan.29, 2023 (I)]

1. 0.2
2. 0.3
3. 0.5
4. 0.4

$a = 4 = \mu g$

$4 = \mu \times 10$

$v = u + at$

$0 = 20 - \mu g \times 5$

$\mu = 0.4$

Ans : (4)

QUESTION

$a = \mu g$

A block of mass 10 kg starts sliding on a surface with an initial velocity of 9.8 ms^{-1}. The coefficient of friction between the surface and block is 0.5. The distance covered by the block before coming to rest in [use $g = 9.8\ ms^{-2}$]

[June 24, 2022 (I)]

$0^2 = (9.8)^2 - 2 \times .5 \times 9.8 \times x$

$x = \frac{9.8 \times 9.8}{9.8}$

1. 4.9 m
2. 9.8 m
3. 12.5 m
4. 19.6 m

Ans : (2)

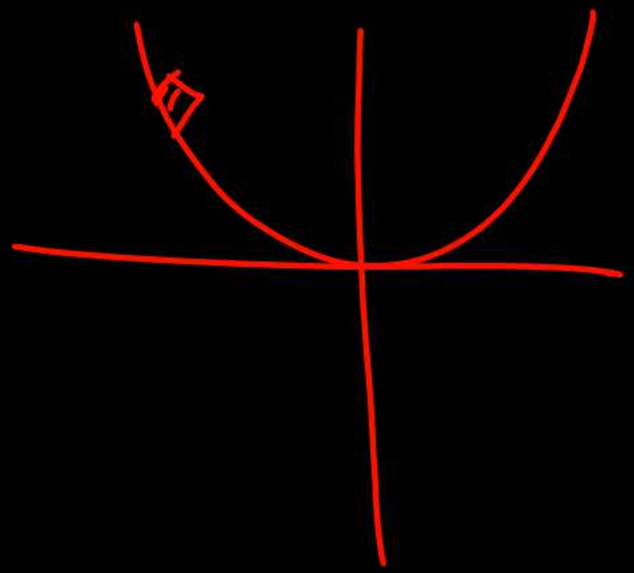
QUESTION

An inclined plane is bent in such a way that the vertical cross-section is given by $y = \frac{x^2}{4}$ where y is in vertical and x in horizontal direction. If the upper surface of this curved plane is rough with coefficient of friction $\mu = 0.5$, the maximum height in cm at which a stationary block will not slip downward is _____ cm. **[Feb. 24, 2021 (I), 2003]**

$\cdot 5 = \tan\theta = \frac{2x}{4}$

$x = 1$

$y = \frac{1}{4}$



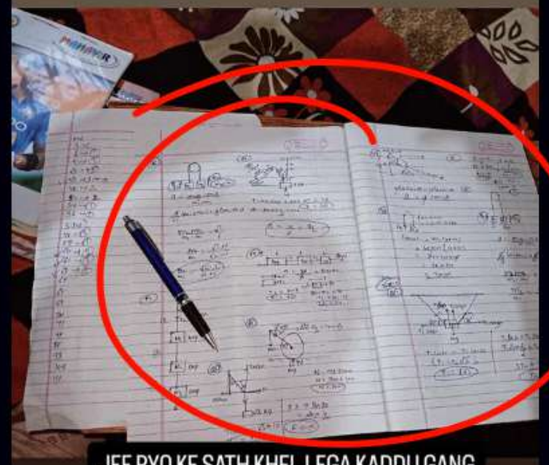
$y = \frac{x^2}{4}$

Ans : (25)

7:46

Mentions · imnaman.09 2h

CRIST99 · AND VOLTAJE PHK >



JEE PYQ KE SATH KHEL LEGA KADDU GANG GONE FOR REAL SIR AMAZING QUESTION KI DASH KRKE DII APNE @saleem.nitt bas 3 number question m fas gya guruji baki sab lapet diya bawaal ho sir aap 🔥🔥🔥 PEN

Add to your story

🤍🤍 EMOTIONAL KR diya aapne sir

Send message...

$T - 300 = 20 \times 2 - 10 \times 3$

$T = 300 + 10 = 310$

Ans. (A)

6. A block is moving on an inclined plane making an angle 45° with the horizontal and the coefficient of friction is μ. The force required to just push it up the inclined plane is 3 times the force required to just prevent it from sliding down. If we define N = 10μ, then N is **[IIT-JEE-2011]**

क्षैतिज से 45° बना रहे एक आनत-तल पर एक गुटका सरक रहा है। उनके बीच घर्षण-गुणांक μ है गुटके को ऊपर सरकाने के लिये आवश्यक बल, उसे नीचे सरकने से रोकने के लिये आवश्यक बल का 3 गुना है। यदि N = 10μ माने, तो N का मान है

Ans. 5

$\mu = 0.5 \quad 10\mu = 5$

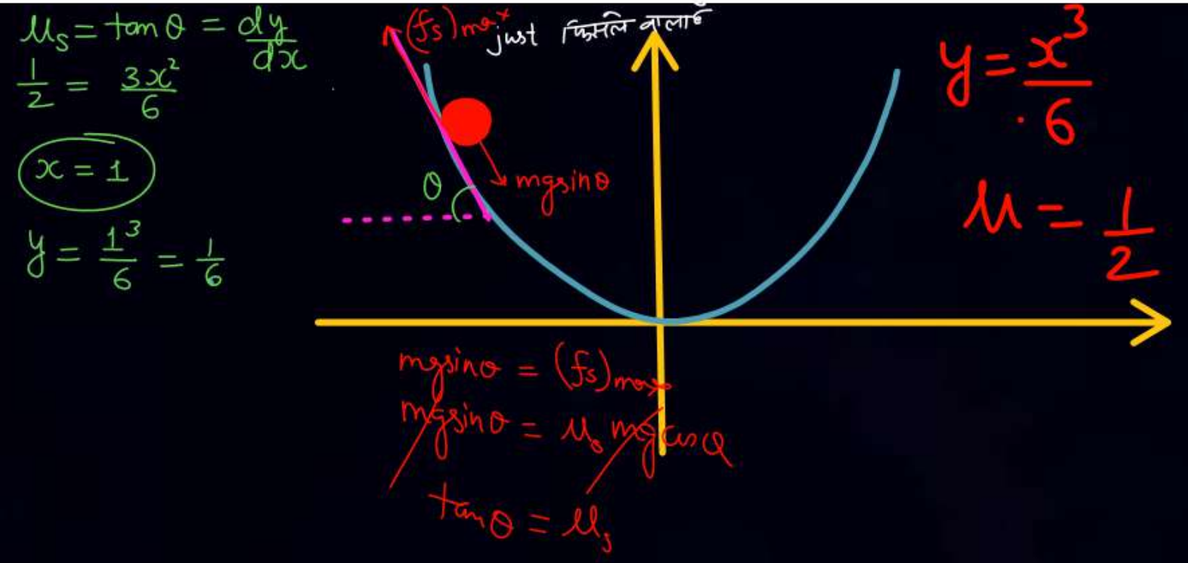
$4\mu = 2$

4. A block of mass m is placed on a surface with a vertical cross section given by $y=\frac{x^3}{6}$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is :- **[JEE-MAIN-2014]**

एक पृष्ठ पर एक द्रव्यमान m ब्लॉक रखा है। पृष्ठ की ऊर्ध्वाधर अनुप्रस्थ काट $y=\frac{x^3}{6}$ से दी जाती है। यदि घर्षण गुणांक 0.5 है, तब धरती से ऊपर वह अधिकतम ऊँचाई, जिस पर बिना फिसले ब्लॉक रखा जा सकता हैं, है :-

(1) $\frac{1}{3}$m (2) $\frac{1}{2}$m (3*) $\frac{1}{6}$m (4) $\frac{2}{3}$m

Ans. (3)



A flexible chain of weight W hangs between two fixed points A & B which are at the same horizontal level. The inclination of the chain with the horizontal at both the points of support is θ. What is the tension of the chain at the mid point?

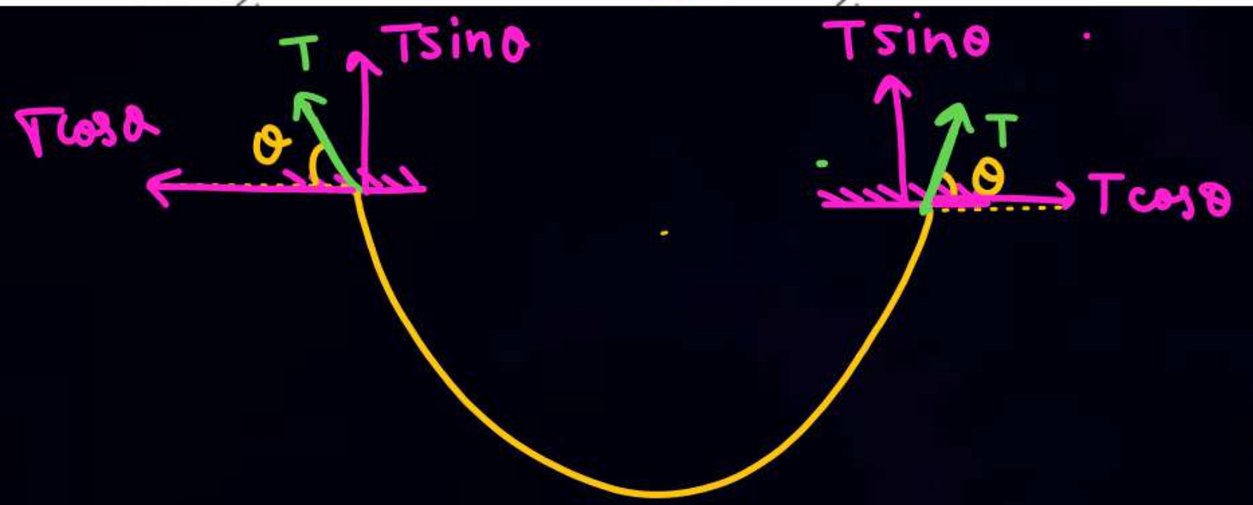
$w = mg$

एक लचीली जंजीर जिसका भार W है, दो स्थिर बिन्दुओं A तथा B (जो कि एक ही क्षैतिज सीध में हैं) के मध्य लटकी हुई है। दोनों बिन्दुओं पर इस जंजीर का क्षैतिज के साथ बनाया गया कोण θ है। मध्य बिन्दु पर जंजीर में उत्पन्न तनाव ज्ञात कीजिए?

$2T\sin\theta = mg = w$

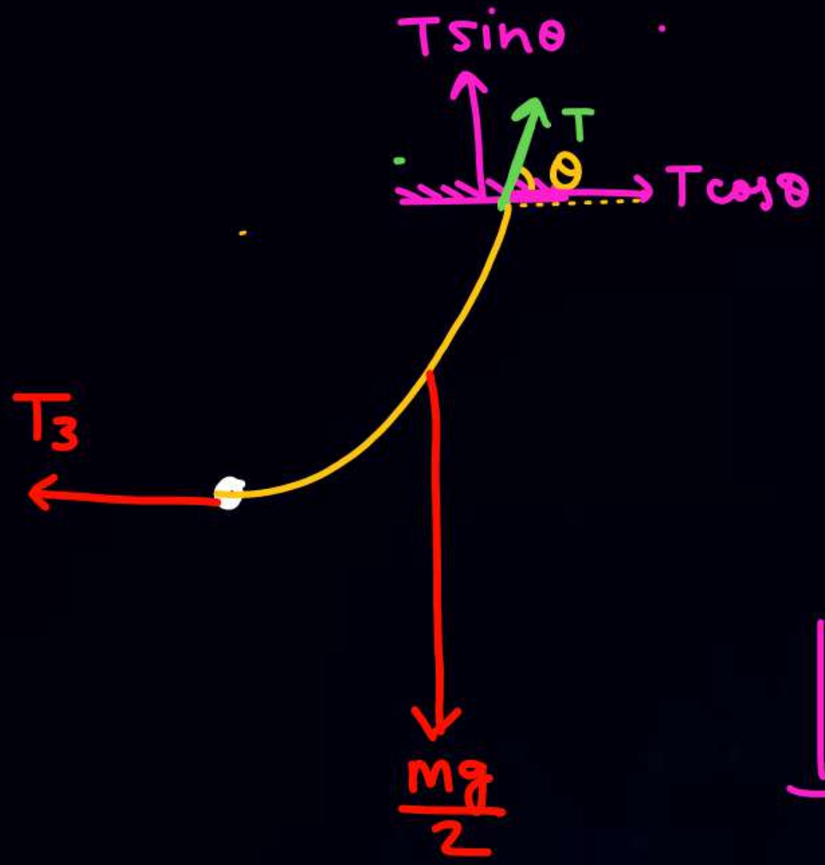
$T = \frac{w}{2}\operatorname{cosec}\theta$ = Tension at end point

(A) $\frac{W}{2}.\,cosec\,\theta$ (B) $\frac{W}{2}.\,tan\,\theta$ (C) $\frac{W}{2}cot\,\theta$ (D) none



$T_1\cos\theta = T_2\cos\theta$

$T_1 = T_2$



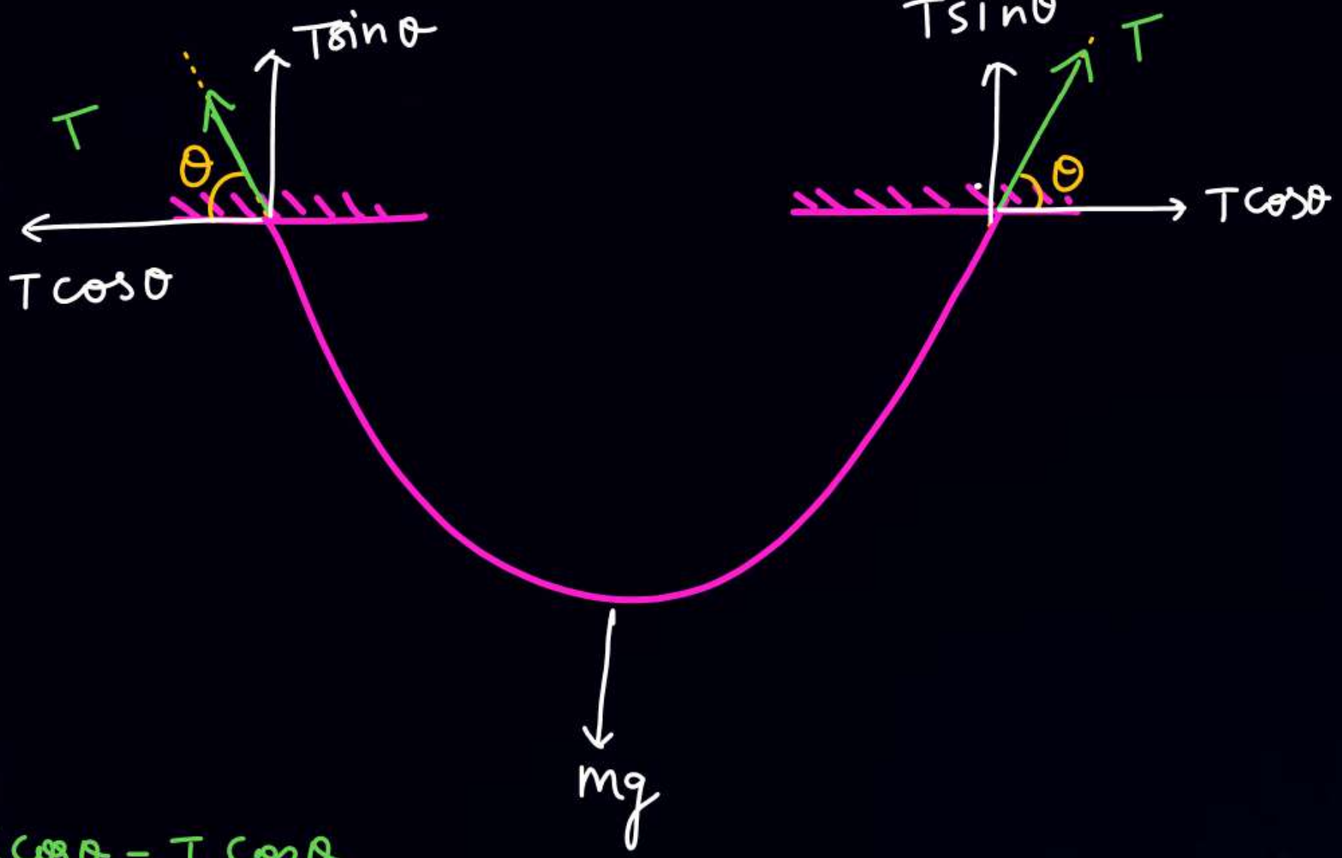
X

$T\sin\theta = mg/2$

$T\cos\theta = T_3$

$\frac{mg}{2\sin\theta} \cdot \cos\theta = T_3$

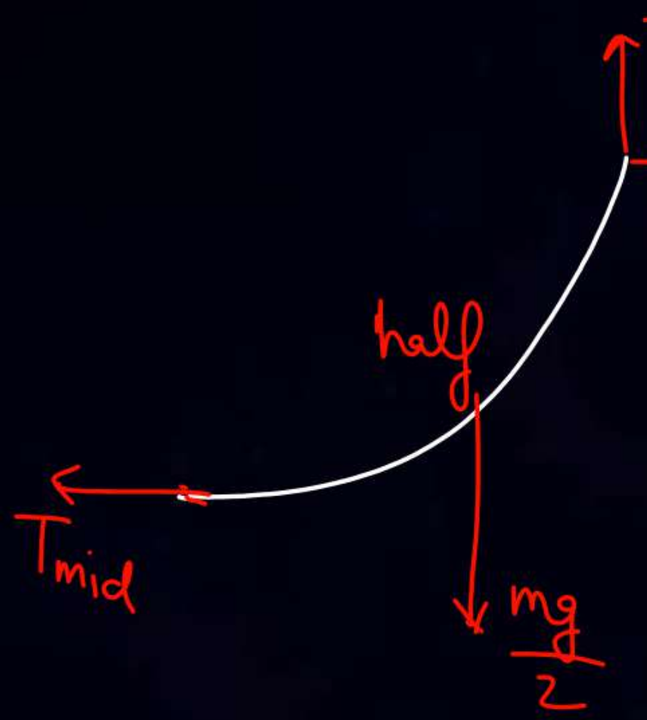
$$T_3 = \frac{mg}{2}\cot\theta$$



$T_1\cos\theta = T_2\cos\theta$

$T_1 = T_2$ = Tension at end point

$2T\sin\theta = mg$ ——— (1)

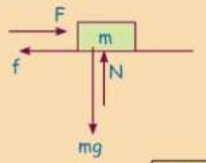


$T\sin\theta = mg/2$

$T\cos\theta = T_{mid}$

काम का डब्बा

★



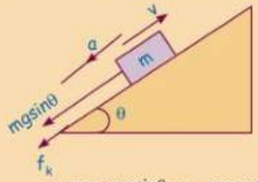
Netcontact force = $\sqrt{N^2 + f^2}$

★

$a = \frac{f_k}{m} = \frac{\mu mg}{m} = \mu g$ (पीछे)

Stopping distance निकालने के लिए 3rd eqn of motion लगाओ $0^2 = v^2 - 2(\mu g)x$

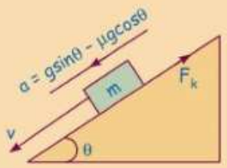
★ When block is moving up along the inclined



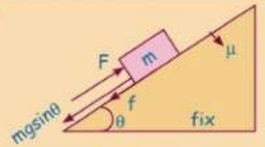
$ma = mg\sin\theta + \mu_k mg\cos\theta$

$a = g\sin\theta + \mu g\cos\theta$
पीछे

★ When block is moving down along the inclined



★

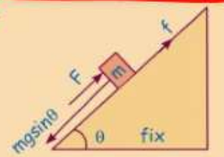


min value of F so that block slide up.

$F_{min} = mg\sin\theta + (f_s)_{max}$

$F_{min} = mg\sin\theta + \mu_s mg\cos\theta$

★



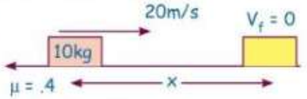
min value of F to prevent the block sliding down

$F + (f_s)_{max} = mg\sin\theta$

$F = mg\sin\theta - \mu mg\cos\theta$

Q. In following fig. Find distance travel by block before coming to rest.

Sol.

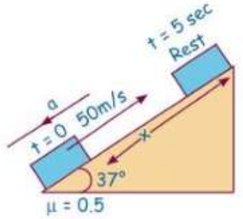


$a = \mu g = 4$ (पीछे) = cost.

$0^2 = (20)^2 - 2 \times 4 \times x$

$x = 50$ m

Q. In the given fig. block is projected along the rough incline ($\mu = 0.5$) with speed 50 m/s. Find distance travel by block before coming to rest.



Home work

- JM PYQ sheet NLM

109, 110, 118, 105, 85, 87, 88, 91, 93, 67, 68
61, 99, 94, (Only इतना)
& mark tick on sheet.

(- KPP-23 Sol^n Attached pls solve ...)

join HCV pdf & sol^n

* HCV NLM (page 82)
33, 34, 42, 40, 31, 32,
24, 25, (13-19)

THANK YOU