PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

FRICTION

Example

1. A block of mass $2kg$ is given velocity $10m/s$ on a rough horizontal surface of friction

coefficent$\mu = 0.2$. Find the magnitude and the direction of friction force acting on it. After how much time and at what distance it will stop ?

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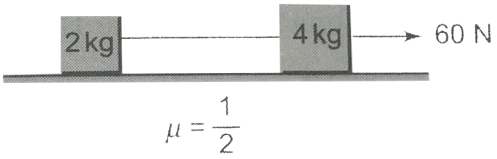
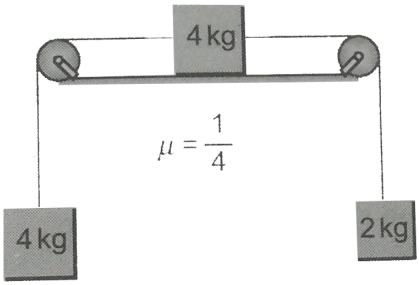
2. Find tension /tensions in the string/strings in the following cases:

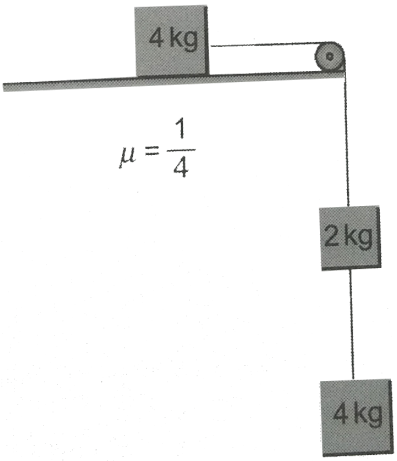
(a)



(b)



(c)



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3. (a) A block slides down an incline of angle 45° with an acceleration $\frac{g}{2\sqrt{2}}$. Find the friction coefficient.

(b) A block slides down at 45° inclined plane in twice the time it takes to slide down a smooth 45° incline. What is friction coefficient between the block and the incline?

(c) A block slides down on a rough inclined plane of inclination 30° with constant velocity. If this block is projected up the plane with a velocity of $10m/s$, then at what distance along the inclined plane , the block will come

to rest?

(d) A body is launched up on a rough inclined plane of inclination θ. If time of ascent is half of time of descent, find the friction coefficient.

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4. A body slides down on an inclined plane of inclination 37° with horizontal. The distance travelled by the body in time t is given by $s = t^2$. Find the friction coefficient between the body and the incline.

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5. In the following problems the air resistance is constant (air resistance always opposes the motion).

(a) A ball is thrown vertically upward. If time of ascent is t_1 and time of descent is t_2, which time is greater ?

(b) A ball is thrown vertically upward with speed u and on returning to the ground, its speed is v_0. Which speed is greater ?

(c) Two balls A and $B(m_A > m_B)$ are thrown

vertically upward with same speed. Which ball A or B (heavier or lighter) wil attain greater height ?

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6. (a) A ball is thrown vertically upward with speed $10m/s$ and it returns to the ground with speed $8m/s$. Find the maximum height attained by the ball.

(b) A ball is thrown vertically upward and if air resistance is half of weight of the ball, find the

ratio of time of ascent and time of descent.

(C) Two balls A and $B(m_A = 2m_B = 2m)$ are thrown vertically upward. If air resistance is $mg/2$, find ratio of maximum height attained by them.

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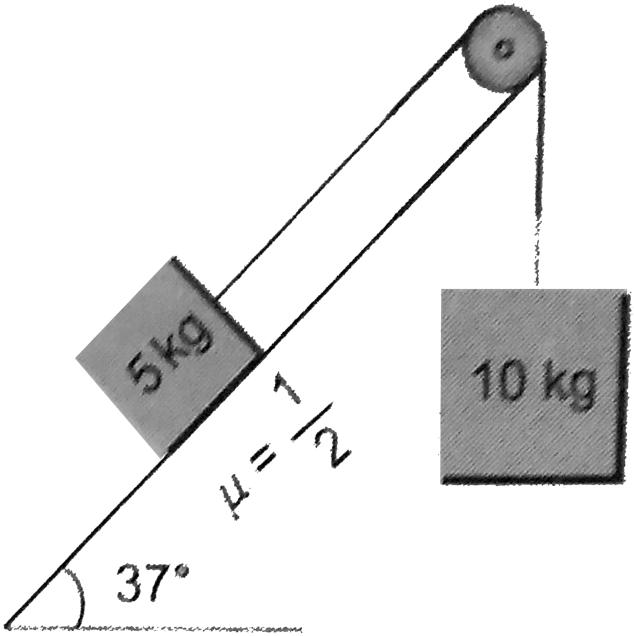
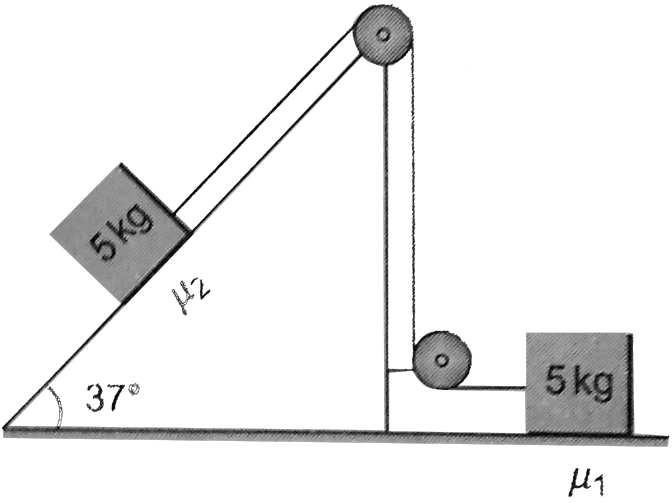
7. In the following problems, string is light, pulleys are smooth and massless.

(a) find the acceleration of each block and tension in the string.

(b) If tension in the string is $15N$ and acceleration of each block is $1m/s^2$, find the value of friction coefficients μ_1 and `mu_(2).





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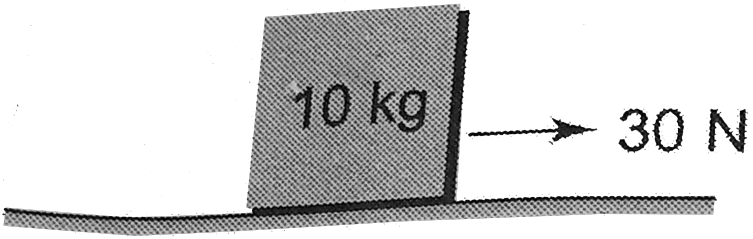
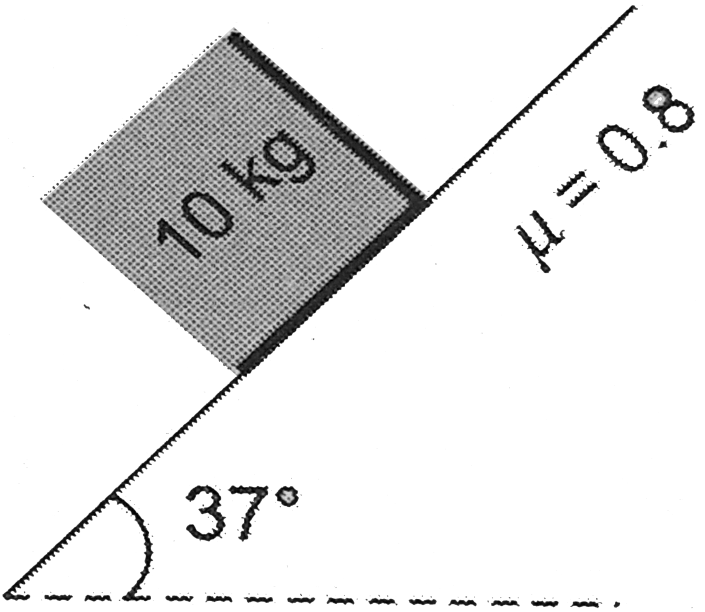
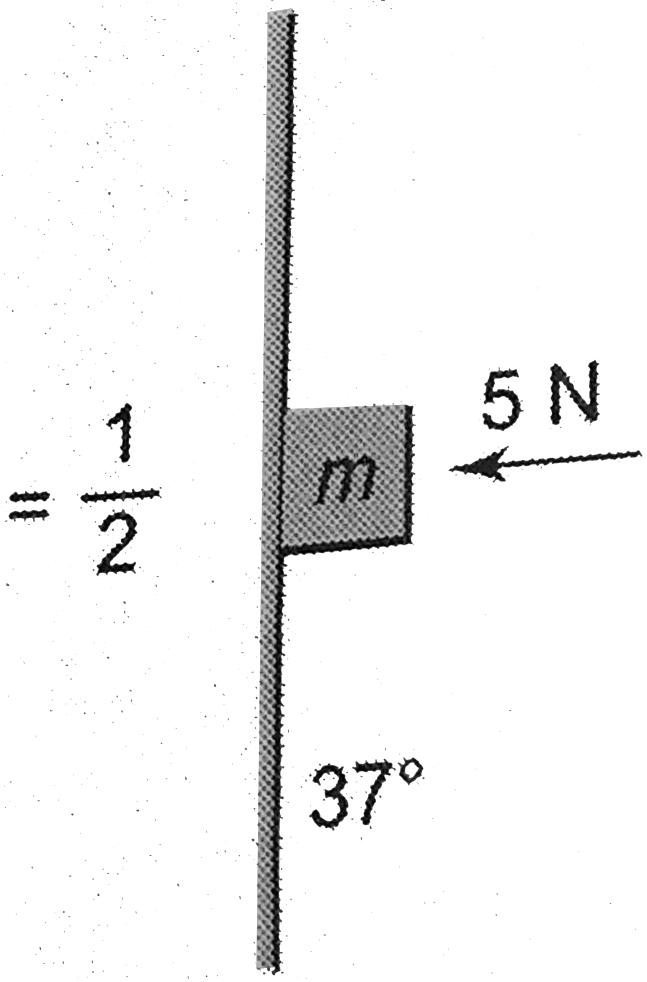
8. Find the friction on the block in the following cases :

(a)

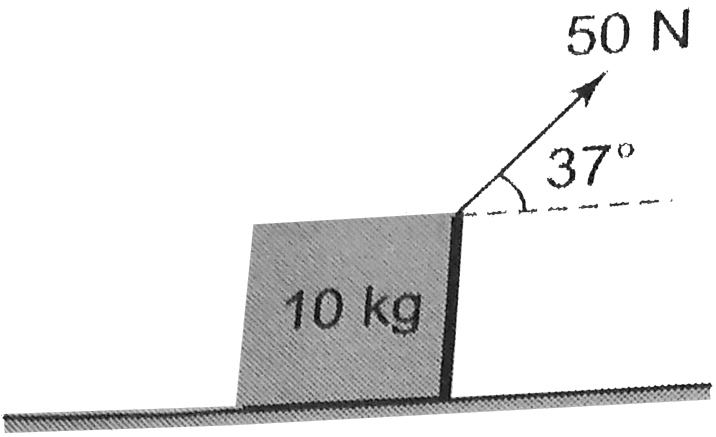


(b)



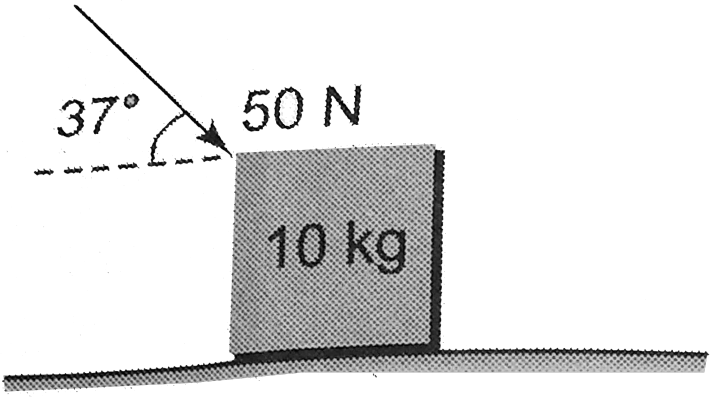


(c) If (i) $m = 0.1kg$ and (ii) $m = 1kg$



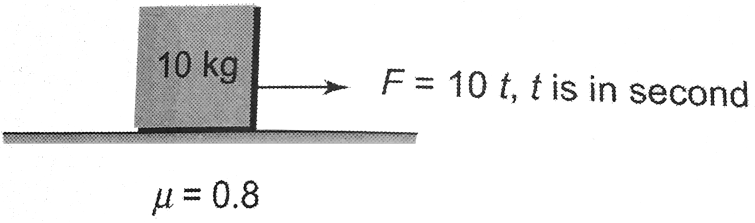
$\mu = 0.8$

(d)



$\mu = 0.8$

(e)



(f)

$If(i)$t = 4 s and (ii)t = 9 s`

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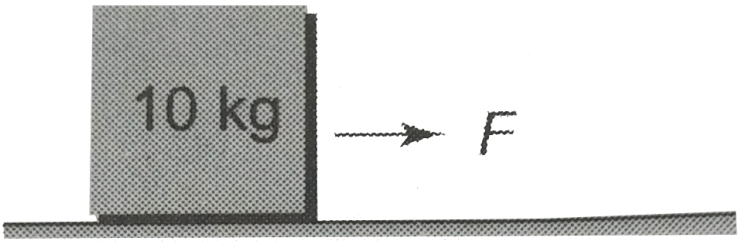
9. Describe motion of the block if F is equal to

(a) $20N$ (b) $40N$ (c) $60N$



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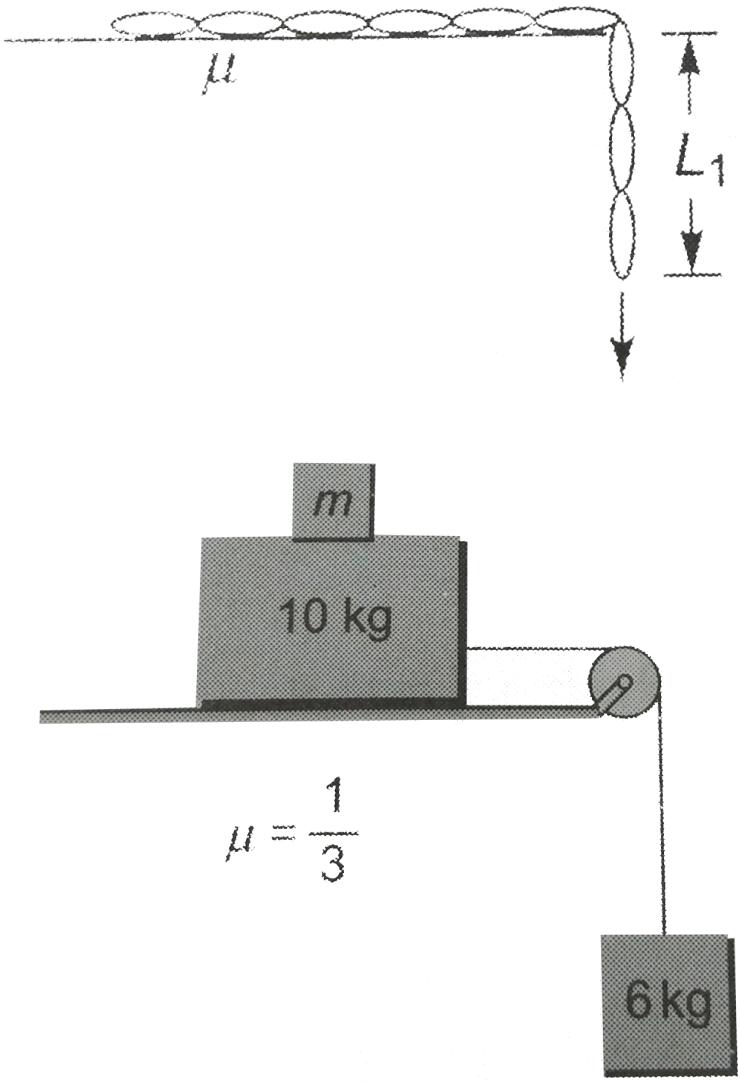
10. A homogeneous chain of length L lie on a table. If the coefficent of friction is μ , find the maximum length L_1 of the chain which can hang from the edge of the table without the chain sliding down.

(b) Consider the situation as shown in the figure. Find teh minimum value of m so that the blocks do not move.



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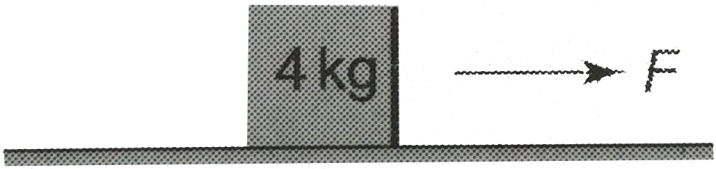
11. If force F is gradually increased from zero to $50N$, tehn (a) find the minimum contact force, (b) find the maximum value of angle of friction when $F = 30N$, (d) find the angle of friction when the block is moving with constant velocity and (e) sketch a graph between friction and applied force.



$\mu_s = 1.0, \mu_k = 0.8$

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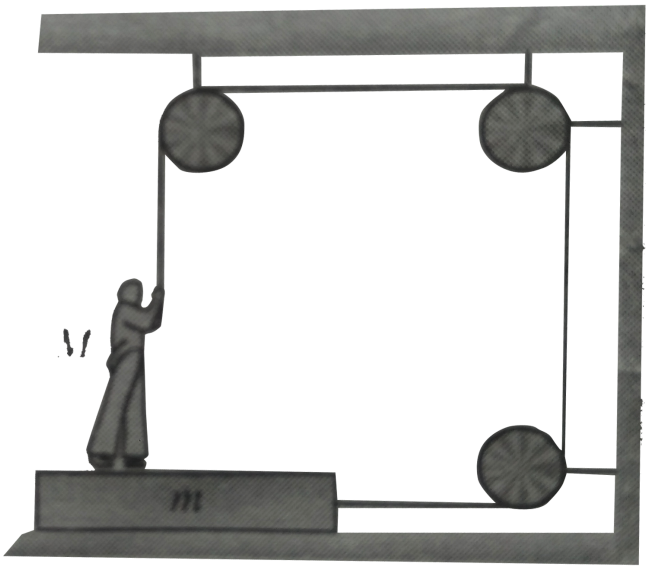
12. The friction coefficient between the board and the floor shown in figure is μ Find the maximum force that the man can exert on the rope so that the board does not slip on the floor



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13. Two masses M_1 and M_2 are connected by a light rod and the system is slipping down a rough incline of angle θ with the horizontal. The friction coefficient at both the contacts is μ. Find the acceleration of the system, and the force by the rod on one of the blocks.

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14. A car starts from rest on a $2 - km$ long bridge. The coefficient of friction is 0.5. Find

the minimum time to cross the bridge.

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15. A lift is moving downwards. A body of mass $2kg$ kept on the floor is pulled horizontally and is in motion. If the coefficient of friction between the body and floor is $1/2$, find the friction acting on the body if (a) lift is moving with a uniform velocity and (b) lift is moving with acceleration $5m/s^2$ in the downward direction.

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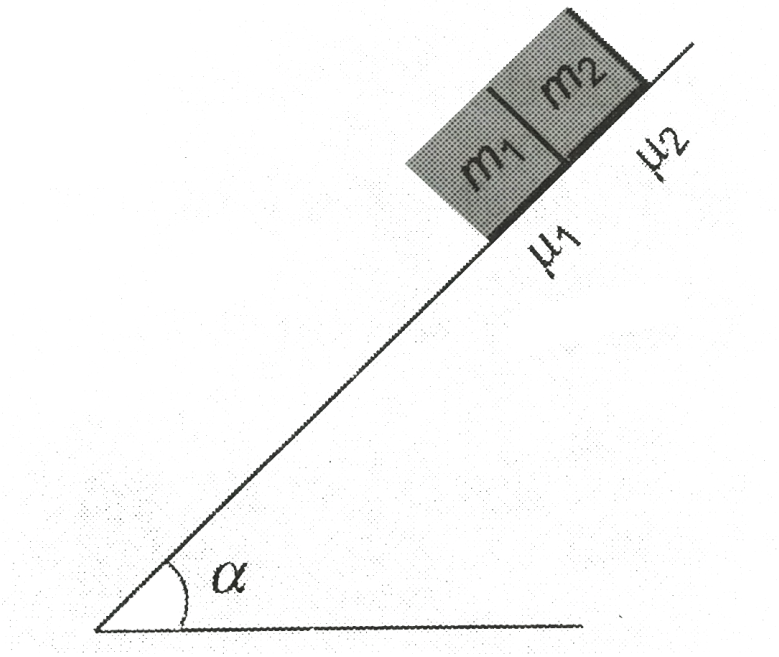
16. Two blocks are in contect moving on an inclined plane of inclination α with the horizontal. The masses of the blocks are equal to m_1 and m_2 and the coefficients of friction between the inclined plane and the blocks are equal to μ_1 and $\mu_2(\mu_1 > \mu_2)$ respectively. Find (a) common acceleration of the blocks and (b)

the contact force between the blocks.



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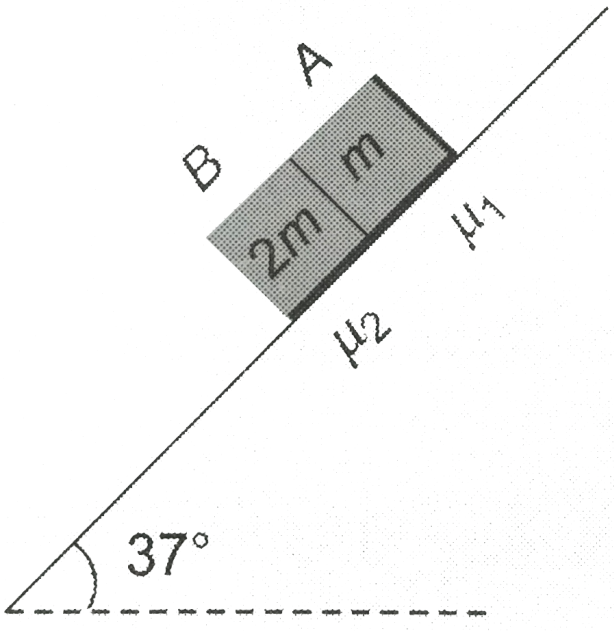
17. Consider the situation as shown in the figure. If μ_1 is the friction coefficient between

block A and incline and μ_2 is the friction coefficient between block B and incline. Find the acceleration of block A if (a) $\mu_1 = \frac{1}{5}, \mu_2 = \frac{2}{5}$ and (b) $\mu_1 = \frac{2}{5}, \mu_2 = \frac{1}{5}$.



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18. A Weight W can be just supported on a rough inclined plane by a force either acting along the plane or horizontally. The angle of friction is ϕ. Find the angle of inclined plane and applied force.

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19. A block of mass m rests on a horizontal floor for which coefficient of friction is μ . Find the magnitude and the direction of force that

should be applied to just move the block so that the applied force is minimum.

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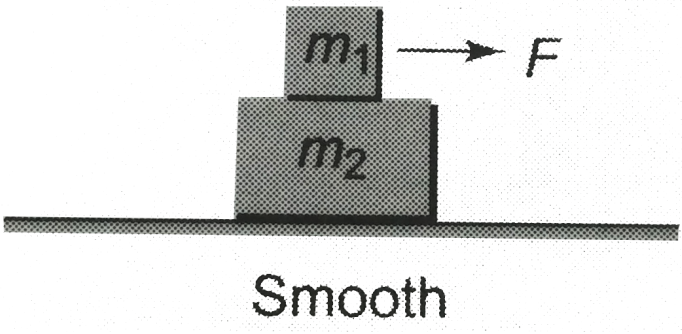
20. Consider the situation as shown in the figgure. The coefficent of friction between the blocks is μ. Find the acceleration of each block.



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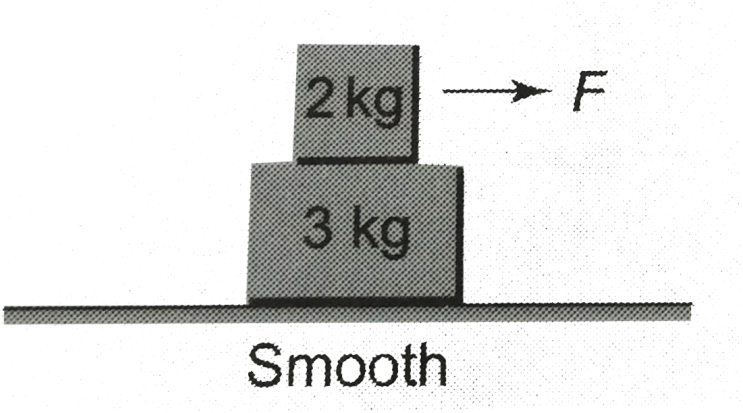
21. The friction coefficient between the blocks is 0.5. Find the acceleration of each block if F is equal to (a) $5N$ and (b) $20N$.



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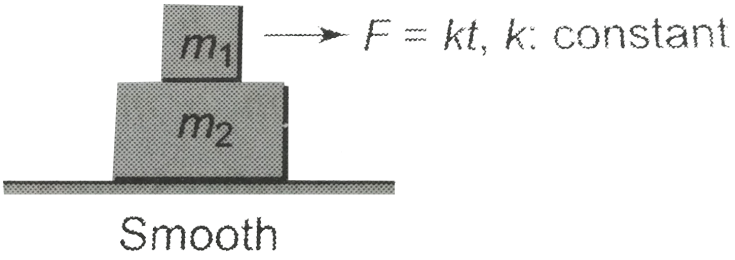
22. The friction coefficient between the blocks is μ. Sketch a graph showing variation of acceleration of the blocks will move separately.



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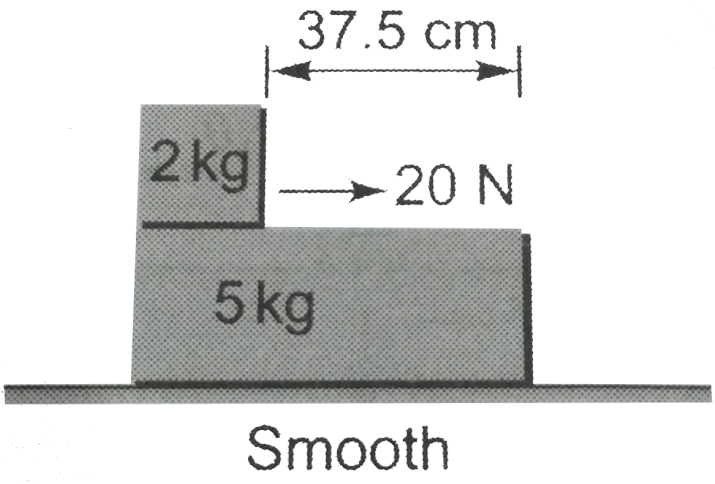
23. If the friction coefficient between the blocks are $\mu_s = 0.52$ and $\mu_k = 0.50$, in how much time , the upper block will lose contact

with the lower block.



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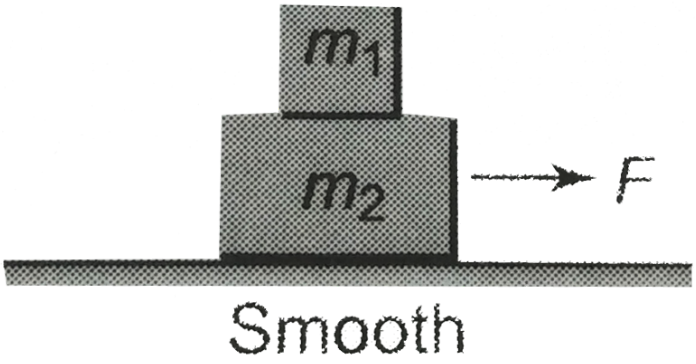
24. The friction coefficient between the blocks is μ. If force F is applied on the lower block ,

analyse motion of two blocks.



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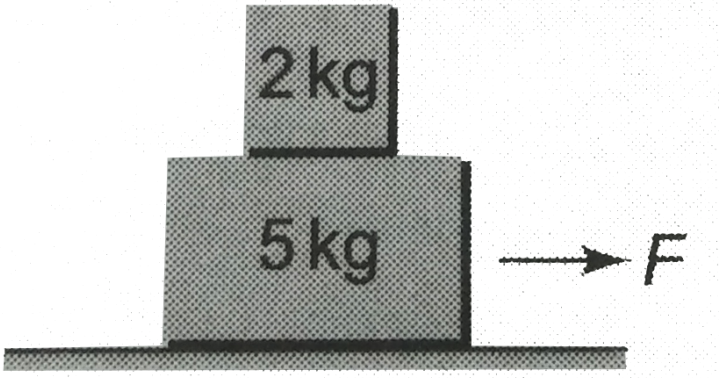
25. The coefficient of friction between the blocks is 0.5. Find the acceleration of each

block if $Fis(a)21N$, $(b)35$ N and $(c)40$ N.



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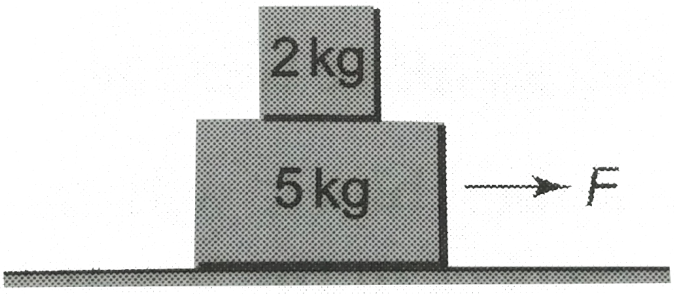
26. The coefficient of friction between the blocks are $\mu_s = 0.3$ and $\mu_k = 0.2$. (a) Find the maximum value of F so that the blocks move together. (b) If force F is twice the value found

in (a), find the acceleration of each block.



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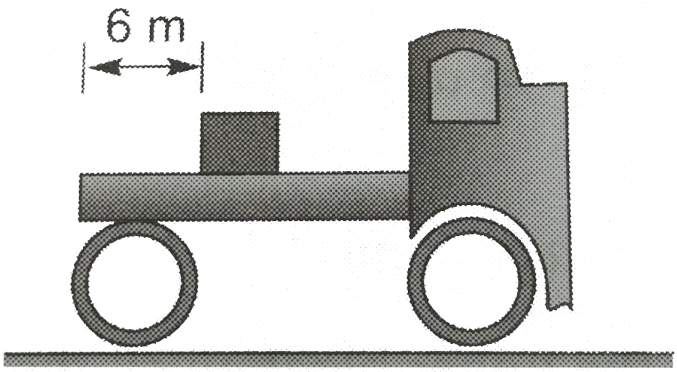
27. A block of mass $2kg$ is placed on a truck as shown in the figure. The coefficient of friction between the block and surface is 0.5. The truck starts from the rest and moves with acceleration a_0. (a) Find the friction force

acting on the block if (i) $a_0 = 2m/s^2$, (ii) $4m/s^2$, (iii) $6m/s^2$ and (b) if acceleration of truck $a_0 = 8m/s^2$. After how much time the blocks falls off the truck and the distance travelled by the truck in this time.



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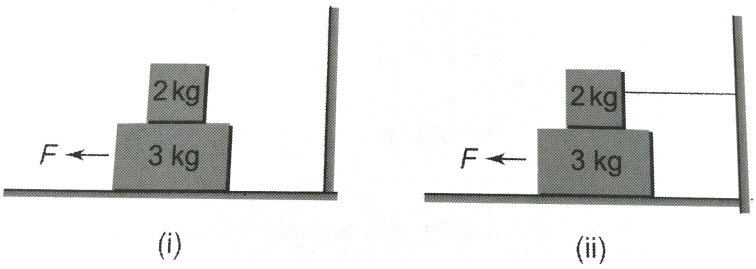
28. Consider the situation as shown in the figure. The coefficient of the friction is 0.5 for all surfaces.

(a) In figure (i) , if $F = 15N$, find the friction force acting on the upper block.

(b) In figure (ii) , find the minimum value of F to move the lower block. The upper block is connected to a rod and held at rest. Find the force applied by rod on the upper block.



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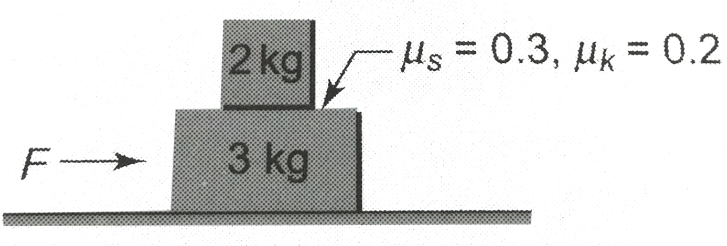
29. Find the minimum value of F to move the lower block between the upper block and the surface . Also, find acceleratuion of each block.



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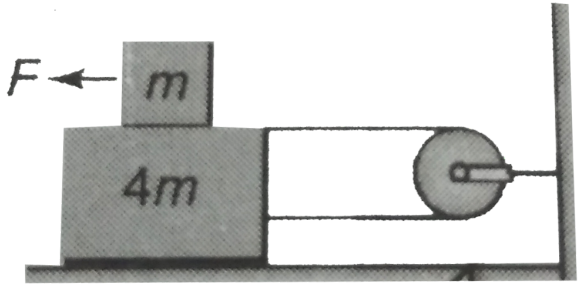
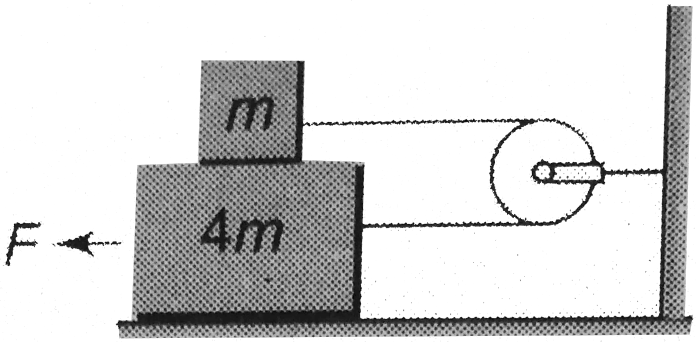
30. Find the minimum value of F and the tension in the string so that the blocks move with constant velocity. The coefficient of friction at all surfaces is μ.

(a)

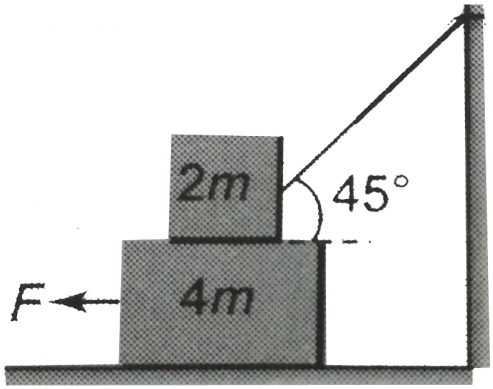


(a)



(b)

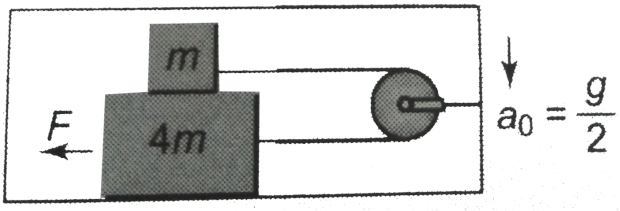
(c)



(c)

$$\left[\text{Take } m = 5 \text{ kg}, \mu = \frac{1}{4}\right]$$

(d)



(d)

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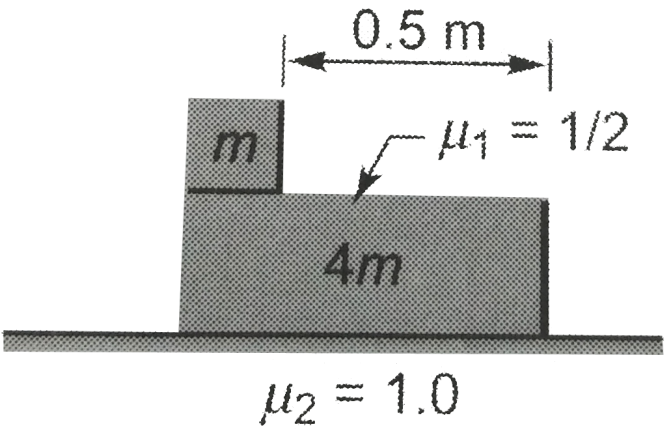
31. Both the blocks are given same velocity towards right. In how much time , the smaller

block will separate from the large block.



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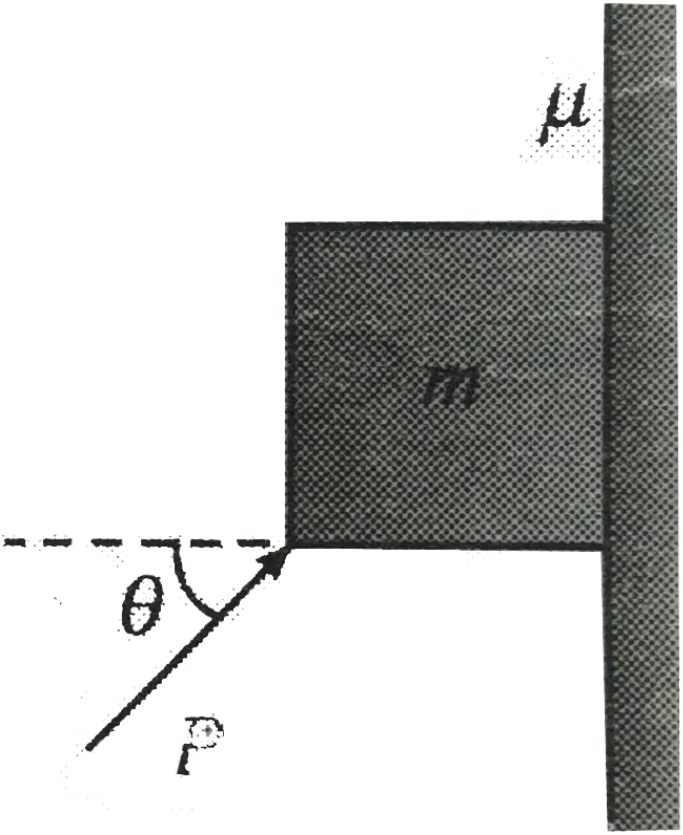
32. A block of mass m is supported on a rough wall by applying a force in figure Coefficient of static friction between block and wall is μ

For what range of value of p , the block remain

in static equilibrium ?



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33. A block is placed on an inclined plane whose angle of inclination is greater than the angle of repose. If the coefficient of friction is μ (a) find force P applied parallel to incline that will keep it in equilibrium (minimum and maximum value of force). (b) Find the range of P if it is applied horizontally on the block. (c) What is the minimum value of P if it is applied perpendicular to the inclined plane?

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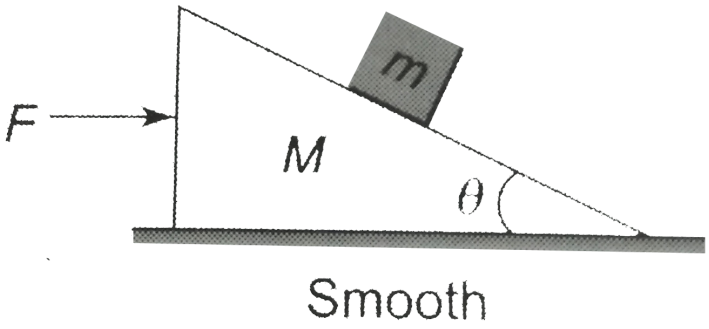
34. Consider the situation shown in the figure . The coefficient of friction between the blocks is μ. Find the minimum and the maximum force F that can be applied so that two blocks move together.



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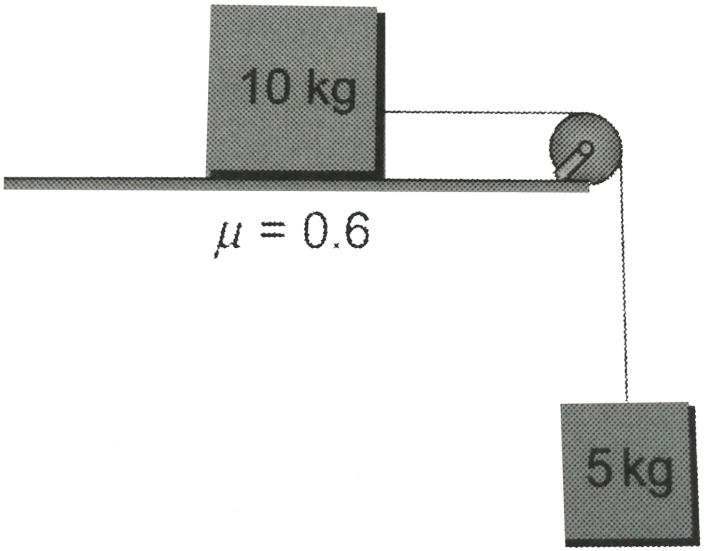
35. Find the acceleration and tension in the string in the following cases . The pulley and string are massless.



(a)

(b)

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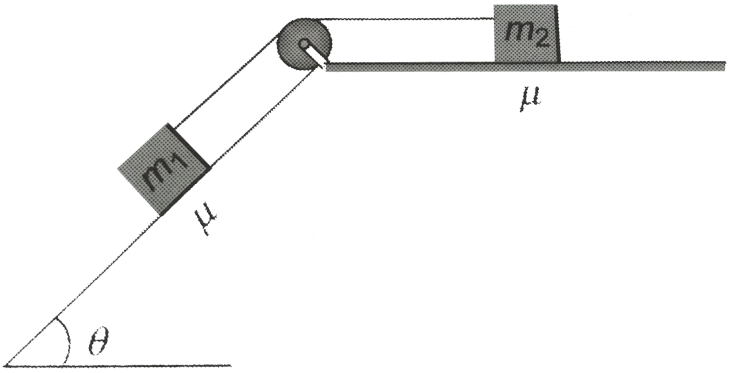
36. Consider the situation as shown in the figure. Find the maximum value of m_1 / m_2 so that the system remains at rest. What will happen if $\tan\theta < \mu$?



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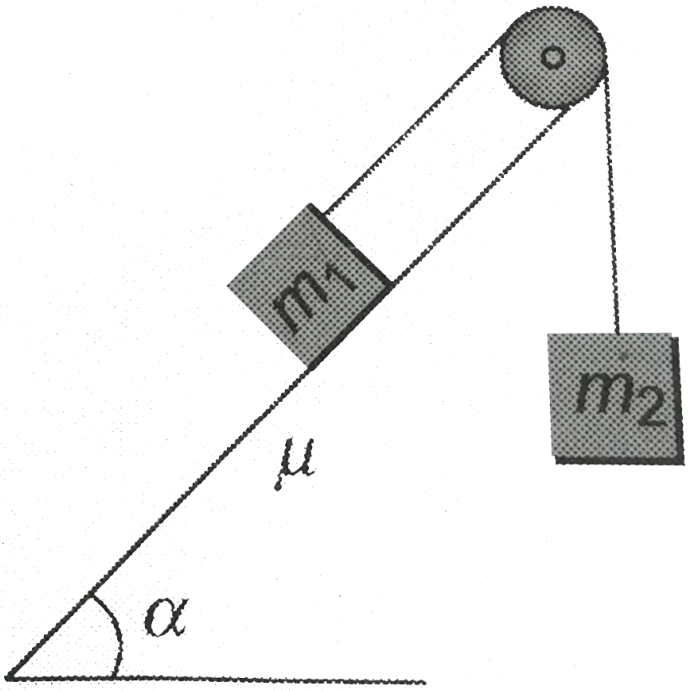
37. Consider the situation as shown in the figure . The masses of pulley and the threads , as well as the friction in the pulley , are negligible. Assuming both bodies to be motionless at the initial moment. Find the mass ratio m_1 / m_2 at which the body m_2

(a) starts coming down

(b) starts going up

(c) is at rest



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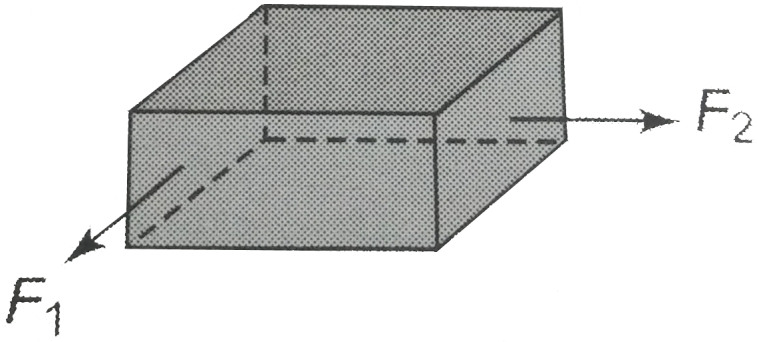
38. A block of mass $8kg$ is kept on a rough floor. The coefficients of friction are $\mu_s = 0.5$

and $\mu_k = 0.4$. Force $F_1 = 15N$ and $F_2 = 20N$ are applied on the block as shown.

(a) Find the magnitude and the direction of friction force .

(b) If $F_1 = 30N, F_2 = 40N,$ find the acceleration of the block.



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39. A block of mass $4kg$ is pushed against a rough vertical wall with a force $80N$ is applied on the block in a direction parallel to the wall . Will the block move? If yes , what is acceleration of the block ?

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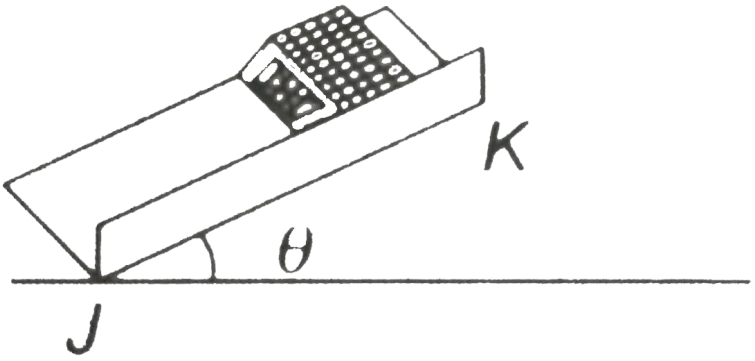
40. A cubical block of mass m is sliding on an inclined right angle trough as shown in the figure. If coefficient of friction is μ , find the

acceleration of the block.



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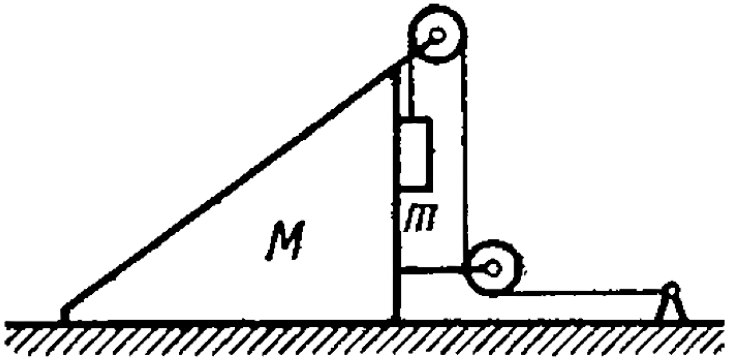
41. In the arrangement shown in figure the masses of the wedge M and the body m are known. The appreciable friction exists only between the wedge and the body m, the friction coefficient being equal to k. The

masses of the pulley and the thread are negligible. Find the acceleration of the body m relative to the horizontal surface on which the wedge slides.



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42. A block sliding down on an inclined plane forms an angle θ with the horizontal. The friction coefficient depends on the distance x covered as $\mu = kx$, where k is a constant. Find the distance covered by the block till it stops and its maximum velocity over this distance. Also , sketch a graph between square of velocity and distance covered x.

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Exercises

1. Choose the correct option

A. The friction force is dependent on the roughness of the surface.

B. The kinetic friction is proportional to normal reaction.

C. The friction is independent on the area of contact.

D. All statements are correct.

Answer: D

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2. Consider a car moving on a straight road with a speed of $100m/s$. The distance at which car can be stopped is $[\mu_k = 0.5]$

A. $100m$

B. $400m$

C. $800m$

D. $1000m$

Answer: D

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3. A car is moving along a stight horizontal road with a speed v_0 . If the coefficient of friction between the tyres and the road is mu, the shortest distance in which the car can be stopped is.

A. $\frac{v_0^2}{2\mu g}$

B. $\frac{v_0}{\mu g}$

C. $\left(\frac{v_0}{\mu g}\right)^2$

D. $\frac{v_0}{\mu}$

Answer: A

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4. Two cars of unequal masses use similar tyres. If they are moving at the same initial speed, the minimum stopping distance

A. is similar for the heavier car

B. is smaller for the lighter car

C. is same for both cars

D. depends on the volume of the car

Answer: C

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5. An ice cube is kept on an inclined plane of angle 30°. The coefficient to kinetic friction between the block and incline plane is $1/\sqrt{3}$. What is the acceleration of the block ?

A. Zero

B. $2m/s^2$

C. $1.5m/s^2$

D. $5m/s^2$

Answer: A

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6. Starting from rest , a body slides down at 45° inclined plane in twice the time it takes to slide down the same distance in the absence

of friction. The coefficient of friction between the body and the inclined plane is

A. 0.33

B. 0.25

C. 0.75

D. 0.80

Answer: C

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7. A smooth block is released at rest on a 45° incline and then slides a distance 'd'. The time taken to slide is 'n' times as much to slide on rough incline than on a smooth incline. The coefficient of friction is

A. $\left(1-\frac{1}{n^2}\right)$

B. $\frac{1}{1-n^2}$

C. $\sqrt{\left(1-\frac{1}{n^2}\right)}$

D. $\sqrt{\frac{1}{1-n^2}}$

Answer: A

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8. A block is released from the top of an inclined plane of inclination θ. Its velocity at the bottom of plane is v. If it slides down a rough inclined plane of the same inclination , its velocity at bottom is $v/2$. The coefficient of friction is

A. $\frac{3}{4}\cos\theta$

B. $\frac{1}{4}\cos\theta$

C. $\frac{1}{4}\tan\theta$

D. $\frac{3}{4}\tan\theta$

Answer: D

Watch Video Solution

9. The upper half of an inclined plane of inclination 45° is perfectly smooth while the lower half is rough. A block starting from rest

at the top comes back to rest at the bottom.

The coefficient of friction for the lower half is

A. $\frac{1}{\sqrt{2}}$

B. 1

C. $\sqrt{2}$

D. 2

Answer: D

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10. A body is sliding down an inclined plane $\left(\mu = \frac{1}{2}\right)$. If the normal reaction is twice that of the resultant downward force along the incline , the inclination of plane is

A. 15°

B. 30°

C. 45°

D. 60°

Answer: C

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11. A ball is thrown vertically with some velocity . A constant air resistance acts. If the time of ascent is t_1 and that of descent is t_2 , then

A. $t_1 < t_2$

B. $t_1 > t_2$

C. $t_1 = t_2$

D. None

Answer: A

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12. In an imaginary atmosphere, the air exerts a small force F on any particle in the direction of the particle's motion. A particle of mass m projected upward takes time t_1 and reaching the maximum height and t_2 in the return journey to the original point. Then

A. $t_1 < t_2$

B. $t_1 > t_2$

C. $t_1 = t_2$

D. None

Answer: B

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13. Two objects A and B are thrown upward simultaneously with the same speed. The mass of A is greater than the mass of B. Suppose their exerts a constant and equal force of resistance on the two bodies.

A. The two bodies will reach the same height.

B. A will go higher than B.

C. B will go higher than A.

D. Any of the above three may happen dependending on the speed with which the objects are thrown.

Answer: B

Watch Video Solution

14. A ball is thrown vertically upward with speed $10m/s$ and it returns to the ground with speed $8m/s$. A constant air resistance acts. The minimum height attained by the ball is

A. $5m$

B. $4.5m$

C. $3.5m$

D. $4.1m$

Answer: D

Watch Video Solution

15. A particle is projected up a rough inclined plane of inclination θ and friction coefficient μ. If the time of ascent is half of the time of descent, the friction coefficient μ is equal to

A. $\frac{3}{4}\tan\theta$

B. $\frac{3}{5}\tan\theta$

C. $\frac{4}{5}\tan\theta$

D. $\frac{1}{2}\tan\theta$

Answer: B

Watch Video Solution

16. A particle is projected up a 37° rough incline with velocity v_0. If $\mu = 1/2$, the speed with which it returns back to the starting point is v. Then v/v_0 is

A. $\frac{1}{2}$

B. $\frac{1}{\sqrt{3}}$

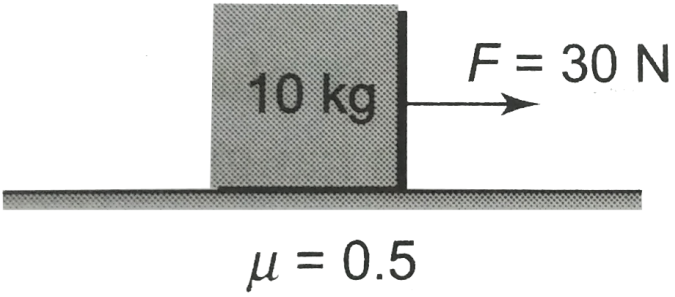
C. $\frac{1}{\sqrt{5}}$

D. $\frac{1}{\sqrt{2}}$

Answer: C

Watch Video Solution

17. As shown in the figure , the friction force acting on the block is



A. $50N$

B. $30N$

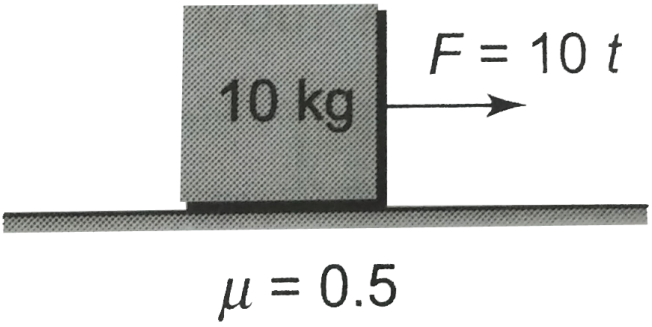
C. $20N$

D. None

Answer: B

Watch Video Solution

18. The friction force acting on the block at time $t = 4s$ will be



A. $50N$

B. $30N$

C. $25N$

D. None

Answer: D

Watch Video Solution

19. A block of mass 2kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is

A. $9.8N$

B. $0.7 \times 9.8 \times \sqrt{3}N$

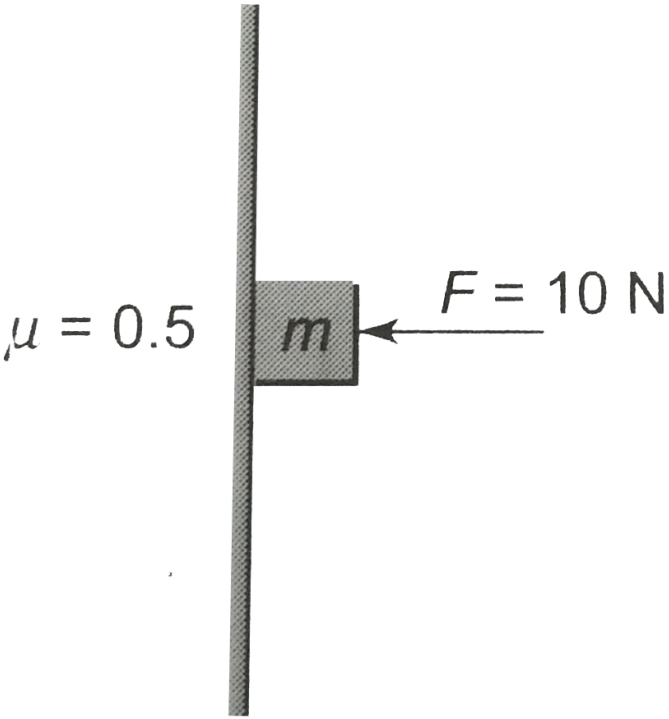
C. $9.8 \times \sqrt{3}N$

D. $0.7 \times 9.8N$

Answer: A

Watch Video Solution

20. Consider the situation as shown in the figure. Choose the correct option.



A. The friction force on the block is

$1N$ if $m = 0.1kg$

B. The friction on the block is

$5N$ if $m = 1.0kg$

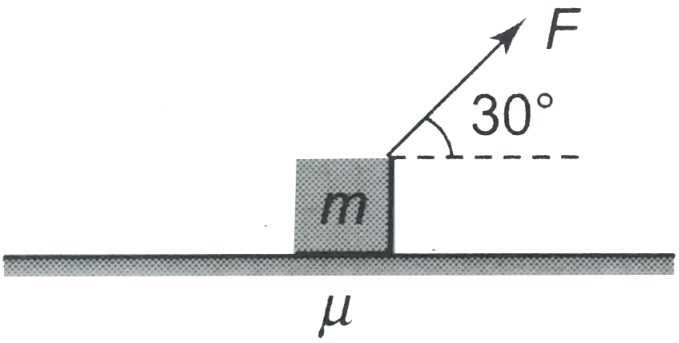
C. Both (1) and (2) are correct

D. Both (1) and (2) are incorrect

Answer: C

Watch Video Solution

21. A block of mass m lying on a rough horizontal surface of friction coefficient μ is pulled by a force F as shown , the limiting friction between the block and surface will be



A. μmg

B. $\mu\left(mg+\frac{F}{2}\right)$

C. $\mu\left(mg-\frac{F}{2}\right)$

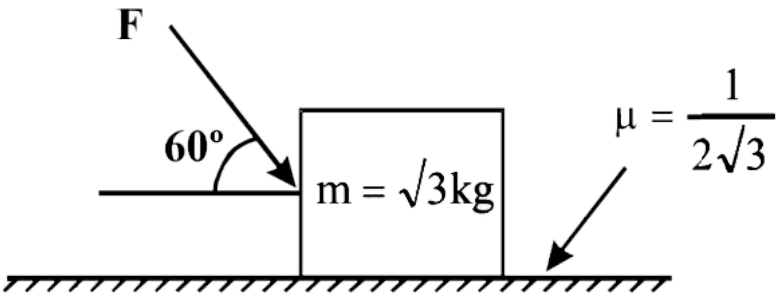
D. $\mu\left(mg-\frac{\sqrt{3}F}{2}\right)$

Answer: C

Watch Video Solution

22. What is the maximum value of the force F such that the block shown in the arrangement,

does not move?



A. $5N$

B. $10N$

C. $15N$

D. $20N$

Answer: D

Watch Video Solution

23. Pulling force making an angle θ to the horizontal is applied on a block of weight W placed on a horizontal table. If the angle of friction is α, then the magnitude of force is α , then the magnitude of force required to move the body is equal to

A. $\frac{W \sin \alpha}{g \tan(\theta - \alpha)}$

B. $\frac{W \cos \alpha}{\cos(\theta - \alpha)}$

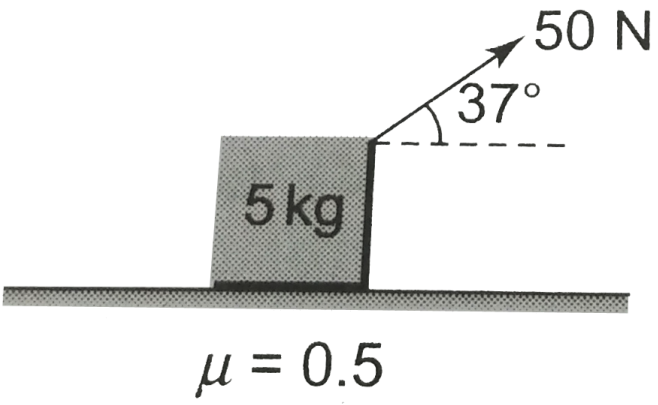
C. $\frac{W \sin \alpha}{\cos(\theta - \alpha)}$

D. $\frac{W \tan \alpha}{\sin(\theta - \alpha)}$

Answer: C

 Watch Video Solution

24. The acceleration of the block is



A. $6m/s^2$

B. $8m/s^2$

C. $10m/s^2$

D. $12m/s^2$

Answer: A

Watch Video Solution

25. A lift is moving downwards with an acceleration equal to g. A block of mass m , kept on the floor of the lift of friction coefficient μ , is pulled horizontally . The friction acting on the block is

A. μmg

B. mg

C. zero

D. None

Answer: C

Watch Video Solution

26. A block of mas m begins to slide down on an inclined plane of inclination θ. The force of friction will be

A. mg

B. $mg\cos\theta$

C. $mg\sin\theta$

D. $mg\tan\theta$

Answer: C

Watch Video Solution

27. A body of mass $10kg$ is lying on a rough inclined plane of inclination 37° and $\mu = 1/2$, the minimum force required to pull the body up the plane is

A. $80N$

B. $100N$

C. $120N$

D. $60N$

Answer: B

Watch Video Solution

28. A block is at rest on an inclined plane making an angle α with the horizontal . As the angle α of the incline is increased the block

starts slipping when the angle of inclination becomes θ. The coefficient of static friction between the block and the surface of the inclined plane is or A body starts sliding down at an angle θ to the horizontal. Then the coefficient of friction is equal to

A. $\sin\theta$

B. $\cos\theta$

C. $\tan\theta$

D. Independent of θ

Answer: C

Watch Video Solution

29. A block of $3kg$ rests in limiting equilibrium on an inclined plane of inclination 30°. If the plane is raised to an inclination 60° , the force along the plane required to support it is

A. $\frac{10}{\sqrt{3}}N$

B. $10\sqrt{3}N$

C. $10N$

D. $\frac{10}{3}N$

Answer: B

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30. A block rests on a rough inclined plane making an angle of 30° with horizontal. The coefficient of static friction between the block and inclined plane is 0.8 . If the frictional force on the block is $10N$, the mass of the block in kg is $\left(g = 10m/s^2\right)$

A. 2.0

B. 4.0

C. 1.6

D. 2.5

Answer: A

 Watch Video Solution

31. The force required just to move a body up an inclined plane is double the force required just to prevent the body sliding down. If the

coefficient of friction is 0.25 , the angle of inclination of the plane is

A. 30°

B. 45°

C. $\tan^{-1}\left(\frac{1}{4}\right)$

D. $\tan^{-1}\left(\frac{3}{4}\right)$

Answer: D

Watch Video Solution

32. A $10kg$ block is initially at rest on a rough horizontal surface. A horizontal force of $60N$ is required to set the block in motion . After it is in motion , a horizontal force of $50N$ is required to keep the block moving with constant velocity . The ratio coefficient of static and kinetic friction is

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{6}{5}$

D. $\frac{3}{2}$

Answer: C

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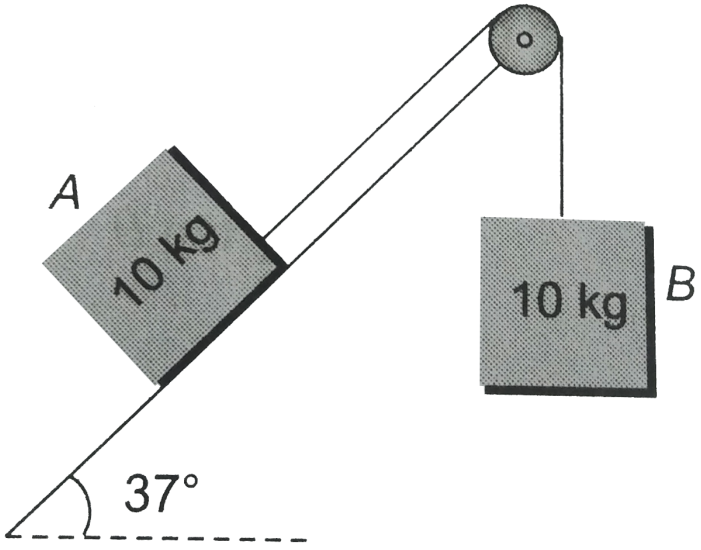
33. Two blocks A and B , each of mass $10kg$, are connected by a light string passing over a smooth pulley as shown in the figure. Block A

will remain at rest if the friction on it is



A. $50N$ up the plane

B. $50N$ down the plane

C. $100N$ up the plane

D. $100N$ down the plane

Answer: B

Watch Video Solution

34. A uniform rope of $\leq n > hLmeters$ is lying over a table. If the coefficient of friction be μ, then the maximum length L_1 of the part of the rope which can overhang the edge without sliding is

A. $\frac{\mu L}{(\mu+1)}$

B. $\frac{(\mu+1)}{\mu L}$

C. $\frac{\mu L}{(\mu - 1)}$

D. $\frac{(\mu - 1)L}{\mu}$

Answer: A

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35. A uniform metal chain is placed on a rough table such that the one end of chain hangs down over the edge of the table, when one-third of its length hang over the edge, the

chain starts sliding. Then the coefficient of static friction is

A. $\frac{3}{4}$

B. $\frac{1}{4}$

C. $\frac{2}{3}$

D. $\frac{1}{2}$

Answer: D

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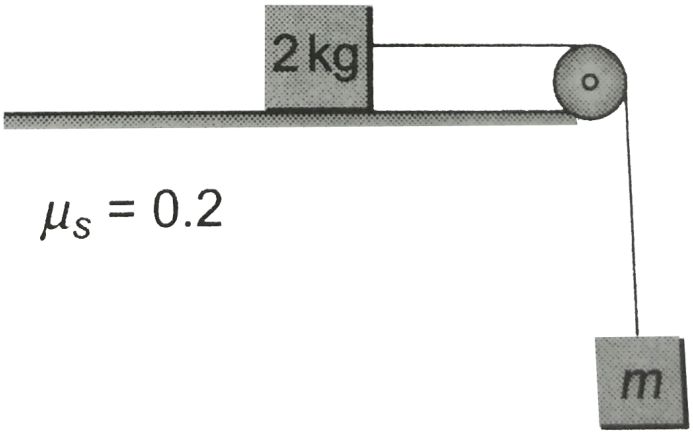
36. Consider the situation as shown in the figure.

The maximum value of m so that the blocks do not move is



A. $0.2kg$

B. $0.4kg$

C. $0.6kg$

D. $0.8kg$

Answer: B

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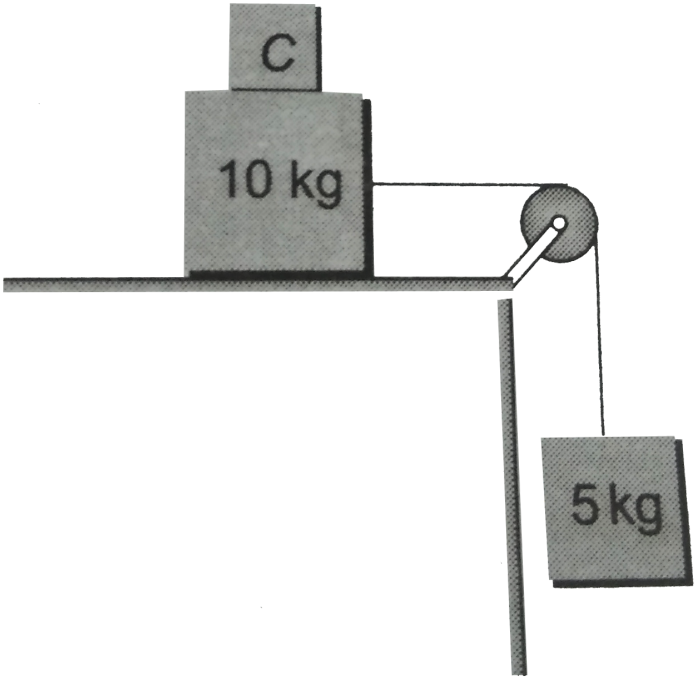
37. Two masses A and B of $10kg$ and $5kg$, respectively , are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown. The coefficient of static friction between A and the table is 0.2.

The minimum mass C that should be placed on A to prevent it from moving is equal to



A. $12kg$

B. $5kg$

C. $10kg$

D. $15kg$

Answer: D

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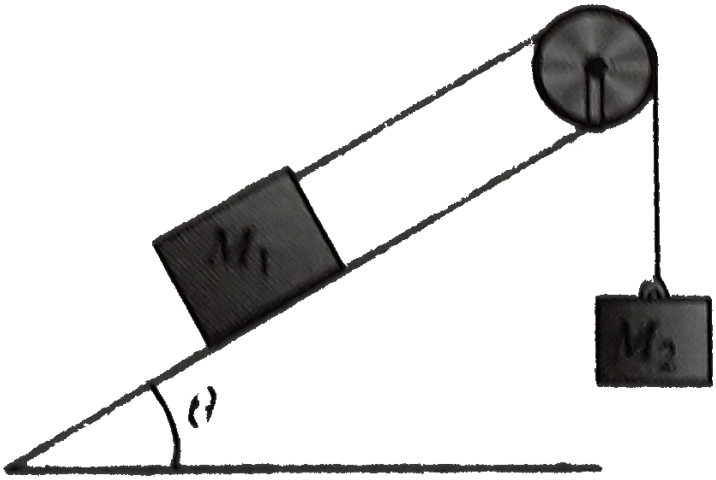
38. Two block of masses M_1 and, M_2 are connected with a string which passed over a smooth pulley . The mass M_1 is placed on a tough inclined plane as shown in figure .The coefficient of friction between and block and the inclined plane is μ what should be the

minimum mass M_2 so that the block M_1 slides upwards?



A. $\frac{m_1}{m_2} = \mu \sin\theta + \cos\theta$

B. $\frac{m_1}{m_2} = \mu \sin\theta - \cos\theta$

C. $\frac{m_1}{m_2} > (\sin\theta + \mu \cos\theta)$

D. $\frac{m_1}{m_2} > (\sin\theta - \mu \cos\theta)$

Answer: C

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39. A car accelerates on a horizontal road due to the force exerted by

A. the engine of the car

B. the driver of the car

C. the earth

D. the road

Answer: D

 Watch Video Solution

40. Which of the following is correct , when a person walks on the rough surface.

A. The frictional force exerted by the force keeps him moving.

B. The force which the man exerts on the floor keeps him moving.

C. The reaction of the force which the man exerts on the surface keeps him moving.

D. None of the above

Answer: A

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41. While walking on ice, one should take small steps to avoid sliping. This is because smaller steps ensure

A. larger friction

B. smaller friction

C. larger normal force

D. smaller normal force

Answer: B

Watch Video Solution

42. A box is placed on an inclined plane and has to be pushed down.The angle of inclination is

A. equal to angle of friction

B. more than angle of friction

C. equal to angle of repose

D. less than angle of repose

Answer: D

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43. A boy of mass M is applying a horizontal force to slide a box of mass M on a rough horizontal surface. The floor is μ and the

between the box and the floor is μ'. In which of the following cases it is certainly not possible to slide the box?

A. $\mu < \mu', M < M'$

B. $\mu > \mu', M < M'$

C. $\mu < \mu', M > M'$

D. $\mu > \mu', M > M'$

Answer: A

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44. A conveyor belt is moving at a constant speed of $2m/s$. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it taking $g = 10ms^{-2}$ is:

A. zero

B. $0.4m$

C. $1.2m$

D. $0.6m$

Answer: B

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45. A car starts from rest on a $1600m$ long bridge. The coefficient of friction between the tyre and road is 0.8. The minimum time taken by the car to cross the bridge is

A. $5s$

B. $10s$

C. $15s$

D. $20s$

Answer: D

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46. Mark the correct statements about the friction between two bodies

A. Static friction is always greater than the kinetic friction.

B. Coefficient of static friction is always greater than the coefficient of kinetic friction.

C. Limiting friction is always greater than the kinetic friction

D. Limiting friction is never less than the static friction.

Answer: A

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47. Consider a vehicle going on a horizontal rod towards east. Neglect any force by the air. The frictional forces on the vehicle by the road

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(iii), (iv)$

D. $(i), (iv)$

Answer: A

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48. A block is placed on a rough floor and a horizontal force F is applied on it.The force of friction f by the floor on the block is measured for different values of F and a graph is plotted between them.

A. (i) only

B. (ii) only

C. (iii) only

D. (iii) and (iv)

Answer: D

Watch Video Solution

49. A body of mass M is kept n a rough horizontal surfasce (friction coefficient $= \mu$). A person is trying to pull he body by applying a horizontal force but the body is not moving. The force by the surface on A is F, where

A. $F = Mg$

B. $F = \mu Mg$

C. $Mg \leq F \leq Mg\sqrt{1 + \mu^2}$

D. $Mg \geq F \geq Mg\sqrt{1+\mu^2}$

Answer: C

Watch Video Solution

50. The contact force exerted by a body A on another body B is equal to the normal force between the bodies. We concude that

A. $(i), (ii)$

B. $(ii), (iv)$

C. $(iii), (iv)$

D. $(i), (iv)$

Answer: B

Watch Video Solution

51. Let F, F_N and f denote the magnitudes of the contact force, normal force and the friction exerted by one surface on the other kept in contact. If none of these is zero,

A. $F > N$

B. $F > f$

C. $N > f$

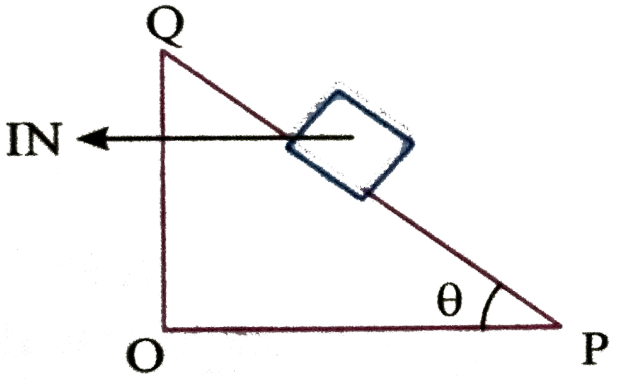
D. $(N - f) < F < (N + f)$

Answer: C

Watch Video Solution

52. A small block of mass of $0.1kg$ lies on a fixed inclined plane PQ which makes an angle θ with the horizontal. A horizontal force of $1N$

acts on the block through its centre of mass as shown in the figure. The block remains stationary if (take $g = 10m/s^2$)



A. $(i), (ii)$

B. $(i), (iii)$

C. $(i), (iv)$

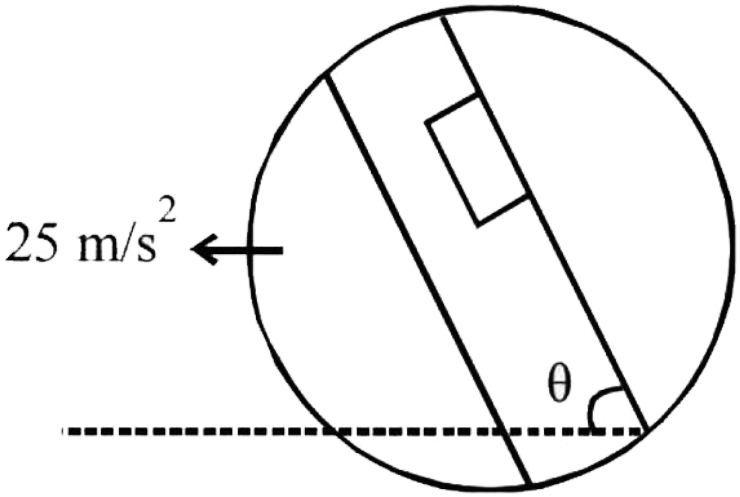
D. $(ii), (iv)$

Answer: B

Watch Video Solution

53. A circular disc with a groove along its diameter is placed horizontally on a rough surface. A block of mass 1 kg is placed as shown. The co-efficient of friction between the block and all surfaces of groove and horizontal surface in contact is $\mu = \frac{2}{5}$. The disc has an acceleration of $25m/s^2$ towards left. Find the acceleration of the block with respect to disc.

Given $\cos\theta = \frac{4}{5}, \sin\theta = \frac{3}{5}$.



A. $10m/s^2$

B. $5m/s^2$

C. $20m/s^2$

D. $1m/s^2$

Answer: A

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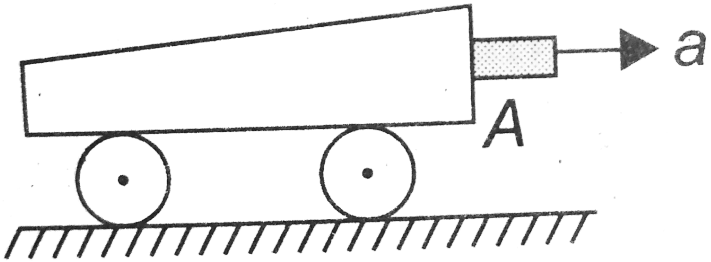
54. The minimum acceleration that must be impprted to the cart in the figure so that the block A will not fall (given μ is the coefficient if friction between the surface of block and

cart) is given by:



A. $a < \frac{g}{\mu}$

B. $a > \frac{mg}{\mu}$

C. $a < \frac{g}{\mu m}$

D. $a \geq \frac{g}{\mu}$

Answer: D

Watch Video Solution

55. Consider the situation as shown in the diagram.

The coefficient of friction between the block is 0.5. The acceleration of the lower block is

A. $1m/s^2$

B. $1.5m/s^2$

C. $2m/s^2$

D. $2.5m/s^2$

Answer: A

Watch Video Solution

56. In the previous problem , if the applied force is made $20N$, the acceleration of the upper and the lower blocks will be

A. $4m/s^2, 2m/s^2$

B. $5m/s^2, 2m/s^2$

C. $5m/s^2, 1m/s^2$

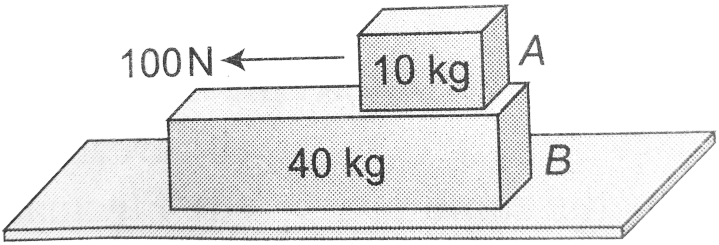
D. $4m/s^2, 1m/s^2$

Answer: B

Watch Video Solution

57. A 40kg slab rests on a frictionless floor as shown in the figure. A 10kg block rests on the top of the slab. The static coefficient of friction between the block and slab is 0.60 while the kinetic friction is 0.40 . The 10kg block is acted upon by a horizontal force 100N. if $g = 9.8m/s^2$, the resulting acceleration of

the slab will be.



A. $1m/s^2$

B. $1.5m/s^2$

C. $2m/s^2$

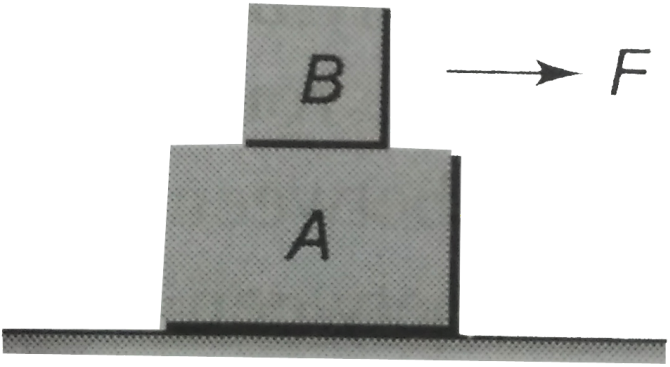
D. $2.5m/s^2$

Answer: A

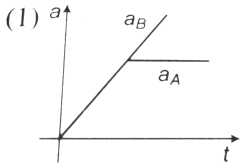
Watch Video Solution

58. A block B is placed on the block A.The mass of block B is less than the mass of block A. Friction exists between the blocks , whereas the ground on which block A is placed is taken to be smooth. A horizontal force F, increasing linearly with time begins to act on B. The acceleration a_A and a_B of blocks A and B, respectively , are plotted against t. The

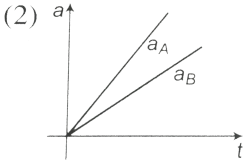
correctly plotted graph is



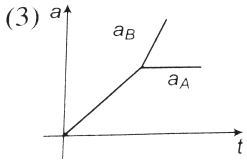
A.

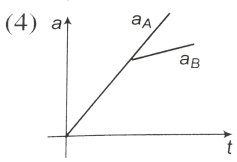


B.



C.



D. 

Answer: C

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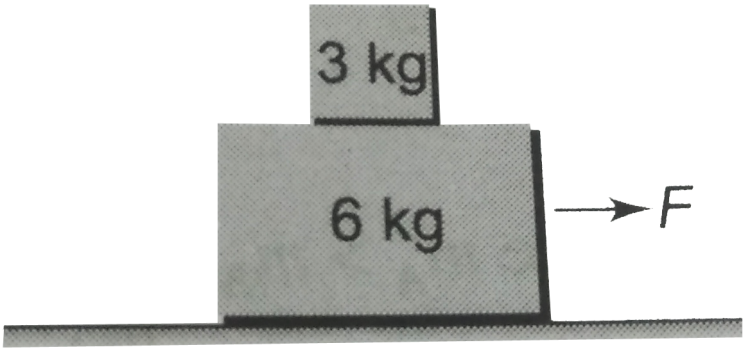
59. Two blocks of mass $m_1 = 6kg$ and $m_2 = 3kg$ are as shown in the diagram. Coefficient of friction between m_1 and m_2 and between m_1 and m_2 and between m_1 and the surface is 0.5 and 0.4 , respectively . The maximum horizontal force that can be applied

to the mass m_1 so that they move without separation is



A. $41N$

B. $61N$

C. $81N$

D. $101N$

Answer: C

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60. The rear side of a truck is open and a box of mass $2kg$ is placed on the truck $8meters$ away from the open end. $\mu = 0.1$ and $g = 10m/s^2$. The truck starts from rest with an acceleration of $2m/s^2$ on a straight road. The box will fall off the truck when it is at distance from the starting point equal to

A. $4m$

B. $8m$

C. $12m$

D. $16m$

Answer: D

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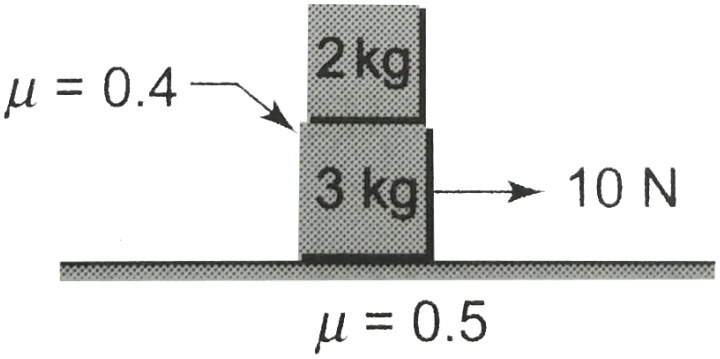
61. The friction acting on the upper block is



A. $8N$

B. $2N$

C. $25N$

D. zero

Answer: D

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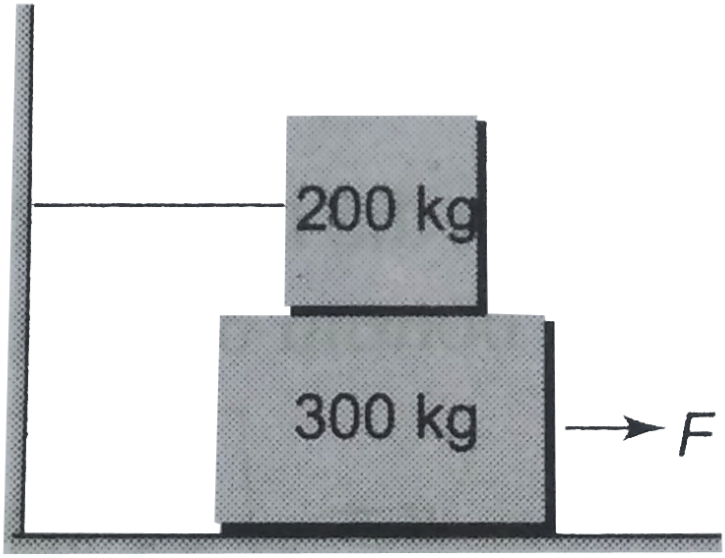
62. A block A of mass $200kg$ rest on a block B of mass $300kg$. A is tied with a horizontal string to a wall. Coefficient of friction between

A and $Bis0.25$ and that between B and floor is 0.2. The horizontal force F needed to move the block B is



A. $550N$

B. $1100N$

C. $1500N$

D. $2200N$

Answer: C

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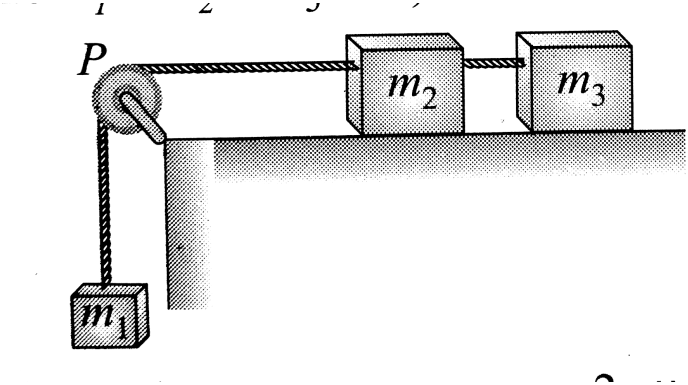
63. A system consists of three masses m_1 , m_1 , m_1 , m_2 and m_3 connected by a string passing over a pulley P . The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction=mu) The pulley is frictionless and of

negligible mass. The downward acceleration of m1 is (Assume $m_1 = m_2 = m_3 = m$).



A. $\frac{2g\mu}{3}$

B. $\frac{g(1-2\mu)}{3}$

C. $\frac{g(1-2\mu)}{2}$

D. $\frac{g(1-g\mu)}{9}$

Answer: B

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