YAKEEN NEET 2.0

2026

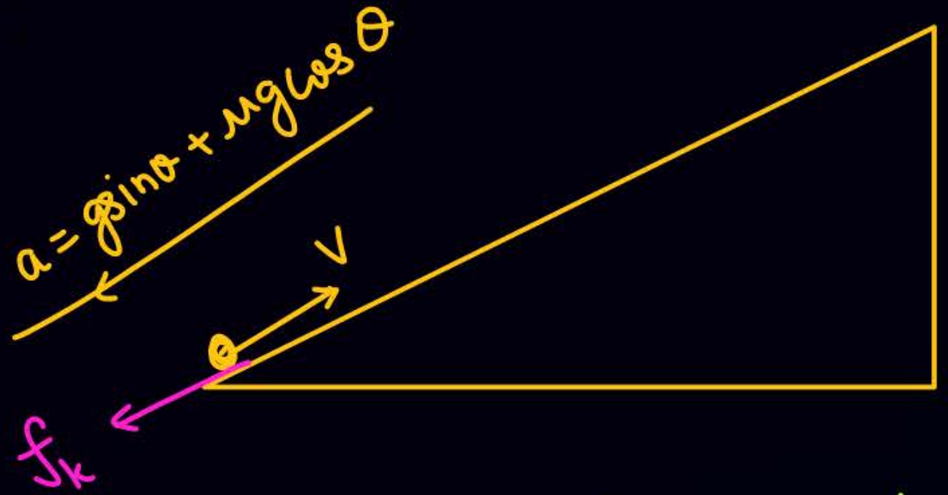
Circular Motion

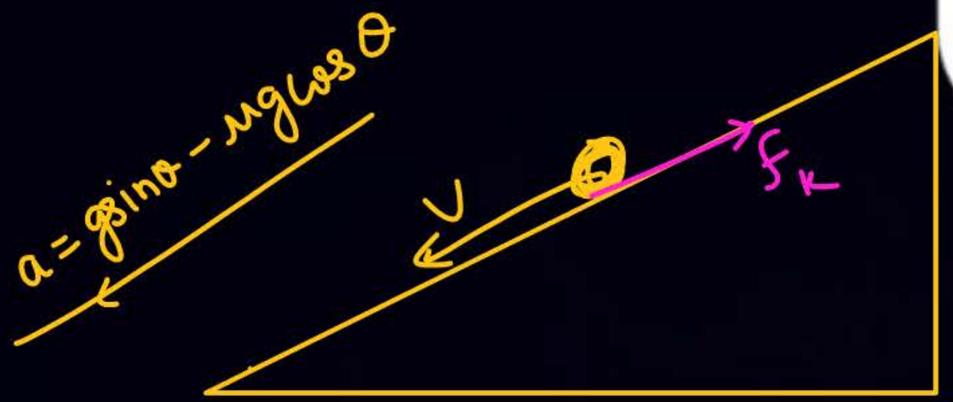
PHYSICS | Lecture 01

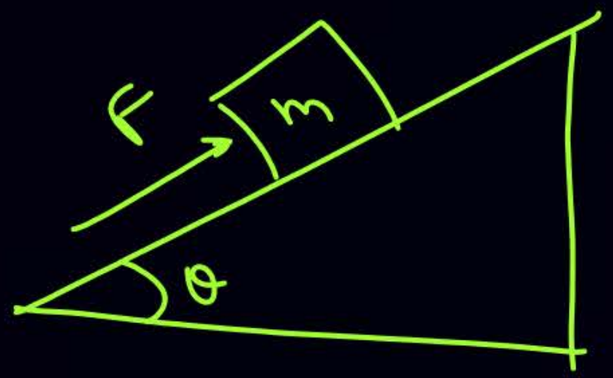
By - Saleem Ahmed Sir

Todays Goal

- Circular motion (aftn 80 mint)
- Ques Practise on friction







$mg\sin\theta - \mu_s mg\cos\theta$

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 _____.

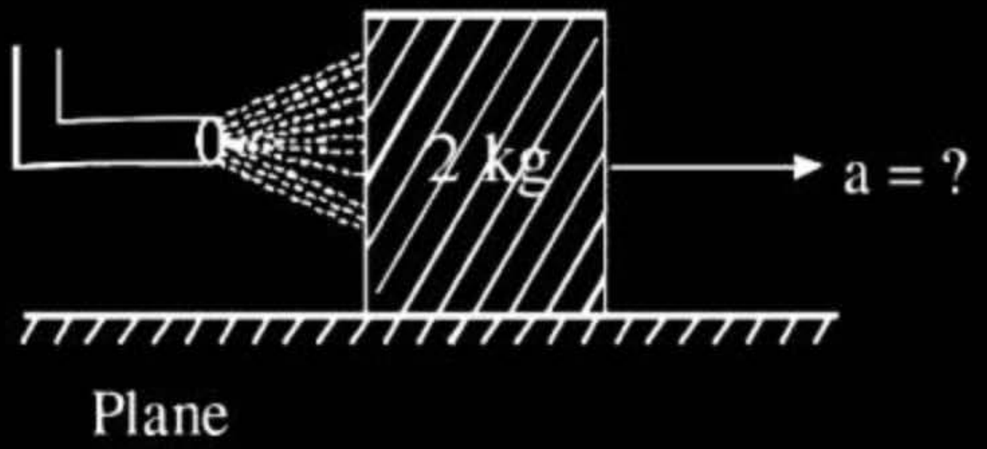
[Jan 29, 2023 (I)]

$v_{rel}\frac{dm}{dt} = 10 \times 1 = ma$

$10 = 2 \times a$

$a = 5$

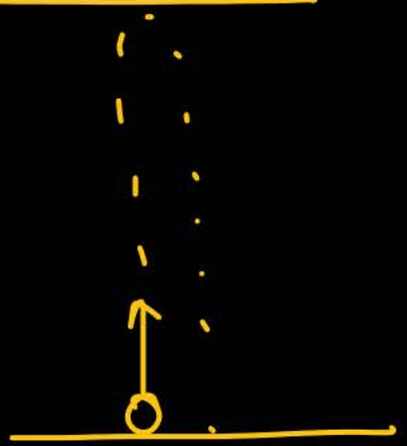
1. 3
2. 6
3. 5
4. 4



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)]**



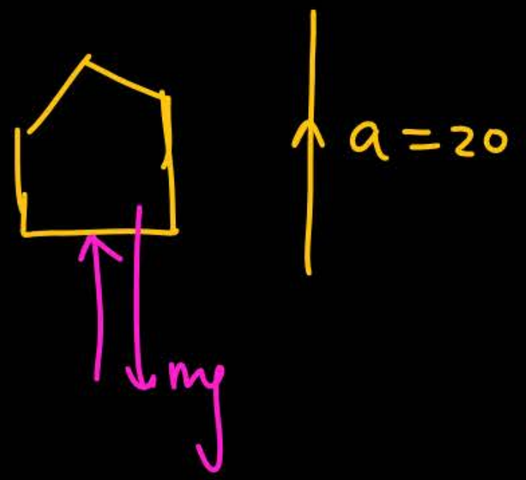
1. $1 : 1$
2. $\sqrt{2} : \sqrt{3}$
3. $\sqrt{3} : \sqrt{2}$
4. $2 : 3$

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. $60\ kg\ s^{-1}$



$F - mg = ma$

$500 \times \frac{dm}{dt} - 10000 = 1000 \times 20$

$500 \frac{dm}{dt} = 1000 \times 30$

$\frac{dm}{dt} = 60$

Ans: (4)

QUESTION

Two fixed frictionless inclined planes making an angle 30° and 60° with the horizontal are shown in the figure. Two blocks A and B are placed on the two planes. What is the relative vertical acceleration of A with respect to B? **[2010]**

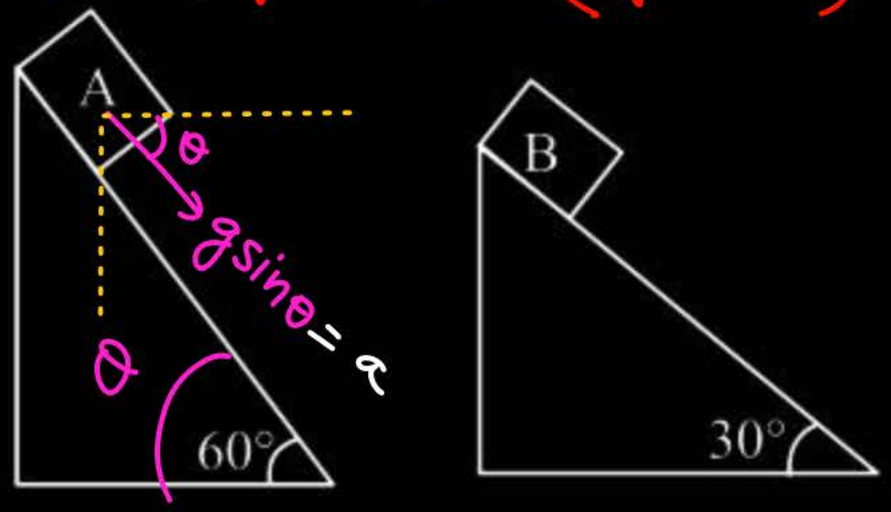
$\vec{a} = g\sin\theta\cos\hat{i} - g\sin\theta\sin\hat{j}$

$y \Rightarrow \vec{a}_{A/B} = \vec{a}_A - \vec{a}_B = (-g\sin^2 60) - (-g\sin^2 30)$

$a_{A/B} = -10\times\frac{3}{4} + 10\times\frac{1}{4}$

$= -5$

1. 4.9 ms^{-2} in horizontal direction
2. 9.8 ms^{-2} in vertical direction
3. Zero
4. 4.9 ms^{-2} in vertical direction



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)]

$5 = kx_1$

$7 = kx_2$

$F_{net} = k(5x_1 - 2x_2)$

$= k\left(5 \cdot \frac{5}{k} - 2 \times \frac{7}{k}\right)$

$= 25 - 14 = 11$

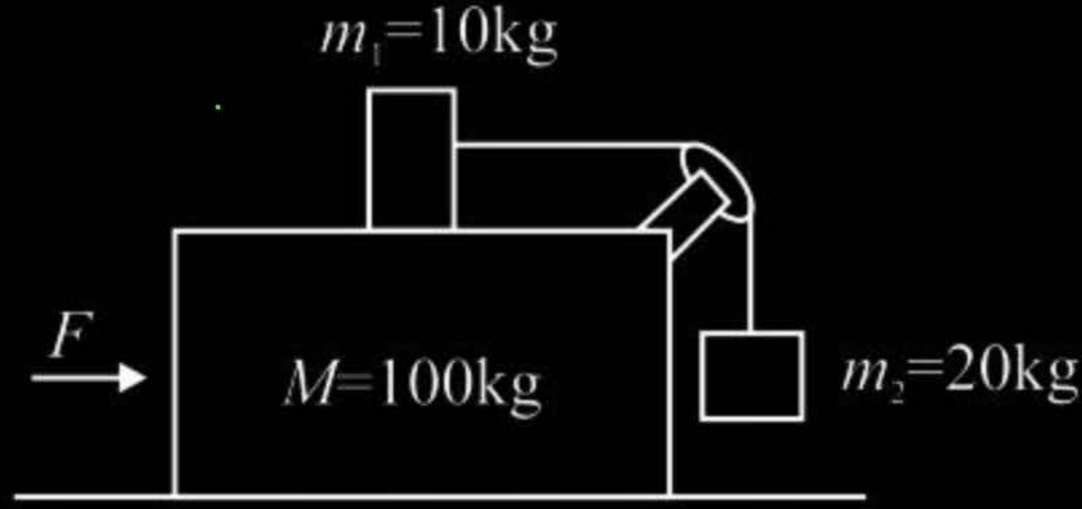
1. 15 N
2. 20 N
3. 11 N
4. 39 N

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)]



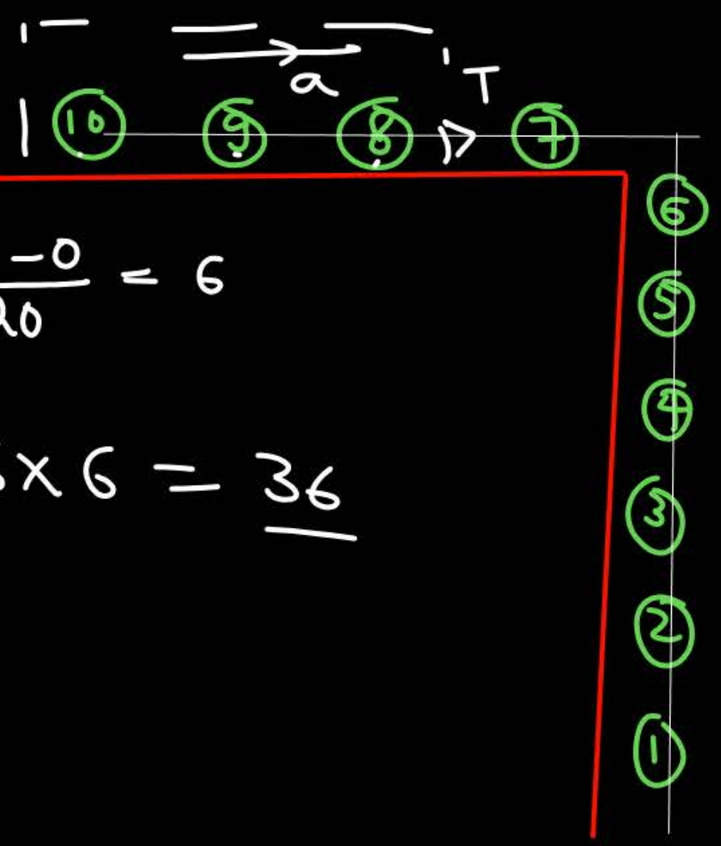
1. 3360 N
2. 3380 N
3. 3120 N
4. 3240 N

Ans : (1)

QUESTION

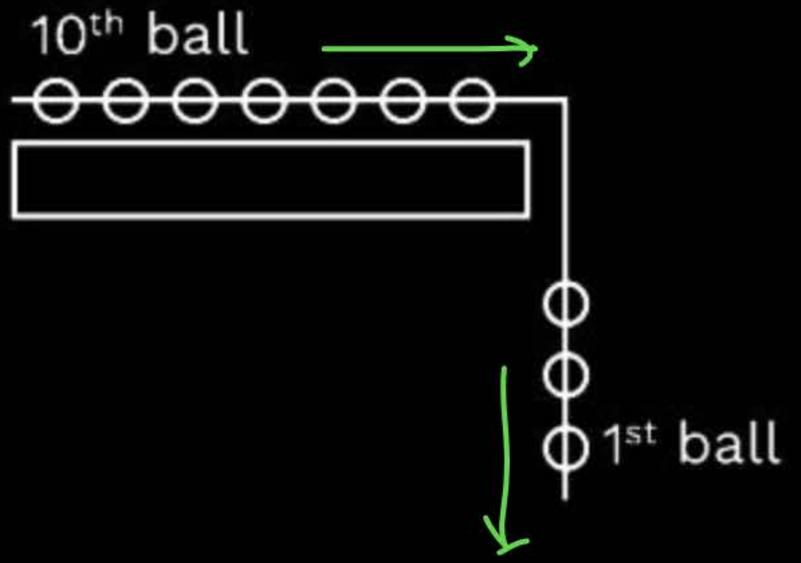
A system of 10 balls each of mass 2 kg are connected via massless and un-stretchable string. The system is allowed to slip over the edge of a smooth table as shown in figure. Tension on the string between the 7^{th} and 8^{th} ball is _____ N when 6^{th} ball just leaves the table.

[June 26, 2022 (II)]



$$a = \frac{120-0}{20} = 6$$

$$T = 6 \times 6 = 36$$



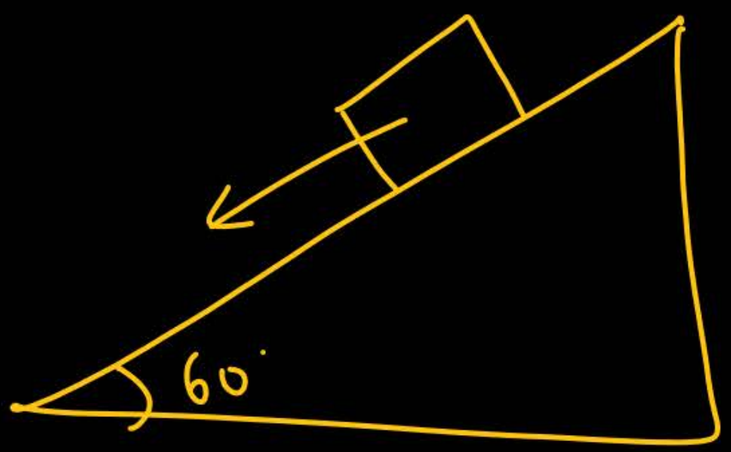
Ans : (36)

QUESTION

A cubic block of mass m is sliding down on an inclined plane at 60° with an acceleration $g/2$, of, the value of coefficient of kinetic friction is:

[April 7, 2025 (I)]

1. $\sqrt{3}-1$
2. $\sqrt{3}/2$
3. $\sqrt{2}/3$
4. $1-\frac{\sqrt{3}}{2}$



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

$$\frac{g}{2} = g\frac{\sqrt{3}}{2} - \mu g\frac{1}{2}$$

$$1 = \sqrt{3} - \mu$$

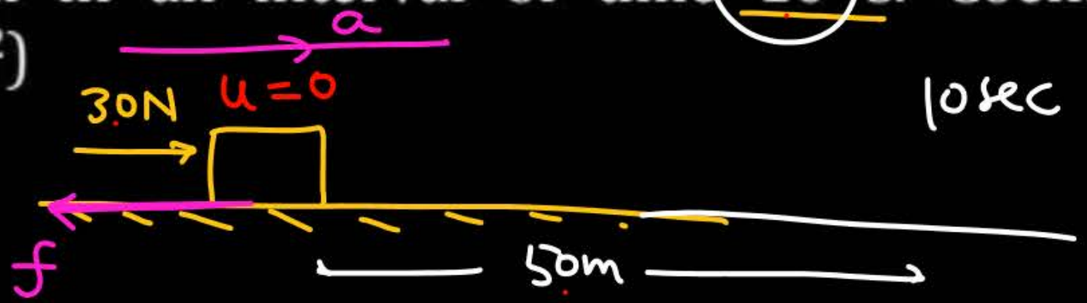
$$\mu = \sqrt{3} - 1$$

Ans : (1)

QUESTION

A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is: (given, $g = 10\ ms^{-2}$)

[Feb. 1, 2023 (I)]



$50 = 0 + \frac{1}{2} \times a \times (10)^2$

$a = 1 = \frac{F - f}{m}$

$1 = \frac{30 - \mu mg}{5}$

$5 = 30 - \mu \times 50$

$\mu 50 = 25$

$\mu = \frac{25}{50} = \frac{1}{2} = .5$

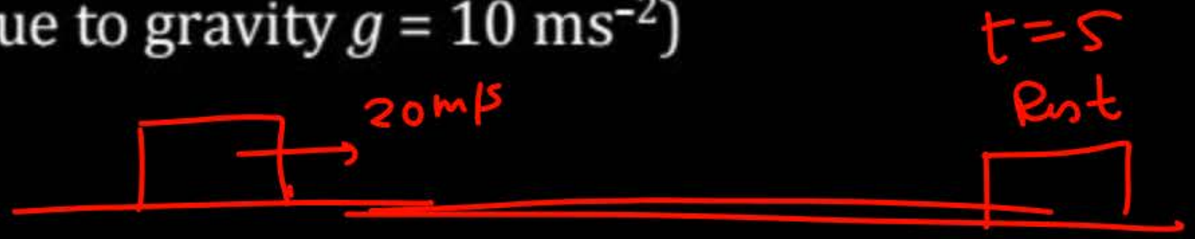
1. 0.50
2. 0.60
3. 0.75
4. 0.25

Ans : (1)

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)]



$v = u + at$

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

$\mu = \frac{20}{50} = .4$

1. 0.2
2. 0.3
3. 0.5
4. 0.4 ✓

Ans : (4)

QUESTION

A block of mass m slides down the plane inclined at angle $30°$ with an acceleration $g/4$. The value of coefficient of kinetic friction will be:

[Jan. 29, 2023 (I)]

1. $\frac{2\sqrt{3}+1}{2}$
2. $\frac{1}{2\sqrt{3}}$
3. $\frac{\sqrt{3}}{2}$
4. $\frac{2\sqrt{3}-1}{2}$

Ans : (2)

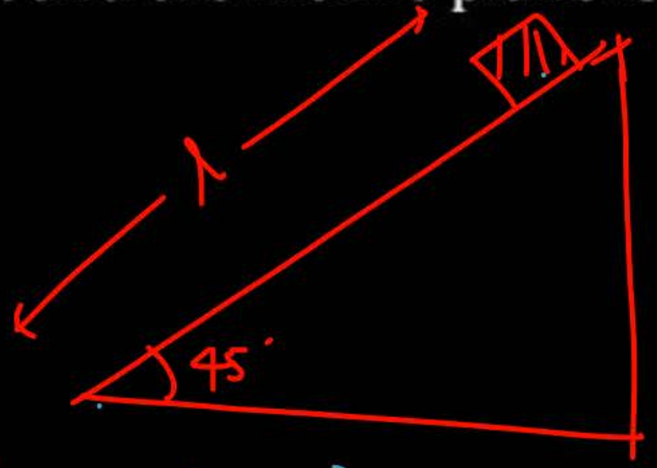
QUESTION

ghr. ** likh

The time taken by an object to slide down 45° rough inclined plane is n times as it takes to slide down a perfectly smooth 45° incline plane. The coefficient of kinetic friction between the object and the incline plane is _____.

[Jan. 29, 2023 (II)]

1. $\sqrt{\frac{1}{1-n^2}}$
2. $\sqrt{1-\frac{1}{n^2}}$
3. $1+\frac{1}{n^2}$
4. $1-\frac{1}{n^2}$



$l = 0 + \frac{1}{2}at^2$

$t = \sqrt{\frac{2l}{a}}$

$\sqrt{\frac{2l}{g\sin\theta - \mu g\cos\theta}} = n\sqrt{\frac{2l}{g\sin\theta}}$

$\frac{1}{g\sin\theta - \mu g\cos\theta} = \frac{n^2}{g\sin\theta}$

$g\sin\theta = n^2 g\sin\theta - n^2\mu g\cos\theta$

$\mu g\cos\theta = \frac{g\sin\theta(n^2-1)}{n^2}$

$\mu = \frac{n^2-1}{n^2} = 1 - \frac{1}{n^2}$

Ans : (4)

QUESTION

$a = 0$

A block of mass M slides down on a rough inclined plane with constant velocity. The angle made by the incline plane with horizontal is θ. The magnitude of the contact force will be:

[July 27, 2022 (II)]

1. Mg
2. $Mg\cos\theta$
3. $\sqrt{Mg\sin\theta + Mg\cos\theta}$
4. $Mg\sin\theta\sqrt{1+\mu}$

Ans : (1)

QUESTION

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)]**

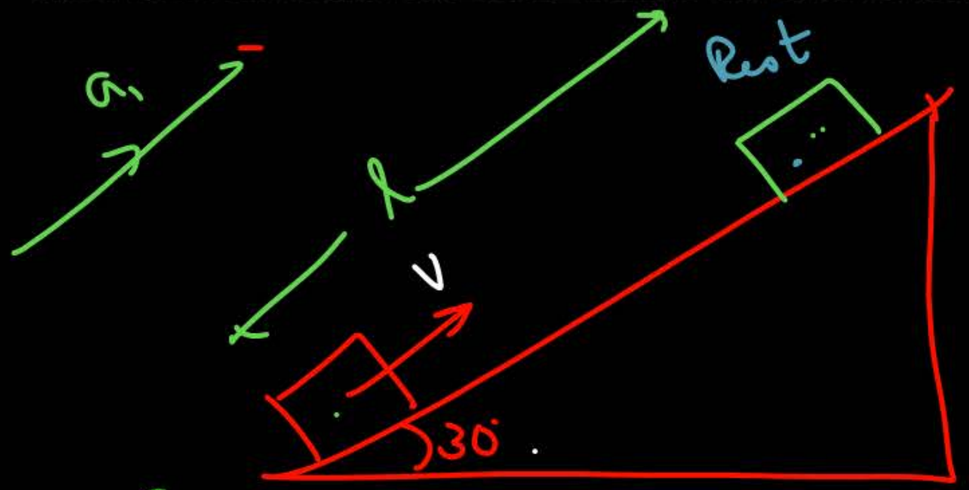
1. 4.9 m
2. 9.8 m
3. 12.5 m
4. 19.6 m

Ans : (2)

QUESTION

2. A body of mass 'm' is launched up on a rough inclined plane making an angle of 30°with the horizontal. The coefficient of friction between the body and plane is $\frac{\sqrt{x}}{5}$ if the time of ascent is half of the time of descent. The value of x is _____.

[July 20, 2021 (II)]



$t_{\text{जाने}} = \frac{1}{2} t_{\text{आने}}$

$\frac{v}{a_1} = \frac{1}{2}\sqrt{\frac{2l}{a_2}}$

$\frac{v^2}{a_1^2} = \frac{l}{2a_2}$

$\frac{v^2}{a_1^2} = \frac{v^2}{2 \times 2a_1 a_2}$

$l = 0 + \frac{1}{2} a_2 t^2$

$g\sin\theta + \mu g\cos\theta = 4(g\sin\theta - \mu g\cos\theta)$

$5\mu g\cos\theta = 3g\sin\theta$

$\mu = \frac{3}{5}\tan\theta = \frac{3}{5} \times \frac{1}{\sqrt{3}}$

$= \frac{\sqrt{3}}{5}$

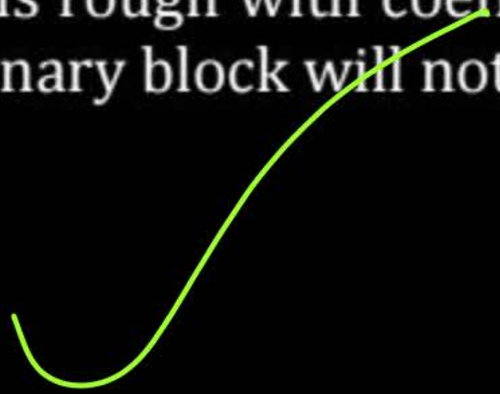
Ans : (3)

① $0^2 = V^2 - 2a_1 l$

② $0 = V - a_1 t$

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]**



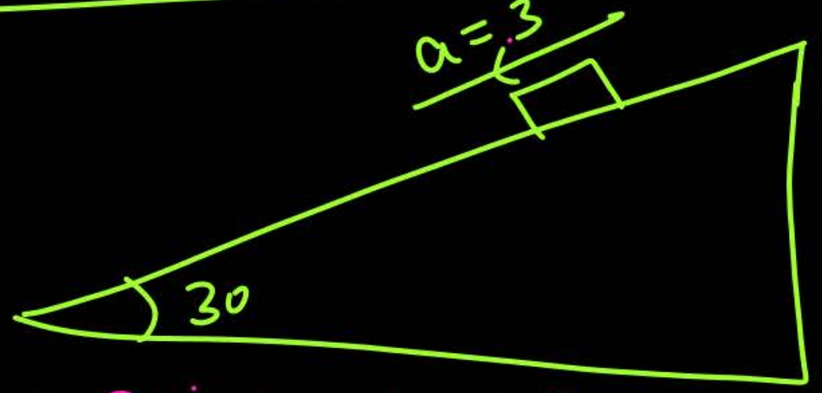
Ans : (25)

QUESTION

A body of mass 2 kg slides down with an acceleration of 3 m/s^2 on a rough inclined plane having a slope of 30°. The external force required to take the same body up the plane with the same acceleration will be: ($g = 10\ m/s^2$)

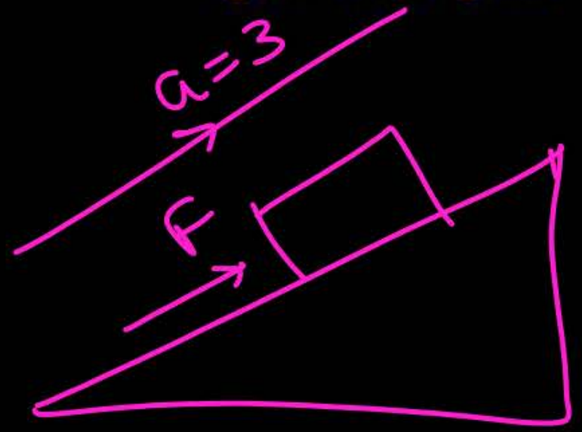
[Online April 15, 2018]

1. 4 N
2. 14 N
3. 6 N
4. 20 N



$a = 3 = g\sin\theta - \mu g\cos\theta$

$\mu g\cos\theta = g\sin\theta - 3$



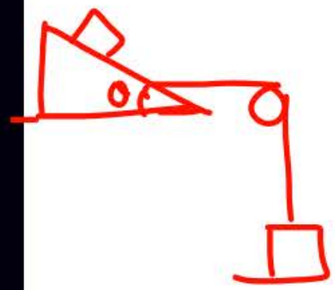
$F - mg\sin\theta - \mu mg\cos\theta = m \times 3$

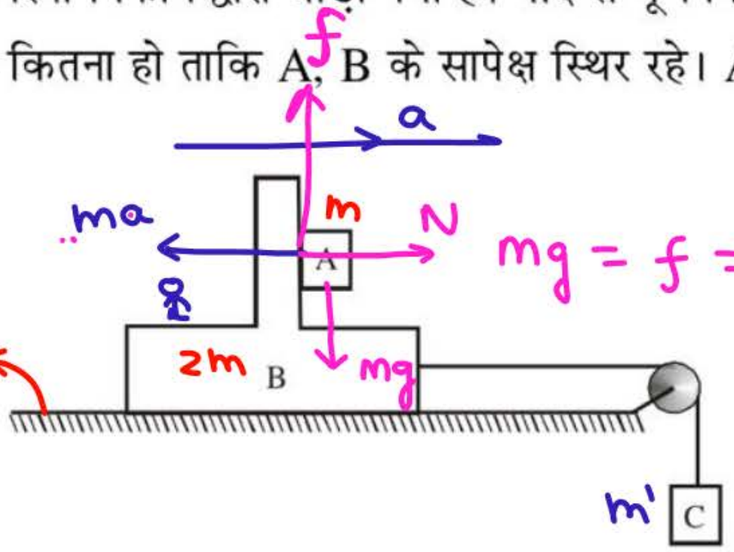
$F - mg\sin\theta - m(g\sin\theta - 3) = m \times 3$

Ans : (4)

5. In the arrangement shown in the figure, mass of the block B and A is 2m and m respectively. Surface between B and floor is smooth. The block B is connected to the block C by means of a string-pulley system. If the whole system is released, then find the minimum value of mass of block C so that A remains stationary w.r.t. B. Coefficient of friction between A and B is μ.

प्रदर्शित चित्र व्यवस्था में ब्लॉक B एवं A के द्रव्यमान क्रमशः 2m एवं m है। B एवं फर्श के मध्य की सतह चिकनी है। ब्लॉक B को ब्लॉक C से रस्सी-घिरनी निकाय द्वारा जोड़ा गया है। यदि सम्पूर्ण निकाय को विरामावस्था से मुक्त किया जाये तो ब्लॉक C का न्यूनतम द्रव्यमान कितना हो ताकि A, B के सापेक्ष स्थिर रहे। A एवं B के मध्य घर्षण गुणांक μ है।





$a = \frac{m'g}{3m+m'} = \frac{g}{\mu}$

$mg = f = \mu N$

$\mu = 0$

$m'g = \mu m'a$

$a = g/\mu$

$m'\mu = 3m + m'$

$m' = \frac{3m}{\mu - 1}$

(A) $\frac{m}{\mu}$ (B) $\frac{2m+1}{\mu+1}$ (C) $\frac{3m}{\mu-1}$ (D) $\frac{6m}{\mu+1}$

Ans. (C)

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]**

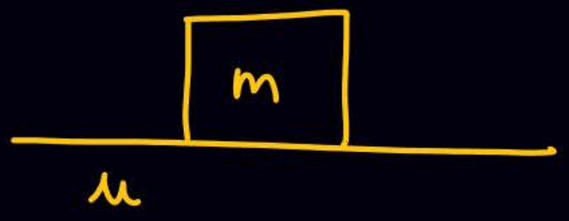
क्षैतिज से 45° बना रहे एक आनत-तल पर एक गुटका सरक रहा है। उनके बीच घर्षण-गुणांक μ है गुटके को ऊपर सरकाने के लिये आवश्यक बल, उसे नीचे सरकने से रोकने के लिये आवश्यक बल का 3 गुना है। यदि N =10μ माने, तो N का मान है

Ans. 5

Very easy

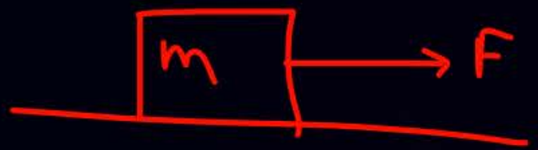
$(mg\sin\alpha + \mu mg\cos\alpha) = 3(mg\sin\alpha - \mu mg\cos\alpha)$

Q



Find the min horizontal force required to move the block.

Sol^n $F_{min} = \mu mg$



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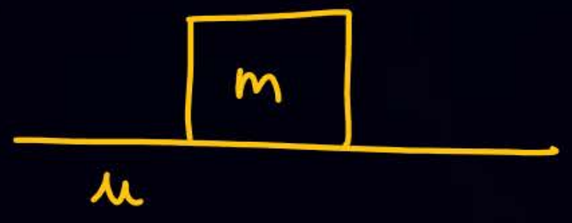


Find the min force required to move the block.

Sol^n $F_{min} = \mu mg$

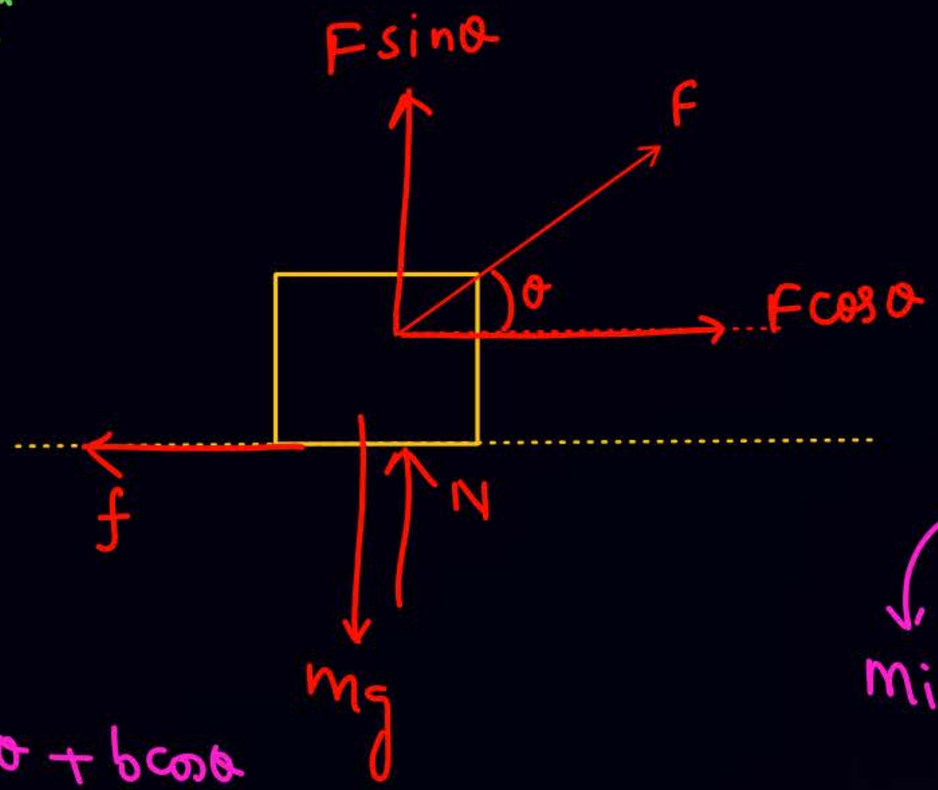
$$F_{min} = \frac{\mu mg}{\sqrt{1+\mu^2}}$$

$\tan\theta = \mu_s$

Derivation

Prof

Soln



$$F\cos\theta > (f_s)_{max} = \mu_s N$$

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

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

$$F(\cos\theta + \mu\sin\theta) = \mu mg$$

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

F_{min}

$$F_{min} = \frac{\mu mg}{\sqrt{1+\mu^2}}$$

$$\tan\theta = \mu_s$$

$$y = a\sin\theta + b\cos\theta$$

$$y_{max} = \sqrt{a^2+b^2}$$

Proof ki Proof

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

$$F = \frac{\mu mg}{\left(\frac{1}{\sqrt{1+\mu^2}}\cos\theta + \frac{\mu}{\sqrt{1+\mu^2}}\sin\theta\right)\sqrt{1+\mu^2}}$$

$$F = \frac{\mu mg}{(\cos\theta \times \sin\alpha + \sin\theta\cos\alpha)\sqrt{1+\mu^2}}$$

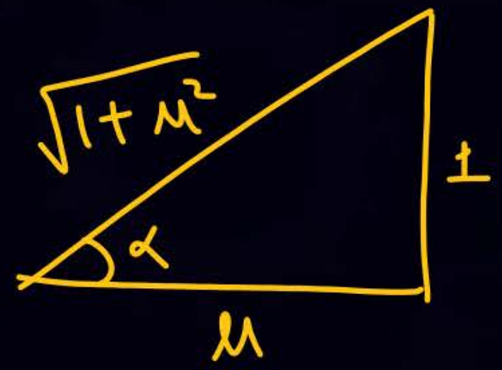
$$F = \frac{\mu mg}{\sin(\theta+\alpha)\sqrt{1+\mu^2}}$$

min

max

$$\frac{1}{\mu} = \cot\theta = \frac{1}{\tan\theta}$$

$$\tan\theta = \mu_s$$

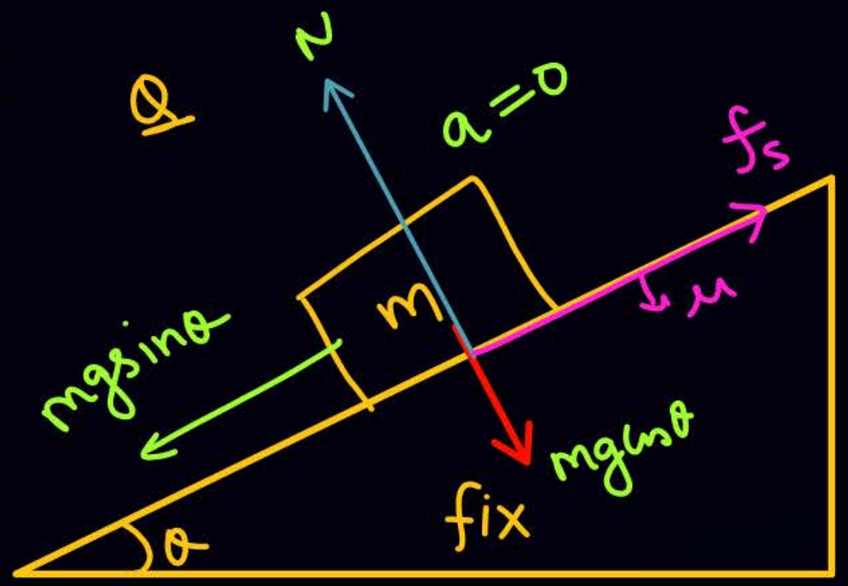


$$\alpha + \theta = 90$$

$$\alpha = 90 - \theta$$

$$\tan\alpha = \tan(90 - \theta)$$

Q



Block is at rest on incline plane

Q

Force applied by inclined plane on block will be

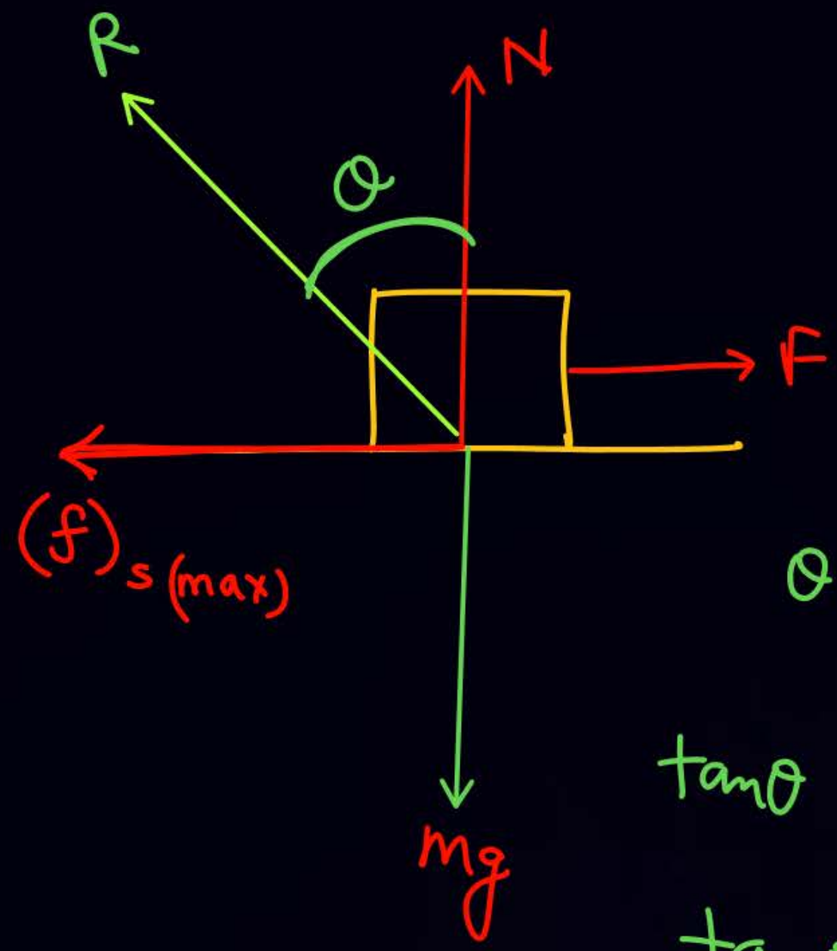
Contact force → $\sqrt{N^2+f^2}$

$mg\cos\theta$ ✗

Ans $\sqrt{N^2+f^2}$

Ans $\sqrt{N^2+f^2} = \sqrt{(mg\cos\theta)^2+(mg\sin\theta)^2}$

$= mg$



Block just about to slide.

$\theta = ?$

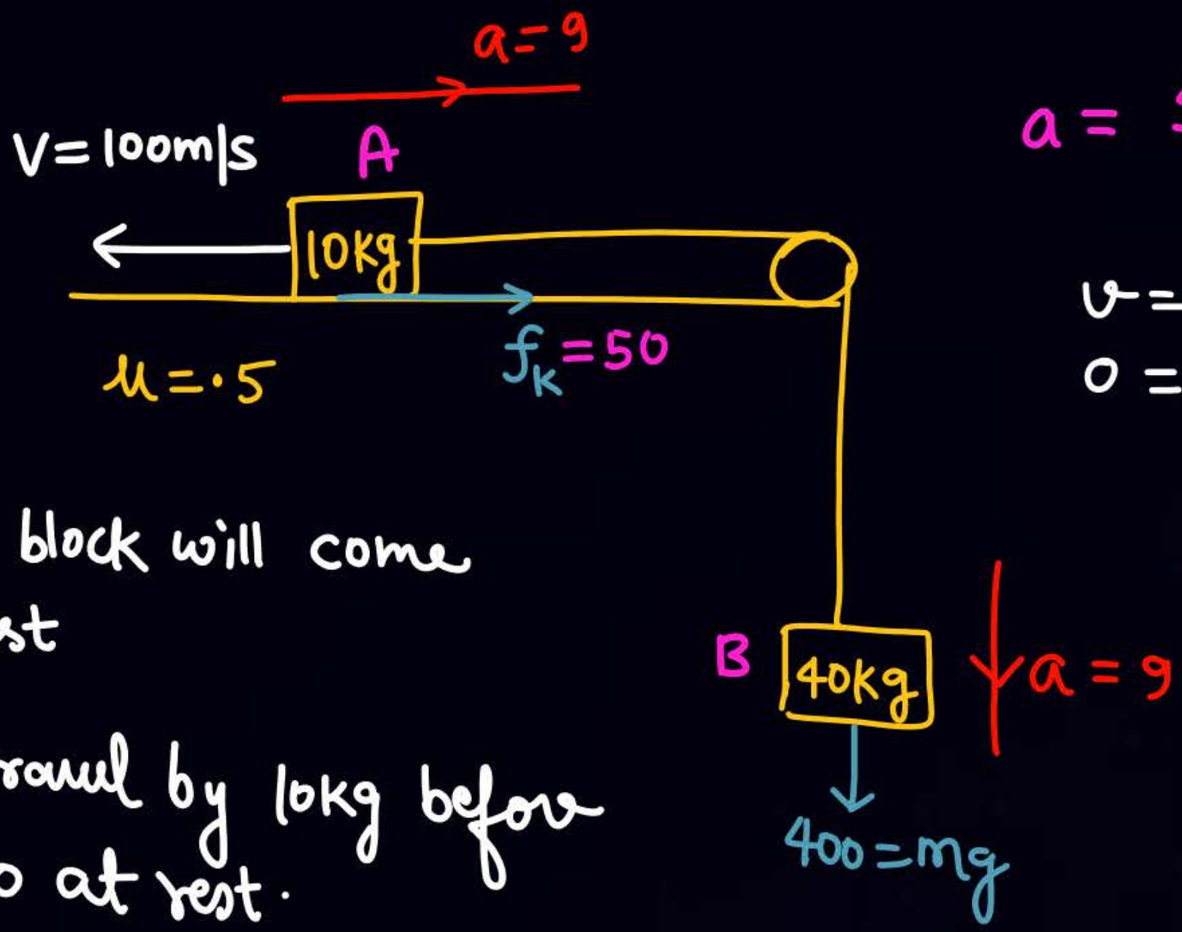
$$\tan\theta = \frac{(f_s)_{max}}{N} = \frac{\mu_s N}{N} = \mu_s$$

$$\tan\theta = \mu_s$$

θ → Angle of friction

μ_s देने का कहलाता है

SSSQ



$$a = \frac{400+50}{50} = g$$

$$v = u + at$$

$$0 = 100 - gt \qquad t = \frac{100}{g}$$

$$x = \frac{(100)^2}{2 \times g}$$

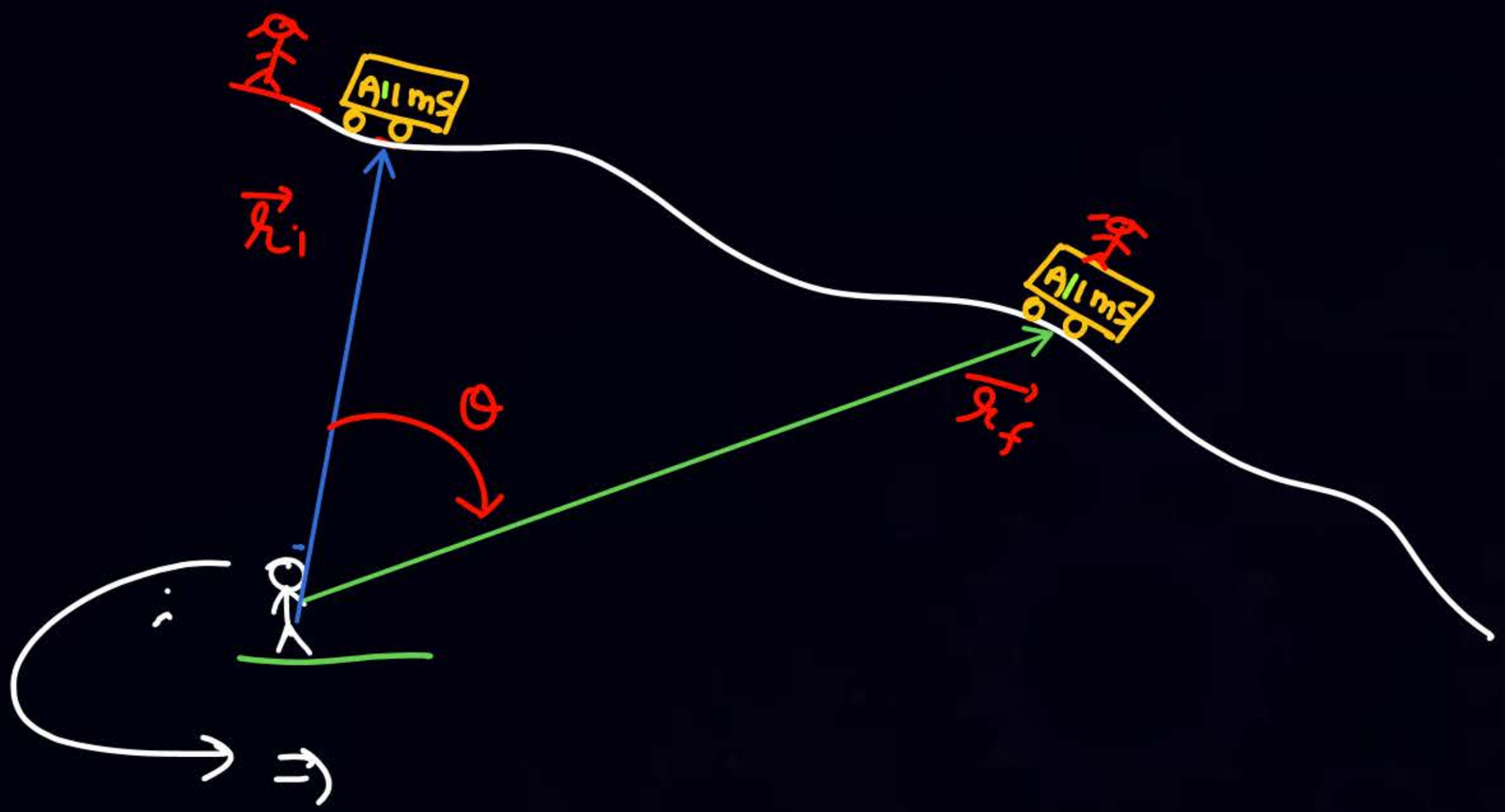
① When 10 kg block will come to at rest

② Distance travel by 10kg before coming to at rest.

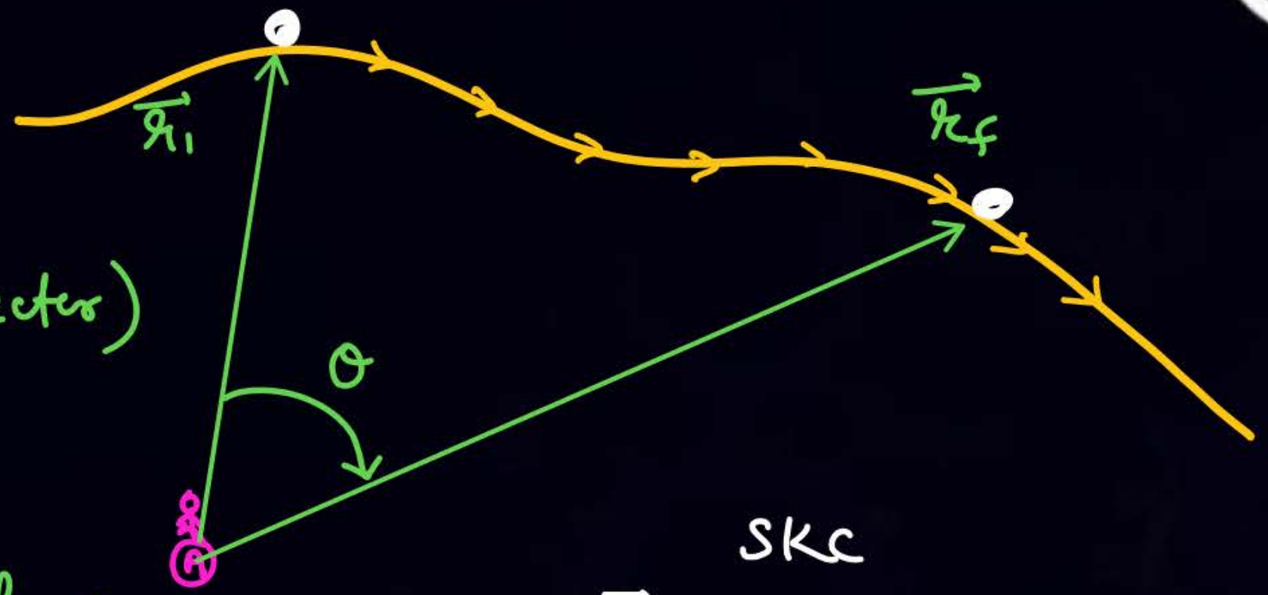
2 block system ⟶ 30 min Records

Circular motion

→ 5-6 Lecture


AIIms
AIIms
$\vec{r}_i$
θ
$\vec{r}_f$

Angular displacement → Angle rotated by position vector (radius vector)



- $\omega = \frac{d\theta}{dt}$ = Rate of change of θ
  - Angular velocity of position vector or radius vector.

$\Rightarrow$ SKC

$$\alpha = \frac{d\omega}{dt}$$

Angular displacement for A
$= \theta = \pi/4$ (cw)

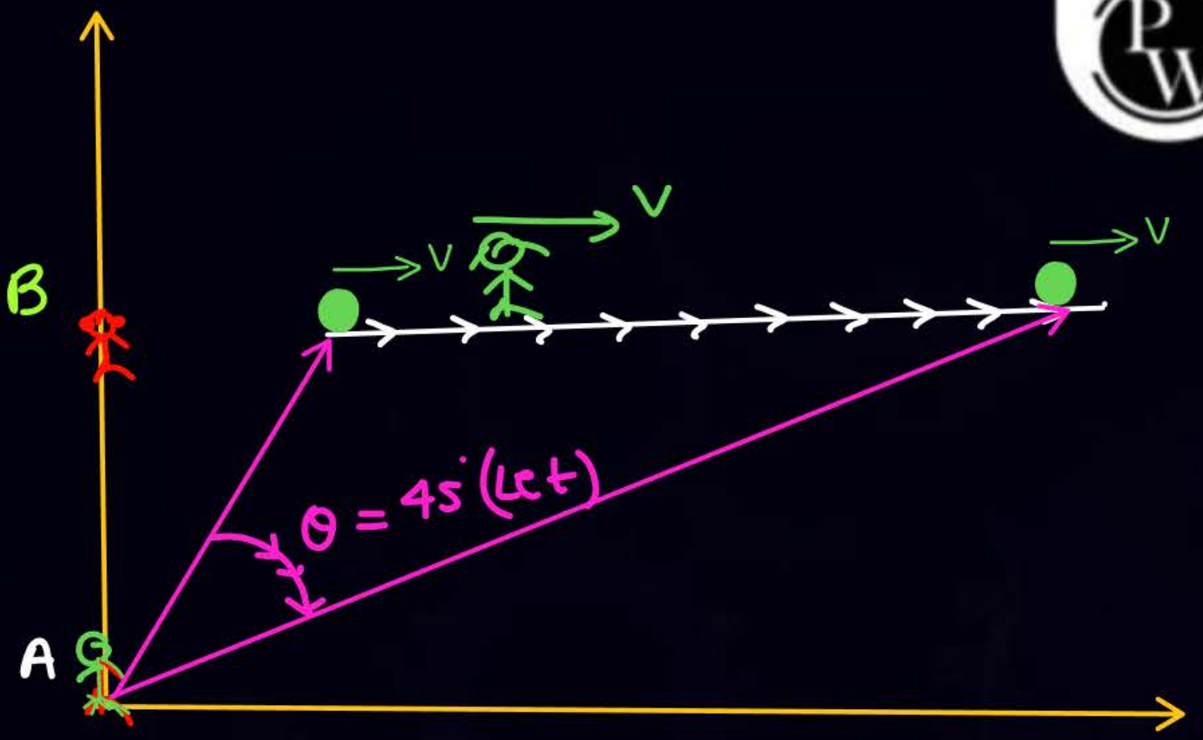
$\omega \neq 0$

$\theta \neq 0$

Angular displacement for B $= 0 = \theta$

$\omega = 0$

$\alpha = 0$



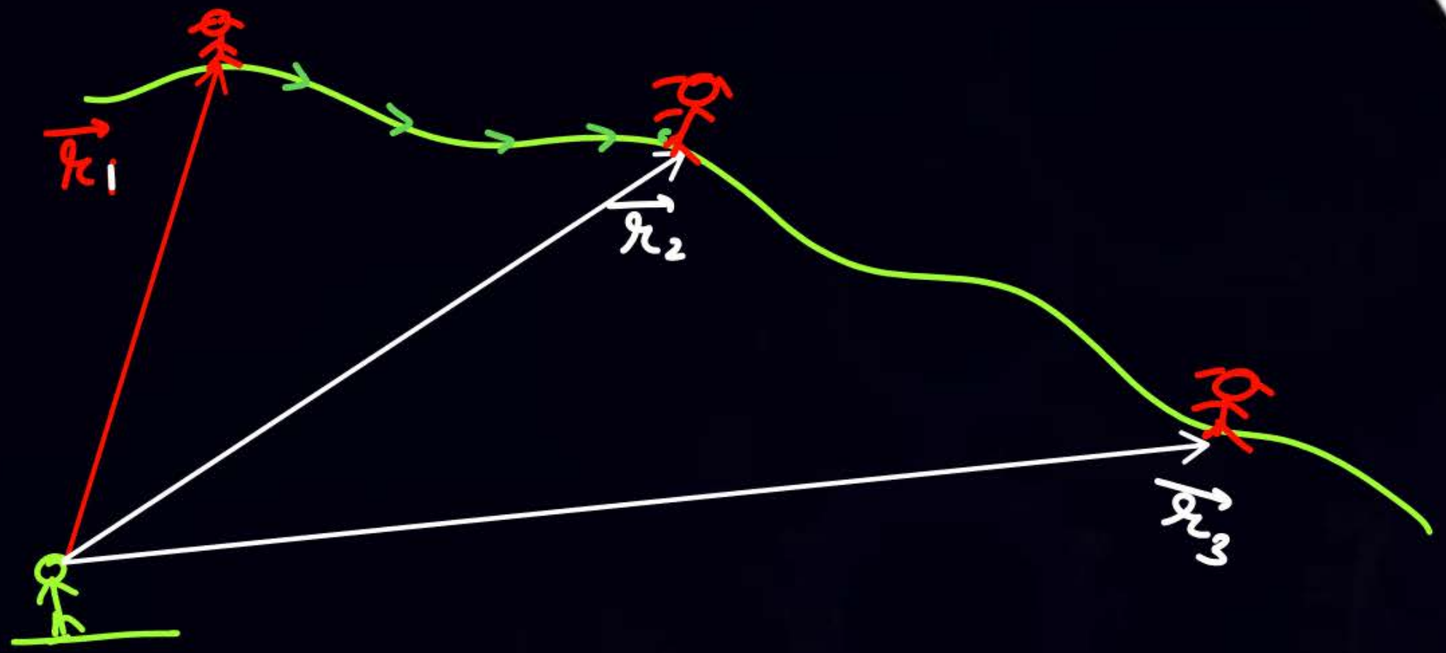
$\theta, \omega, \alpha \longrightarrow$ depend on observer
(Relative)

$\vec{r}$ → घूम रहा है (CW)

dir^{n} → change

$\vec{r}$ का magnide change ho raha hai.

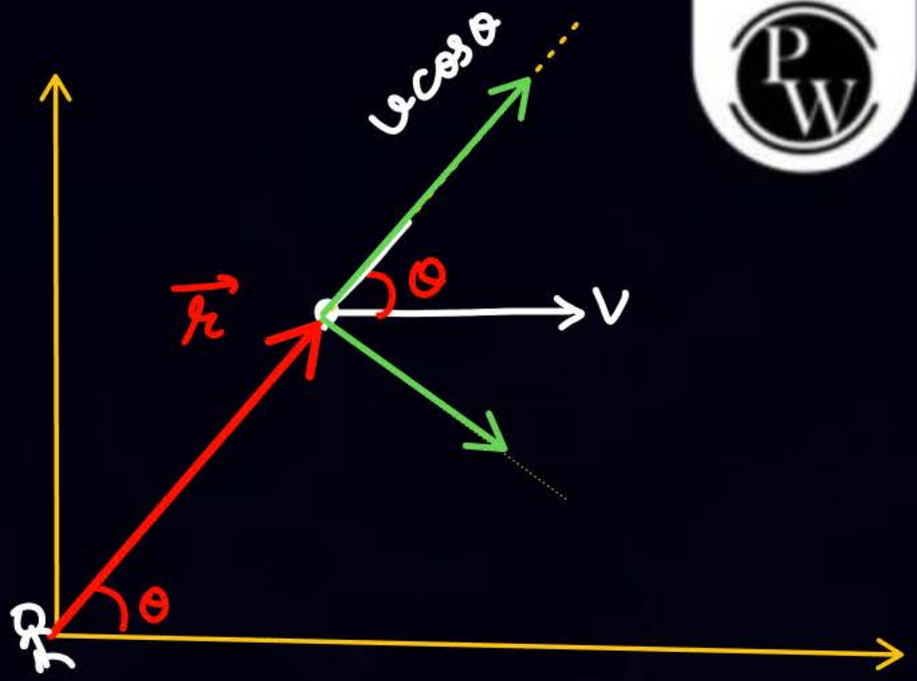
→ Iski length.



$$\frac{d|\vec{r}|}{dt} = v\cos\theta$$

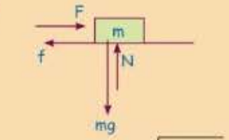
$$(\omega_p)_{\text{wrt origin}} = \frac{v\sin\theta}{r} = \omega = \frac{v_\perp}{r}$$

(Deriv. बाद में)



काम का डब्बा

★



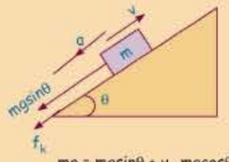
Netcontact force = $\sqrt{N^2 + f^2}$

★

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

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

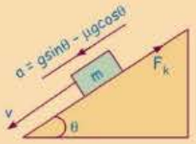
★ When block is moving up along the inclined



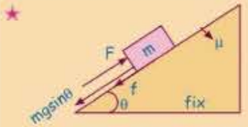
$ma = mg\sin\theta + \mu_k mg\cos\theta$

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

★ When block is moving down along the inclined



★

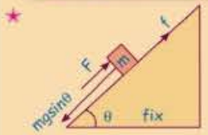


min value of F so that block slide up.

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

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

★



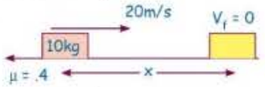
min value of F to prevent the block sliding down

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

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

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

Sol.

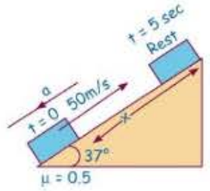


$a = \mu g = 4$ (पीछे) = cost.

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

$x = 50$ 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

- NEET PYQ sheet ko sunday tak khatam karna hai (only NLM + friction)
  will upload today evening.
- JM PYQ sheet — (Reuploaded) → (updated)
  (NLM + friction) ⇒ (39 – 100) (60 ques ≡ 2.5 hour)

← join it I will upload (HCV pdf + sol^n)

THANK YOU