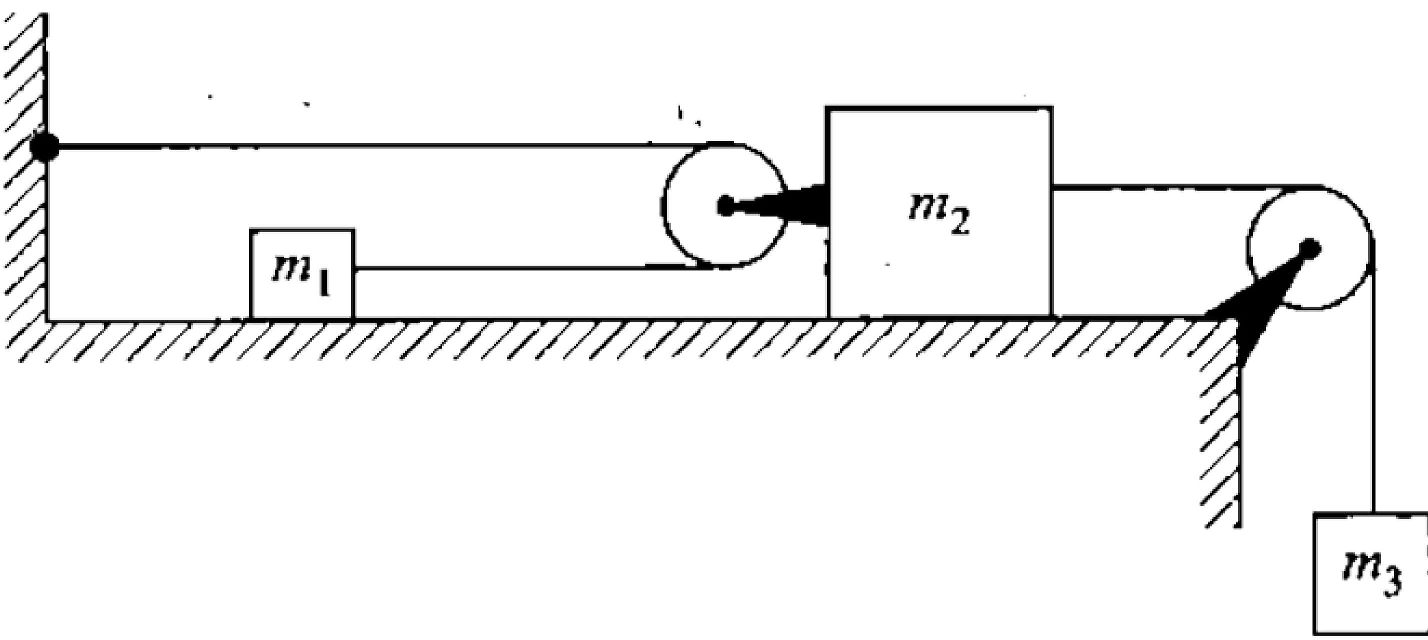
PHYSICS

BOOKS - PHYSICS GALAXY

NEWTONS LAWS OF MOTION

Practice Exerice 2.1

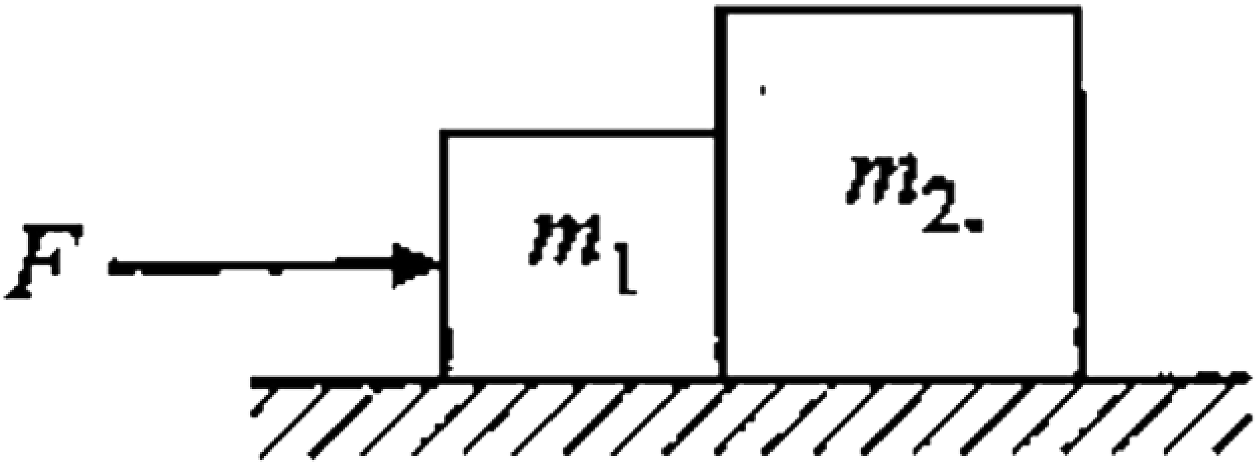
1. Find the tensions in the two cords and the accelerations of the blocks in figure-2.22 if friction is negligible. The pulleys are massless and frictionless, $m_1 = 200$ gm, $m_2 = 500$ gm and $m_3 = 400$ gm, Take $g = 10 m/s^2$.



$[0.94 N, 3.06 N, 4.7 m/s^2, 2.35 m/s^2, 2.35 m/s^2]$

Practice Exerice

1. Two blocks with masses `m_(1)=3kg ` and `m_(2) = 4kg` are touching each other on a frictionless table, as shown in figure-2.33. If the force shown acting on `m_(1)` is 5 N (a) What is the acceleration of the two blocks and (b) How hard does `m_(1)` push against `m_(1)` ?

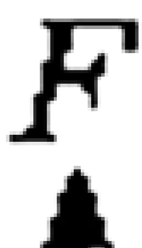


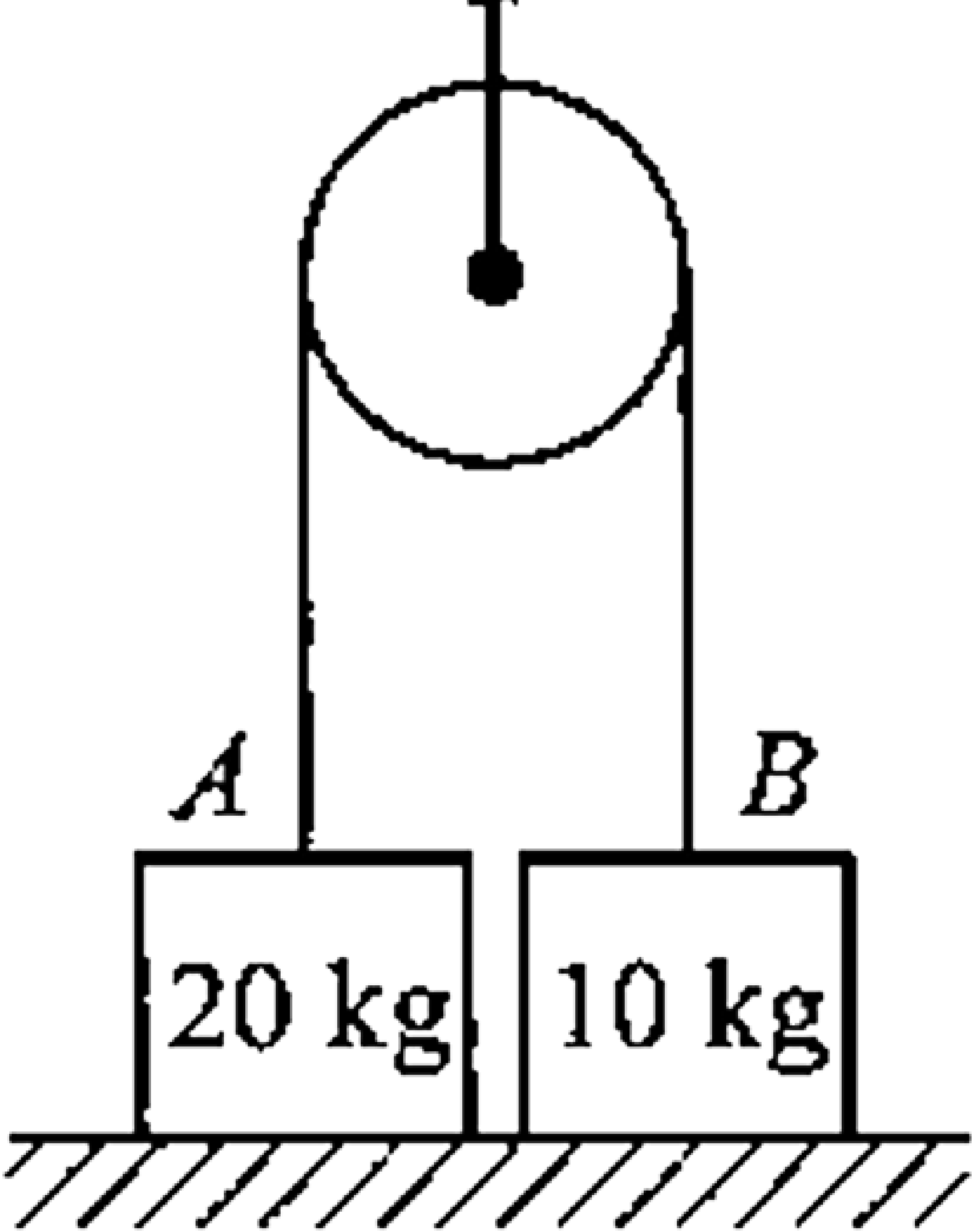
`[0.714 m//s^(2),2.85 N]`

Watch Video Solution

Practice Exercise

1. The masses of blocks A and B in figure-2.24 are 20 kg and 10 kg, respectively. The blocks are initially at rest on the floor and are connected by a massless string passing over a massless and frictionless pulley. An upward force F is applied to the pulley. Find the acceleration `a_(1)` and `a_(2)` of the two blocks A and B when F is (a) 124 N (b) 294 N (c) 424 N.



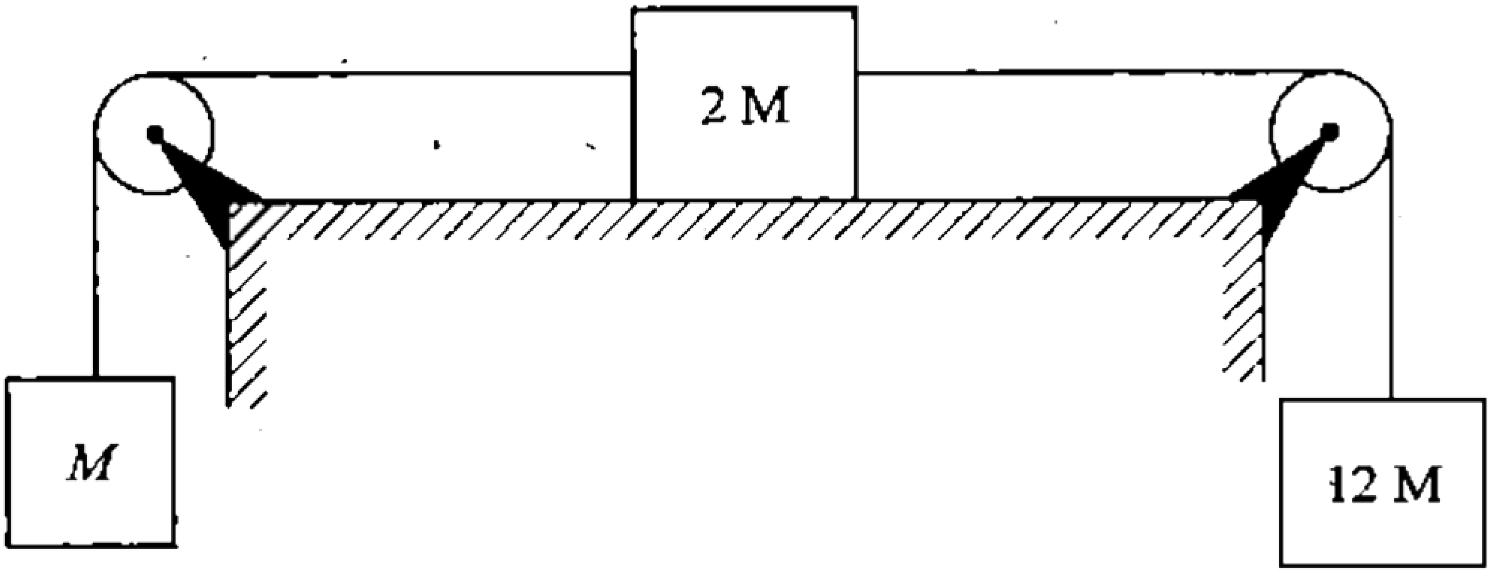


`[(a)0,0(b)0,4.7m//s^(2), (c ) 0.6m//s^(2),11.2 m//s^(2)]`

Watch Video Solution

Practice Exerice

1. The three blocks in figure-2.25 are released from rest and accelerate at the rate of `5m//s^(2)`. If M = 4kg, what is the magnitude of the frictional force on the block that slides horizontally?

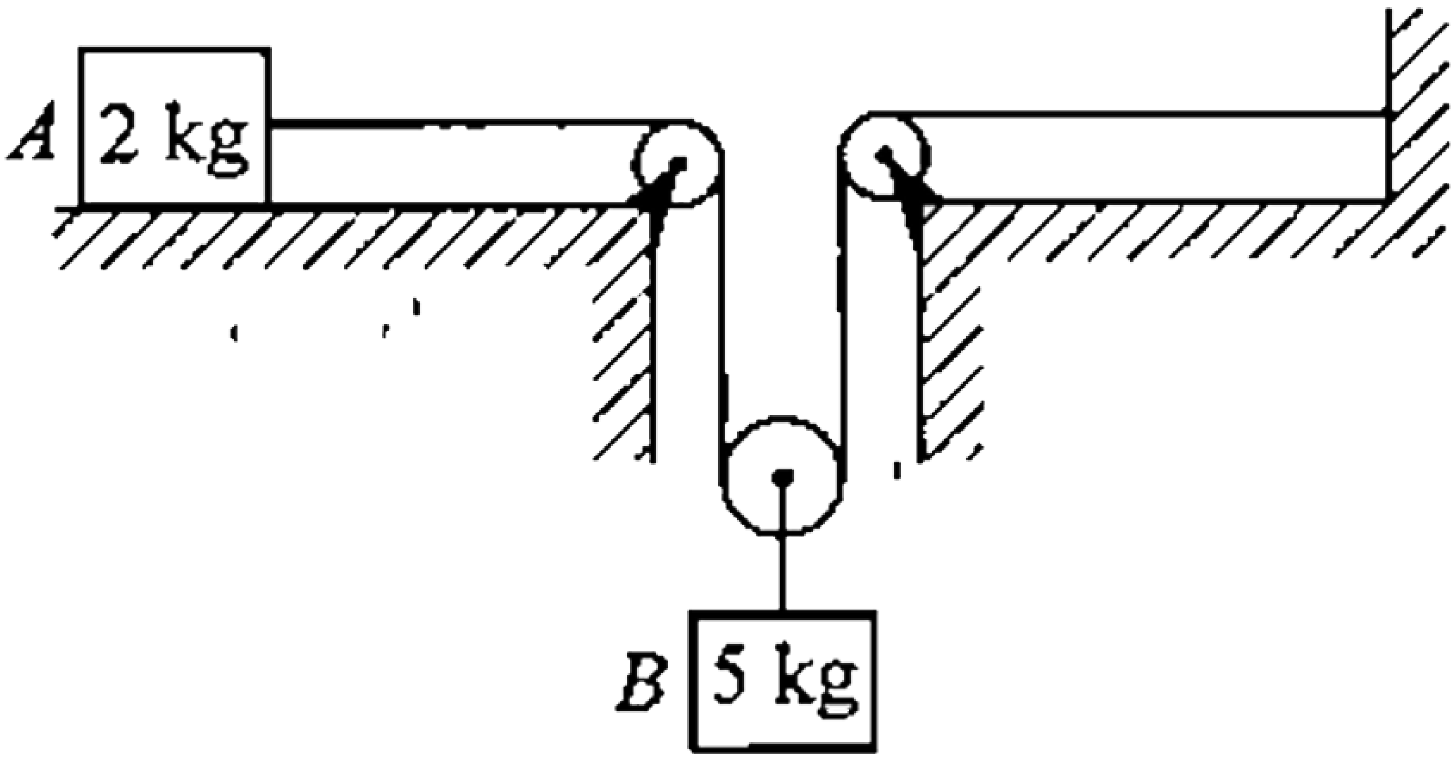


[140 N]

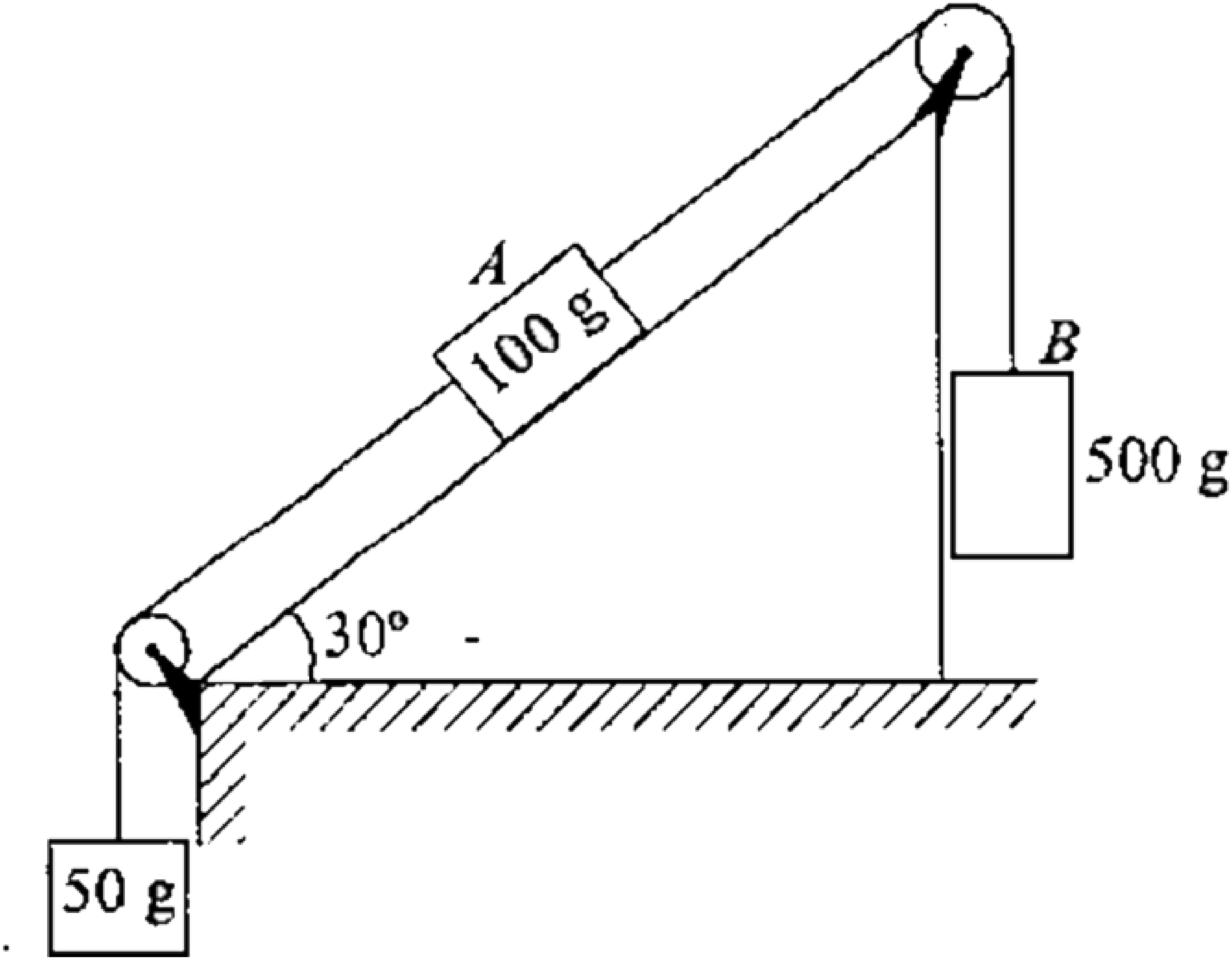
Watch Video Solution

Practice Exercise

1. Find the acceleration of the blocks A and B shown in figure-2.26 (a) and (b)



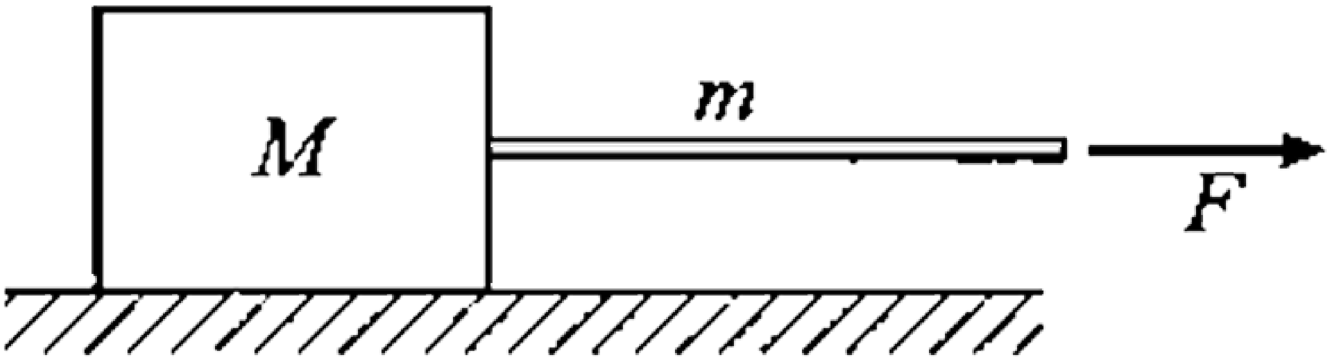
`[(a) 10g//13 " forward, "5g//13 " downward, "(b) 8g//13 " downward"]`



Watch Video Solution

Practice Exerice

1. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m, as shown in figure-2.27. A horizontal force F is applied to one end of the rope. (a) Find the force the rope exerts on the blocks, and (b) the tension in the rope at its midpoint.

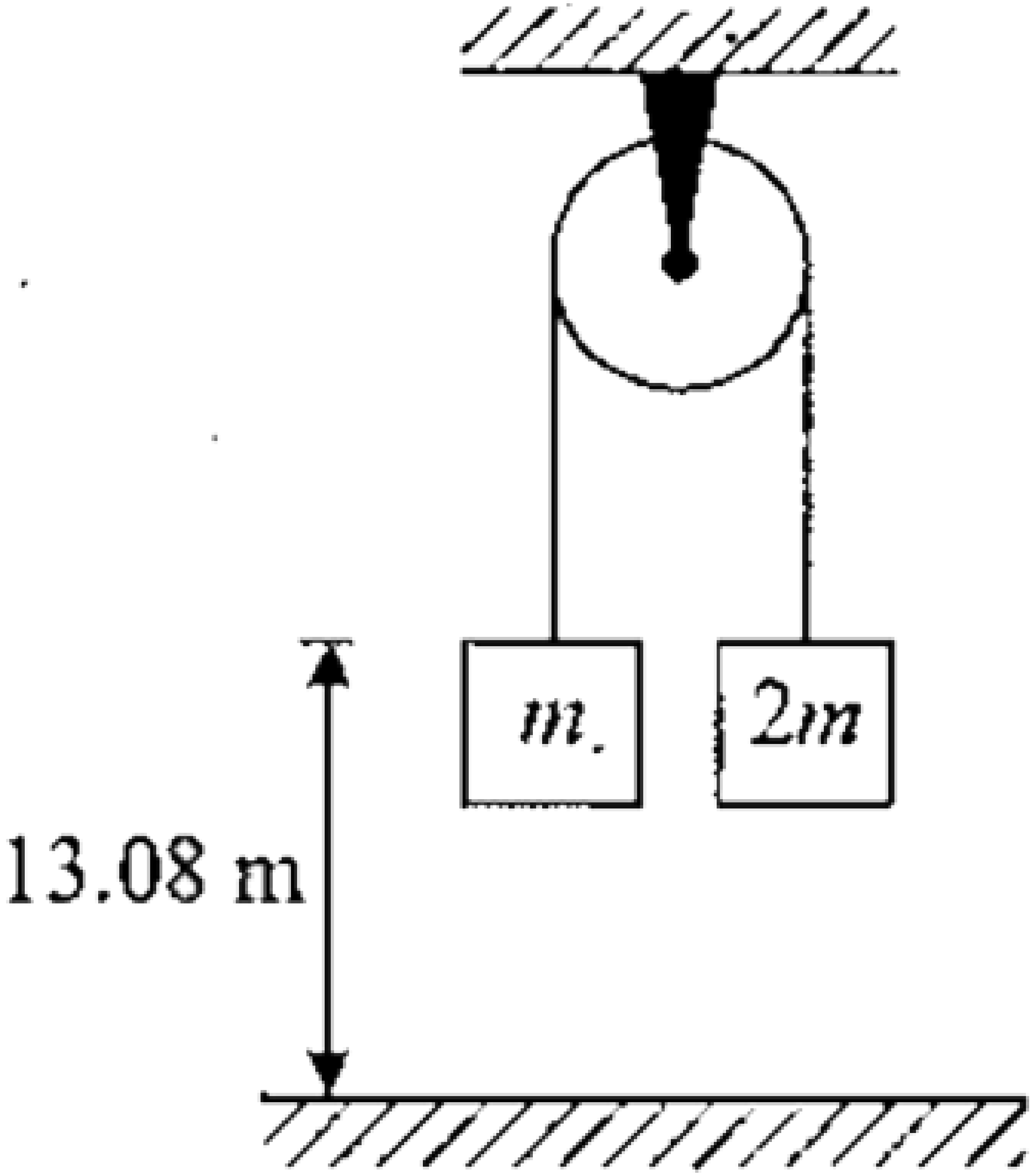


`[(MF)/(M+m),((m+m//2)F)/(M+m)]`

Watch Video Solution

Practice Exercise

1. Two masses m and 2m are connected by a mass less string which passes over a light frictionless pulley shown in figure-2.28. The masses are initially held with equal lengths of the strings on either side of the pulley. Find the velocity of the masses at the instant the lighter mass moves up a distance of 6.54 mts. This string is suddenly cut at that instant. Calculate the time taken by each mass to reach the ground. Take `g = 9.8 m//s^(2)`.

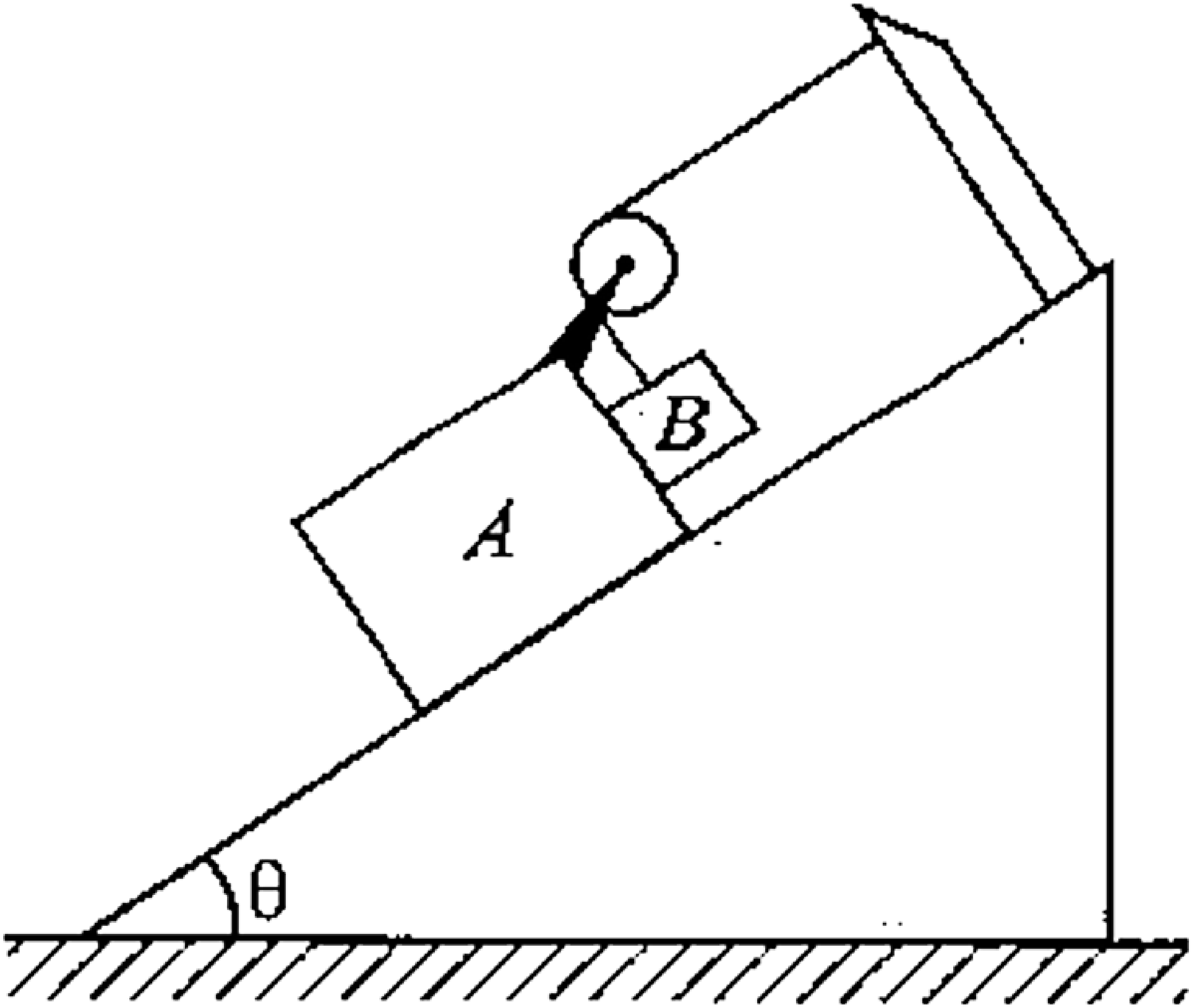


`[3.27 m//s^(2), 2.78 sec, 2//3 sec]`

Watch Video Solution

Practice Exerice

1. A block A of mass M on an inclined surface and a small weight B of mass m is attached to a string as shown in figure-2.29. Determine the acceleration of block A and B after system is released from rest

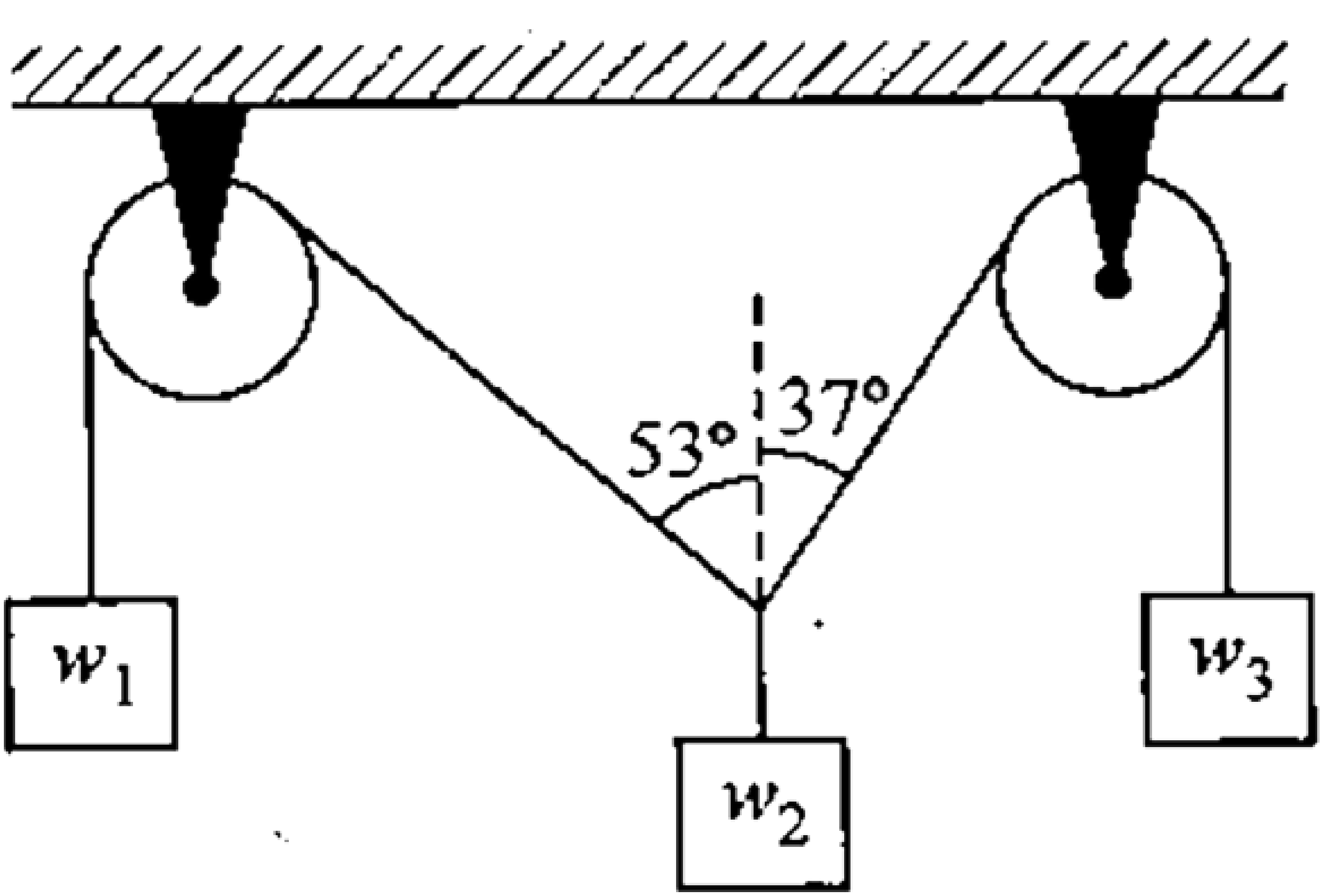


`[((M+m)sintheta-mcostheta)/(M+2m)g,((M+m)sintheta-mcostheta)/(M+2m)sqrt(2)g]`

Watch Video Solution

Practice Exercise 2.2

1. Three equal masses are suspended from frictionless pulleys as shown in figure-2.46. If the weight `w_(2)` in figure is 400 N, what must be the values of the weights `w_(1)` and `w_3)`.

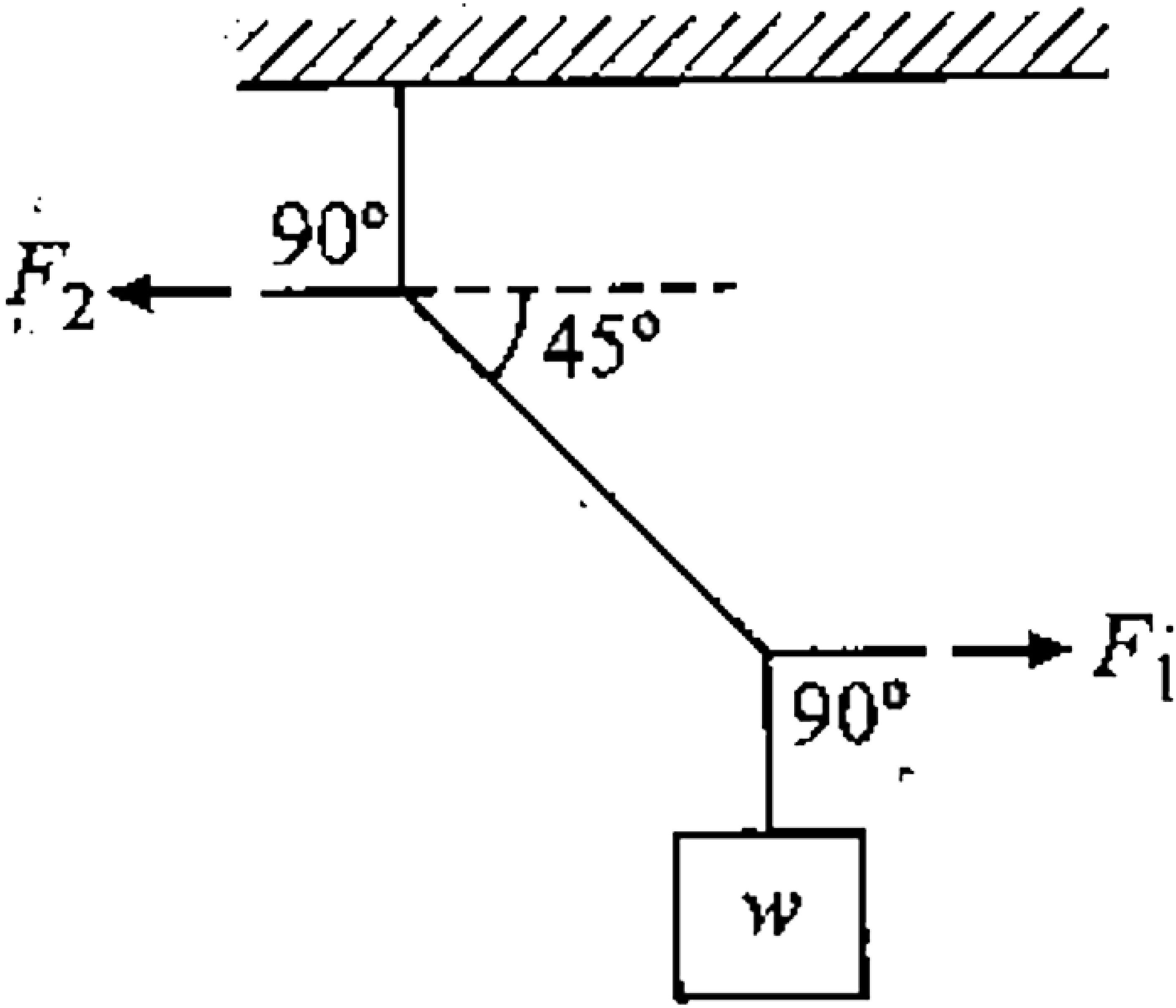


[240 N, 320 N]

Watch Video Solution

Practice Exercise

1. In figure-2.47 the tension in the diagonal string is 60 N. Find the magnitudes of the horizontal forces `F_(1)` and `F_(2)` the must be applied to hold the system in the position shown in figure-2.48. What is the weight of the suspended block.



[42.4 N each, 42.4 N]

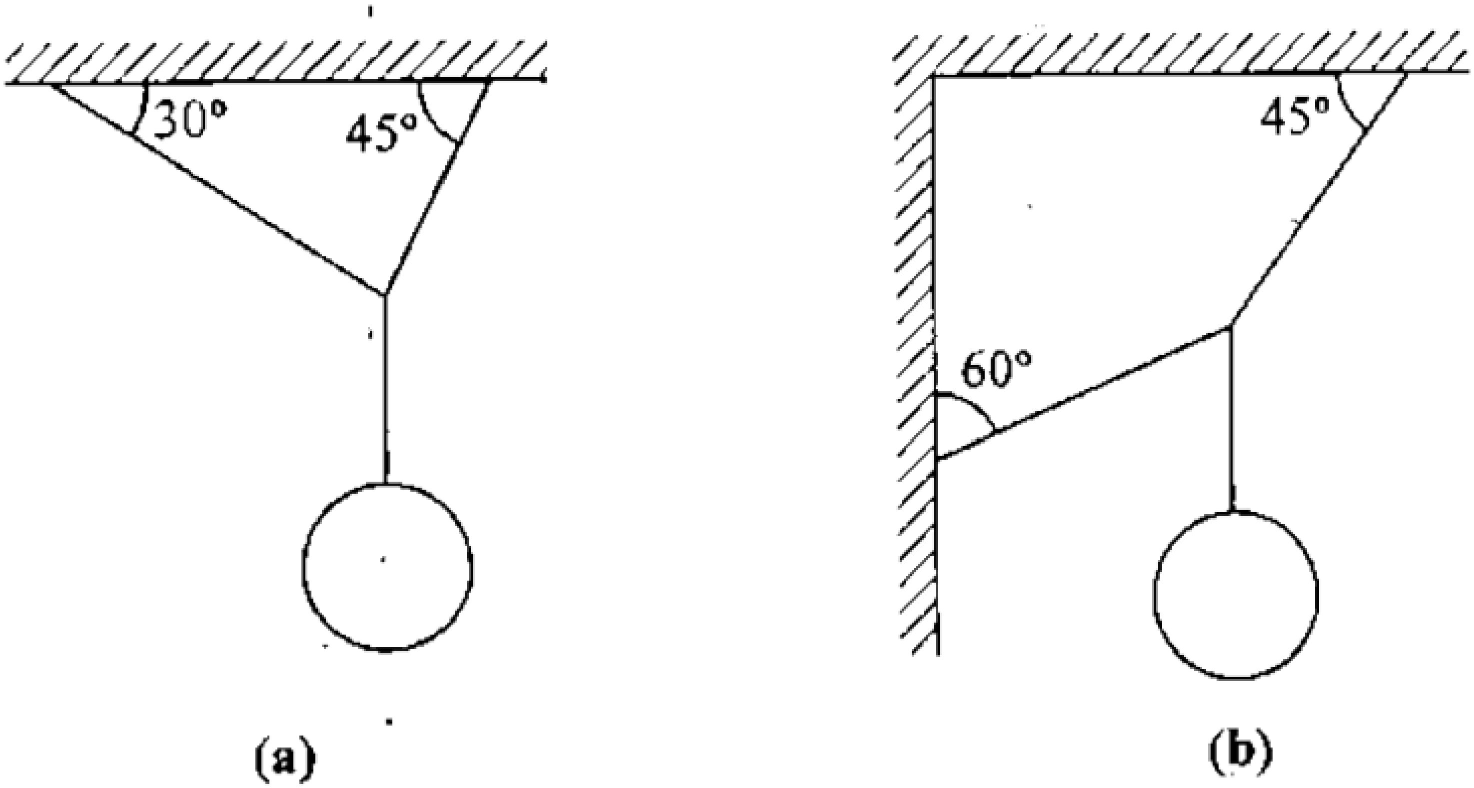
Watch Video Solution

2. A 1 m rod of mass 100 kg is hanging from two in extensible support strings at its ends of equal lengths. If an another mass of 20 kg is placed on rod at a distance 30 cm from the left end, find the tension in the two support strings, if rod remains horizontal. Take `g = 10m//s^(2)`

[560 N, 640 N]

Watch Video Solution

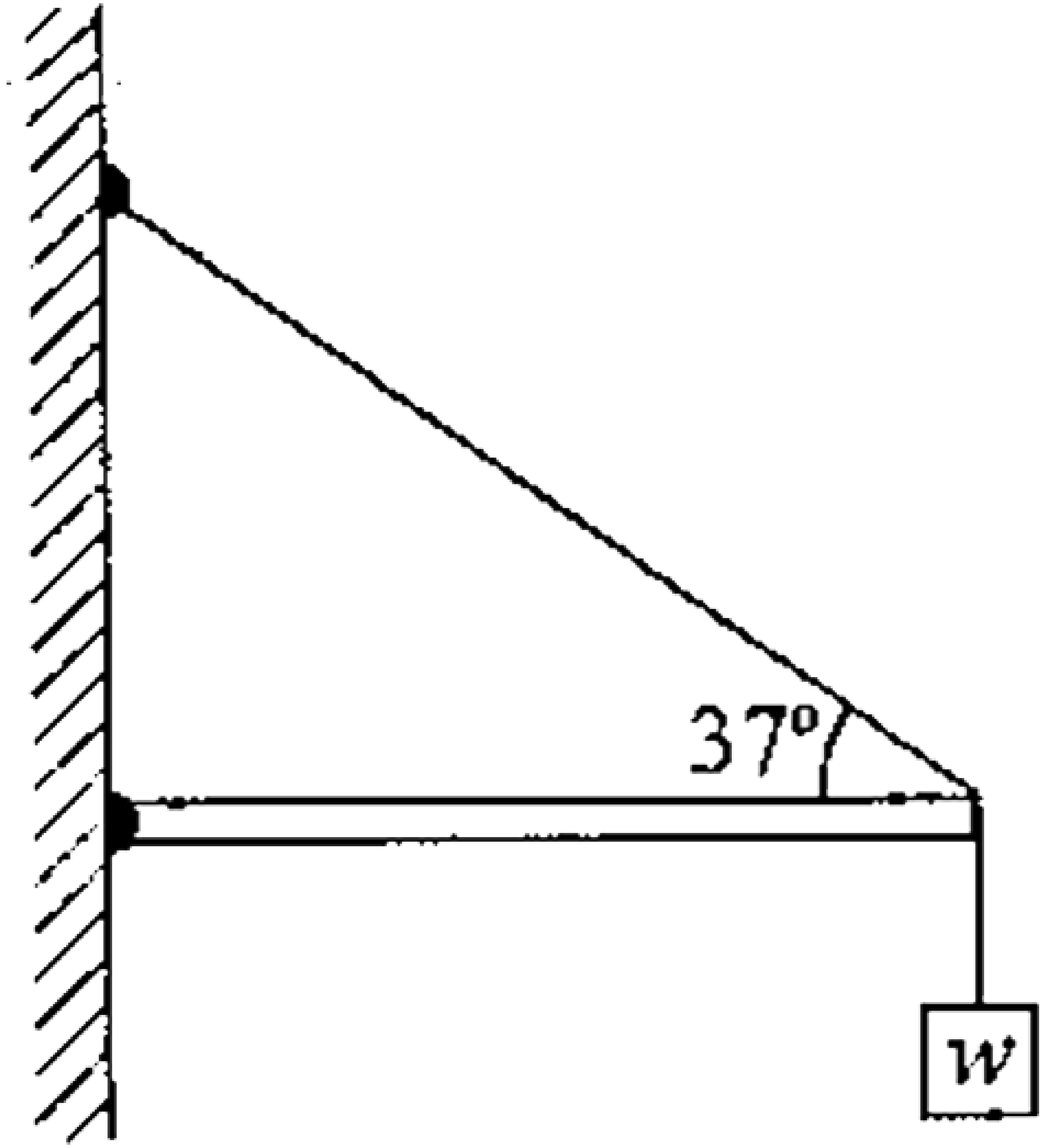
3. Find the tension in each cord in figure-2.48, if the weight of the suspended block is w.



`[(a)(2w)/(1+sqrt(3)),(sqrt(6)w)/(1+sqrt(3)),(b) (2w)/(sqrt(3)-1),(sqrt(6)w)/(sqrt(3)-1)]`

Watch Video Solution

4. A horizontal uniform boom that weighs 200 N and is 5m long supports a load of 1000N, as shown in figure-2.49. Find all the forces acting on the boom.

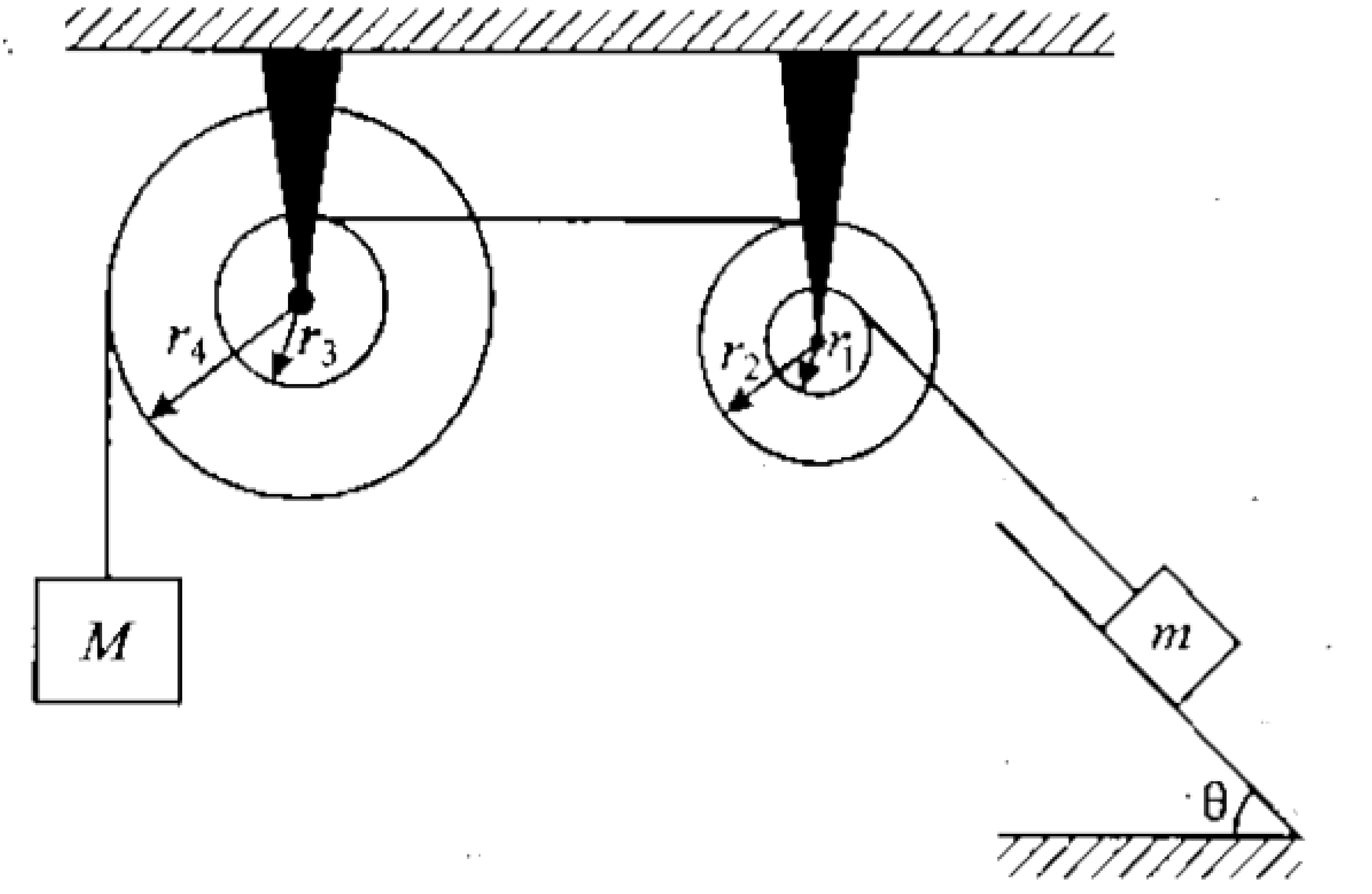


[T=1833.33 N, H = 1466.67 N, V = 100 N]

Watch Video Solution

5. A step pulley system is shown in figure-2.50. Find the relation in masses m and M for which the system remain in equilibrium. Assume string will not slide over the pulleys. `((r_(1))/(r_(2))=(1)/(2),(r_(3))/(r_(4))=

(3)/(4))`



`[(M)/(m)=(3)/(8)sintheta]`

Watch Video Solution

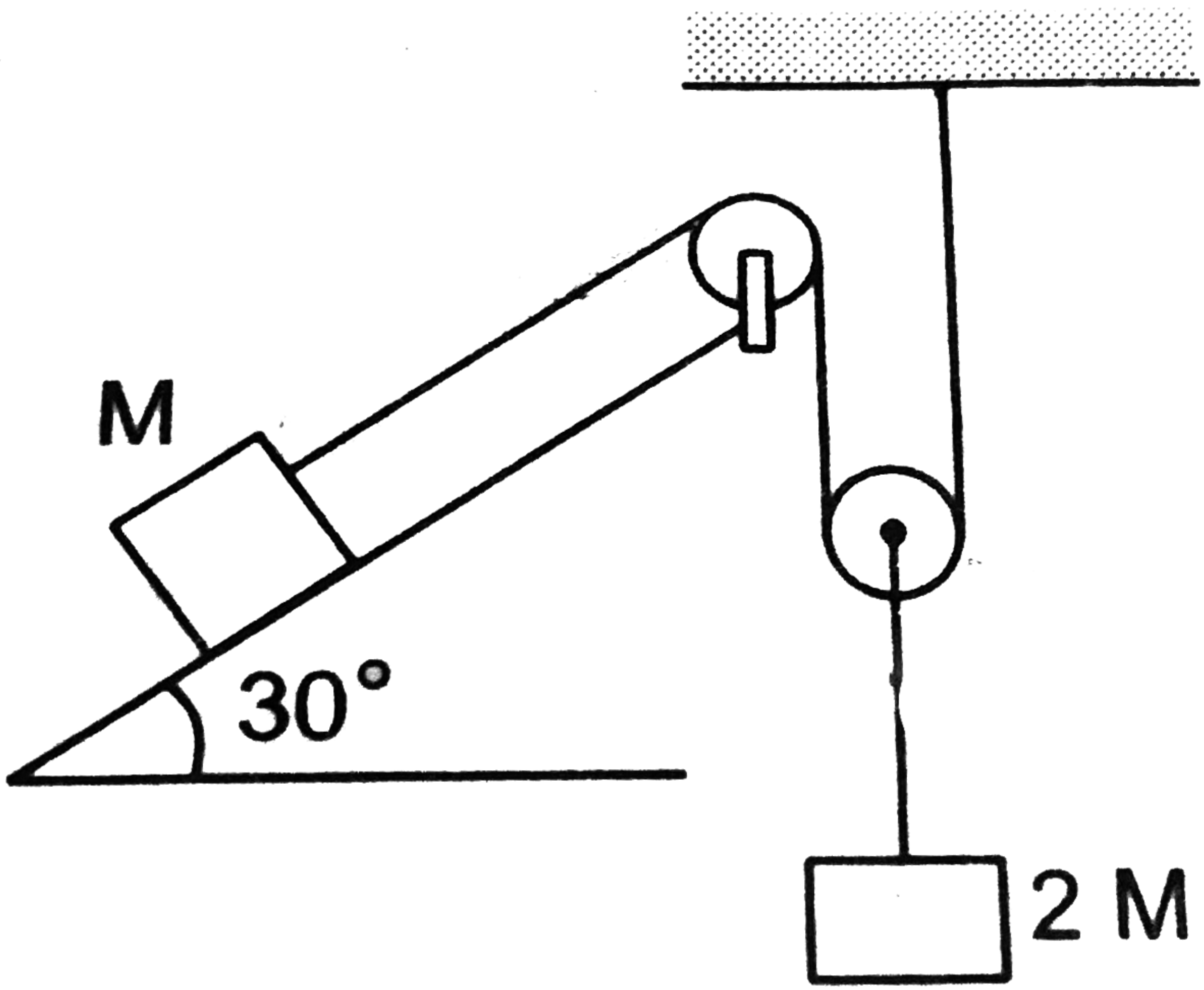
6. A nut cracker is used to crack a nut. In it nut is held in two arms at a distance 2 cm from the hinge and the handle of it is at a distance 25 cm from hinge. The force required to crack a walnut is 30 N. What is the minimum force required to crack it with the nut cracker.

[2.4 N]

Watch Video Solution

Practice Exercise 2.3

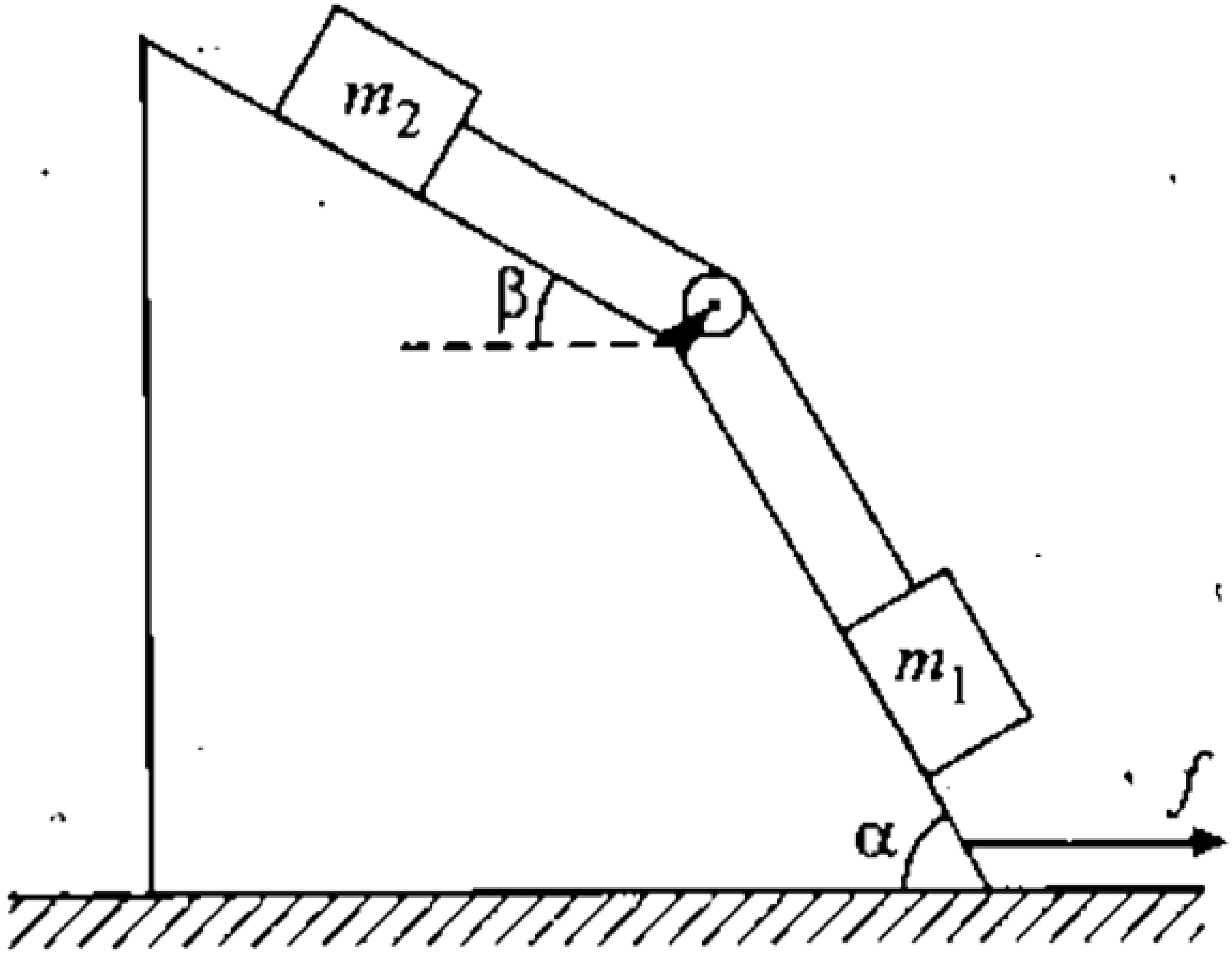
1. Find the mass M of the hanging block in figure which will prevent the smaller block from slipping over the triangular block. All the surfaces are frictions and the strings and the pulleys are light.



Watch Video Solution

Practice Exercise

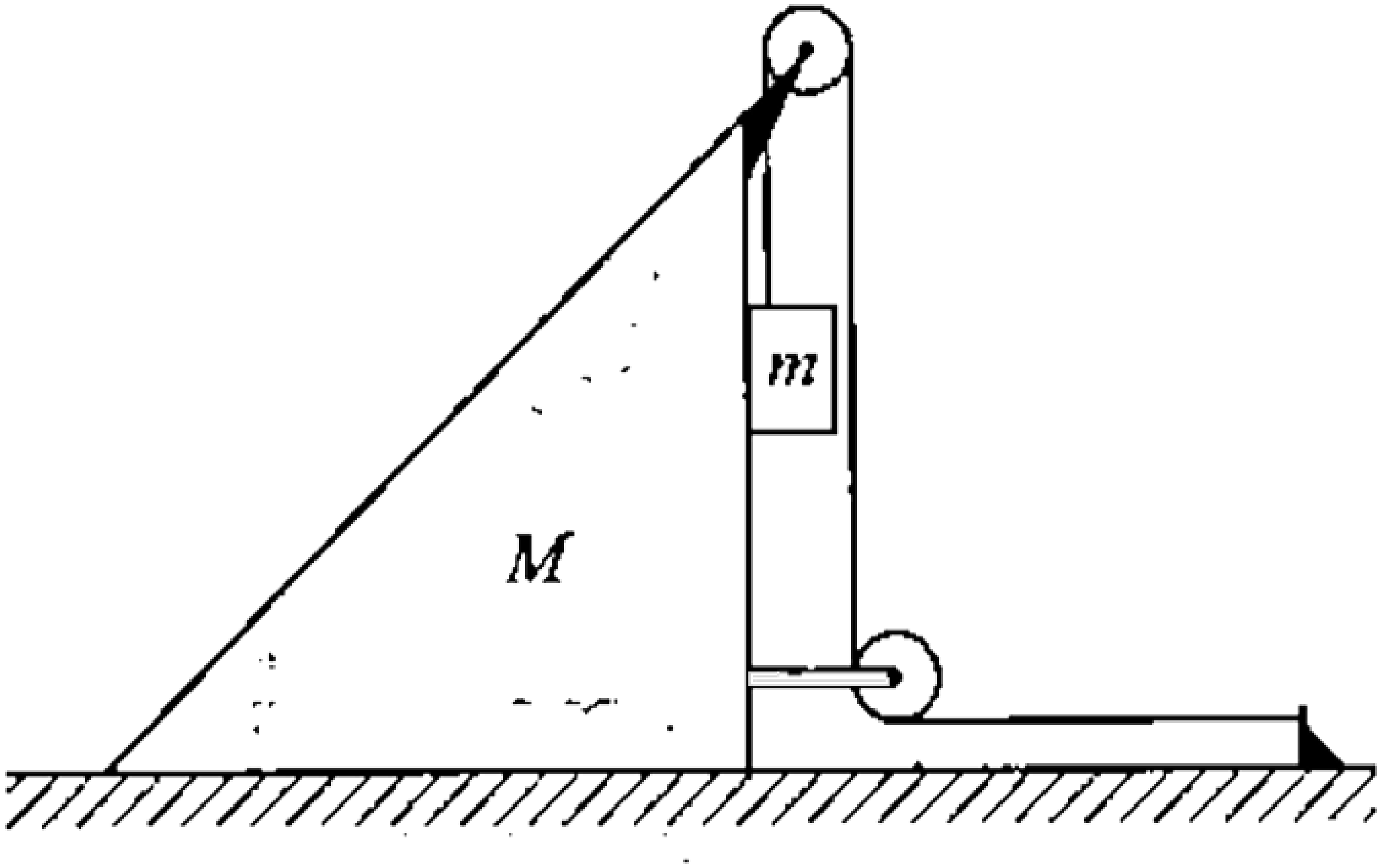
1. Two cubes of masses `m_(1)` and `m_(2)` lie on two frictionless slopes of the block A which rests on horizontal table. The cubes are connected by a string, which passes over a pulley as shown in the figure-2.67. To what horizontal acceleration "f" the block accelerates so that the cubes do not slide down the planes ? What is the tension in the string in this situation ?



`[f=g((m_(1)sinalpha+m_(2)sinbeta)/(m_(1)cosalpha+m_(2)cosbeta)),T = (m_(1)m_(2)gsin(alpha-beta))/(m_(1)cosalpha+m_(2)cosbeta)]`

Watch Video Solution

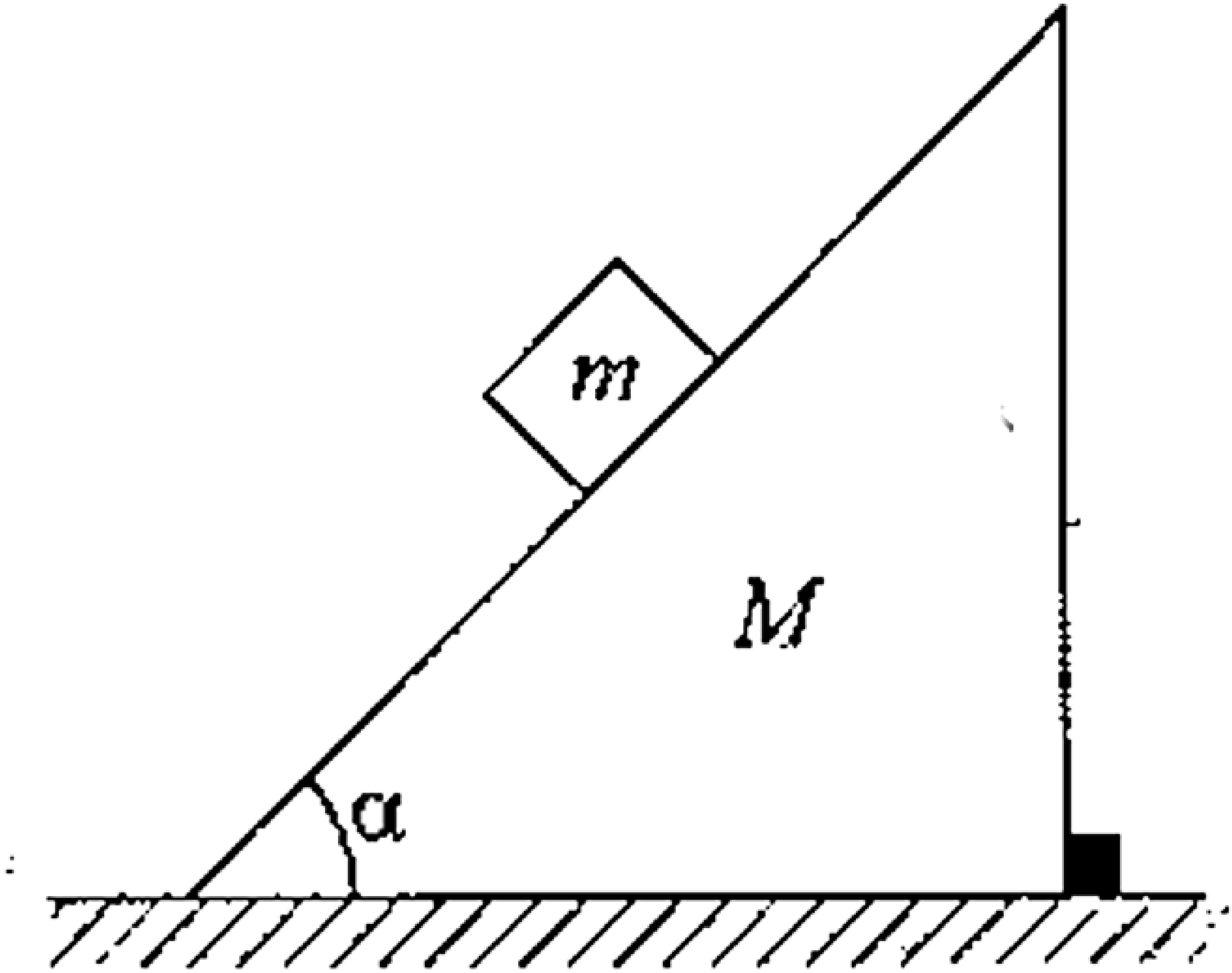
2. In the arrangement shown in figure-2.68 the masses of the wedge M and the body m are known. There is no friction at any of the surfaces. The mass of the pulleys and thread is negligible. Find the acceleration of the body m relative to the horizontal surface on which the wedge slides.



`[(sqrt(2)mg)/(M+2m)]`

Watch Video Solution

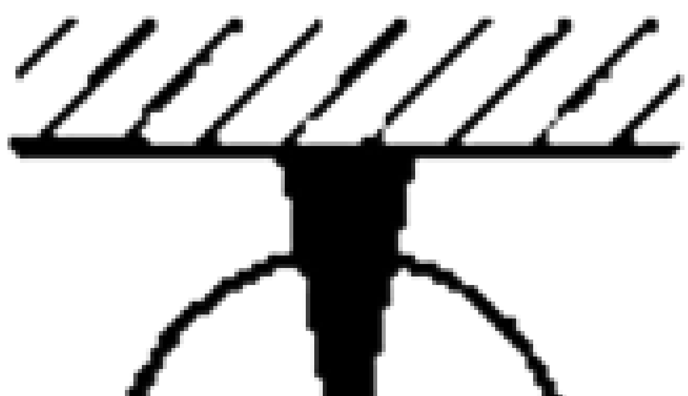
3. A body with a mass m slides along the surfac of a trihedral prism of mass M, whose upper plane is inclined at an angle `alpha` to the horizontal. The prism rests on a horizontal plane having a vertical ledge at the rear edge of the prism to keep it at rest as show in figure-2.69. Find the force exerted by the base of the prism on the plane ? Also find the force exerted by ledge on prism.

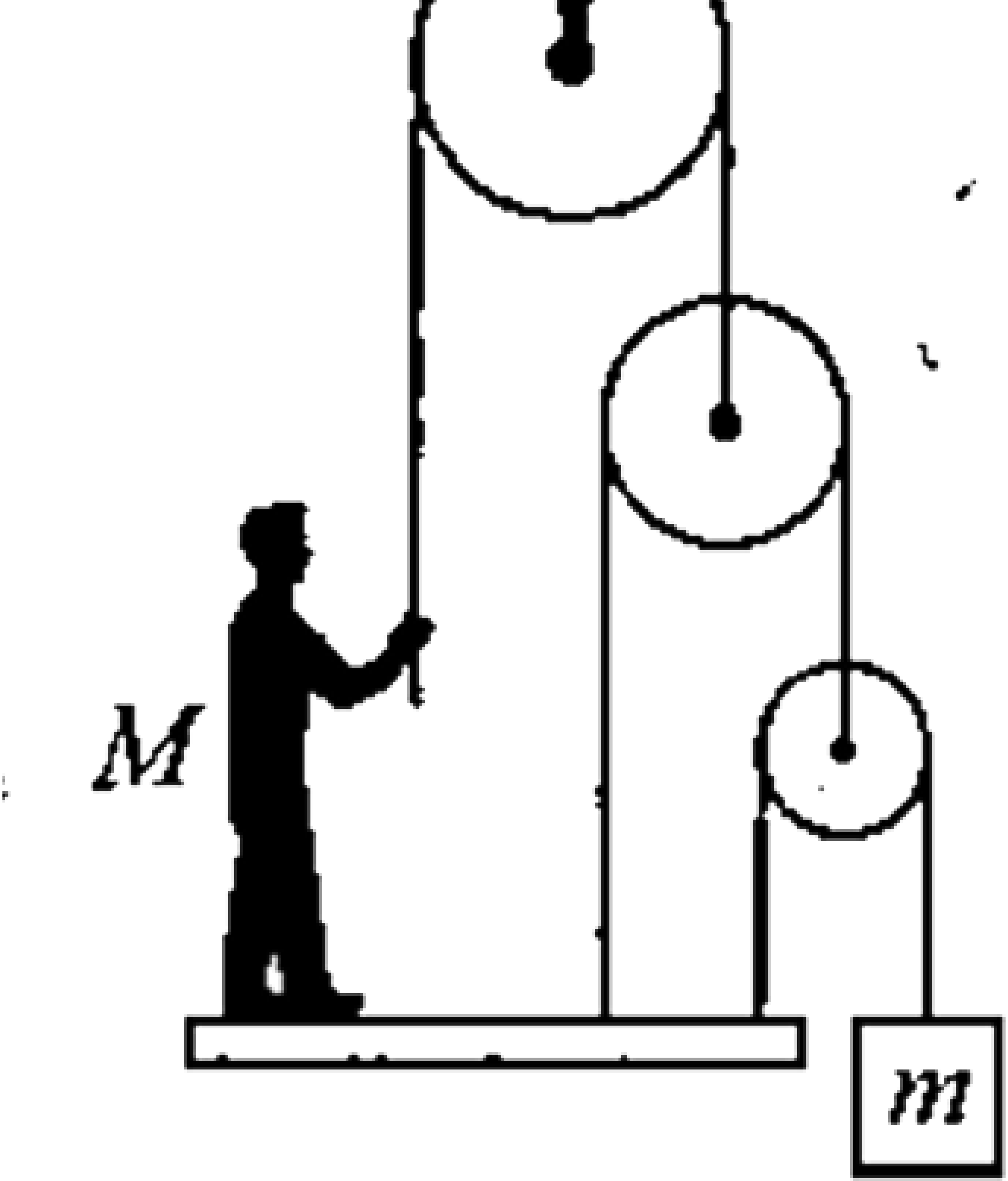


`[Mg +mgcos^(2)alpha, mg sinalphacosalpha]`

Watch Video Solution

4. If the man manages to keep himself at rest on platform, as shown in figure-2.71. Find the acceleration of the system masses m and M. All pulleys, platform and string are light and frictionless. Also find the force man has to exert on string in this situation.





`[(7m-M)/(49m+M)g,(8mM)/(49m+M).g]`

Watch Video Solution

Practice Exercise 2.4

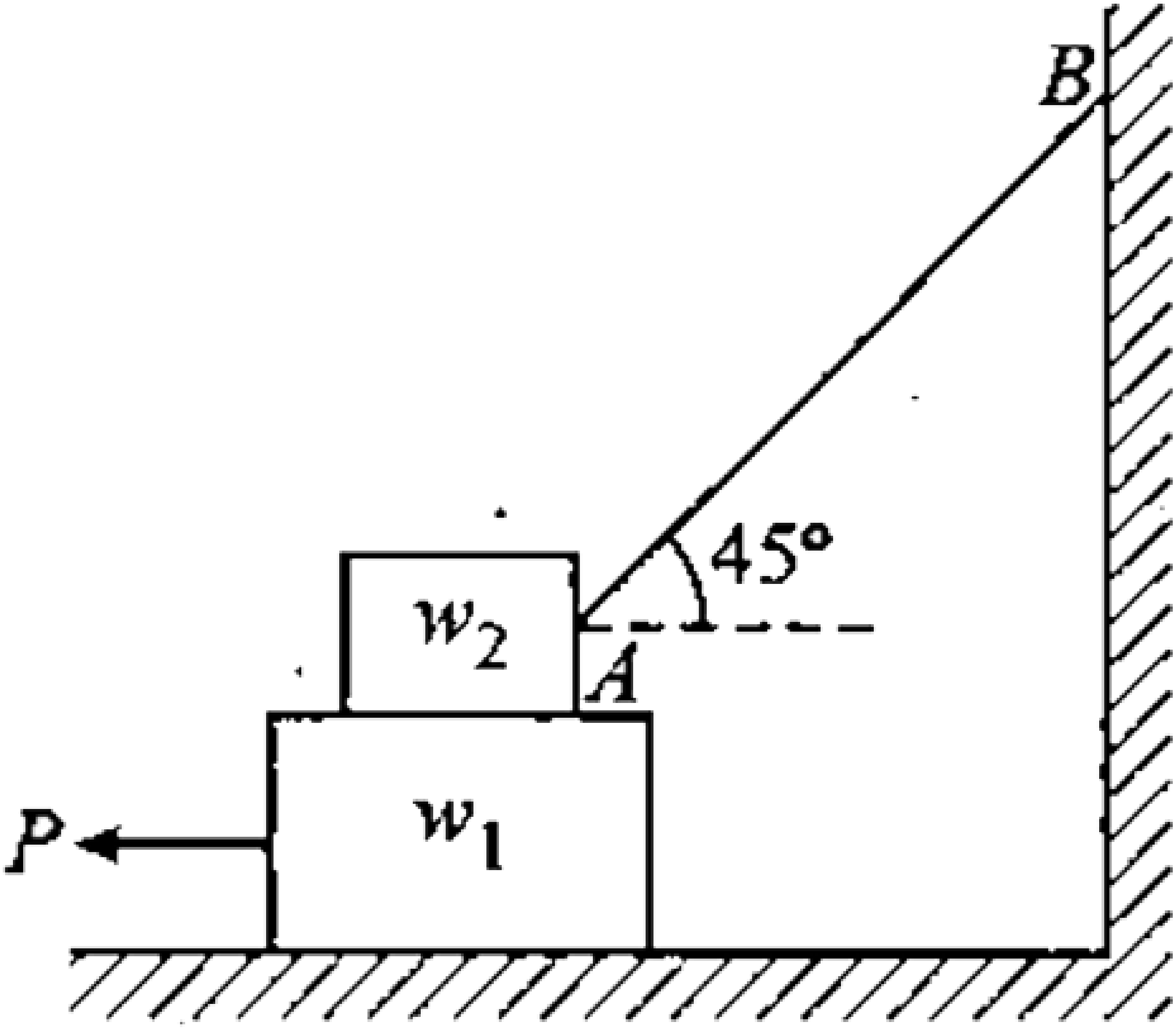
1. A child pushes a box that has mass m up an incline plane at an angle α above the horizontal. The coefficients of friction between the incline and the box are μ_{s} and μ_{k}. The force applied by the child is horizontal, (a)If μ_{s} is greater than some critical value, the child cannot start the box moving up the incline, no matter how hard he pushes. Calculate this critical value of μ_{s}. (b) Assume that μ_{s} is less than this critical value. What magnitude of force must the child apply to keep the box moving up the plane at constant speed.

$\left[\cot\alpha, \frac{mg(\sin\alpha+\mu_{k}\cos\alpha)}{\cos\alpha-\mu_{k}\sin\alpha}\right]$

Watch Video Solution

Practice Exercise

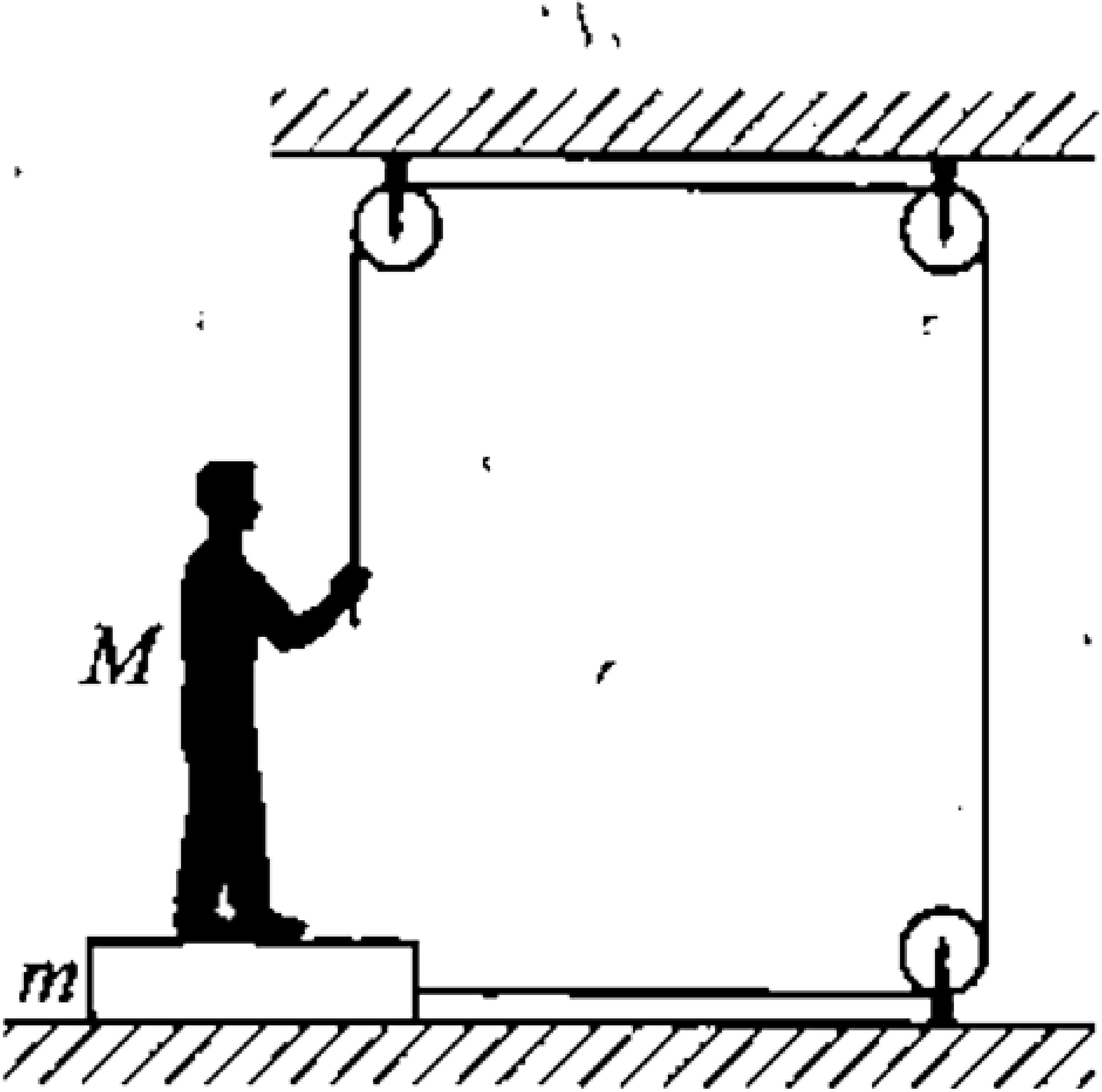
1. Calculate the force P required to cause the block of weight $W_{2}=200N$ just to slide under the block of weight $W_{1}=100N$ shown in figure-2.83. What is the tension in the string AB ? Coefficient of friction $\mu = 0.25$ for all surfaces in contact.



`[90 N, 20sqrt(2)N]`

Watch Video Solution

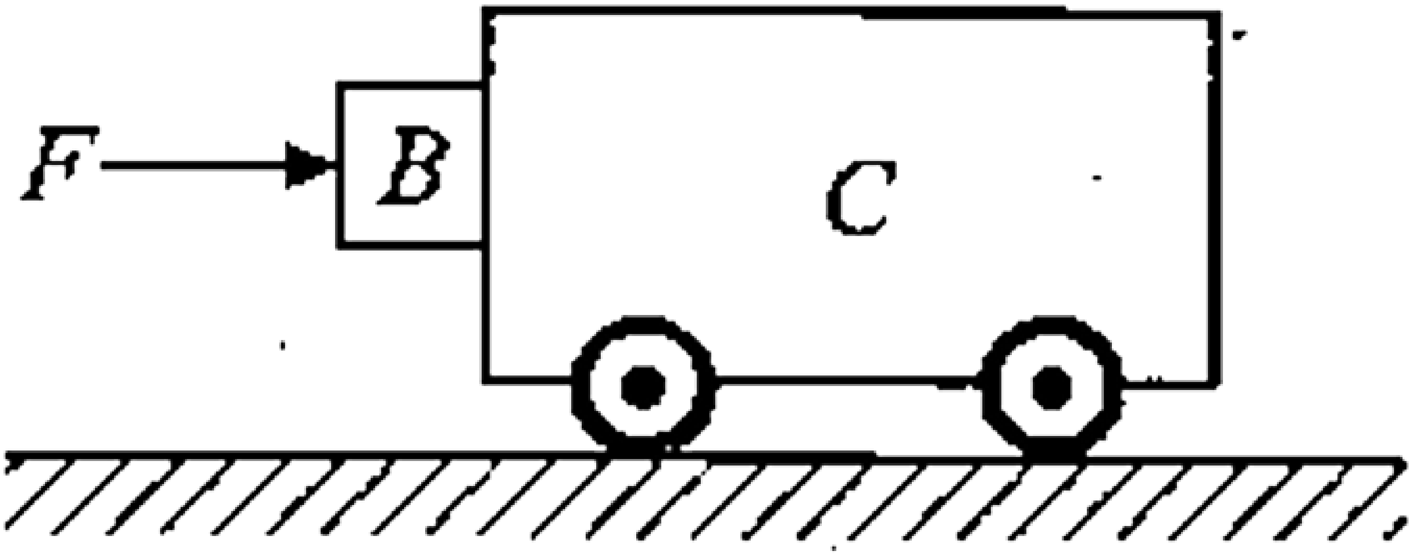
2. Figure-2.84 shows a man ofmass M standing on a board of mass m.What minimum force is required to exert on string to slide the board. The friction coefficient between board and floor is `mu` and there is sufficient friction between man and board so that man does not slip.



`[(mu(M+m)g)/(1+mu)]`

Watch Video Solution

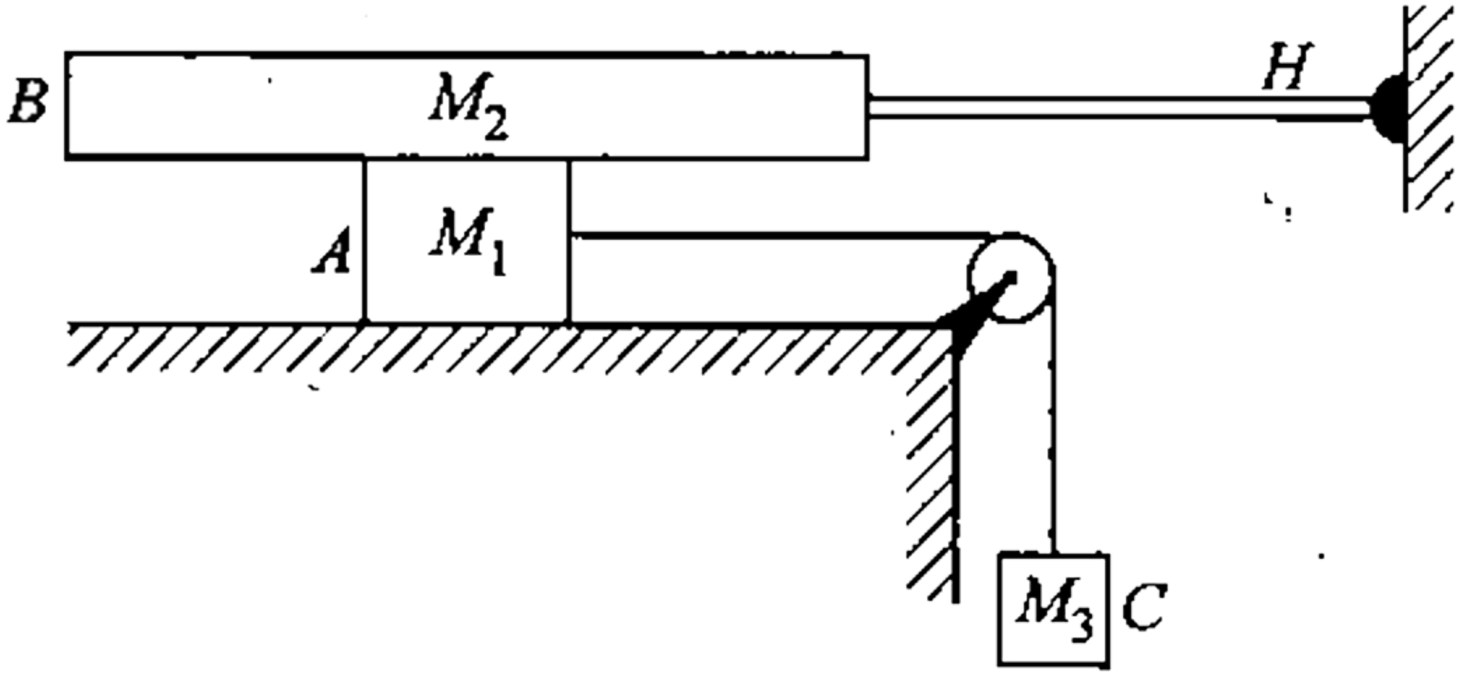
3. Figure-2.85 shows a block B of mass m, cart C of mass M, and the coefficient of static between the block and the cart is `mu`. Neglect frictional between wheels and axles and the rotational effects of the wheels. Determine the minimum value of F which must be applied on B such that it will not slide.



`[(mg)/(mu)(1+(m)/(M))]`

Watch Video Solution

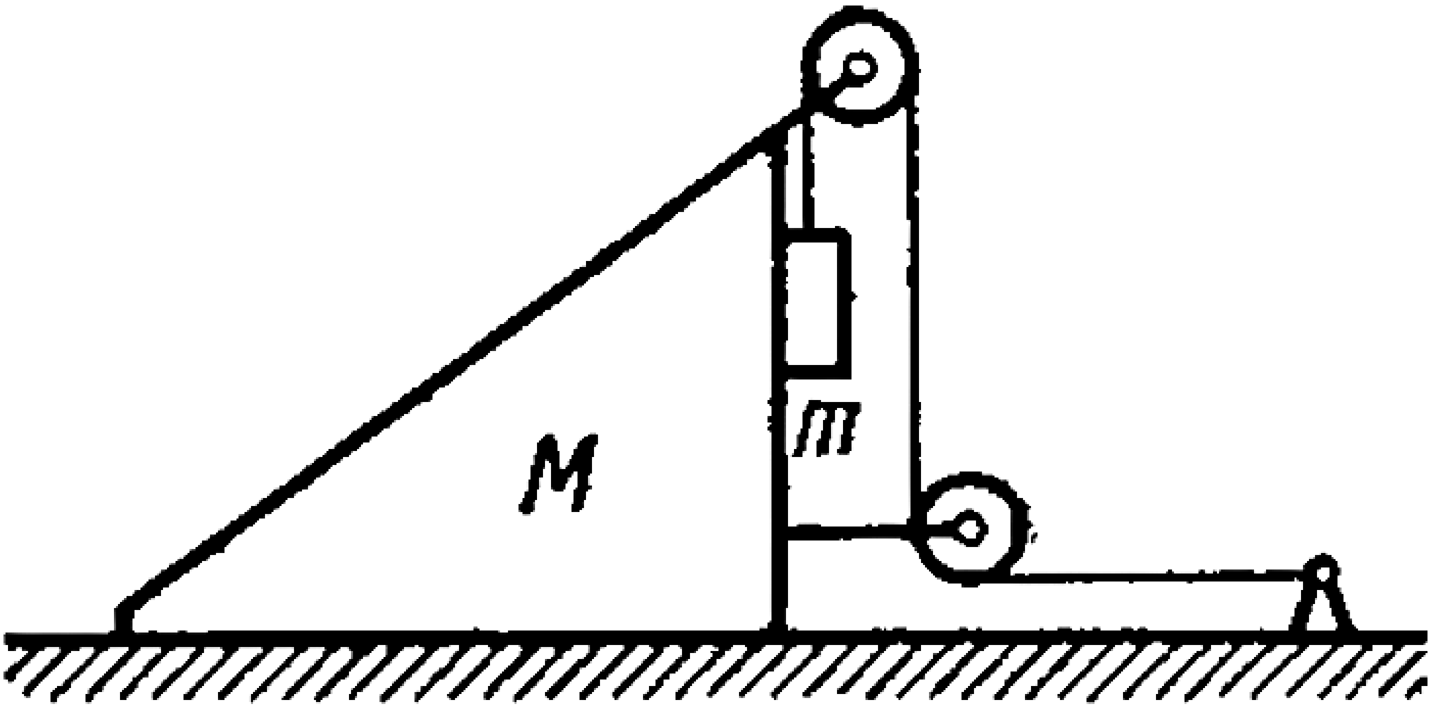
4. In figure-2.86, the blockA of mass `M_(1)` rests on a rough horizontal surface. The coefficient of friction between the block and the surface is `mu`. A uniform plank B, of mass `M_(2)` rests on A. B is prevented from moving by connecting it to a light rod R which is hinged at one end H.The coefficient of friction between A and B is `mu`. Findthe acceleration of blocks A and C.



`[(M_(3)g-mug(M_(1)+2M_(2)))/((M_(1)+M_(3)))]`

Watch Video Solution

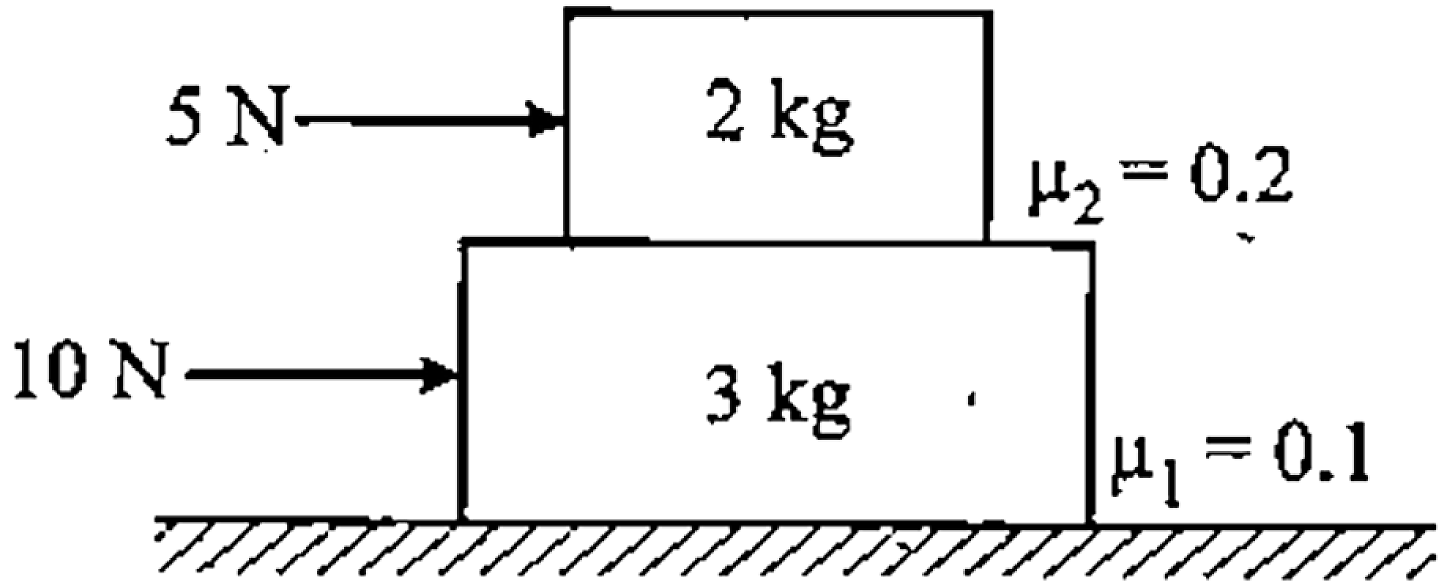
5. In the arrangement shown in figure the masses of the wedge `M` and the body `m` are known. The appreciable friction exists only between the wedge and the body `m`, the friction coefficient being equal to `k`. The masses of the pulley and the thread are negligible. Find the acceleration of the body `m` relative to the horizontal surface on which the wedge slides.



Watch Video Solution

Practice Exercise 2.5

1. Find the acceleration of the two blocks shown in figure-2.101.Take `g=10m//s^(2)`



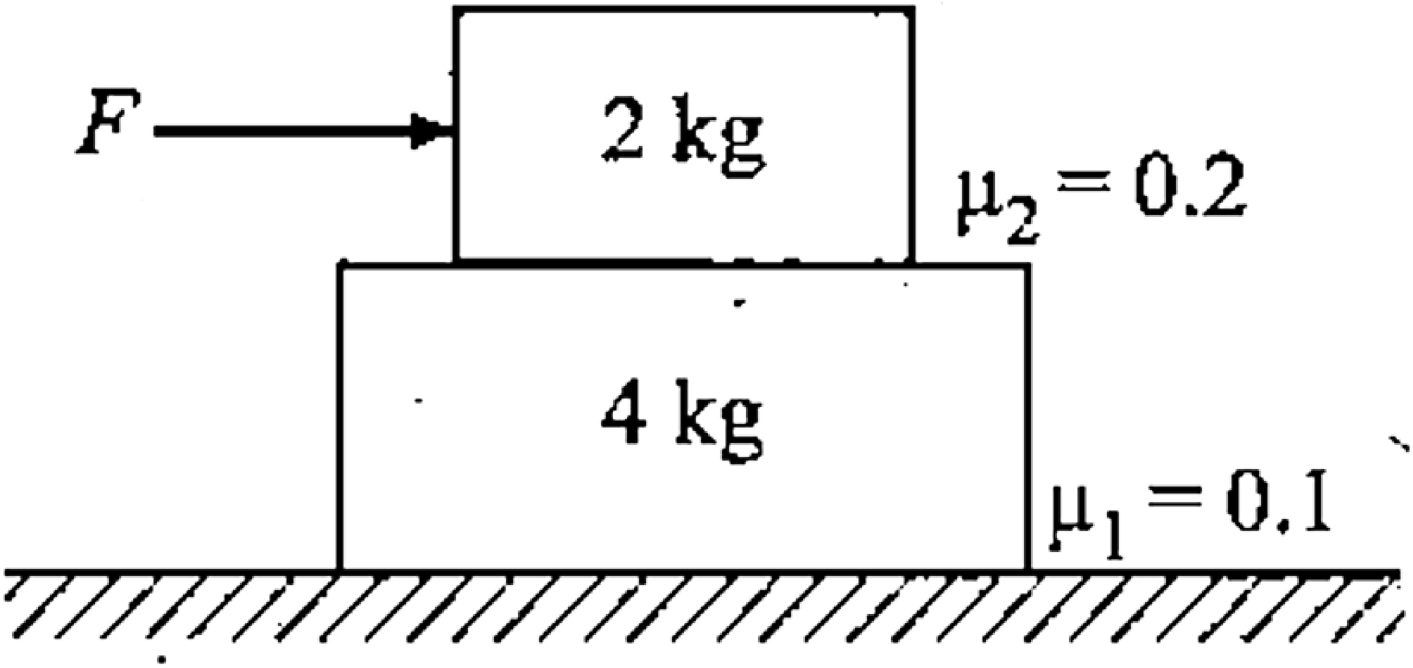
`[2m//s^(2), 2m//s^(2)]`

Watch Video Solution

Practice Exercise

1. In the situation shown in figure-2.102, (a) What minimum force will make any part for whole system move.

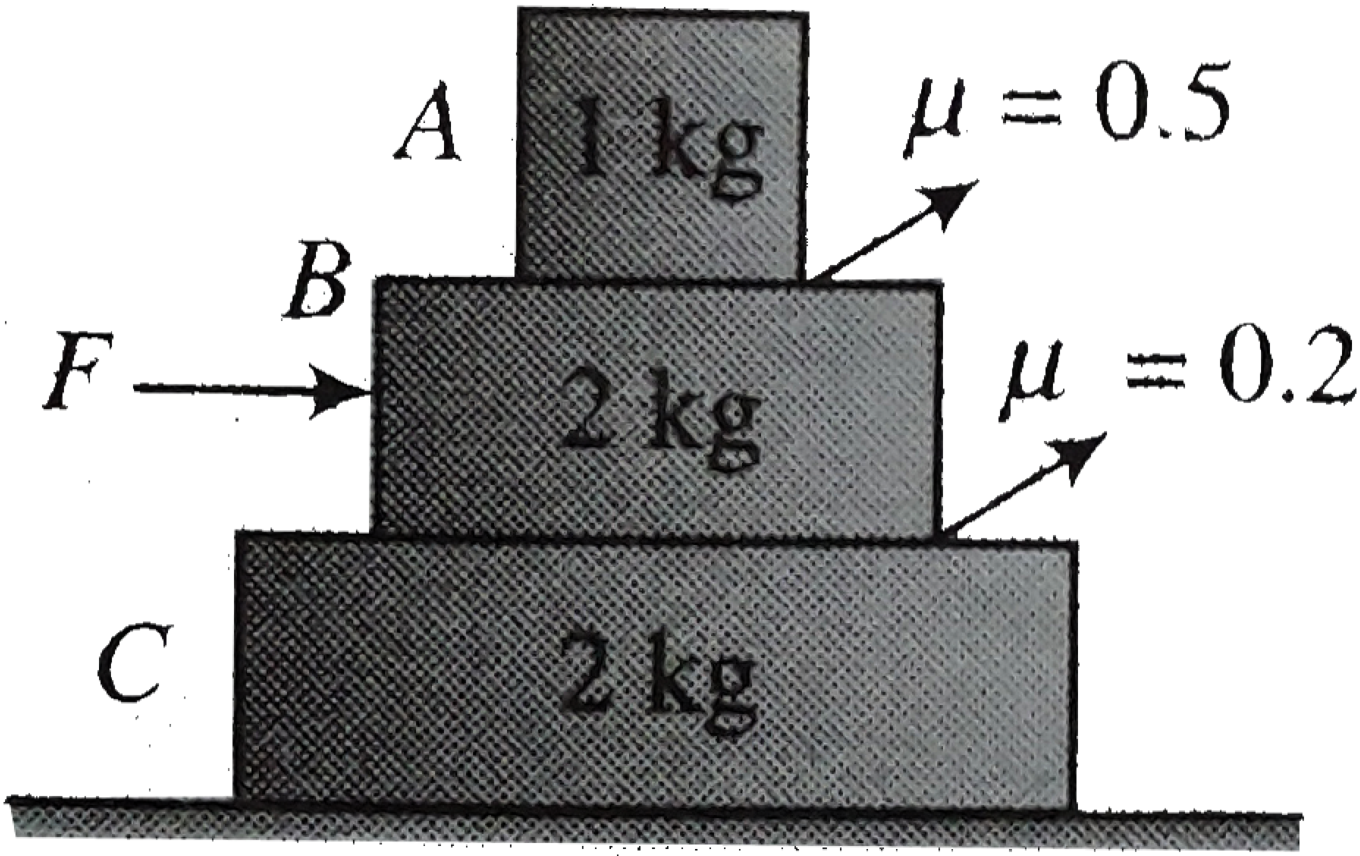
(b) For the following values of force, find the acceleration of two blocks, nature and value of friction at the two surfaces 2 N and 6 N. Take ` g = 10 m//s^(2)`.



`[(a) 4N, (b) 1m//s^ (2),0]`

Watch Video Solution

2. In the sitution shown in figure there is no friction between `2 kg` and ground.



a. For what maximum value of force `F` can all three blocks move together?

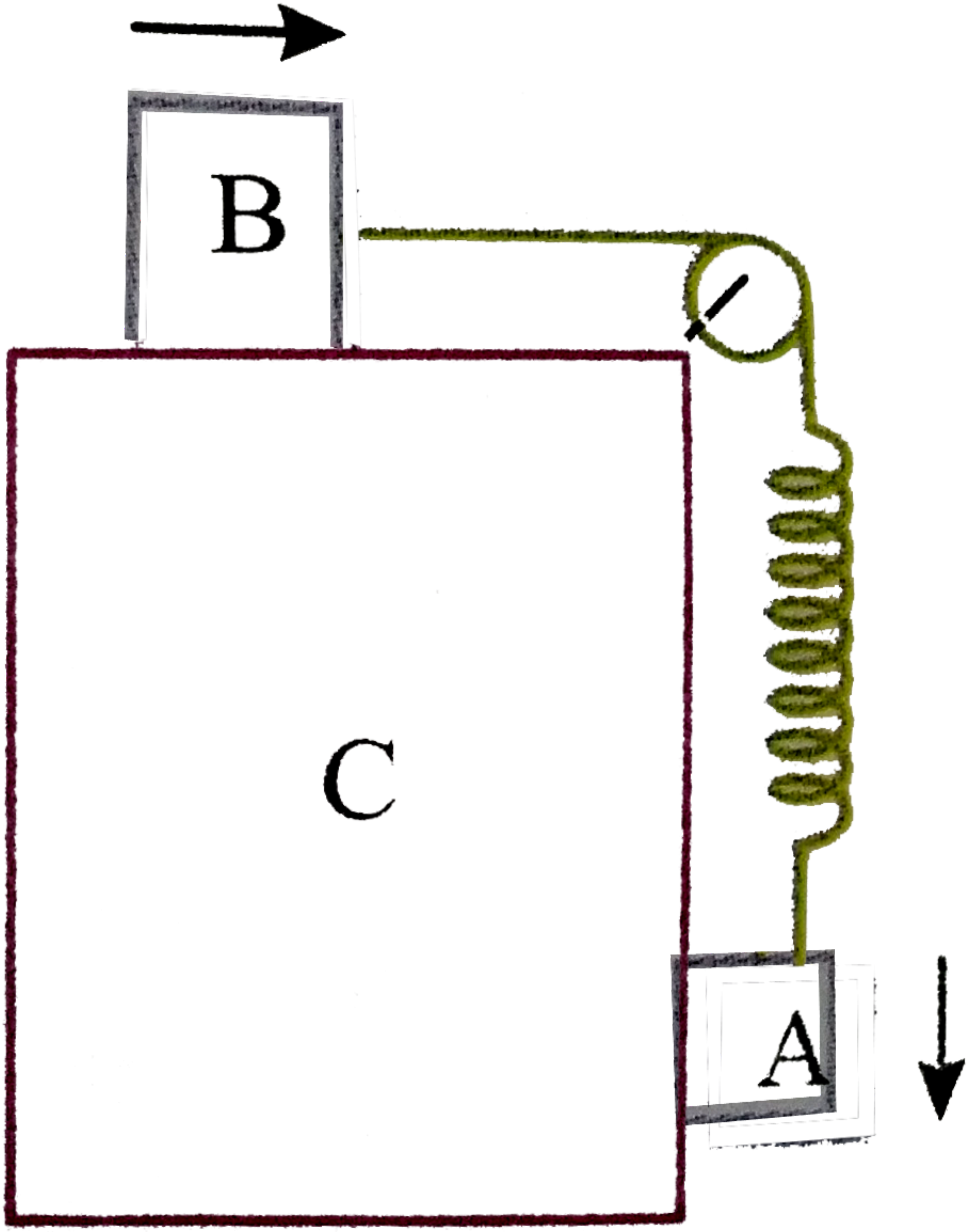
b. Find the value of force `F` at which sliding starts at other rough surfaces.

c. Find acceleration of all blocks, nature and value of friction force for the following values of force `F` (i) `10N` (ii) `N` and (iii) `25 N`

Watch Video Solution

Practice Exercise 2.6

1. Two blocks `A` and `B` are connected to each other by a string and a spring , the string passes over a frictionless pulley as shown in the figure. Block `B` slides over the horizontal top surface of a stationary block `C` and the block A slides along the vertical side of `C`, both with the same uniform speed. The coefficient of friction between the surface and blocks is `0.5, K = 2000 N//m`. If mass of `A` is `2 kg` calculate mass of `B`.

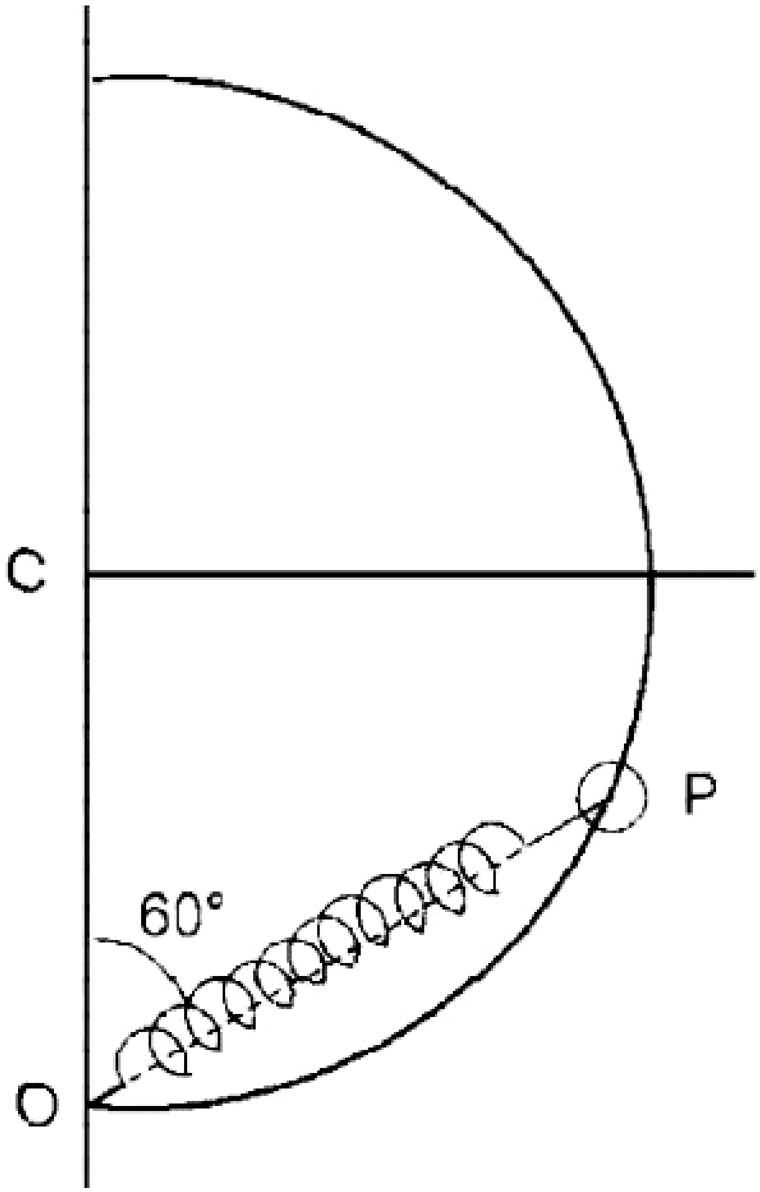


.

Watch Video Solution

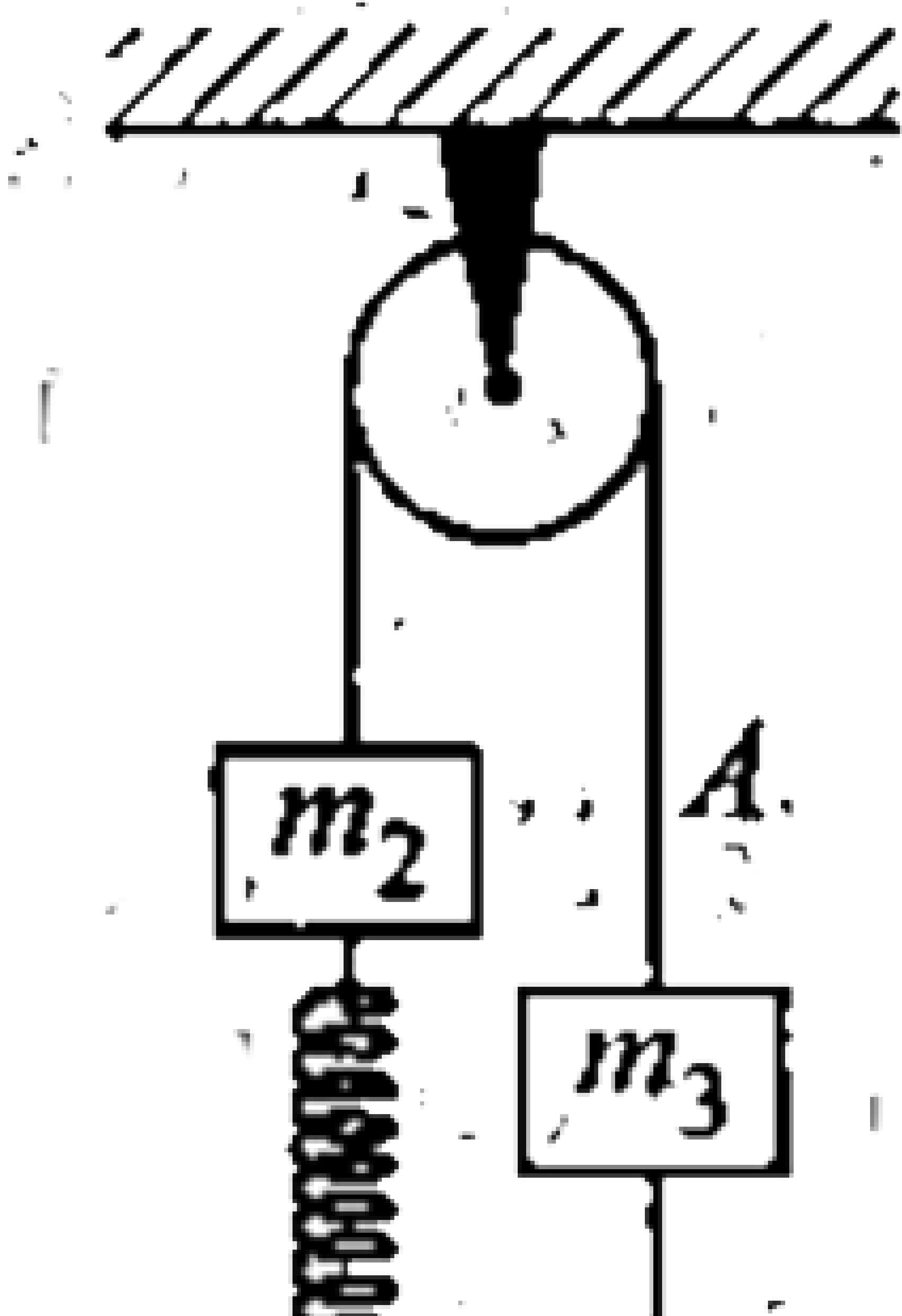
Practice Exercise

1. A smooth semicircular wire-track of radius R is fixed in a vertical plane. One end of a massless spring of natural length `3R//4` is attached to the lowest point O of the wire-track. A small ring of mass m, which can slide on the track, is attached to the other end of the spring. The ring is held staionary at point P such that the spring makes an angle of `60^@` with the vertical. The spring constant `K=mg//R`. Consider the instant when the ring is released, and (i) draw the free body diagram of the ring, (ii) determine the tangential acceleration of the ring and the normal reaction.



Watch Video Solution

2. Find the acceleration of masses `m_(1), m_(2)` and `m_(3)` shown in figure-2.119 just after the string is cut at point A.

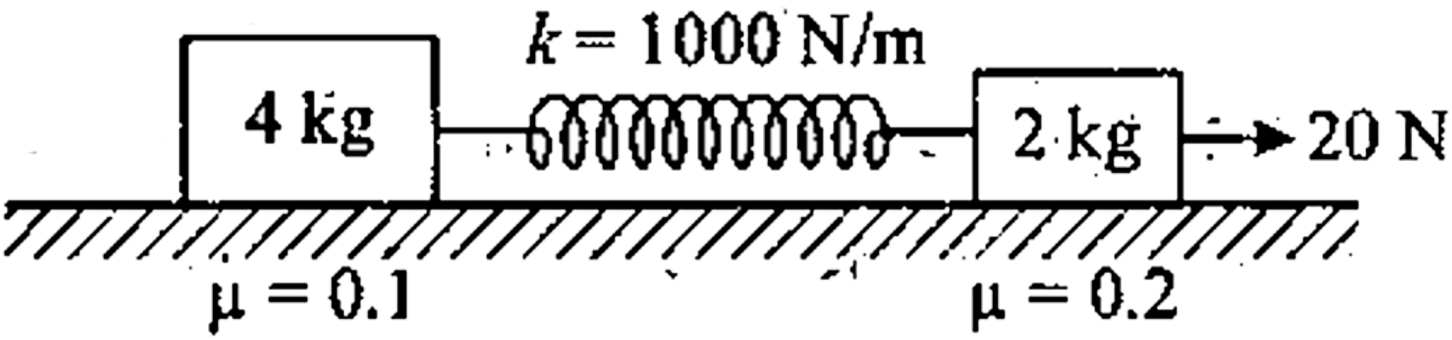


m_2
A
m_3

`[0,(1+(m_(1))/(m_(2)))g, g]`

Watch Video Solution

3. In figure shown if 2 kg block is moving at an acceleration `2 m//s^(2)`, find the elongationin spring and acceleration of 4 kg block at this instant. Take ` g= 10m//s^(2)`.



`[0.012 m, 2 m//s^(2)]`

Watch Video Solution

Discussion Question

1. Objects on the moon weigh only about one sixth as much' as they do on earth, you would almost certainly be able to lift a heavy person. Could you easily stop him if he was running at a fast rate across the moon's surface ?

Watch Video Solution

2. Assertion`:-` A ball is thrown from the edge of a very high clif. No matter what the angle at which it is thrown , due to air resistance, the ball will eventually end up moving vertically downward.

Reason `:-` In horizontal direction there is a component of retarding force of air resistance alone.

Watch Video Solution

3. You are riding in a car.The driver suddenly applies the brakes and you are pushed forward. Who pushed you forward?

Watch Video Solution

4. A block of mass M is supported by a cord C from a rigid support , and another cord D is attached to the bottom of the block . If D is given a sudden jerk D breaks But if D is pulled steadily , cord C breaks . Why ?

Watch Video Solution

5. A spring scale is used to weight beans on an elevator. How will the readings for a given amount of beans change when the elevator is (a) going down with constant velocity,(b) moving with a constant downward acceleration less than g, (c) moving upward with a constant velocity, (d) accelerating upward with an acceleration a. What happens in above cases if we use a beam balance.

Watch Video Solution

6. A bird alights on a stretched telegraph wire. Does this change the tension in the wire ? If so,by an amount less than, equal to, or greater than the weight of the bird ?

Watch Video Solution

7. Is there any directional relation between the net force on an object and the object's velocity ? If so,what is that relation ?

Watch Video Solution

8. A horse is urged to pull a wagon the horse refuses to try, citing Newton's third laws as a defense: the pull of the horse on the wagon is equal to but opposite the pull of the wagon on the horse. "If I can never exert a greater force on the wagon than it exerts on me, how can I ever start the wagon moving ?" Asks the horse. How would you reply ?

Watch Video Solution

9. A coin is put on a long play record.The player is started but, before the final speed of rotation is reached, the coin flies off. Explain why?

Watch Video Solution

10. In a tug of war, one team is giving way to other. What work is being done and by whom?

Watch Video Solution

11. You are an astronaut in the lounge of an orbiting space station and you remove the cover from'a long thin jar containing a single olive. Describe several ways to remove the olive from the jar.

Watch Video Solution

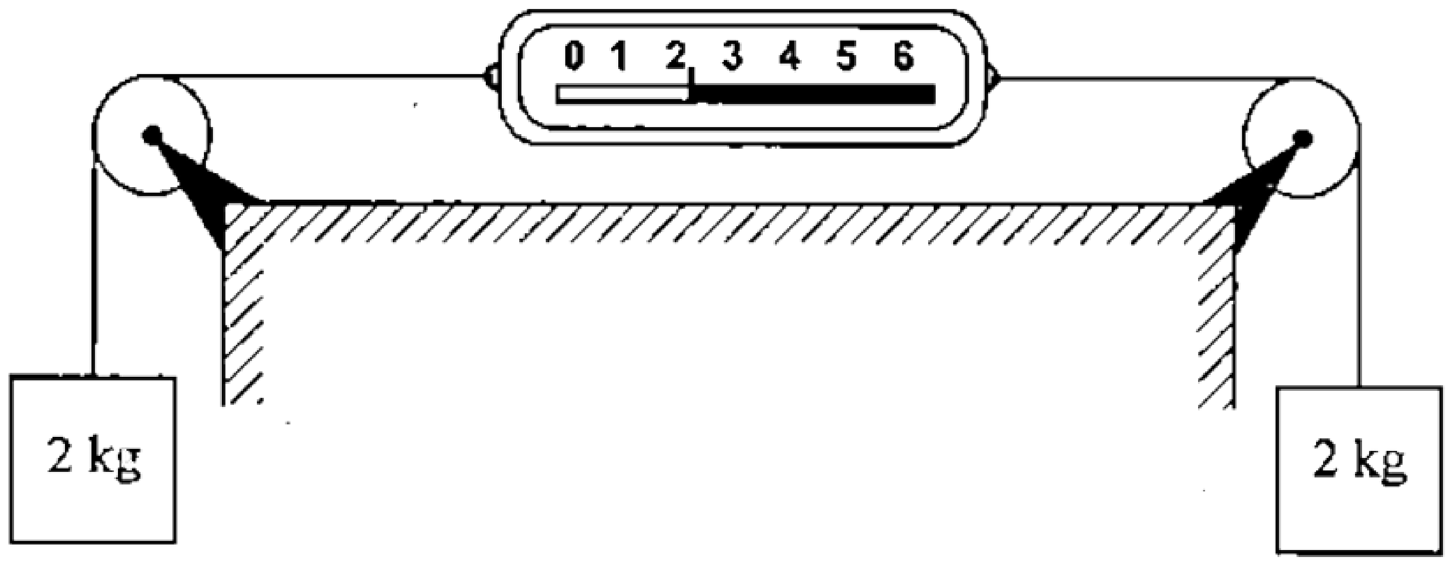
12. If you stand facing forward during a bus or subway ride, why does a quick deceleration topple you forward and a quick increase in speed throw you backward ? Why do you have better balance if you face toward the side of the 'bus or'' subway train?

Watch Video Solution

13. When an object is thrown inair, does it travel agreater horizontal distance while climbing to its maximum height or while descending from its maximum height back to the ground ? Or is the horizontal distance travelled the same for both ?

Watch Video Solution

14. Two 2 kg weight are attached to spring balance as shown in figure-2.122. What is the reading of the scale ?



Watch Video Solution

15. An elevator is supported by a single cable.There is no counter weight.The.elevator receives passengers atthe ground floor and takes them to the top floor, where they disembark. New passengers enter and are taken down to the ground floor. During this round trip, when is the tension in the cable equal to the weight of the elevator plus passengers ? When greater ? When less ?

Watch Video Solution

16. Under what conditions could unequal masses by strung over a pulley without the pulley having any tendency to turn ?

Watch Video Solution

17. At noon, the sun and the earth pull the objects on the earth's surface in opposite directions. At midnight, the sun and the earth pull these objects in same direction. Is the weight of an object as measured by a spring balance on the earth's surface , more at midnight as compared to its weight as noon?

Watch Video Solution

18. A block rests on an inclined plane with enough friction to prevent its sliding down, to start the block moving, is it easier to push it up the plane, down the plane, or sideways ? Discuss all the three cases in detail.

Watch Video Solution

19. A soda water bottele is falling freely . Will the bubbles of gas rise in the water of the bottle ?

Watch Video Solution

20. Does the work done in raising a body through a certain height depend upon how fast it is raised ?

Watch Video Solution

21. In a tug of war, three men pull on a rope to the left at A and three men pull to the right at B with forces of equal magnitude. Then a 5 lb weight is hung from the centre of the rope.'(a) Can the men get the rope AB to be horizontal ? (b)If not, explain. If so, determine the magnitudes of the forces at A and B required to do this.

Watch Video Solution

22. Air is thrown on a sail attached to a boat from an electric fan placed on the boat . Will the boat start moving ?

Watch Video Solution

23. A massless rope is strung over a frictionless pulley. A monkey holds onto one end of the rope, and a mirror, having the same weight as the monkey, is attached to the other end of the rope at the monkey's level.Can the monkey get away from its image seen in the mirror (a) by climbing up the rope,(b) by climbing down the rope, or (c) by releasing the rope ?

Watch Video Solution

24. Two teams of students are having a tug-of-war. The rope passes through a small hole fence that separates the two teams.Neither team can see the other.Both teams pull mightily, but neither budges. As lunch time approaches the members of one team decide to tie their end of the rope to a stout tree while they take a lunch break. Can the other team tell that the first is not pulling on the motionless rope ? Analyse the forces in this problem.

Watch Video Solution

25. (A) : Polishing a surface beyond a certain limit increases rather than decreases the frictional forces .

(R) : When the surface is polished beyond a certain limit , the molecules exert strong attractive force . This is called surface adhesion , to overcome which additional force is required . Hence frictional force increases .

Watch Video Solution

26. Why do tyres have a better grip of the road while going on a level road than while going on an incline?

Watch Video Solution

27. A box, heavier than you is placed on a rough floor. The coefficient of static friction between the box and the floor is the same as that between your shoes and the floor. Can you displace the box across.the floor.

Watch Video Solution

28. "The path of a projectile under gravity is a parabola because it has no horizontal acceleration", Discuss the above statement.

Watch Video Solution

29. A heavy iron ball is taken into space where it is weightless. Will it hurt to kick this football since it is weightless ?

Watch Video Solution

30. When .you tighten a nut on a bolt, how are you increasing the frictional force ?

Watch Video Solution

31. Suppose that you drop a marble of mass m into a jar of honey. As the marble sinks, its speed is effectively constant., What is the net force on the marble us it sinks ? What are the magnitude and direction of the forces exerted by the honey ?

Watch Video Solution

32. Could you weigh yourself on a scale whose maximum reading is less than your weight ? If so, how ?

Watch Video Solution

33. A ladder is resting against a wall and a person climbs up the ladder.Is the ladder more likely to slip out at the bottom as the person climbs closer to the top of the ladder? Explain.

Watch Video Solution

34. A man sits in a chair that is suspended from arope. The rope passes over a pulley suspended from the ceiling, and the man holds the other end of the rope in his hands.What is the tension in the rope, and what force does the chair exert on the man ?

Watch Video Solution

35. What happens to a baseball that is fired downward through air at twice its terminal speed does it speed up, slow down, or continue to move with its initial speed?.

Watch Video Solution

36. You throw a baseball straight upward. If air resistance is not neglected, how does the time required for the ball to.go, from the height at which it was thrown up to its maximum height compare to the time required for it to fall from its maximum height back down to the height from which it was thrown ? Explain your answer.

Watch Video Solution

37. A car at rest is struck from the rear by a second car. The injuries incurred by the two drivers are of distinctly different character Explain.

Watch Video Solution

38. There is more water in a beaker placed in the pan of a spring balance.If we dip our finger in this water without touching the bottom of the beaker, then what would be the effect on the reading of the balance ?

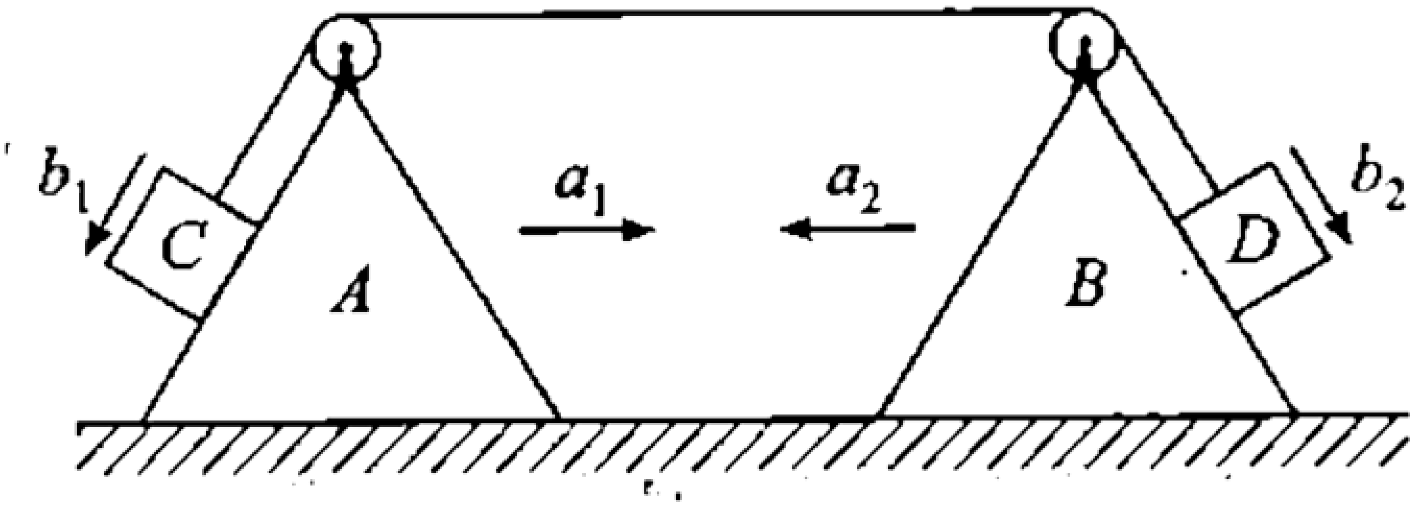
Watch Video Solution

39. In a box car a helium filled balloon is tied to the, floor with a string. Car is moving on a horizontal road. If suddenly breaks are applied, what happens to the balloon. Will it jerked forward, backward or remain at rest.

Watch Video Solution

Conceptual MCQs

1. Let `a_(1) & a_(2)` are the acceleration of A & B. Let `b_(1) & b_(2)` the acceleration of C & D relative to the wedges A and B respectively, choose the right relation. (directions of `a_(1), a_(2), b_(1) & b_(2)` are shown in figure below) :



A. `a_(1)-a_(2) +b_(1) -b_(2) =0`

B. `a_(1)+a_(2) - b_(1) - b_(2) =0`

C. `a_(1)+a_(2) + b_(1) + b_(2) =0`

D. `a_(1)+b_(2) = a_(2) + b_(1)`

Answer: B

Watch Video Solution

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

A. Larger friction

B. Smaller friction

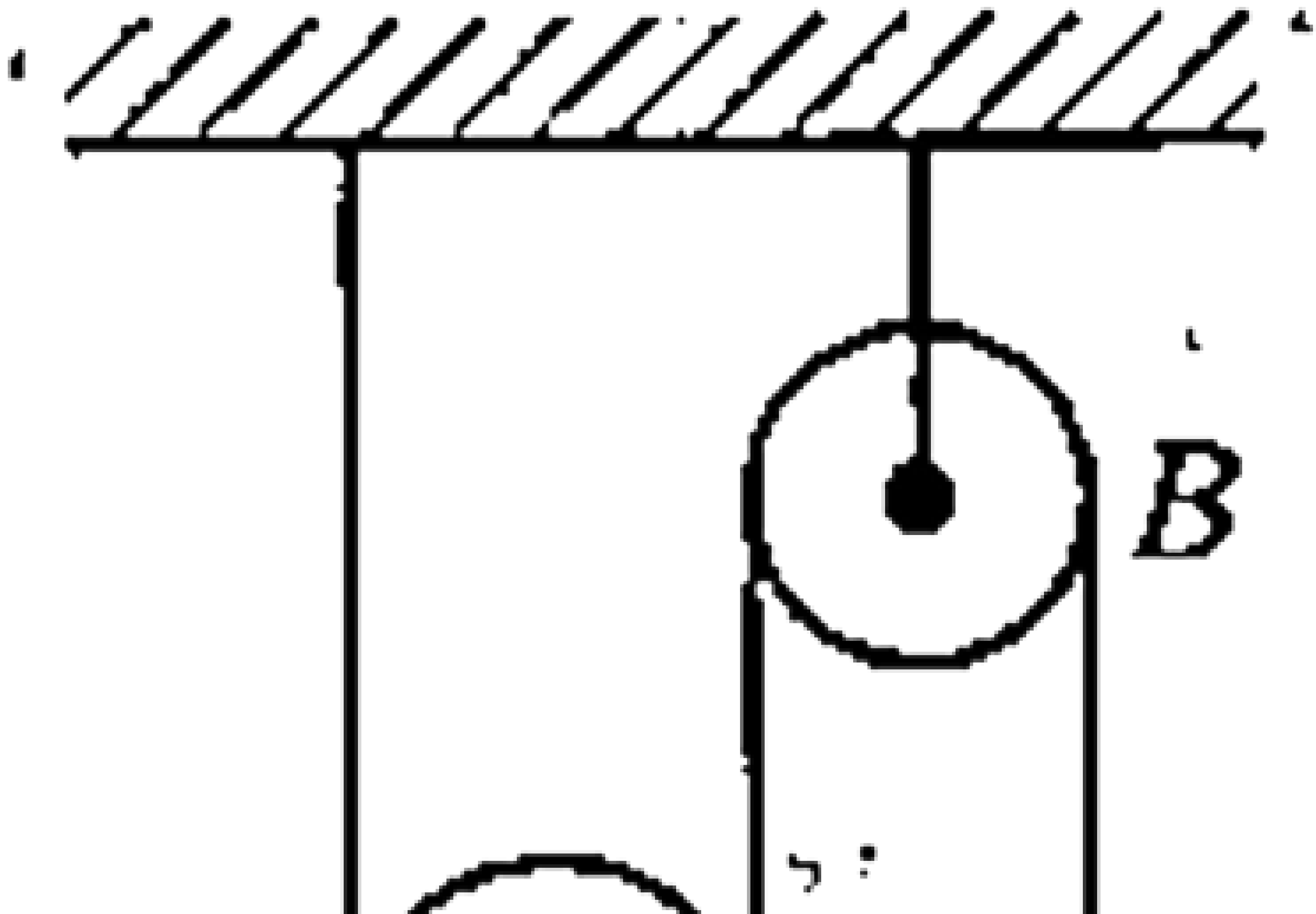
C. Larger normal force

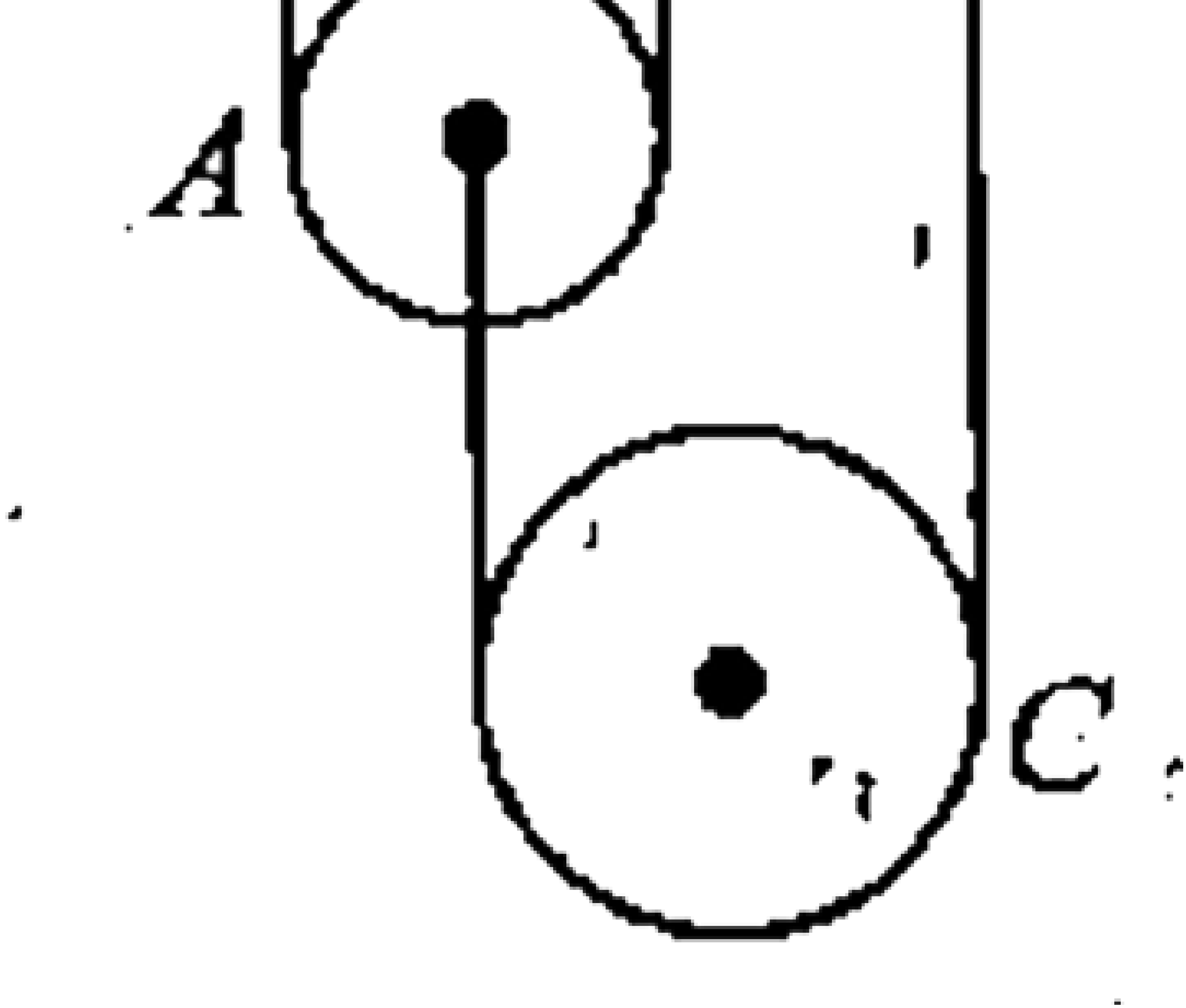
D. Smaller normal force

Answer: B

Watch Video Solution

3. In the arrangement shown in figure-2.124 pulley A and B are massless and the thread is inextensible. Mass of pulley C is equal to m. If friction in all the pulleys negligible, then :





A. Tension in thread is equal to `1//2 mg`

B. Acceleration of pulley C is equal to `g//2` (downward)

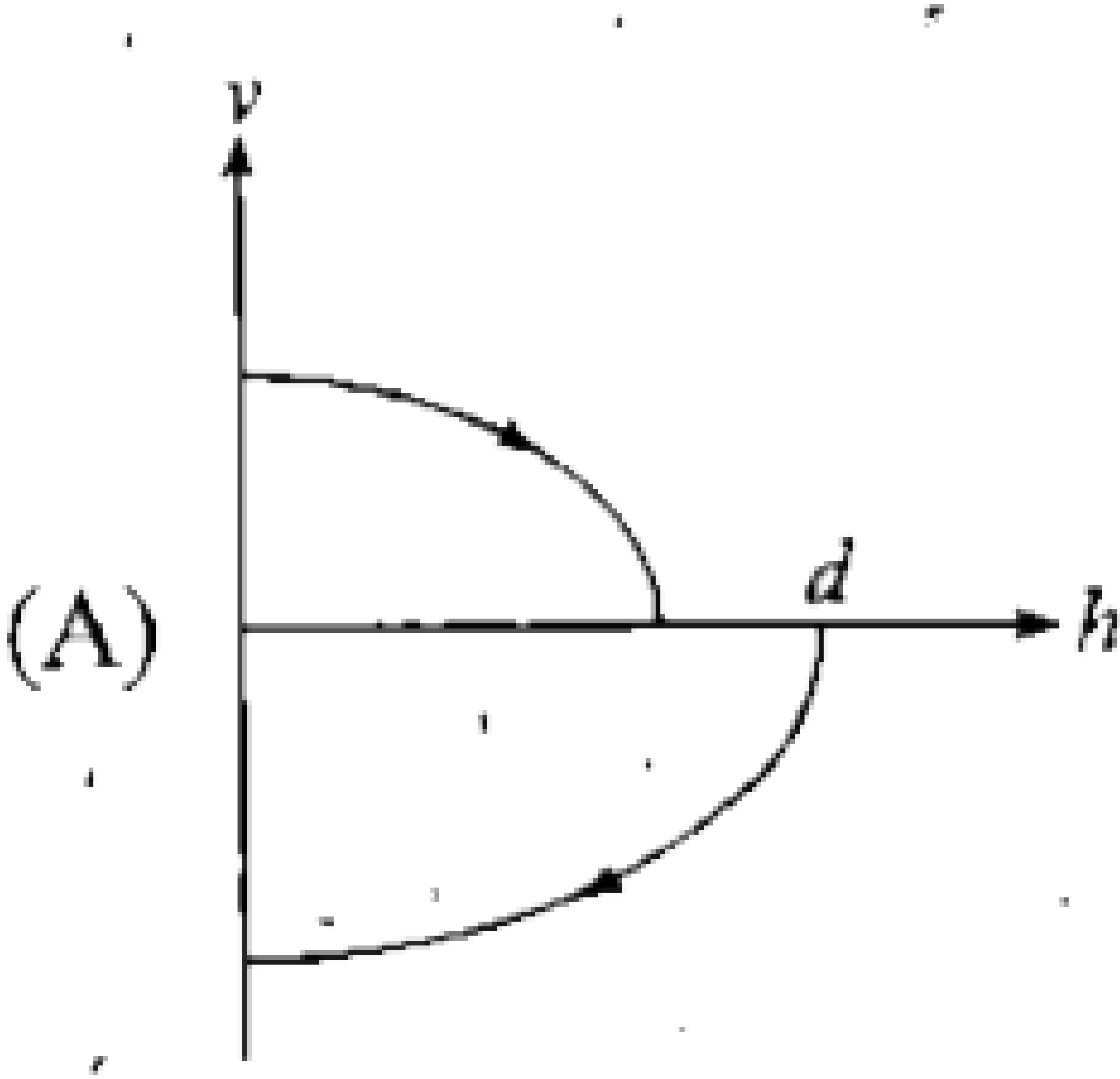
C. Acceleration of pulley A is equal to `g//2` (upward)

D. Acceleration of pulley A is equal to 2 g (upward)

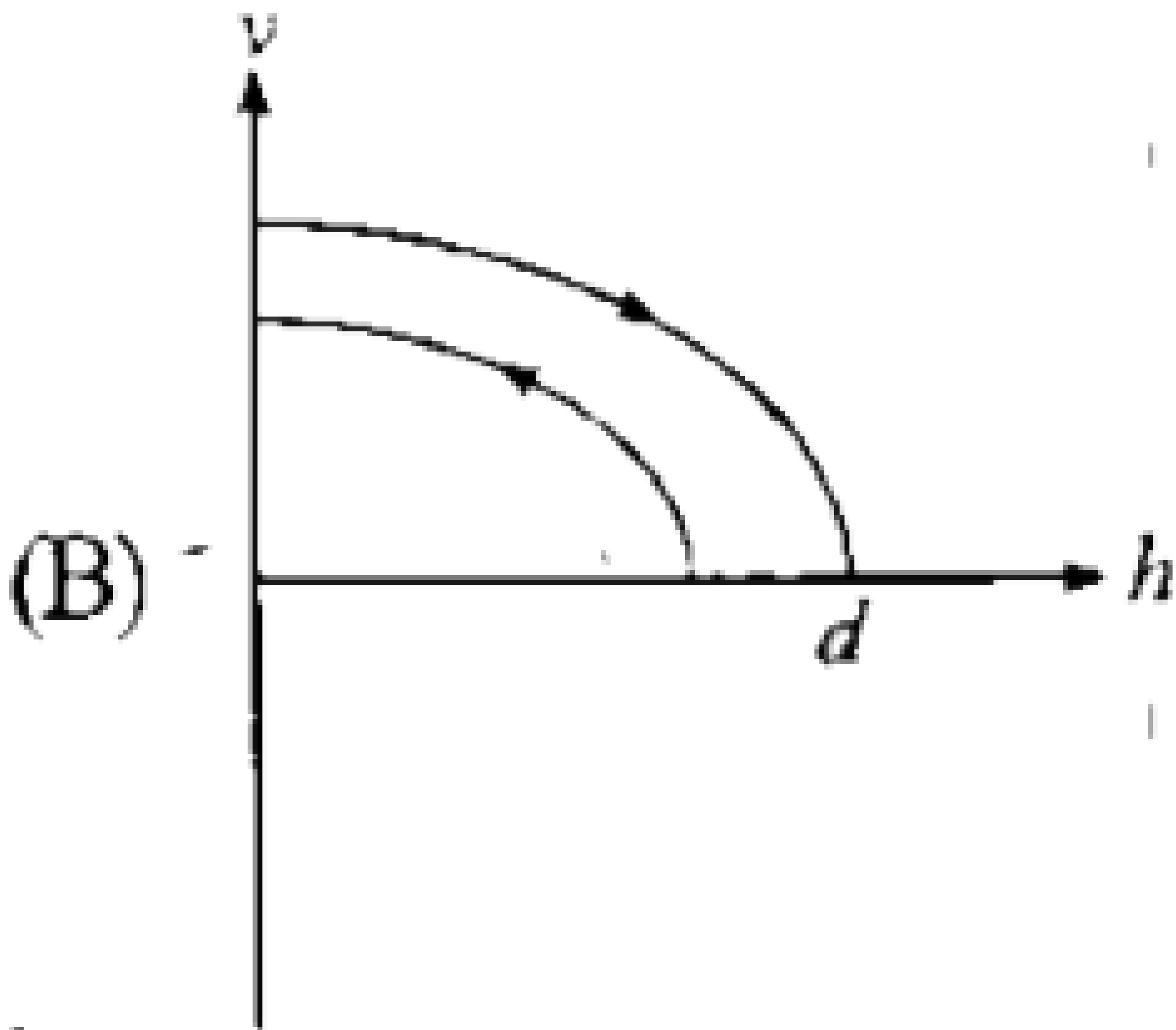
Answer: D

Watch Video Solution

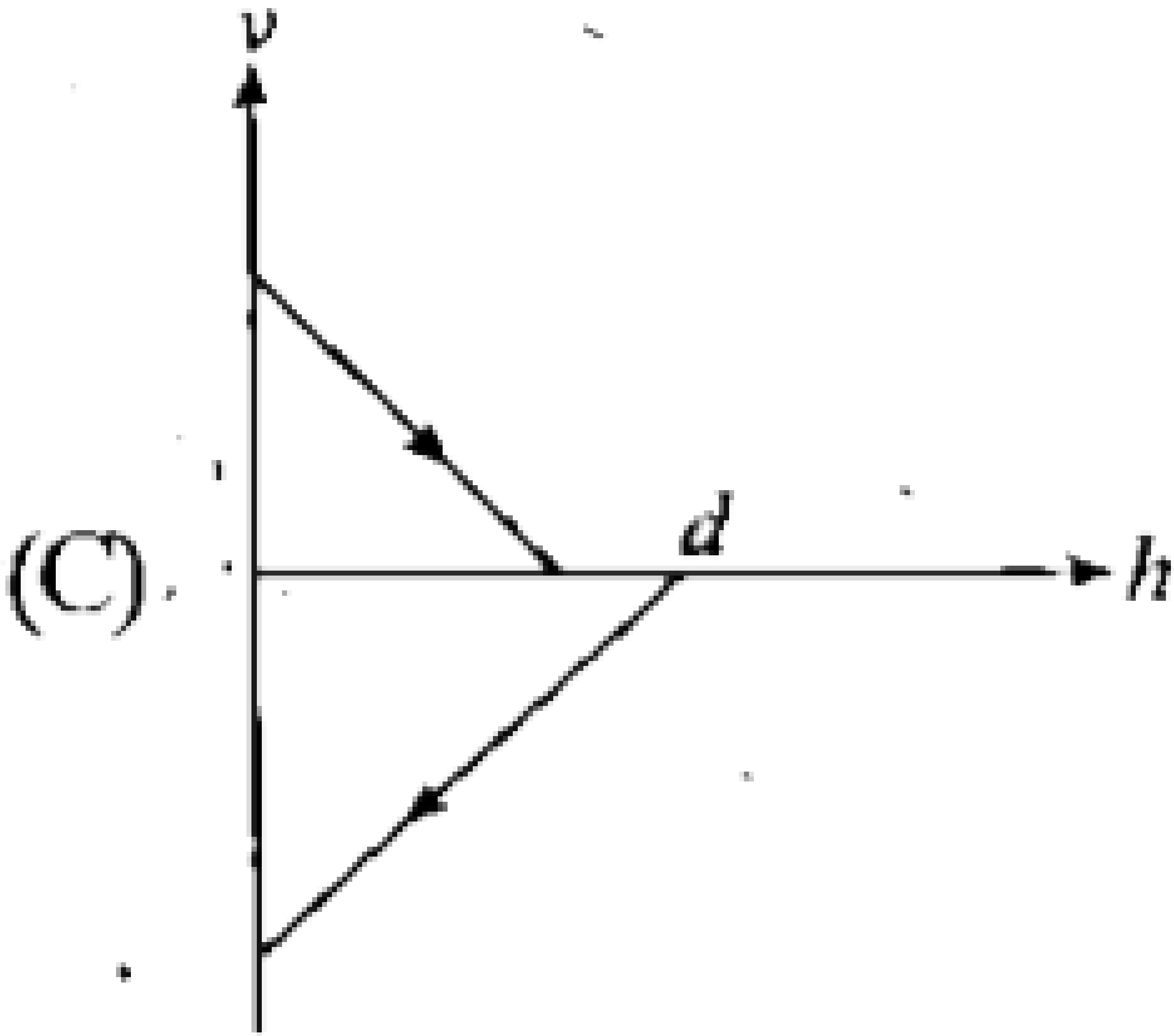
4. A ball is dropped vertically from `a` height `d` above the ground . It hits the ground and bounces up vertically to a height ` (d)//(2). Neglecting subsequent motion and air resistance , its velocity `v` varies with the height `h` above the ground as



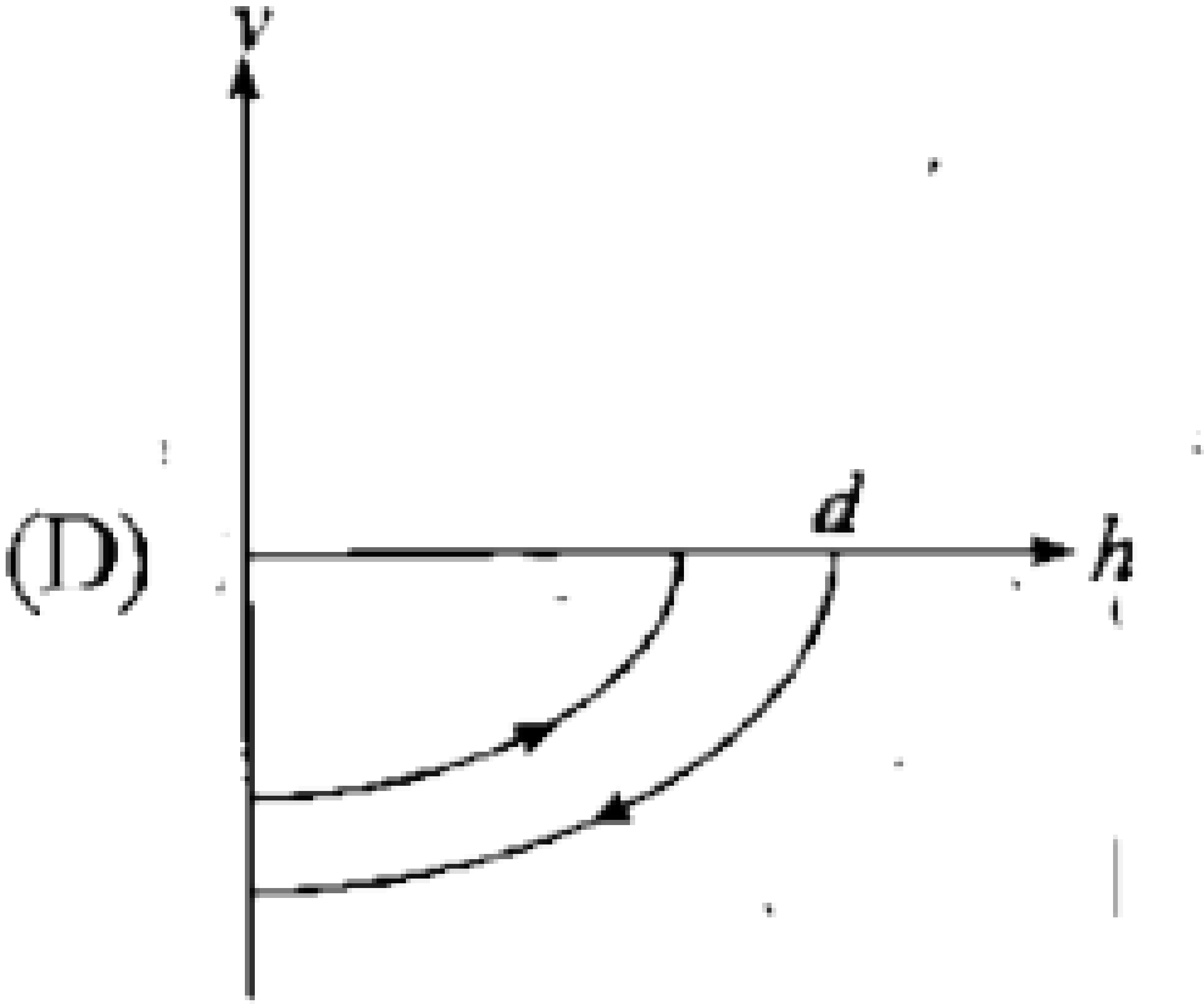
A.



B.



C.



D.

Answer: A

Watch Video Solution

5. A bicycle moves on a horizontal road with some acceleration. The forces of friction between the road and the front and rear wheels are `F_(1)` and `F_(2)` respectively.

A. Both `F_(1)` and `F_(2)` act in the forward direction

B. Both `F_(1)` and `F_(2)` act in the reverse direction

C. `F_(1)` acts in the forward direction, `F_(2)` act in the reverse direction

D. `F_(2)` acts in the forward direction, `F_(1)` act in the reverse direction

Answer: D

Watch Video Solution

6. Consider the situation shown in figure. The wall is smooth but the surfces of A and B in contact are rough.

The friction on B due to A in equilibrium.

A. Is upward

B. Is downward

C. Is zero

D. The system cannot remain in equilibrium

Answer: D

Watch Video Solution

7. A block is about to slide down an inclined plane when its inclination to the horizontal is `theta`. If now a 5 kg weight is attached on the block :

A. It is still about to slide down the plane

B. It will not slide down the plane unless the inclination is increased

C. It will not slide down the plane unless .the inclination is decreased .

D. It will never slide down whatever be the inclination

Answer: A

Watch Video Solution

8. 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 that B

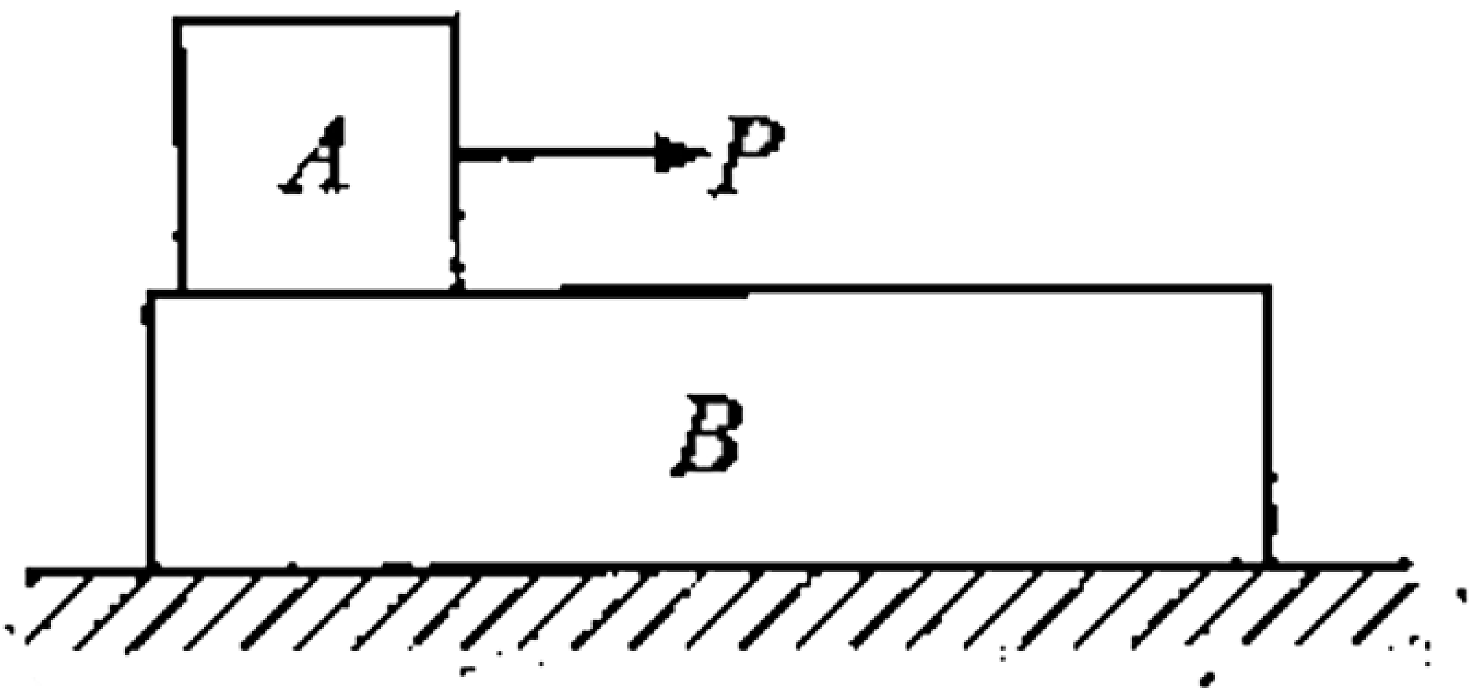
C. B will go higher than A

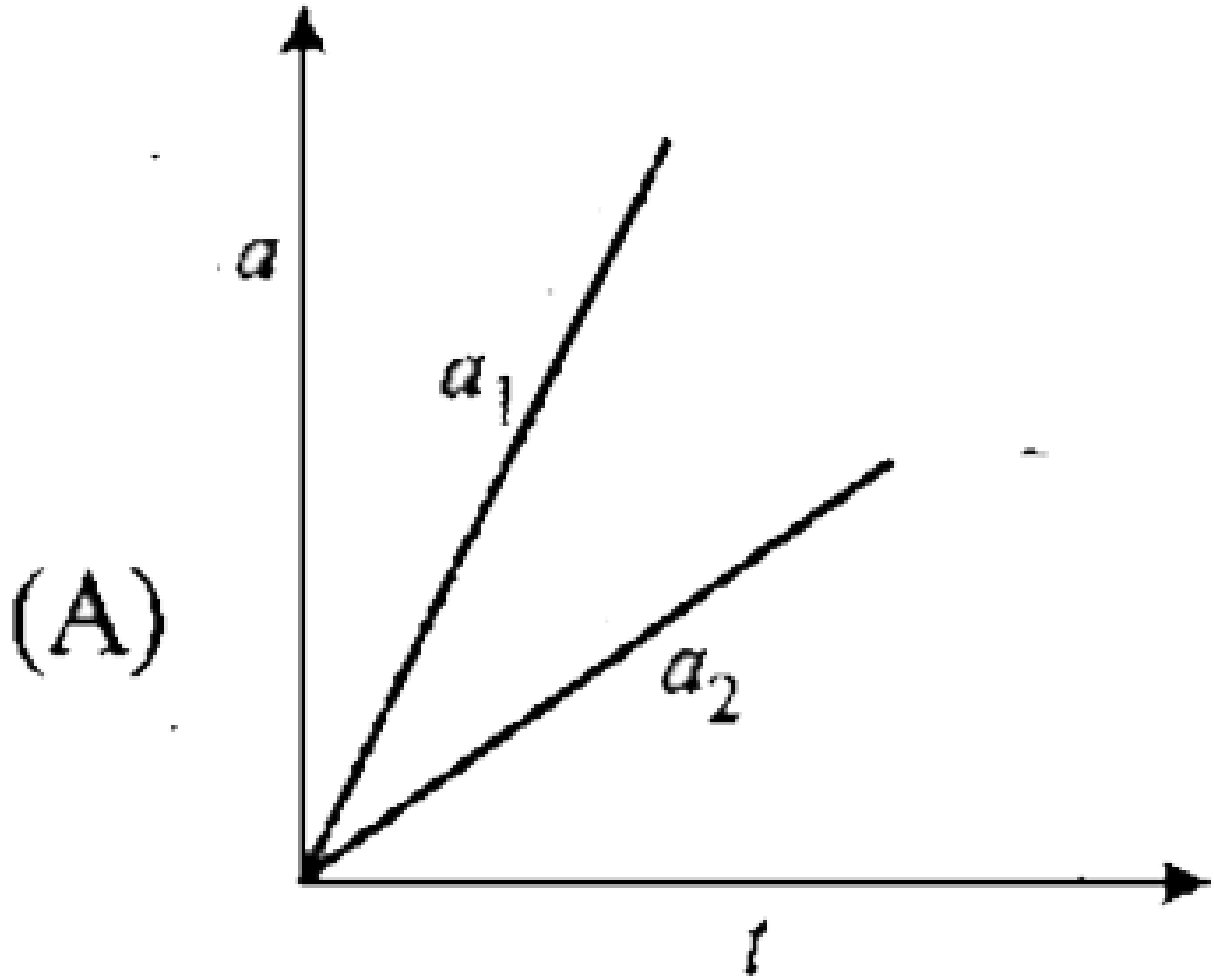
D. Any of the above three may happen depending on the speed with which the object are thrown.

Answer: B

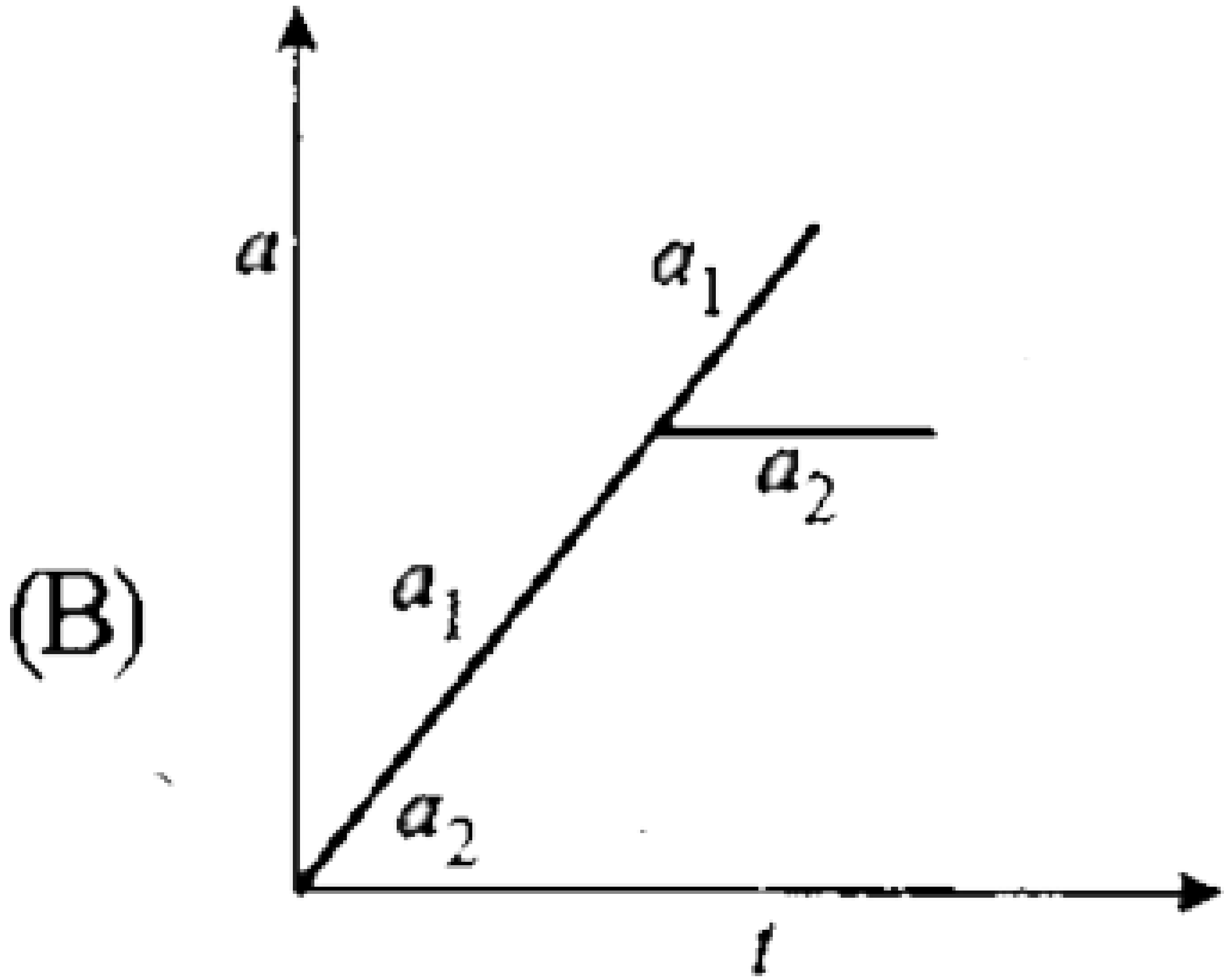
Watch Video Solution

9. Block A is placed on block B, whose mass is greater than that of A. There is friction between the blocks, while the ground is smooth. A horizontal force P, increasing linearly with time, begins to act on A. The acceleration `a_(1)` and `a_(2)` of A and B respectively are plotted against time (t). Choose the correct graph :



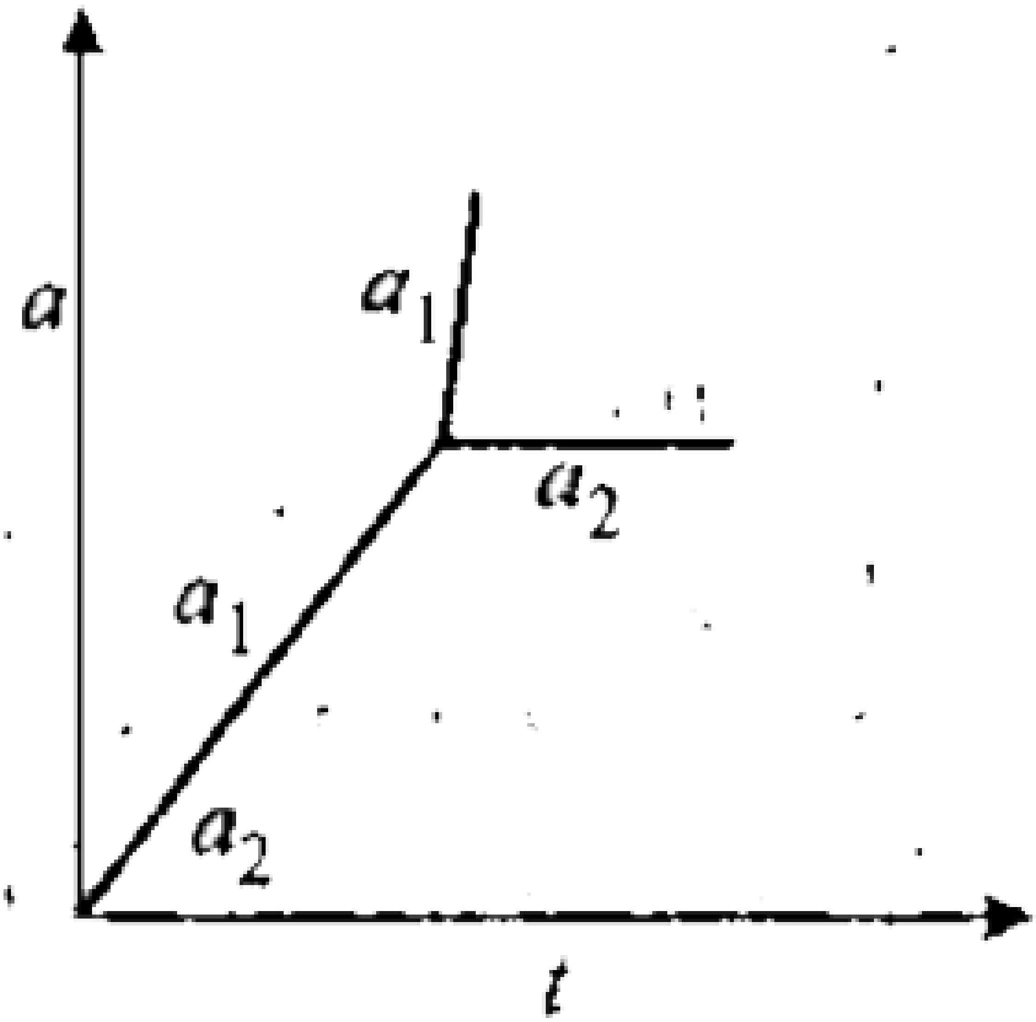


A.

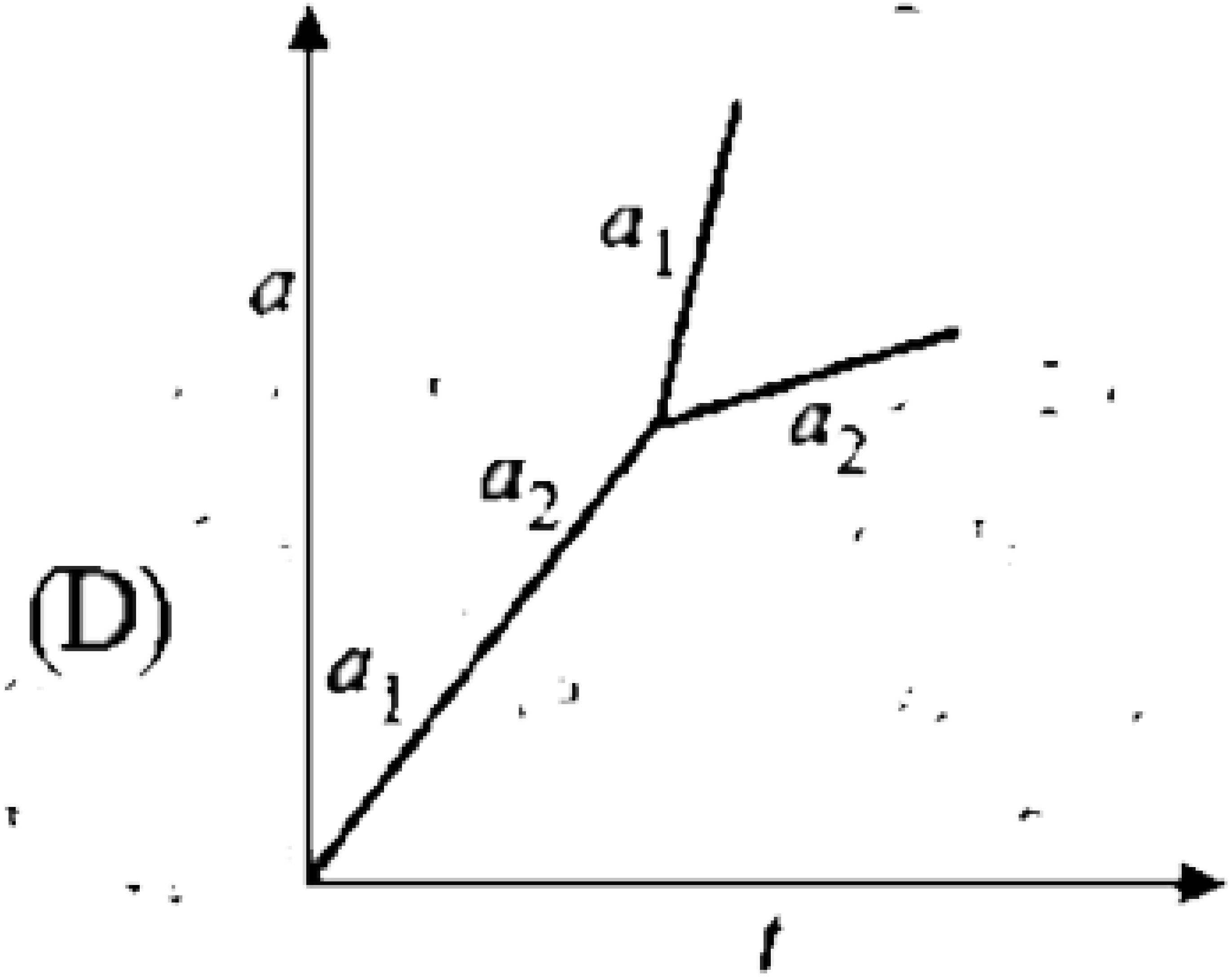


B.

(C)



C.



D.

Answer: C

Watch Video Solution

10. A body of mass `M` is applying horizontal force to slide a box of mass `M_(1)` on a rough horizontal surface The coefficient of friction between the shoe of the boy and the floor is `mu` and that between the box and the floor is `'mu_(1)'` In which of the following cases is it certainly not possible to slide the box ? .

A. `mu lt mu', M lt M'`

B. `mu gt mu', M lt M'`

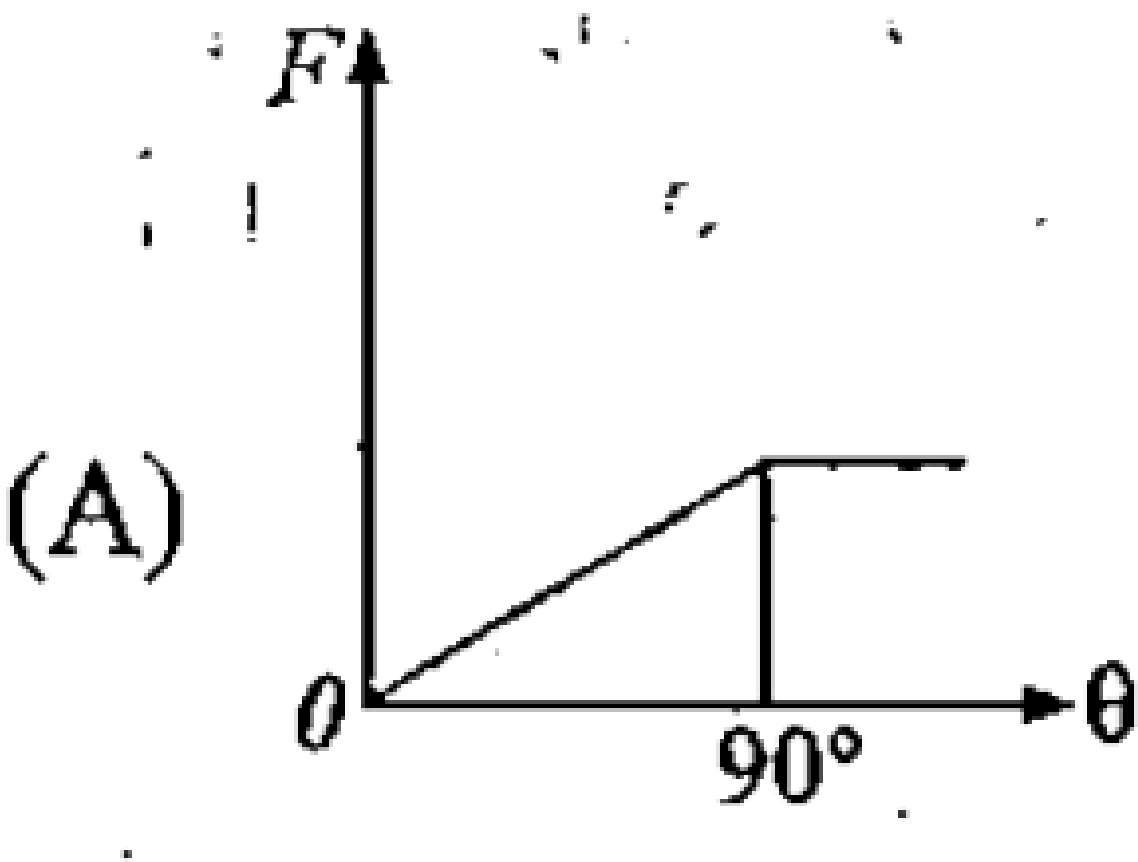
C. `mu lt mu', M gt M'`

D. `mu gt mu', M gt M'`

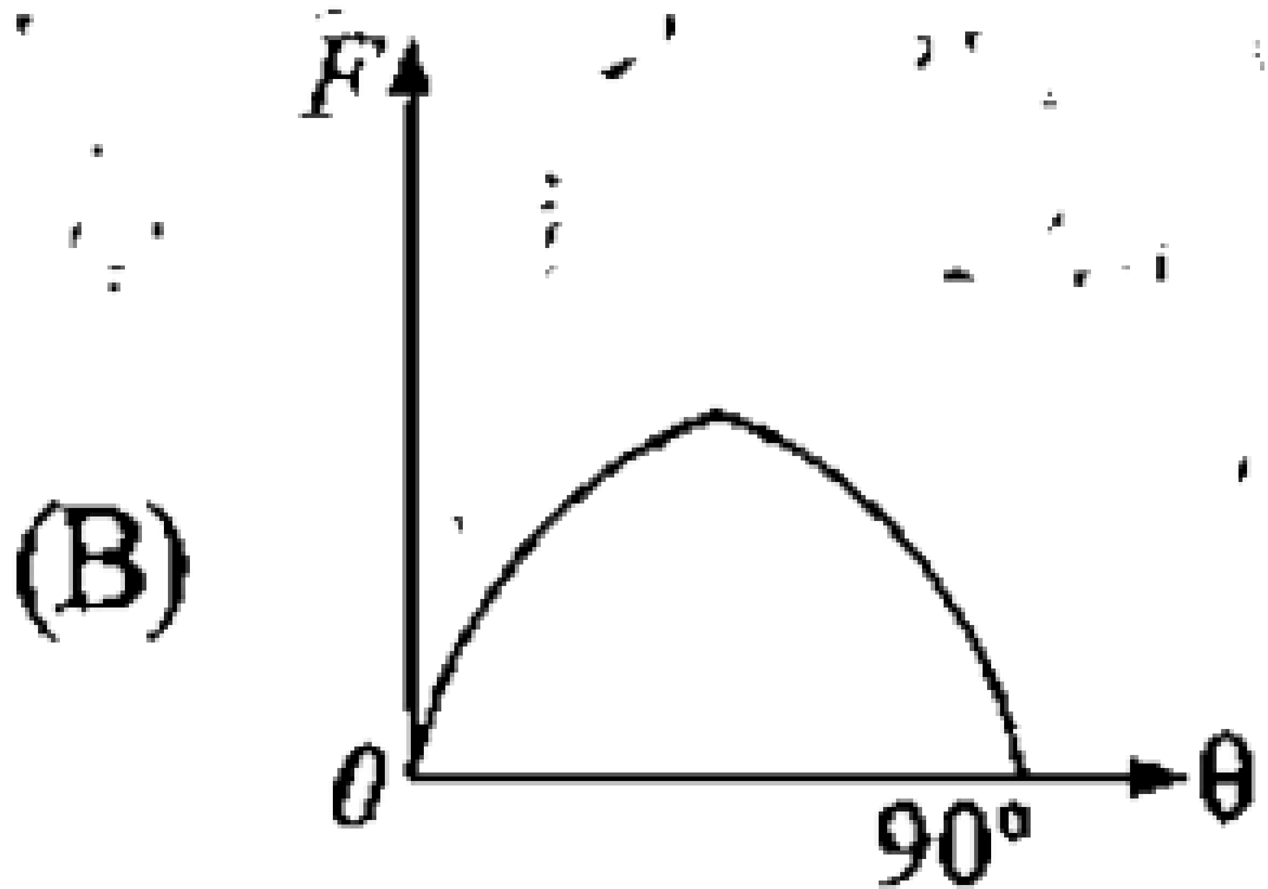
Answer: A

Watch Video Solution

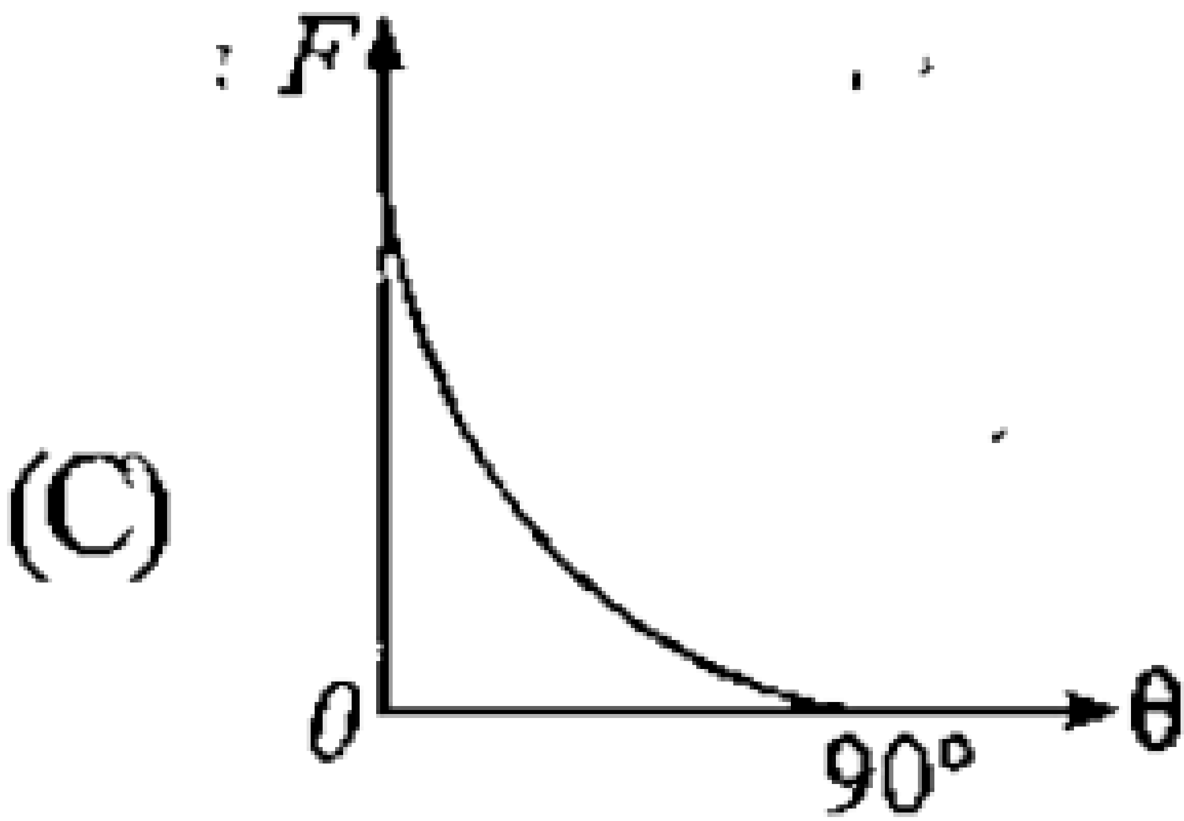
11. A block rests on a rough plane whose inclination `theta` to the horizontal can be varied. Which of the following graphs indicates how the friction force `F` between the block and the plane varies as `theta` is increased?



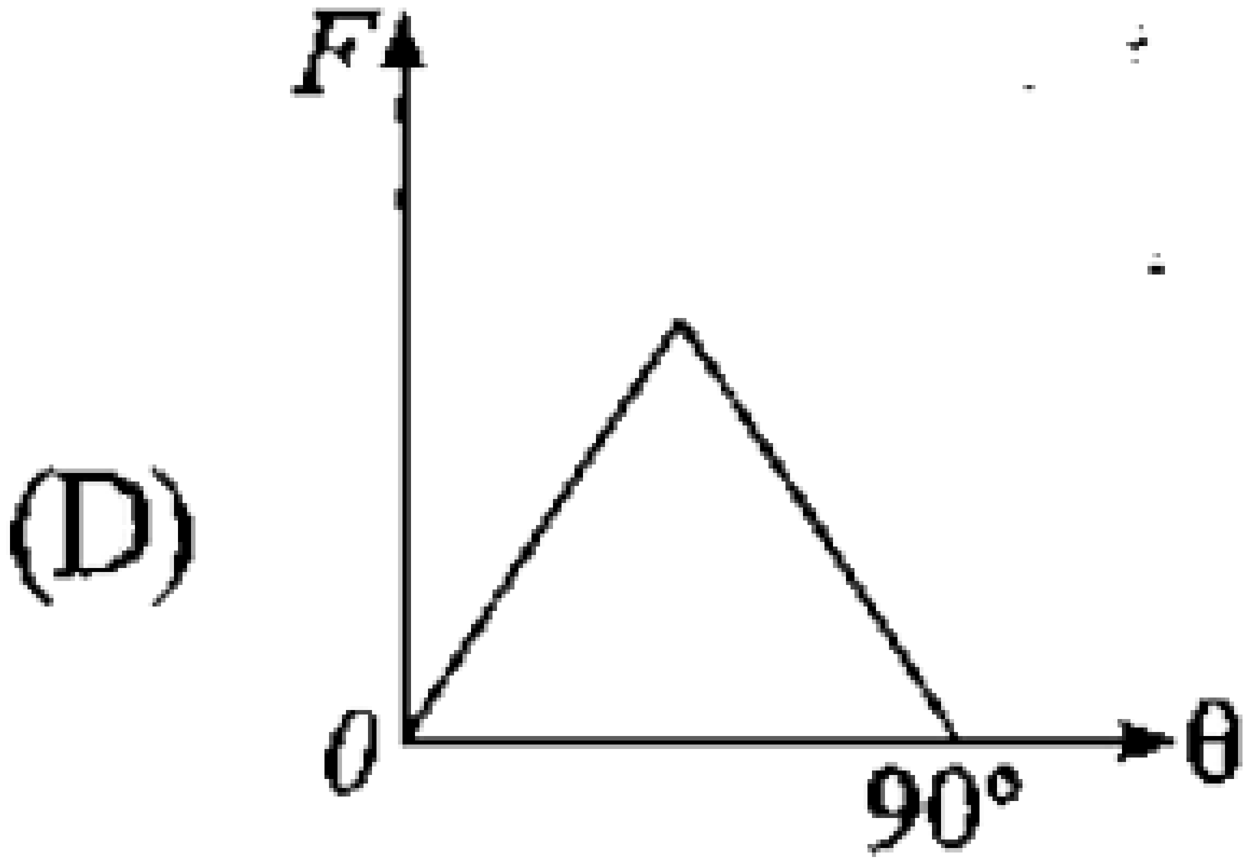
A.



B.



C.

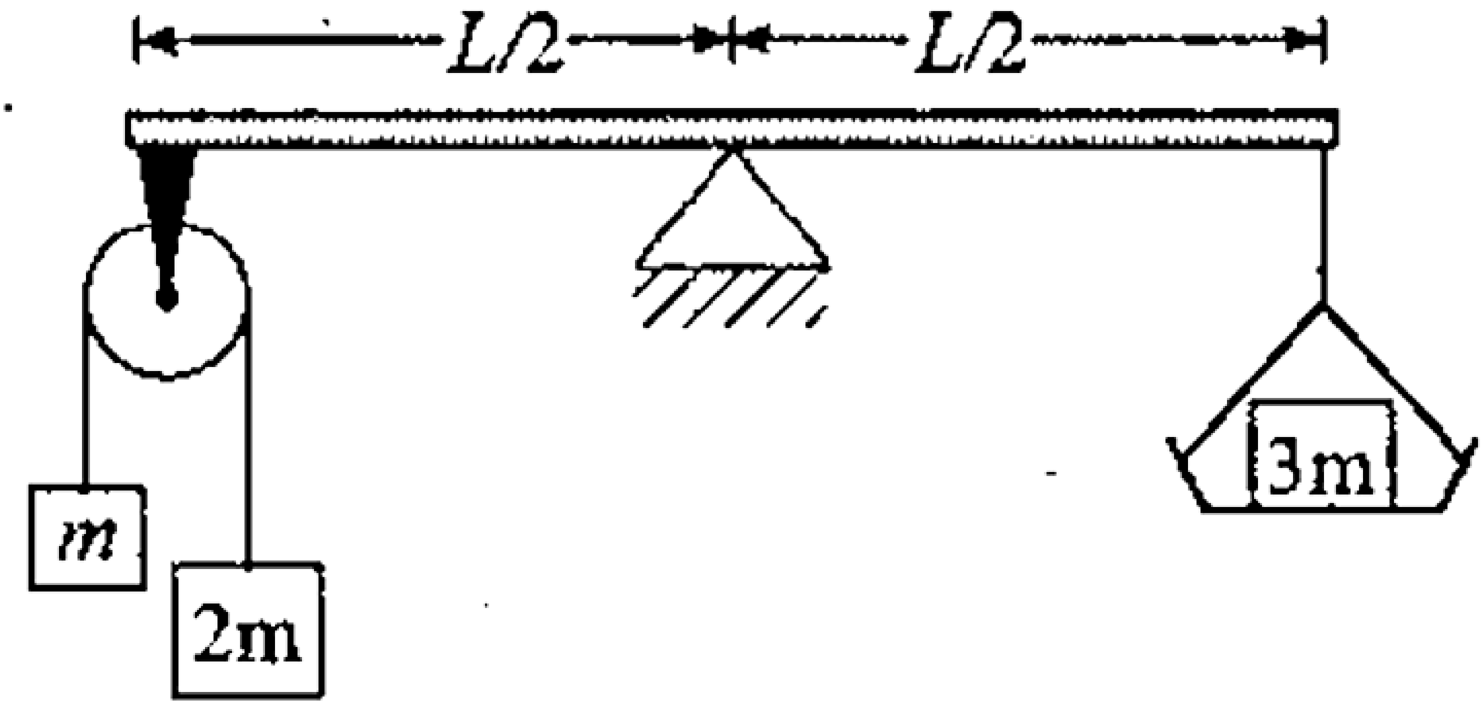


D.

Answer: B

Watch Video Solution

12. In the balance machine, shown in the figure-2.127 which arm will move dowward ?



A. Left

B. Right

C. None

D. Cannot be said

Answer: B

Watch Video Solution

13. In a situation the contact force by a rough horizontal surface on a body placed on it has constant magnitude. If the angle between this force and the vertical is decreased, the frictional force between the surface and the body will

A. Increase

B. Decrease

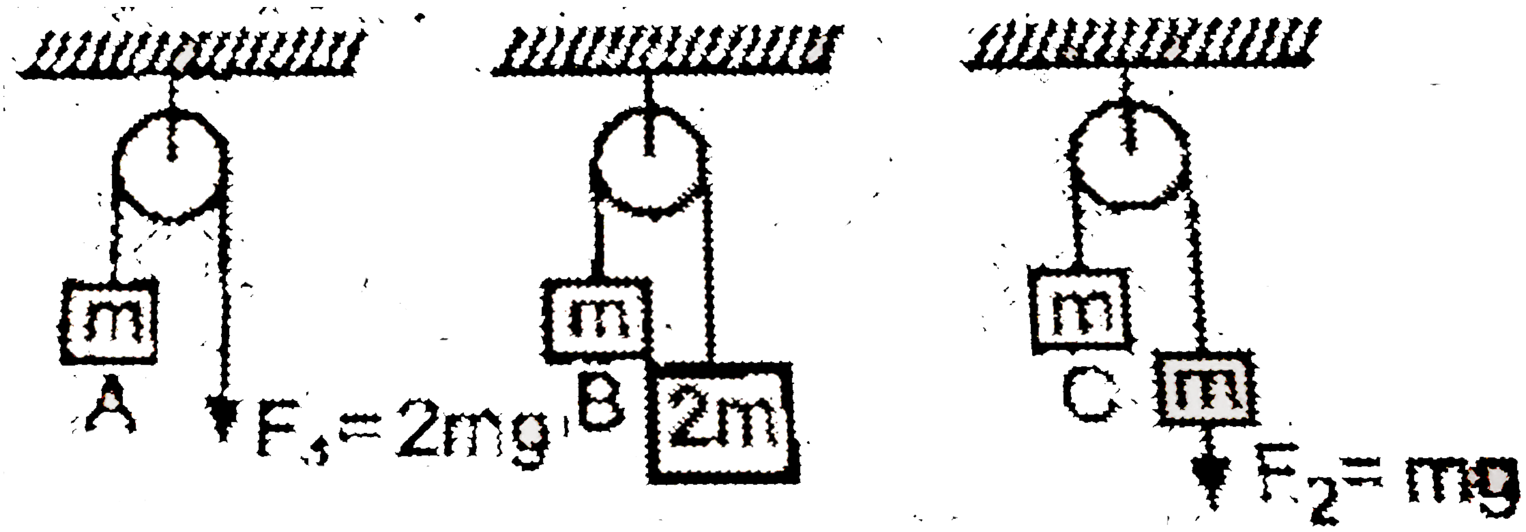
C. Remain the same

D. May increase or decrease

Answer: B

Watch Video Solution

14. In the figure the block A,B and C of mass `m` each, have acceleration `a_(1),a_(2)` & `a_(3)` respectively. `F_(1) & F_(2)` are external forces of magnitude ` 2 mg` and `mg` respectively :



A. `a_(1) =a_(2)=a_(3)`

B. `a_(1) gta_(3)gta_(2)`

C. `a_(1) = a_(2), a_(2) gt a_(3)`

D. `a_(1) gt a_(2), a_(2) = a_(3)`

Answer: B

Watch Video Solution

15. A block kept on an inclined surface, just begins to slide if the inclination is `30^(@)`. The block is replaced by another block B and it is just begins to slide if the inclination is `40^(@)`, then :

A. Mass of A `gt` mass of B

B. Mass of A `lt` mass of B

C. Mass of A = mass of B

D. All the three are possible.

Answer: D

Watch Video Solution

16. When the force of constant magnitude always act perpendicular to the motion of a particle then :

A. Velocity is constant

B. Acceleration is constant

C. K.E. is constant

D. None of these

Answer: C

Watch Video Solution

17. Essential characteristic of equilibrium is:

A. Momentum equal zero

B. Acceleration equals zero

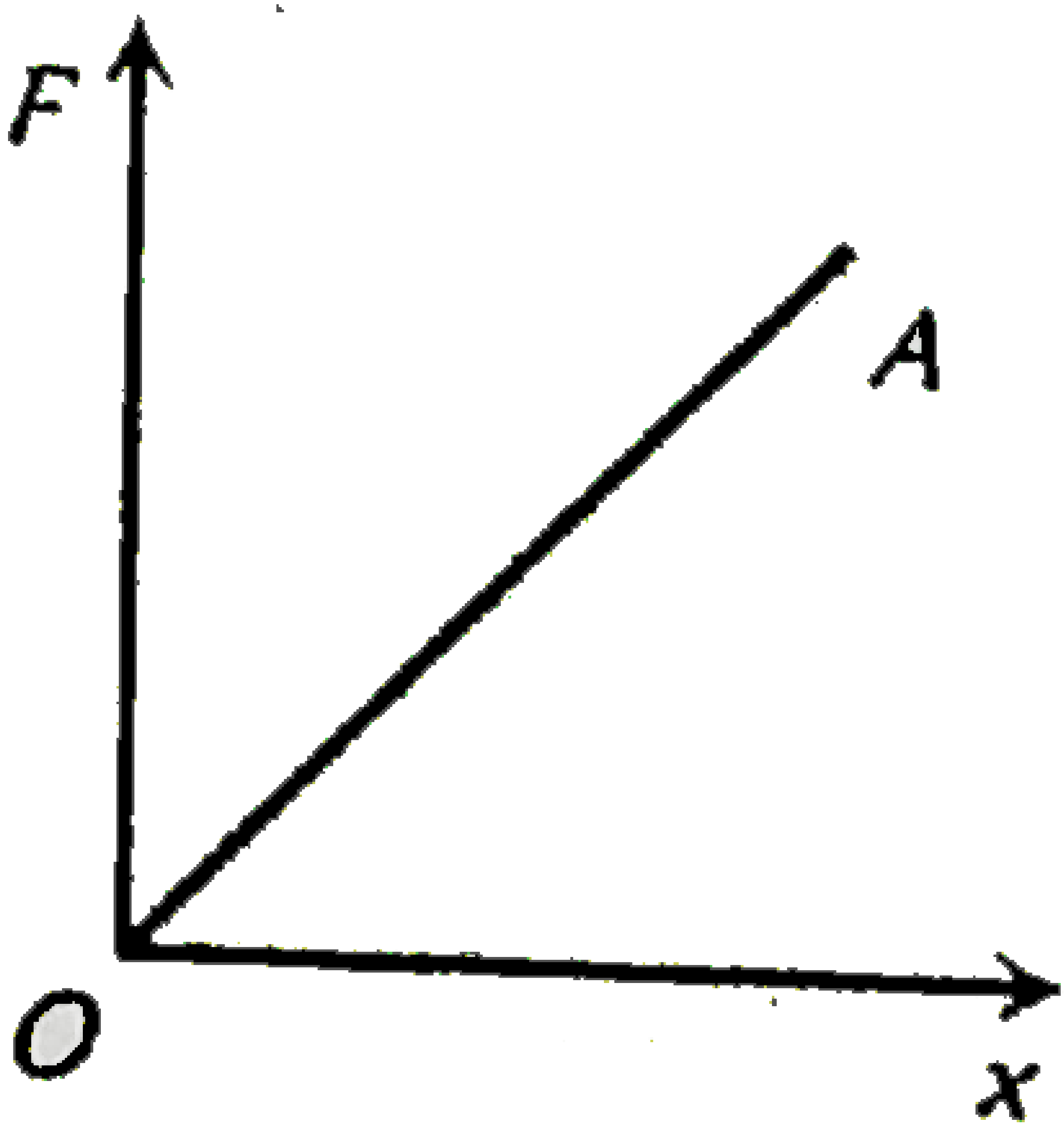
C. K.E. equals zero

D. Velocity equals zero

Answer: B

Watch Video Solution

18.



The force required to stretch a spring varies with the distance a shown in the figure. If the experiment is performed with the above spring of half length, the line OA will

A. Rotate clockwise

B. Rotate anticlockwise

C. Remain as it is

D. Become double in length

Answer: B

Watch Video Solution

19. A person standing oin the floor of an elevator drops as coin. The coin reaches the floor of the elevator in a time t_1 if the elevator is stationary and in the t_2 if it is moving uniformly. Then

A. $t_{(1)} = t_{(2)}$

B. $t_{(1)} < t_{(2)}$

C. $t_{(1)} > t_{(2)}$

D. $t_{(1)} < t_{(2)}$ or $t_{(1)} > t_{(2)}$ depending on whether the lift if going up or down.

Answer: A

Watch Video Solution

20. A scooter starting from rest moves wilth as constant acceleration for a time Δt_1, then with a constant velocity for the next Δt_2 and finally with a constant deceleration for the next Δt_3 to come to rest with resect to the scooter wilthout touching any other part. The force exerted by the seat on the man is

A. 500 N throughout the journey

B. Less than 500 N throughout the journey

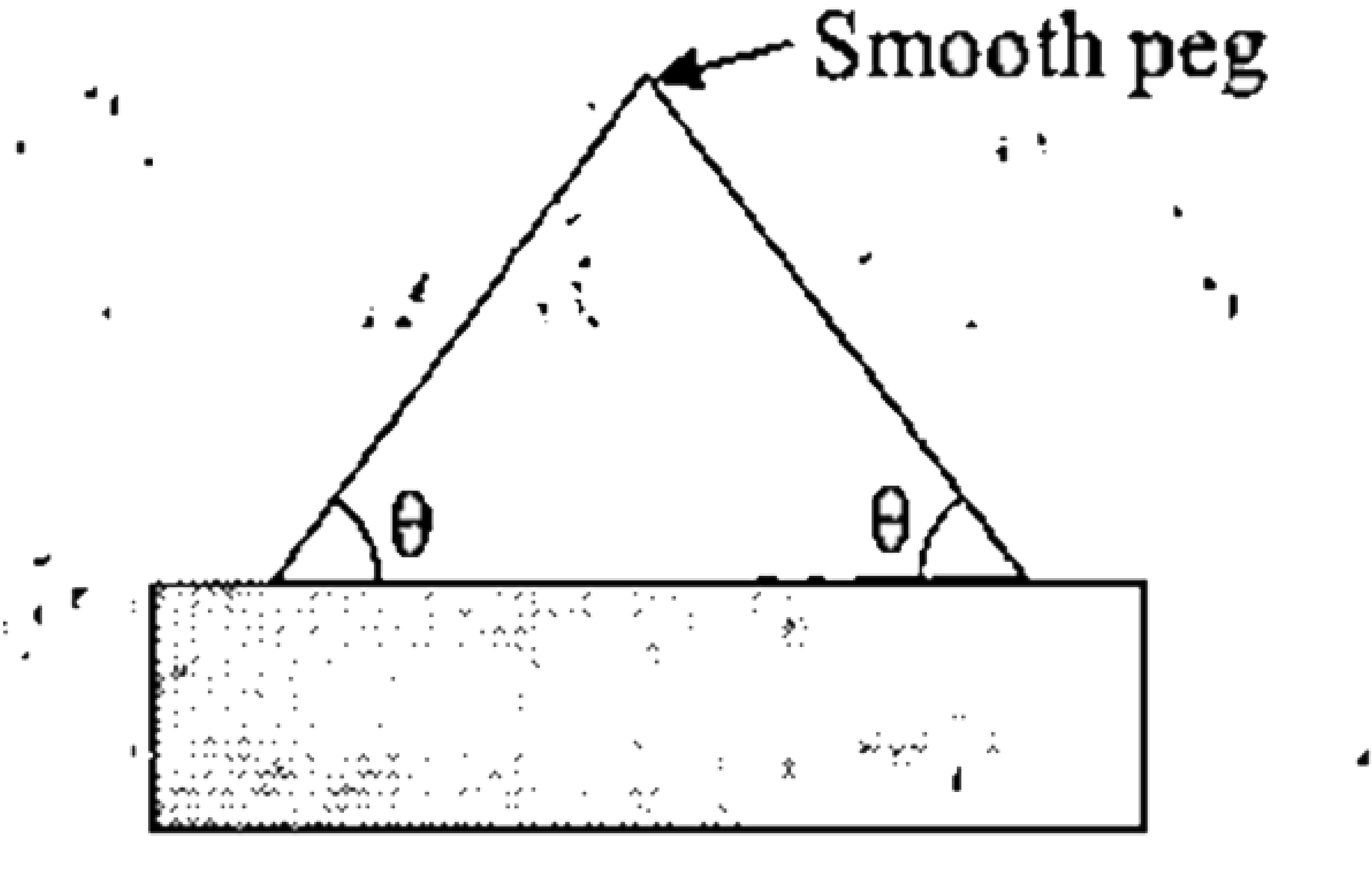
C. More than 500 N throughout the journey

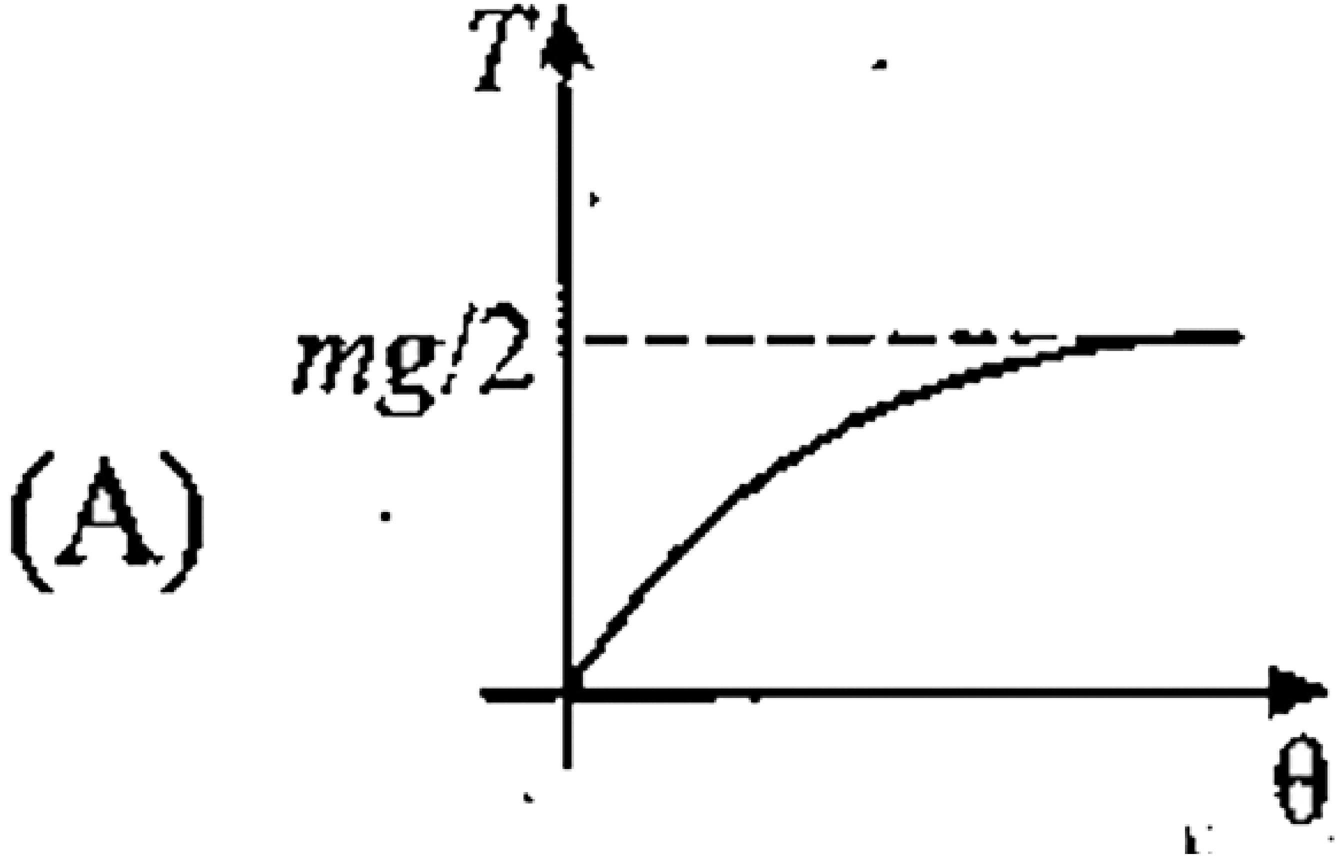
D. `gt` 500 N for time `Deltat_(1)` and `Deltat_(3)` and 500 N for `Deltat_(2)`

Answer: D

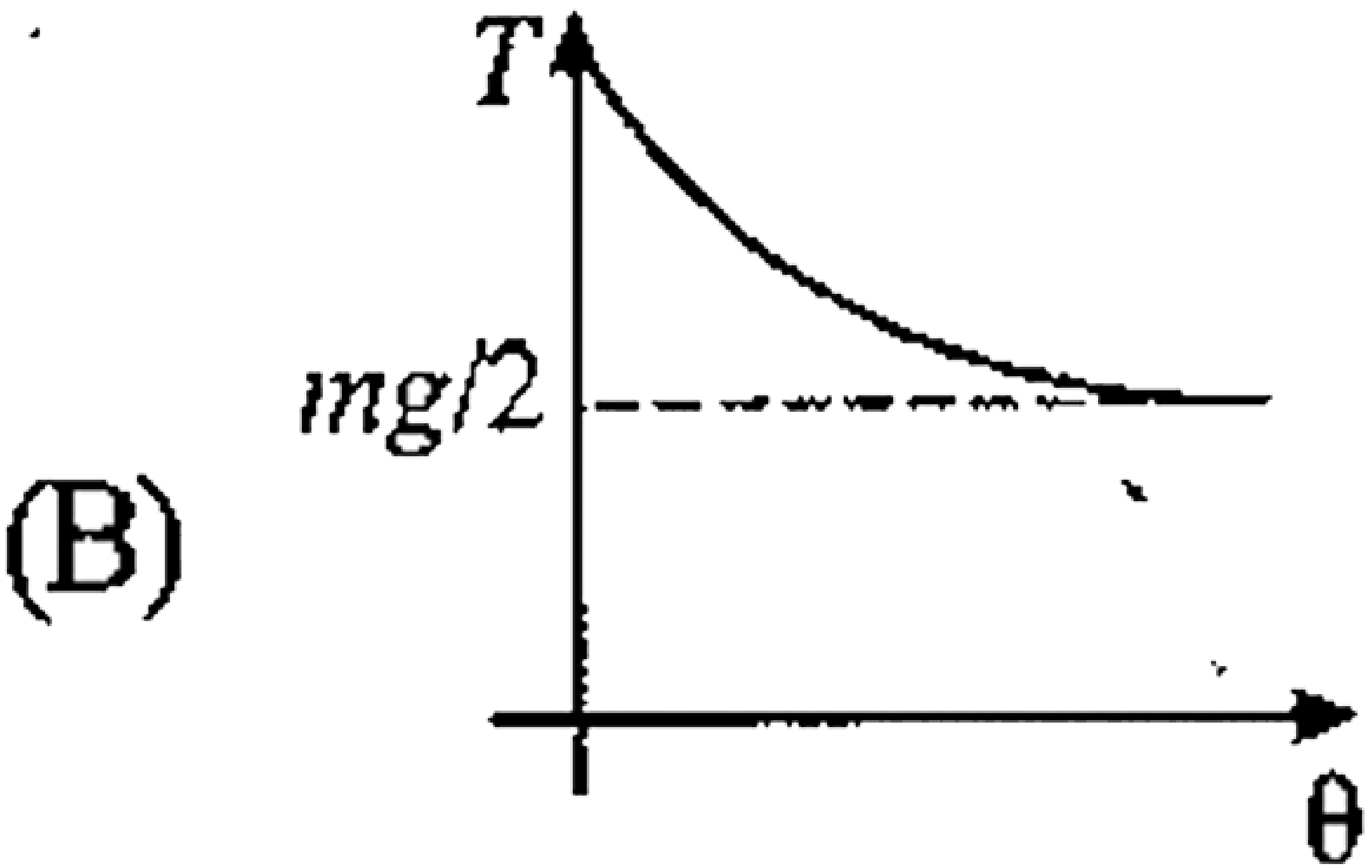
Watch Video Solution

21. A block of mass m is supported by a string passing through a smooth peg as shown in the figure-2.130. Variation of tension in the string T as a function of `theta` best represented by (here the total length of the string is varied).

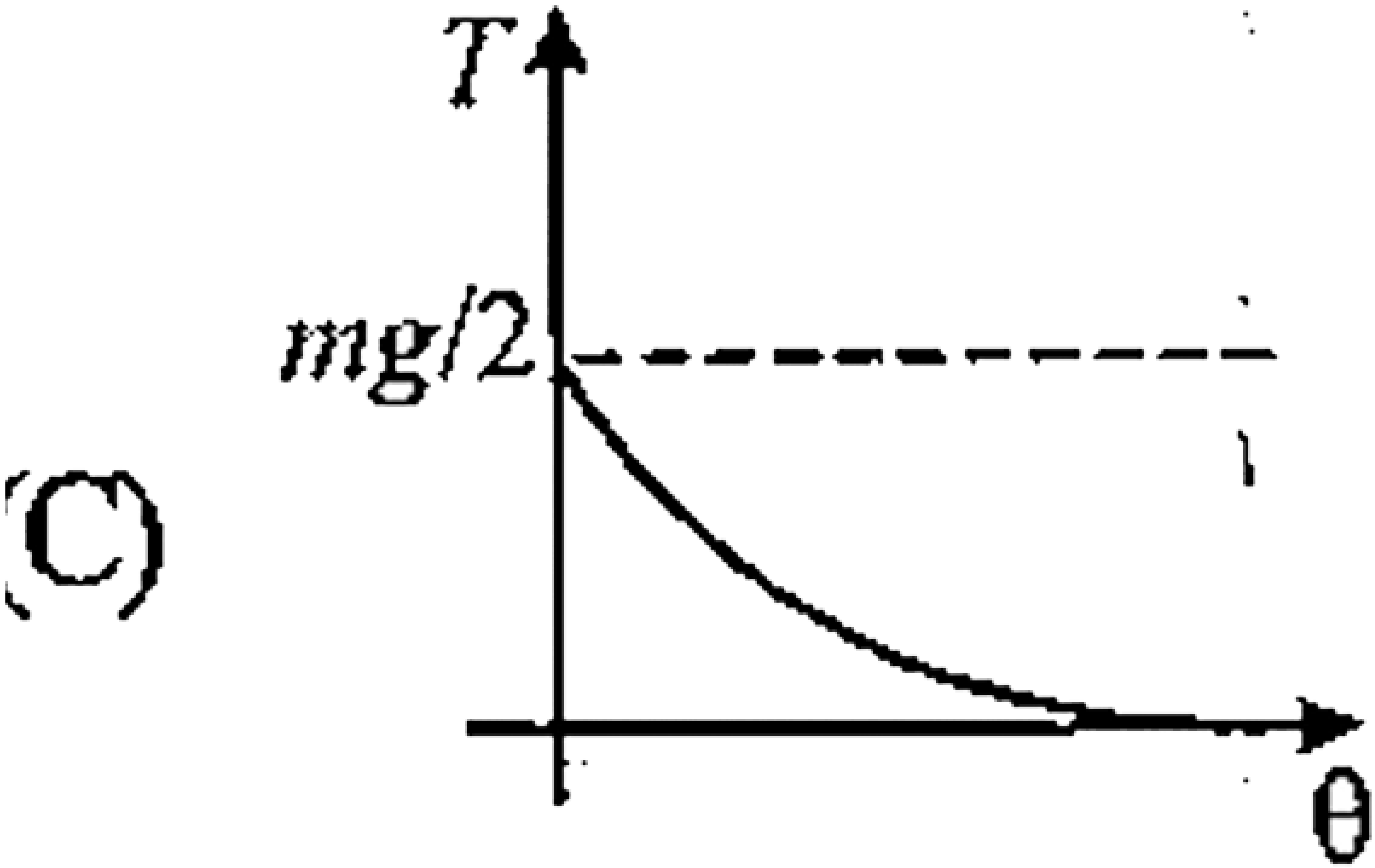




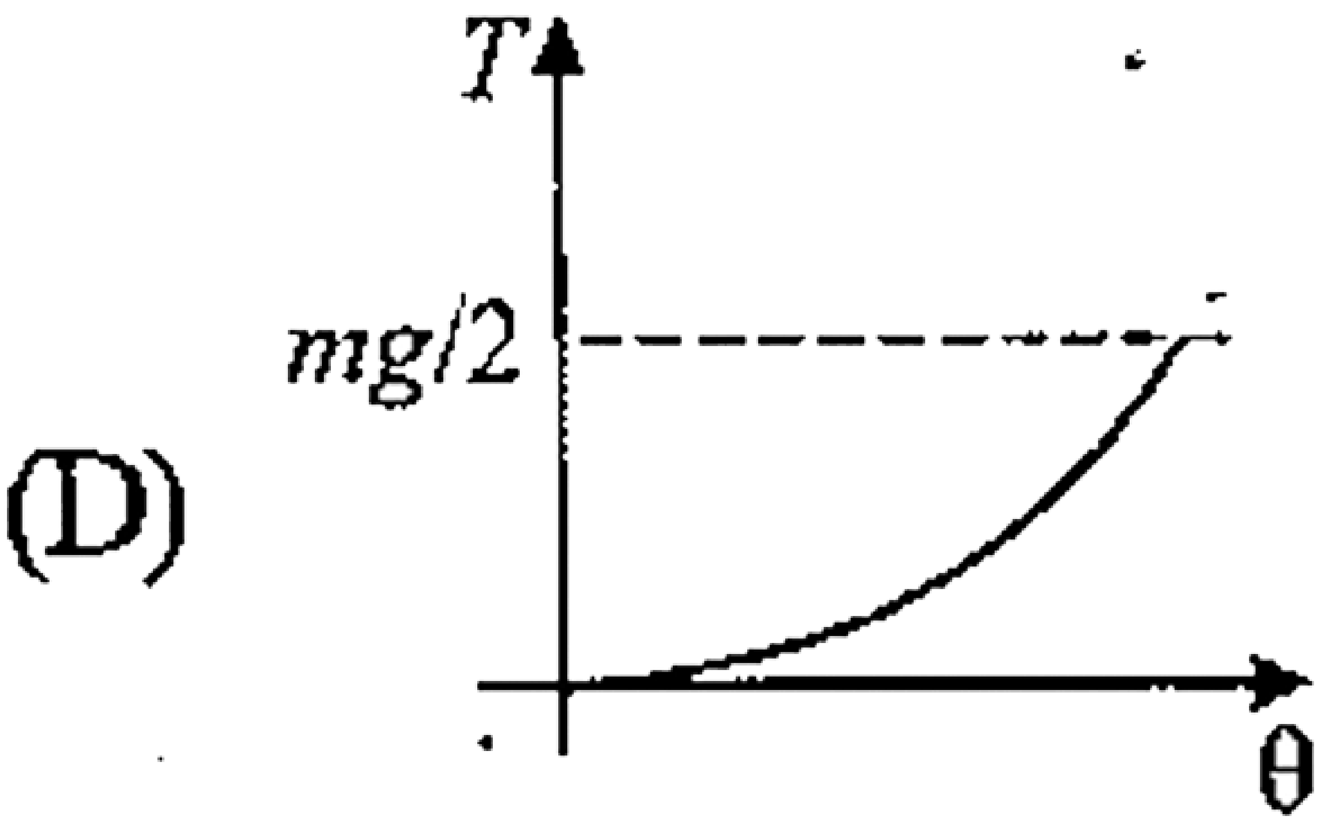
A.



B.



C.

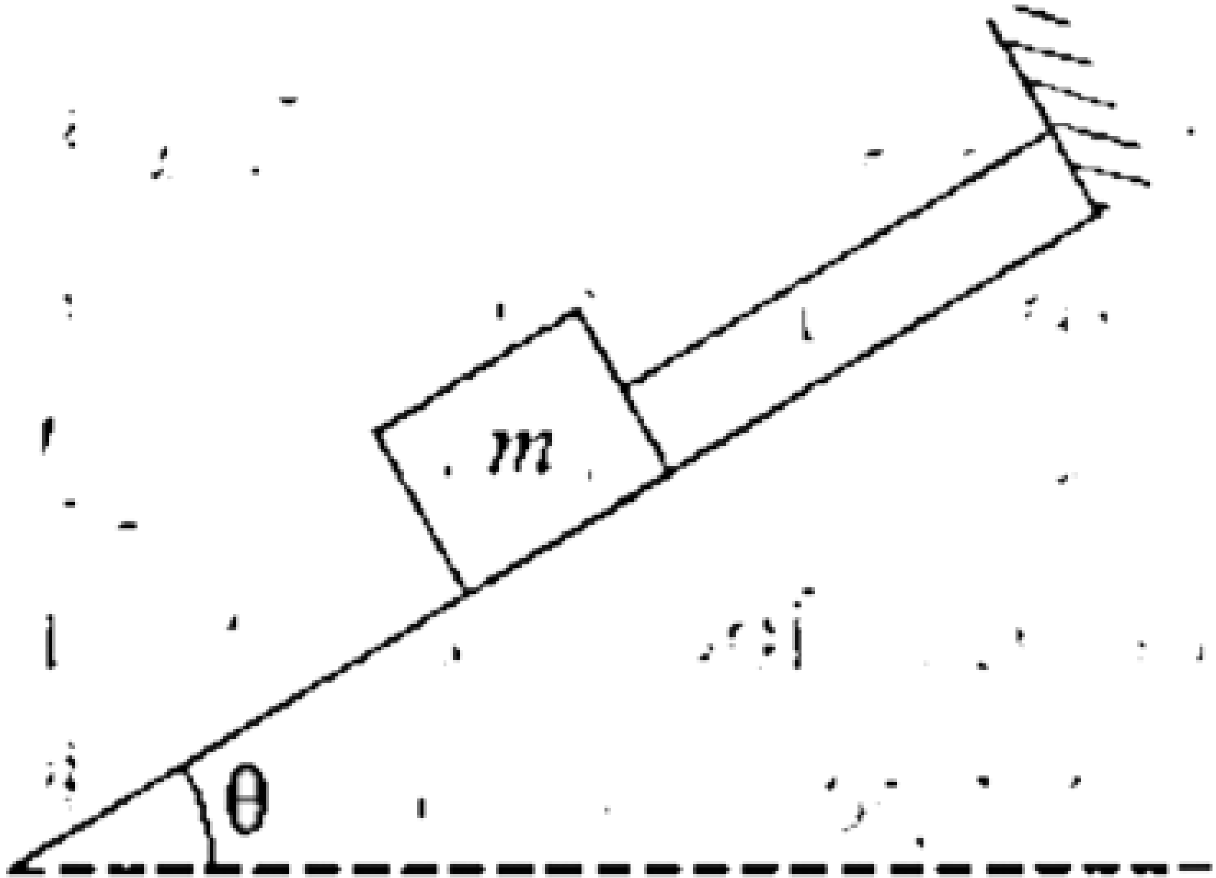


D.

Answer: B

Watch Video Solution

22. A metal block of mass m is placed on a smooth metallic plane in support with string as shown in diagram. If after long time due to corrosiom, the contact surface becomes rough with coefficient of friction `mu`, then friction force acting on the block will be :



A. `mu mg cos theta`

B. `mg sun theta`

C. `mg^(1)`

D. None

Answer: D

Watch Video Solution

23. 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. $t_{(1)} = t_{(2)}$

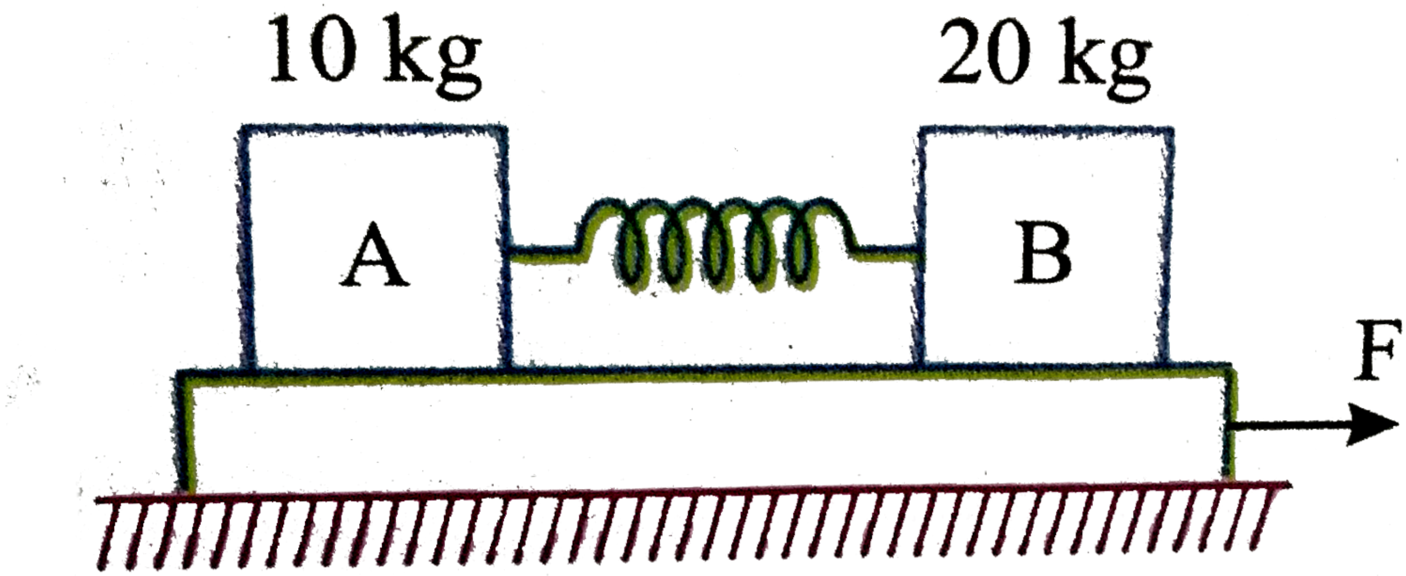
D. The relation between $t_{(1)}$ and $t_{(2)}$ depends on the mass of the particle

Answer: B

Watch Video Solution

Numerical MCQs

1. Two blocks `A & B` attached to each other by a mass-less spring, are kept on a rough horizontal surface $\mu=0.1$. A constant force `F=200 N` is applied on blcok `B` horizon tally as shown below. If a some instant the acceleration of `10 kg` mass is `12 m//s^(2)`, then the acceleration of `20 kg` mass is



A. `2.5 m//s^(2)`

B. `4.0 m//s^(2)`

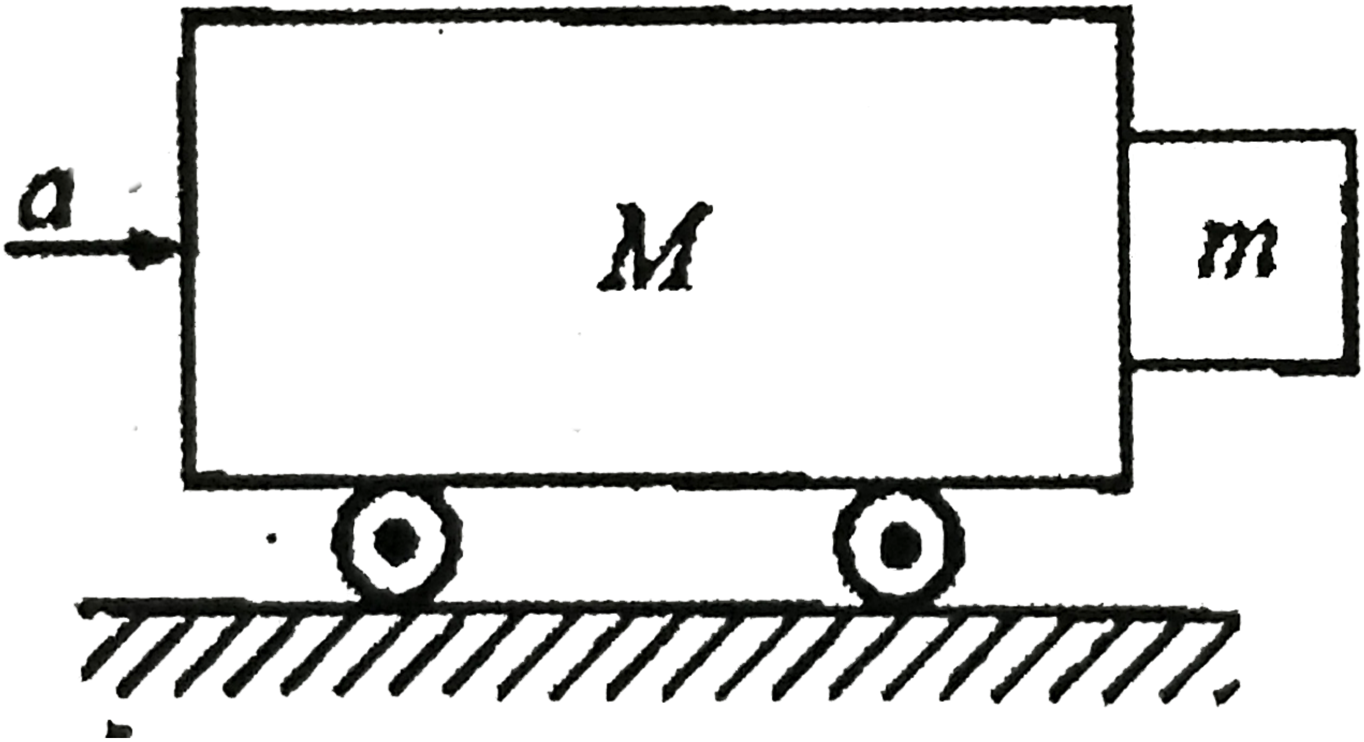
C. `3.6 m//s^(2)`

D. `1.2 m//s^(2)`

Answer: A

Watch Video Solution

2. A cart of mass M has a block of mass m in contact with it as shown in the figure-2.133. The coefficient of friction between the block and the cart is `mu`. What is the minimum acceleration of the cart so that the block m does not fall ?



A. ` mu g`

B. `g//mu`

C. `mu//g`

D. `Mmug//m`

Answer: B

Watch Video Solution

3. A body of mass `m` is kept on a rough fixed inclined plane of angle of inclination `theta=30^(@)`. It remains stationary. Then magnitude of force acting on the body by the inclined plane is equal to `:`

A. mg

B. mg sin `theta`

C. mg cos `theta`

D. None

Answer: A

Watch Video Solution

4.

Two blocks A (1 kg) and B (2 kg) are connected by a string passing over a smooth pulley as shown in the figure. B rests on rough horizontal surface and A rest on B. The coefficient of friction between A and B is the same as that between B and the horizontal surface. The minimum horizontal force F required to move A to the left is 25 N. The coefficient of friction is:

A. 0.67

B. 0.5

C. 0.4

D. 0.25

Answer: B

Watch Video Solution

5. A particle moving on the inside of a smooth sphere of radius r describing a horizontal circle at a distance $r/2$ below the centre of the sphere. What is its speed ?

A. $\sqrt{5gr}$

B. $\sqrt{4gr/3}$

C. $\sqrt{3gr/2}$

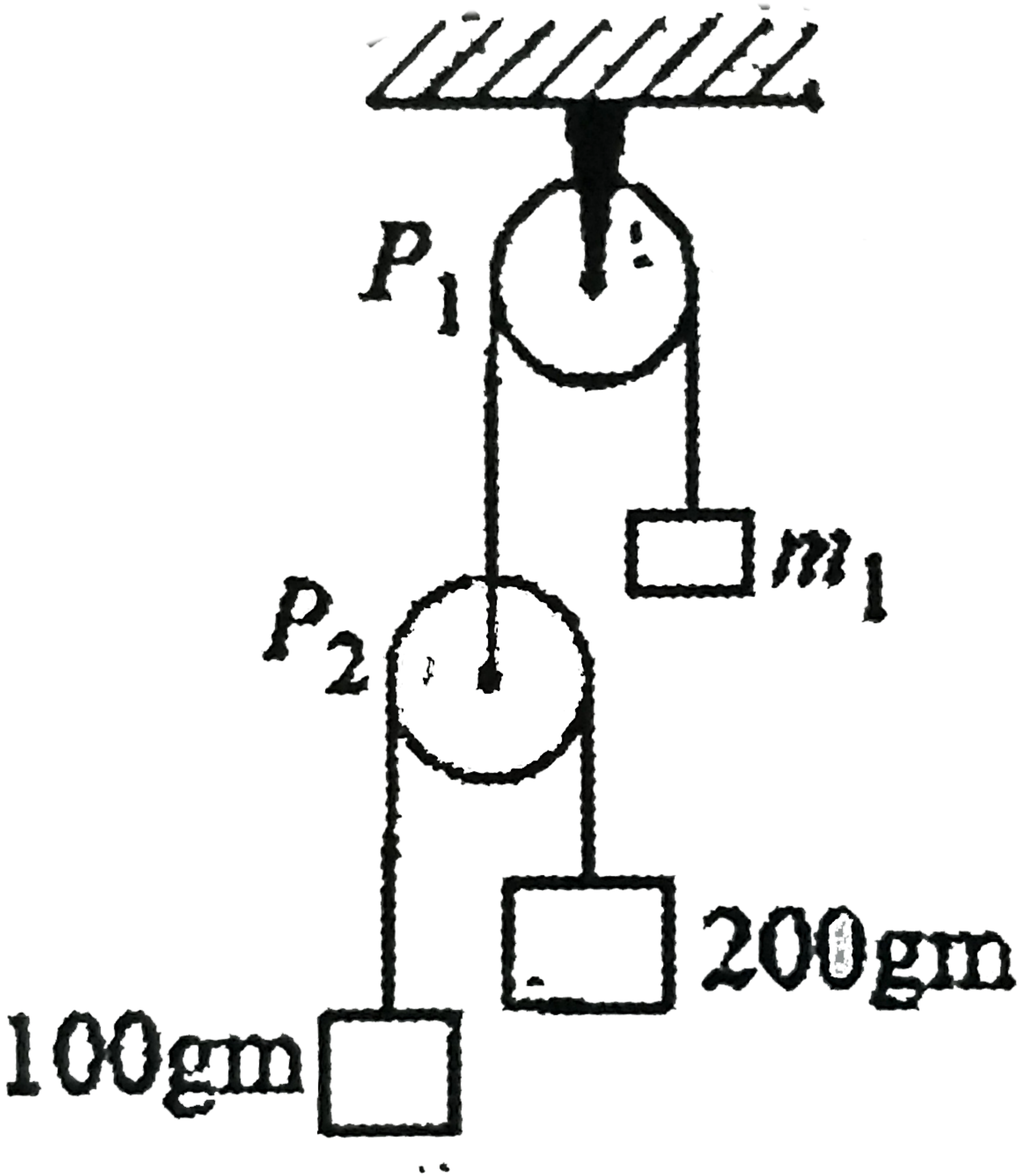
D. $\sqrt{\sqrt{3}gr}$

Answer: C

Watch Video Solution

6. In the system of pulleys shown what should be the value of `m_(1)` such that 100 gm remains at rest :

(Take `g = 10 m//s^(2)`)



A. 180 gm

B. 160 gm

C. 100 gm

D. 200 gm

Answer: B

Watch Video Solution

7. A body of mass M is kept on a rough horizontal surface (friction coefficient `= mu`). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on the body is F where :

A. F = Mg

B. `F = mu Mg`

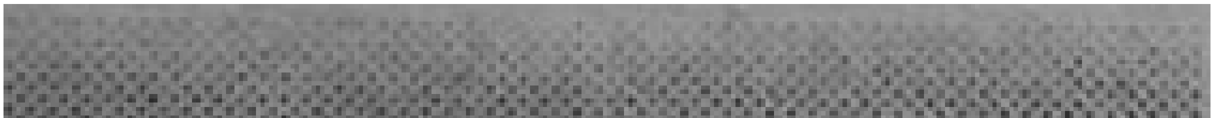
C. `Mg le F le Mg sqrt(1+mu^(2))`

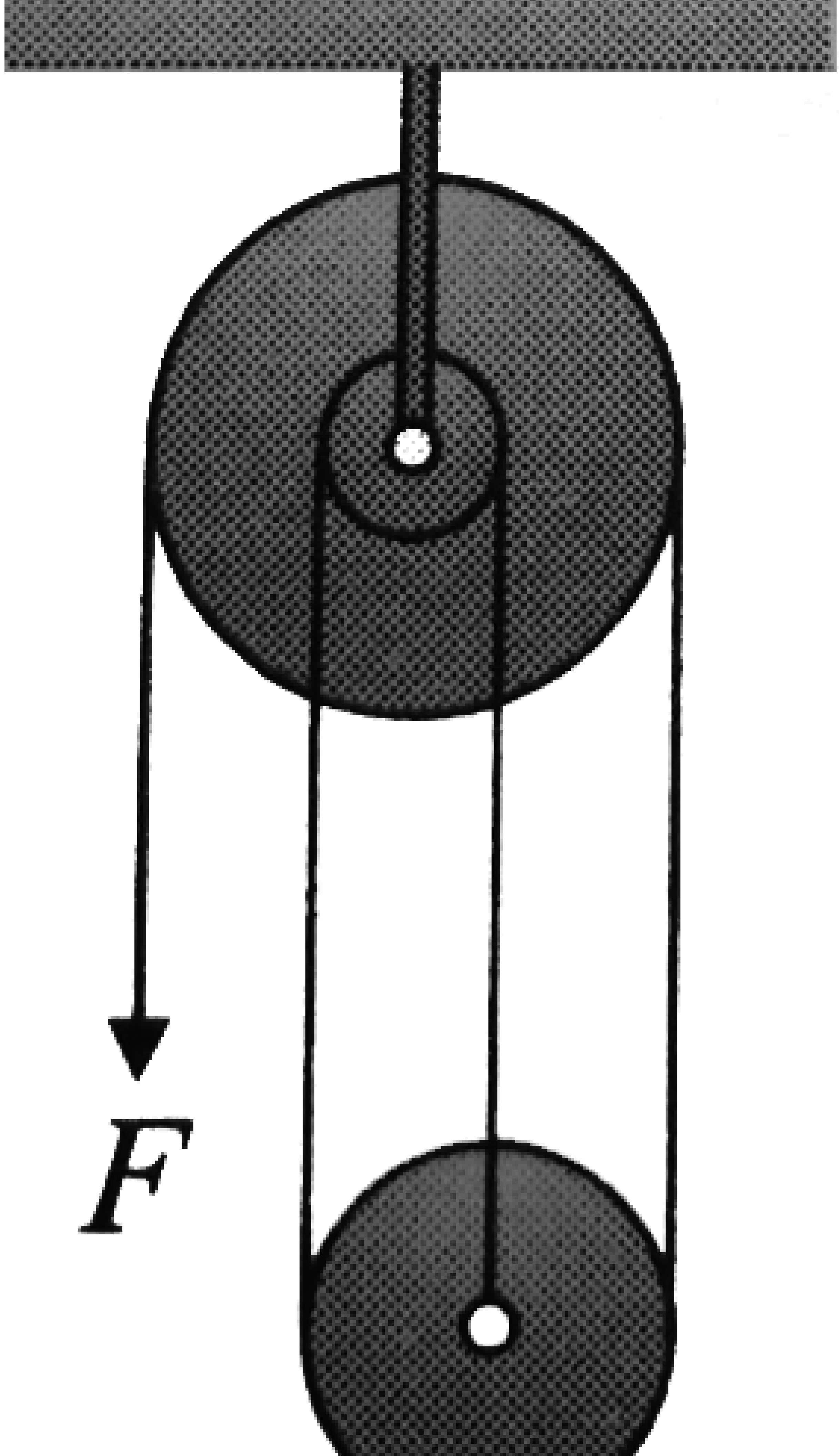
D. `Mg ge F ge Mg sqrt(1-mu^(2))`

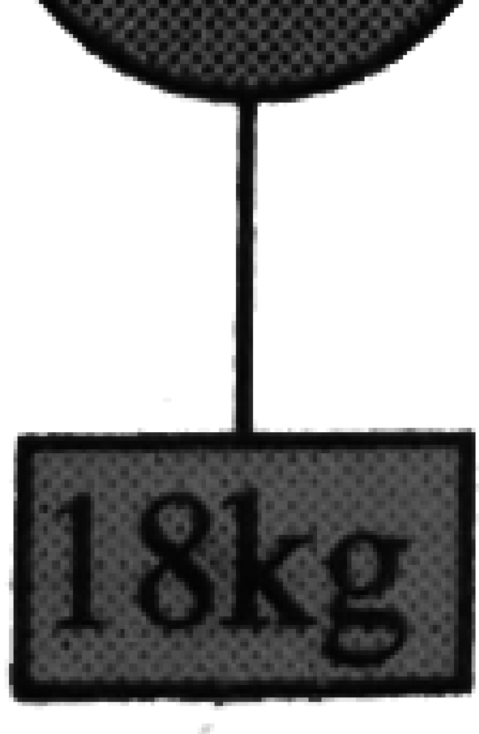
Answer: C

Watch Video Solution

8.




F



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

A. 200 N

B. 120 N

C. 180 N

D. 240 N

Answer: D

Watch Video Solution

9. A ball weighing `10g` hits a hard surface vertically with a speed of `5m//s` and rebounds with the same speed The ball remains in contact with the surface speed The ball remains in contact with the surface for `0.01s` The average force exerted by the surface on the ball is .

A. 100 N

B. 10 N

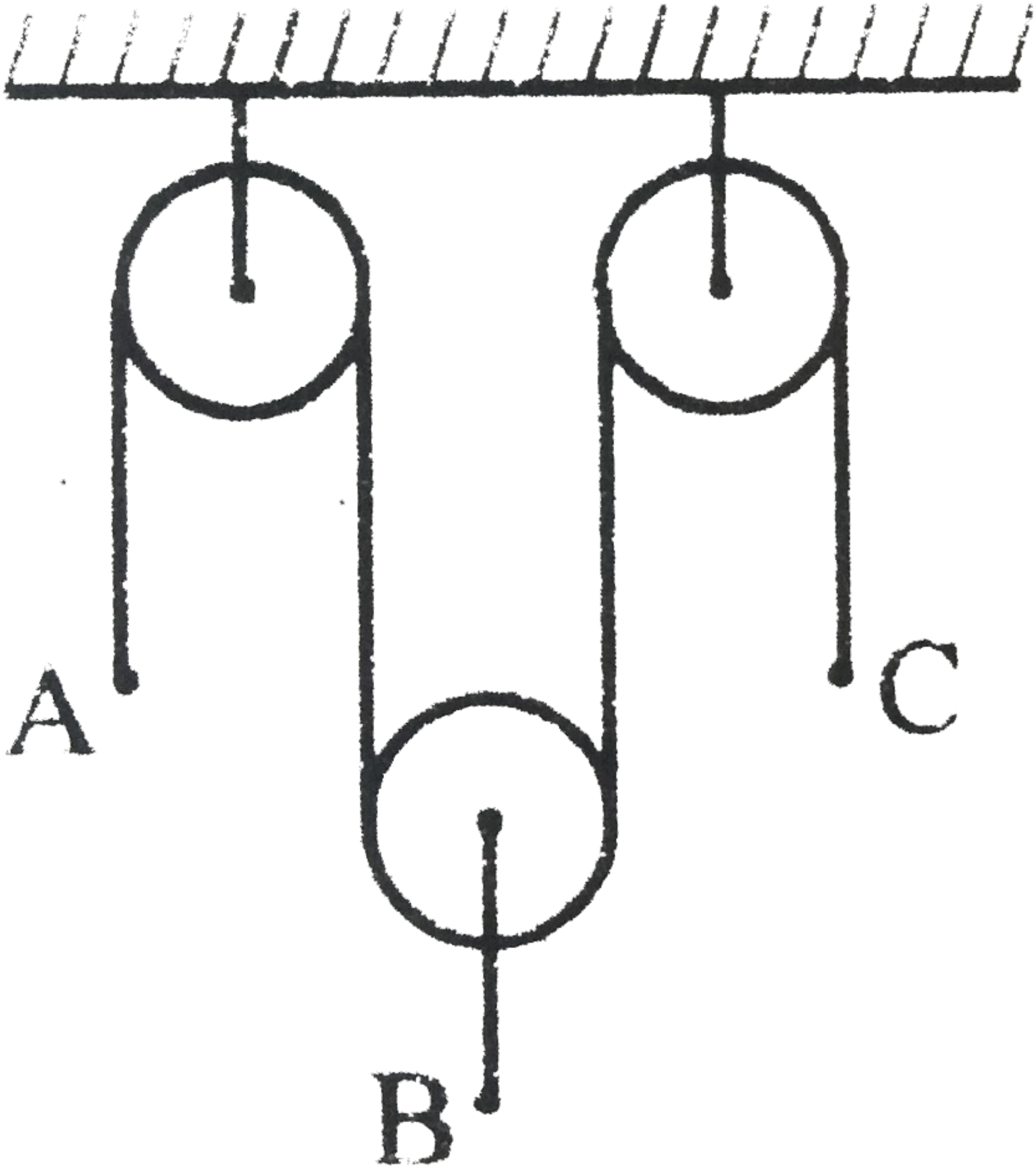
C. 1 N

D. 150 N

Answer: B

Watch Video Solution

10. The pulley in the diagram are all smooth and light. The acceleration of `A` is `a` upwards and the acceleration of `C` is `f` downwards. The acceleration of `B` is



A. `(1)/(2) (f-a)` up

B. `(1)/(2) (a+f)` down

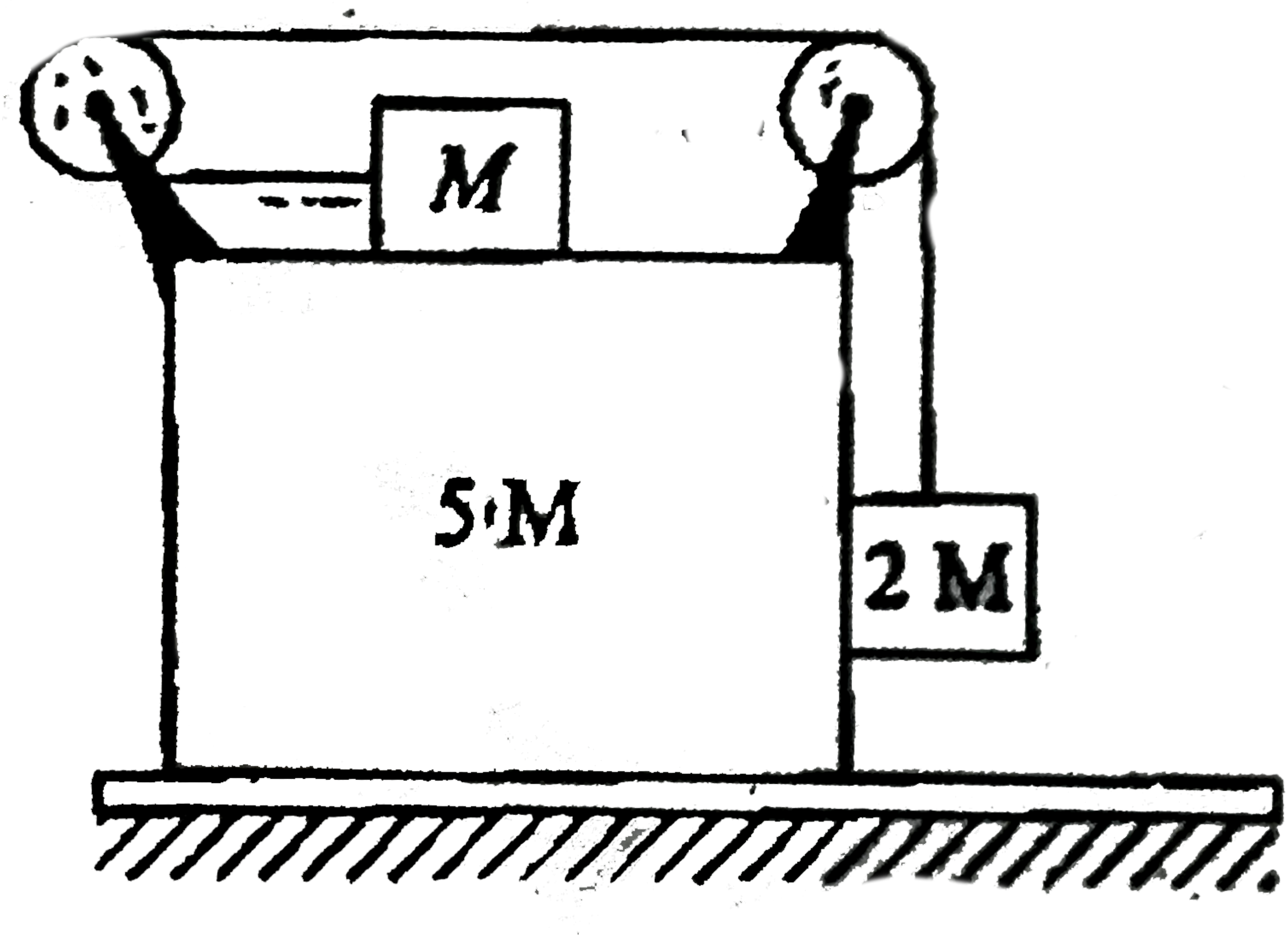
C. `(1)/(2) (a+)` up

D. `(1)/(2) (a-f)` up

Answer: A

Watch Video Solution

11. In the system shown, the initial acceleration of the wedge of mass 5M is (there is no friction anywhere)



A. Zero

B. `2g//23`

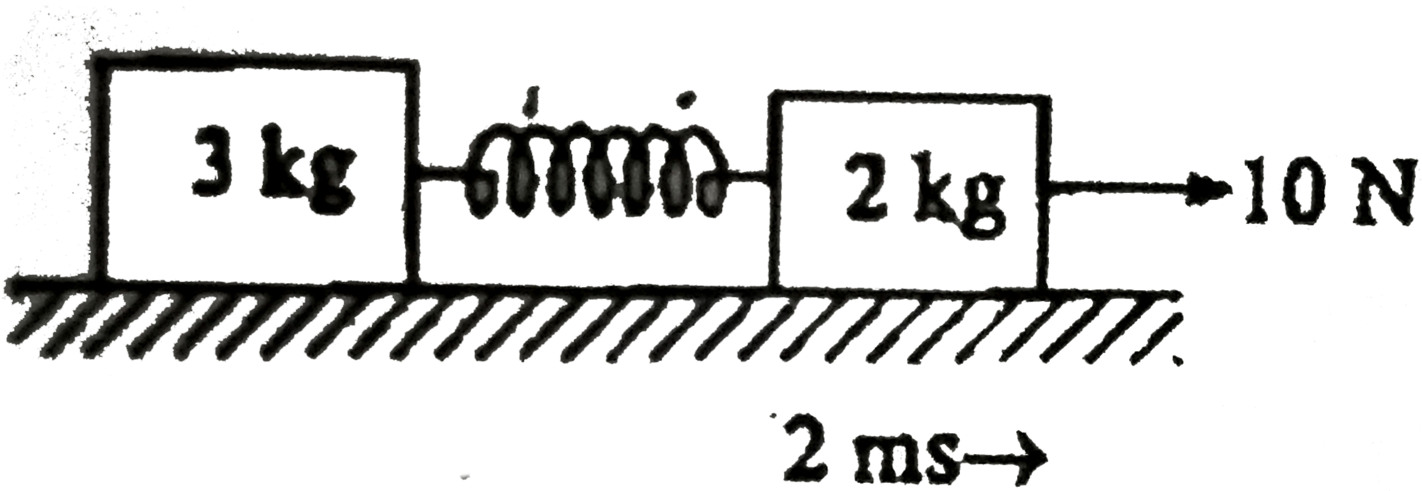
C. `3g//23`

D. None

Answer: B

Watch Video Solution

12. Find the acceleration of 3 kg mass when acceleration of 2 kg mass is `2ms^(-2)` as shown in figure-2.140



A. `3ms^(-2)`

B. `2ms^(-2)`

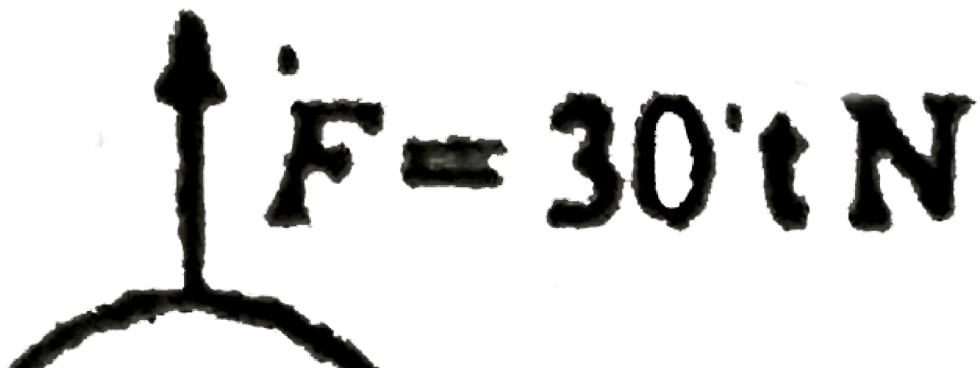
C. `0.5ms^(-2)`

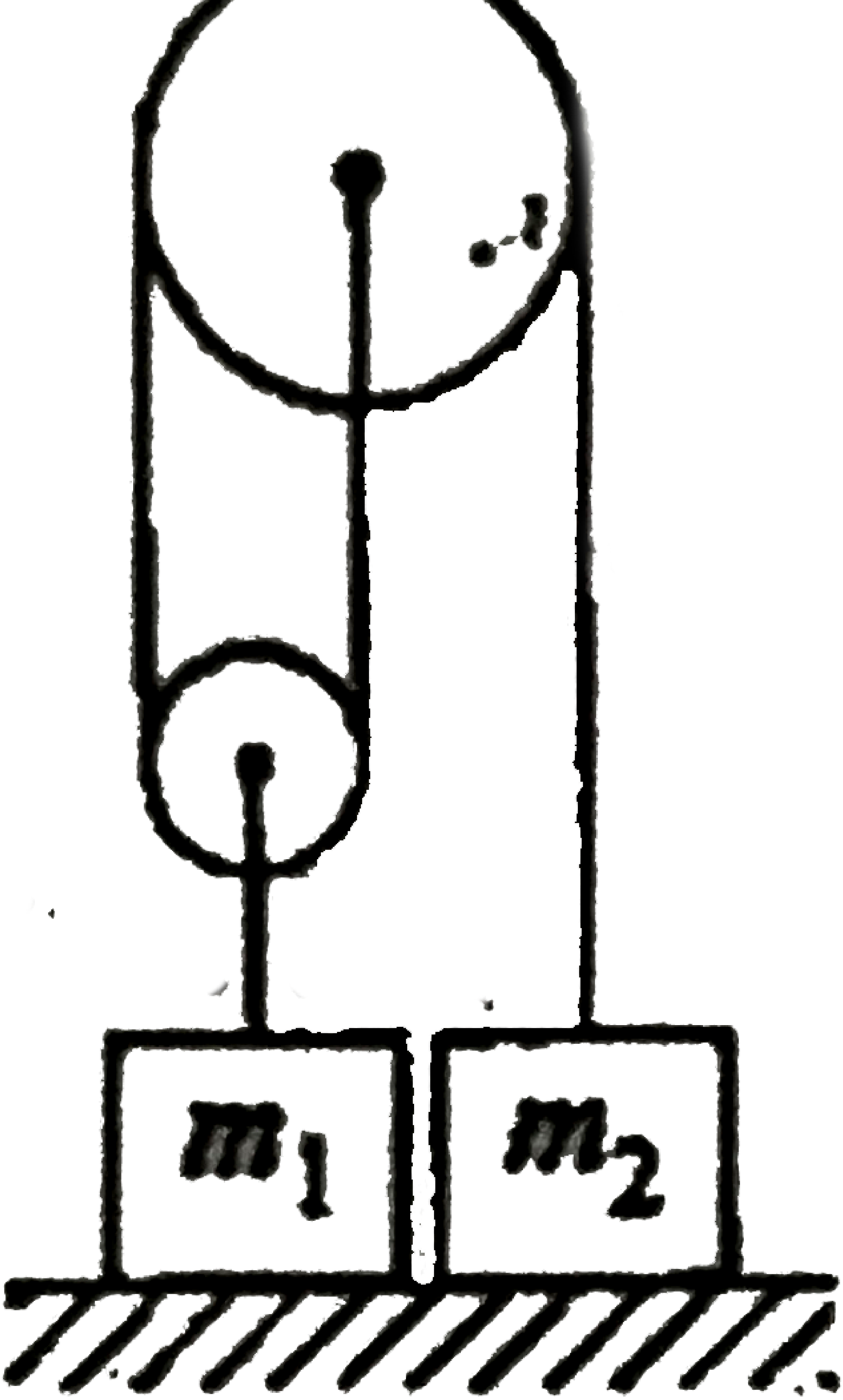
D. Zero

Answer: B

Watch Video Solution

13. Force F is applied on upper pulley. If F = 30 t where t is time in second. Find the time when `m_(1)` loses contact with floor : (Take `g = 10 m//s^(2)`)





$m_1 = 4\ kg$ $m_2 = 1\ kg$

A. 1 sec

B. 1.66 sec

C. 2 sec

D. None of these

Answer: C

Watch Video Solution

14. A varying horizontal force `F =` at acts on a block of mass `m` kept on a smooth horizontal surface An identical block is kept on the first block.The coefficient of friction between the blocks is `mu` . The time after which the relative sliding between the blocks prevails is

A. `2mg//b`

B. `2 mu g`

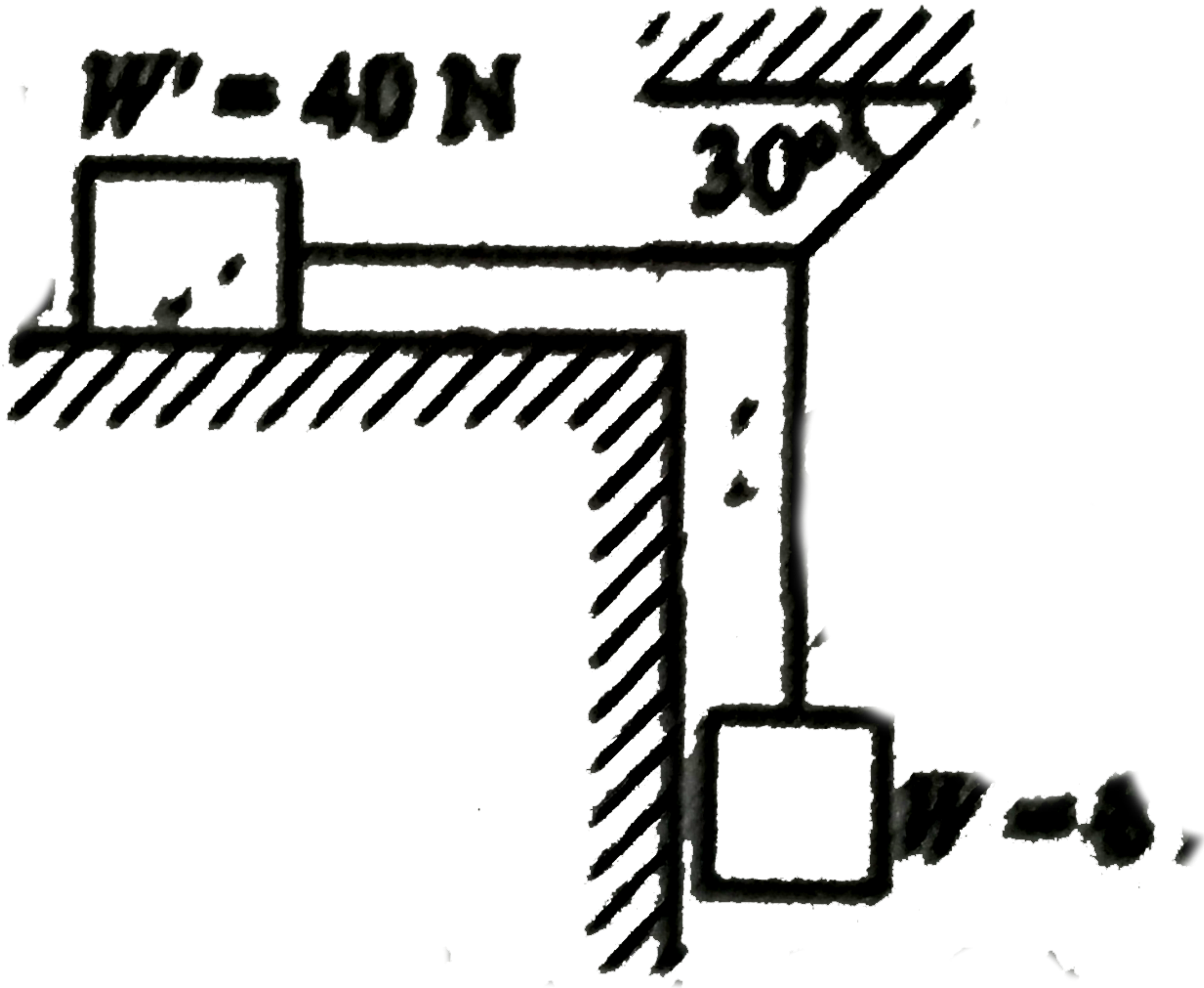
C. `mu m g//b`

D. None of these

Answer: D

Watch Video Solution

15. The system shown is just on the verge of slipping. The coefficient of static friction between the block and the table top is :



A. 0.5

B. 0.95

C. 0.15

D. 0.35

Answer: D

Watch Video Solution

16. A body is moving down a long inclined plane of angle of inclination `theta`. The coefficient of friction between the body and the plane varies as `mu - 0.1 x`, where x is the distance moved down the plane. The body will have the maximum velocity when it has travelled a distance x given by :

A. `x = 10 tan theta`

B. `x = 5 tan theta`

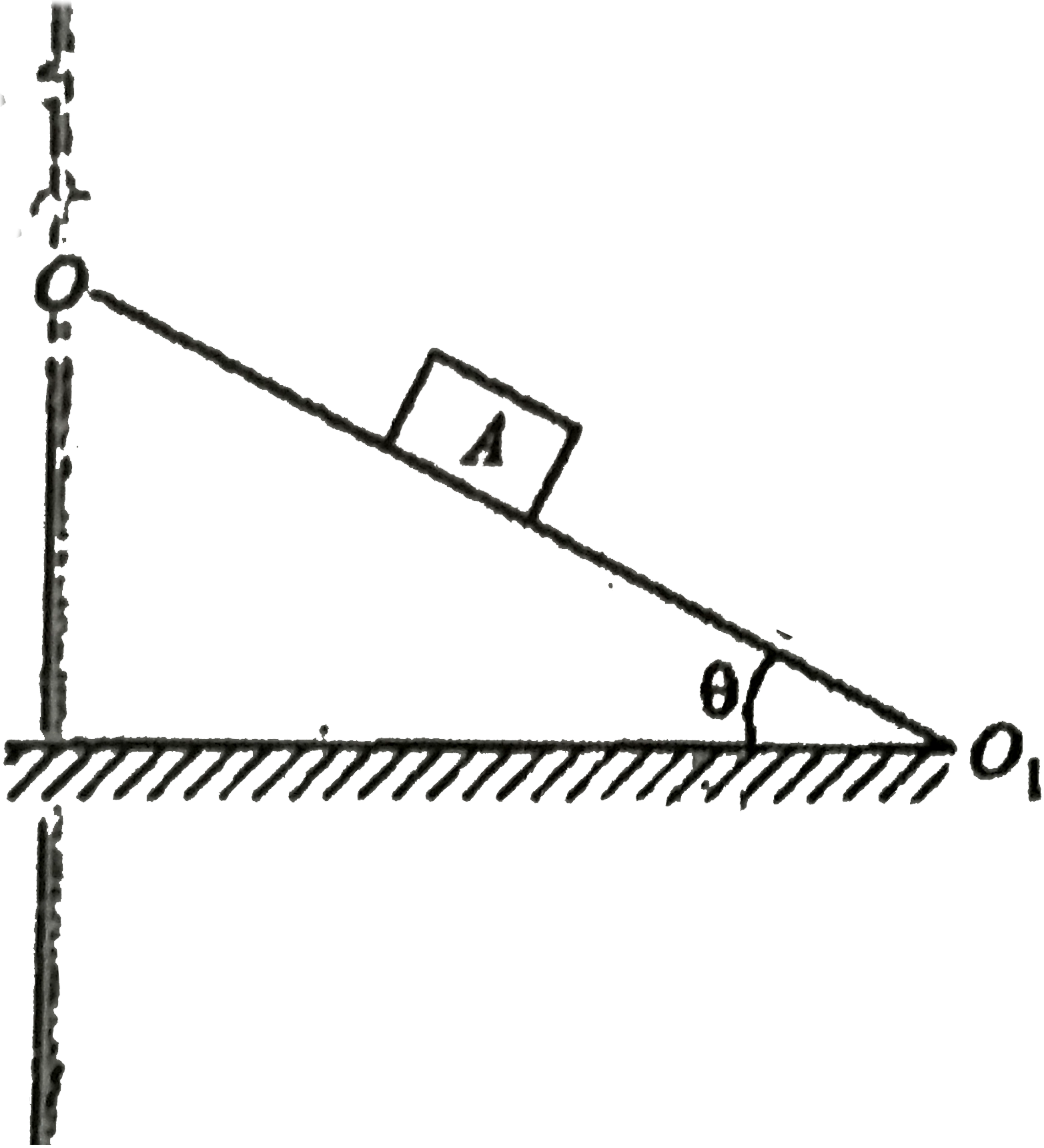
C. `sqrt(2) cot theta`

D. `x = (sqrt(10))/(cottheta)`

Answer: A

Watch Video Solution

17. A block A kept on a rough plate `(OO_(I))` with coefficient of static friction `mu_(s)=0.75` & coefficient of kinetic friction `mu_(hat(k))=0.5`. The plate is leaning with horizontal at an angle `theta=tan^(-1)(mu'_(s))`. If the plate is further tilted slightly then the acceleration of block will be :



A. `1.5 m//s^(2)`

B. `2 m//s^(2)`

C. `2.5 m//s^(2)`

D. None of these

Answer: B

Watch Video Solution

18. For a particle rotating in a vertical circle with uniform speed, the maximum and minimum tension in the string are in the ratio 5 : 3. If the radius of vertical circle is 2 m, the speed of revolving body is (`g=10m//s^(2)`)

A. `sqrt(5) m//s`

B. `4sqrt(5) m//s`

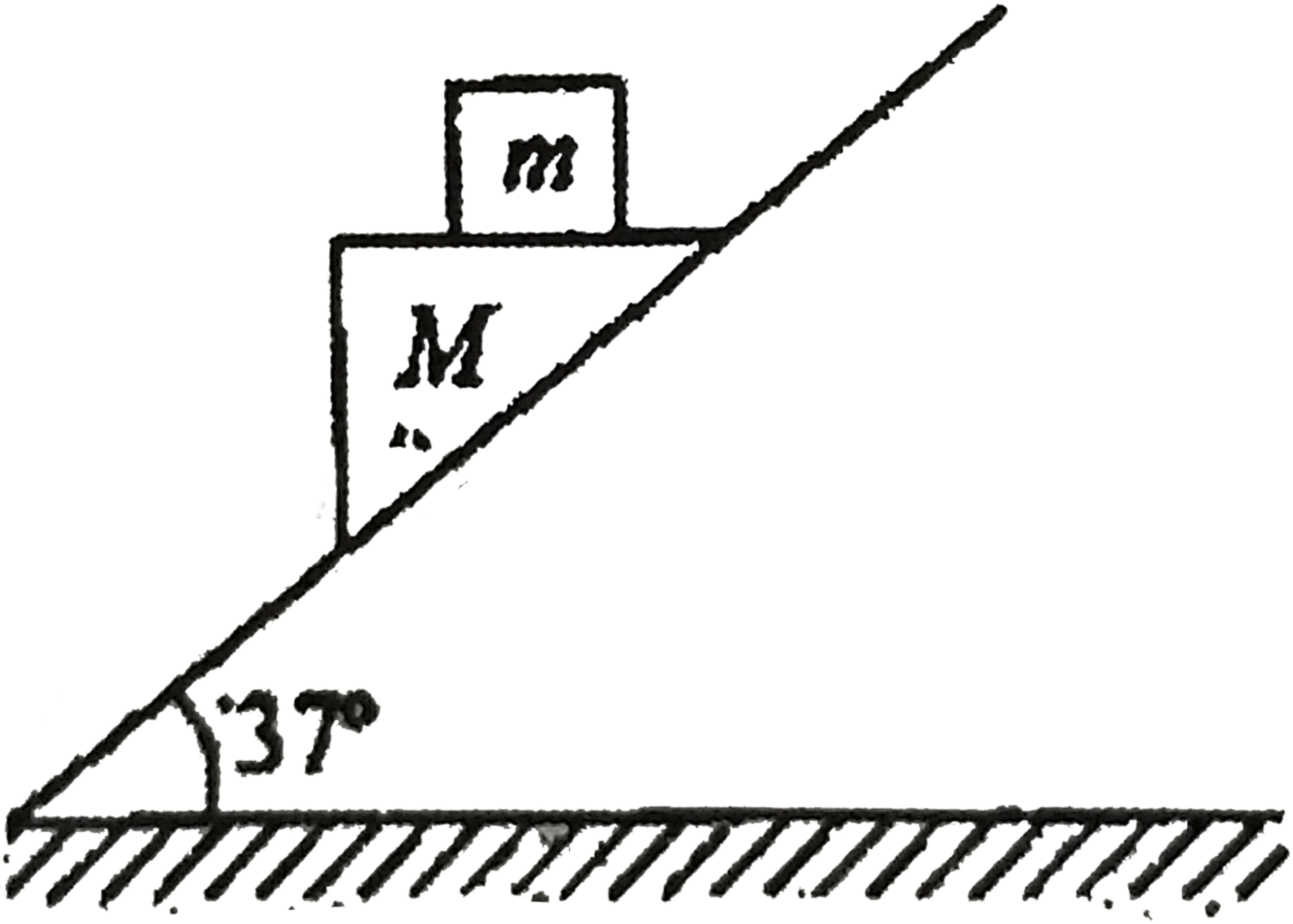
C. `5m//s`

D. `10m//s`

Answer: B

Watch Video Solution

19. Block M slides down on frictionless incline as shown. The minimum friction coefficient so that m does not slide with respect to M would be :



A. `(1)/(4)`

B. `(1)/(2)`

C. `(3)/(4)`

D. None of these

Answer: C

Watch Video Solution

20. A force `F = Be^(Ct)` acts on a particle whose mass is m and whose velocity is 0 at t = 0. It's terminal velocity is :

A. `(C )/(mB)`

B. `(B)/(mC)`

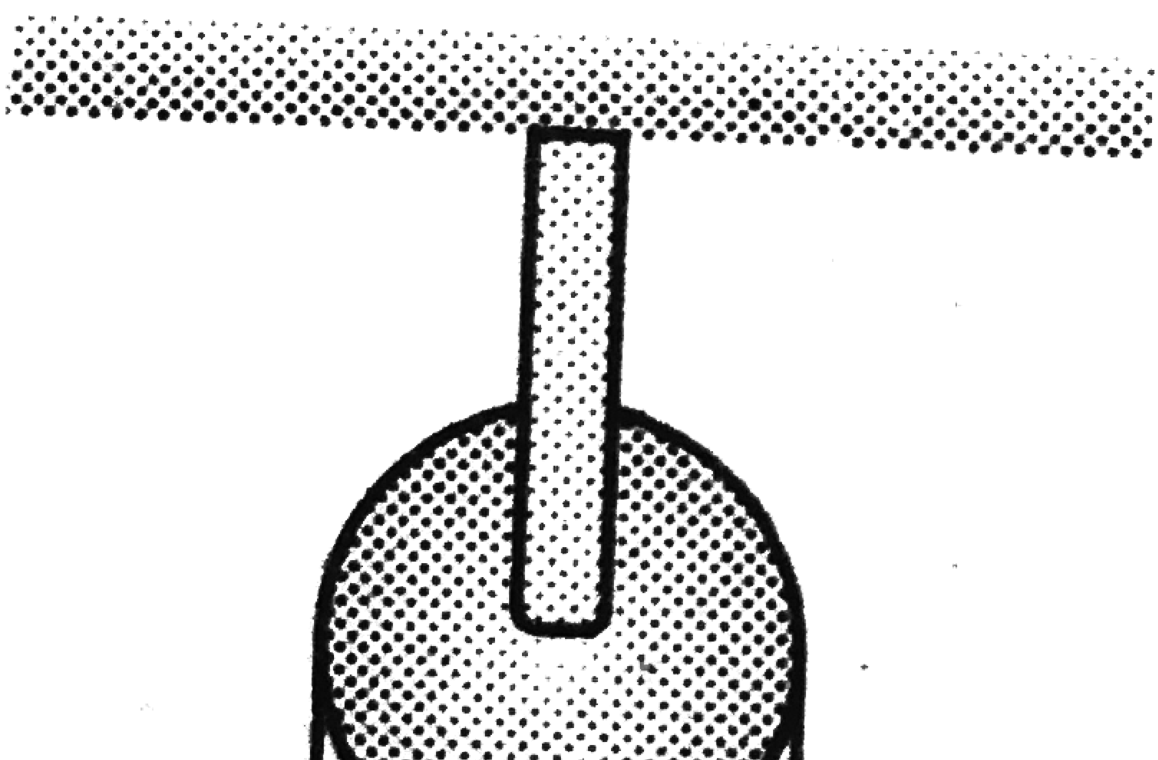
C. `(BC)/(m)`

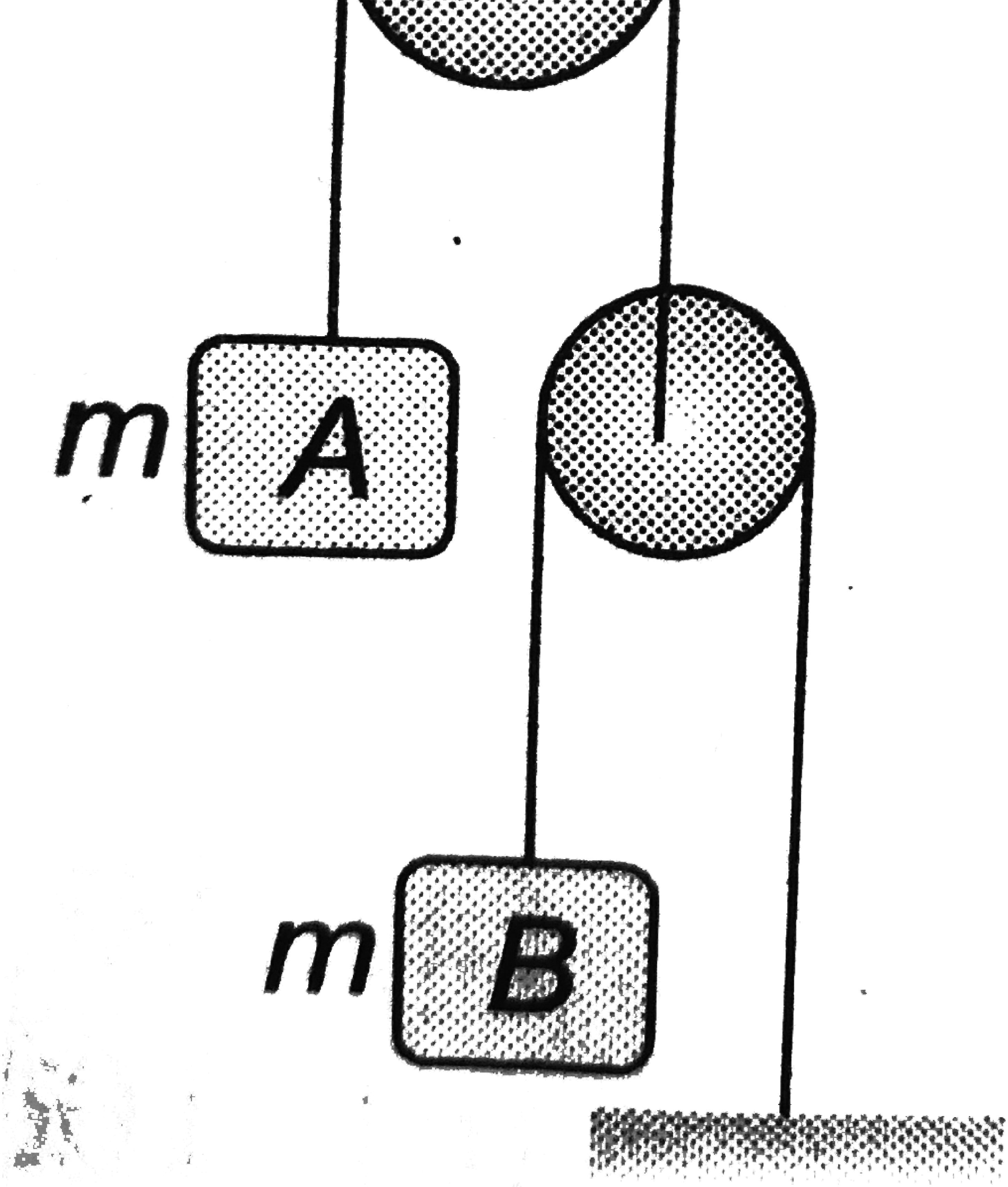
D. `-(B)/(mC)`

Answer: B

Watch Video Solution

21. In the figure shown neglecting friction and mass of pulley, what is the acceleration of mass `B` ?





A. `g//3`

B. `5g//2`

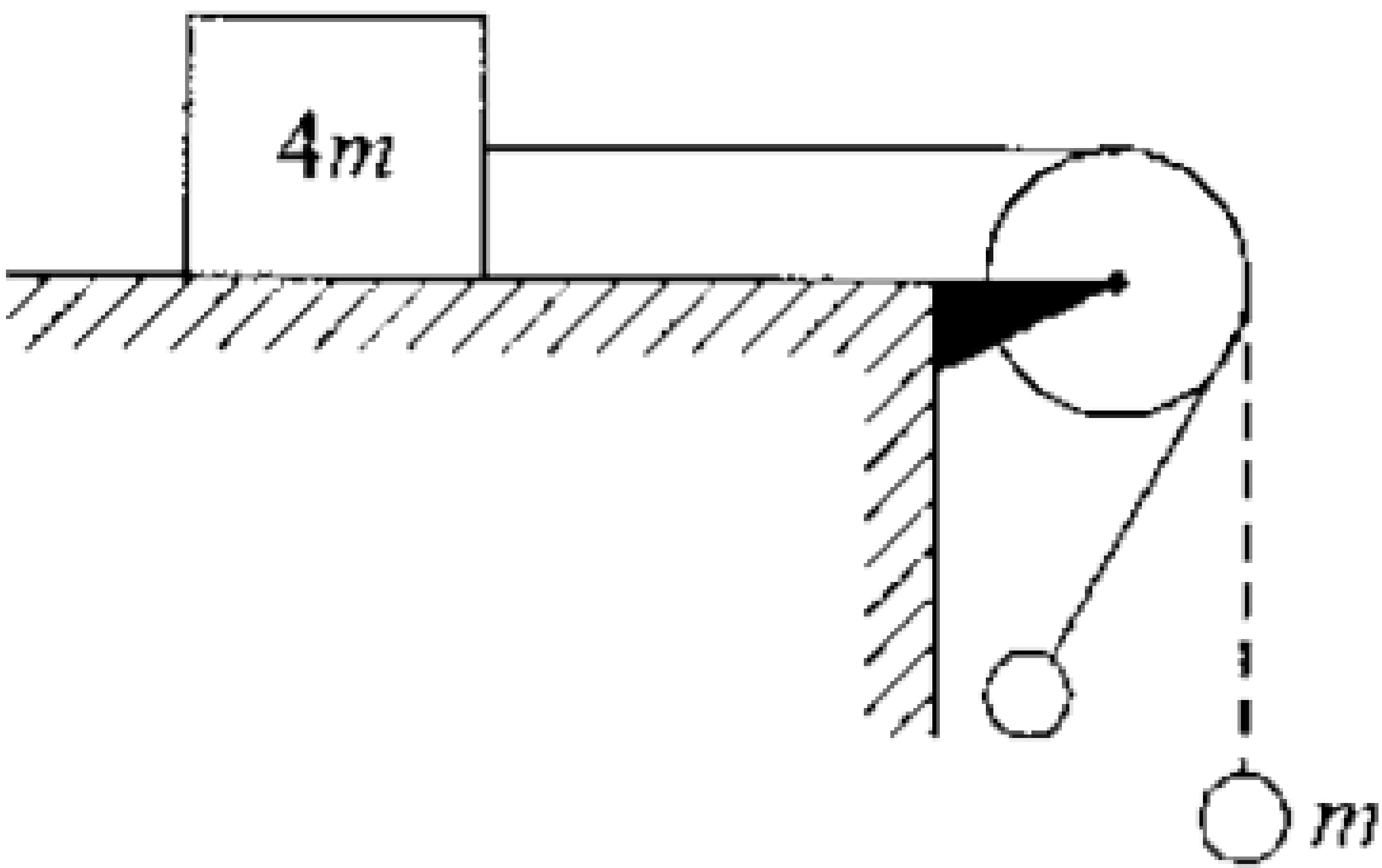
C. `2g//3`

D. `2g//5`

Answer: D

Watch Video Solution

22. Two bodies of mass m and 4m are attached by a string shown in the figure-2.146. The body of mass m hanging from a string of length l is executing simple harmonic motion with amplitude A while other body is at rest on the surface. The minimum coefficient of friction between the mass 4m and the horizontal surface must be to keep it at rest is :



A. `(1)/(4)(1-(A^(2))/(l^(2)))`

B. `(1)/(4)(1+(A^(2))/(l^(2)))`

C. `(1)/(4)(A)/(l)costheta`

D. `(1)/(4)`

Answer: B

Watch Video Solution

23. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of :

A. `(2//3)k`

B. `(3//2)k`

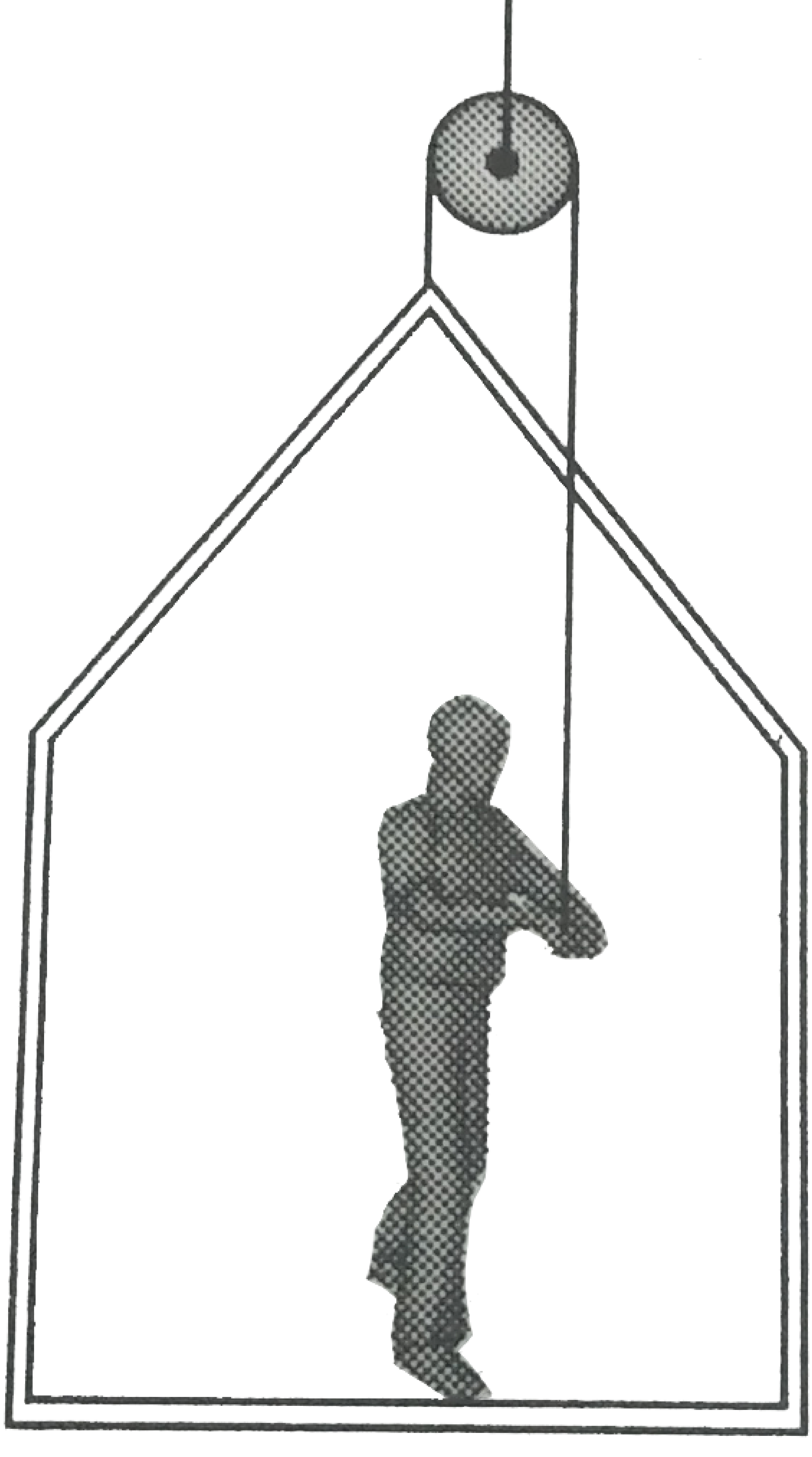
C. 3k

D. 6k

Answer: B

Watch Video Solution

24. A man of mass m stands on a frame of mass M. He pulls on a light rope, which passes over a pulley. The other end of the rope is attached to the frame. For the system to be in equilibrium, what force must the man exert on the rope?



A. `((M+m)g)/(2)`

B. `(M+m)g`

C. `(M-m)g`

D. `(M+2m)g`

Answer: A

Watch Video Solution

25. A car starts from rest to cover a distance s. the coefficient of friction between the road and the tyres is `mu`. The minimum time in which the car can cover the distance is proportional to

A. `mu`

B. `sqrt(mu)`

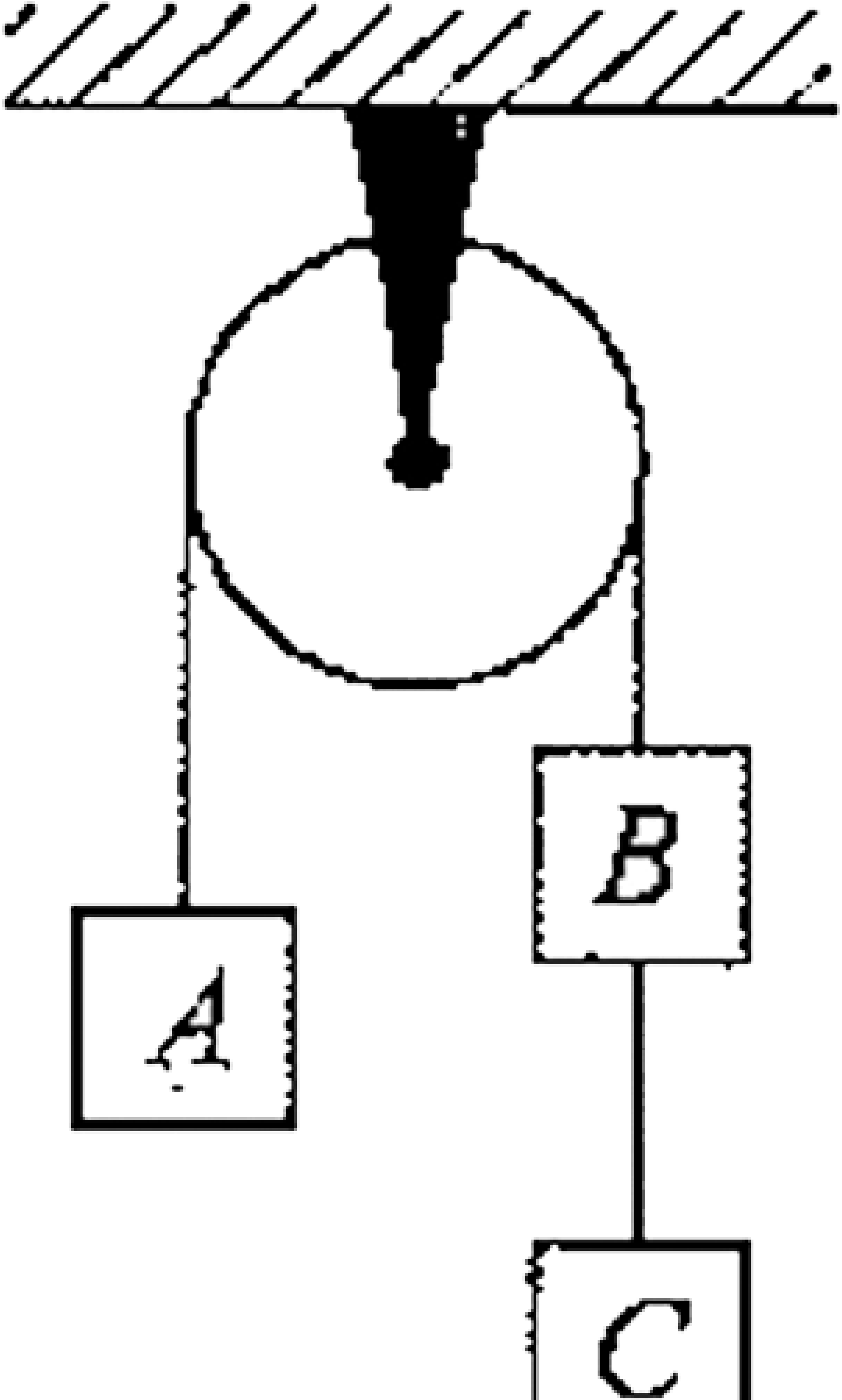
C. `1//mu`

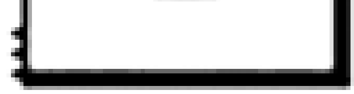
D. `1//sqrt(mu)`

Answer: D

Watch Video Solution

26. Three equal weights of mass 3 kg each are hanging on a string passing over a fixed pulley as shown in figure-2.147. The tension in the string connecting weight B and C is : (Take `g = 10m//s^(2)`)


A
B
C



A. 1 kg wt

B. 2 kg wt

C. 3 kg wt

D. 4 kg wt

Answer: B

Watch Video Solution

27. A block of mass` m_(1) = 1 kg` is horizontally thrown with a velocity of `v = 10 m//s` on a statonary long plank of mass`m_(2) = 2 kg` whose surface has `mu = 0.5 ` plank rest on frictionless surface find the time when the block comes to rest w.r.t plank

A. 2 sec

B. $\frac{3}{4}$ sec

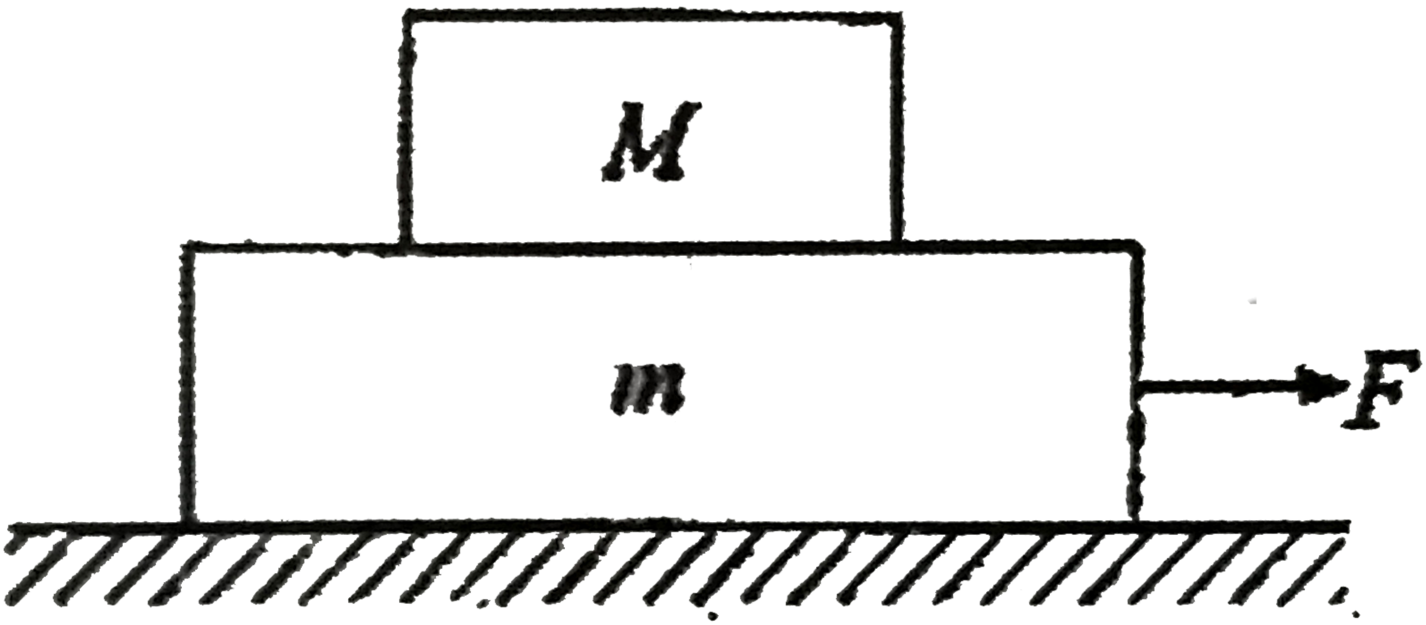
C. $\frac{4}{3}$ sec

D. 1 sec

Answer: C

Watch Video Solution

28. A board of mass m = 1 kg lies on a table and a weight of M = 2 kg on the board. What minimum force F must be applied on the board in order to pull it out from under the road ? The coefficient of friction between board and table is $\mu_2 = 0.5$: (Take $g = 10 m/s^2$)



A. 7.5 N

B. 15 N

C. 22.5 N

D. 30 N

Answer: C

Watch Video Solution

29. A man is standing in a lift which goes up and comes down with the same constant acceleration. If the ratio of the apparent weights in the two cases is `2 : 1` , then the acceleration of the lift is : (Take `g = 10 m//s^(2)`)

A. `3.3 ms^(-2)`

B. `2.50 ms^(-2)`

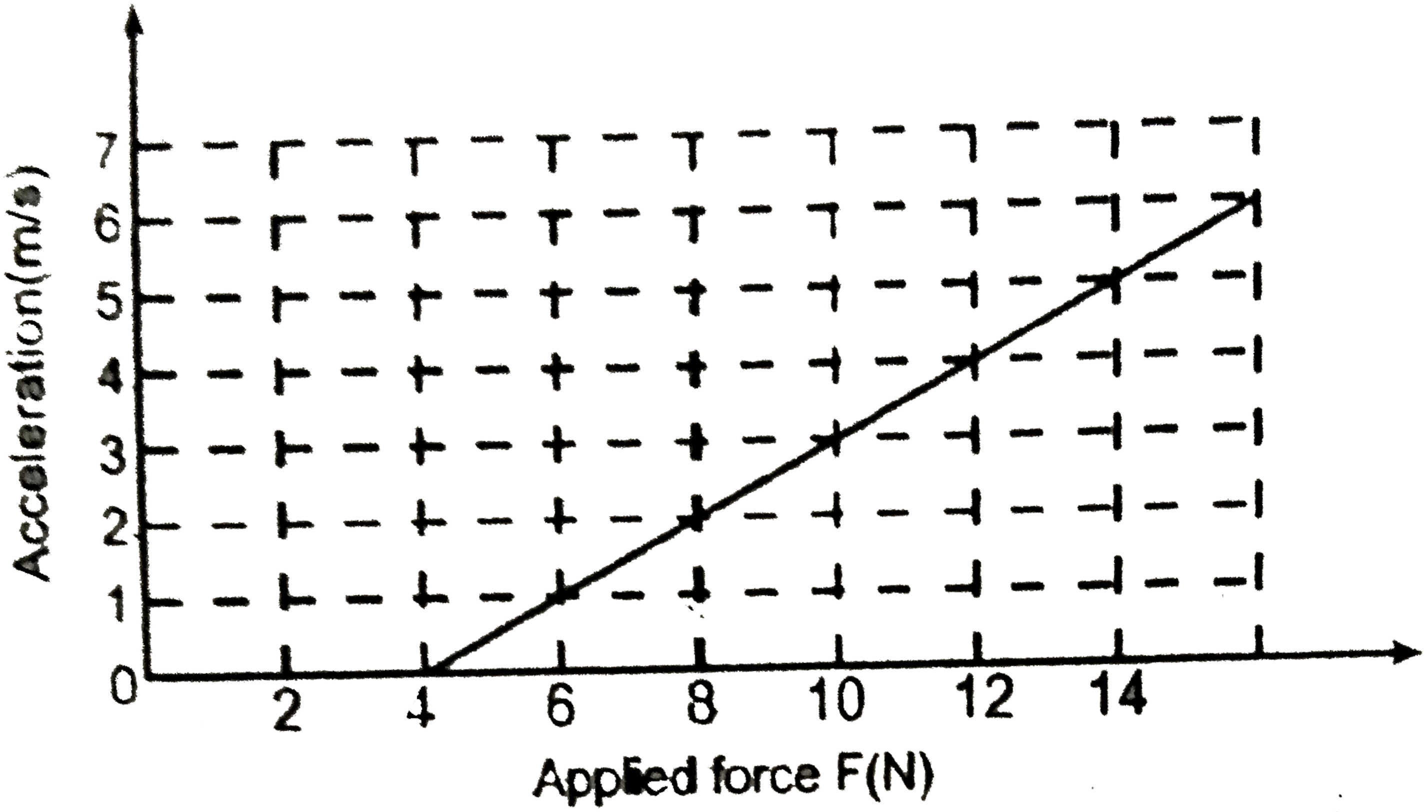
C. `2.00 ms^(-2)`

D. `1.67 ms^(-2)`

Answer: A

Watch Video Solution

30. A block of unknown mass is at rest on a rough, horizontal surface. A horizontal force `F` is applied to the block. The graph in the figure shows the acceleration of the block with respect to the applied force. The mass of the block is



A. 1.0 kg

B. 0.1 kg

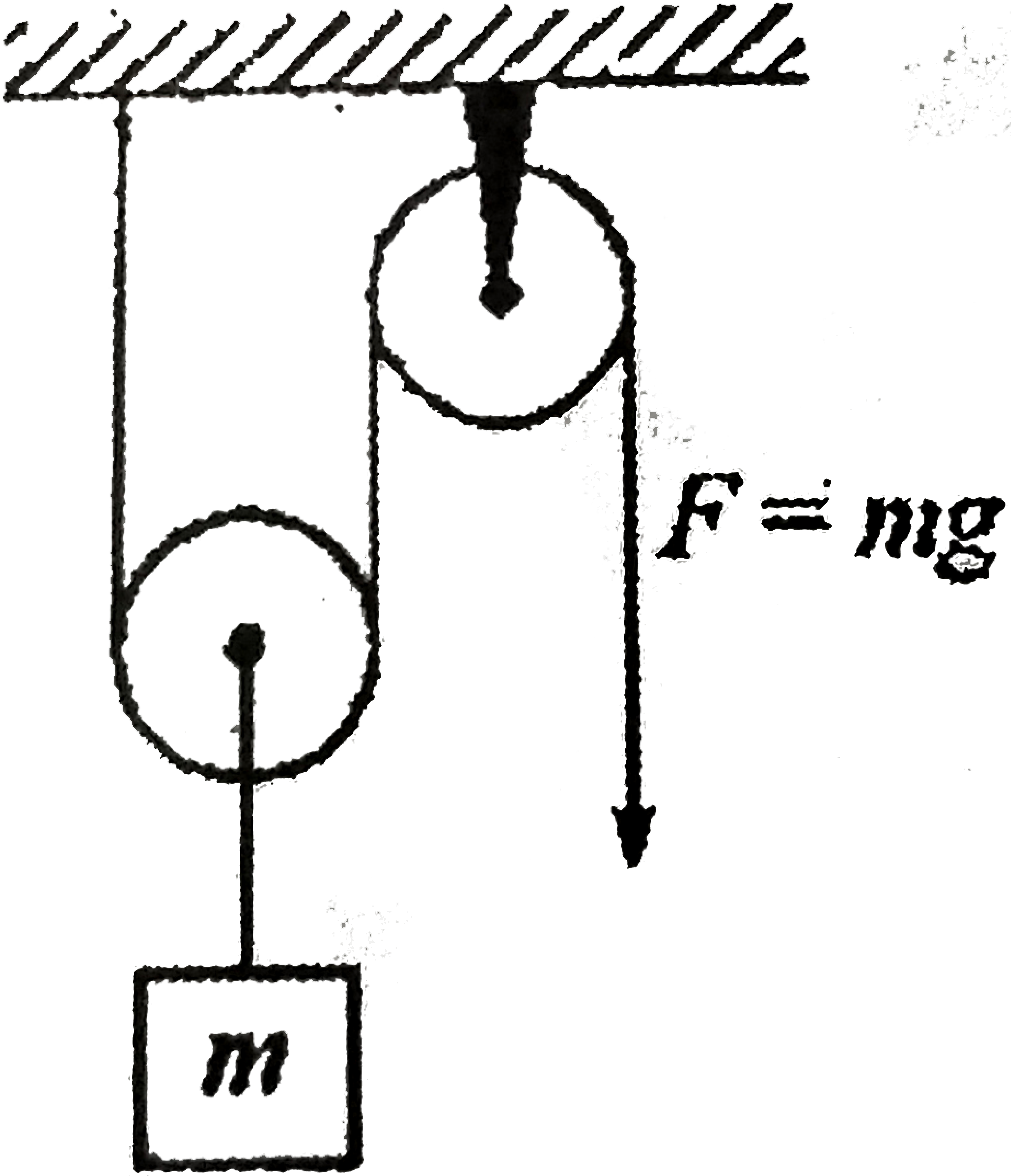
C. 2.0 kg

D. 0.2 kg

Answer: C

Watch Video Solution

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



A. `g//2`

B. 0

C. g

D. 3g

Answer: C

Watch Video Solution

32. A block is given certain upward velocity along the incline of elevation `alpha`. The time of ascent to upper point was found to be half the time of descent to initial point. The co-efficient of friction between block and incline is :

A. `0.5 tan alpha`

B. `0.3 tan alpha`

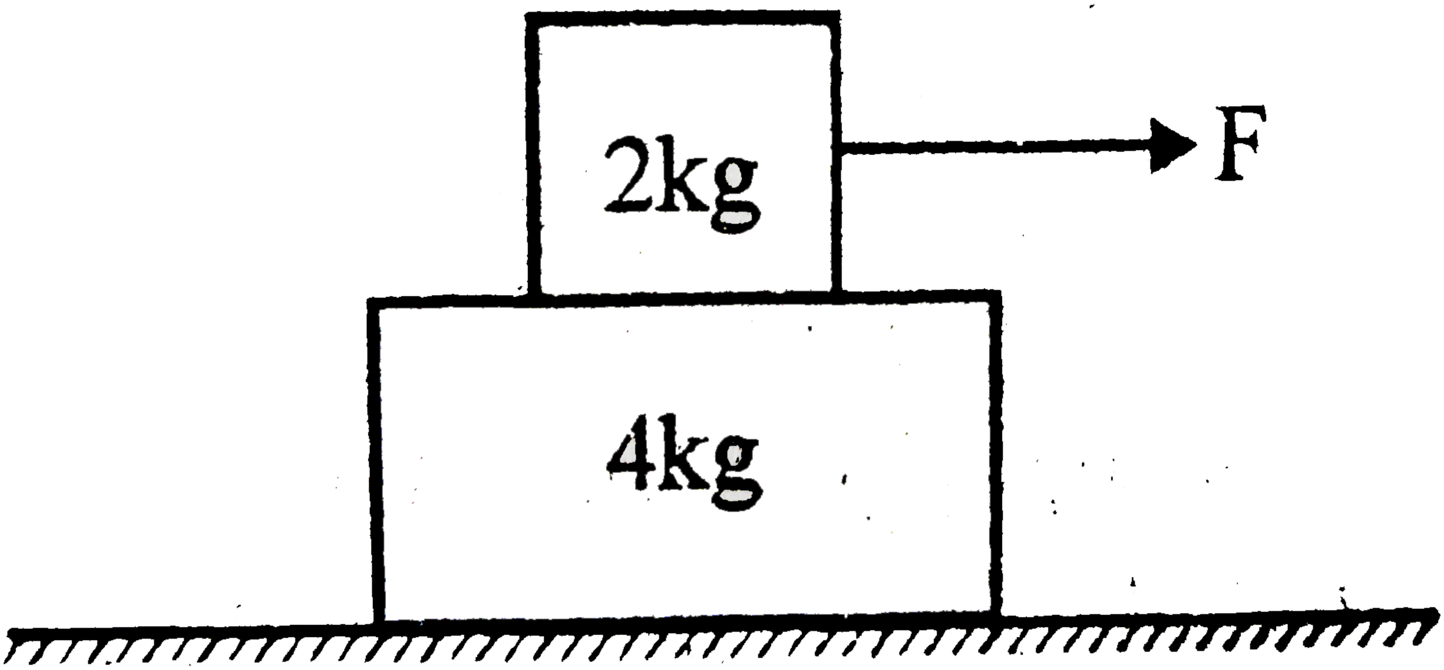
C. `0.6 tan alpha`

D. `0.2 tan alpha`

Answer: C

Watch Video Solution

33. Consider the shown arrangement. The coefficient of friction between the two blocks is 0.5 . There is no friction between the 4 kg block and of 12 N is applied on the 2 kg block as shown in the figure, the acceleration of the 4 kg block would be



A. `2.5 m//s^(2)`

B. `2 m//s^(2)`

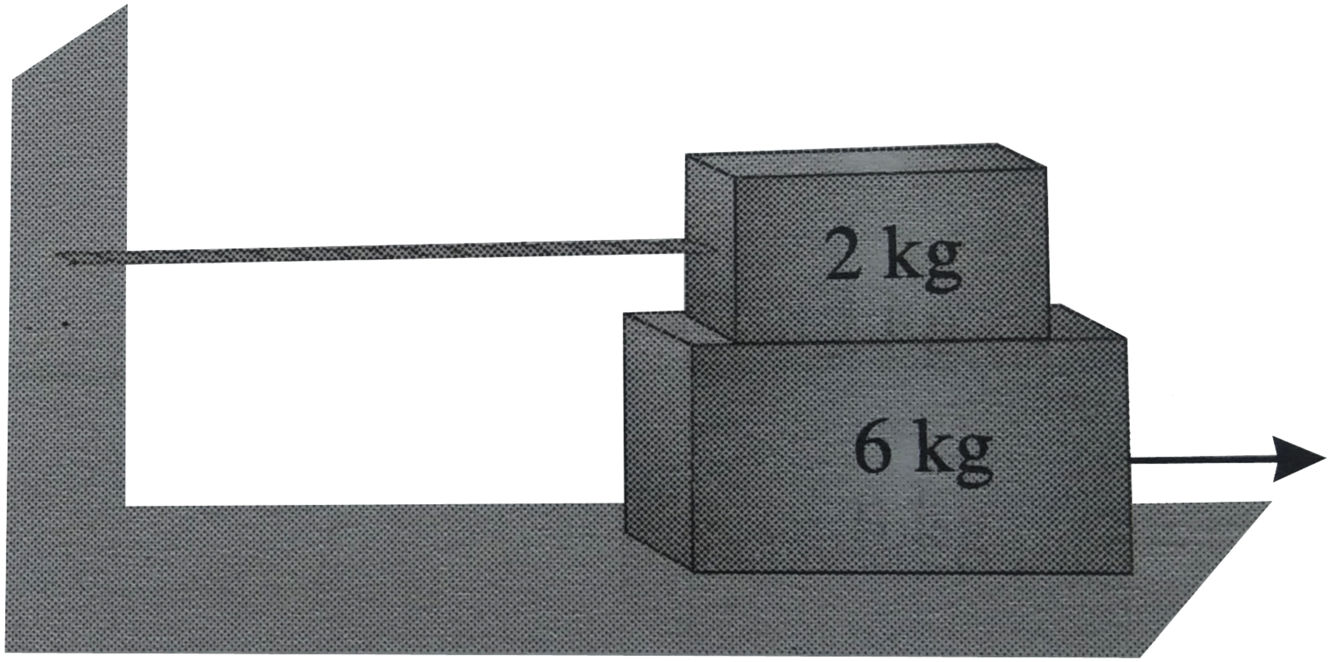
C. `5 m//s^(2)`

D. None of these

Answer: B

Watch Video Solution

34.



A 40 kg slb rest on a frictionless floor as shown in the figure. A 10 kg block rests on the top of the slab. The static corfficient of friction between the block and slab is 0.60 while the kinetic friction is 0.40 the 10 kg block is acted upon by a horizontal force 100N. If `g=9.8(m)/(s^2)`, the resulting acceleration of the slab will be.

A. `1 m//s^(2)`

B. `1.47 m//s^(2)`

C. `1.52 m//s^(2)`

D. `6.1 m//s^(2)`

Answer: A

Watch Video Solution

35. A load attached to the end of a spring and in equilibrium produces 9 cm extension of spring. If the spring is cut into three equal parts and one end of reach is fixed at 'O' and other ends are attached to the same load, the tension in cm of the combination in equilibrium now is :

A. 1

B. 3

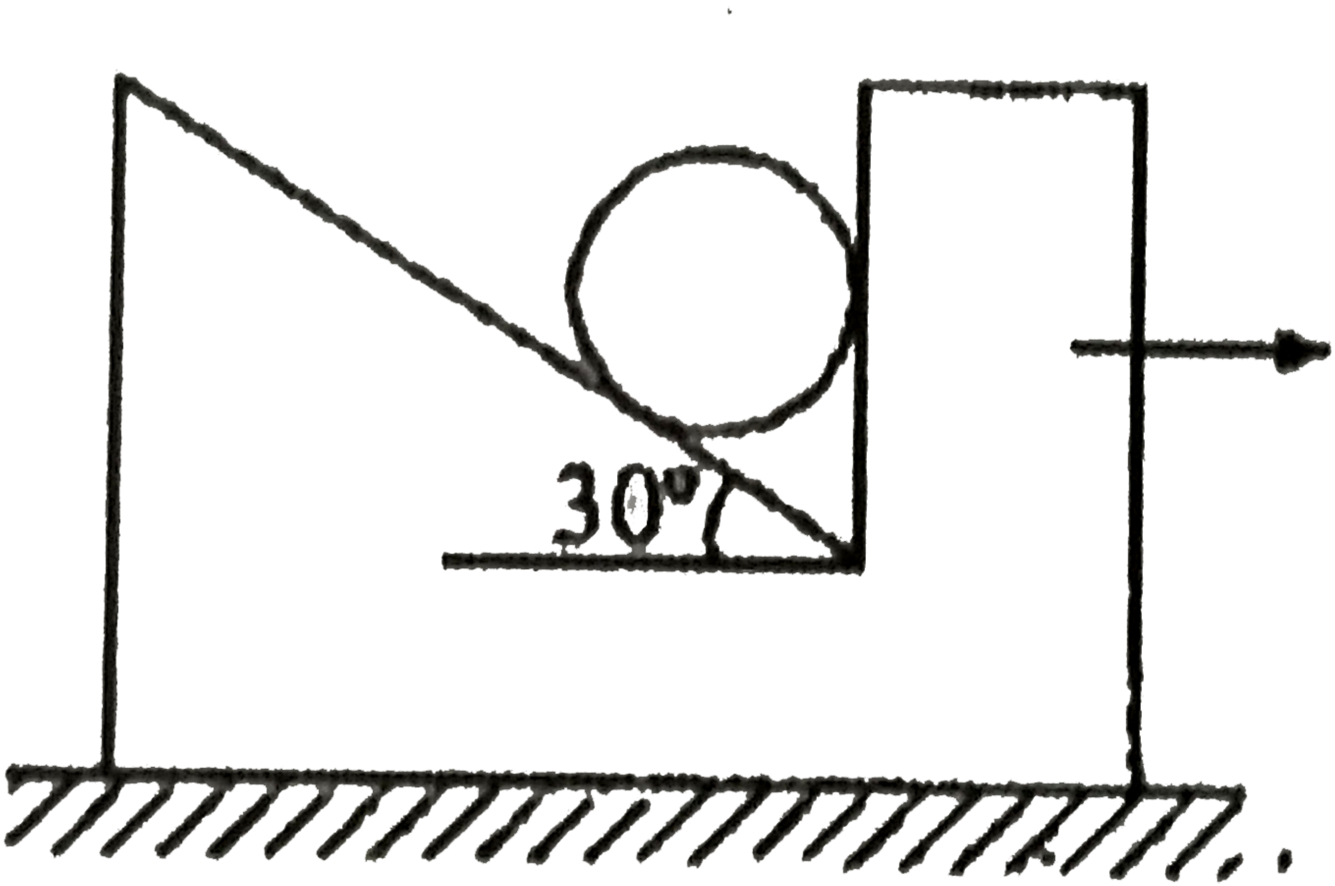
C. 6

D. 9

Answer: A

Watch Video Solution

36. A heavy spherical ball is constrained in a frame as shown in figure-2.153. The inclined surface is smooth. The maximum acceleration with which the frame can move without causing the ball to leave the frame :



A. `g//2`

B. `g sqrt(3)`

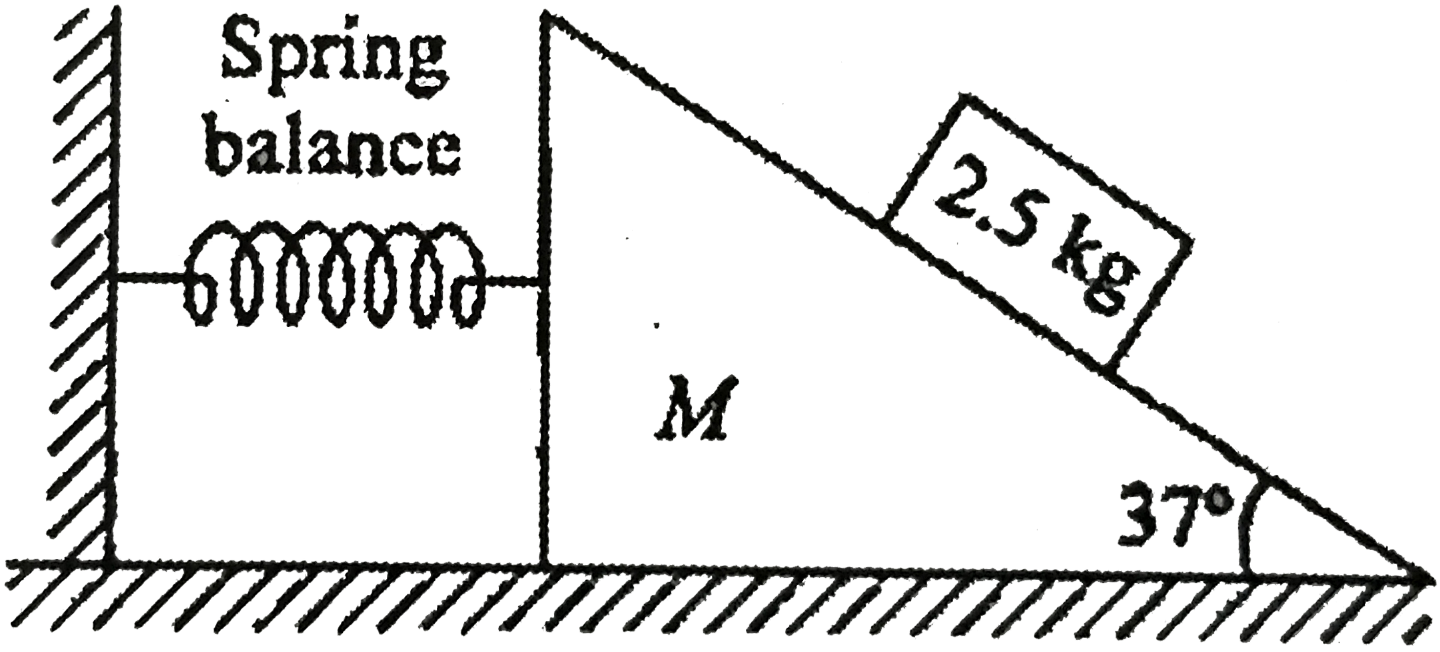
C. `(g)/sqrt(3)`

D. `(g)/sqrt(2)`

Answer: C

Watch Video Solution

37. Find the reading of spring balance as shown in figure-2.154. Assume that mass M is in equilibrium :



A. 8 N

B. 9 N

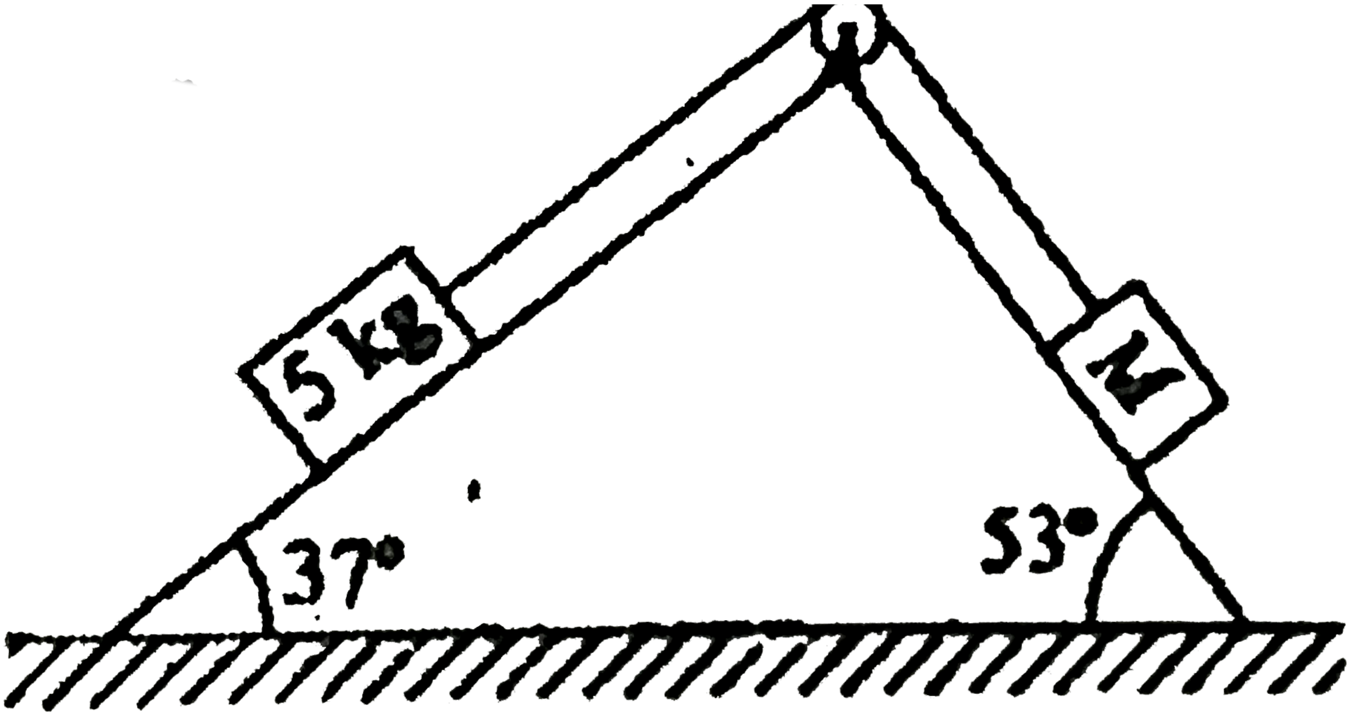
C. 12 N

D. Zero

Answer: C

Watch Video Solution

38. For what value of M will the masses be in equilibrium. Masses are placed on fixed wedge :



A. 5 kg

B. 4 kg

C. 3.75 kg

D. 3 kg

Answer: C

Watch Video Solution

39. A body of mass m starts sliding down an incline of `30^(@)` from rest. The body comes to rest just when it reaches the bottom. If the top half of the plane is perfectly smooth and the lower half is rough, find the force of friction :

A. `(mg)/(4)`

B. `(mg)/sqrt(3)`

C. mg

D. `(mg)/sqrt(2)`

Answer: C

Watch Video Solution

40. A mass of 0.5 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is `60^(@)`. The minimum force necessary to pull the mass up the incline along the line of greatest slope is : (Take `g=10m//s^(2)`)

A. 20 N

B. 9 N

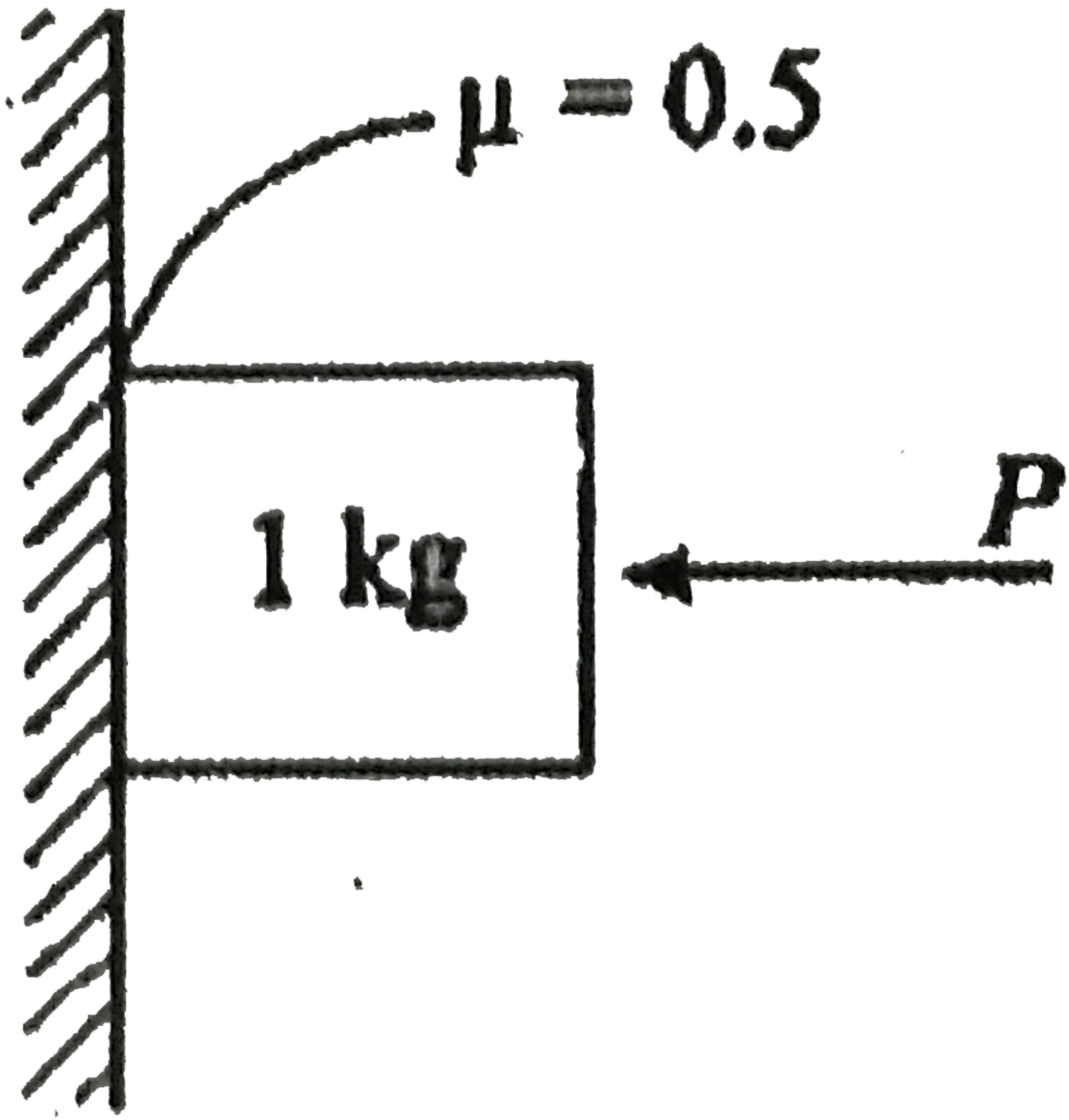
C. 100 N

D. 1 N

Answer: B

Watch Video Solution

41. Minimum force required to keep a block of mass 1 kg at rest against a rough vertical wall is P. If a force `P//2` is applied then the acceleration of the block will be :



A. `5 m//s^(2)`

B. `2.5 m//s^(2)`

C. `2 m//s^(2)`

D. `0.9 m//s^(2)`

Answer: A

Watch Video Solution

Watch Video Solution

42. A 60 kg body is pushed with just enough force to start it moving across a floor and the same force continues to act afterwards. The coefficient of static friction and sliding friction are 0.5 and 0.4 respectively. The acceleration of the body is

A. `6 m/s^(2)`

B. `1 m//s^(2)`

C. `2.5 m//s^(2)`

D. `3 .8 m//s^(2)`

Answer: B

Watch Video Solution

43. A particle of small m is joined to a very heavy body by a light string passing over a light pulley. Both bodies are free to move. The total downward force on the pulley is

A. mg

B. 2 mg

C. 4 mg

D. `gtgt mg`

Answer: C

Watch Video Solution

44. A 20 kg monkey slides down a vertical rope with a constant acceleration of `7 ms^(-2)`. If `g = 10 m//s^(-2)`, what is the tension in the rope ?

A. 140 N

B. 100 N

C. 60 N

D. 30 N

Answer: C

Watch Video Solution

45. A block A of mass 2 kg rests on another block B of mass 8 kg which rests on a horizontal floor. The coefficient of friction between A and B is 0.2 while that between B and floor is 0.5. when a horizontal force of 25 N is applied on the block B. the force of friction between A and B is

A. Zero

B. 3.9 N

C. 5.0 N

D. 49 N

Answer: A

Watch Video Solution

46. A man slides down a light rope whose breaking strength in `eta` times his weight `(eta lt 1)`. What should be his maximum acceleration so that the rope just breaks ?

A. `etag`

B. `g(1-eta)`

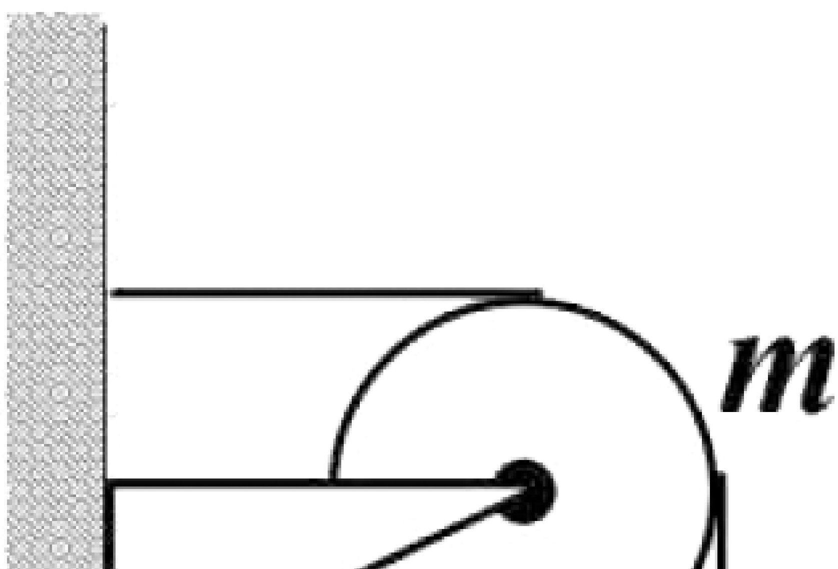
C. `(g)/(1+eta)`

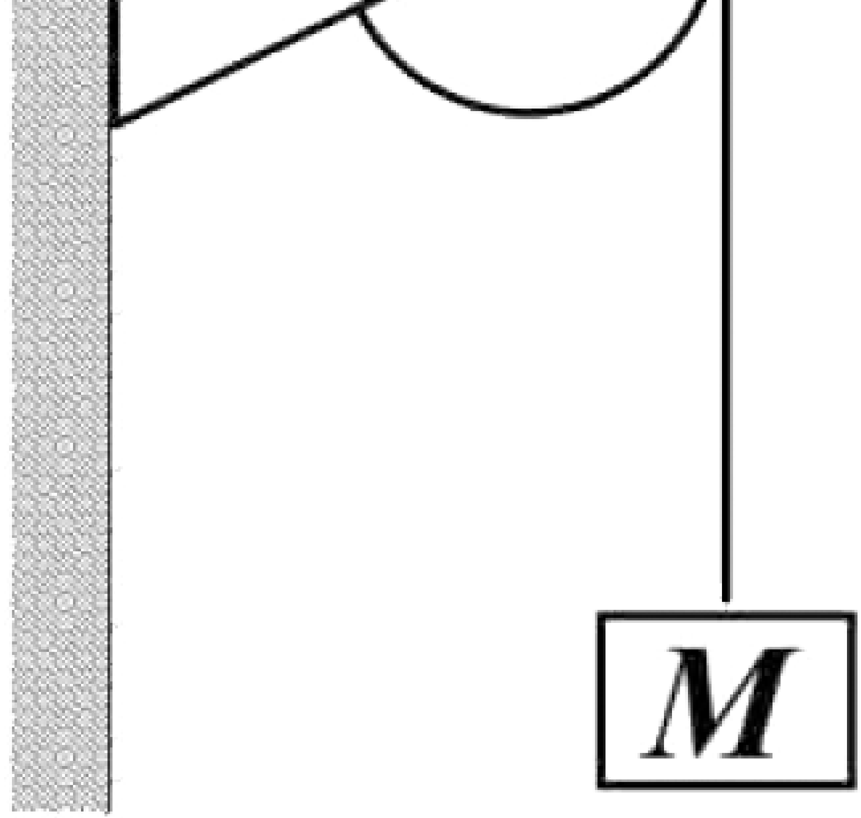
D. `(g)/(2-eta)`

Answer: B

Watch Video Solution

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





A. `sqrt(2)Mg`

B. `sqrt(2)mg`

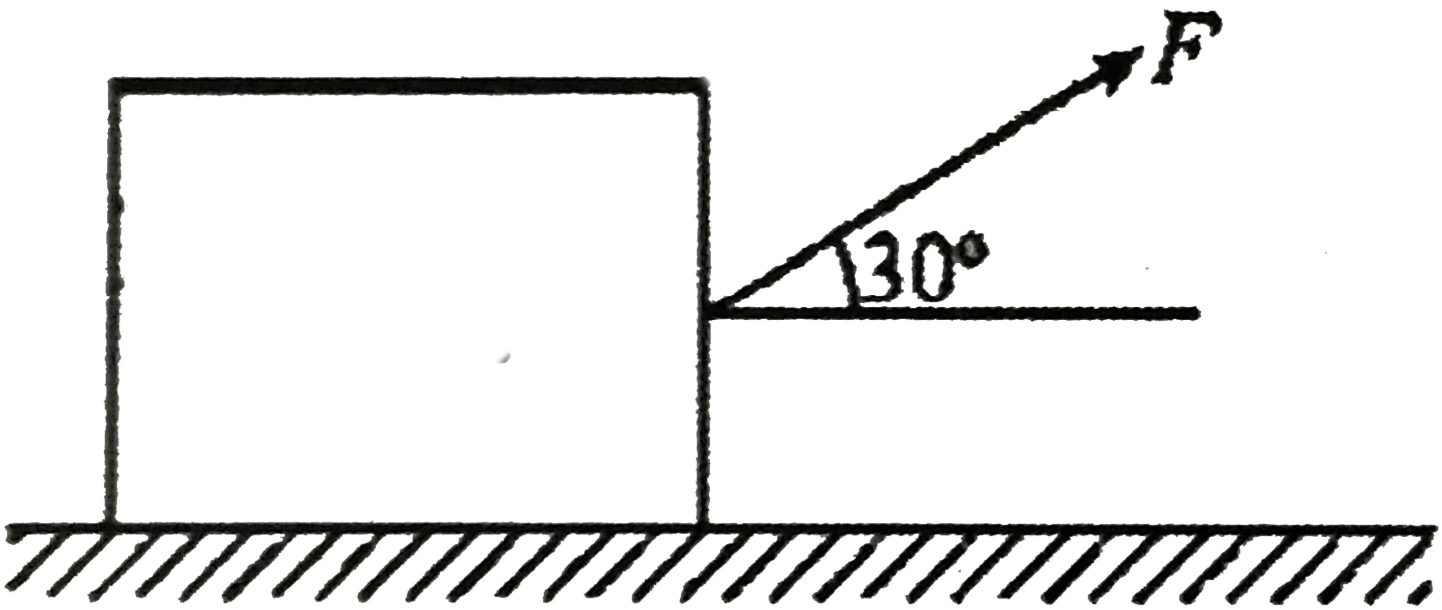
C. `sqrt((M+m)^(2)+m^(2))g`

D. `sqrt((M+m)^(2)+M^(2))g`

Answer: D

Watch Video Solution

48. A mass m rests under the action of a force F as shown in the figure-2.158 on a horizontal surface. The coefficient of friction between the mass and the surface is `mu`. The force of friction between the mass and the surface is :



A. `mumg`

B. `mu[mg+(F)/(2)]`

C. `(Fsqrt(3))/(2)`

D. `mu[mg-(F)/(2)]`

Answer: C

Watch Video Solution

49. A block of mass 0.1 is held against a wall applying a horizontal force of 5N on block. If the coefficient of friction between the block and the wall is 0.5, the magnitude of the frictional force acting on the block is:

A. 0.49 N

B. 0.98 N

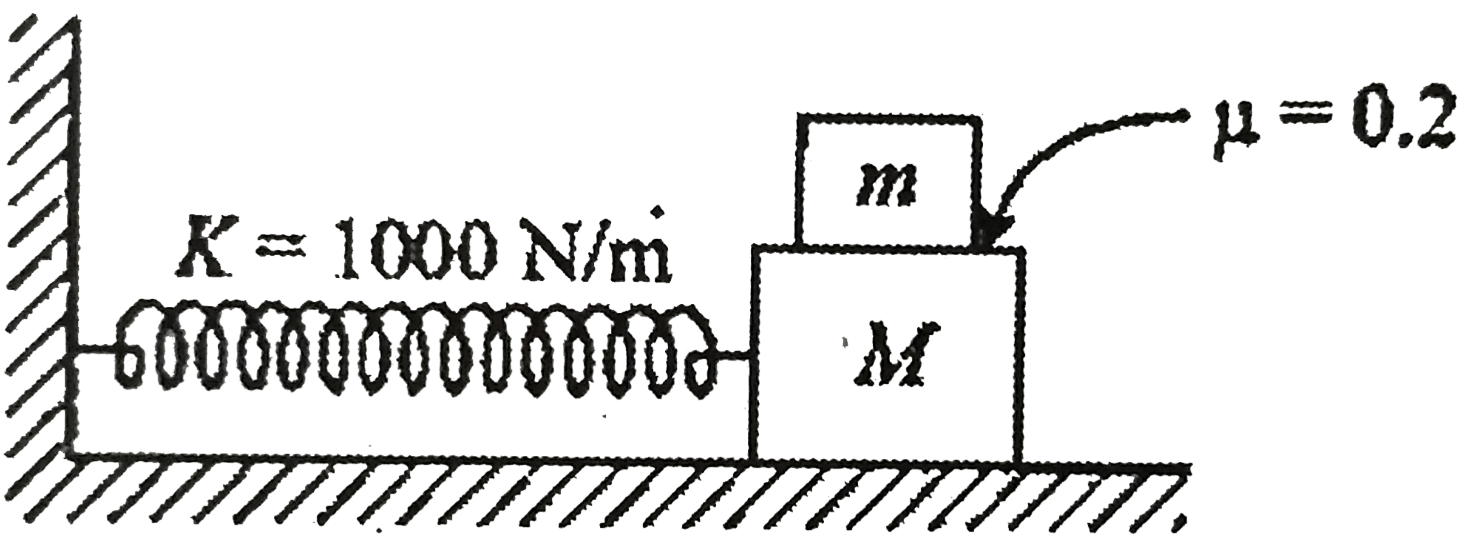
C. 2.5 N

D. 4.9 N

Answer: B

Watch Video Solution

50. A block of mass M = 4 kg is kept on a smooth horizontal plane. A bar of mass m = 1 kg is kept on it. They are connected to a spring as shown & the spring is compressed. Then what is the maximum compression in the spring for which the bar will not slip on the block when released if coefficient of friction between them is 0.2 & spring constant = 1000 N/m : (Take `g=10m//s^(2)`)



Answer: A

Watch Video Solution

51. If Newton is redefined as the force of attraction between two masses (each of 1 kg) 1 meter apart, the value of G is :

A. `10 N Kg^(-2)m^(2)`

B. `0.1 N Kg^(-2)m^(2)`

C. `1 N Kg^(-2)m^(2)`

D. `100 N Kg^(-2)m^(2)`

Answer: C

Watch Video Solution

52. Two weights `w_(1)` and `w_(2)` are suspended from the ends of a light string passing over a smooth fixed pulley. If the pulley is pulled up at an acceleration g , the tension in the string will be

A. `(4W_(1)W_(2))/(W_(1)+W_(2))`

B. `(2W_(1)W_(2))/(W_(1)+W_(2))`

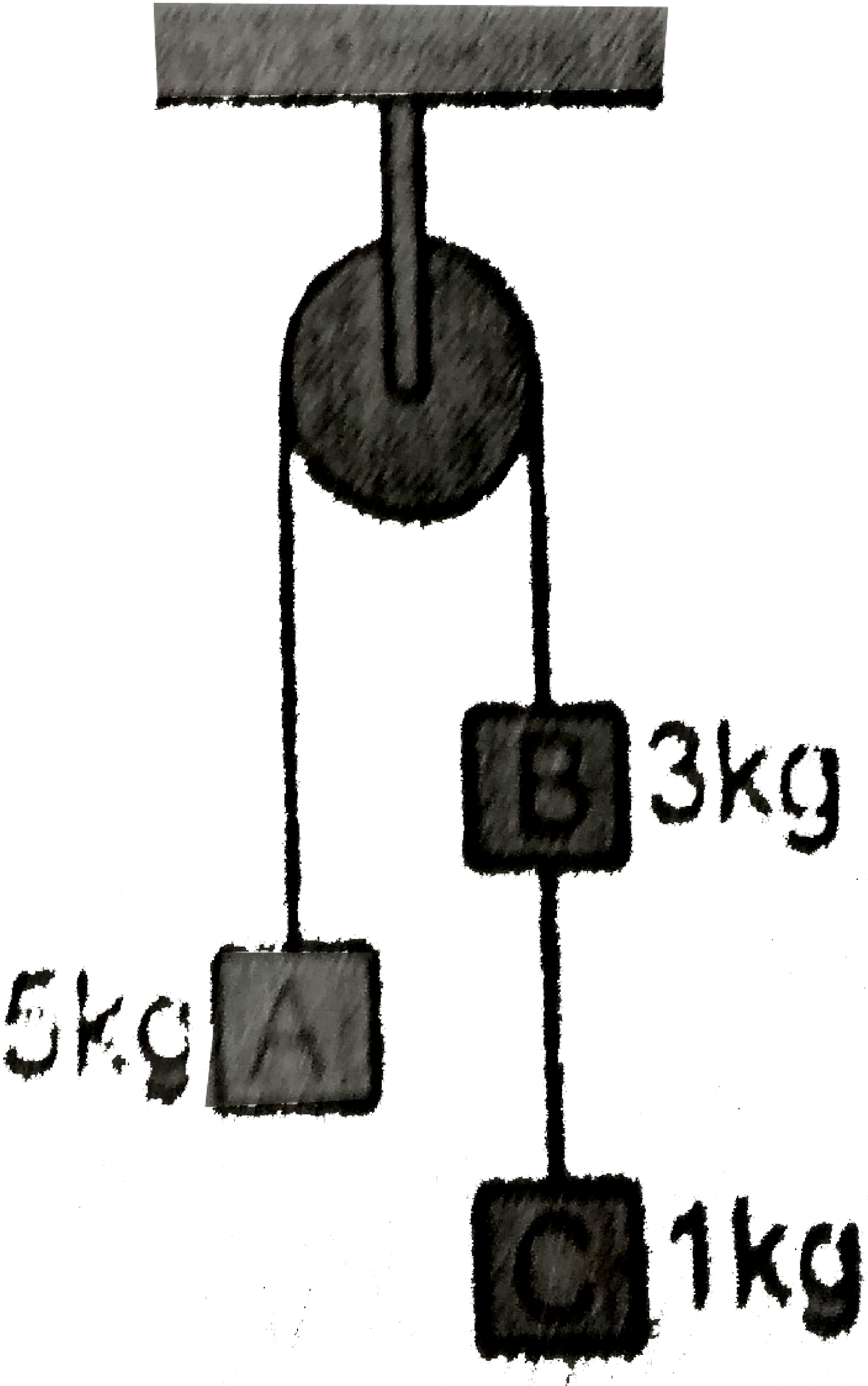
C. `(W_(1)-W_(2))/(W_(1)+W_(2))`

D. `(W_(1)W_(2))/(2(W_(1)+W_(2)))`

Answer: A

Watch Video Solution

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


B
3kg
5kg
A
C
1kg

A. g

B. `g//9`

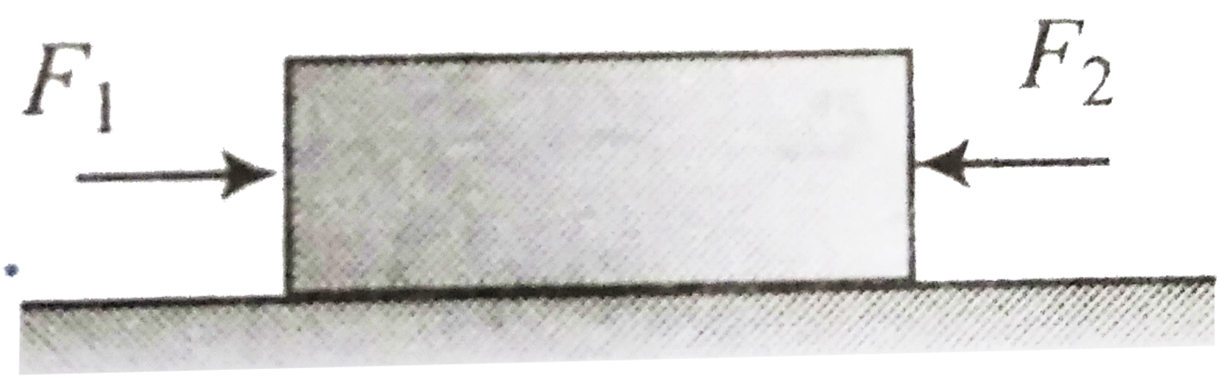
C. `8g//9`

D. `10g//9`

Answer: D

Watch Video Solution

54. Figure shown a wooden block at rest in equilibrium on a rought horizontal plane being acted upon by force `F_(1) = 10 N, F_(2) = 2 N`, as shown .IF`F_(1)` is removed , the resulting force acting on the block will be



A. 2 N towards left

B. 2 N towards right

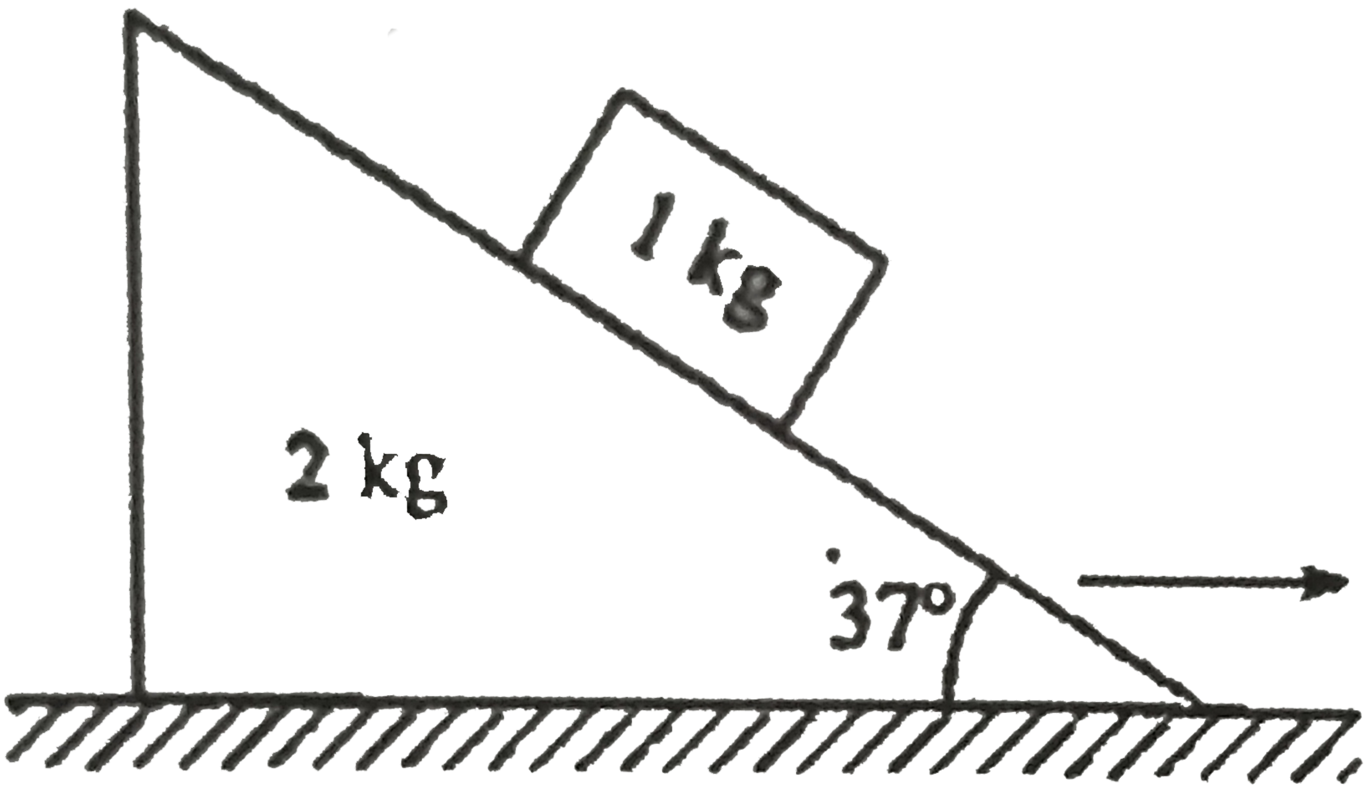
C. 0 N

D. Cannot be determined

Answer: C

Watch Video Solution

55. Figure-2.162 shows a wedge of mass 2kg resting on a fritionless floor. A block of mass 1 kg is kept on the wedge and the wedge is given an acceleration of `5 m//s^(2)` towards right. Then :



A. Block will remain stationary w.r.t. wedge.

B. The block will have an acceleration of `1 m/sec^(2)` w.r.t. the wedge.

C. Normal reaction on the blockis 11N.

D. Net force acting on the wedge is 4 N.

Answer: C

Watch Video Solution

56. A man drags an m kg crate across a floor by pulling on a rope inclined at angle `theta` above the horizontal. If the coefficient of static friction between the floor and crate is then the tension required in the rope to start the crate moving is :

A. `(mu_(s)mg)/((sin theta-mu_(s)costheta))`

B. `(mu_(s)mg)/((sin theta+mu_(s)costheta))`

C. `(mu_(s)mg)/((cos theta-mu_(s)sintheta))`

D. `(mu_(s)mg)/((cos theta+mu_(s)sintheta))`

Answer: D

Watch Video Solution

57. If the coefficient of kinetic friction be in above question then the initial acceleration of the crate will be :

A. `[((T)/(mg))(costheta+mu_(k)sintheta)+mu_(k)]g`

B. `[((T)/(mg))(costheta+mu_(k)sintheta)-mu_(k)]g`

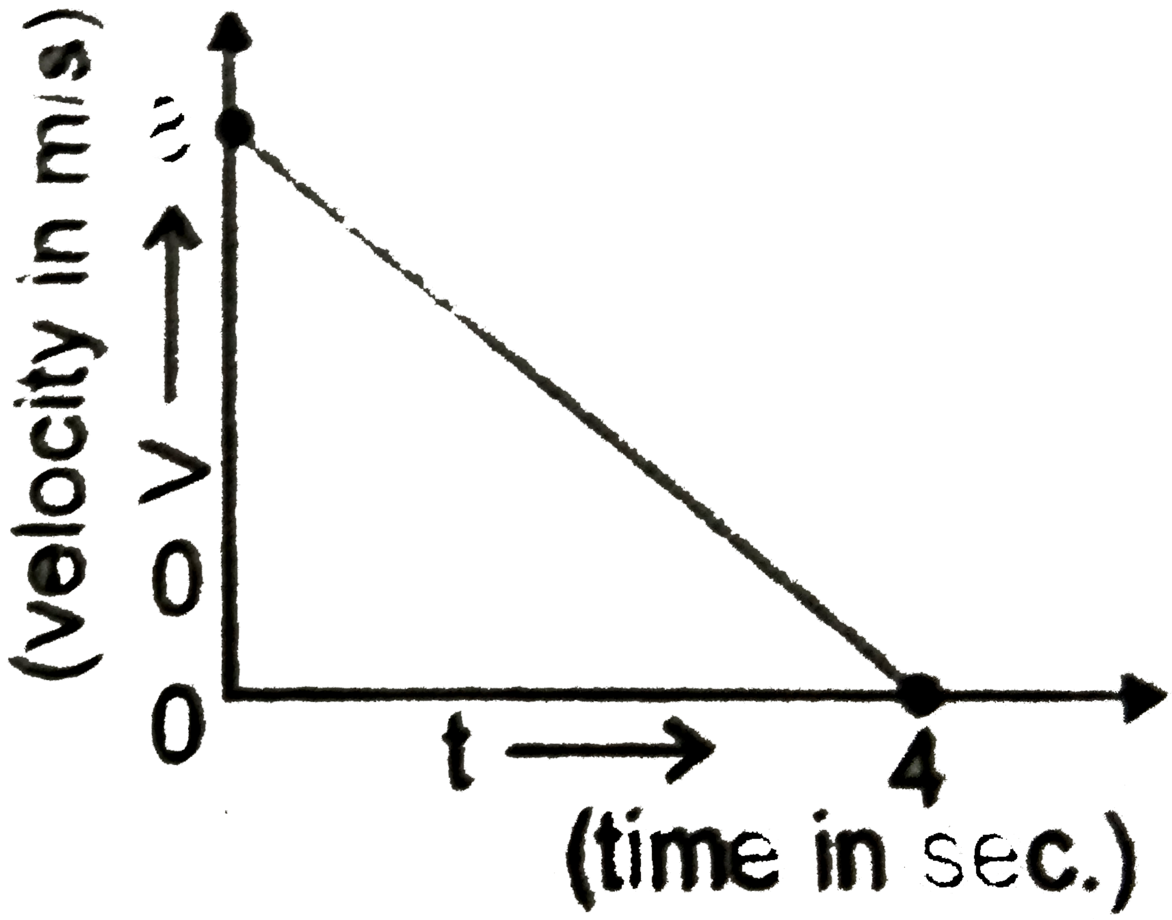
C. `[((T)/(mg))(sintheta+mu_(k)sintheta)-mu_(k)]g`

D. `[((T)/(mg))(sintheta+mu_(k)sintheta)+mu_(k)]g`

Answer: B

Watch Video Solution

58. A block of mass `2 kg` is given a push for a moment horizontally and then the block starts sliding over a horizontal plane. The graph shows the velocity`-` time of the motion. The co`-` efficient of sliding friction between the plane and the block is `:`



A. 0.02

B. 0.2

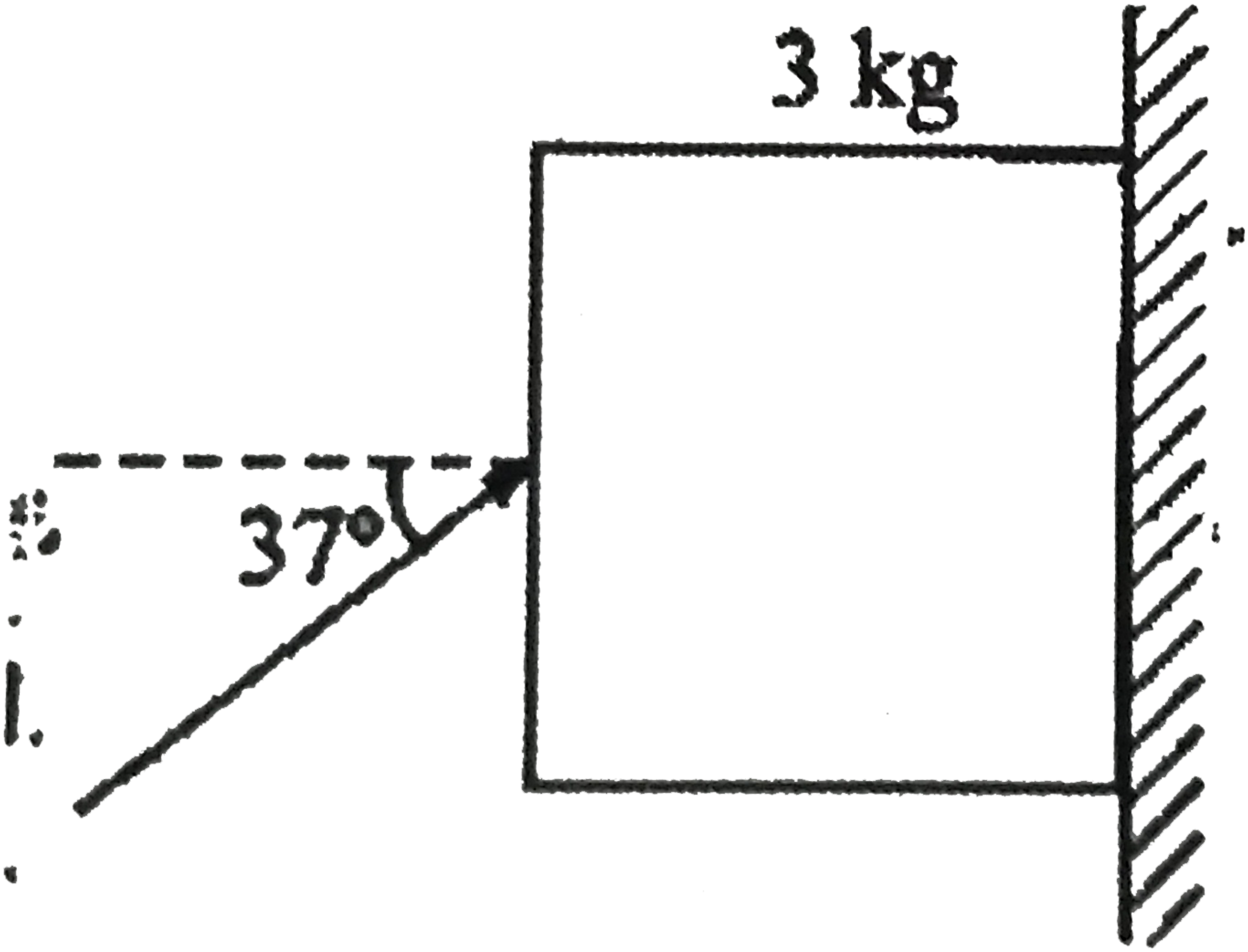
C. 0.04

D. 0.4

Answer: B

Watch Video Solution

59. A force of 100N is applied on a block of mass 3 kg as shown in the figure-2.164. The coefficient of friction between the surface and the block is 0.25.The frictional force acting on the block is: (Take `g=10m/s^(2)`)



A. 15 N downwards

B. 25 N upwards

C. 20 N downwards

D. 30 N upwards

Answer: C

Watch Video Solution

60. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is `5m//s^2`, the frictional force acting on the block is...........newtons.

A. 2 N

B. 3 N

C. 5 N

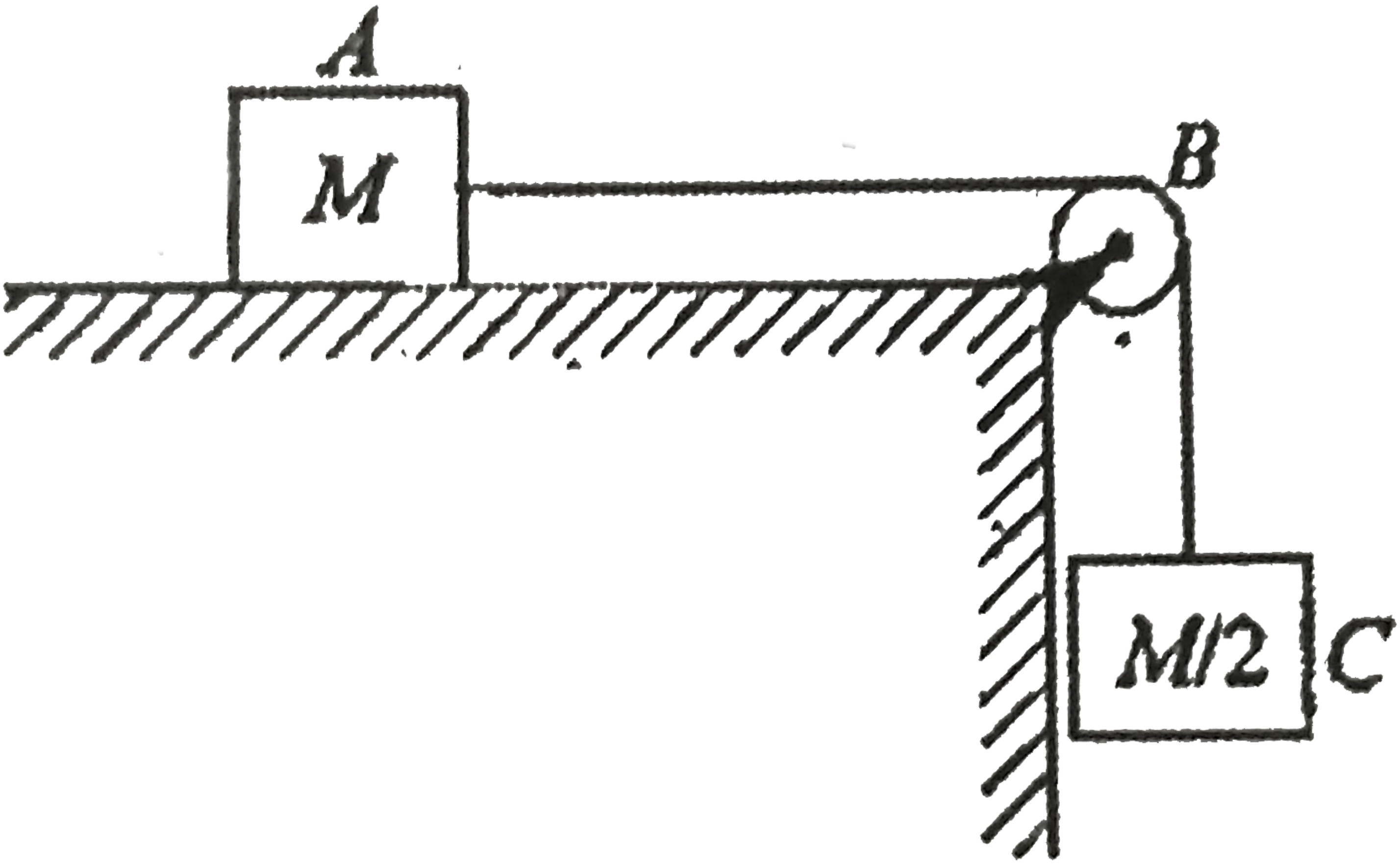
D. 6 N

Answer: C

Watch Video Solution

61. A block of mass M on a horizontal smooth surface is pulled by a load of mass `(M)/(2)` by means ofa rope AB and string BC as shown in the figure-2.165. The length & mass of the rope AB are L and `(M)/(2)`

respectively and BC is massless. As the block is pulled from AB= L t oAB = 0 its acceleration changes from :



A. `(3g)/(4)` to g

B. `(g)/(4)` to `(g)/(2)`

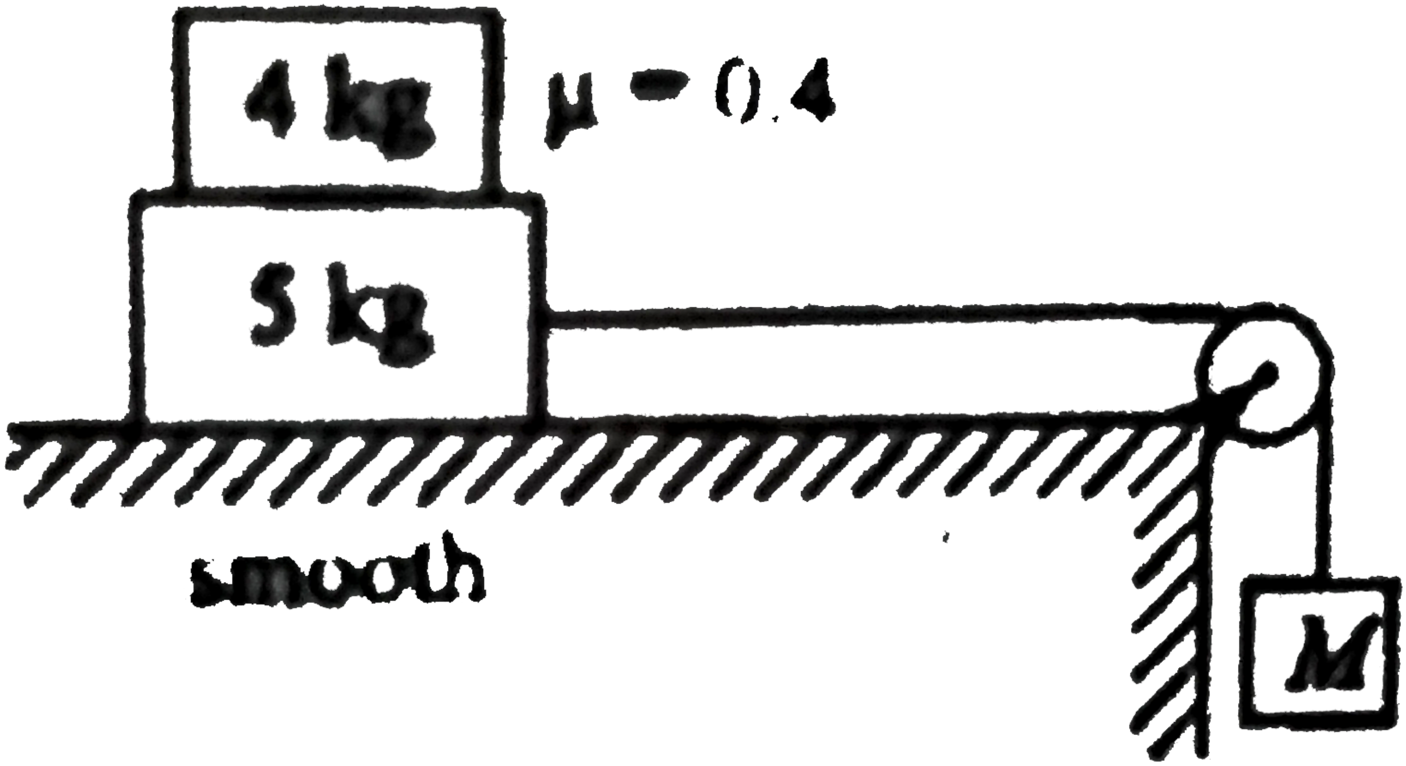
C. `(g)/(4)` to g

D. `(3g)/(2)` to 2g

Answer: B

Watch Video Solution

62. What should be the maximum value of M so that the 4 kg block does not slip over the 5 kg block : (Take `g=10 m//s^(2)`)



A. 12 kg

B. 8 kg

C. 10 kg

D. 6 kg

Answer: D

Watch Video Solution

63. The direction of three forces 1N, 2N and 3N acting at a point,are parallel to the sides of an equilateral triangle taken in order. The magnitude of their resultant is:

A. `sqrt(3) N`

B. `sqrt(3)/(2)N`

C. `(3)/(2)N`

D. Zero

Answer: A

Watch Video Solution

64. A body weighs 6gms when placed in one pan and 24gms when placed on the other pan of a false balance. If the beam is horizontal when both the pans are empty, the true weight of the body is :

A. 13 gm

B. 12 gm

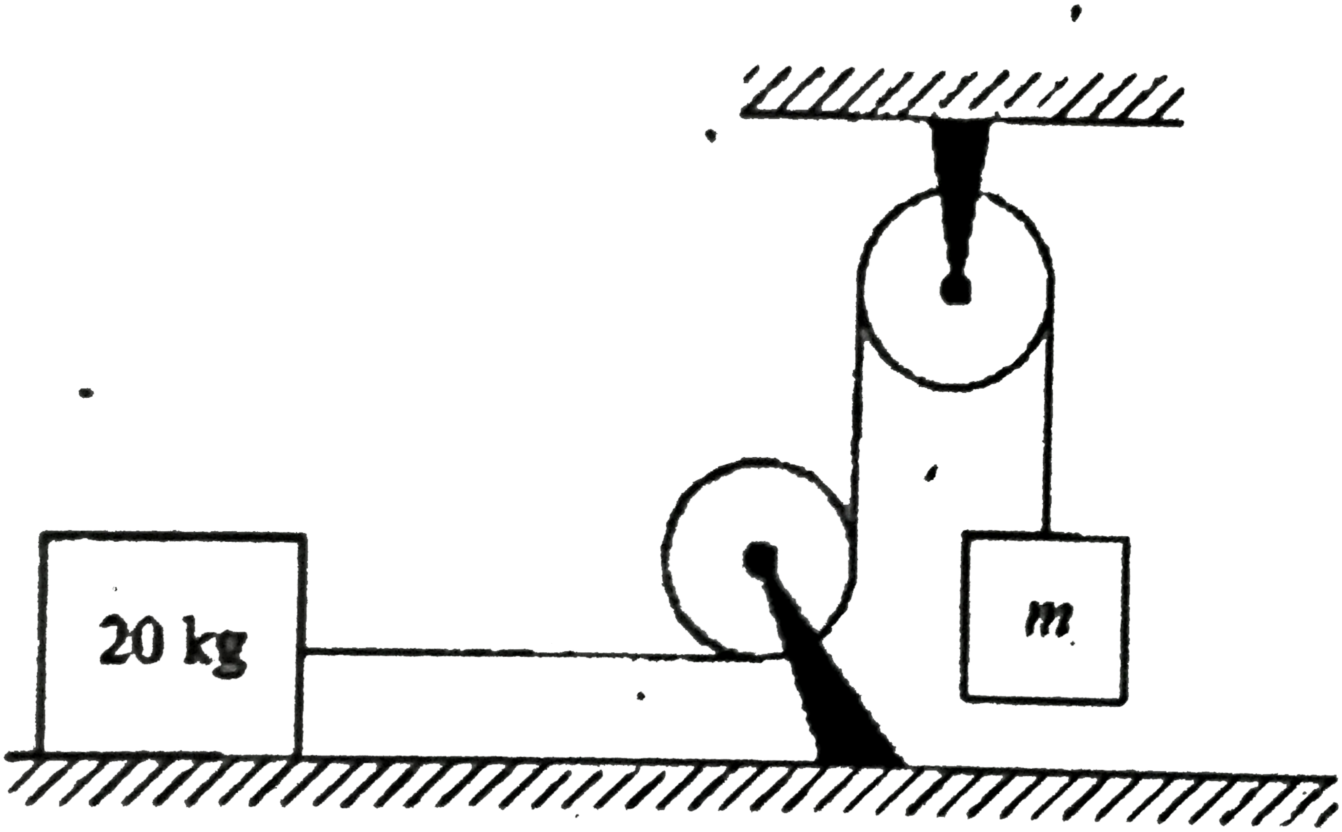
C. 15.5 gm

D. 15 gm

Answer: B

Watch Video Solution

65. A 20 kg block placed on a level frictionless surface is attached to a cord which passes over two small frictionless pulleys,as shown in figure-2.167,to a hanging block originally at rest 1m above the floor. If the hanging block strikes the floor 2 s after the system is released, the weight of the hanging block is :



A. 3.5 N

B. 5.27 N

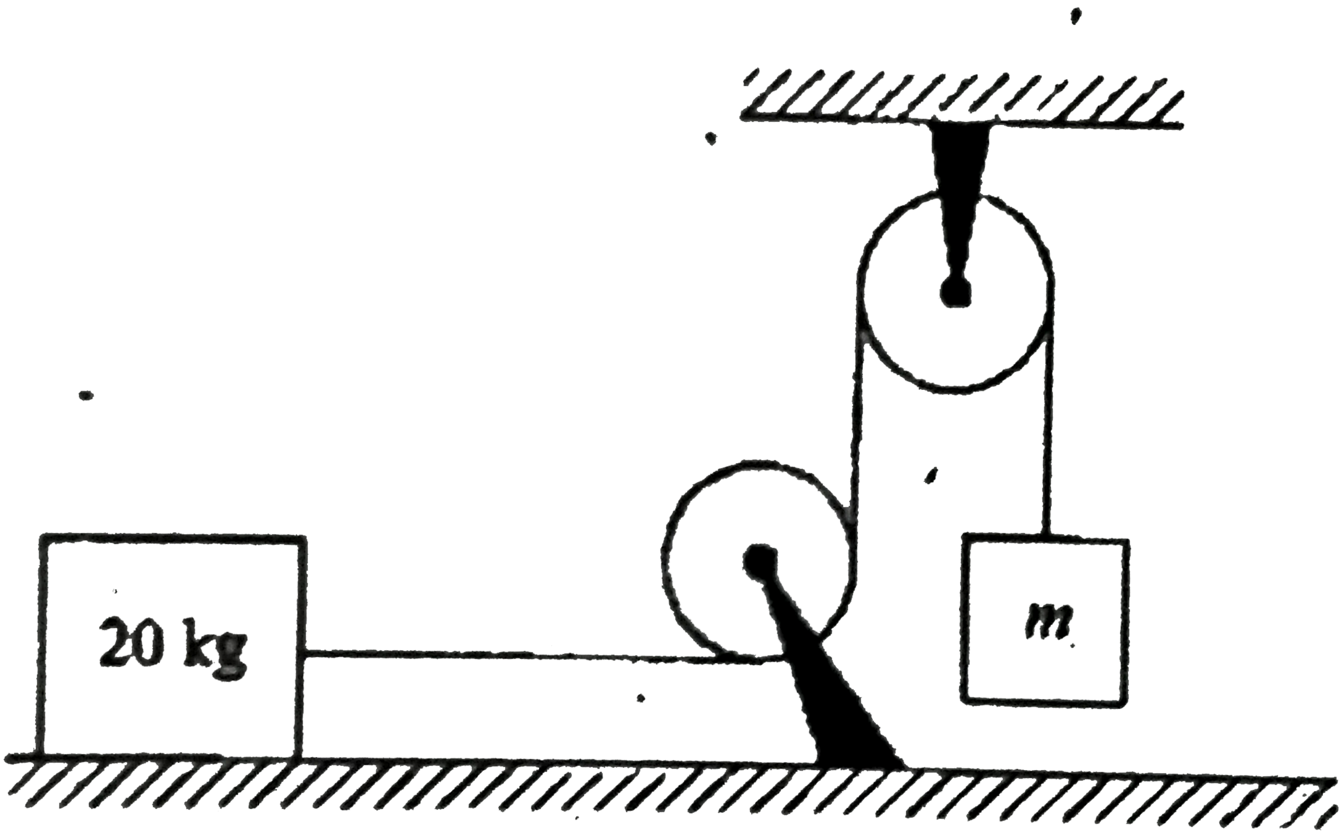
C. 5.4 N

D. 10.54 N

Answer: D

Watch Video Solution

66. For the arrangement shown in figure-2.169, the tension in the string to prevent it from sliding down, is :



A. 6 N

B. 6.4 N

C. 0.4 N

D. None of these

Answer: D

Watch Video Solution

67. A given object takes 3 times as much time to slide downa `45°` rough incline as it takes to slide down a perfectly smooth `45°` incline. The coefficient of friction between the object and the incline is :

A. `1//8`

B. `8//9`

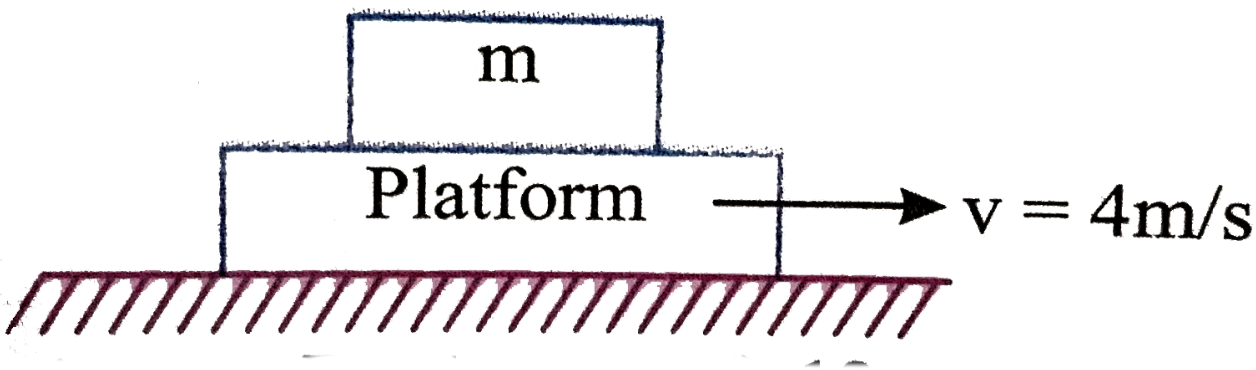
C. `1//2sqrt(2)`

D. `2sqrt(2)//3`

Answer: B

Watch Video Solution

68. A stationary body mass `m` is slowly lowered onto a rough massive plat from moving at a constant velocity `v_(o)=4m//s`. On smooth surface. The distance the body will slide with respect to the plat from `(mu=0.2)` is:



A. 4 m

B. 6 m

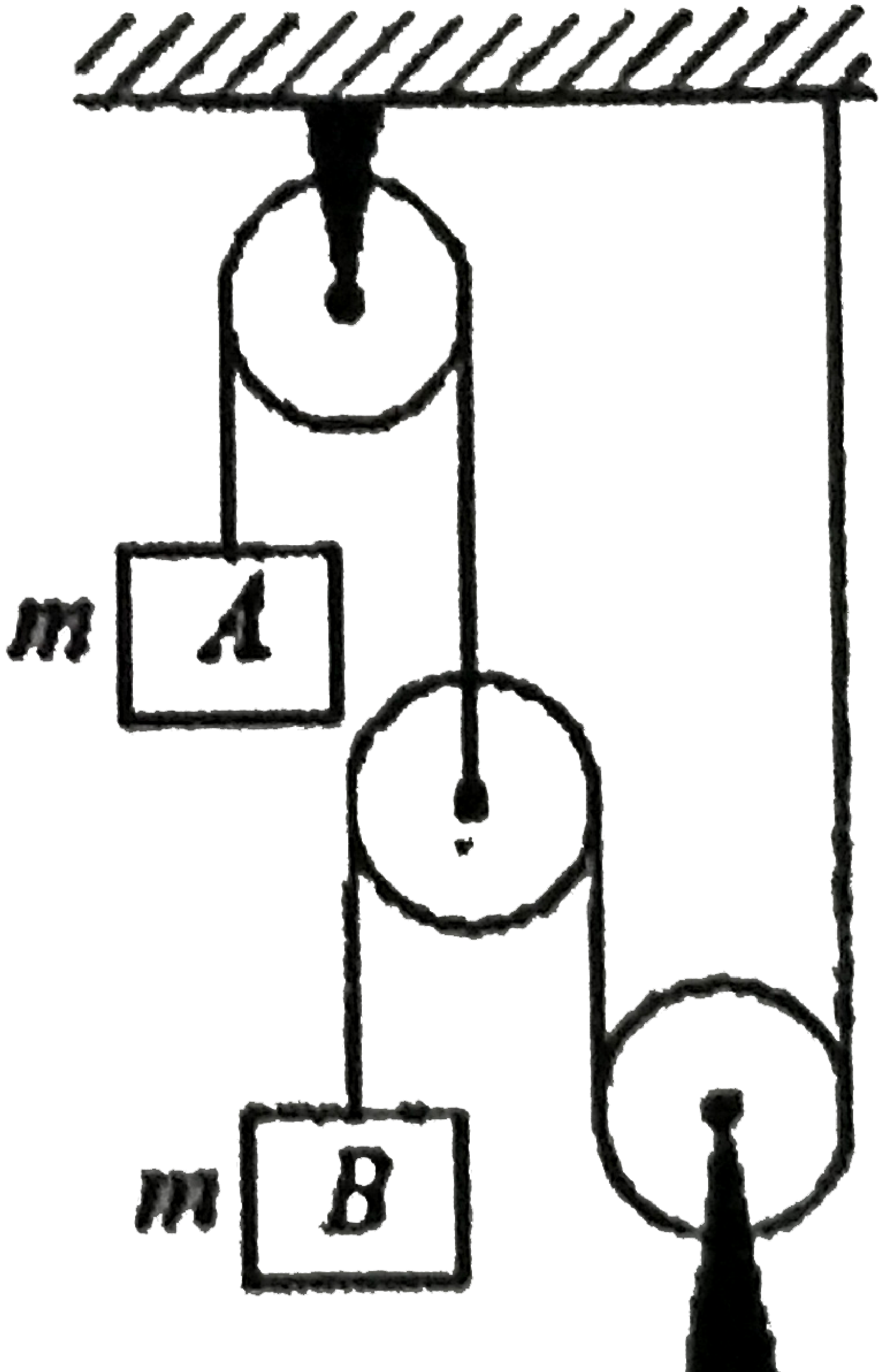
C. 12 m

D. 8 m

Answer: A

Watch Video Solution

69. In the arrangement shown, the pulleys are smooth and the strings are inextensible. The acceleration of block B is :



A. g/5

B. 5g/5

C. 2g/5

D. 2g/3

Answer: C

Watch Video Solution

70. An empty plastic box of mass 9 kg is found to accelerate up at the rate of `g//3` when placed deep inside water. Mass of the sand that should be put inside the box so that it may accelerate down at the rate of `g//4` is :

A. 7 kg

B. 6 kg

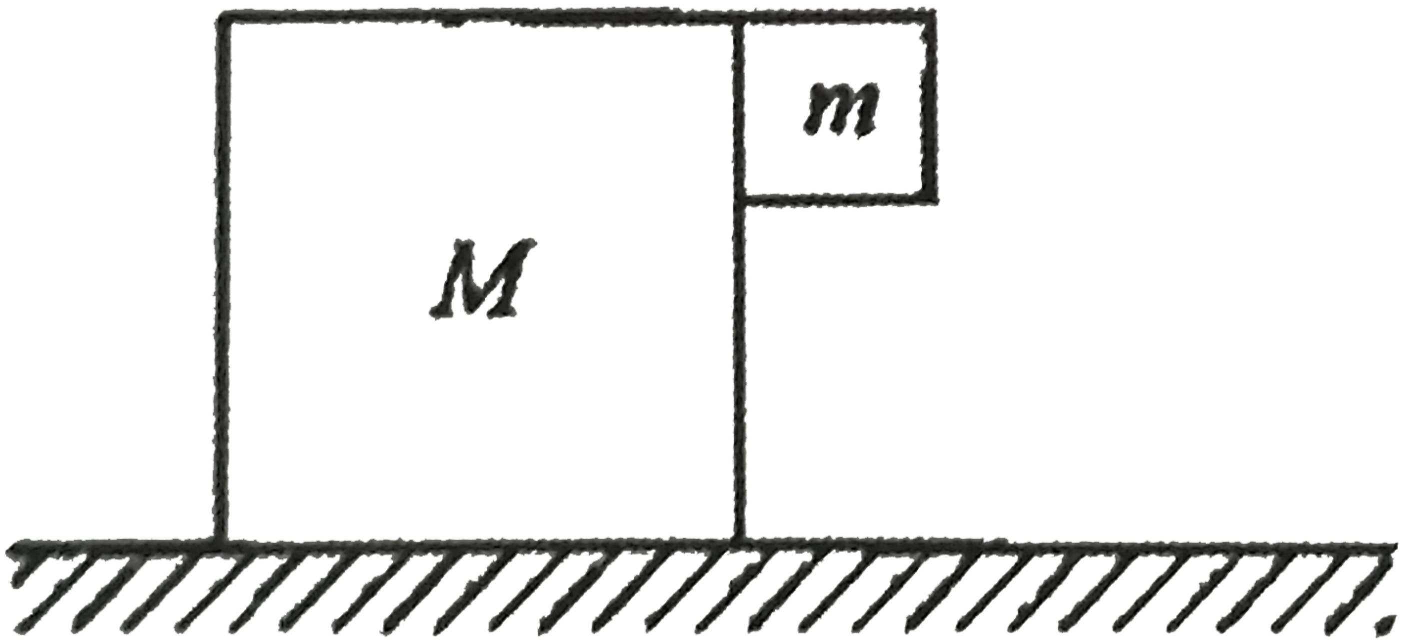
C. 9 kg

D. None of these

Answer: A

Watch Video Solution

71. With what minimum acceleration mass M must be moved on frictionless surface so that m remains stick to it as shown in figure-2.171. The co-efficient of friction between M & m is `mu` :



A. `mug`

B. `(g)/(mu)`

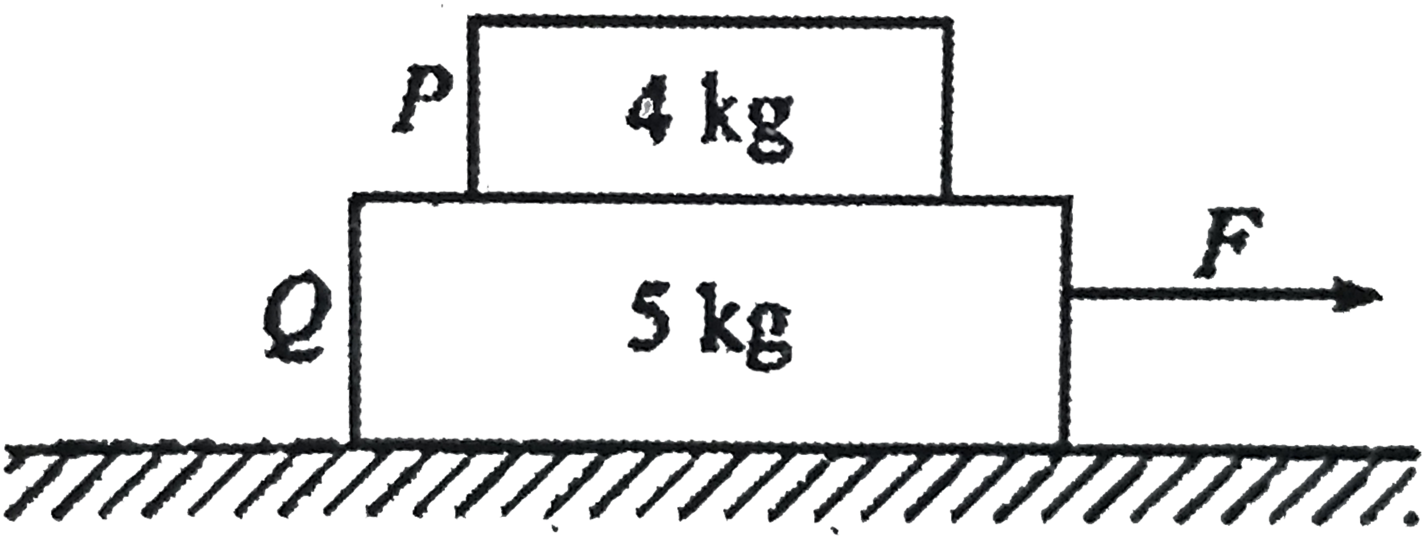
C. `(mumg)/(M+m)`

D. `(mumg)/(M)`

Answer: B

Watch Video Solution

72. The coefficient of friction between 4 kg and 5 kg blocks is 0.2 and between 5 kg block and ground is 0.1 respectively. Choose the correct statement : (Take `g=10m//s^(2)`)



A. Minimum force needed to cause system to move is 17 N

B. When force is 4 N static friction at all surfaces is 4 N to keep system at rest

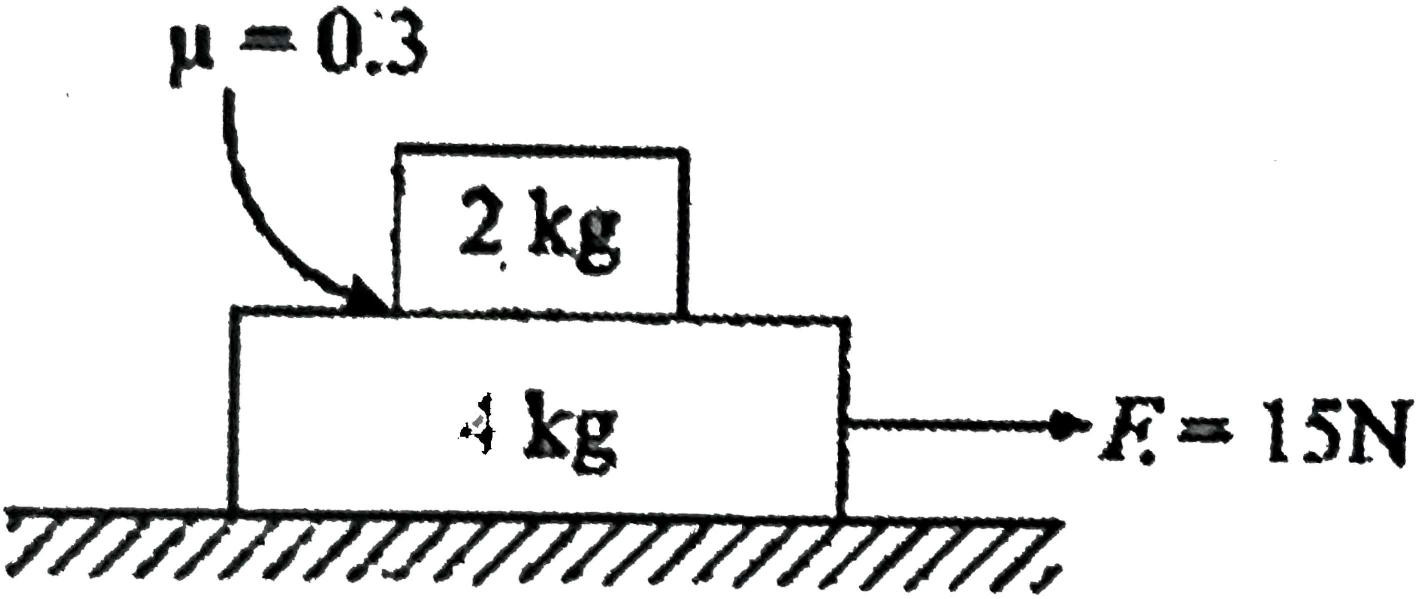
C. Maximum acceleration of 4 kg block is `2 m//s^(2)`

D. Slipping between 4 kg and 5 kg blocks start when F is 17 N

Answer: C

Watch Video Solution

73. Find the friction force between the blocks in the figure-2.173:



A. 6 N

B. 18 N

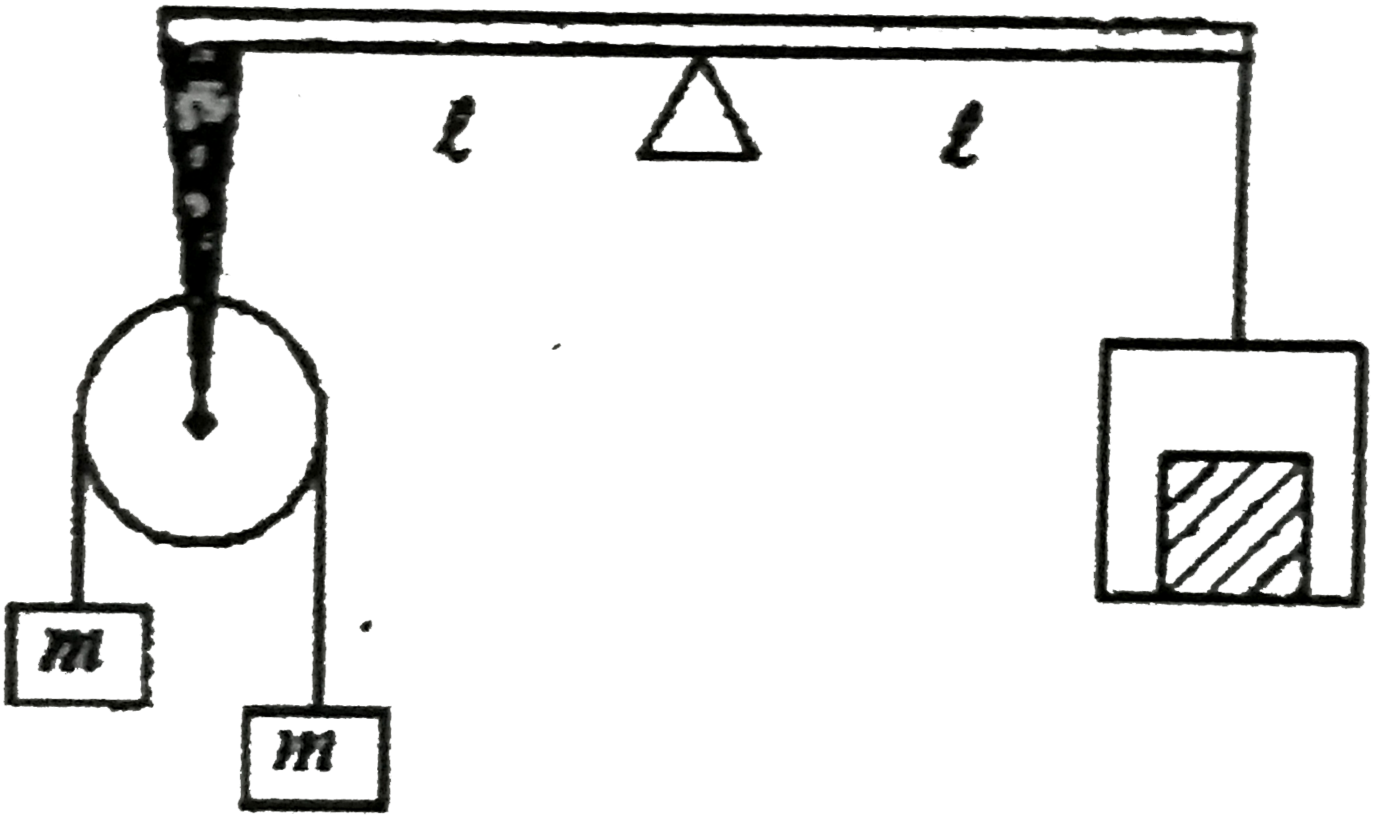
C. 5 N

D. 12 N

Answer: C

Watch Video Solution

74. A pulley is attached to one arm of a balance and a string passed around it carries two masses `m_(1)` and `m_(2)`. The pulley is provided with a clamp due to which `m_(1)` and `m_(2)` do not move. On removing the clamp, `m_(1)` and `m_(2)` start moving. How much change in counter mass has to be made to restore balance ?



A. `((m_(1)+m_(2))^(2))/(m_(1)-m_(2))`

B. `((m_(1)-m_(2))^(2))/(m_(1)+m_(2))`

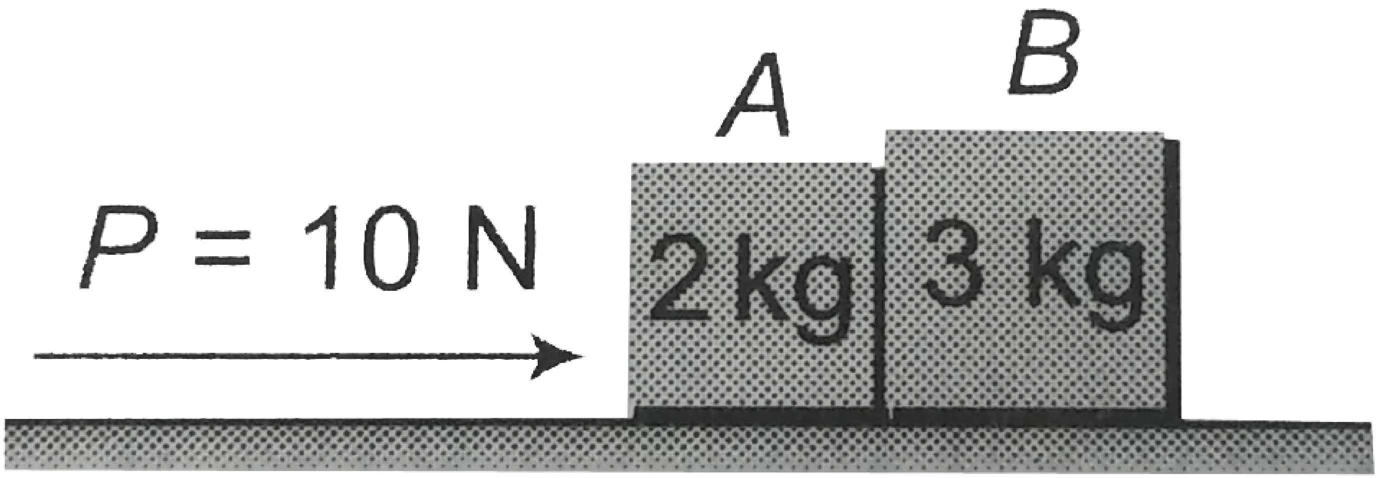
C. `2m_(1)-m_(2)`

D. `m_(1)-m_(2)`

Answer: B

Watch Video Solution

75. Blocks A and B have masses of 2 kg and 3 kg. respectively. The ground is smooth. P is an external force of 10 N. The force exerted by B on A is



A. 4 N

B. 6 N

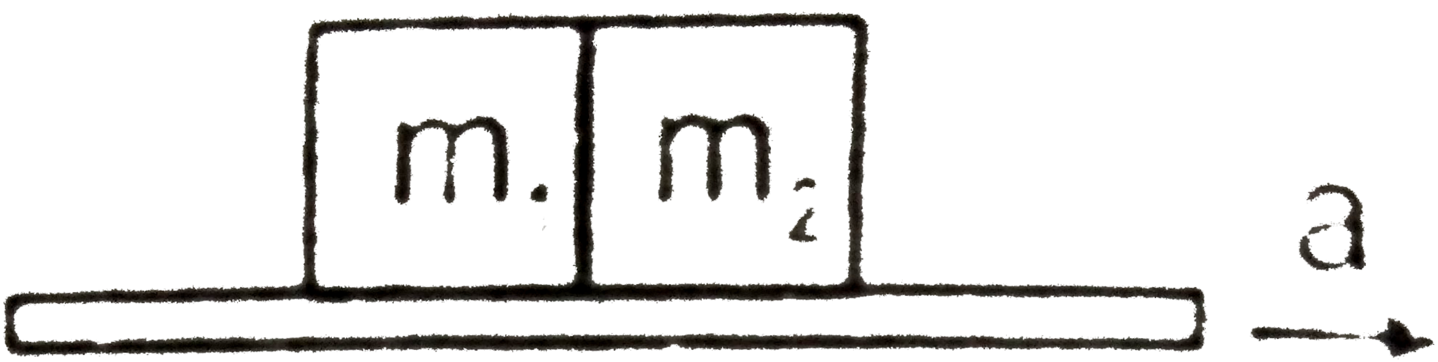
C. 8 N

D. 10 N

Answer: B

Watch Video Solution

76. Two blocks of masses `m_(1)` and `m_(2)` are placed in contact with each other on a horizontal platform. The coefficient of friction between the platform and the two blocks is the same. The platform moves with an acceleration. The force of interaction between the blocks is `:`



A. Zero in all cases

B. Zero only if $m_{1} = m_{2}$

C. Non zero only if $m_{1} > m_{2}$

D. Non zero only if $m_{1} < m_{2}$

Answer: A

Watch Video Solution

77. A body of weight w_1 is suspended from the ceiling of a room through as chain of weight w_2. The ceiling pulls the chain by a force

A. w_{1}

B. w_{2}

C. $w_{1}+w_{2}$

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

Answer: C

Watch Video Solution

78. A horizontal uniform rope of length L, resting on a frictionless horizontal surface, is pulled at one end by force F. What is the tension in the rope at a distance l from the end where the force is applied?

A. $\frac{F(y-x)}{y}$

B. `(F.y)/(y-x)`

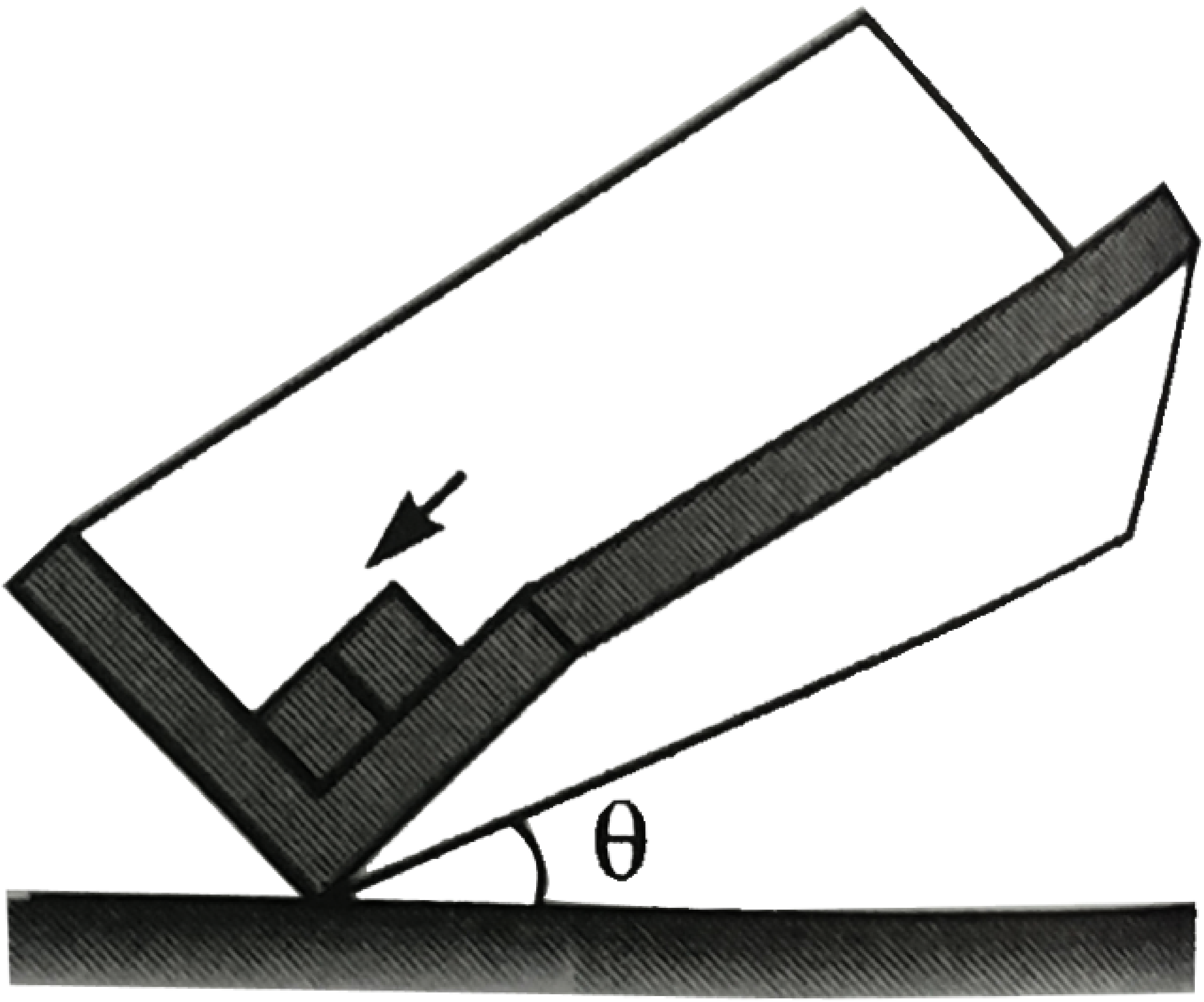
C. `(F.y)/(x)`

D. `(F.y)/(y)`

Answer: A

Watch Video Solution

79. A block of mass `m` slides down an inclined right angled trough .If the coefficient of friction between block and the trough is `mu_(k)` acceleration of the block down the plane is



A. `(costheta-musintheta)g`

B. `(sintheta-musintheta)g`

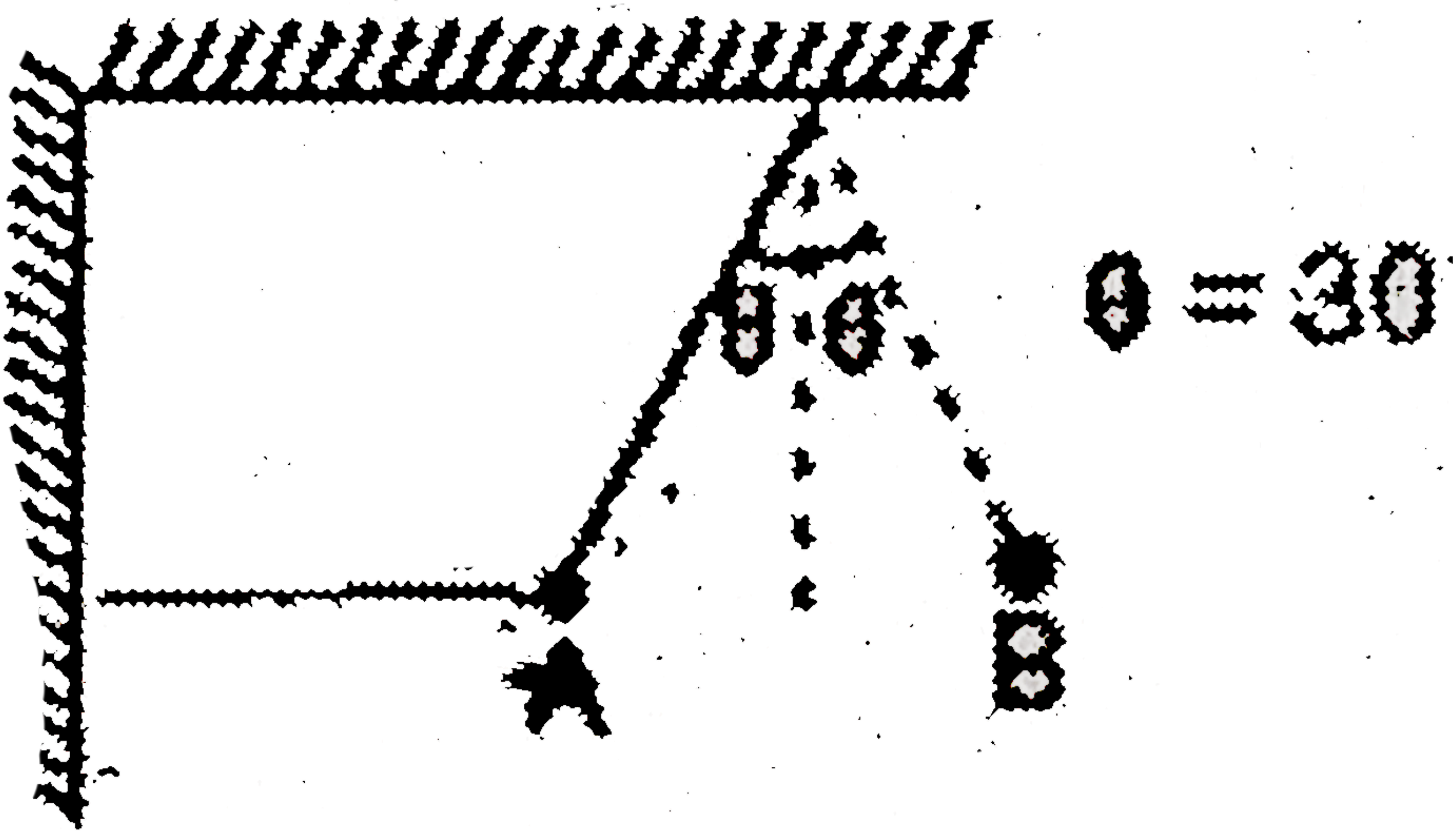
C. `(sintheta-mucostheta)g`

D. `(sintheta-sqrt(2)mucostheta)g`

Answer: D

Watch Video Solution

80. A ball is held at rest in position A by two light cords. The horizontal cord is now cut and the ball swings to the position B. What is the ratio of the tension in the cord in position B to that in position A?



A. 3

B. `3//4`

C. `1//2`

D. 1

Answer: B

Watch Video Solution

81. A boy standing on a weighing machine notices his wight as 400 N. When he suddenly jumps upward the weight shown by the machine becomes 600 N. The acceleration with which the boy jumps up is : (Take `g=10m//s^(2)`)

A. `5 ms^(-2)`

B. `3.4 ms^(-2)`

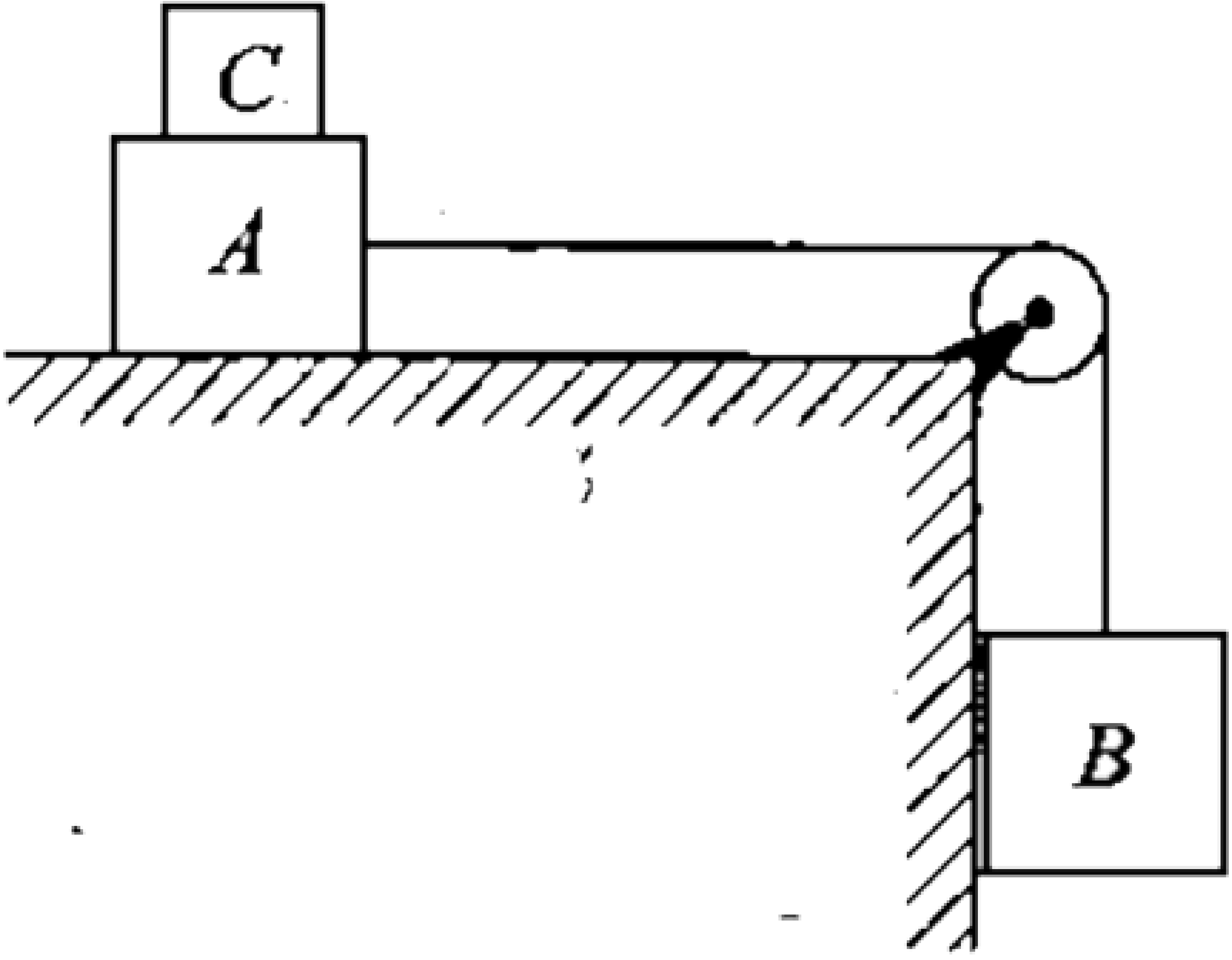
C. `6 ms^(-2)`

D. `9.8 ms^(-2)`

Answer: A

Watch Video Solution

82. Two mass A and B of 5 kg and 6 kg are connected by a string passing over a frictionless pulley fixed at the corner of table as shown in figure-2.179. The coefficient of friction between A and the table is 0.3. The minimum mass of C that must be placed on A to prevent it from moving is equal to : (Take `g=10ms^(2)`)



A. 15 kg

B. 10 kg

C. 5 kg

D. 3 kg

Answer: A

Watch Video Solution

83. A heavy body of mass `25kg` is to be dragged along a horizontal plane (`mu` = `(1)/(sqrt(3))`. The least force required is `(1 kgf = 9.8 N)`

A. 25kgf

B. 2.5kgf

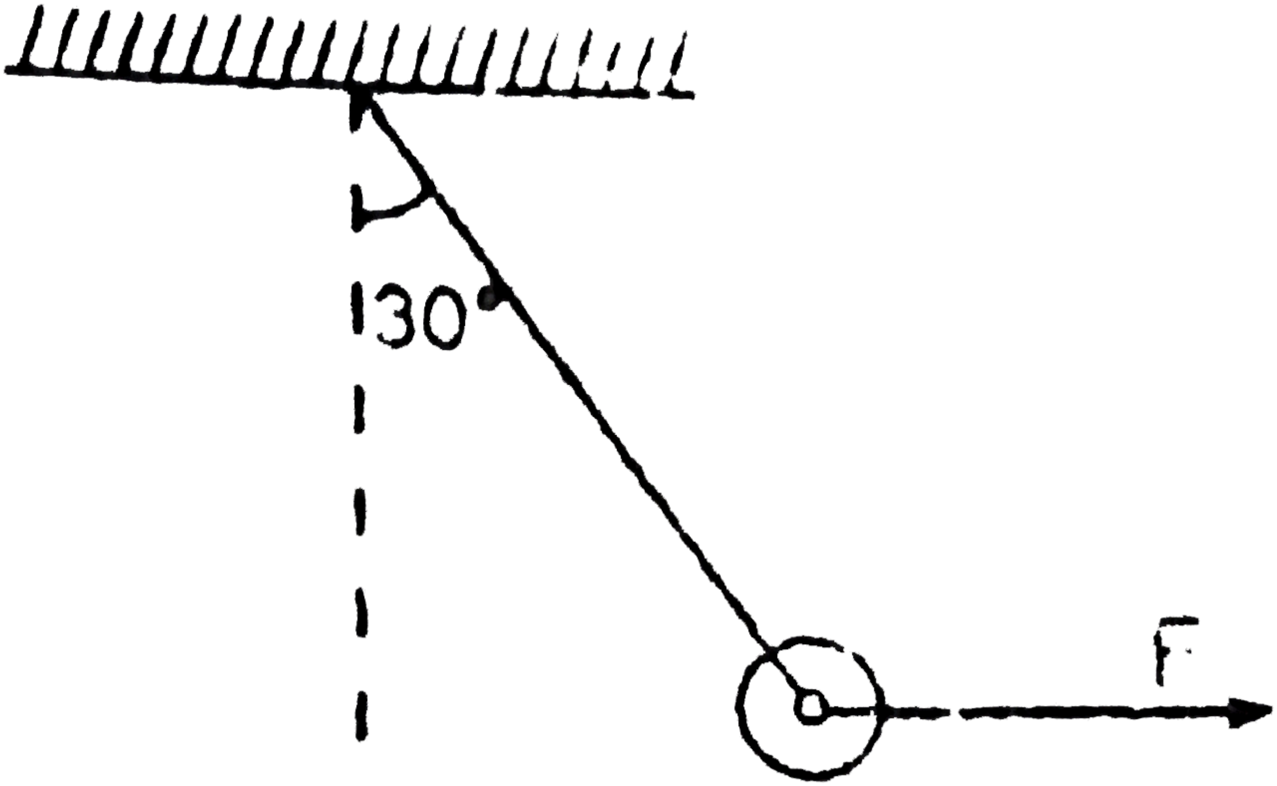
C. 12.5kgf

D. 50kgf

Answer: C

Watch Video Solution

84. A heavy particle of mass `1kg` suspended from a massless string attached to a roof. A horizontal force F is applied to the particle such that in the equilibrium position the string makes and angle `30^(@)` with the vertical. The magnitude of the force F equals



A. 10 N

B. `10 sqrt(3) N`

C. 5 N

D. `10//sqrt(3) N`

Answer: D

Watch Video Solution

85. The human body can safely stand an acceleration 9 times that due to gravity which is `10 m//s^(2)`. The minimum radius of curvature with which a pilot may safely turn a plane vertically upward at the end of a dive, when the plane's speed is 720km/hr is :

A. 500 m

B. 612 m

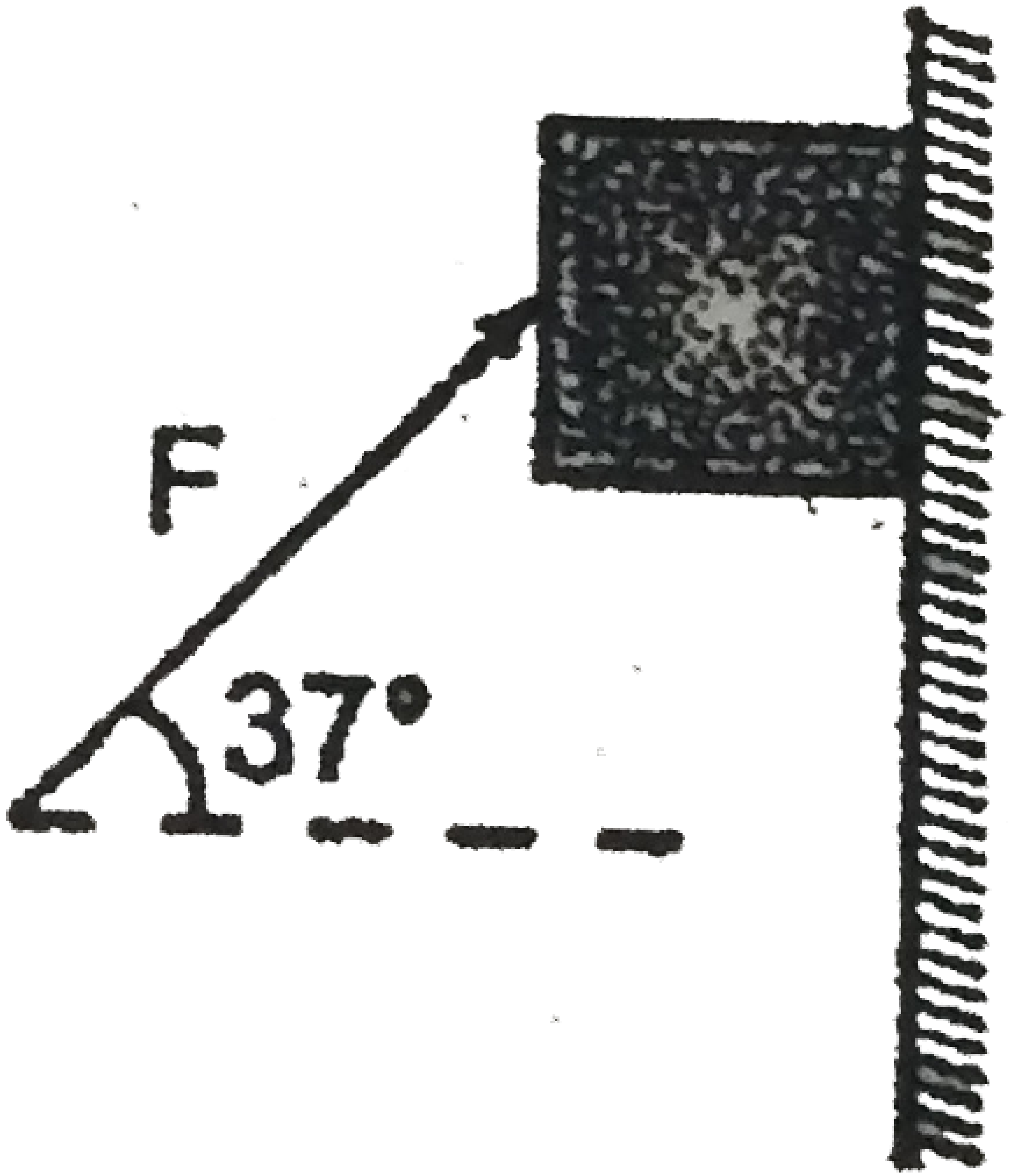
C. 475 m

D. 323 m

Answer: A

Watch Video Solution

86. A 1 kg block is being pushed against a wall by a force F=75N as shown in the figure. The coefficient of friction is 0.25. The magnitude of acceleration of the block is:



A. `10 m//s^(2)`

B. `20 m//s^(2)`

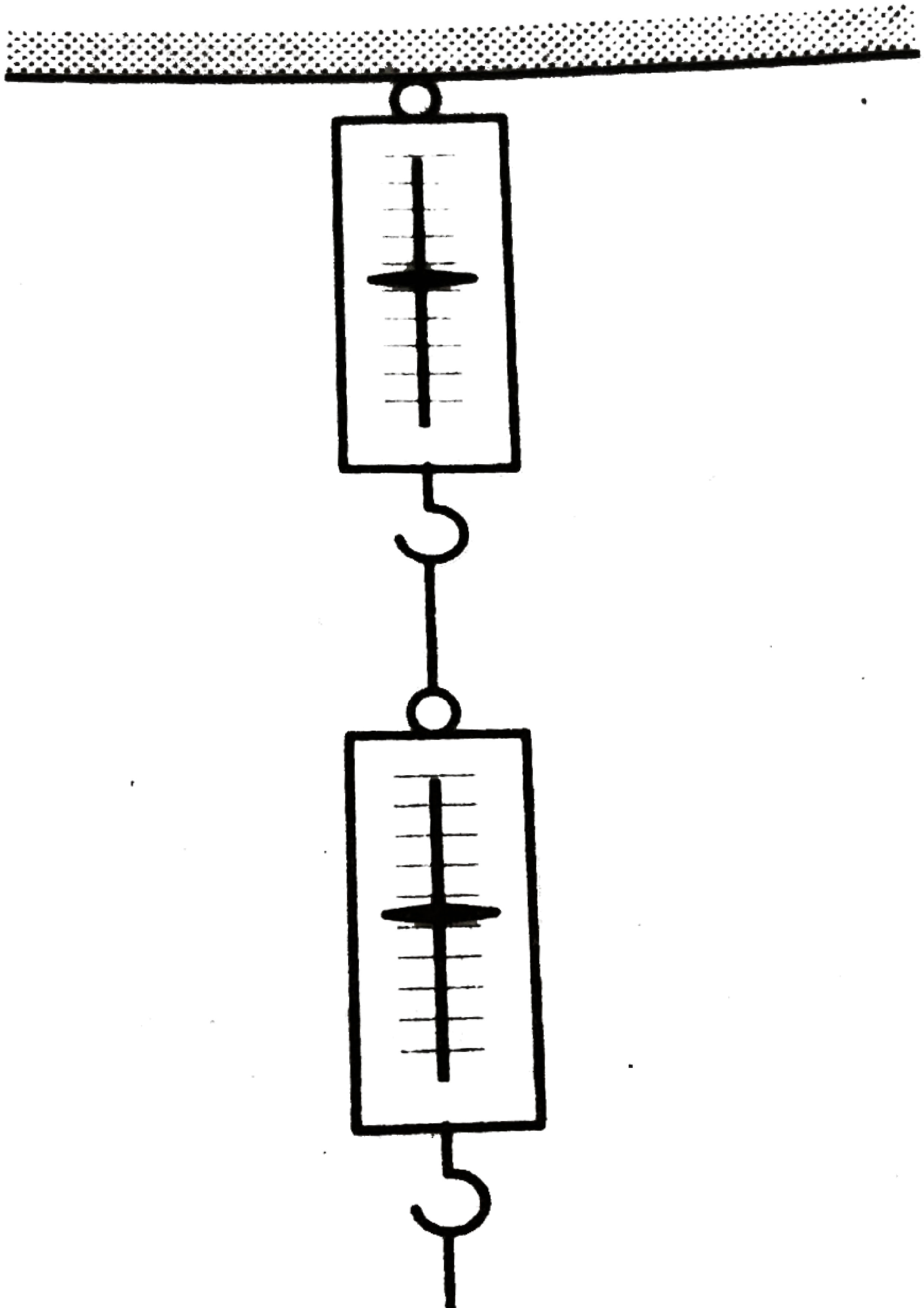
C. `5 m//s^(2)`

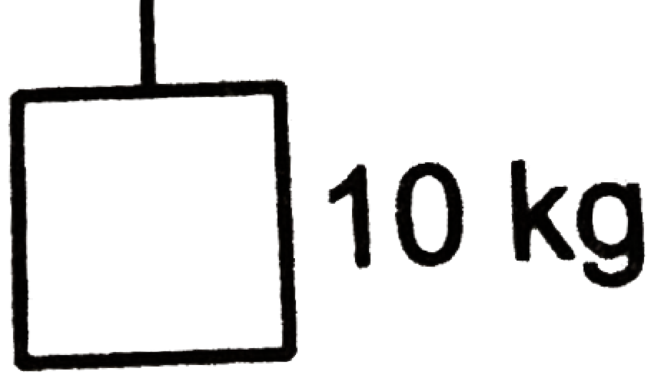
D. None

Answer: B

Watch Video Solution

87. A block of mass 10 kg is suspended through two light spring balances as shown in figure





A. Both the scales will read 10 kg

B. Both the scales will read 5 kg

C. The upper scale will read 10 kg and the lower zero.

D. The reading may be anything but their sum will 10 kg.

Answer: A

Watch Video Solution

88. Three rigit rods are joined to form an equilaterla triangle ABC of side 1 m. Three particles carrying charges `20 muC` each are attached to the vertices of the triangle. The whole system is at rest in an inertial frame. The resultant force on the charged particle. A has the magnitude.

A. Zero

B. 3.6 N

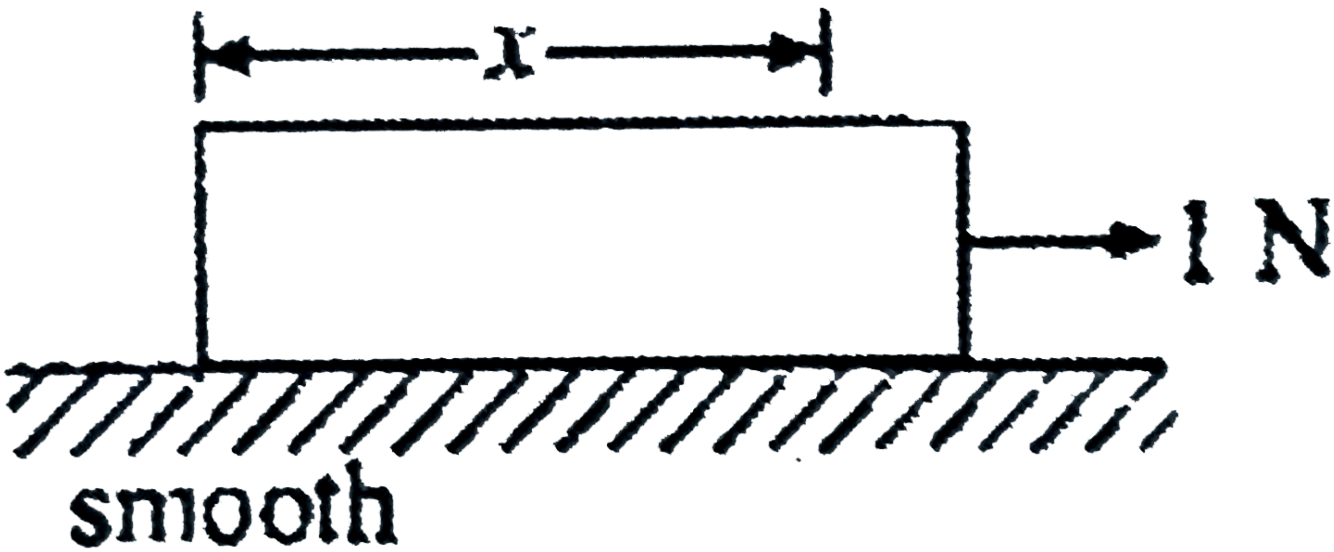
C. `3.6 sqrt(3)N`

D. 7.2 N

Answer: A

Watch Video Solution

89. A rope of length L has its mass per unit langth `lambda` varies according to the function `lambda(x)=e^(x//L)`. The rope is pulled by a constant force of 1 N on a smooth horizontal surface. The tension in the rope at `x=L//2` is :



A. 0.50 N

B. 0.38 N

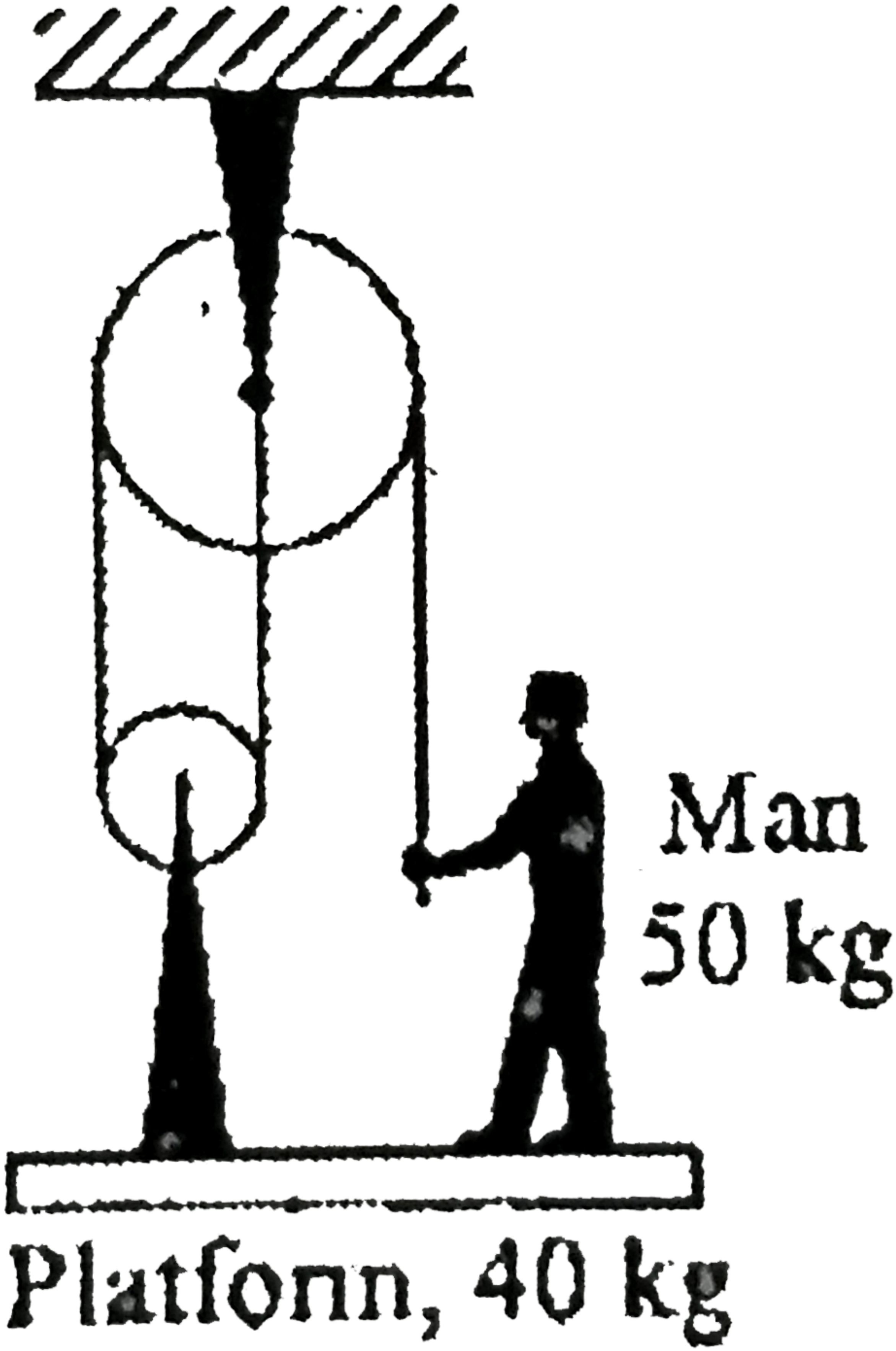
C. 0.62 N

D. None

Answer: B

Watch Video Solution

90. What force must man exert on rope to keep platform in equilibrium : (Take `g=10m//s^(2)`)



A. 100N

B. 200N

C. 300N

D. 500N

Answer: C

Watch Video Solution

Advance MCQs

1. A particle is acted upon by a force of constant magnitude which is always perpendiculr to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

A. Its velocity is constant

B. Its acceleration is constant

C. Its kinetic energy is constant

D. It moves in a circular path

Answer: C::D

Watch Video Solution

2. A reference frame attached to the earth

A. Is the inertial frame as motion of earth is at uniform speed.

B. Cannot be the inertial frame because earth is revolving around the sun

C. Is an inertial frame because Newton's Law are applicable in this frame

D. Cannot be the inertial frame because earth is rotating about its own axis

Answer: B::D

Watch Video Solution

3. When a bicycle is motion the force of friction exerted by the ground on the two wheels is such that is acts

.

A. In the backward direction on the front wheel and in the forward direction on the rear wheel.

B. In the forward direction on the front wheel and in the backward direction on the rear wheel.

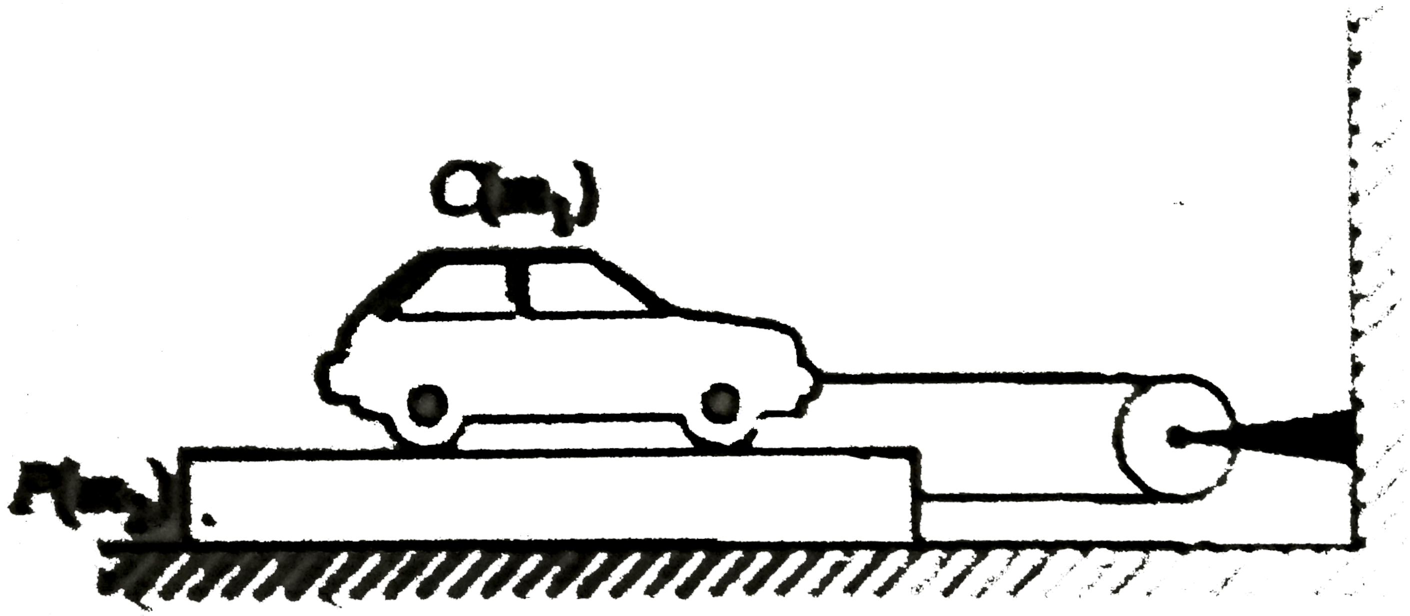
C. In the backward direction on both the front and on the rear wheel.

D. In the forward direction on both the front and on the rear wheel

Answer: A::C

Watch Video Solution

4. A car C of mass `m_(1)`, rests on a plank of mass `m_(2)`. The plank rests on a smooth floor. The string and pulley are ideal. The car starts and moves towards the pulley with certain acceleration :



A. If `m_(1) gt m_(2)`, the string will remain under tension

B. If `m_(1) lt m_(2)`, the string will become slack

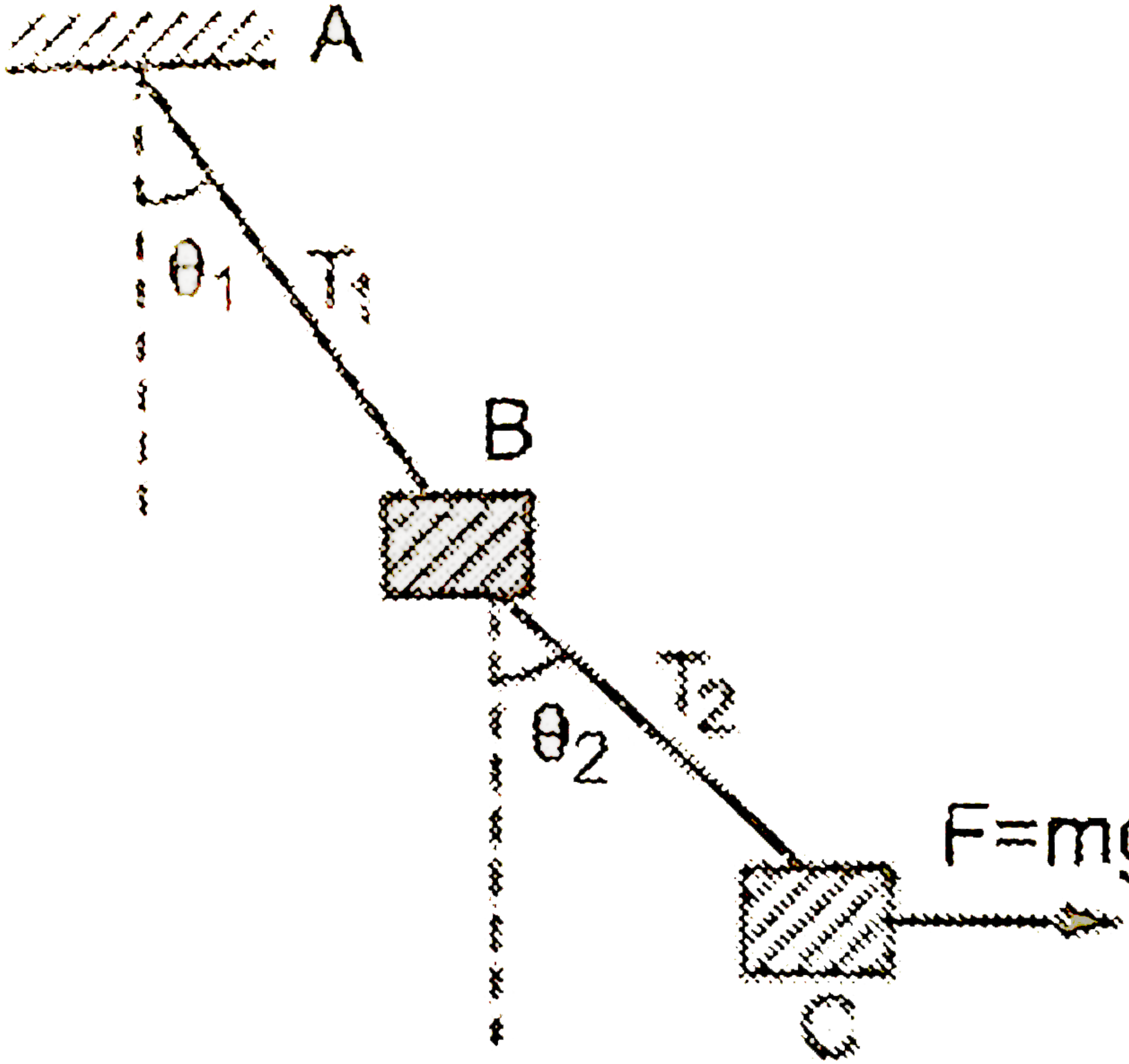
C. If `m_(1)=m_(2)`, the string will have no tension, and C and P will have accelerations of equal magnitudes

D. C and P will have acceleration of equal magnitude if `m_(1) ge m_(2)`

Answer: A::B::C::D

Watch Video Solution

5.



The blocks B and C in the figure have mass m each. The strings AB and BC are light, having tensions T_1 and T_2 respectively. The system is in equilibrium with a constant horizontal force mg acting on C.

A. $\tan\theta_1=\frac{1}{2}$

B. $\tan\theta_2=1$

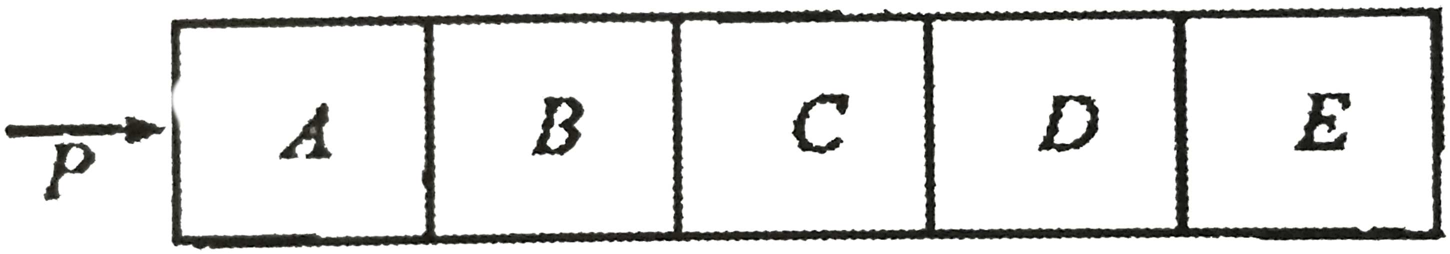
C. $T_1=\sqrt{5}mg$

D. $T_2=\sqrt{2}mg$

Answer: A::B::C::D

Watch Video Solution

6. Five identical cubes each of mass 'm' are on a straight line with two adjacent faces in contact on a horizontal surface as shown in the figure-2.187. Suppose the surface is frictionless and a constant force P is applied from left to right to the end face of A. which of the following statements are correct :



A. The acceleration of the system is `(5P)/(m)`

B. The resultant force acting on each cube is `(P)/(5)`

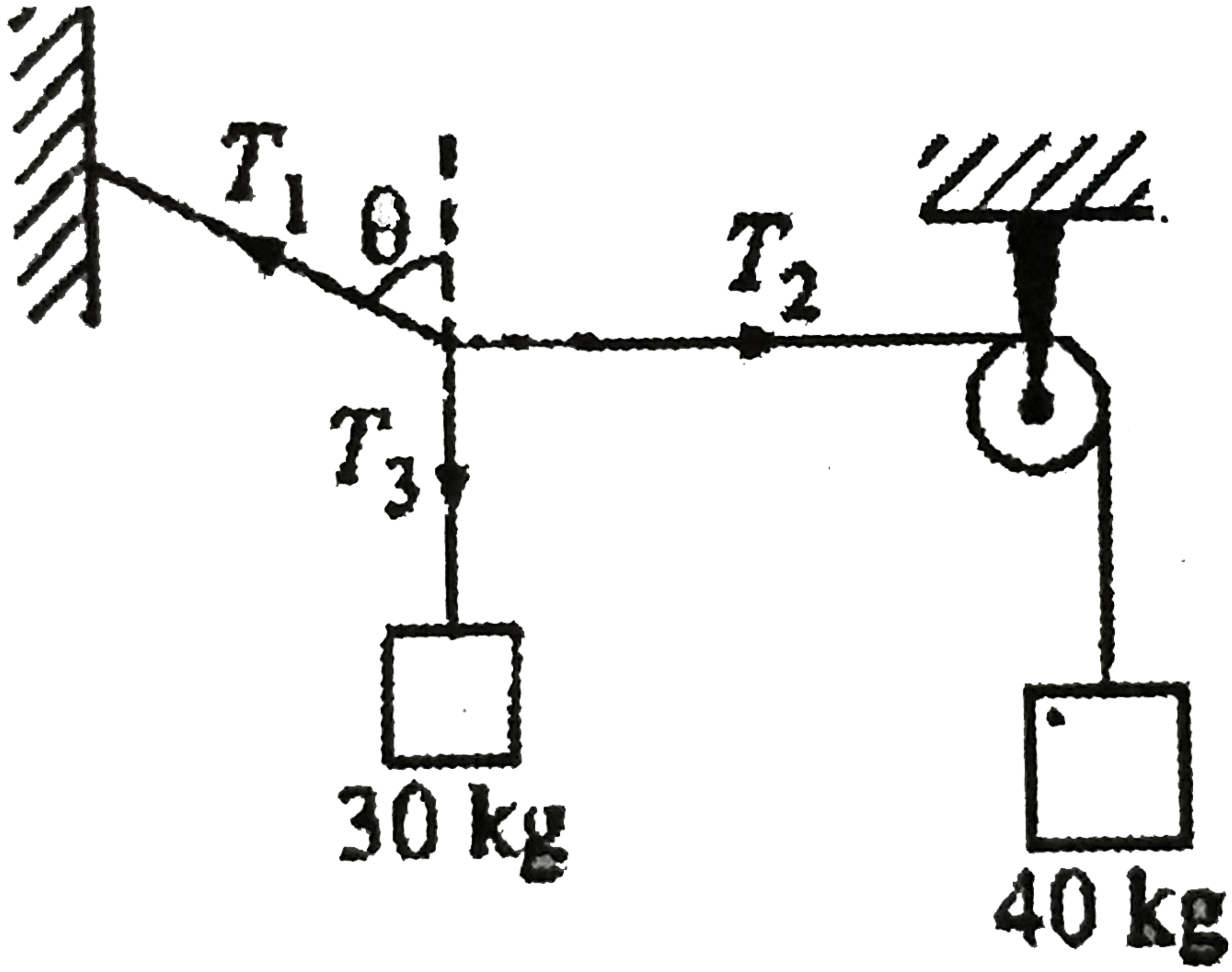
C. The force exerted b C & D is `(2P)/(5)`

D. The acceleration of the cube D is `(P)/(5)`m

Answer: B::C

Watch Video Solution

7. In the arrangement shown in the figure-2.188 if system is in equilibrium `(g=10 m//s^(2))`



A. Tension `T_(1)`=50 N

B. Tension `T_(1)` =500N

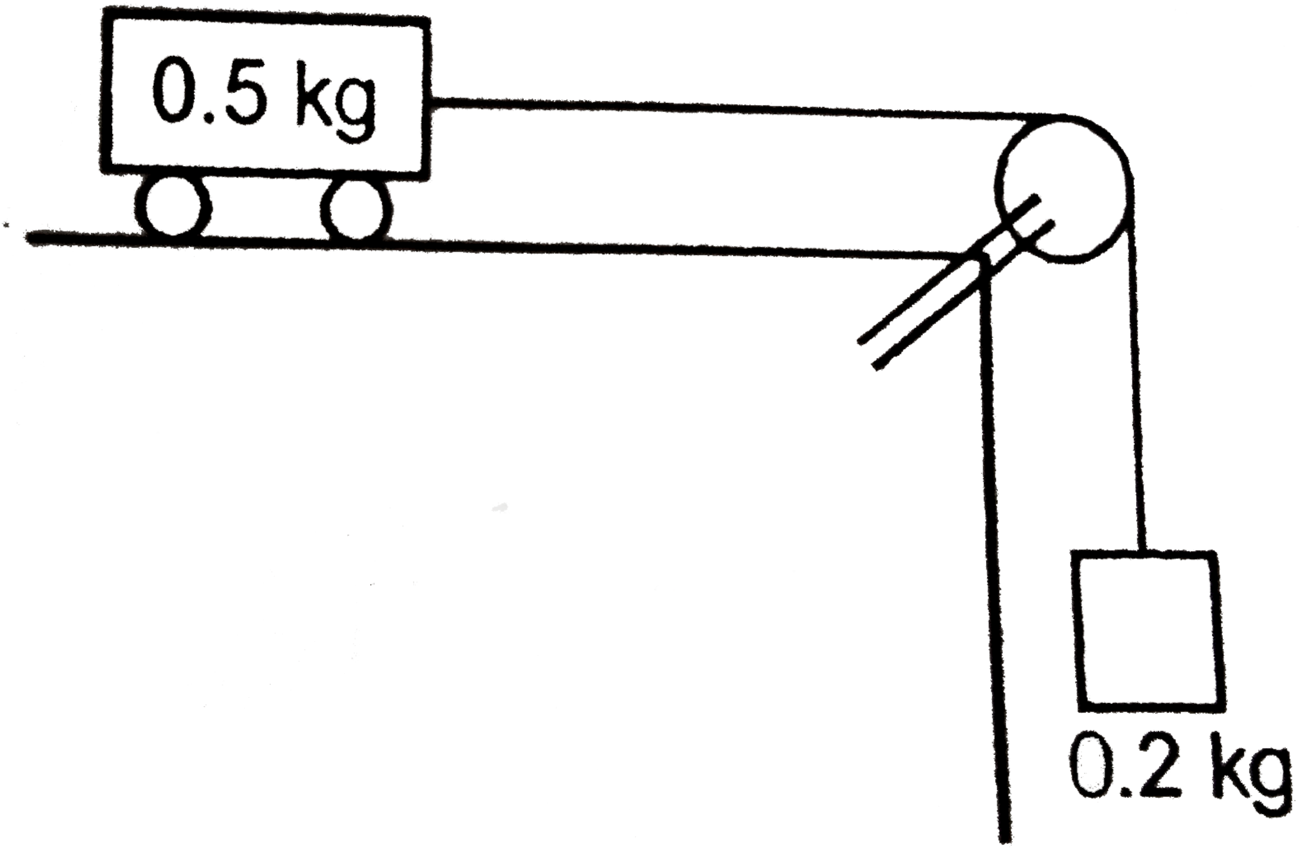
C. Angle `theta=37^(@)`

D. Angle `theta=53^(@)`

Answer: B::D

Watch Video Solution

8. A cart of mass `0.5kg` is placed on a smooth surface and is connected by a string to a block of mass `0.2 kg.` At the initial moment the cart moves to the left along a horizontal plane at a speed of `7m//s ("Use "g=9.8m//s^(2))`



A. The distance covered by cart in 5 sec is zero

B. After 5 sec weight of mass m will be in same position

C. The distance covered by cart in 5 sec is 17.5 m

D. None of the above

Answer: B::C

Watch Video Solution

9. A block of weight `9.8N` is placed on a table. The table surface exerts an upward force of `10N` on the block. Assume `g=9.8m//s^(2)`.

A. The block exerts a force of 10N on the table

B. The block exerts a force of 19.8 N on the table

C. The block exerts a force of 9.8 N on the table

D. The block has an upward acceleration.

Answer: A::D

Watch Video Solution

10. A 10 kg block is placed on a horizontal surface whose coefficient of friction is 0.2.A horizontal force P = 15 N first acts on it in the eastward direction. Later, in addition to P a second horizontal force Q = 20 N acts on it in the northward direction: (Take `g= 10m/s^(2)`)

A. The block will not move when only P acts, but will move when both P and Q act.

B. If the block moves,the acceleration will be `0.5 m/s^(2)`.

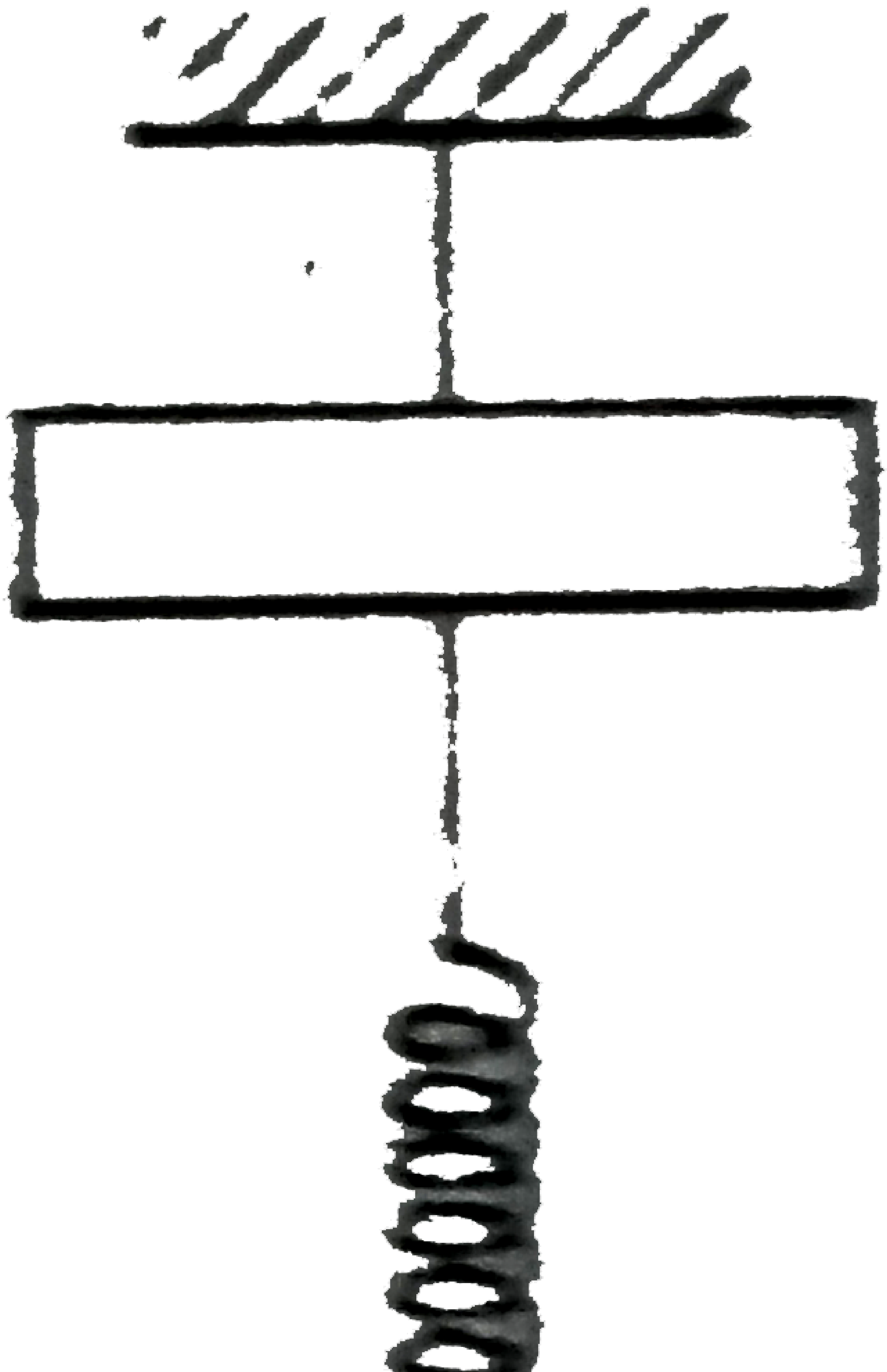
C. When the block moves, its direction of motion will be `tan^(-1)(3/4)` east of north

D. When both P and Q act, the direction of the force of friction acting on the block will be `tan^(-1)(3/4)` west of south

Answer: A::B::C

Watch Video Solution

11. Two identical blocks are connected by a light spring. The combination is suspended at rest from a string attached to the ceiling, as shown in the figure-2.190 below. The string breaks suddenly. Immediately after the string breaks:



A. Acceleration of both the blocks would be g downward

B. Acceleration of centre of mass of the combined block system would be g downward

C. Acceleration of upper block would be 2g downward

D. Acceleration of lower block would be g upward

Answer: B::C

Watch Video Solution

12. A block of mass m is pulled by a constant powert `P` placed on a rough horizontal plane. The friction coefficient the block and surface is `mu`. The maximum velocity of the block is.

A. The maximum velocity ofthe block during the motion is `(P)/(mumg)`

B. The maximum velocity ofthe block during the motion is P `(P)/(2mumg)`

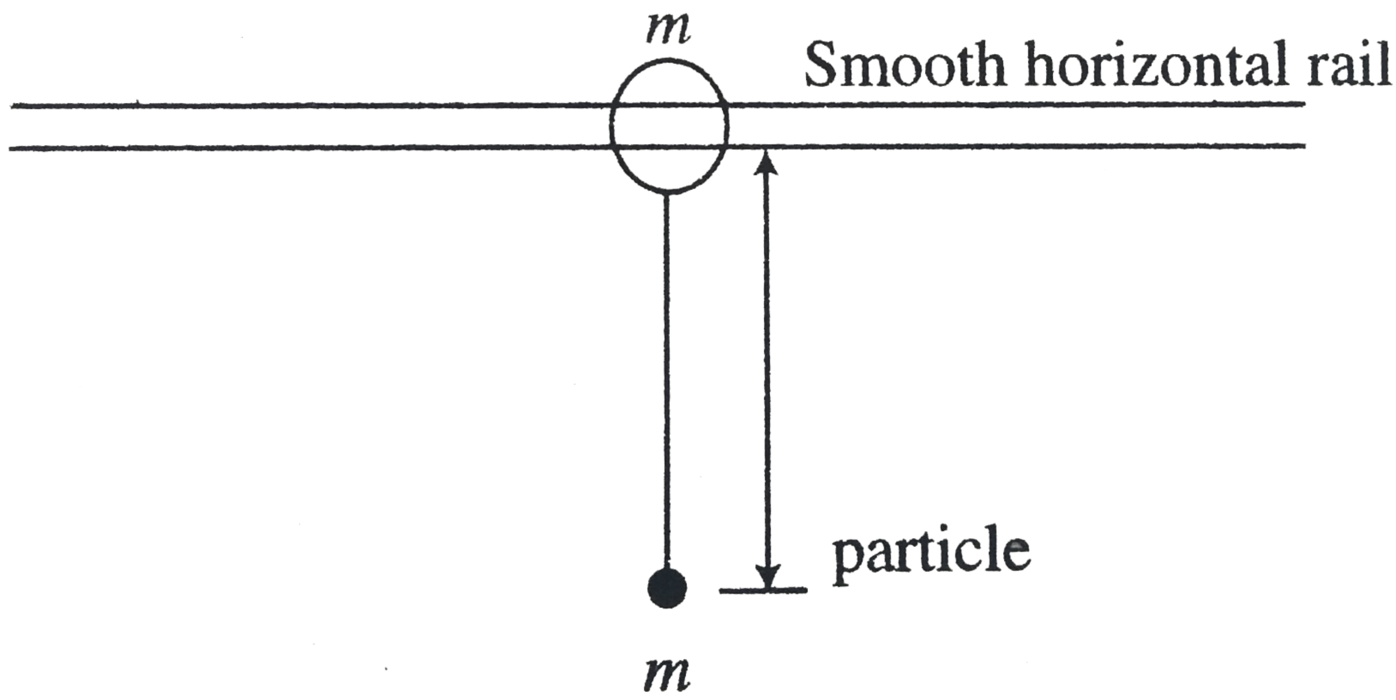
C. The block's speedis never decreasing and finally becomes constant.

D. The speed of the block first increases to a maximum value and then decreases

Answer: A::C

Watch Video Solution

13. The ring shown in fig. is given a constant horizontal acceleration `(a_(0)=gsqrt(3))`. The maximum deflection of the string from the vertical is `theta_(0)`. Then



A. `theta_(0)=30^(@)`

B. `theta_(0)=60^(@)`

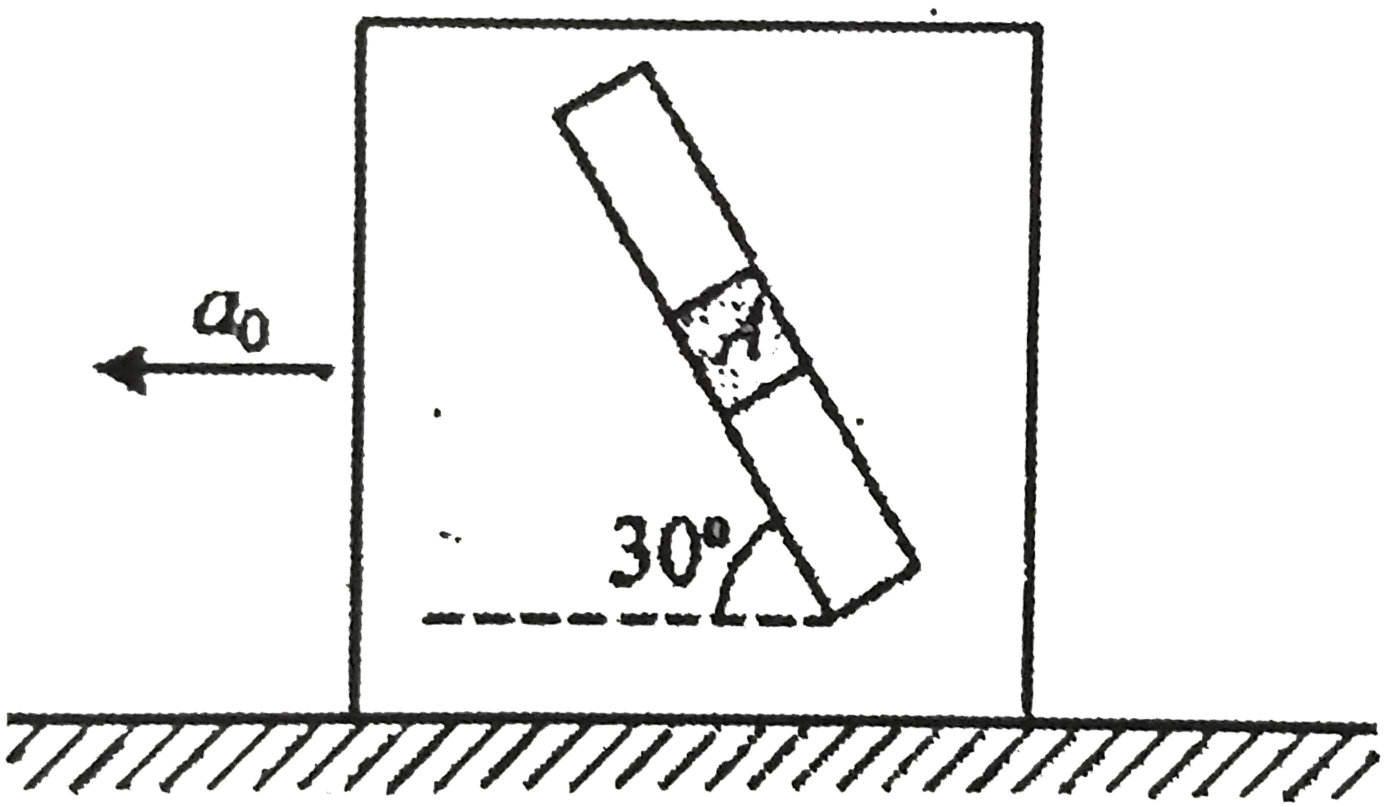
C. at maximum deflection, tension in string is equal to mg

D. at maximum deflection, tension in string is equal to `(2mg)/sqrt(3)`

Answer: A::D

Watch Video Solution

14. In the adjacent figure there is a cube having a smooth groove at an inclination of `30°` with horizontal in its vertical face. A cylinder A of mass 2kg can slide freely inside the grove. The cube is moving with constant horizontal acceleration `A_(0)` parallel to the shown face, so that the slider does not have acceleration along horizontal.



A. The normal reaction acting on cube is zero

B. The value of `a_(0)` is `gsqrt(3)`

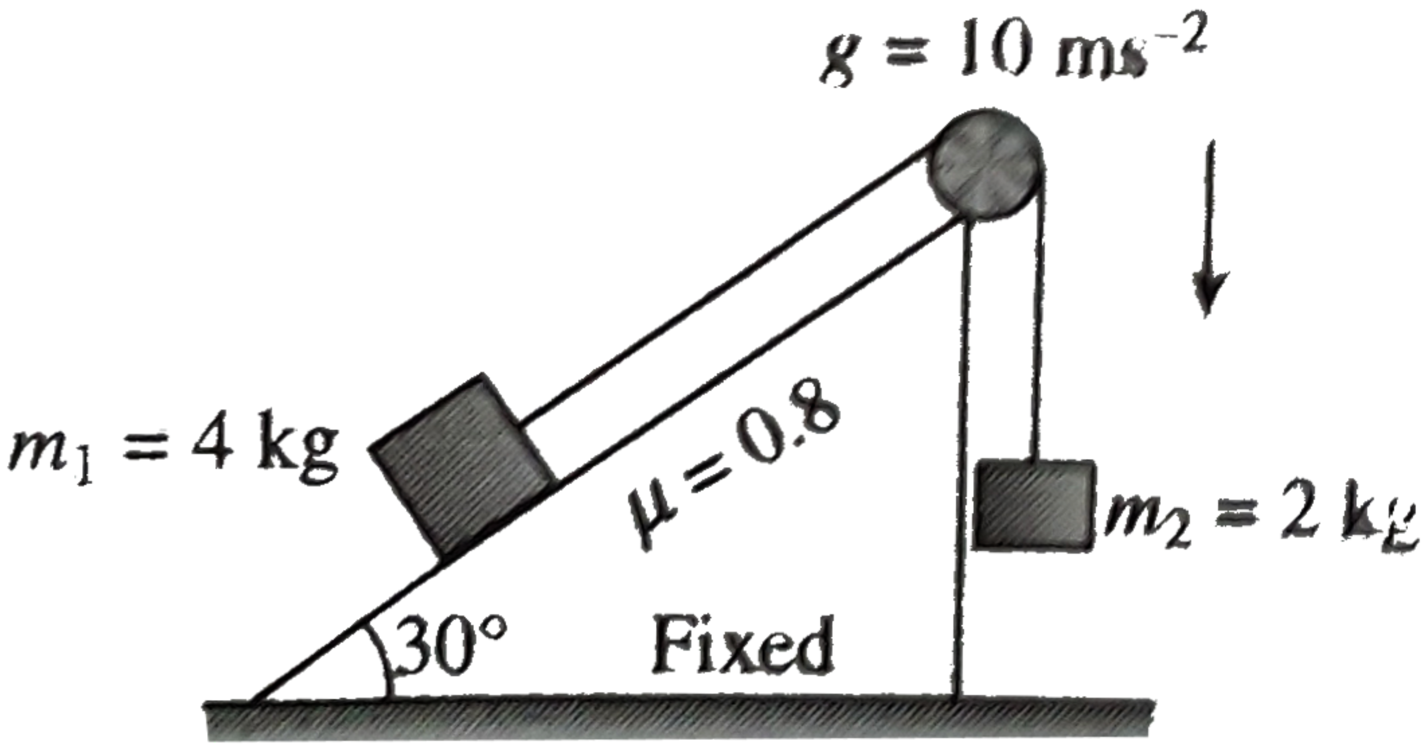
C. The value of `a_(0)` is g.

D. Acceleration of the particle in groimd frame is g

Answer: A::B::D

View Text Solution

15. Two blocks of masses `m_(1)` and `m_(2)` are connected through a massless inextensible string .A block of mass `m_(1)` is placed at the fixed rigid inclined surface while the block of mass `m_(2)` hanging at the other end of the string which is passing through a fixed massless frictionless pulley shown in figure The coefficient of static friction between the block and the inclined plane is `0.8` The system of masses `m_(1)` and `m_(2)` released from rest



A. the tension in the string is 20 N after releasing the system

B. the contact force by the inclined surface on the block is along normal to the inclined surface

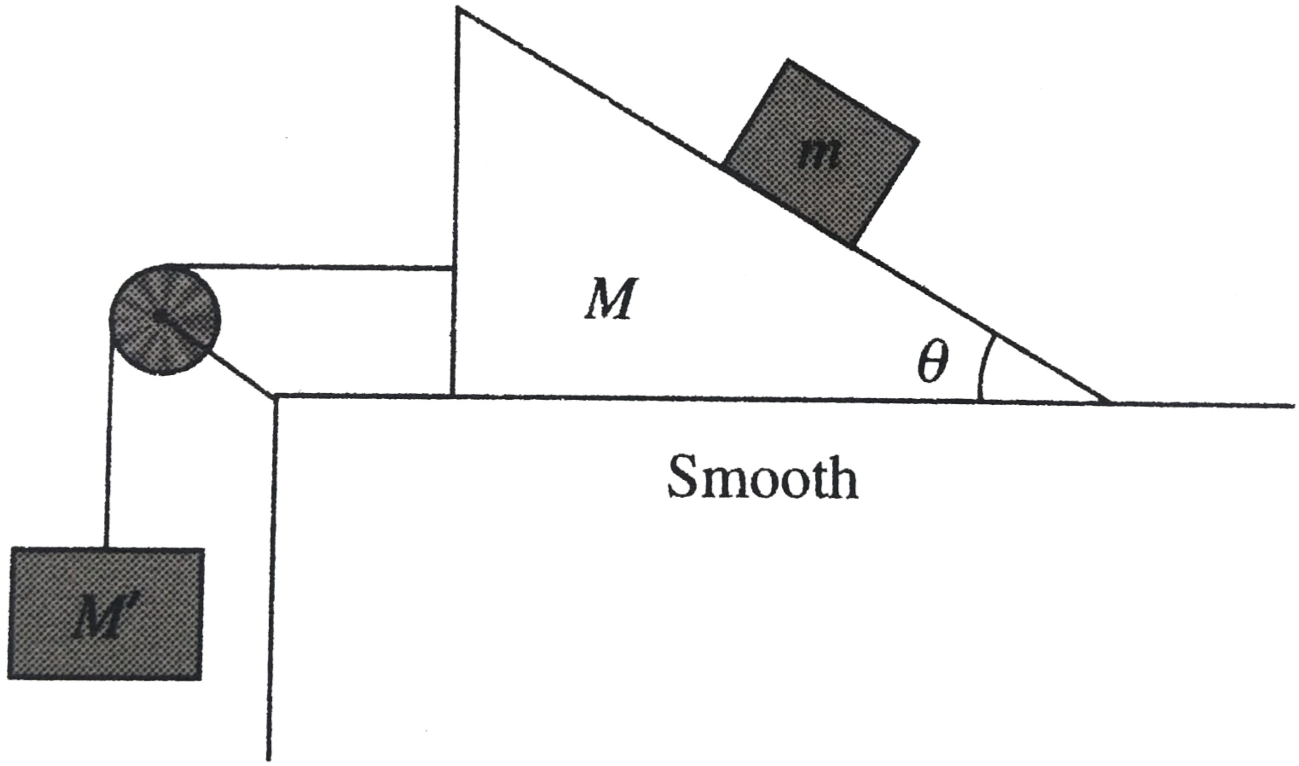
C. the magnitude ofcontact force by the inclined surface on the block `m_(1)`, is `20sqrt(3) N`

D. None of these

Answer: A::B::C

Watch Video Solution

16. Figure shown a block of mass m placed on a smooth wedge of mass M. Calculate the minimum value of M' and tension in the string, so that the block of mass m will move vertically downwards with acceleration `10ms^(-2)`



A. the value M' is `(Mcot theta)/(1-cottheta)`

B. the value M' is `(Mcot theta)/(1-tantheta)`

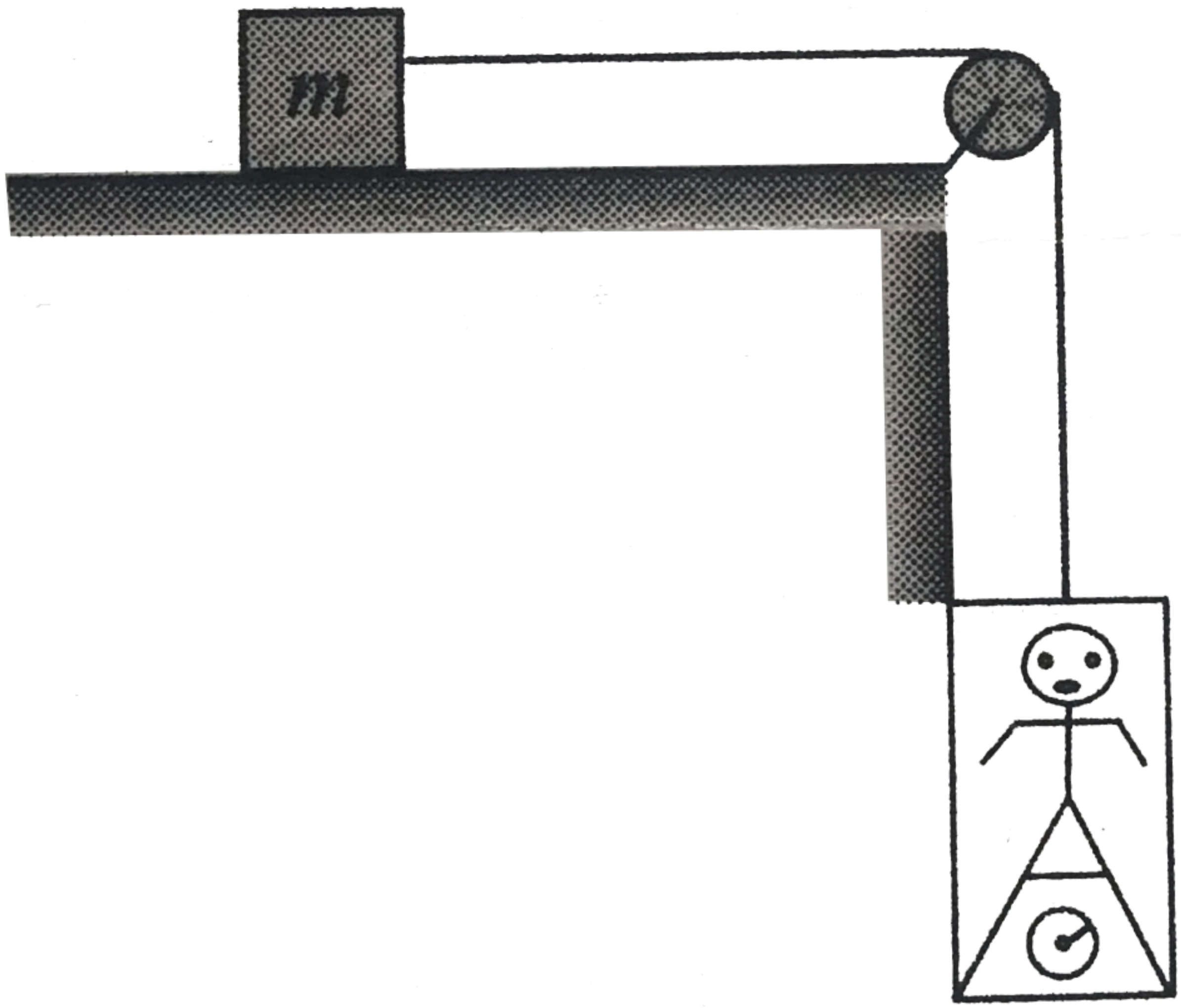
C. the value of tension in the string is

D. the value of tension is `(Mg)/(cottheta)`

Answer: A::C

Watch Video Solution

17. In fig., a man true mass M is standing on a weighing machine placed in a cabin. The cabin is joined by a string a body of mass m. Assuming no friction, and negligible mass of cabin and weighing machine, the measured mass of man is (normal force between the man and the machine is proportional to the mass)



A. Measured mass of man is `(Mm)/((M+m))`

B. Acceleration of man is `(mg)/((M+m))`

C. Acceleration of man is `(mg)/((M+m))`

D. Measured mass of man is M

Answer: A::C

Watch Video Solution

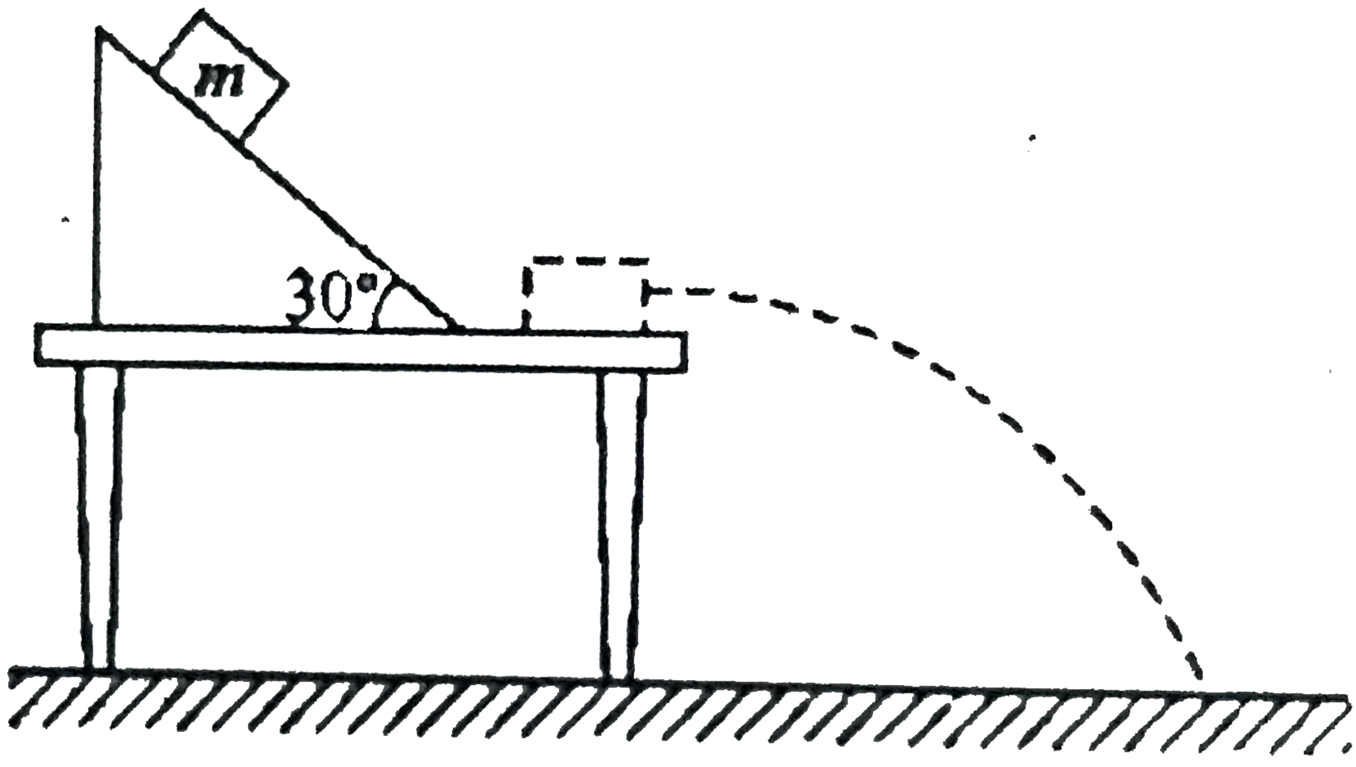
Unsolved Numerical Problem

1. A packet of 150kg is released from an air plane travelling due east at an altitude of 7200 m with a ground speed of 100 m/s. The wind applies a constant force on the packet of 300 N directed horizontally in the opposite direction to the plane's flight path. Where and when does the packet hit the ground, (with respect to the release location and time)

Answer: [38 s, 2.36 km]

Watch Video Solution

2. A block m= 0.5kg slides down a frictionless inclined plane 2 m long as showi in figure-2.196. It then slides on a rough horizontal table surface of `mu = 0.3` for 0.5 m. It then leaves the top of the table,which is 1.0 m high. How far from the base of the table does the block land ?



Answer: [1.85 m]

Watch Video Solution

3. A baseball is dropped from the roof of at all building. As the ball falls, the air exerts a drag force that varies directly with the speed as f=qv is a constant. Show that the ball acquires a terminal speed. Find the speed of the falling ball as a function of time.

Answer: `[(mg)/(q)(1-^(-qt//m))]`

Watch Video Solution

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

Answer: `[2.5 m//s^(2)]`

Watch Video Solution

5. Having gone through a plank of thickness h, a bullet changed its velocity from `v_(0)` to `v_(1)`. Find the time of motion of the bullet on the plank, assuming the resistance force to be proportional to the square of the velocity.

Answer: `[(h(v_(0)-v))/(v_(0)vlog_(e)(v_(0)//v))]`

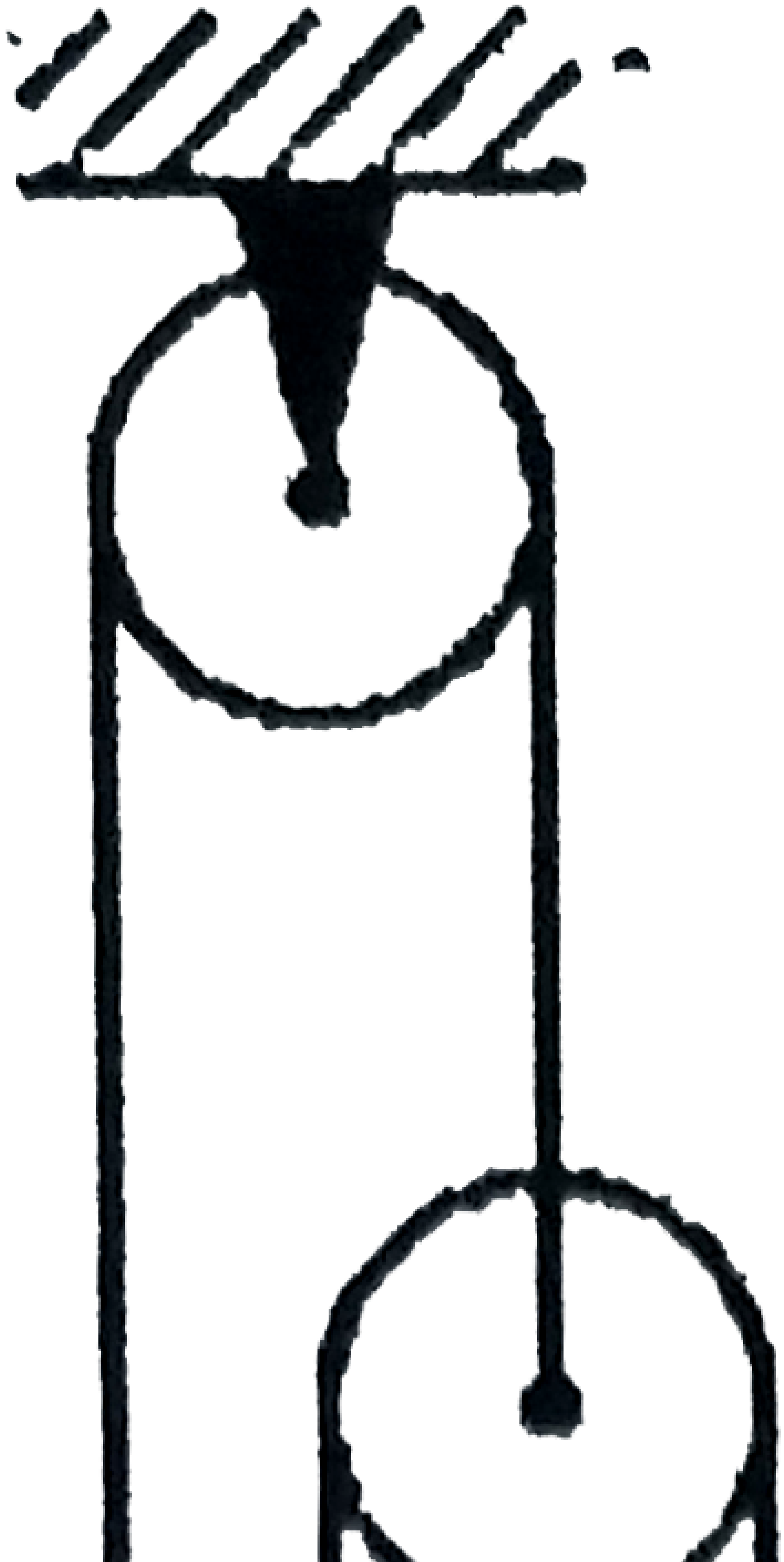
Watch Video Solution

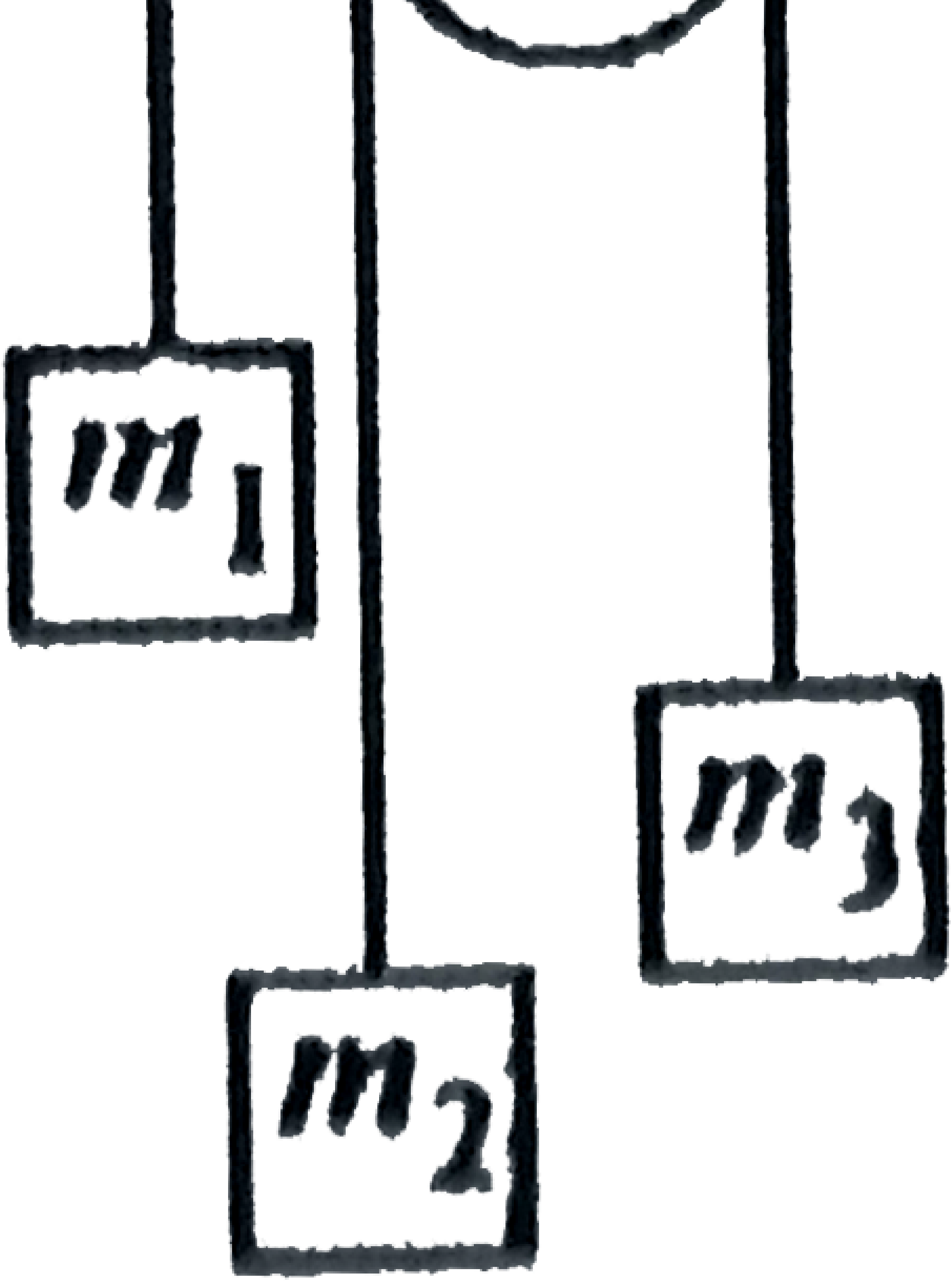
6. A particle of mass M is dropped vertically into a medium that offers resistance proportional to the velocity of the particle. The buoyancy of the medium is negligible, and the resisting force per unit velocity is f. What uniform velocity will the particle finally attain ?

Answer: `[(Mg)/(f)]`

Watch Video Solution

7. Consider the system ofpulleysasshown in figure-2.197. Find the acceleration of the three masses `m^(1),m^(2)` and `m^(3). (m_(1) = I kg,m_(2) = 2kg " and " m_(3) =3kg)`

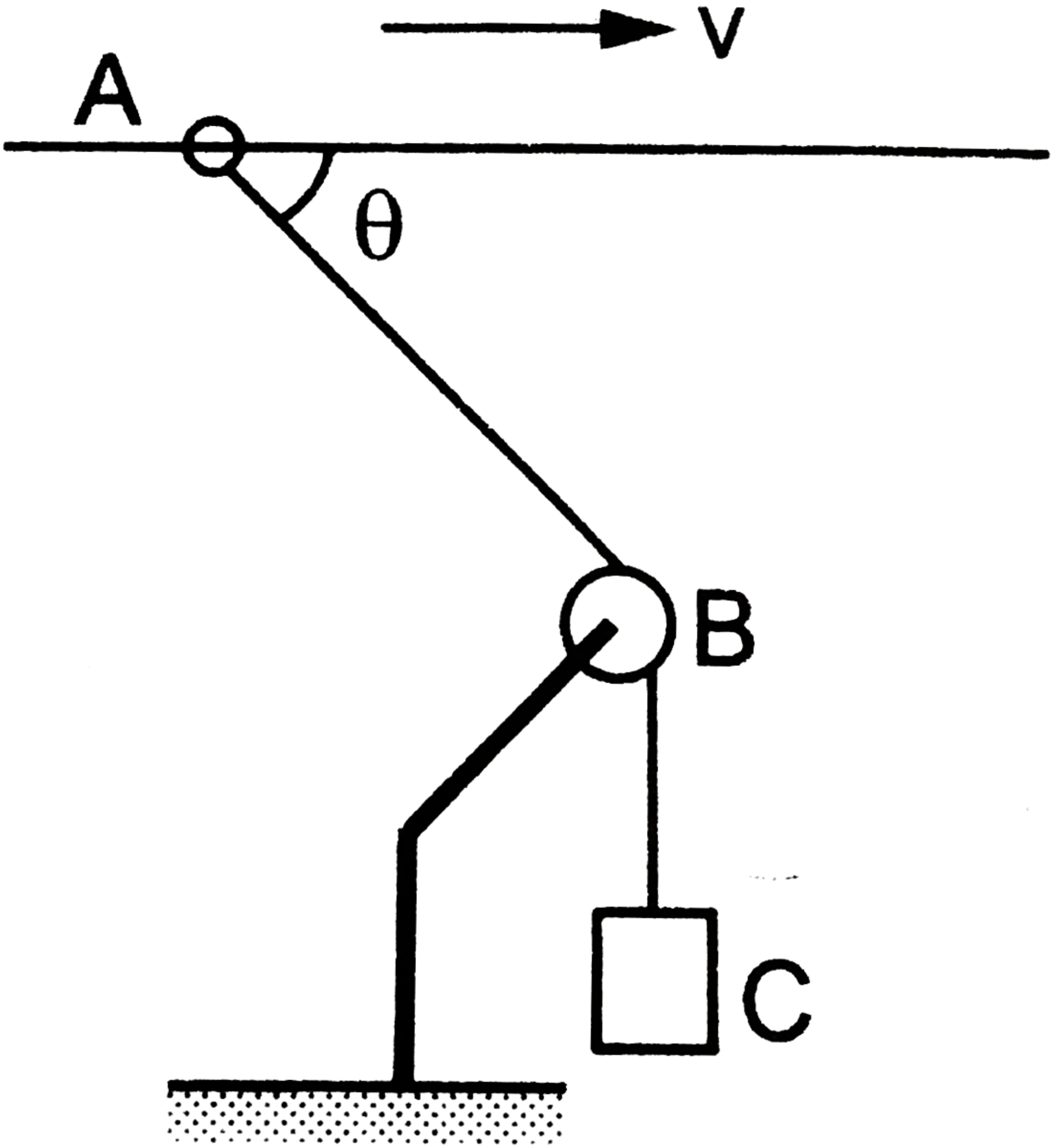




Answer: `[19g//29, 17g//29, 21g//29]`

Watch Video Solution

8. A smooth ring A of mass m can slide on a fixed horizontal rod. A string tied to the ring passes over a fixed pulley B and carries a block C of mass `M(=2m)` as shown in figure. At an instant the string between the ring and the pulley makes an angle `theta` with the rod. (a). Show that, if the ring slides with a speed v, the block descends with speed `v cos theta`, (b). With what acceleration will the ring starts moving if the system is released from rest with `theta= 30^0`



Answer: `[6.78 m//s^(2)]`

Watch Video Solution

9. When an archer pulls on the bow string with a force of 500 N, the bow string makes angles of `53^(@)` with the arrow. What is the tension in the string.

Answer: [416.67 N]

Watch Video Solution

10. A man with mass 85 kg stands on a platform with mass 25 kg. He pulls on the free end of a rope that runs over a pulley on the ceiling and has its other end fastened to the platform. The mass of the rope and the mass of the pulley can be neglected, and the pulley is frictionless. With what force does he have to pull so that he and the platform have an upward acceleration of `2.2m/s^(2)`. (Take `g= 10m/s^(2)`)

Answer: [15 N, 270 N]

Watch Video Solution

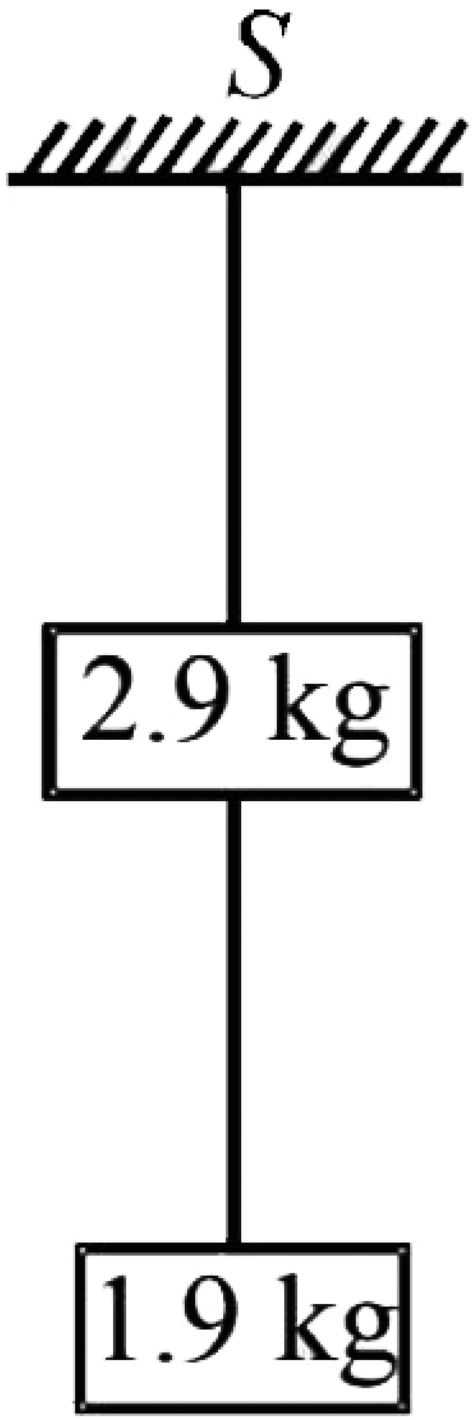
11. A body of mass `5xx10^(-3)` kg is launched upon a rough inclined plane making an angle of `30^(@)` with the horizontal. Obtain the coefficient of friction between the body and the plane if the time of ascent is half of the time of descent.

Answer: [0.36]

Watch Video Solution

12. Two blocks of mass 2.9 kg and 1.9 kg are suspended from a rigid support S by two inextensible wires each of length 1 meter, see fig. The upper wire has negligible mass and the lower wire has a uniform mass of `0.2kg//m`. The whole system of blocks wires and support have an upward acceleration of `0.2m//s^2`.

Acceleration due to gravity is `9.8m//s^2`.



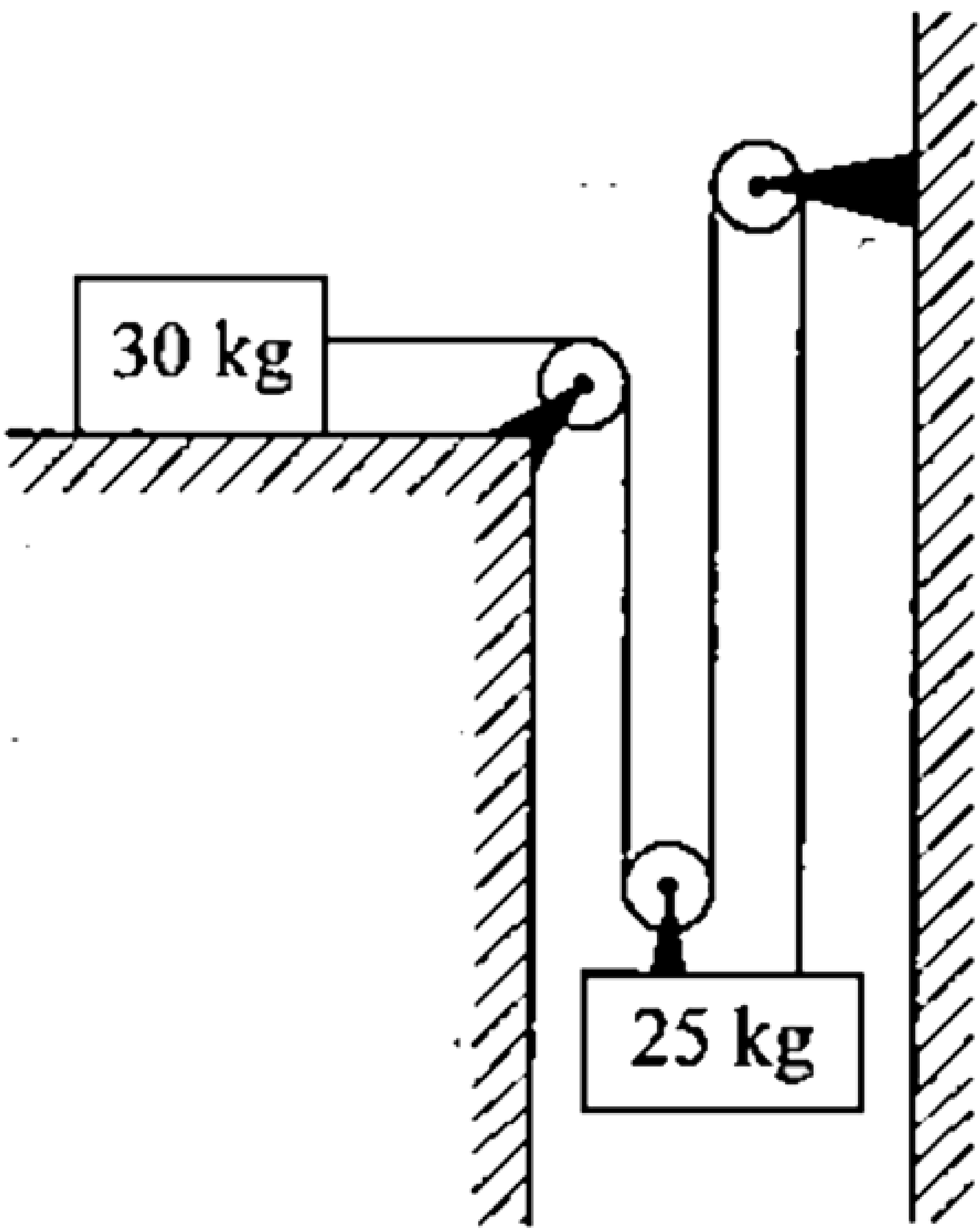
(i) Find the tension at the mid-point of the lower wire.

(ii) Find the tension at the mid-point of the upper wire.

Answer: [20 N, 50 N]

Watch Video Solution

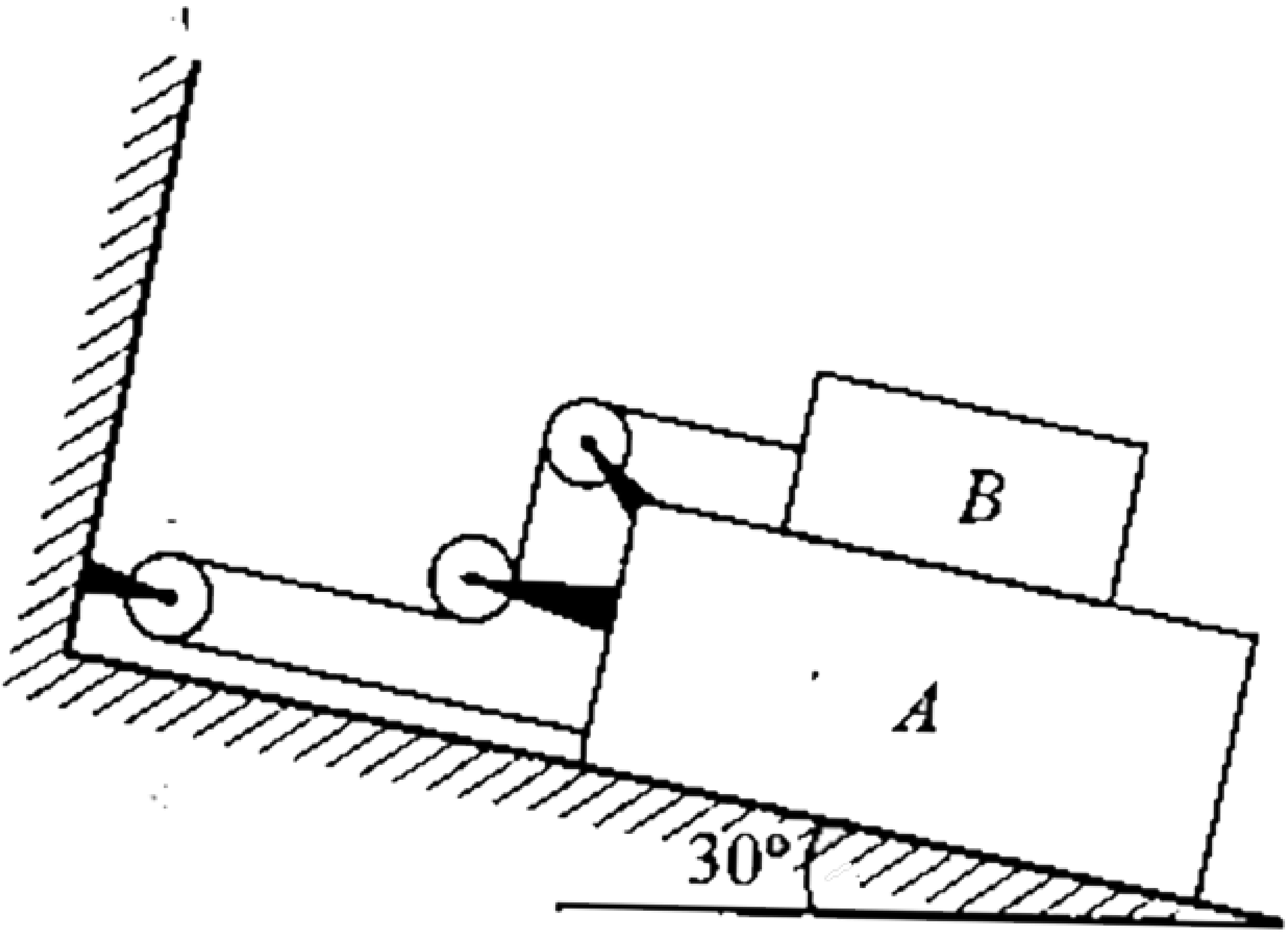
13. The two blocks shown in figure-2.200 are initially at rest. Assuming ideal pulleys and strings and neglecting friction at all the surfaces, find the accelerations of the two blocks and the tension in the cable. (Take `g = 9.8m/s^(2)`)



Answer: **`[2.49 m//s^(2), 0.831 m//s^(2), 74.8 N]`**

Watch Video Solution

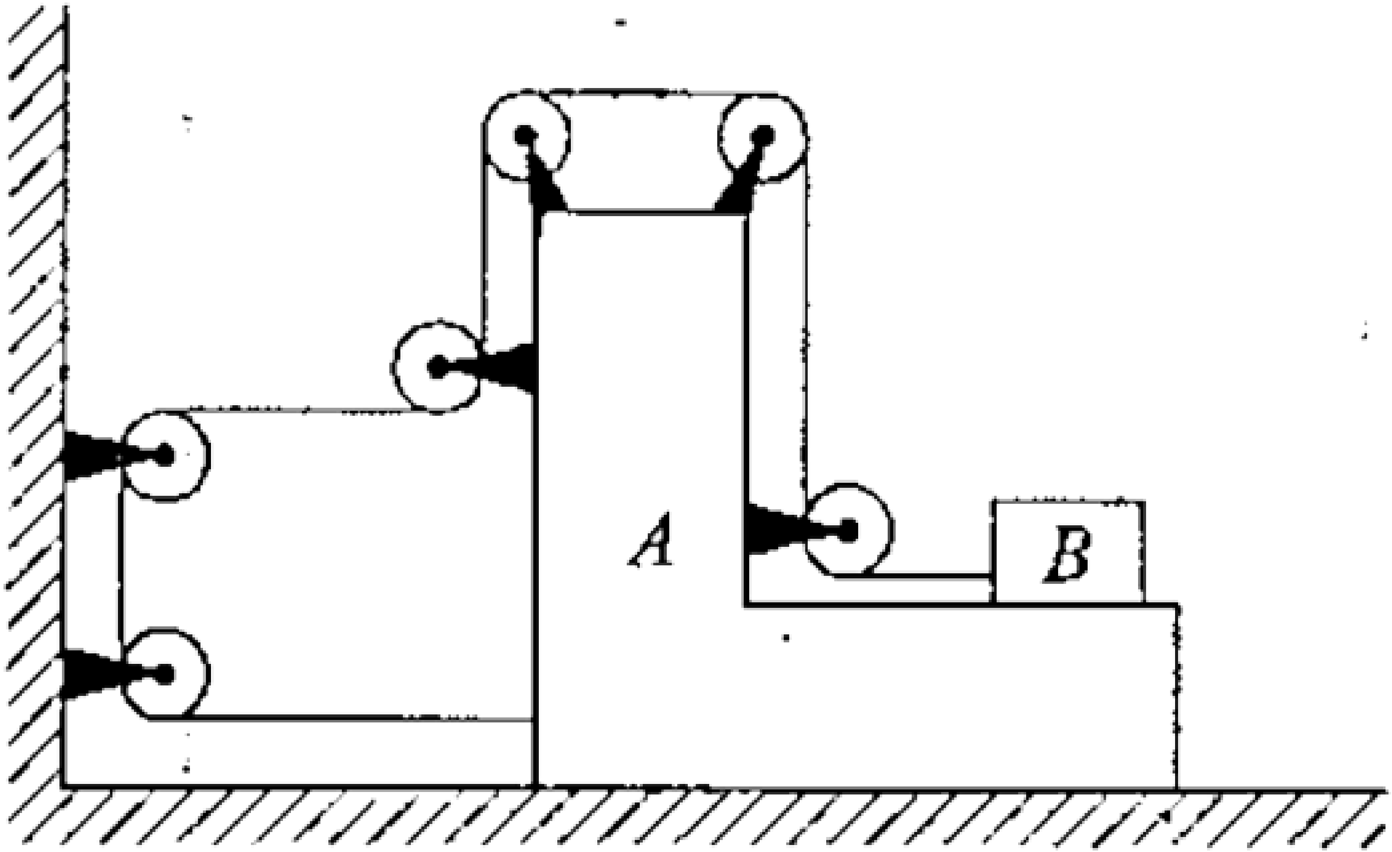
14. In the figure-2.201 shown the bigger block A has a mass of 40kg and the upper block 5 is of 8kg.The coefficients of friction between all surfaces,of contact are 0.2 (static) and 0.15 (sliding). Find the acceleration of masses when set free.



Answer: `[1.6 m//s^(2)]`

View Text Solution

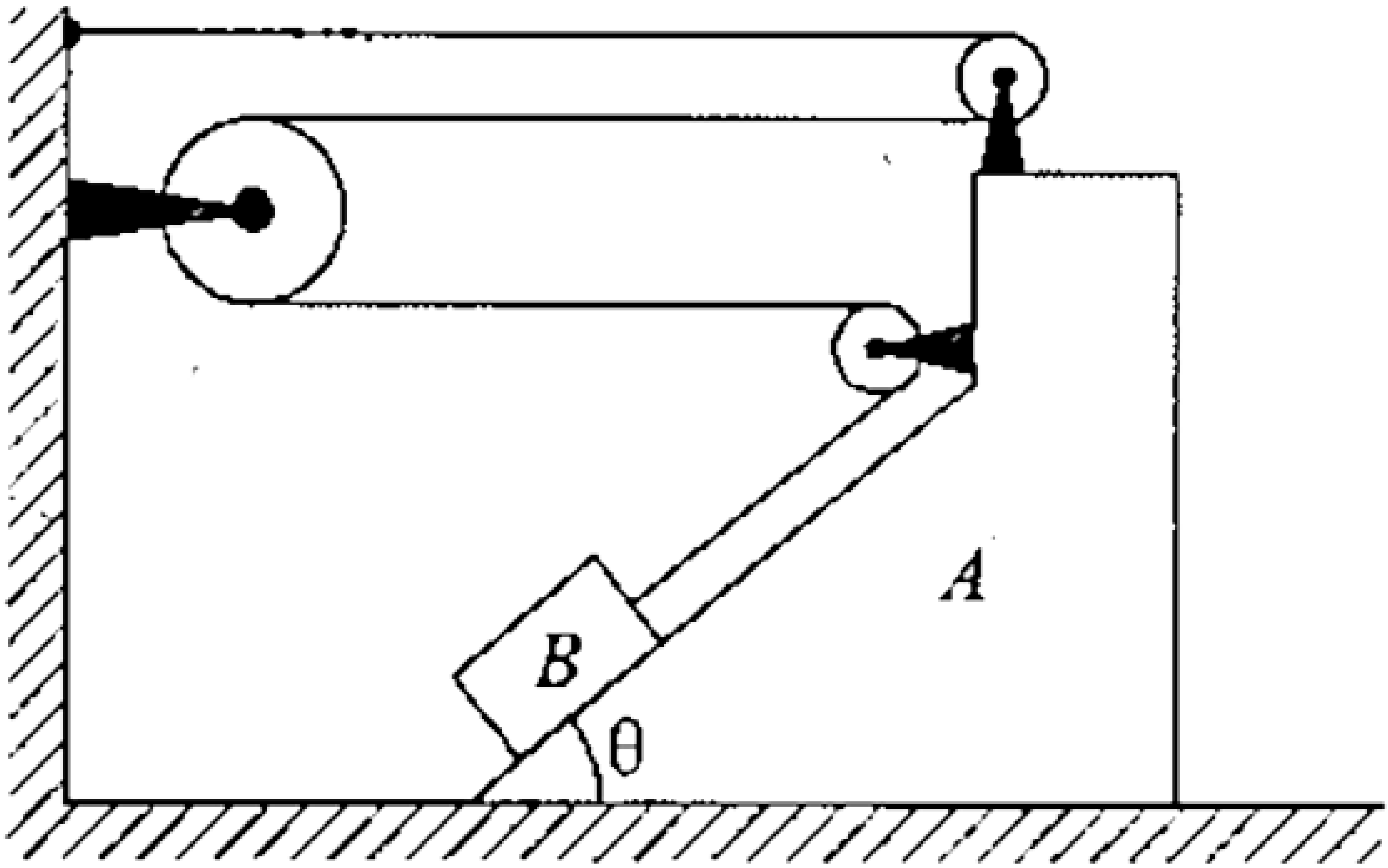
15. Figure-2.202 shows a two block constrained motion system. Block A has a mass M and B has a mass m. If block A is pulled toward right horizontally with an external force F, find the acceleration of the block B relative to ground.



Answer: `[[a=(f)/(M+m)]]l`

Watch Video Solution

16. Solve the previous problem if the blocks A and B are of different shapes as shown in figure-2.203.



Answer: `[((f-3mg sin theta)/(M+10m))sqrt((10-6costheta))]`

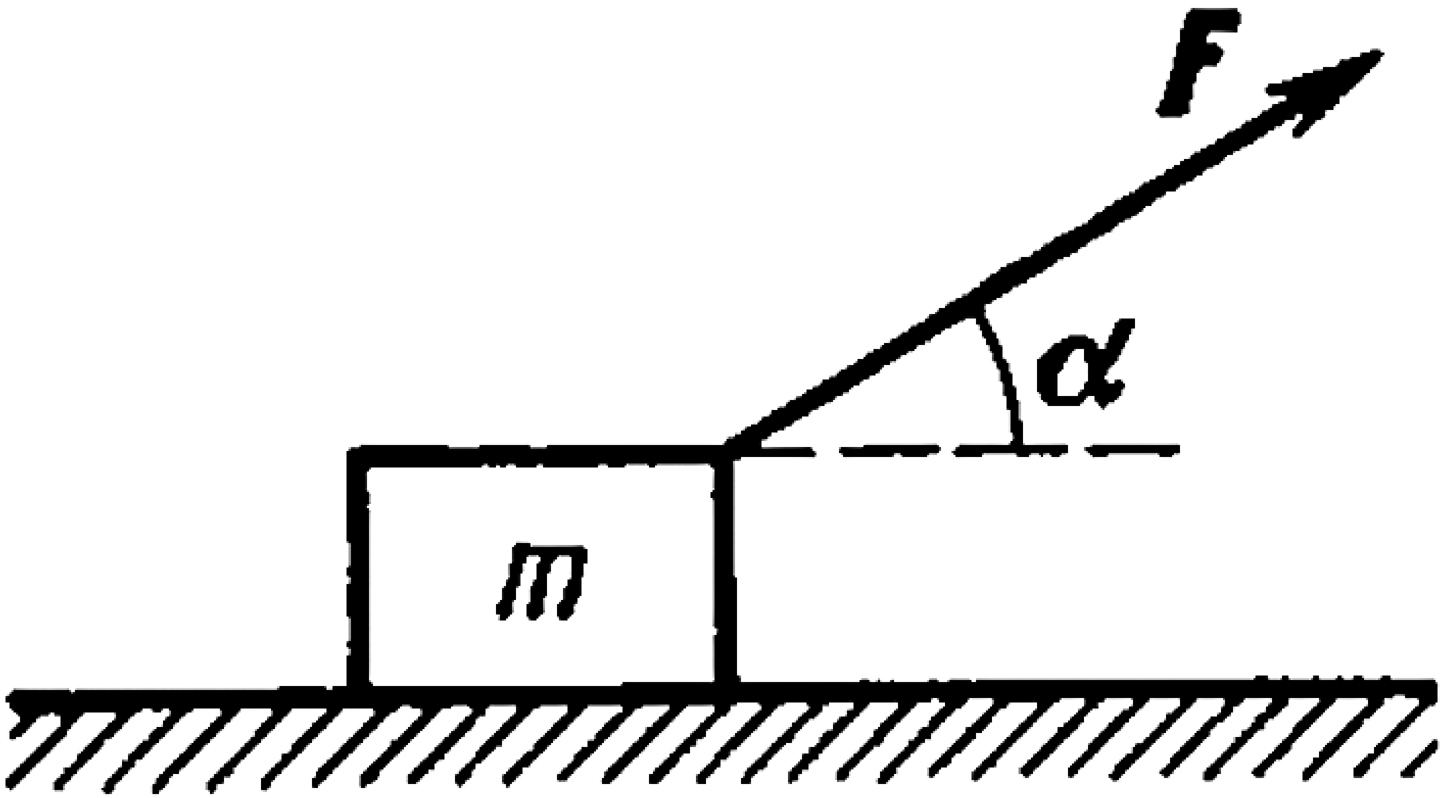
View Text Solution

17. At the moment `t=0` the force `F=at` is applied to a small body of mass `m` resting on a smooth horizontal plane (a is constant).

The permanent direction of this force forms an angle `alpha` with the horizontal (figure). Find:

(a) the velocity of the body at the moment of its breaking off the plane,

(b) the distance traversed by the body up to this moment.



Answer: `[(mg^(2))/(2k),(costheta)/(sin^(2)theta),(m^(3)g^(3)costheta)/(6k^(2)sin^(3)theta)]`

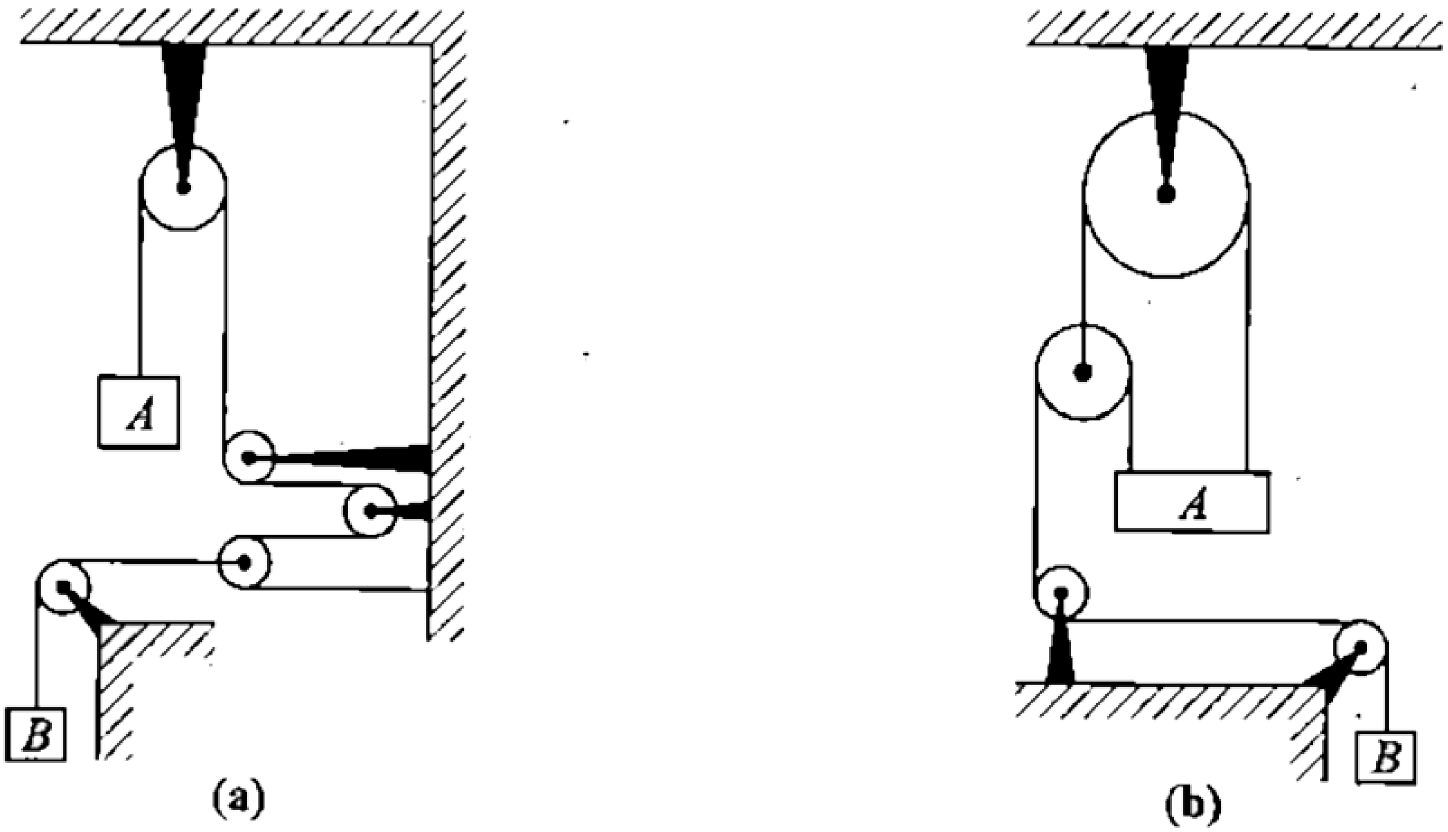
Watch Video Solution

18. A chain of length l is placed on a smooth spherical surface of radius R with one of its ends fixed at the top of the sphere. What will be the acceleration w of each element of the chain when its upper end is released? It is assumed that the length of the chain `llt1/2piR`.

Answer: `[(Rg)/(l)(1-cos.(l)/(R))]`

Watch Video Solution

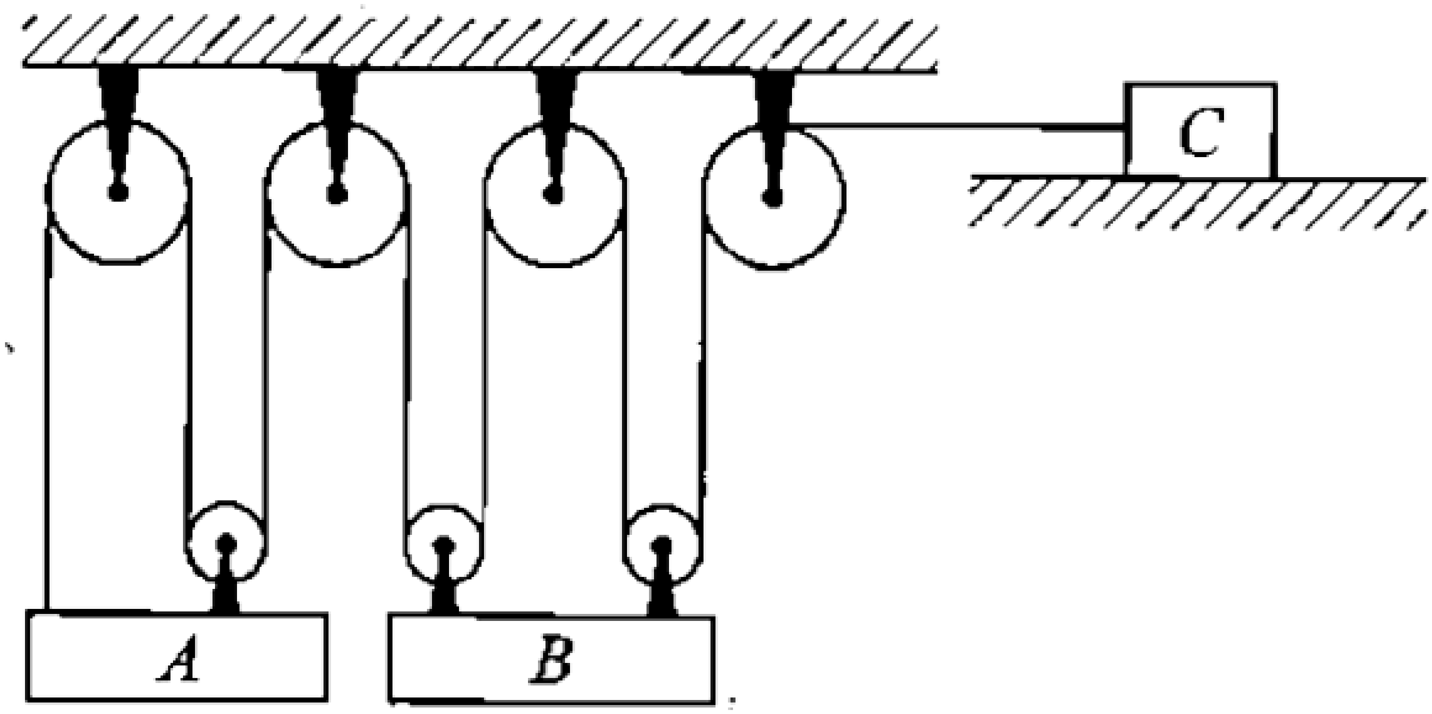
19. If masses of the blocks A and B shown in figure-2.204 (a) and 2.204(b) are 10kg and 5kg respectively, find the acceleration of the two masses. Assume all pulleys and strings are ideal. (Take `g=9.8m/s^(2)`)



Answer: `[((20)/(3)),((10)/(3)).m//s^(2),(10)/(11)m//s^(2),(30)/(11)m//s^(2)]`

Watch Video Solution

20. In the figure-2.205 shown in blocks A, B and C has masses `m_(A)= 5 kg, m_(B) = 5 kg` and `m_(C )= 10kg` respectively, find the acceleration of the three blocks. Assume all pulleys and strings are ideal. (Take `g = 10m//s^(2)`)



Answer: `[a_(A)=1.8m//s^(2)uarr,a_(B)=1m//s^(2)darr,a_(C )=4.2m//s^(2)larr]`

Watch Video Solution

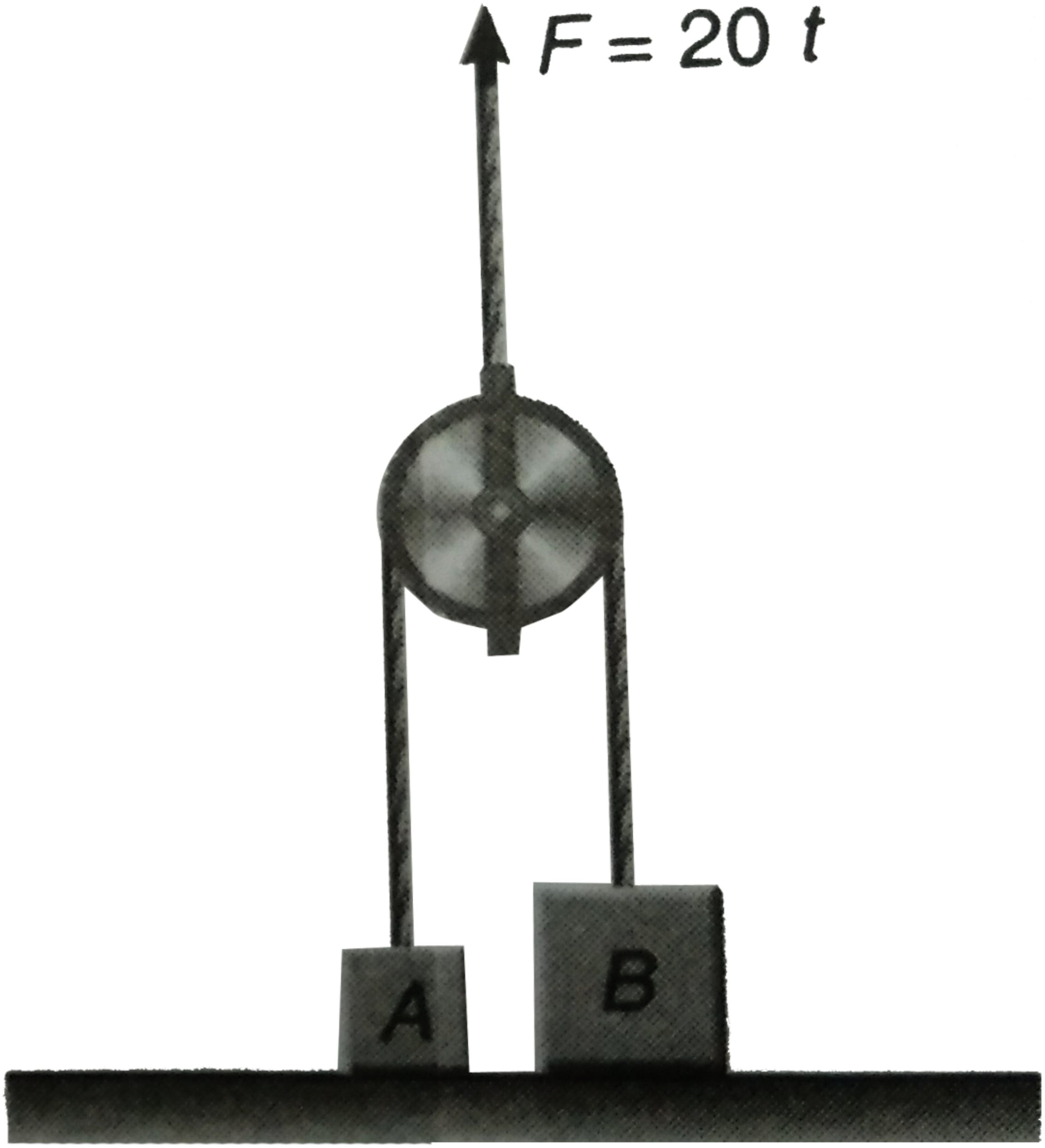
21. One end of a string is attached to a 6kg mass on a smooth horizontal table. The string passes over the edge of the table and to its other end is attached a light smooth pulley.Over this pulley passes another string to the ends of which are attached masses of 4kg and 2kg respectively. Show that the 6kg mass moves with an acceleration of `8g//17`.

Watch Video Solution

22. Two blocks of masses `m_(1)` and `m_(2)` kept touching each other on an inclined plane of inclination a with the horizontal. Show that (i) theforce of interaction between the blocks is `((mu_(1)-mu_(2))m_(1)m_(2)gcosalpha)/((m_(1)+m_(2)))` and (ii) the minimum value of `alpha` at which the blocks just start sliding is $a = \tan^{-1}\left(\frac{\mu_1 m_1+\mu_2 m_2}{m_1+m_2}\right)$. Where μ_1 and μ_2 are the coefficients of friction between the block m_1 and the inclined plane and between the block m_2 and the inclinedplane respectively.

Watch Video Solution

23. Two block A and B of masses $1kg$ and $2kg$ respectively are connected by a string, passing over a light frictionless pulley as shown. Another string connect the center of pulley. Both the blocks are resting on a horizontal floor and the pulley is help such that string remains just taut. At moment $t = 0$, a force $F = 20 t$ starts acting on the pully along vertically upwards direction as shown in figure.Calculate



(a) velocity of `A` when `B` loses contact with the floor.

(b) height raised by the pulley upto that instant.

(Take =`g =10 m//s^(2))`

Answer: `[5 m//s, 5//6 m]`

Watch Video Solution

24. A worker wishes to pile a cone of sand onto a circular area in his yard. The radius of the circle is r,and no sand is to spill on to the surrounding area. If `mu` is the static coefficient of friction between each layer of sand along the slope and the sand, show that the greatest volume of sand that can be stored in this manner is `(1)/(3) pi muR^(3)`.

Watch Video Solution

25. A `30 kg` mass is initially at rest on floor of a truck . The coefficient of static friction between the mass and the floor of truck in `0.3` and coefficient of kinetic friction is `0.2` . Initially the truck is travelling due east at constant speed.Find the magnitude and direction of the friction force acting on the mass , if : (take `g = 10 m//s^(2))`

(a) the truck acceleration at `1.8 m//s^(2)` eastward

(b) the truck acceleration at `3.8 m//s^(2)` westward

Answer: [54 N, 59 N]

Watch Video Solution

26. At the moment t = 0 a stationary particle of mass m experiences a time-dependent force `F = kt(t'-t)`,where is a constant vector, t' is the time during which the given force acts. Find :

(a) The momentum of the particle when the action of the force discontinued,

(b) The distance covered by particle while the force acted.

Answer: `[kt^(3)//6,dt=(kt^(4))/(12m)]`

Watch Video Solution

27. An empty tin can of mass M is sliding with speed `V_(0)` across a horizontal sheet of ice in a rain storm. The area of opening of the can is A. The rain is falling vertically at a rate of n drops per second per square metre. Each rain drop has a mass m and is falling with a terminal velocity `V^(n)`. (a) Neglecting friction, calculate the speed of the can as a function of time,(b) Calculate the normal force ofreaction ofice on the can as a function of time.

Answer: `[v=M(V_(0))/(M+mAnt),Fn=Mg+nAm(Vn+g t)" upwards"]`

Watch Video Solution

28. A crate is pulled along a horizontal surface at constant velocity by an applied force F that makes an angle `theta` with the horizontal. The coefficient of kinetic friction between the crate and the surface is `mu`. Find the angle `theta` such that the applied force is minimum to slide the block. Also find the minimum value of this force.

Answer: `tan^(-1)mu,(mmg)/(sqrt(1+m^(2))]`

Watch Video Solution

29. A small body was launched up an inclined plane set at an angle `alpha=15^@` against the horizontal. Find the coefficient of friction, if the time of the ascent of the body is `eta=2.0` times less than the time of its descent.

Answer: `[k=((eta^(2)-1))/((eta^(2)+1))tanalpha]`

Watch Video Solution

30. A motor-boat of mass m moves along a lake with velocity `v_(0)`. At the moment t = 0 the engine of the boat is shut down. Assuming the resistance of the particle to-be proportional to the velocity of the boat F = -rv, find:

(a) How long the motor boat moved with the shut down engine,

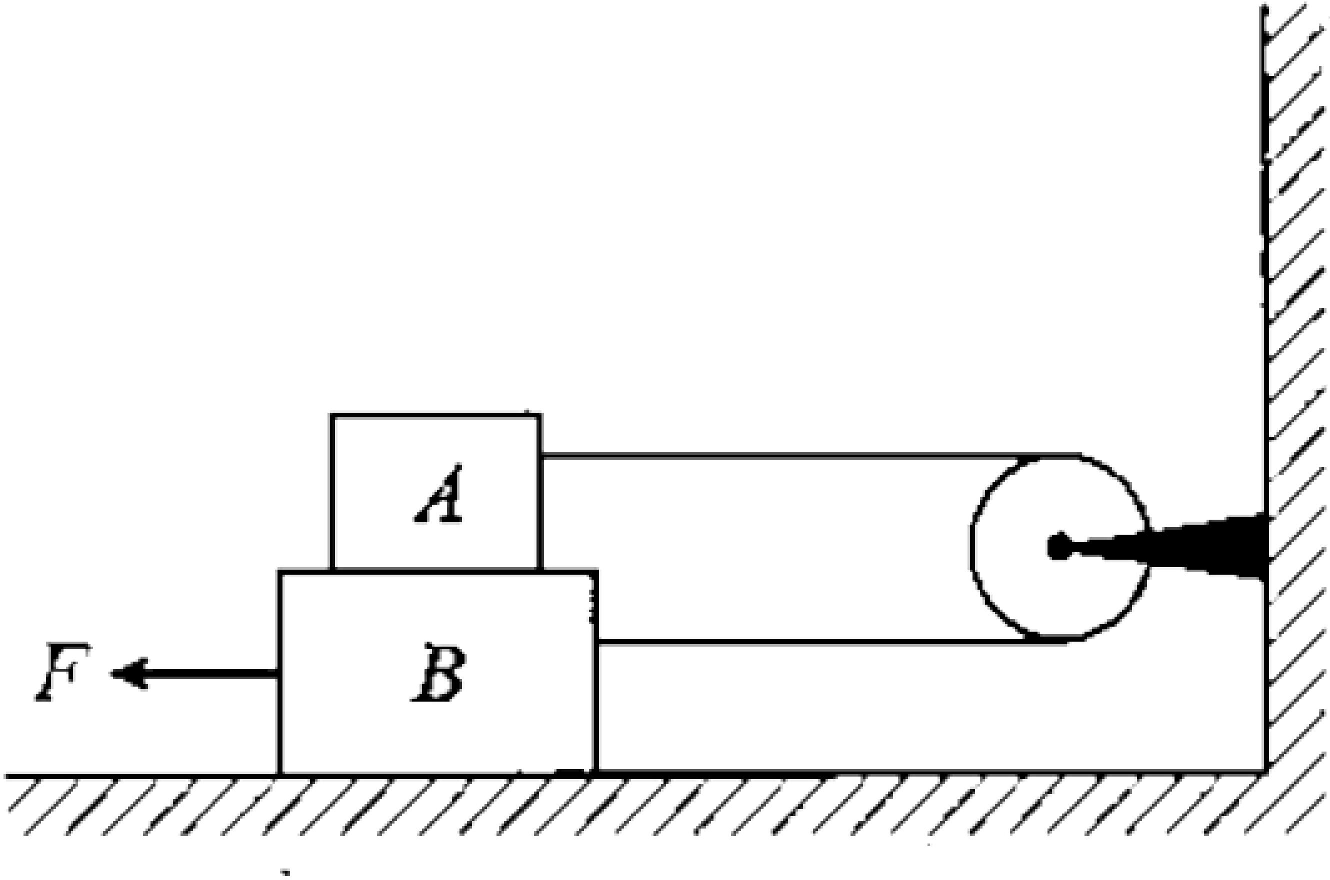
(b) (b) The velocity of the motor boat as a function of the distance covered with the shutdown engine, as well as total distance covered till the complete stop.

(c) The mean velocity of the motor boat over the time interval (beginning with the moment t=0), during which its velocity decreases `eta` times.

Answer: `[oo,v=v_(0)-(rs)/(m')(mv_(0))/(r'),(v_(0)(eta-1))/(ln(eta))]`

Watch Video Solution

31. Block A in figure-2.207 weights 2.7N and block B weighs 5.4 N the coefficient of kinetic friction between all surfaces is 0.25. Find the magnitude of the horizontal force F necessary to drag blocks to the left at constant speed if A and B are connected by a light, flexible cord passing around a fixed frictionless pulley



Answer: [3.38 N]

Watch Video Solution

32. A uniform cone of half angle `phi` stands on a rough inclined plane. Show that as the inclination of the plane is increased the cone will slide down before it topples over if the coefficient of friction is less than 4 tan `phi`.

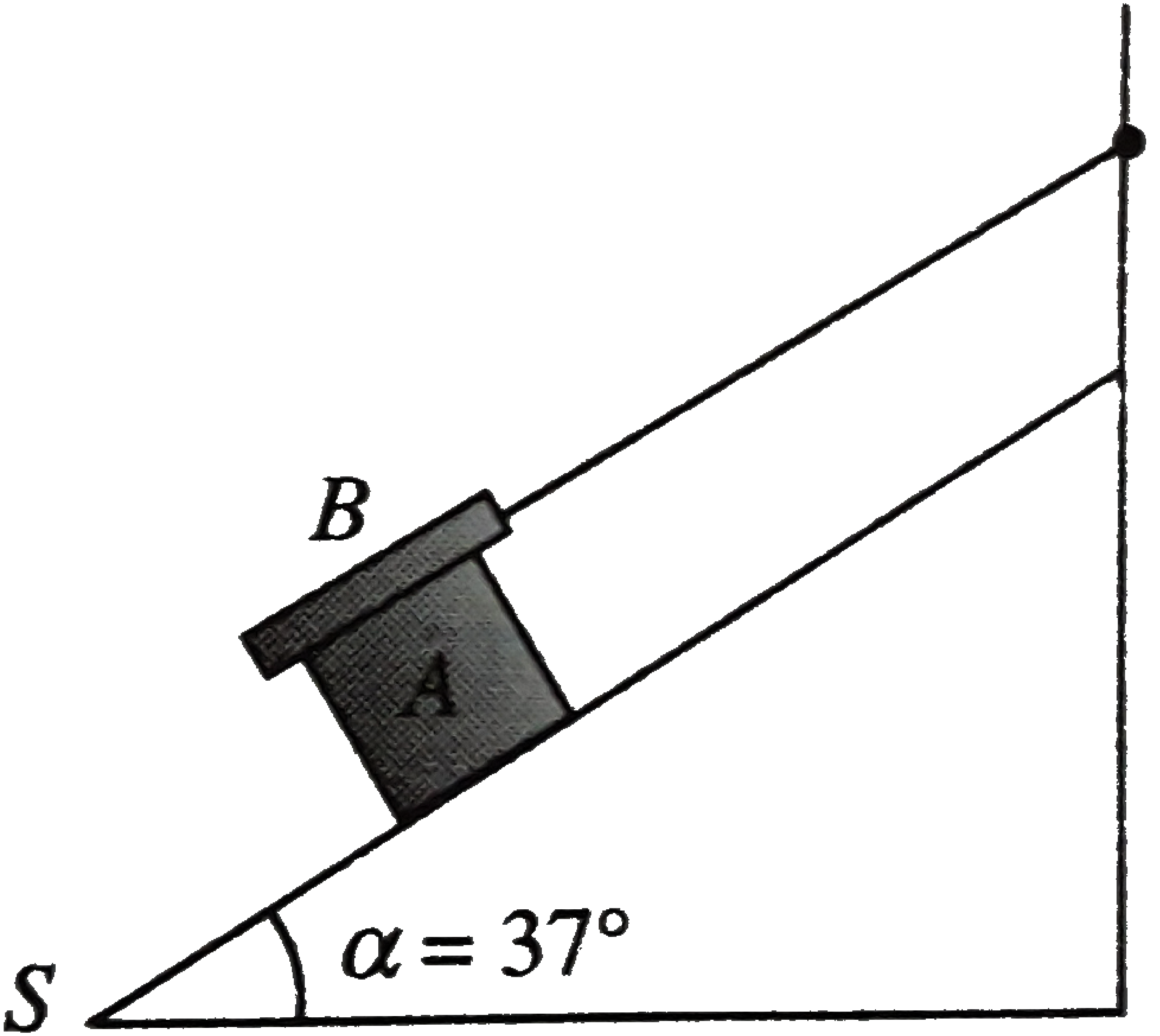
Watch Video Solution

33. A weight of 200kg hangs freely from the end of a rope. The weight is hauled up vertically from rest by winding up the rope. The pull starts at 250 kg and diminishes uniformly at the rate of one kg per metre wound up. Find the velocity after 30 metres have been wound up. Neglect the weight ofthe rope.

Answer: `[sqrt(10.5)g m//s^()]`

Watch Video Solution

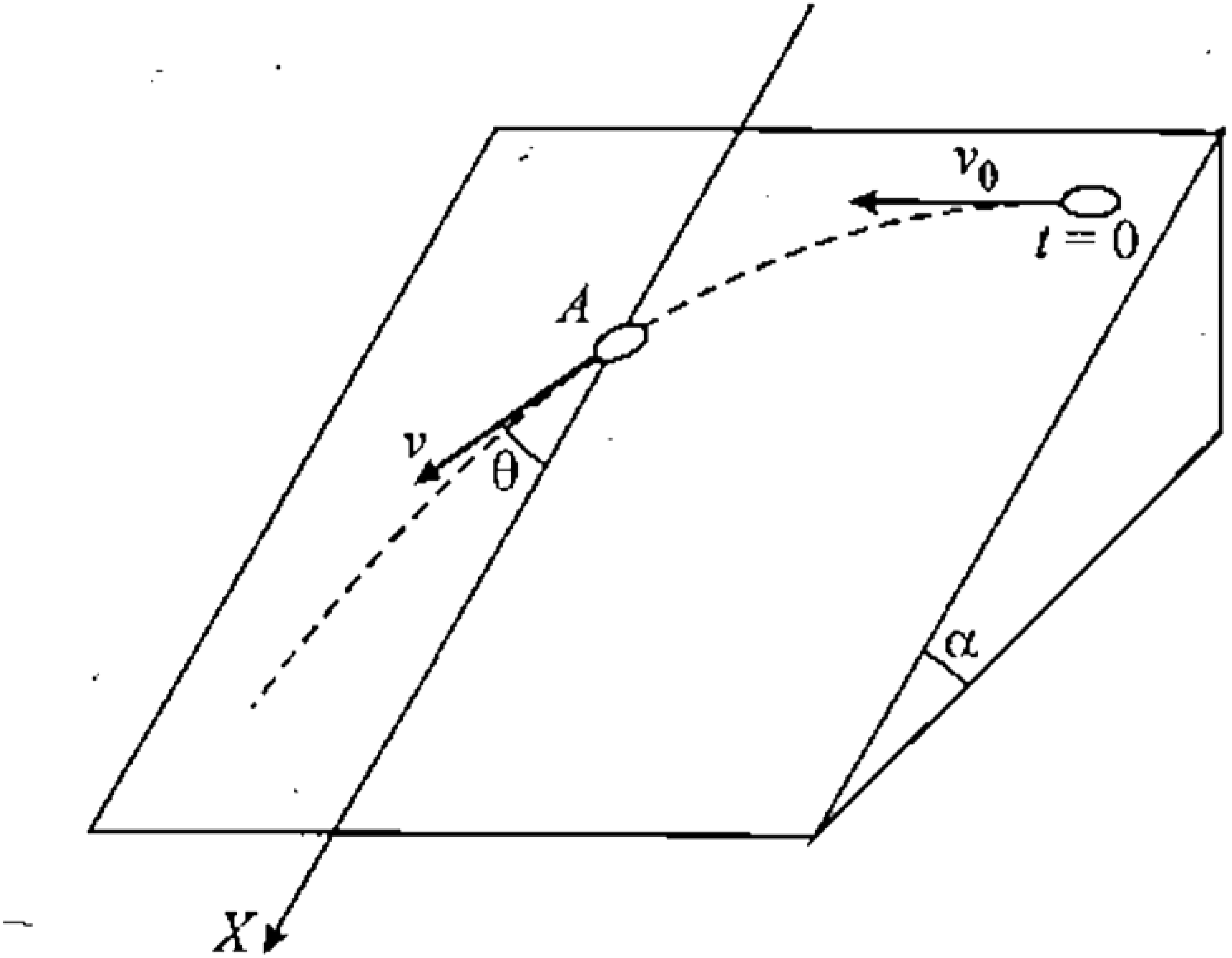
34. A block A of weight `W` slide down an inclined plane S of slope`37^(@)`at a contact velocity,while the plane B also of weight `W` rests on top of `A` The plank B is atteched by a cord to the top of plane .The coefficient of kinetic friction`mu` is the same between the surface A and B and between S and A Determine the value of `1//mu`



Answer: [0.375]

Watch Video Solution

35. A small disc A is placed on an inclined plane forming an angle `alpha` with the horizontal and is imparted an initial velocity `v_(0)`. Find how the velocity of the disc depends on the angle `theta`, shown in figure-2.209, if the friction coefficient `mu = tan alpha` and at the initial moment `theta=pi//2`



Answer: `[v=(v_(0))/(1+cosphi)]`

Watch Video Solution

36. A horizontal plane with the coefficient of friction `k` supports two bodies: a bar and an electric motor with a battery on a block. A thread attached to the bar is wound on the shaft of the electric motor. The distance between the bar and the electric motor is equal to `l`. When the motor is switched on, the bar, whose mass is twice as great as that of the other body, starts moving with a constant acceleration `w`. How soon will the bodies collide?

Answer: `[t=sqrt((2L)/(3a+mug))]`

Watch Video Solution

37. A fixed pulley carries a weightless thread with masses `m_(1)` and `m_(2)` at its ends. There is friction between the thread and the pulley. It is such that the thread starts slipping when the ratio `m_(2)//m_(1)=eta_(0)` find :

(a) The friction coefficient

(b) The acceleration of the mass when `m_(2)//m_(1)=eta gt eta_(0)`

Answer: `[mu=ln((eta_(0))/(pi)),a=(eta-eta_(0))/(eta+eta_(0))g]`

Watch Video Solution

38. A body with zero initial velocity slips from the top of an inclined plane forming an angle `alpha` with the horizontal. The coefficient of friction `mu` between the body and the plane increases with the distance s from the top according to the law `mu = bs`. After what distance the body will stop.

Answer: `[(2tanalpha)/(b)]`

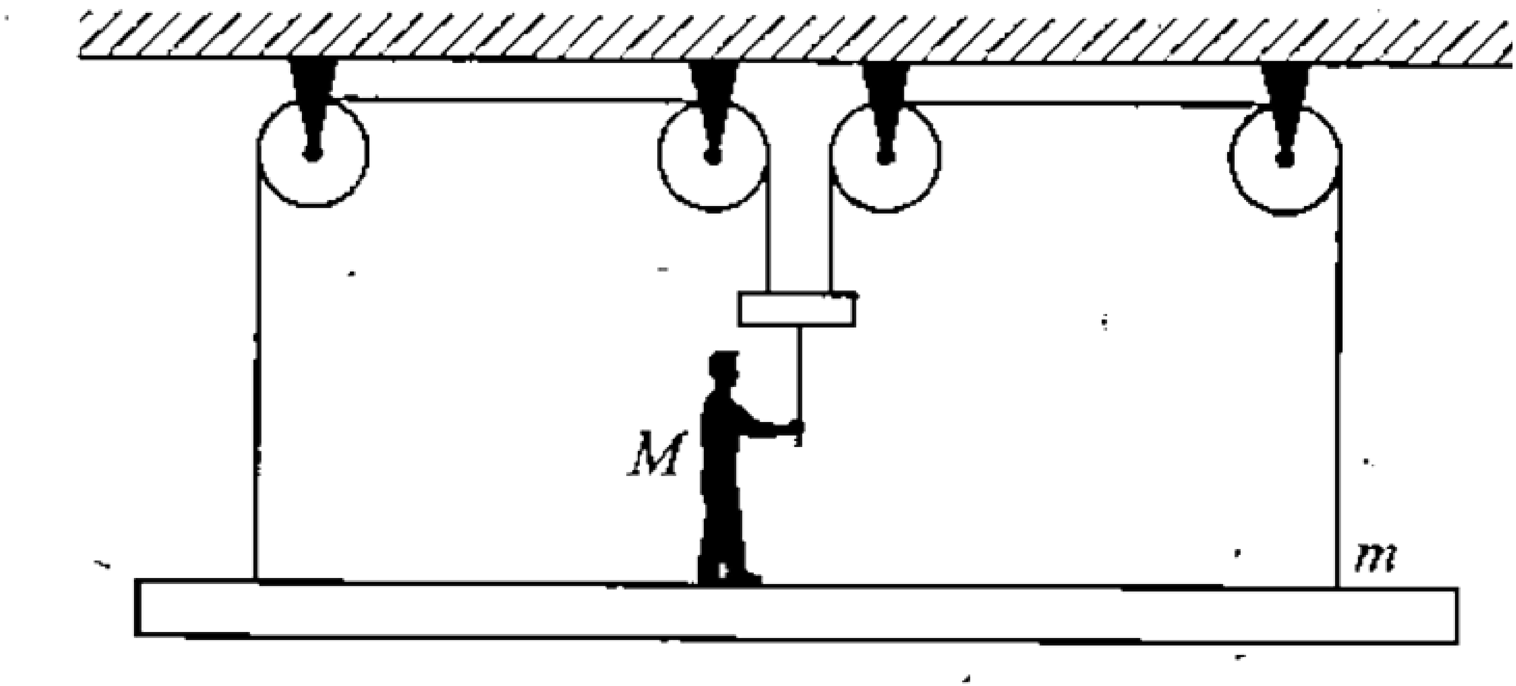
Watch Video Solution

39. A homogeneous chain of length 2l and mass M lies on an absolutely smooth table. A small part of the chain hangs from the table. At the initial moment, the part of the chain lying on the table is held and released, after which the chain begins to slide off the table under the weight of the hanging end. Find the velocity of the chain when the length of the hanging part is equal to `x(x lt l)`. Also calculate the acceleration and the force with which it acts on the edge of the table.

Answer: `[xsqrt((g)/(2l)),(xg)/(2l),(sqrt(2)Mg)/(4l^(2))(2l-x)x]`

View Text Solution

40. A boy of mass M stands on a platform of mass m as shown in figure-2.210, supporting two stringsvia a massless support S. Strings are passing over the pulleys and other ends are connected to the platform as shown. Find the acceleration of the platform and the boy if he applies a constant force T to the string he isholding, which is connected to support S.



Answer: `[(2T-(M+m)g)/(M+m)]`

Watch Video Solution

41. An empty box is put on the pan of a spring balance and scale is adjusted to zero.A stream of small identical beads,each of mass 4.5gm are then dropped into the box from height 7.6m at constant rate of 100 beads/sec. If the collision between each bead and box is completely inelastic fmd the reading of the scale, 10 seconds after beads begin to hit the box. '

Answer: [5 kg]

Watch Video Solution

42. A very flexible uniform chain of mass M and length l is suspended vertically in a lift so that its lower end is just touching the surface of the floor. When the upper end of the chain is released, it falls with each link coming to rest the instant it strikes the floor of the lift.Find the force exerted by the floor of the lift on the chain at the moment, when one fourth of the chain has already rested on the floor. Assume that lift is moving up with an acceleration g/2.

Answer: `[9Mg//8]`

Watch Video Solution

43. A 12kg monkey climbs a light rope.The rope passes over a pulley and is attached to a 16kg bunch of bananas resting on floor. Mass and friction in the pulley are negligible so that the pulley's only effect is to reverse the direction of the rope. What is the maximum acceleration the monkey can have without lifting the bananas ? (Take `g=10m//s^(2)`)

Answer: `[10//3 m//s^(2)]`

Watch Video Solution

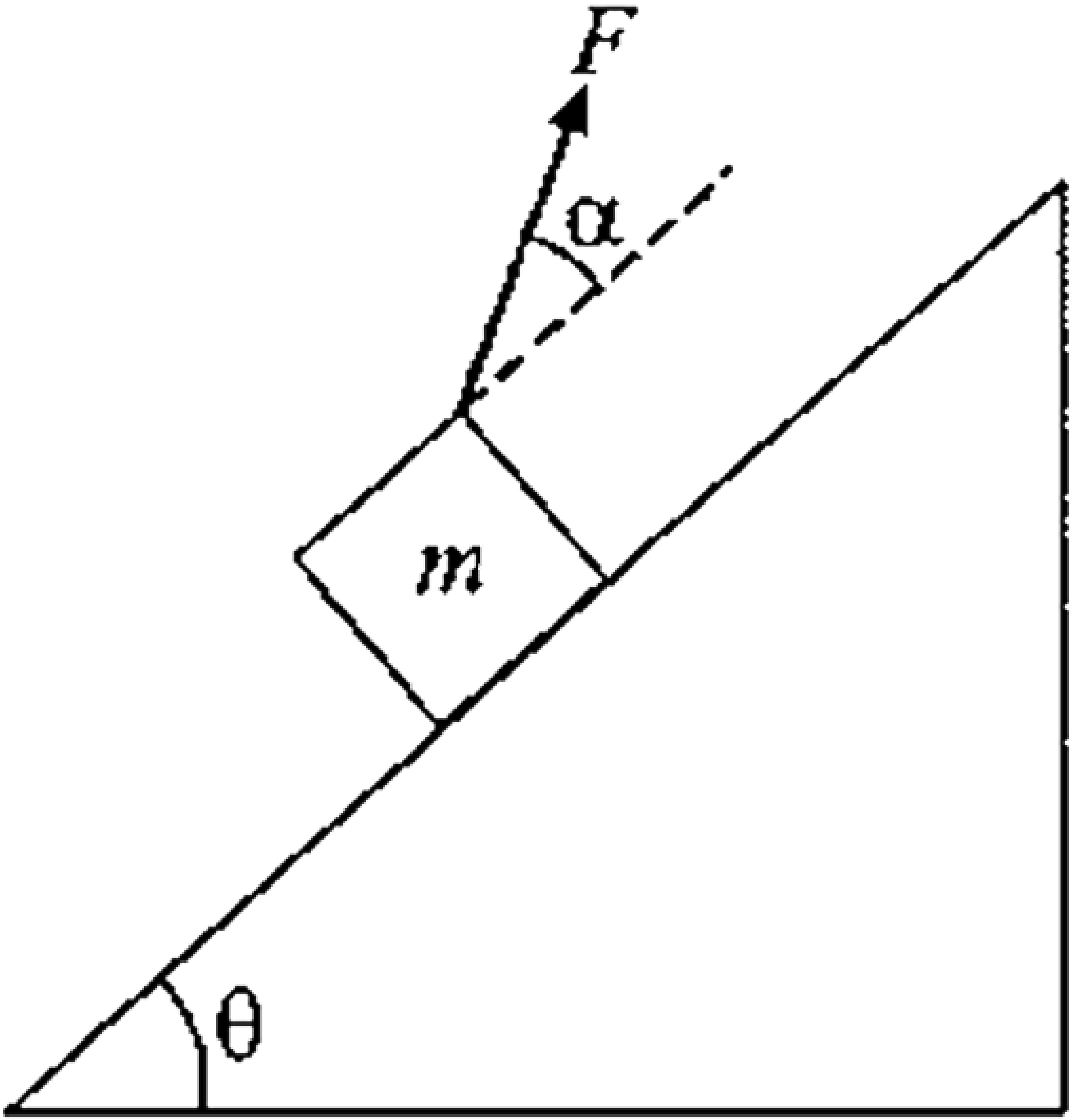
44. A heavy mass M resting on the ground is attached to a small mass m via massless inextensible string passing over a pulley.The string connected to M is loose.The smaller mass falls freely through a height h and the string becomes tight. Obtain the time from this instant when the heavier mass again makes contact with the ground. Also obtain the loss in K.E. when M is jerked in to motion.

Answer: `[(2m)/((M-m)g)sqrt((2h)/(g)),(Mmgh)/(M+m)]`

View Text Solution

45. A bar of mass m is pulled by means of a thread up an inclined plane forming an angle `theta` with the horizontal as shown in figure-2.211. The coefficient of friction is `mu`. Prove that

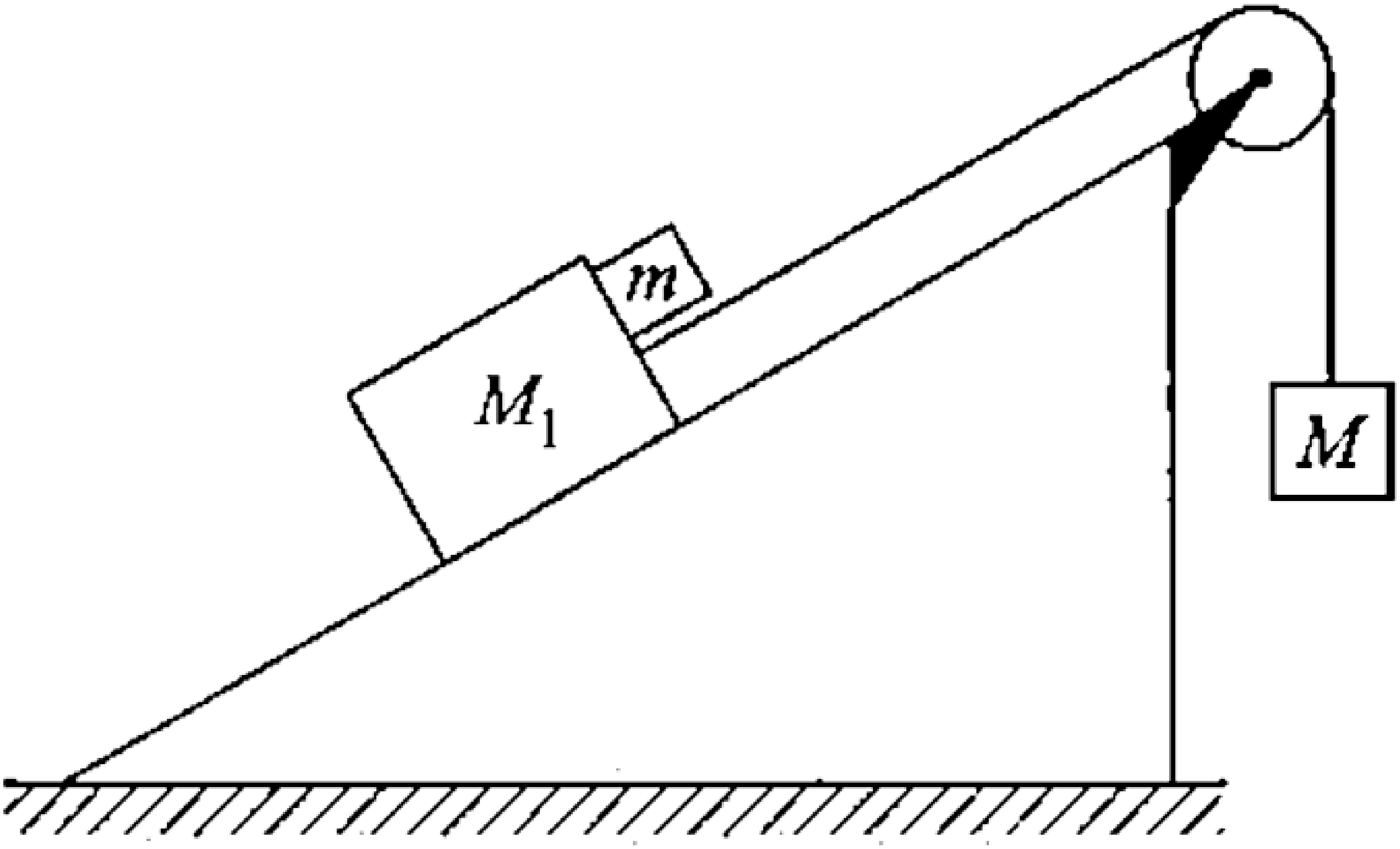
(a)`alpha=tan^(-1)mu`, where `alpha` is the angle which the thread must from with the inclined plane for the tension of the thread to be minimum.



Answer: `T_("min")=(mgsintheta+mumgcostheta)/(sqrt(1+mu^(2))`

Watch Video Solution

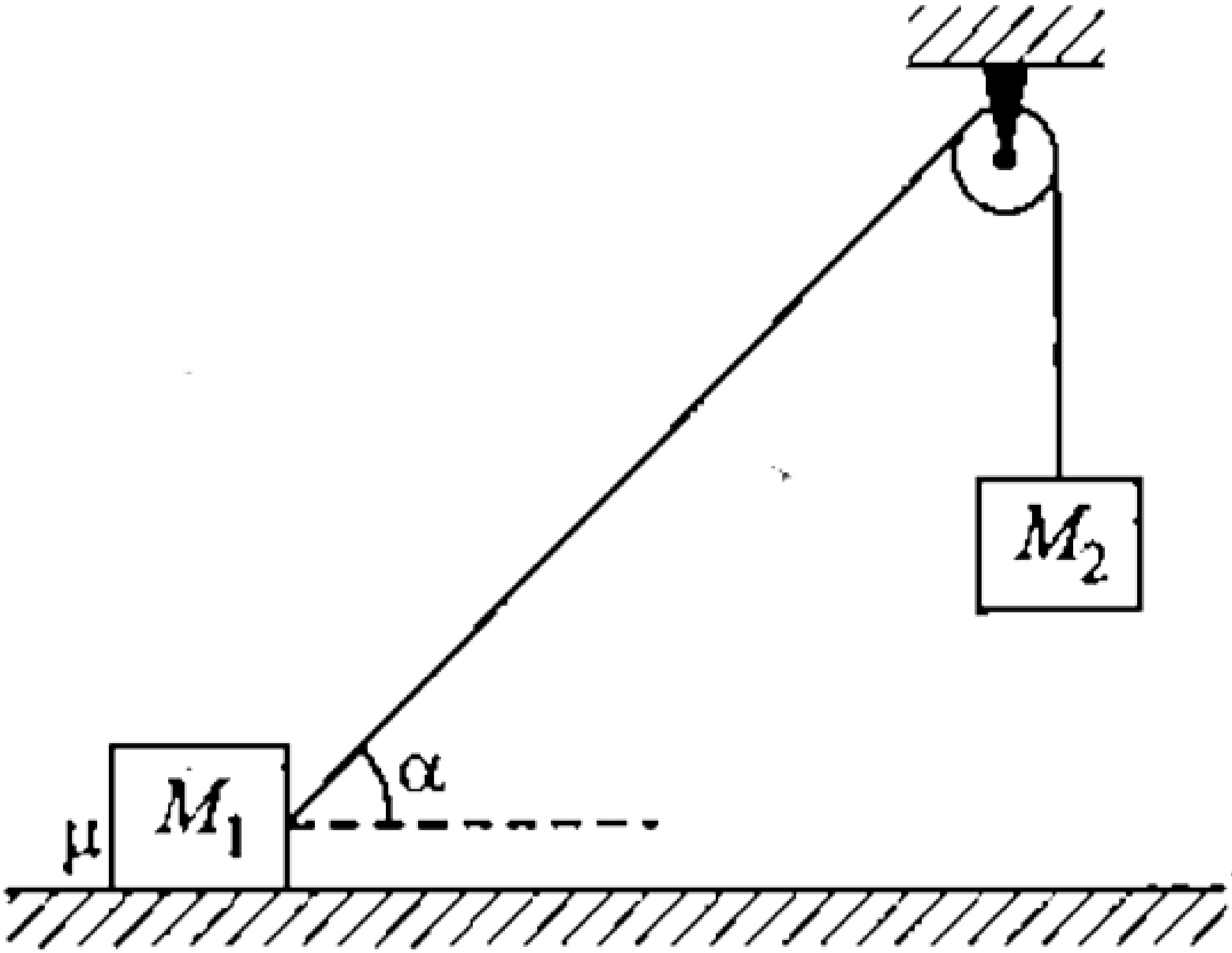
46. Find the mass M in the situation shown in figure-2.212 such that m remains at rest on the front surface of `M_(1)`. The coefficient of friction between the front surface of `M_(1)` and that of m is `mu`.



Answer: `[((m+M_(1))costheta)/((mucostheta+musintheta))]`

Watch Video Solution

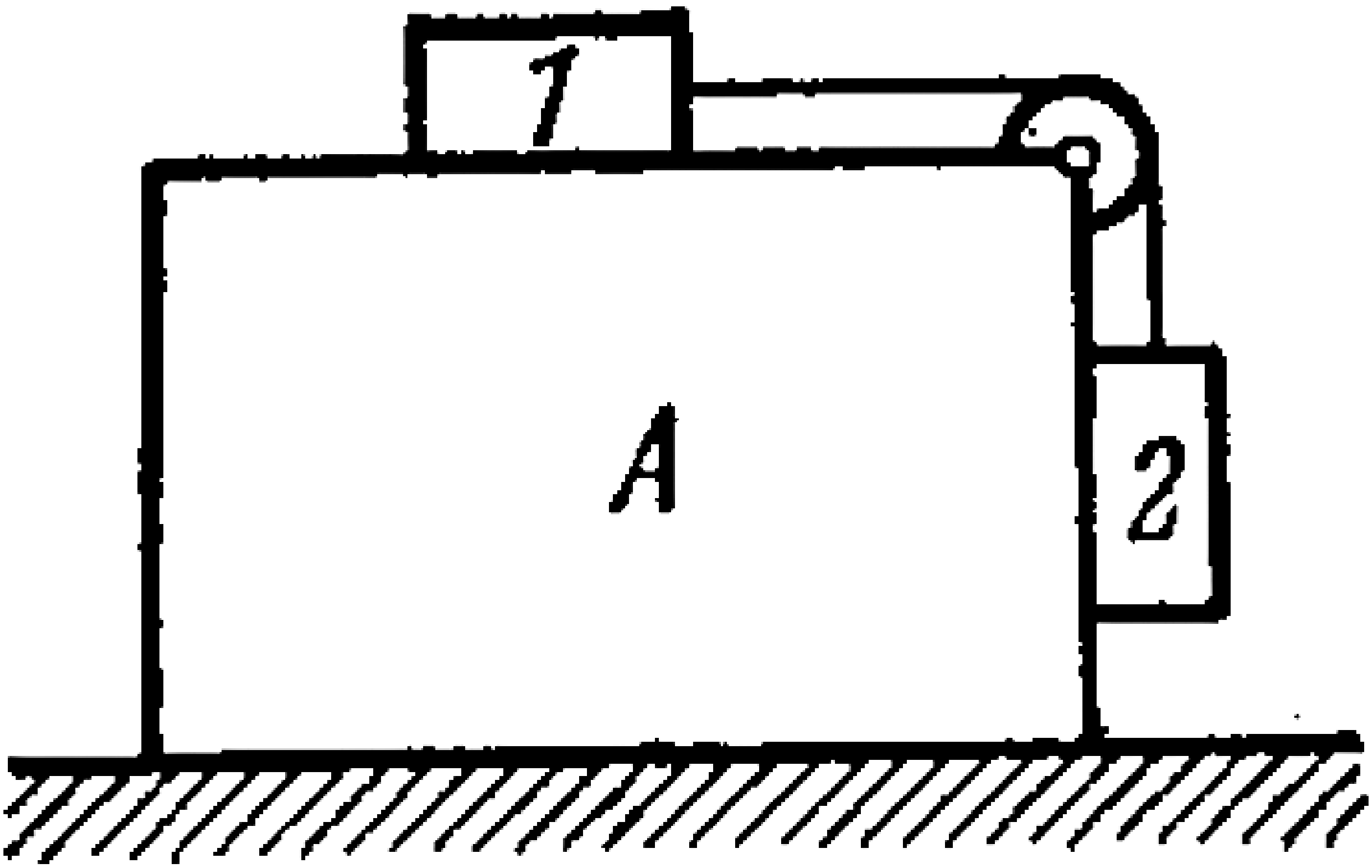
47. A block of mass `m_(1)` rests on a rough horizontal plane with which its coefficient of friction is `mu`. A light string attached to this block passes over a light frictionless pulley and carries another block of mass `m_(2)` as shown in figure-2.213. When the system is just about to move, find the value of `mu` in terms of `m_(1) m_(2)` and `alpha`. Also find the tension in the string.



Answer: `[(m_(2)cosalpha)/(m_(1)-m_(2)sinalpha)]`

Watch Video Solution

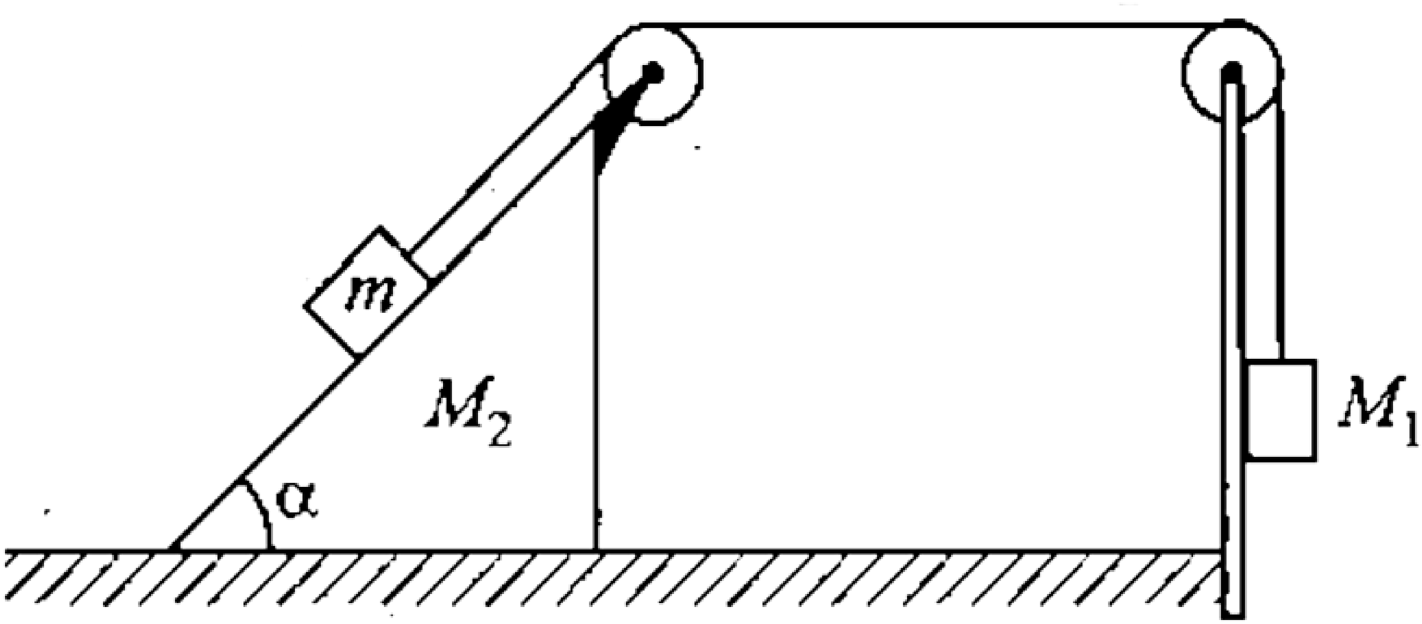
48. What is the minimum acceleration with which bar A (figure) should be shifted horizontally to keep bodies 1 and 2 stationary relative to the bar? The masses of the bodies are equal, and the coefficient of friction between the bar and the bodies is equal to k. The masses of the pulley and the threads are negligible, the friction in the pulley is absent.



Answer: `[(g(1-k))/(1+k)]`

Watch Video Solution

49. Find out the value(s) of `theta` of the inclined plane such that the mass m remains at rest on the wedge of mass `M_(2)` as shown in figure-2.215. Friction between the small block and the wedge plane is `mu` and all other surface are smooth.



Answer: `[sinalpha_("max")-sqrt(4p^(2)q^(2)-4(p^(2)+q^(2))(r^(2)-p^(2))-2qr)/(2(p^(2)+q^(2)))`

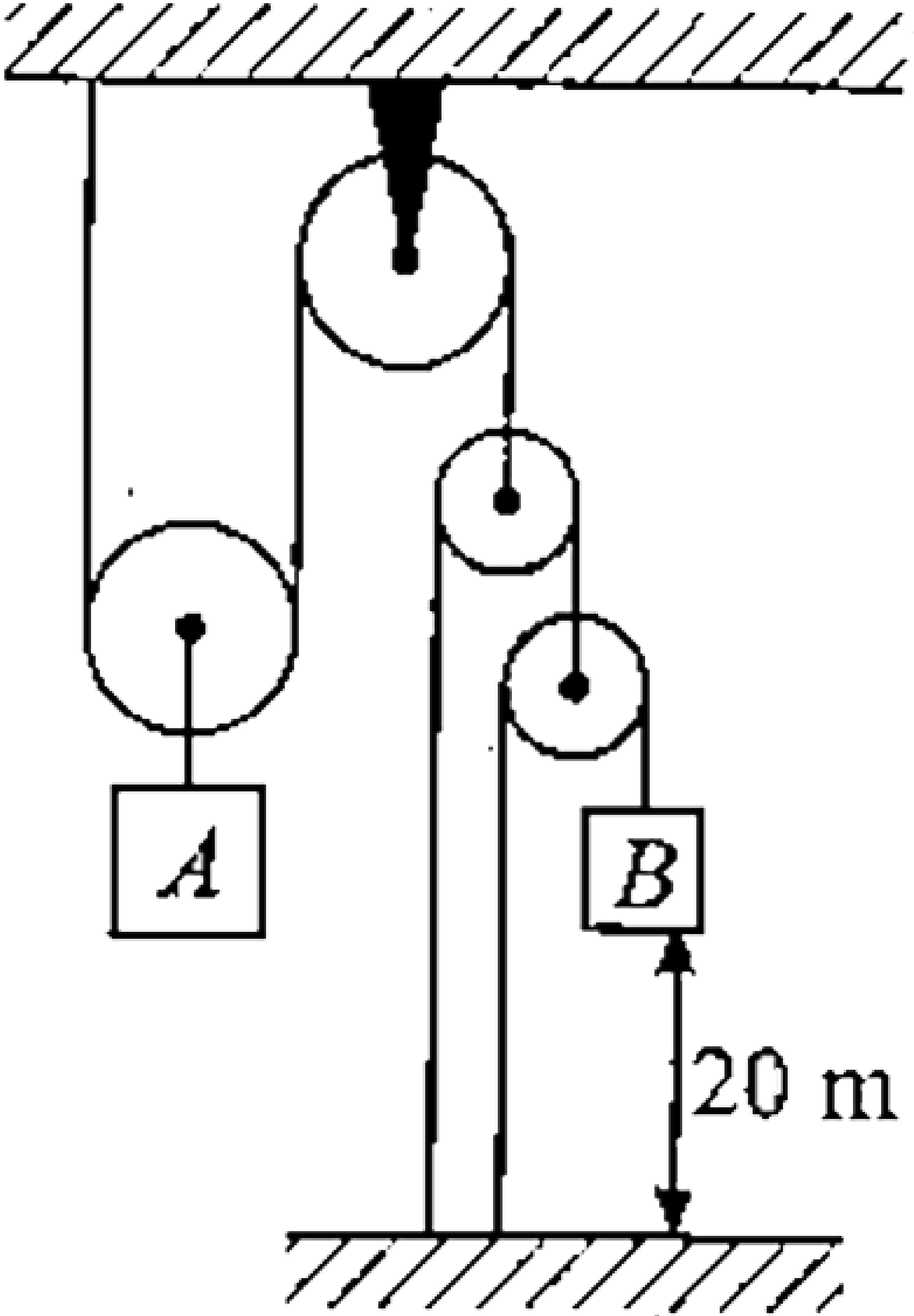
where `p=m(g-mua),q=m(a+mug),r=M_(1)(a-g)" and "a=(M_(1)g)/(M_(1)+M_(2)+m)`

`sinalpha_("min")=sqrt(4l^(2)k^(2)-4(l^(2)+k^(2))(n^(2)-l^(2))-2kn)/(2(l^(2)+k^(2)))`,

where `l= m(a-mug),k=m(g+mua),n=M_(1)(a-g)" and "a=(M_(1)g)/(M_(1)+M_(2)+m)]`

View Text Solution

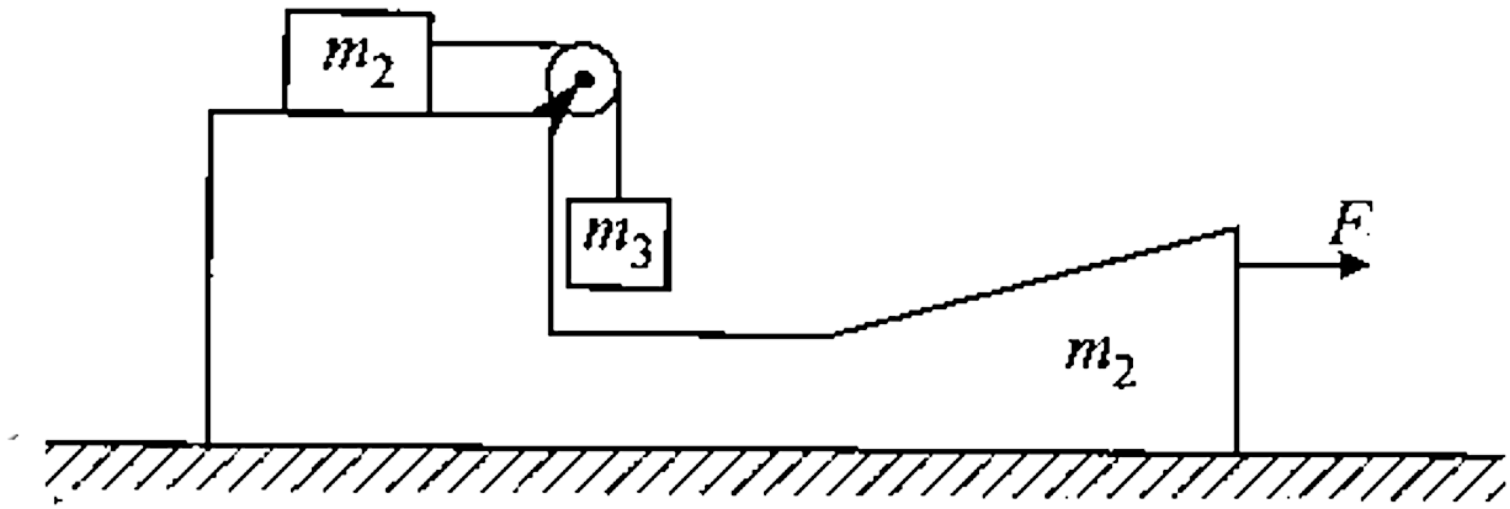
50. In the figure-2.216, the masses A and B are of 4kg and 12 kg respectively. When the system is released from rest, find the time after which the block B will hit the ground.



Answer: [2.05 sec]

Watch Video Solution

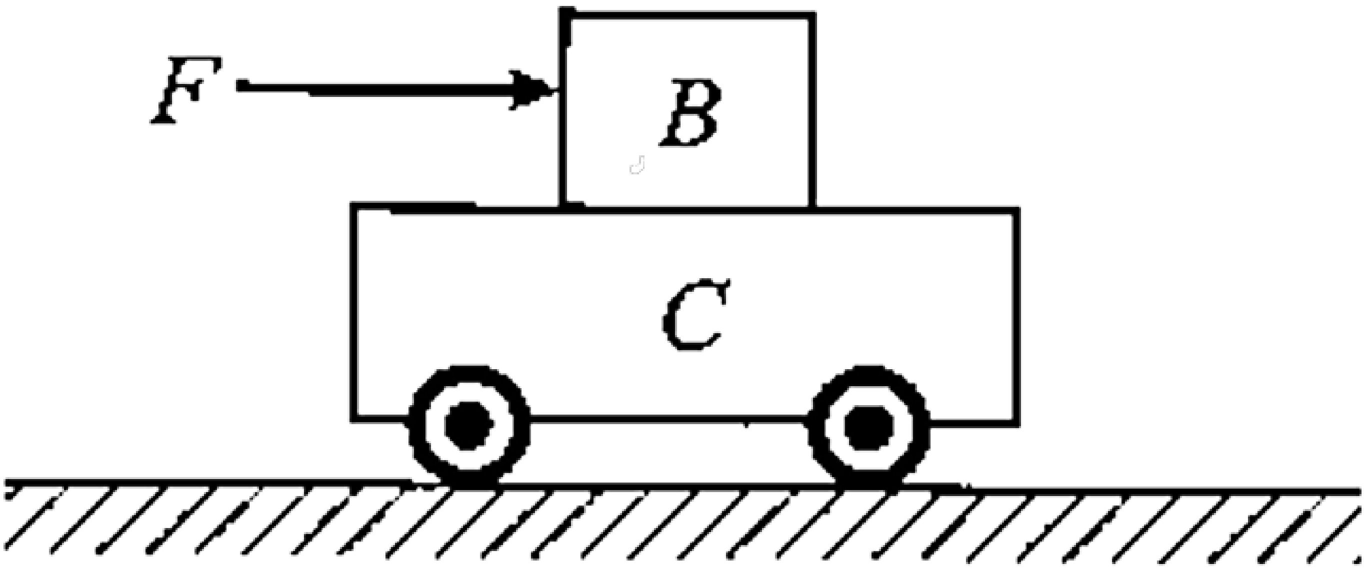
51. In the figure2.217 all the surfaces are frictionless. What force F is required to be applied on the bigger block so that `m_(2)` and `m_(3)` will remain at rest on it.



Answer: `[(m_(3)(m_(1)+m_(2)+m_(3))g)/(m_(2))]`

Watch Video Solution

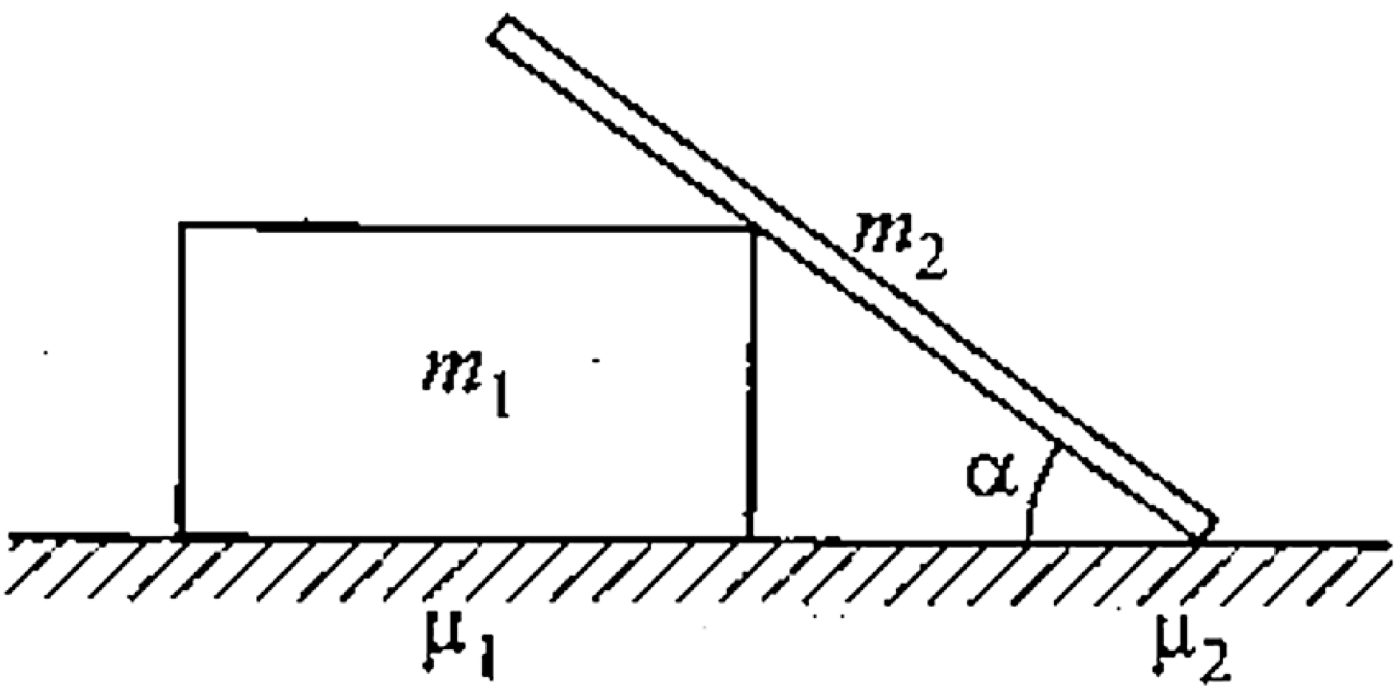
52. Mass of block B shown in figure-2.218 is m and that of cart C is M. Show that the maximum value of force F such that the block does not slip over the surface of C, has a magnitude



Answer: `F_("max")=mumg(1+(m)/(M))`

Watch Video Solution

53. In the figure-2.219 shown, if the system is in equilibrium. Find the relation in `m_(1)` and `m_(2)` forthe case (i) if the bar is just going to slide and (ii) if box is just going to slide.



Answer: `[(i)mu_(1)m_(1)g gt mu_(2)m_(2)g. (sinalpha-mu_(2)cosalpha)/(sinalpha+mu_(2)cosalpha) (ii)mu_(2)m_(2)g gt mu_(1) m_(1)g.(sinalpha+mu_(1)cosalpha)/(sinalpha-mu_(1)cosalpha)]`

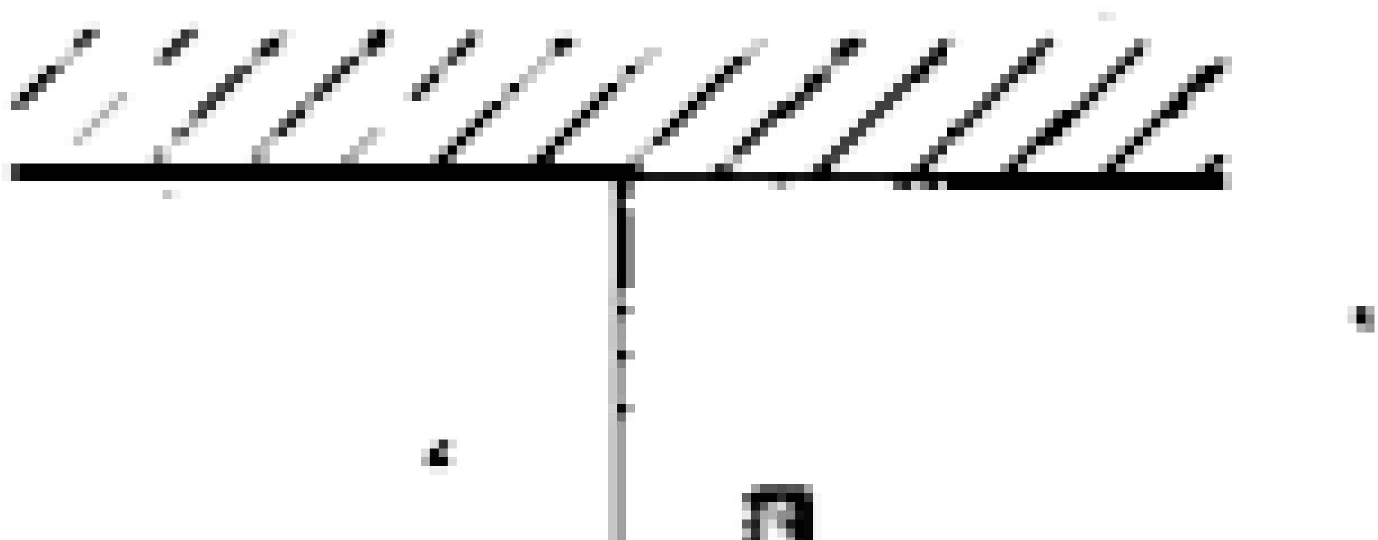
Watch Video Solution

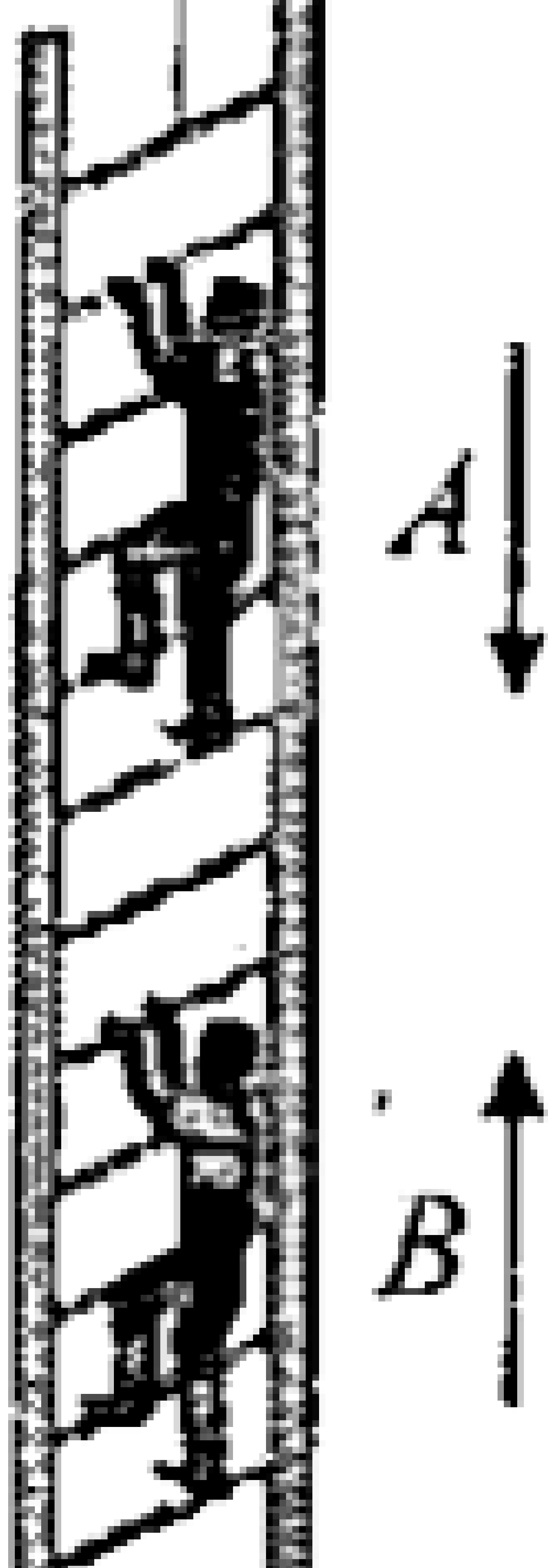
54. A meter stick is hung from two spring balances A and B of equal lengths that are located at the 20 cm and 70 cm marks of the meter stick. Weights of 2.0N are placed at the 10cm and 40cm marks, while a weight of 1.0N is placed at the 90cm mark. The weight of the uniform meter stick is 1.5 N. Determine the scale readings of the two balances A and B.

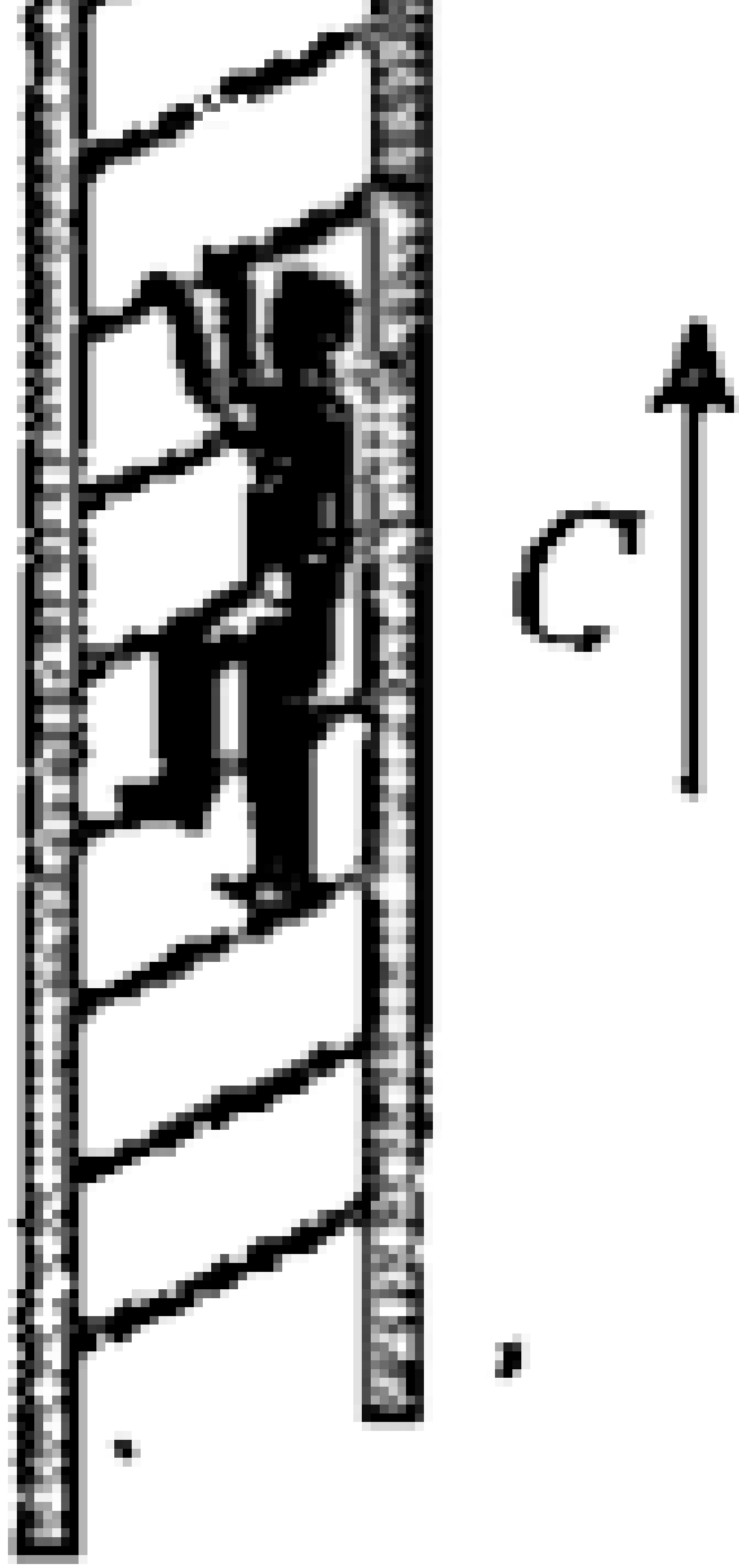
Answer: `[3.8 N, 2.7 N]`

Watch Video Solution

55. A ladder is hanging from ceiling as shown in figure-2.220. Three men of masses 10kg,12kg and 8kg are climbing in such away that man A is going down with an acceleration of `1.6 m//s^(2)` and C is rising up with an acceleration of `0.9 m//s^(2)` and man B is going up with a constant speed of `0.6m//s`.. Find the tension in the string supporting the ladder.




A
B



Answer: [291.2 N]

Watch Video Solution

56. A 54kg girl on ice skates on a frozen lake pulls with a constant force on all light rope that is tied to a 41 kg sled. The sled is initially 22m from the girl, and both the sled and the girl start from rest. Neglecting friction, determine the distance the girl travels to the point where she meets the sled.

Answer: [9.5 N]

Watch Video Solution

57. The force which keeps a hot air balloon is the buoyant force F. Suppose a hot air balloon ofmass M has a downward acceleration of magnitude a.Find the ballast mass that must be dropped from it to cause the balloon to accelerate upward with same magnitude a.'

Answer: `[(2Ma)/(g+a)]`

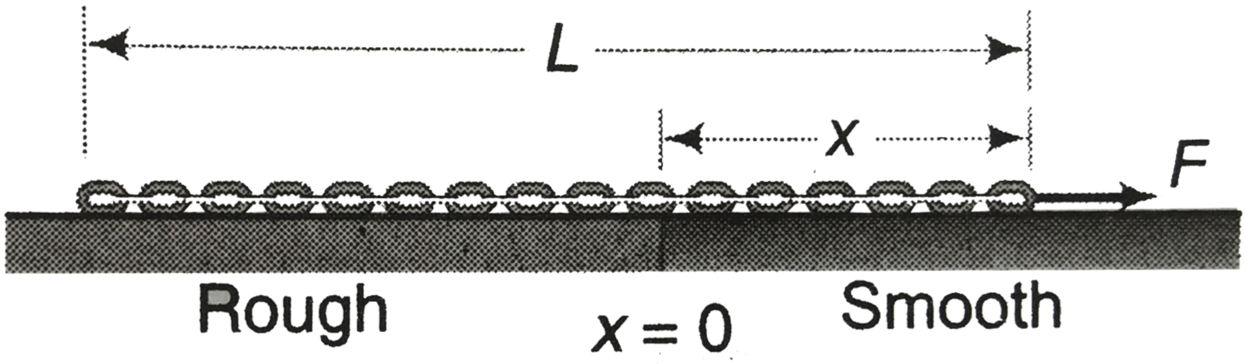
Watch Video Solution

58. A 20 kg bucket is lowered by a rope with constant velocity of 0.5m/s. What is the tension in the rope? A 20kg bucket is lowered with a constant downward acceleration of `1m//s^(2)`. What is the tension in the rope? A 10kg bucket is raised with a constant upward acceleration with same magnitude a.

Answer: [200 N, 180 N, 220 N]

Watch Video Solution

59. A heavy chain with a mass per unit length `p` is pulled by the constant force `F` along a horizontal surface consisting of a smooth section and a rough section. The chain is initially at rest on the rough surface with `x = 0` . If the coefficient of kinetic friction between the chain and the rough surface is `mu_(k)` determine the velocity `v` of the chain when `x = L` . The force `F` is greater than `mu_(k) pgL` in under to initiate the motion ,



Answer: `[sqrt((2F)/(rho)-mu_(k)gL)]`

Watch Video Solution

60. A 400 kg ice boat moves on runners on essentially frictionless ice.A steady wind blows,applying a constant force to the sail. At the end of 8.0 sec run,the acceleration is `0.5m/s^(2)`. (a) What was the acceleration at the beginning of the run? (b) What was the force due to the wind ? (c) What retarding force must be applied at the end of 4.0 sec to bring the ice boat to rest by the end of the next 4 sec ? (assume boat was at rest at time t = 0)

Answer: `[0.5 m//s^(2), 200 N, 400 N]`

Watch Video Solution

61. A box is placed in the middle of the bed of a flatbed truck and is not strapped down. The coefficient `mu` between the bed and the box is 0.75. If the truck is travelling at a speed of 22m/s along a horizontal street, what is the minimum stopping distance such that the box will not slide ?

Answer: [33 m]

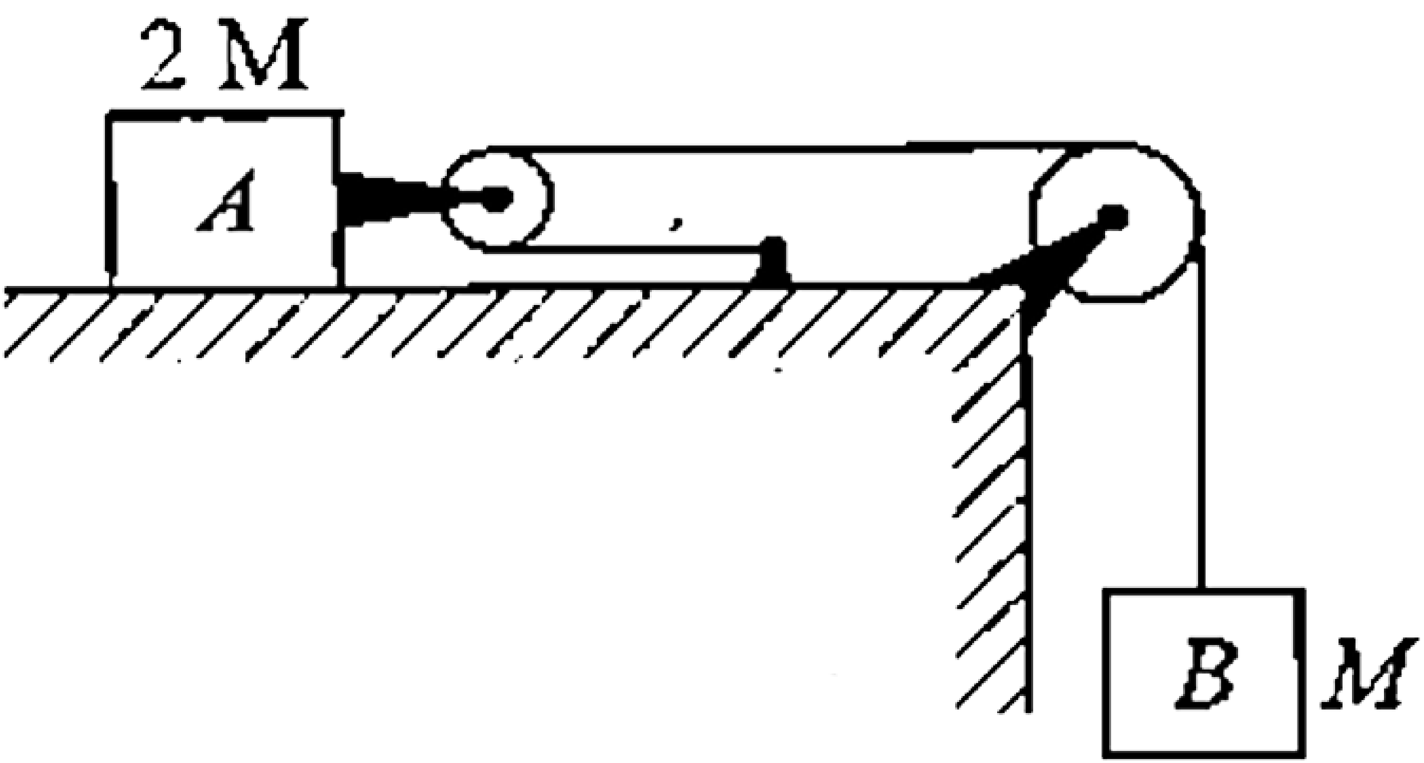
Watch Video Solution

62. A person weighting 400N stands on spring scales in an elevator that is moving downward with constant speed of 4m/s the brakes suddenly grab, bringing the elevator to a stop in 1.8 s. Describe the scale readings from just before the brakes grab until after the elevator is at rest.

Answer: [400 N, 488.89 N, 400 N]

Watch Video Solution

63. Determine the expression for the acceleration of blocks and B as shown in figure-2.222. Assume that the surface of body A are small and have well lubricated bearings. Also find the force, the pulley exerts on the clamp ?



Answer: `[g//3, 2g//3, sqrt(2)Mg//3]`

Watch Video Solution

64. The upper portion of an inclined plane of inclination `alpha` is smooth and the lower portion is rough. A particle slides down from rest from the top and just comesto rest at the foot.If the ratio ofthe smooth length to rough length is w : find the coefficient of friction.

Answer: `[(m+n)/(n)]`

Watch Video Solution

65. A light container filled with apples is to bed ragged on a rough floor where sliding friction coefficient is 0.35. The rope used for the purpose can bear a maximum of 1100 N tension. Find the angle with the horizontally which one has to pull the rope to carry maximum amount of apples. Also find this maximum amount of apples in kilograms.

Answer: `[(a) 19.3^(@), (b) 3329.5 N]`

Watch Video Solution

66. A simple At wood machine composed of a single pulley and two masses `m_(1)` and `m_(2)` is on an elevator. When `m_(1)`=44.7 kg and `m^(2)`=45.3 kg, it takes 5.0 sec for mass `m_(2)` to descend exactly one meter from rest relative to the elevator. What is the elevator's motion?

Answer: [`2 m//s^(2)` upwards]

Watch Video Solution

67. When travelling freely a train is subjected to resistances which vary directly as the velocity and at 9= kph this is equal to 1 percent of the weight of the train. The brakes when applied create a further resistance equal to `l//16th` of the weight of the train. If the brakes are suddenly applied when the velocity is 90kph find the time and distance travelled before the train comes to rest.

Answer: [3.7 sec, 467 m]

View Text Solution

68. A bar of mass m resting on a smooth horizontal plane starts moving due to the force `F=mg//3` of constant magnitude. In the process of its rectilinear motion the angle `alpha` between the direction of this force and the horizontal varies as `alpha=as`, where a is a constant, and s is the distance traversed by the bar from its initial position. Find the velocity of the bar as a function of the angle `alpha`.

Answer: `[sqrt((2g)/(3k))sintheta]`

Watch Video Solution

69. A 20kg box rests on the flat floor of a truck. The coefficients of friction between box and floor are `mu_(s)`= 0.15 and `mu_(k)`=0.10. The truck stops at a stop sign and then starts to move with an acceleration of `2 m/s^(2)`. If the box is 2.2 m from the rear of the truck when the truck starts, how much time elapses before the box falls of fthe rear of the truck? How far does the truck travel in this time.

Answer: [2.1 s, 4.4 m]

Watch Video Solution

70. If the coefficient of static friction between a table and a uniform massive rope is `mu`, what fraction of the rope can hang over the edge of a table without the rope sliding.

Answer: `[(mu)/(1+mu)]`

Watch Video Solution

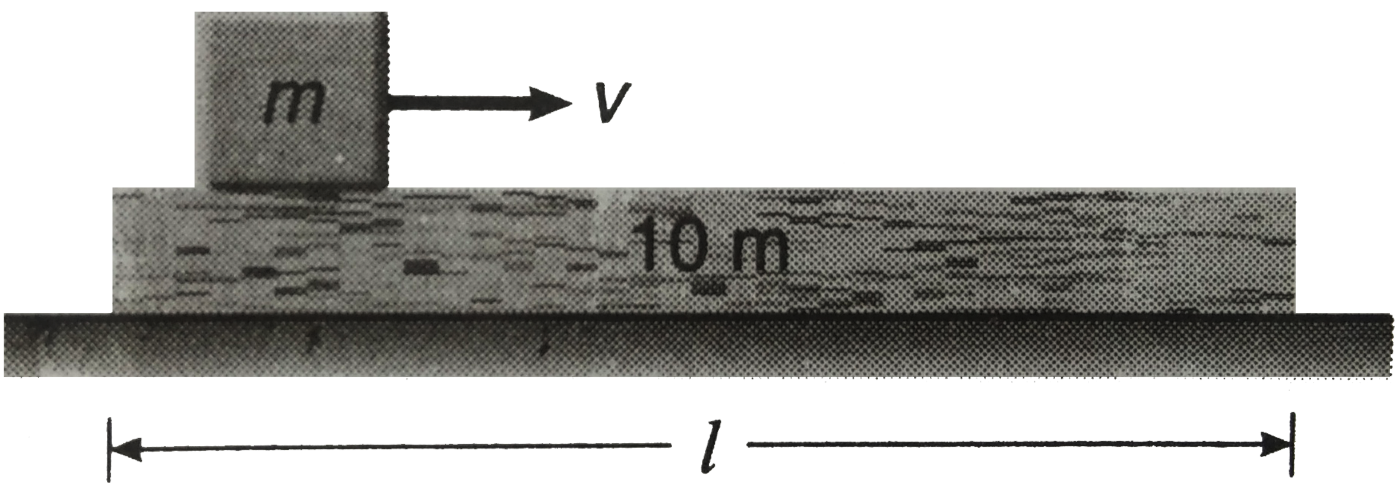
71. Two small balls of the same size and of mass m_{1} and $m_{2}(m_{1} > m_{2})$ are tied by a thin light thread and dropped from a large height. Determine the tension T of the thread during the flight after the motion of the balls has become steady. (Air resistance force is same on two balls)

[Take $m_{1}=2kg$, $m_{2}=1kg$, $g=10m/s^{2}$]

Answer: $\frac{1}{2}(m_{1}-m_{2})g$

Watch Video Solution

72. A small block of mass m is projected on a larger block of mass $10 m$ and length l with a velocity v as shown in the figure. The coefficient of friction between the two block is μ_{2} while that between the lower block and the ground is μ_{1}. Given that $\mu_{2} > 11 \mu_{1}$.



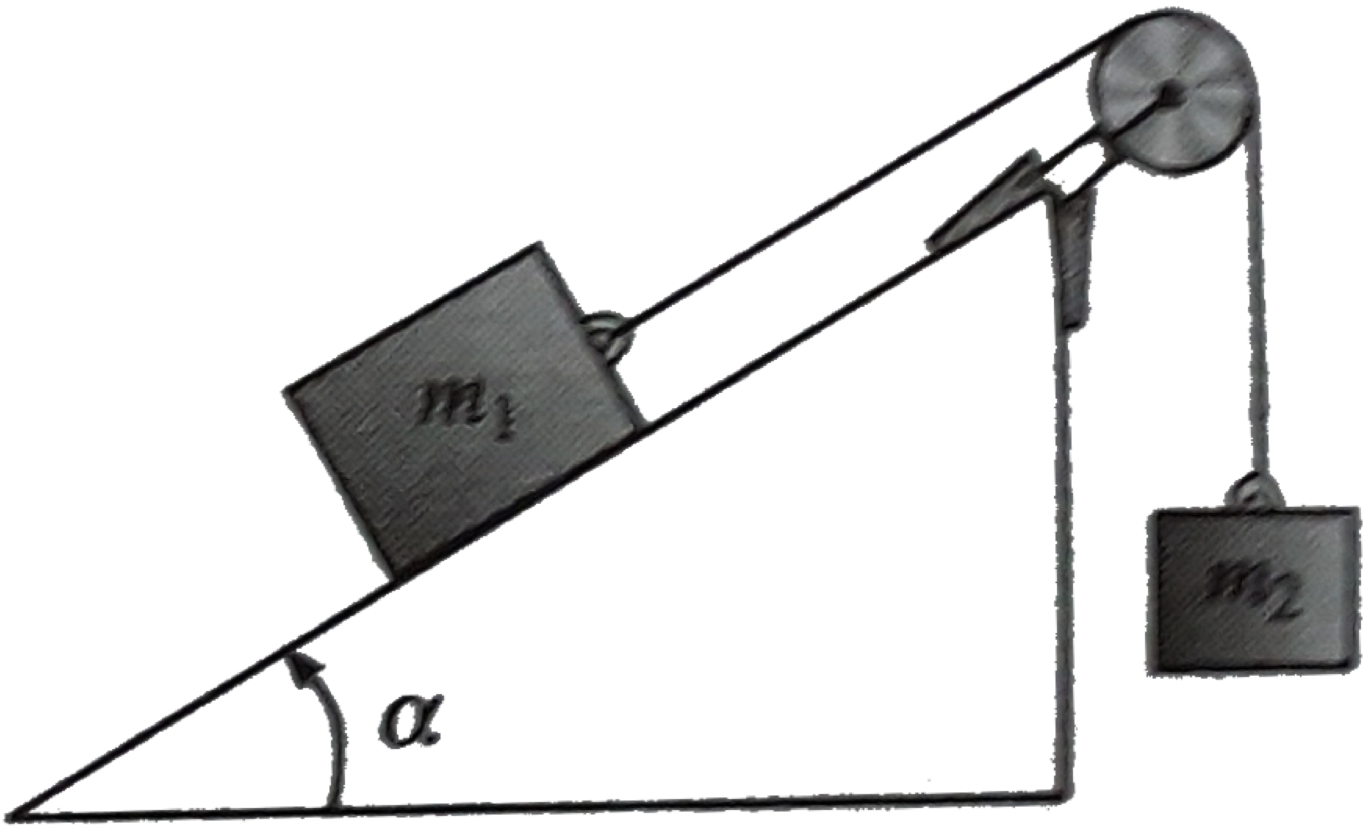
(a) Find the minimum value of v, such that the mass m falls off the block of mass $10 m$.

(b) If v has minimum value, find the time taken by block m to do so.

Answer: (a) $v_{min} = \sqrt{\frac{22(\mu_{1}-\mu_{1})g}{10}}$ (b) $t = \sqrt{\frac{20l}{11g(\mu_{2}-\mu_{1})}}$

Watch Video Solution

73. A block with mass `m_(1)` is placed on an inclined plane with slope angle `alpha` and is connected to a second hunging block with mass `m_(2)` by a cord passing over a small . Friction less pulley as shown in fig 7.247 . The coefficient of static friction is `mu_(2)` and the coefficient of kinetic friction is `mu_(s)`



a. Find the mass `m_(2)` for which block `m_(1)` moves up plane at constant speed once it is set in motion

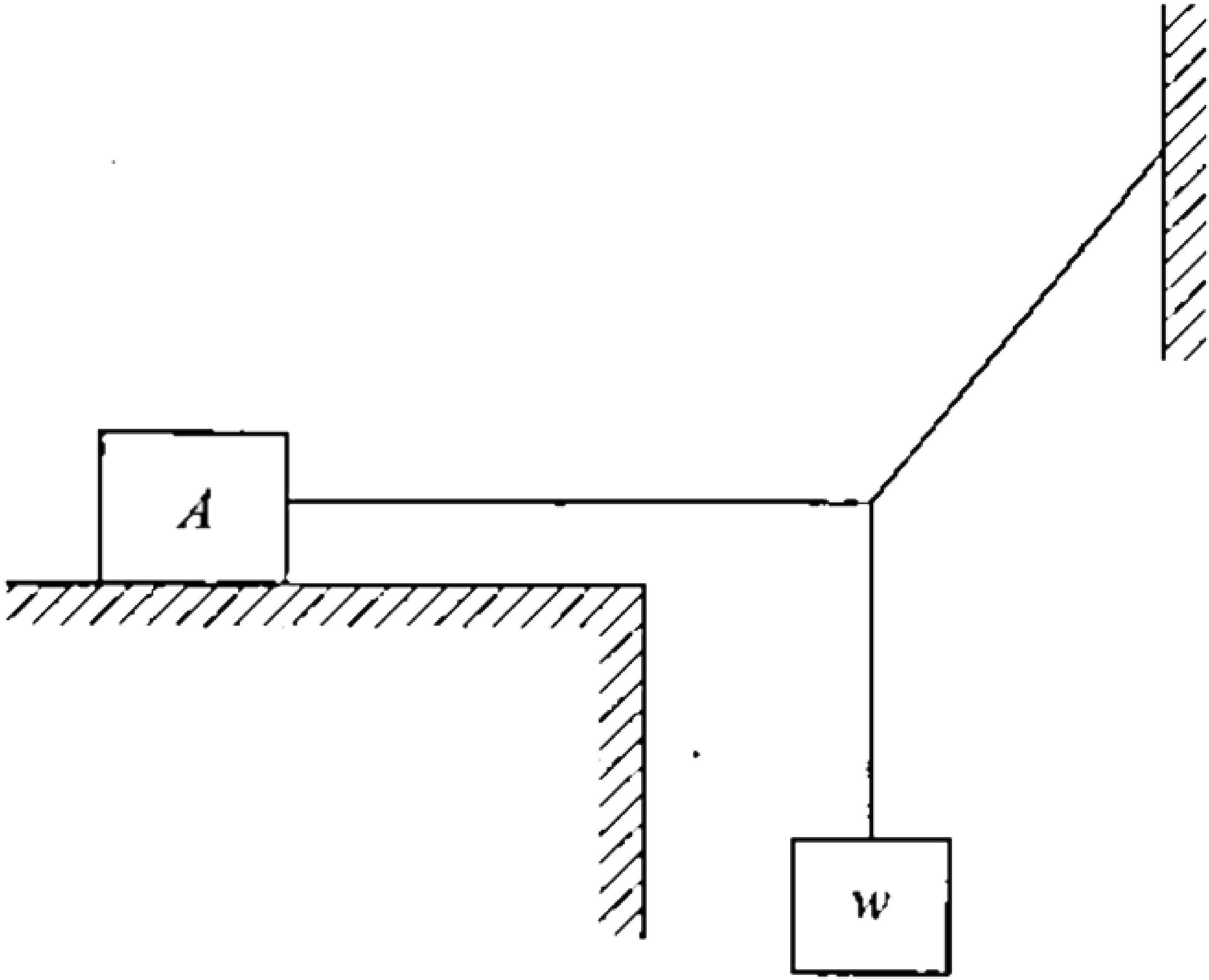
b. Find the mass `m_(2)` for which block `m_(1)` moves down the plane at constant speed once it is set in motion

c.For what range of `m_(2)` will the blocks remain at rest if they are released from rest?

Answer: `m_(1) sin theta +mu_(k)m_(1) cos theta, m_(1) sin theta - mu_(k)m_(1) cos theta`

Watch Video Solution

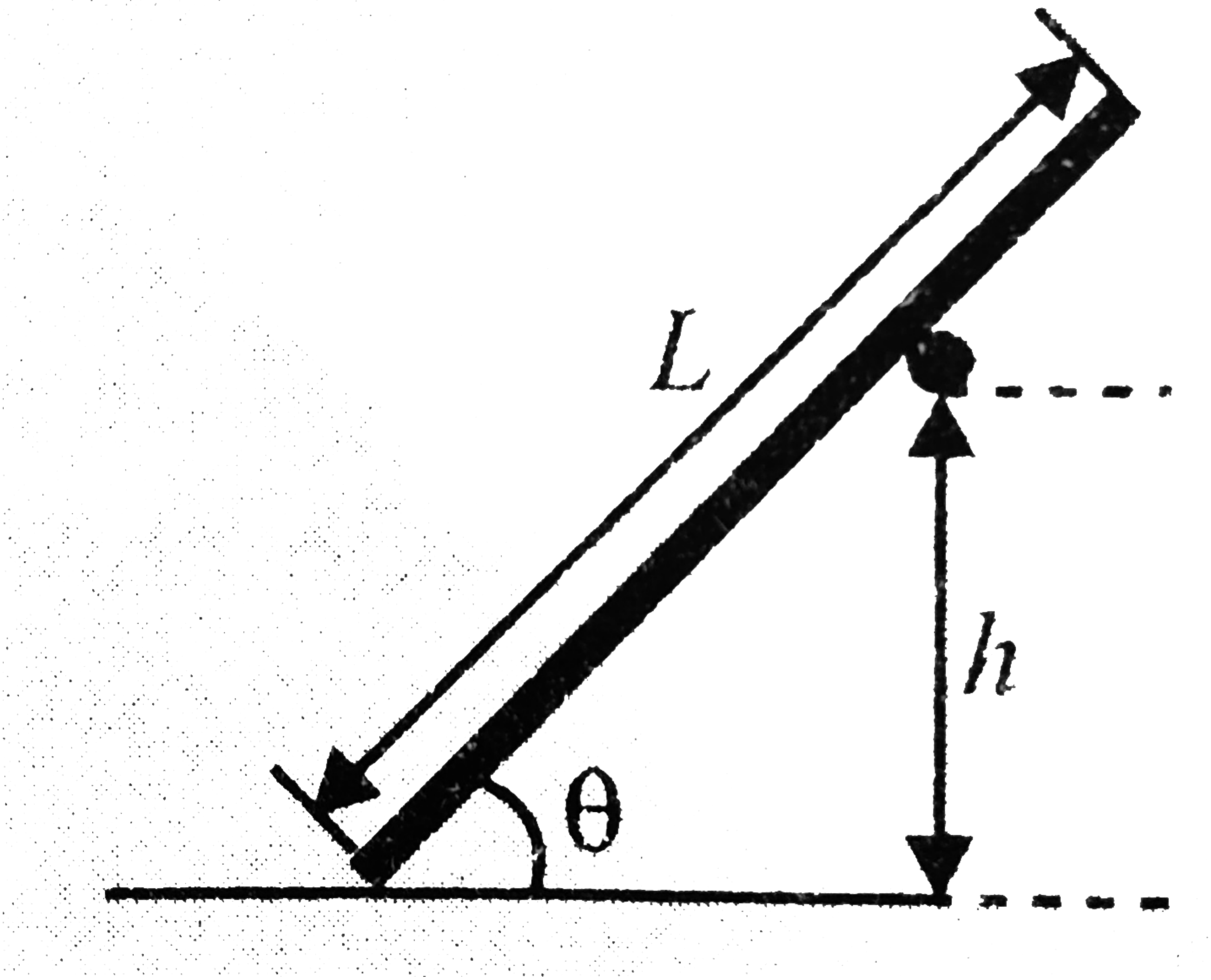
74. Block A in figure weights 90 N. The coefficient of static friction between the block and the surface on which it rests is 0.3. The weight w is 15N, and the system is in equilibrium. Find the friction force exerted on block A.(b) Find the maximum weight w for which the system will remain in equilibrium.



Answer: `8.66N, 46.76 N`

Watch Video Solution

75. A uniform rod of length `L` rests against a smooth roller as shown in Fig. Find the friction coefficient between the ground and the lower end if the minimum angle that the rod can make with the horizontal is `theta`.



Answer: `(L cos theta sin^(2)theta)/(2h-L cos^(2)theta sin theta)`

Watch Video Solution

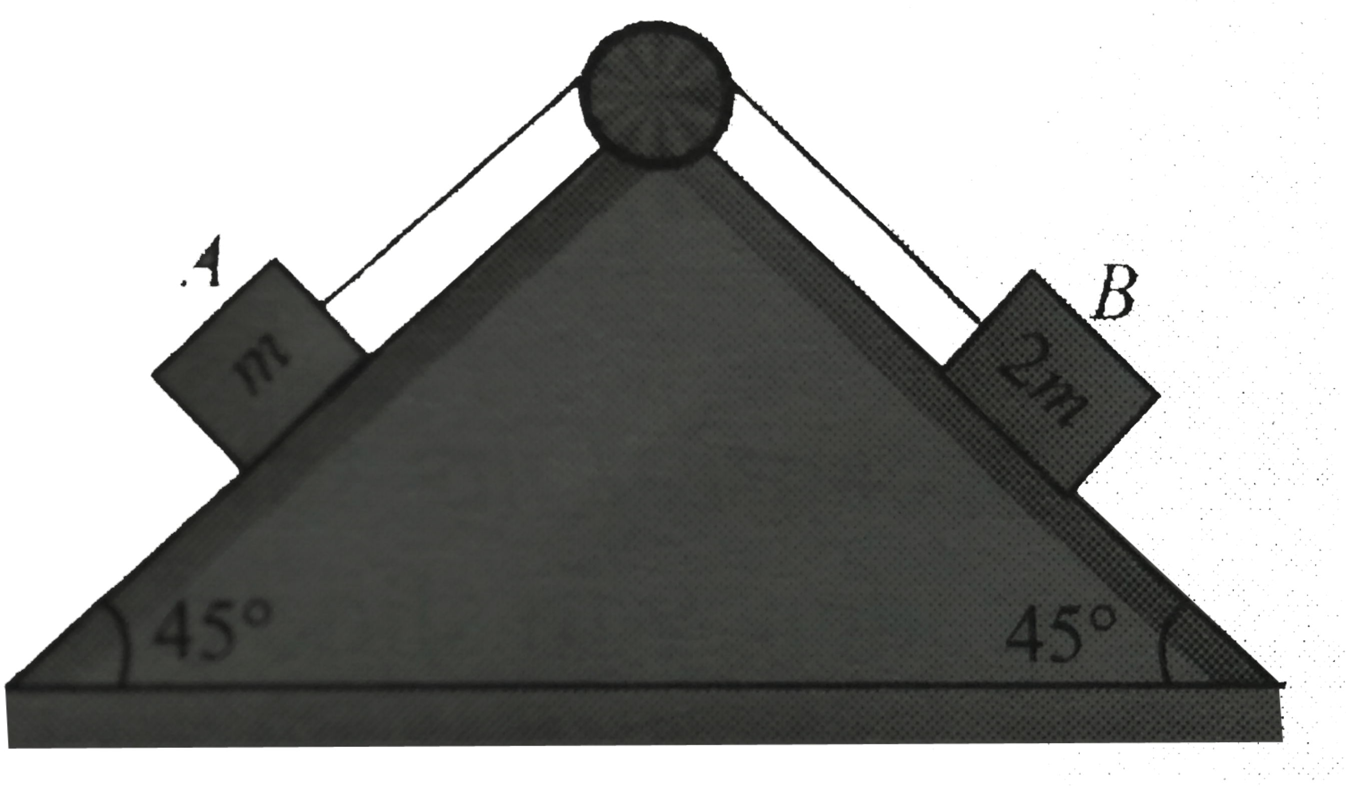
76. Block `A` of mass `m` and block `B` of mass `2m` are placed on a fixed triangular wedge by means of a light and inextensible string and a frictionless pulley as shown in fig . The wedge is inclined at `45^(@)` to the horizontal on both sides . The coefficient of friction between the block `A`and the wedge is `2//3` and that between the block `B` and the wedge is `1//3` .If the system of `A and B` is released from rest then find

.

a. the acceleration of `A`

b. tension in the string

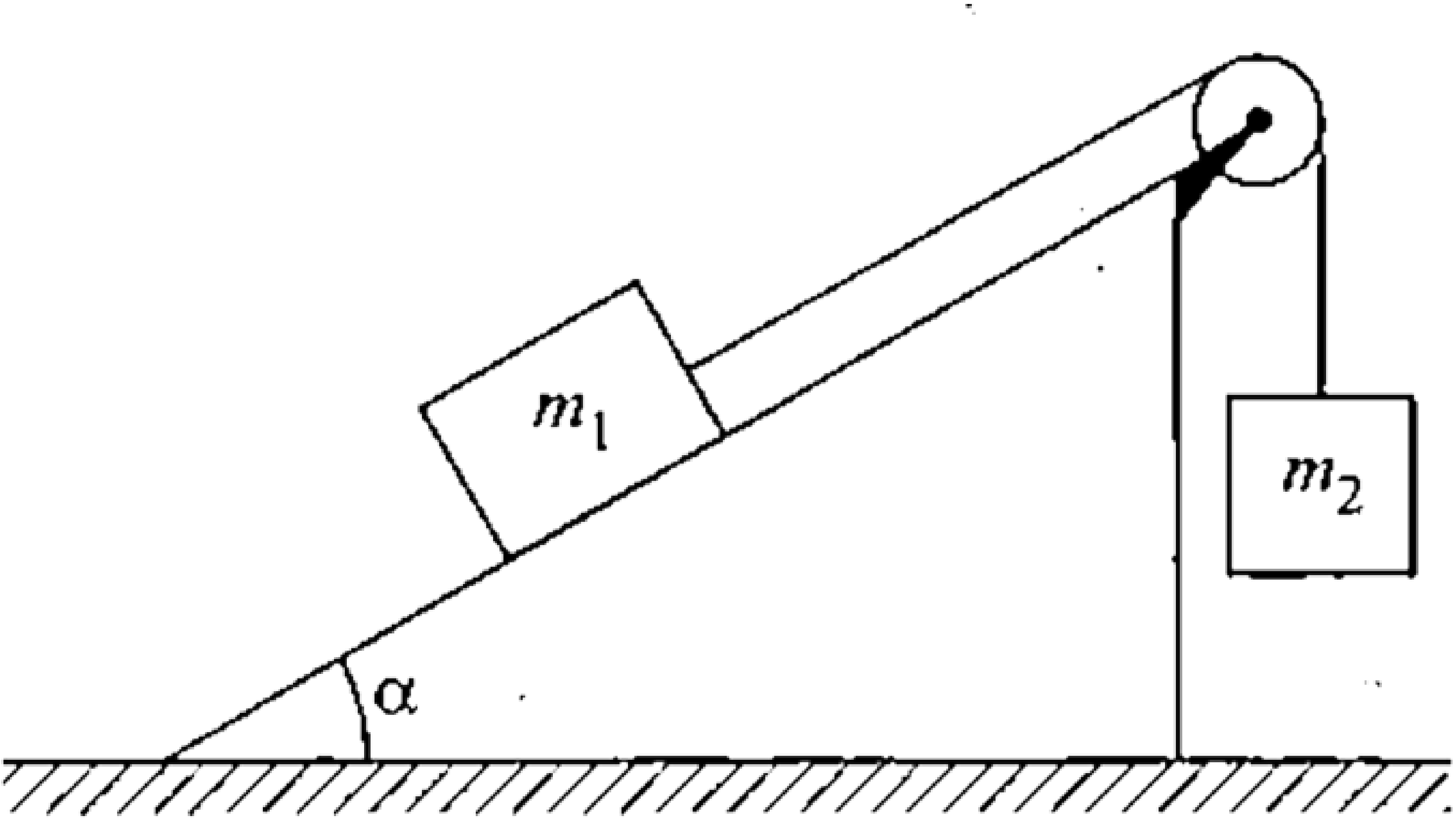
c.the magnitude and direction of the frictional force acting on `A`



Answer: `0,2(sqrt(2))/(3)mg, (mg)/(3sqrt(2))` downward

Watch Video Solution

77. Find the acceleration of the prism of mass M and that of the bar of mass m shown in figure.



Answer: `(g)/((1+(M)/(m)cot^(2)theta)), (g)/((tan theta +(M)/(m)cot theta))`

Watch Video Solution

78. (i) A uniform ladder of length L and weight w rests against a vertical wall and makes an angle `theta` with the horizontal ground. If the coefficient of friction at the point of contact of the ladder with the wall and ground is `mu`, show that the greatest height x, measured along the ladder from the foot to which a man of weight w may climb without the ladder slipping is given by

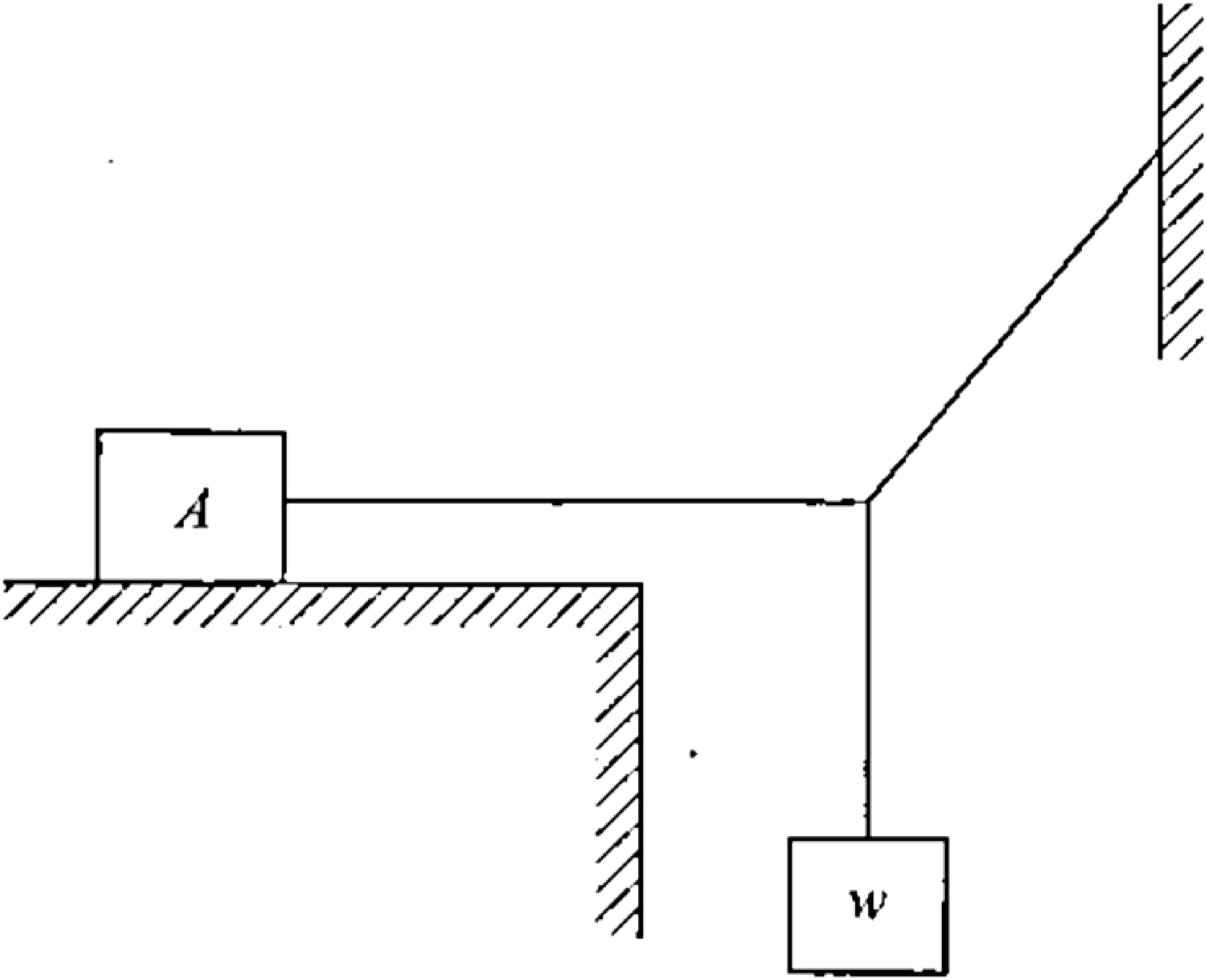
`(x)/(L) = (mu(W+w))/(W(1+mu^(2))) (mu +tan theta) - (w)/(2W)`

(ii) If the wall be smooth and coefficient of friction between ladder and ground be 0.25, show that

`x = (L)/(4) (1-(w)/(W)) tan theta - (wL)/(2W)`

Watch Video Solution

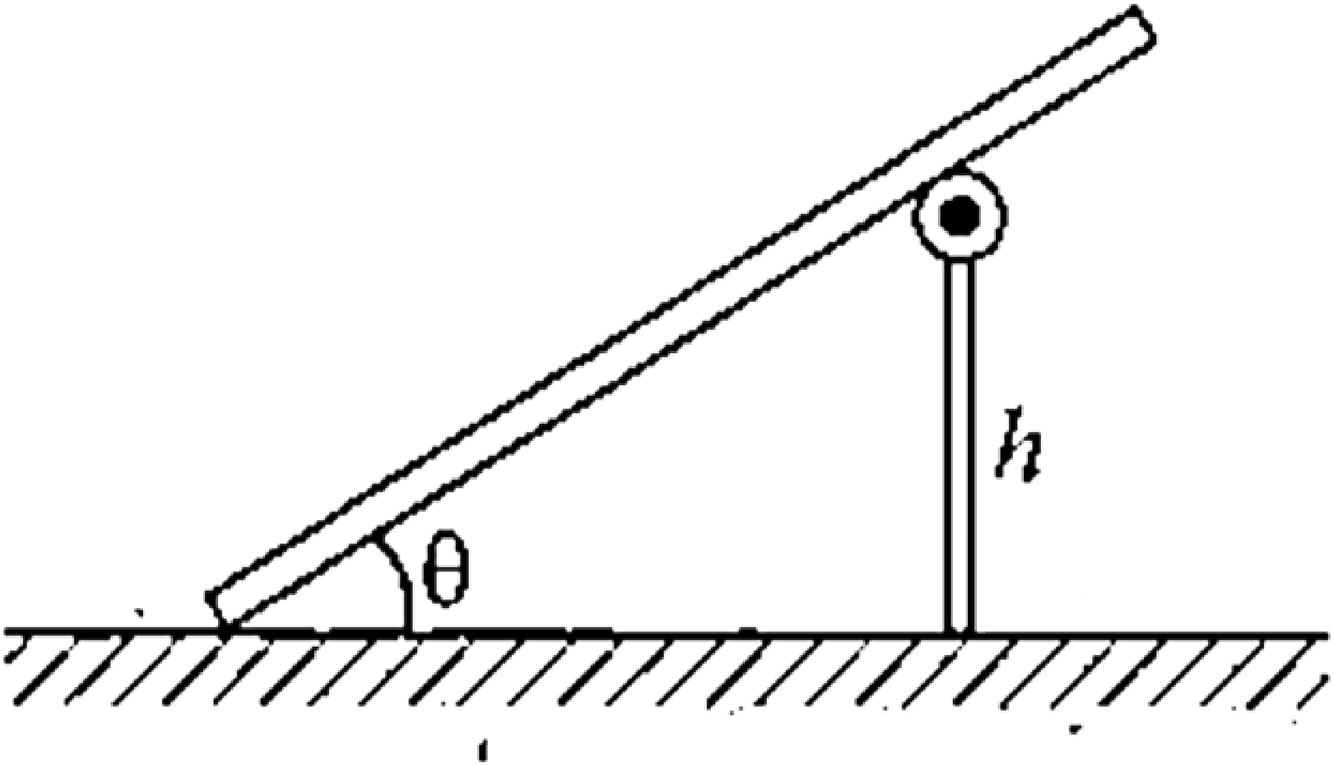
79. Consider the situation shown in figure. Find the acceleration of the system and the tension in the strings.



Answer: `(2m-mu_(1)(M+m)g)/(M+m[5+1(mu_(2)-mu_(1))])`

Watch Video Solution

80. Two masses `M_(1)` and `M_(2)` are connected by light string, which passes over the top of a smooth plane inclined at `30^(@)` to the horizontal, so that one mass rests on the plane and the other hangs vertically as shown in figure. It is found that `M_(1)`, hanging vertically can draw `M_(2)` up the full length of the plane in half the time in which `M_(2)` hanging vertically draws `M_(1)` up. Find `M_(1)//M_(2)`. Assume pulley to be smooth. Initially at time `t = 0` smooth masses `M_(1) = 15 kg` and `M_(2) = 10 kg` are held at rest and then they released. if after one second. the string snaps, find the further time taken for the 15 kg mass to return to its original position on the plane. Take `g = 10 m//s^(2)`



Answer: `3//2, 0.69` sec

View Text Solution

81. Two block , with masses `m_(1)` and `m_(2)` are staked as shown in fig and placed on a frictionless horizontal surface . There is a friction between the two block .An external force of magnitude `F` is applied to the top block at an angle `alpha` below the horizontal . The coefficient of friction between `m_(1)` and `m_(2)` are `mu_(s)`

b. If the two blocks move together, find their acceleration

b . Calculate the maximum value of force so that blocks will move together

Answer: `(F cos alpha)/(m_(1)+m_(2))`

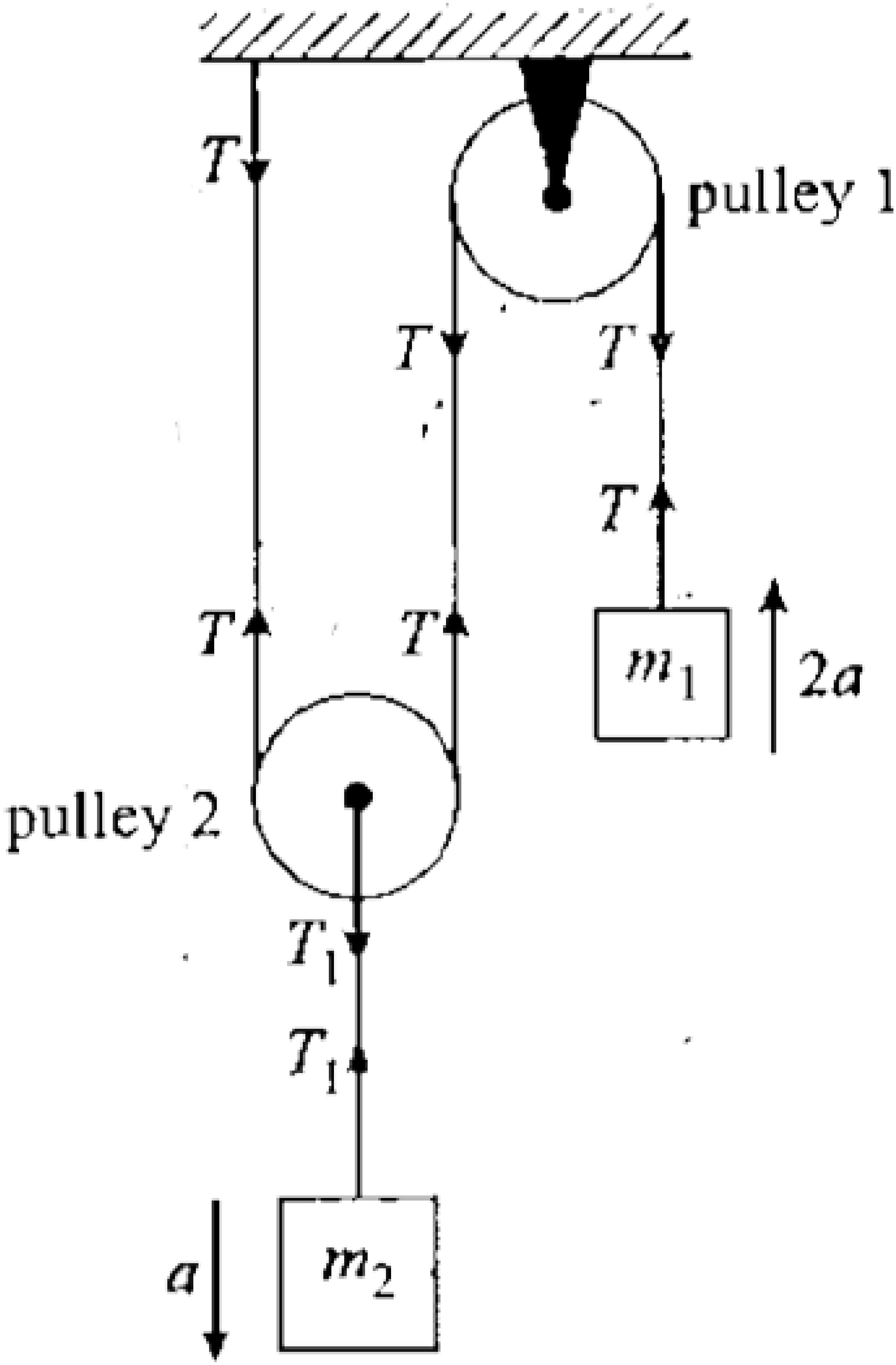
Watch Video Solution

Illustravtive Example

1. Find the acceleration of masses `m_(1)` and `m_(2)` connected by an inextensible string, shown in figure-2.13(a). The string and pulley are assumed to be massless and frictionless.

Watch Video Solution

2. A situation is shown in figure-2.15, Find the acceleration of masses `m_(1)` abd `m_(2)` mass of pulley is `m_(P)`. Consider the string going over the pulley is massless and frictionless.

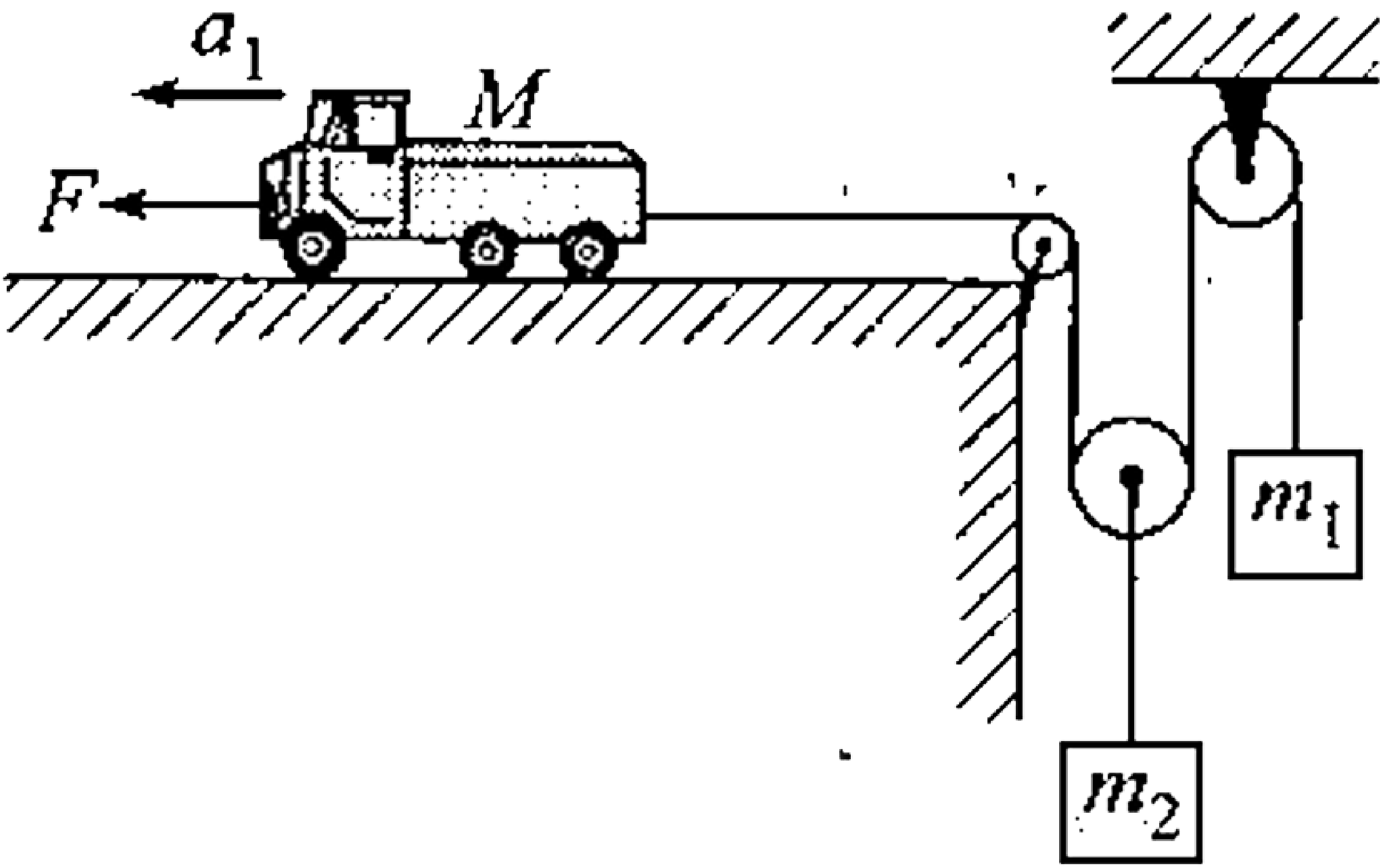


Watch Video Solution

3. Find the acceleration of masses `m_(1)` and `m_(2)` moving down the smooth incline plane. The string and the pulley are masseless and frictionless.

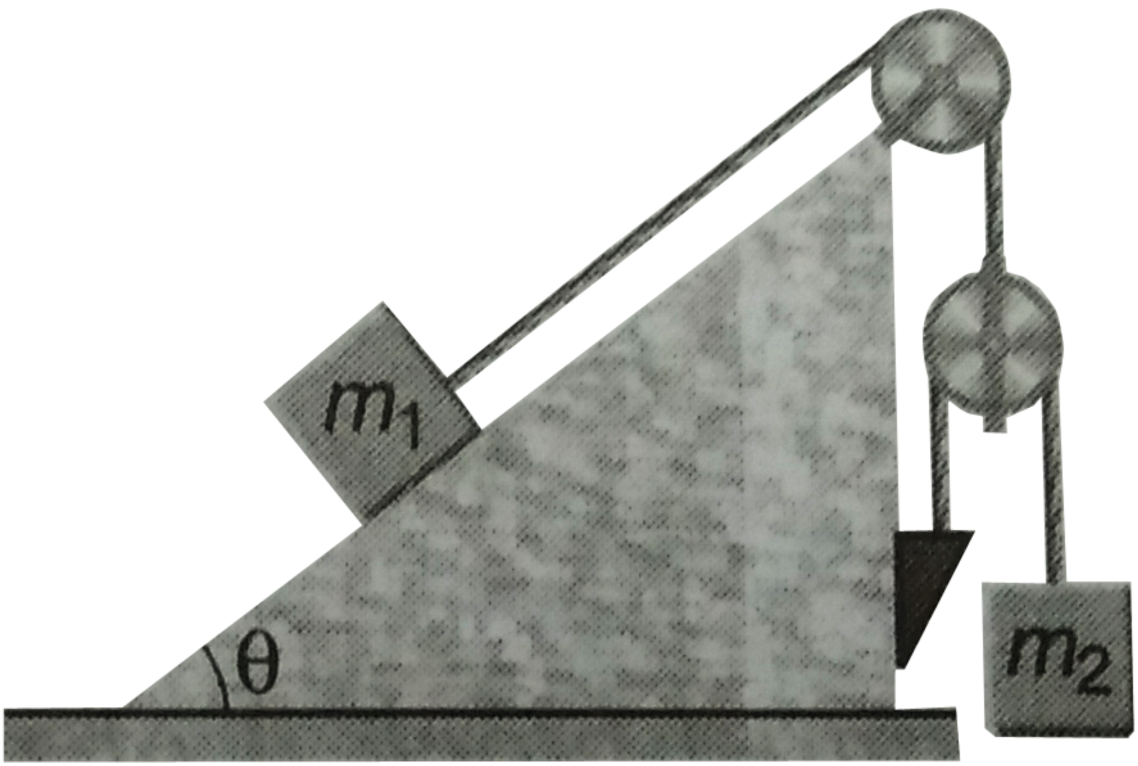
Watch Video Solution

4. A toy truck of mass M is moving towards left with an acceleration `a_(1)` as shown in figure-2.17. It is connected to a mass `m_(1)` with a massless and frictionless string, going over a movable massless pulley, to which another mass `m_(2)` is connected. Find the force acting on the truck towards right and the acceleration of masses `m_(1)` and `m_(2)`



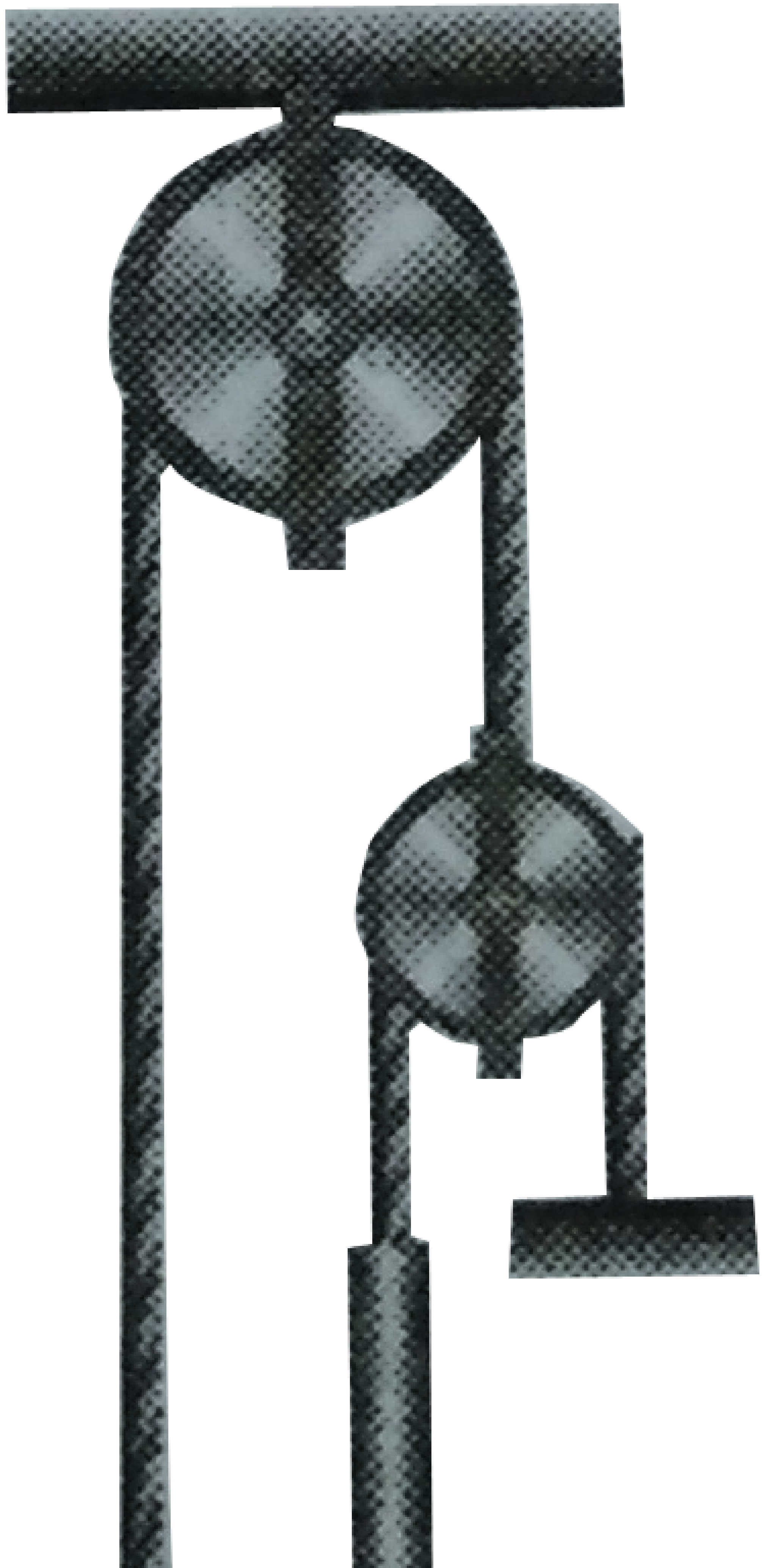
Watch Video Solution

5. Find the acceleration of the body of mass `m_(2)` in the arrangement shown in figure. If the mass`m_(2)` is `eta` time great as the mass `m_(1)` and the angle that the inclined plane forms with the horizontal is equal to `theta`. The masses of the pulley and threads, as well as the friction, are assumed to be negligible.



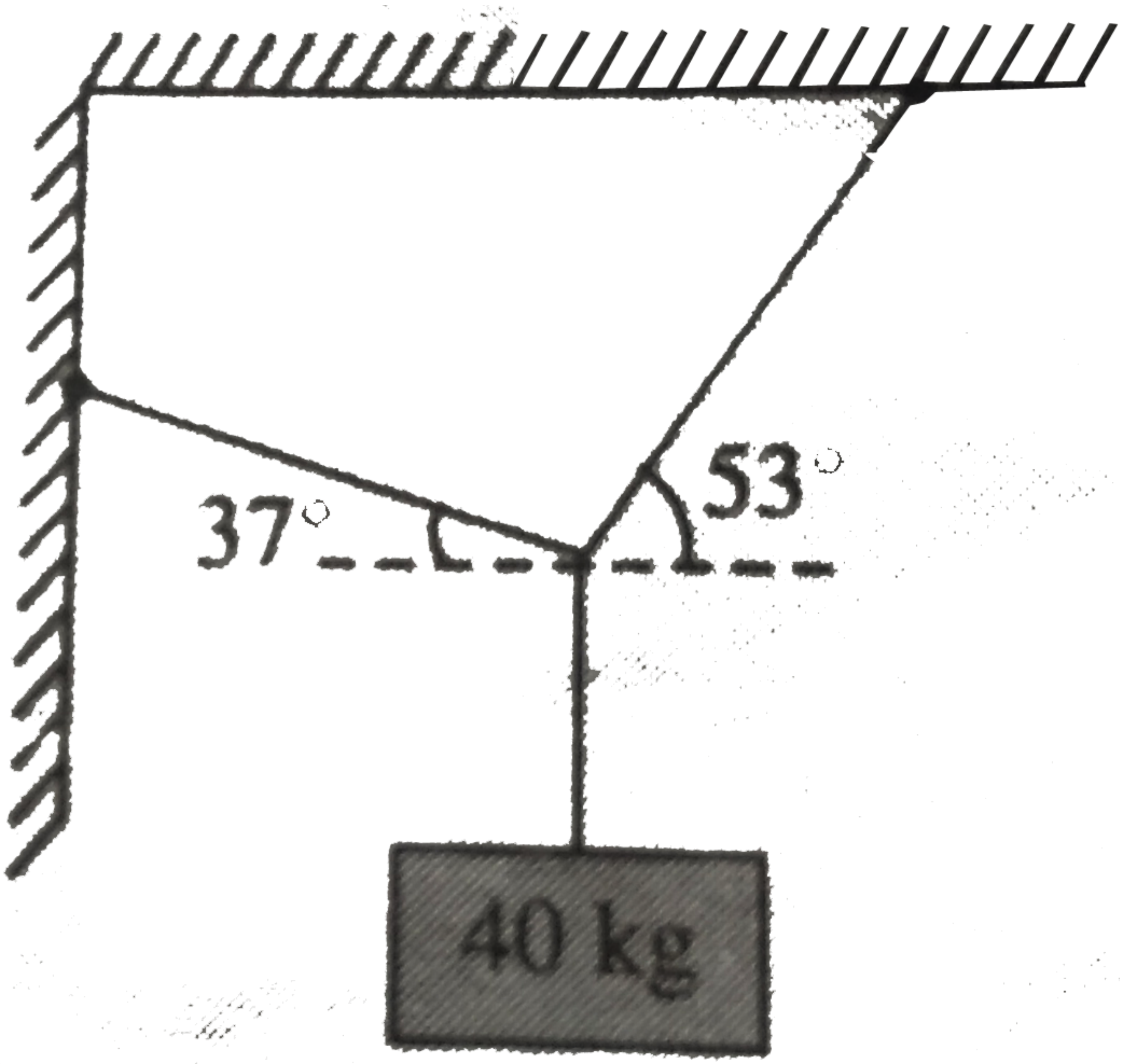
Watch Video Solution

6. In the arrangement shown in figure the mass of the ball is `eta` times as that of the rod. The length of the rod is `L` the masses of the pulleys and the threads as well as the friction, are negligible. The ball is set on the same level as the lower end of the rod and then released. How soon will the ball be opposite the upper and of the rod?



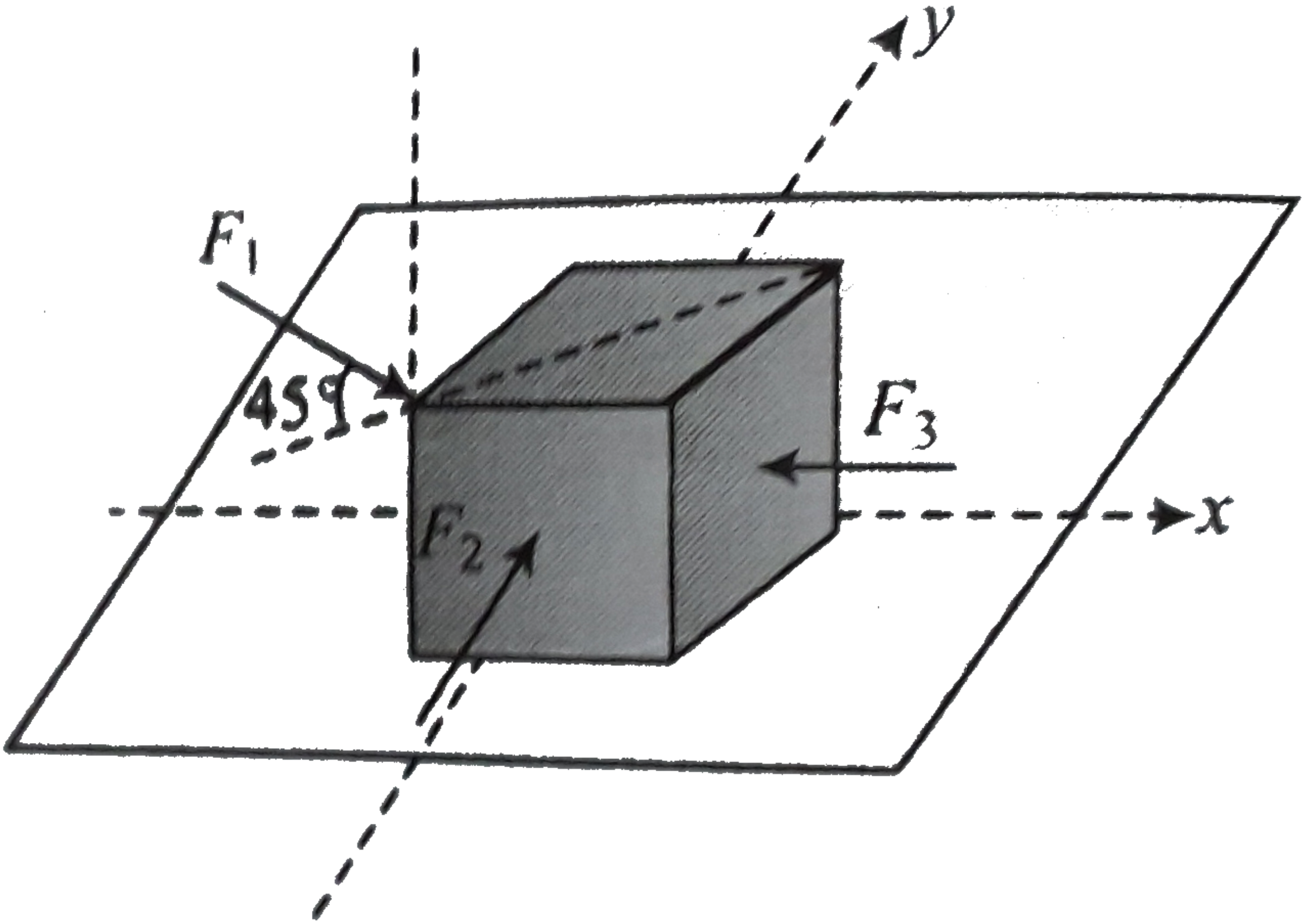
Watch Video Solution

7. The object in fig. weighs 40kg and hangs at rest. Find the tensions in the three cords that hold it.

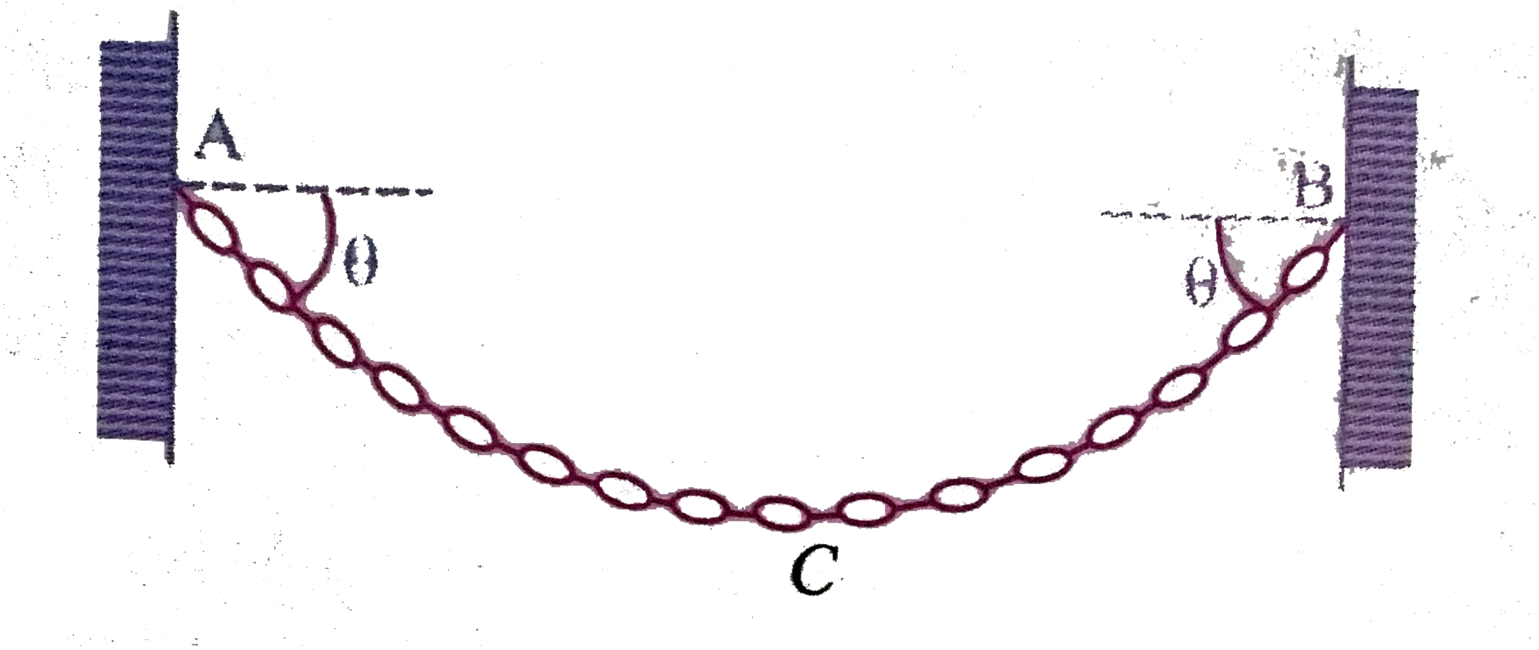


Watch Video Solution

8. A cubical block is experiencing three forces `F_(1) = 20 N` acts at angle `45^(@)`with horizontal and lies in diagram plane of the cube `F_(2) = 30 N` acts along y- axis and `F_(3) = 40 N` acts in x- direction as shown in fig find the friction force acting on the block if it is at rest



9. A chain of mass 'm' is attached at two points `A` and `B` of two fixed walls as shown in the Find the tension in the chain near the walls at point `A` and at the mid point `C`

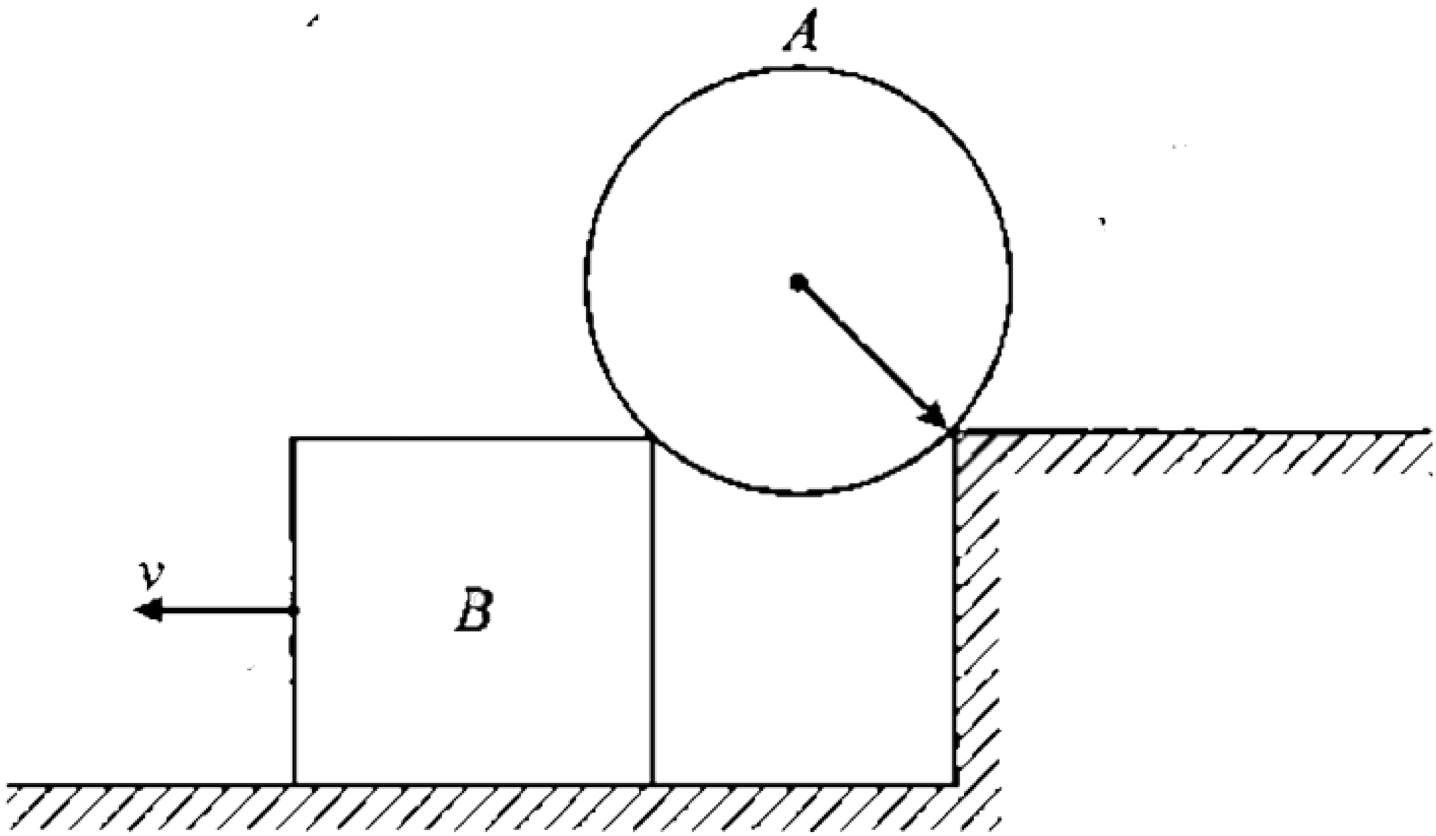


.

Watch Video Solution

10. Figure-2.35 shows a cylinder A of mass M which is resting on two smooth edges, one fixed and other is that of a block of B. At an instant block B is pulled toward left with a constant speed v. Find the force exerted by the cylinder on the fixed edge after some time when the distance between the two edges will become `x

= sqrt(2)R. "At " t = 0` the distance betwween the two edges was zero.

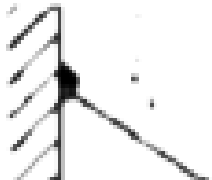


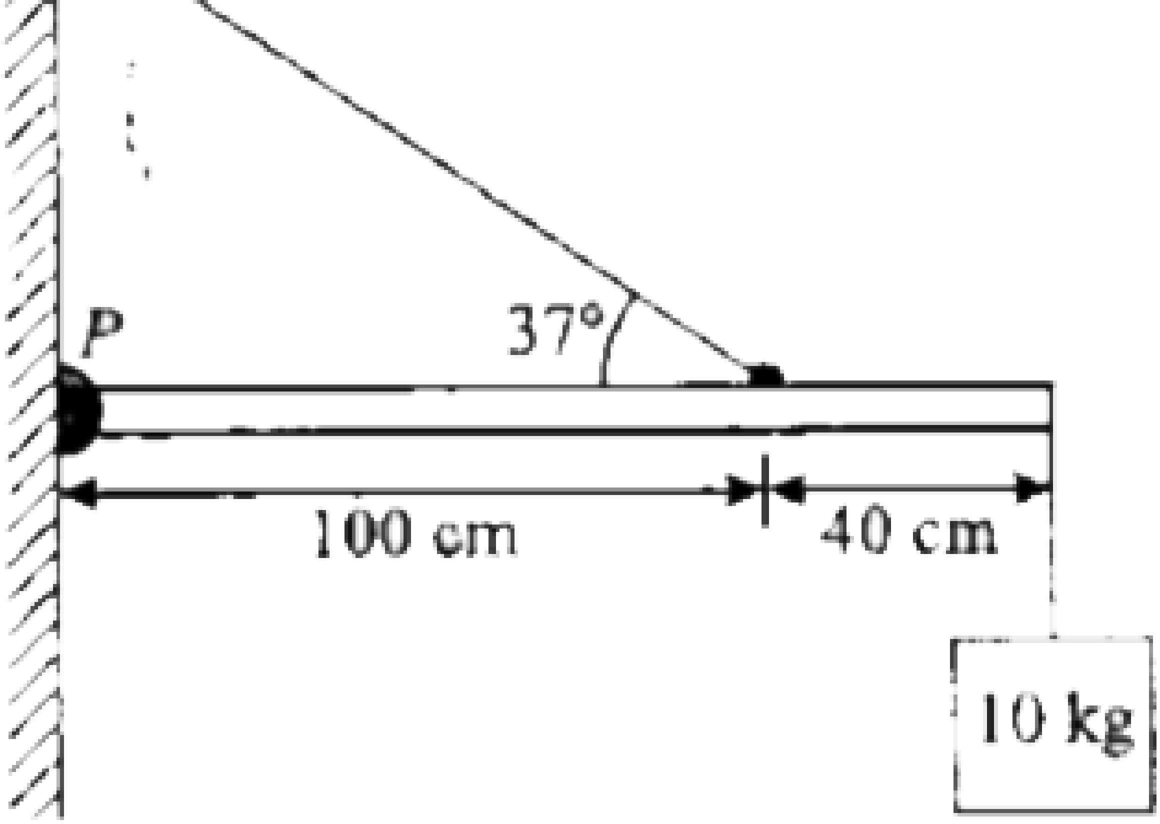
Watch Video Solution

11. In figure-2.40(a), we see a beam of length L pivoted at one end and supporting a 200 kg object at the other end. Find the tension T in the supporting cable that runs upward to the ceiling. Assume that the weight of the negligible. Take `g = 10m//s^(2)`

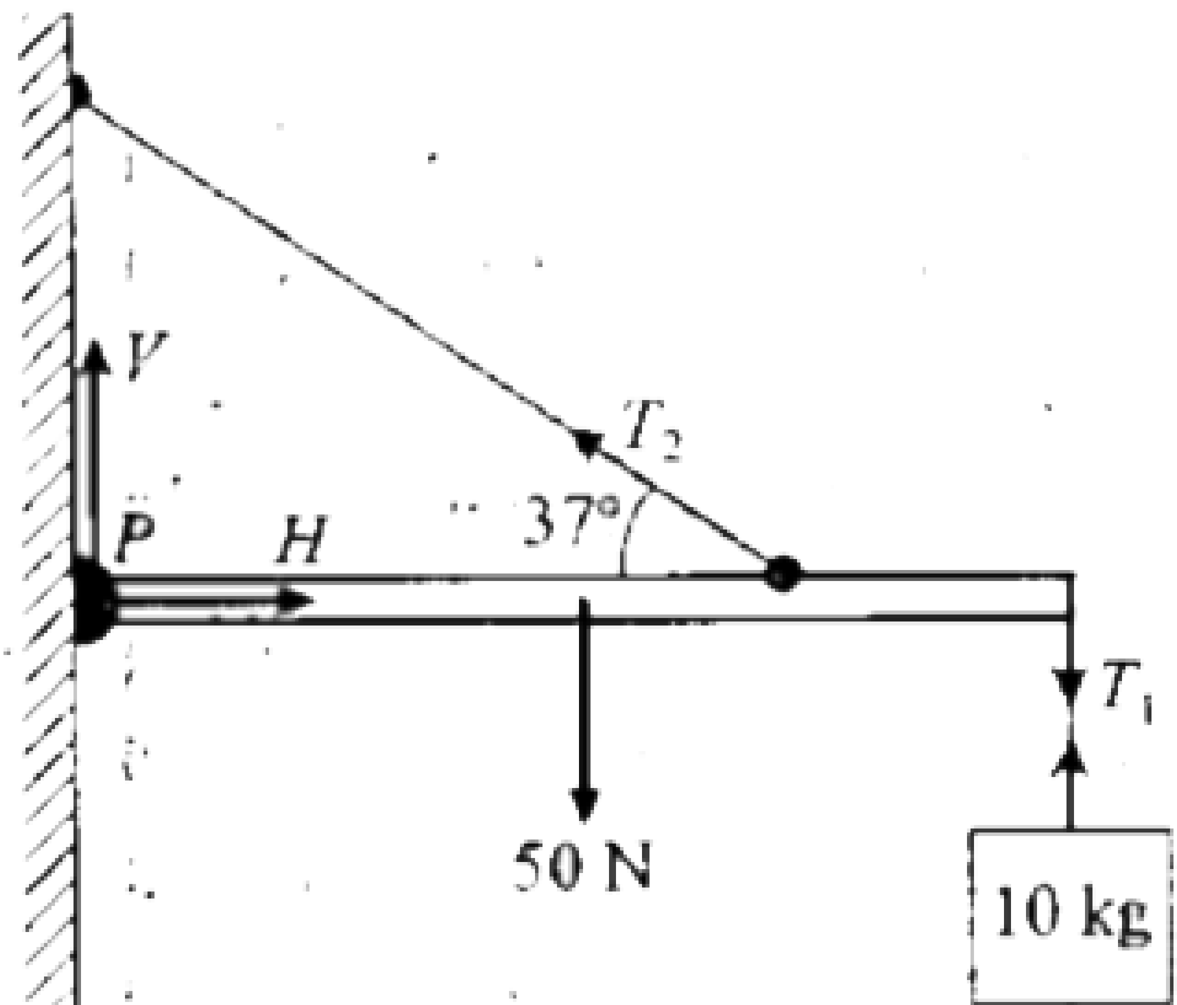
Watch Video Solution

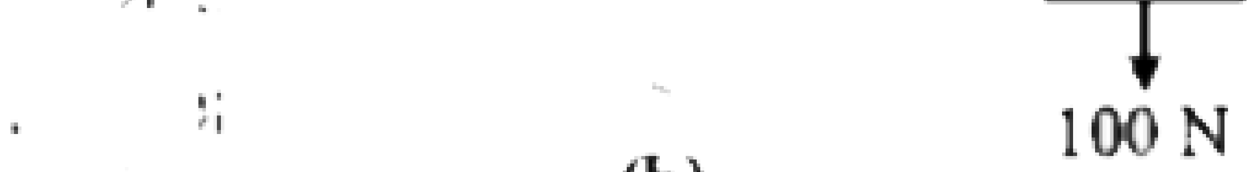
12. For the uniform 5 kg beam shown in figure-2.41(a), how large is the tension in the supporting cable and what are the components of the force exerted by the hinge on the beam ? Take `g = 10 m//s^(2)`





(a)

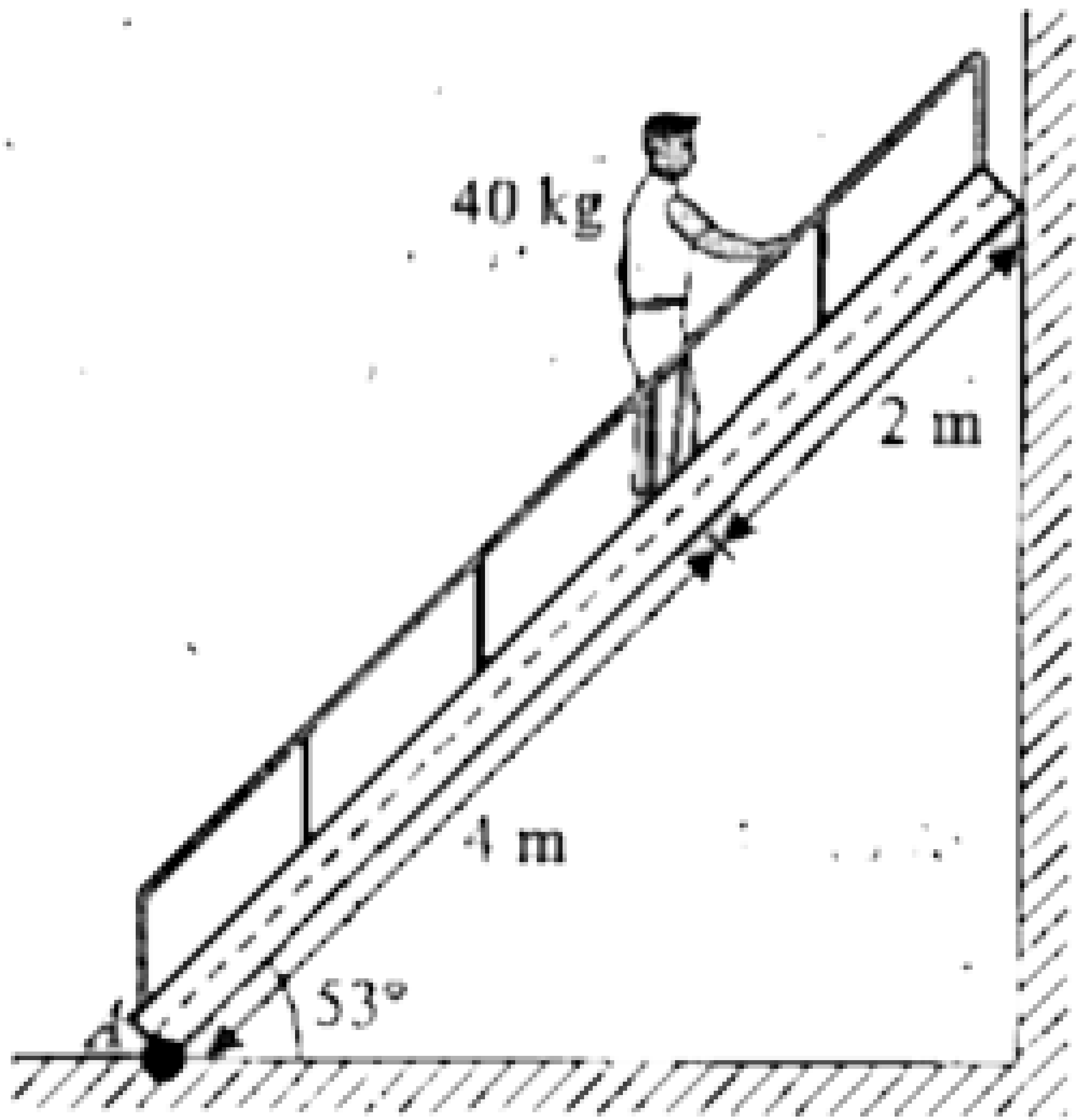




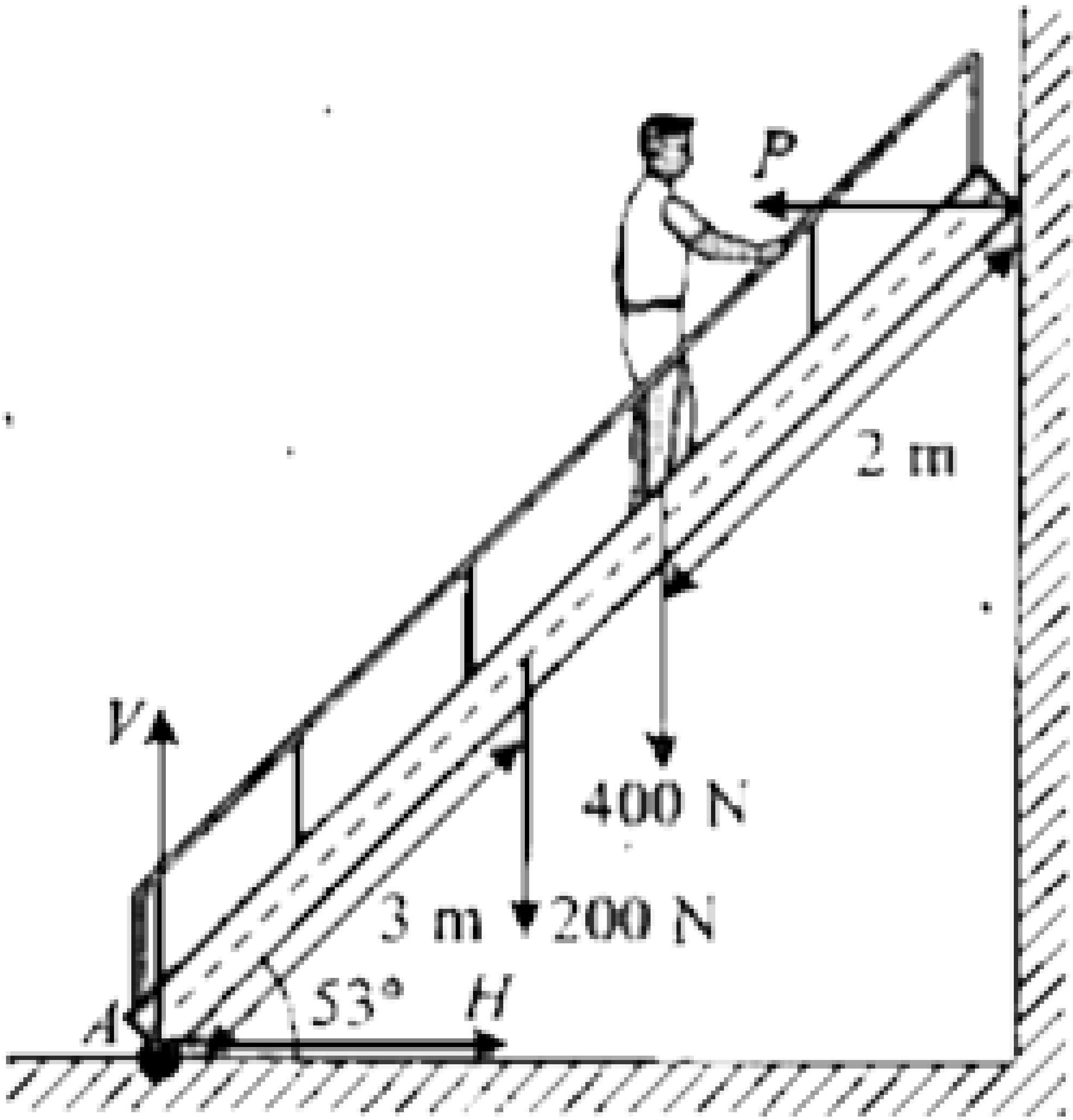
(b)

Watch Video Solution

13. The uniform 20 kg ladder hinged at the bottom in figure-2.42(a), leans against a smooth wall. If a 40 kg person stands on the ladder shown, how large are the forces at the wall the ground Take ` g = 10 m//s^(2)`.



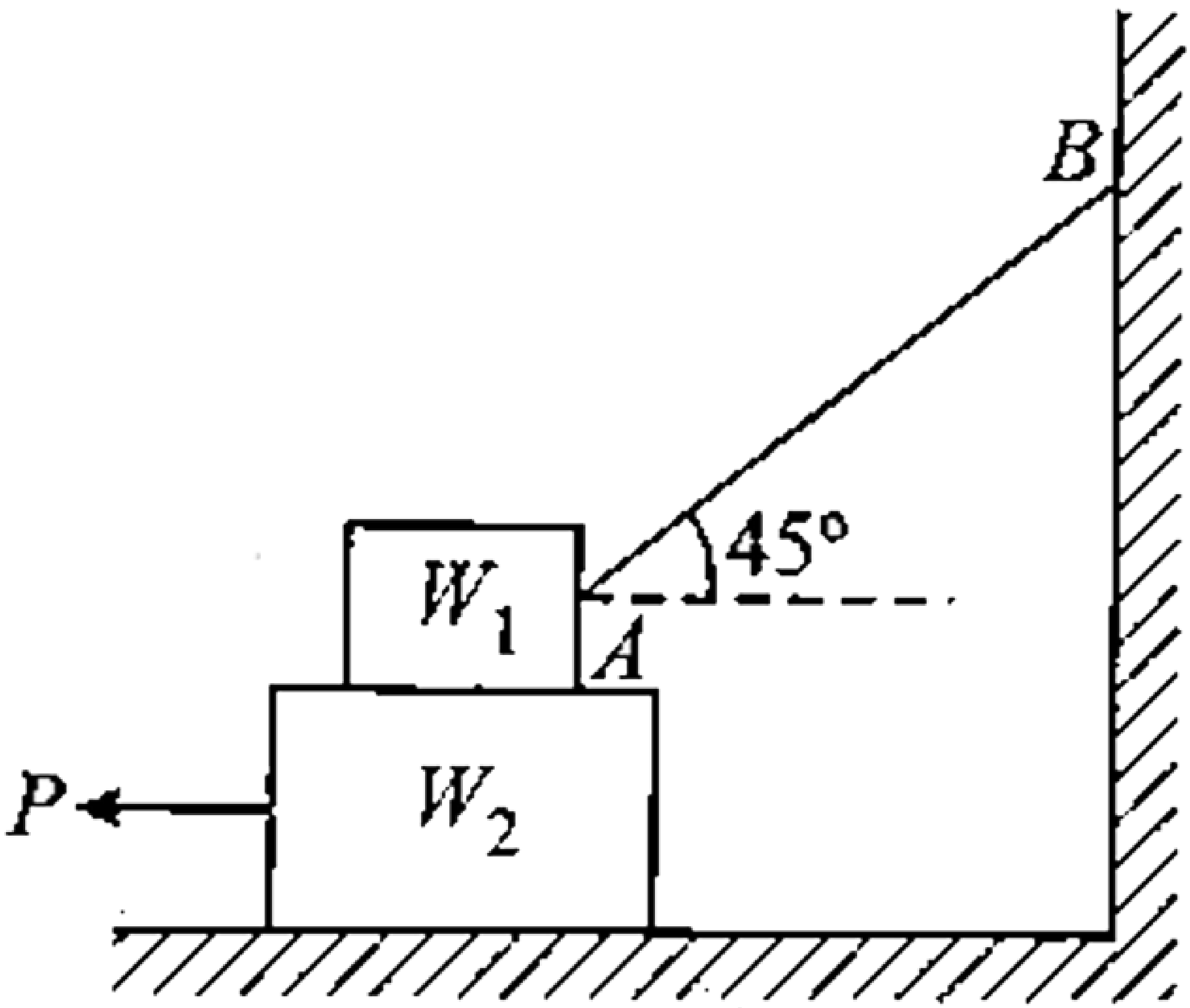
(a)



(b)

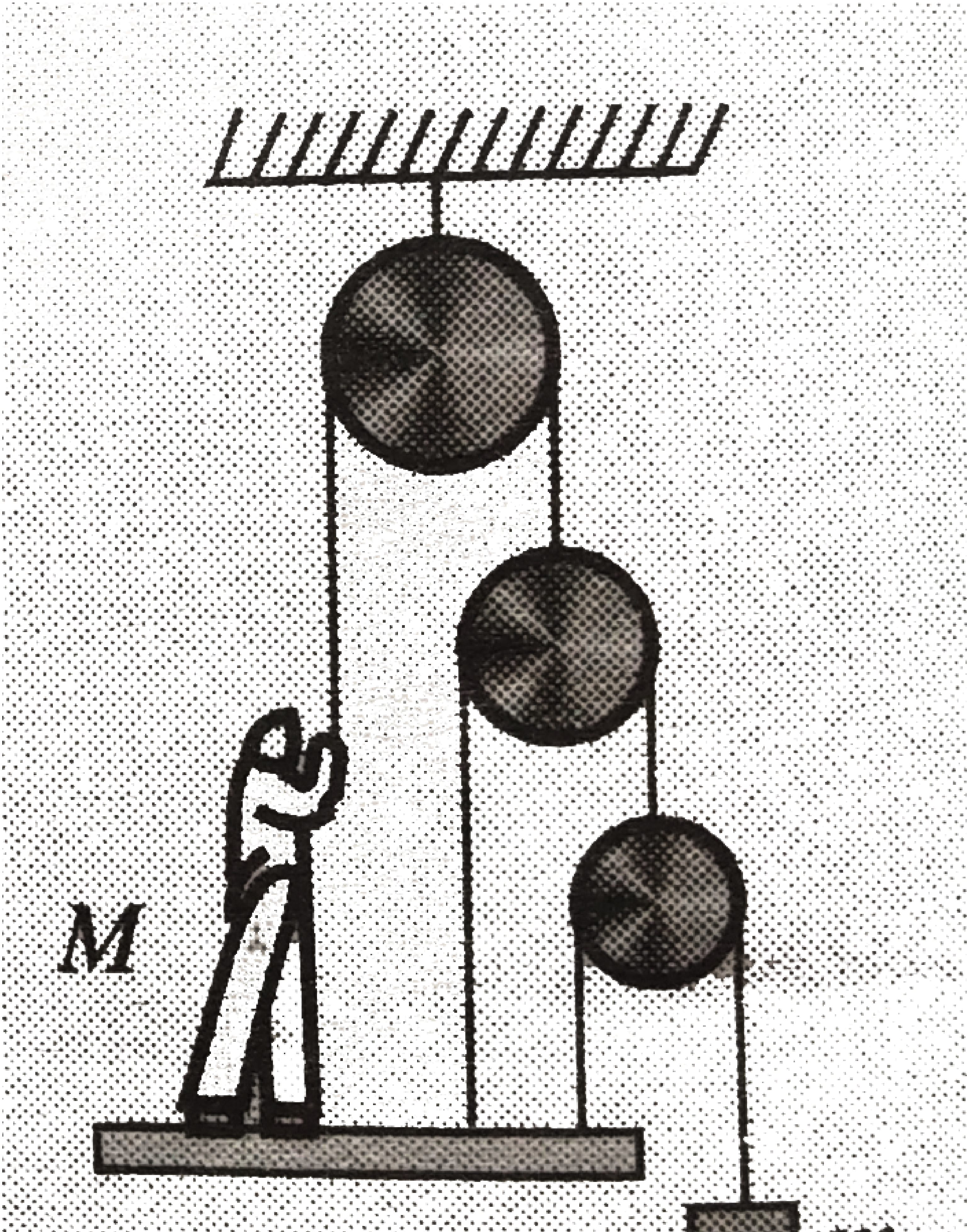
Watch Video Solution

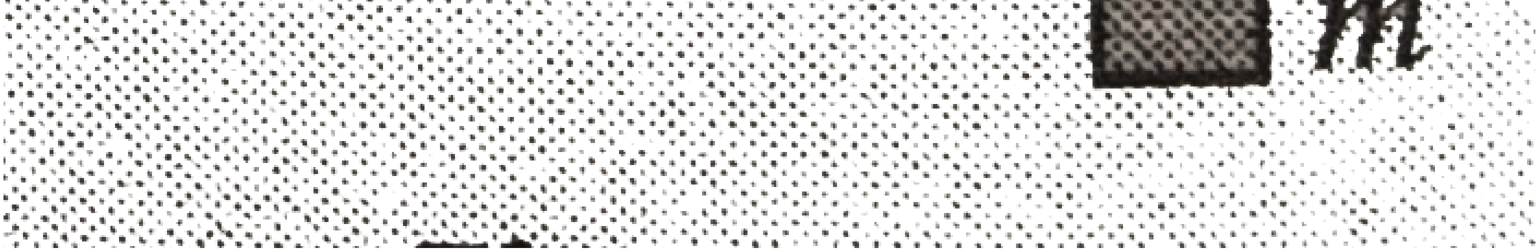
14. Calculate the force P required to cause the block of weight `W_(2)=200N` just to slide under the block of weight `W_(1)=100N` shown in figure-2.43. What is the tension in the string AB and the normal forces acting between the blocks and that applied by ground on `W_(2)`? Surfaces of the blocks in contact are rough and the frictional force between the two blocks is 25 N and that between lower block and ground is 75 N Take `g = 10 m//s^(2)`.



Watch Video Solution

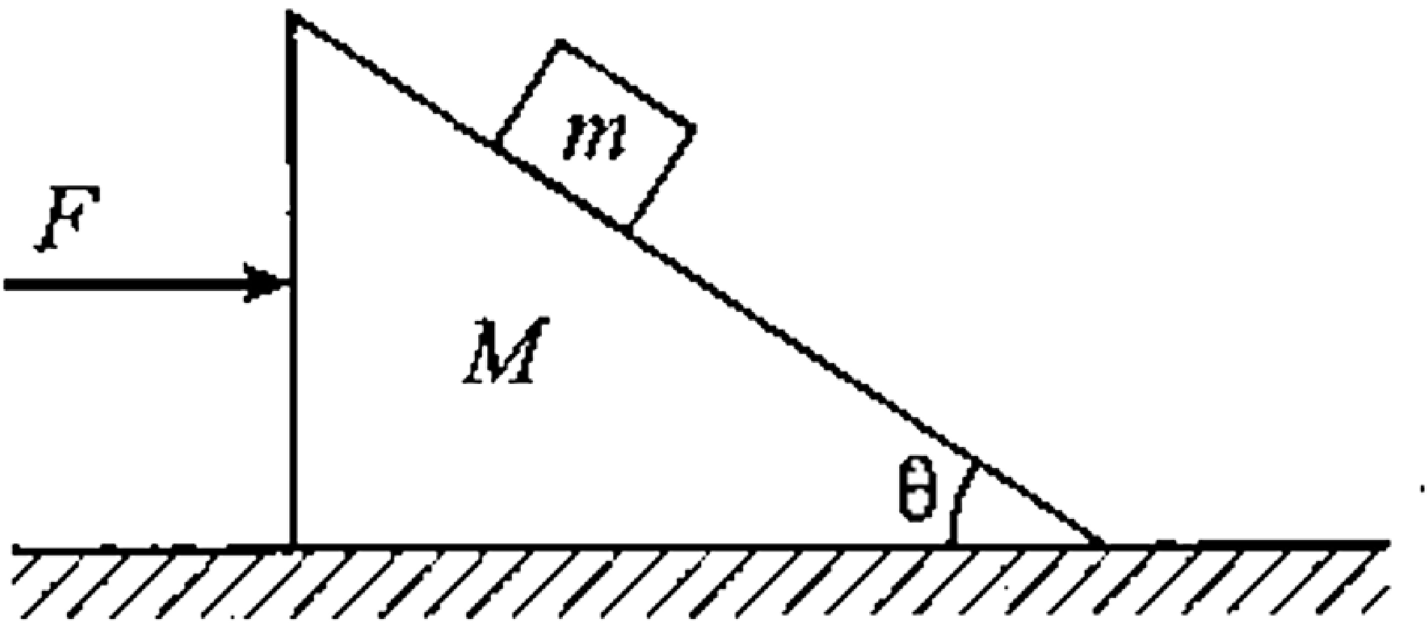
15. Figure shows a light platform on which a man of mass M is standing and holding a string passing over a system of ideal pulleys. Another mass m is hanging as shown in fig. Find the force the man has to exert to maintain the equlibrium of system, and find the force exerted by the platform on the man. Also find the ratio of `M//m`.





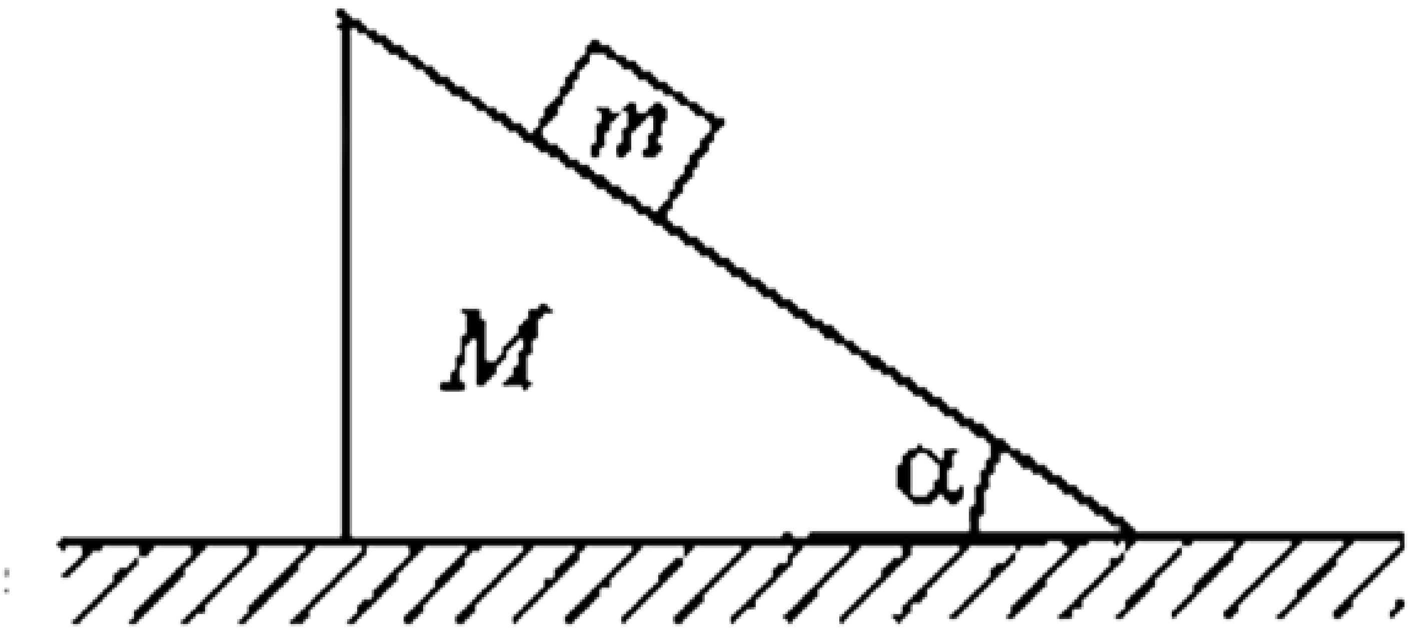
Watch Video Solution

16. Figure-2.52 shows a box of mass m is placed on a wedge of mass M on a smooth surface. How much force F is required to be applied on M so that during motion m remains at rest on its surface



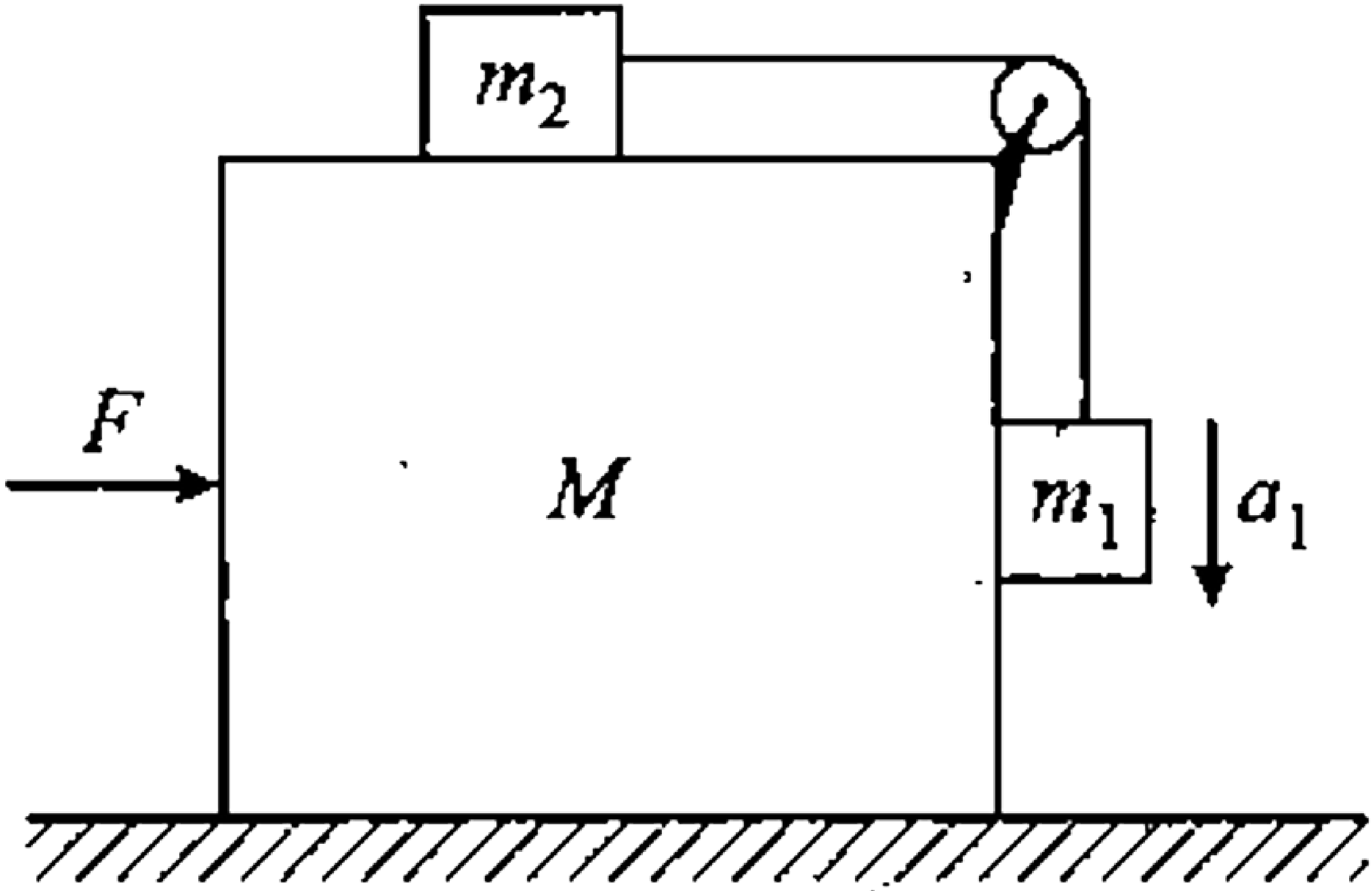
Watch Video Solution

17. Figure-2.54 shows a block of mass m is placed on an inclined wedge of mass M If the system is released from rest find the acceleration of m and M.



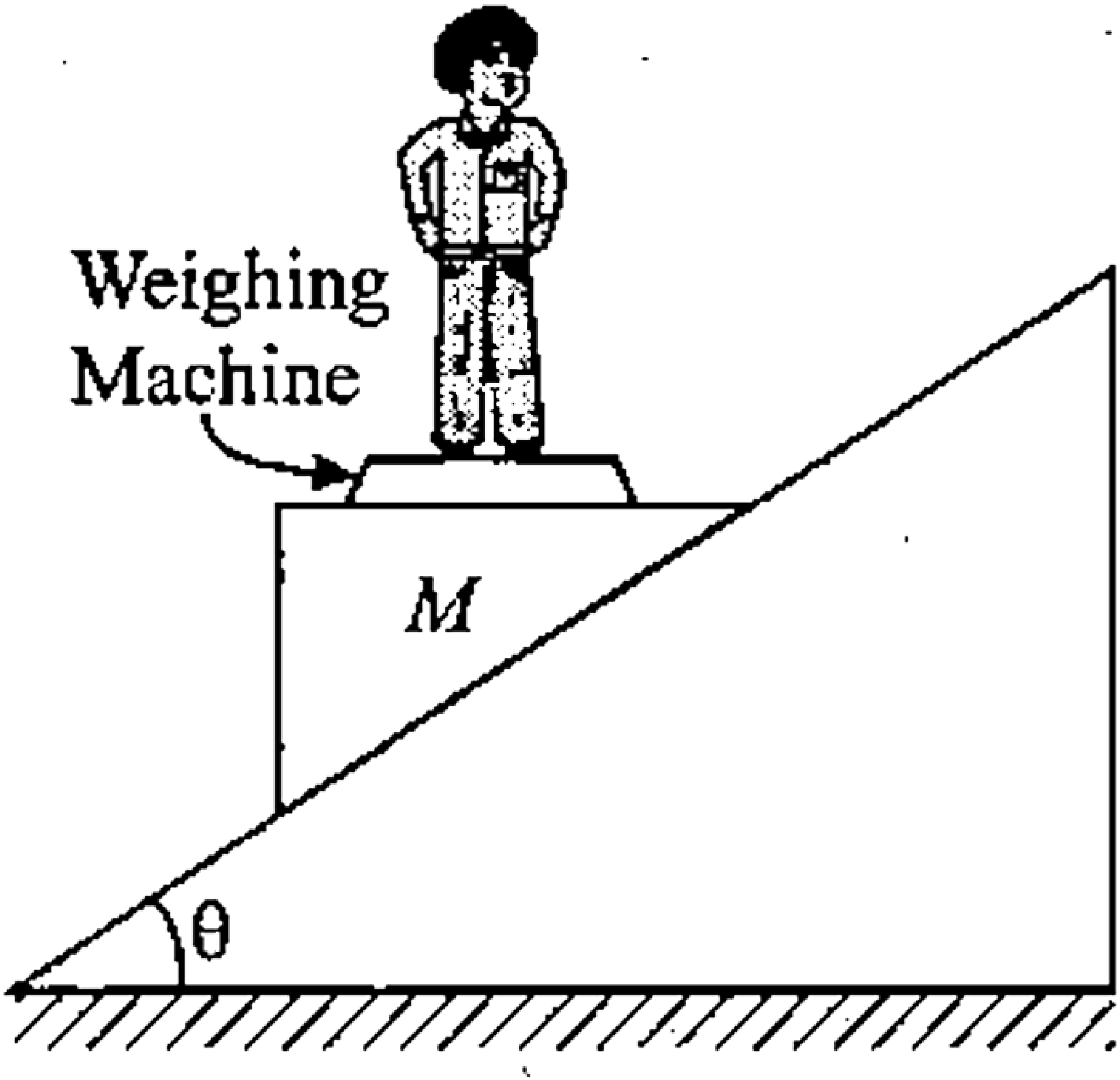
Watch Video Solution

18. Figure-2.57 shows a large block of mass M, supporting two small mass `m_(1)` and `m_(2)`, connected by a light, frictionless thread. A force F is acting on M, such that the block `m_(1)` is sliding down, with an acceleration `a_(1)`. Find the force F applied on M and also the acceleration of M. Assuming all surfaces are frictionless.



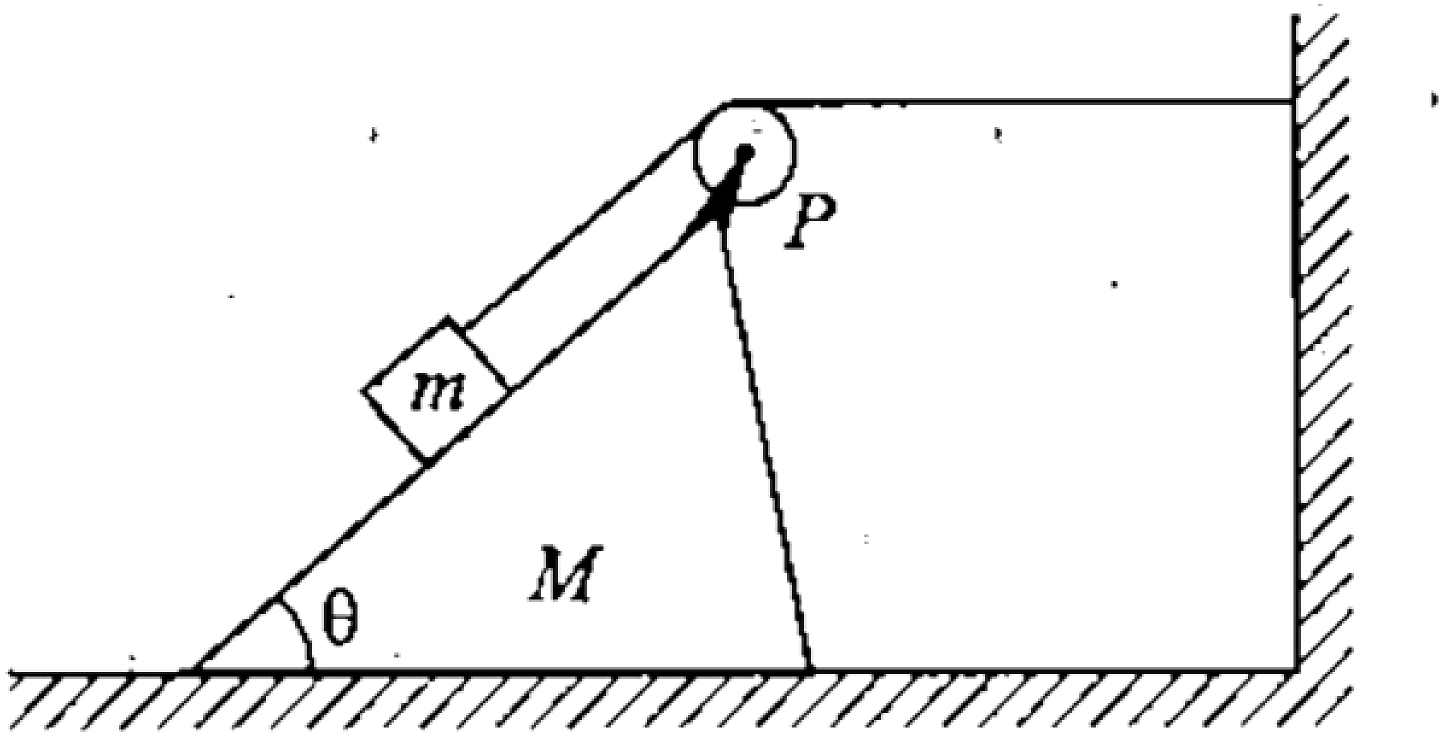
Watch Video Solution

19. Find the weight shown by the weighing machine on which a man of mass m is standing at rest relative to it as shown in figure-2.59. Assume that the wedge of mass M is in free fall.



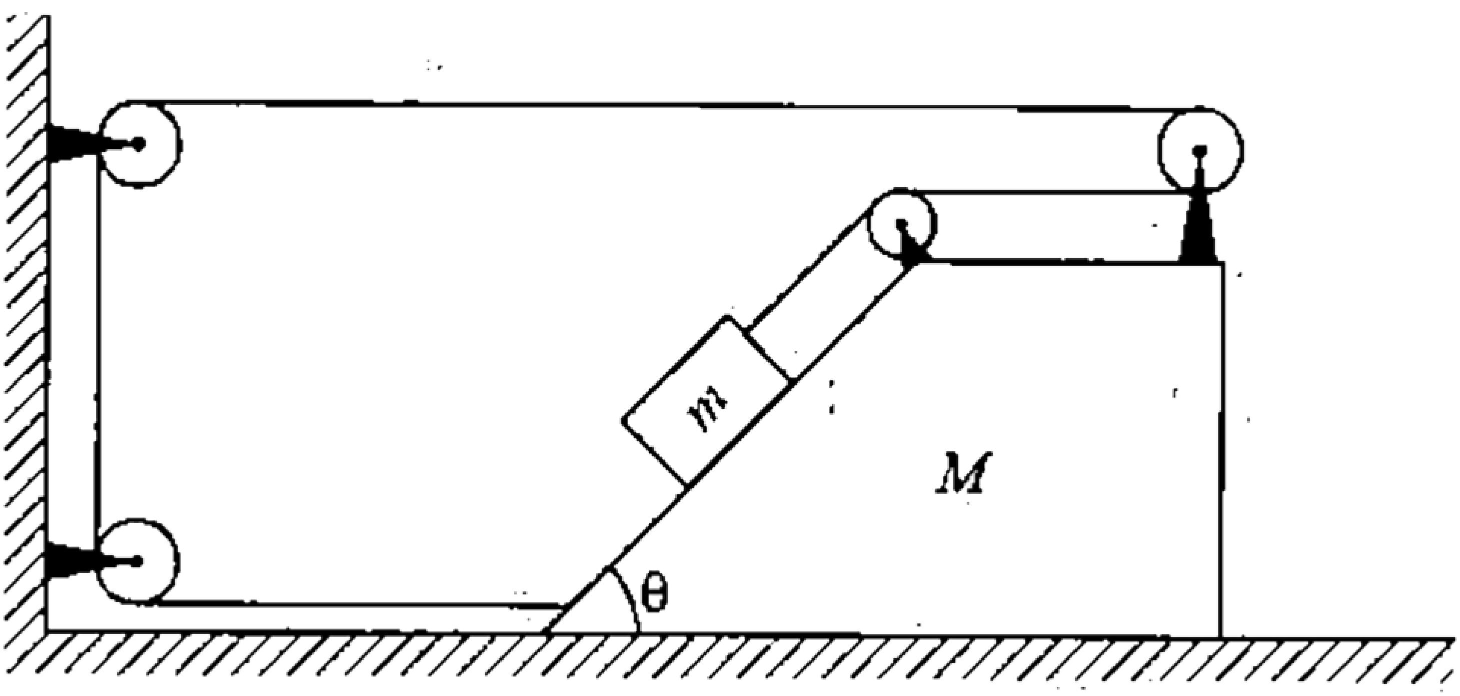
Watch Video Solution

20. In the figure-2.61 a bar of mass m is on the smooth inclined face of the wedge of mass M,the inclination to the horizontal being 0.The wedge is resting on a smooth horizontal plane.Assuming the pulley to be smooth and the string is light and inextensible. Find the acceleration of M,when M and m are always in contact.



Watch Video Solution

21. Figure-2.64 shows a block of mass M supporting a bar of mass m through a pulley system. If system is released from rest, find the acceleration of block M and the tension in the strings

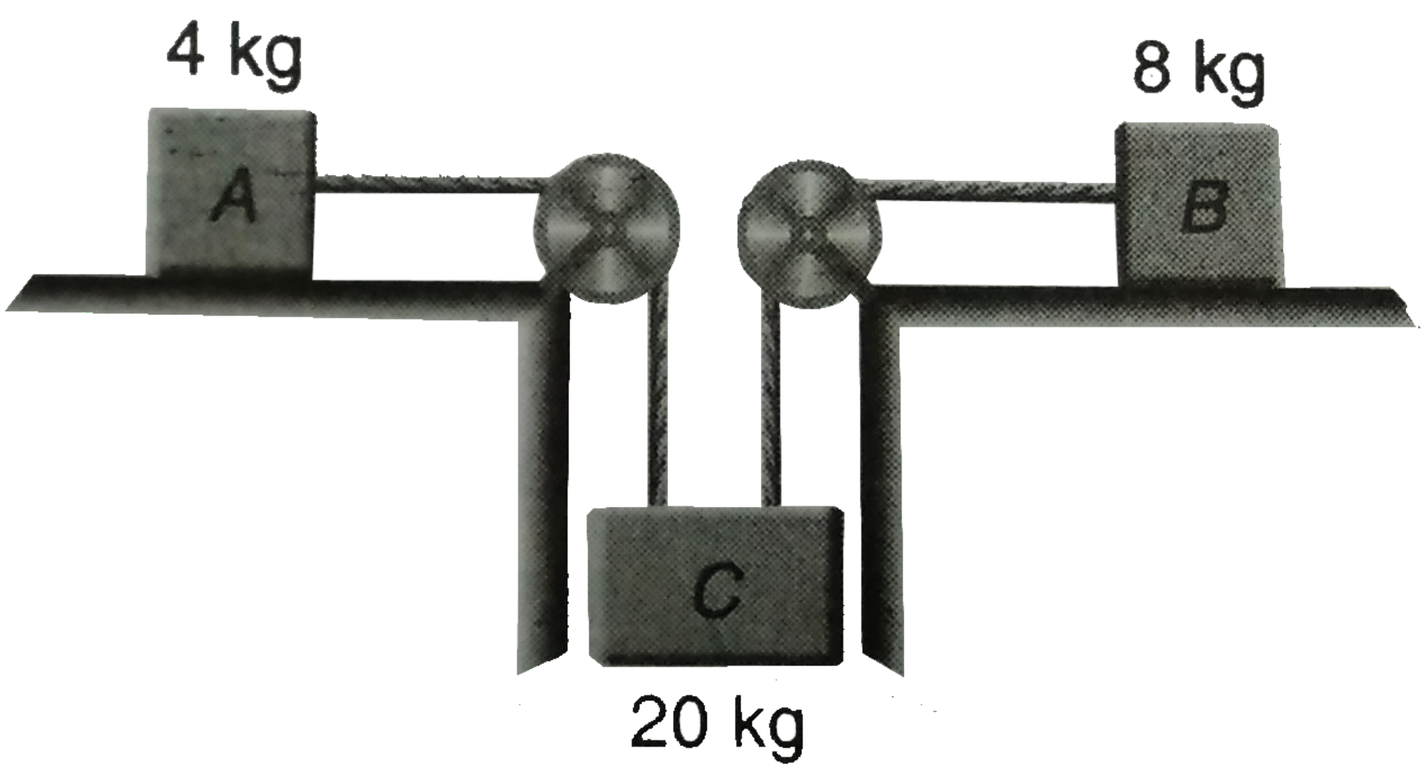


Watch Video Solution

22. A `100 kg` load is uniformly moved over a horizontal plane by a force F applied at an angle `30^(@)` to the horizontal. Find this force if the coefficient of friction between the load and the plane is 0.3. Take `g = 10m//s^(2)`

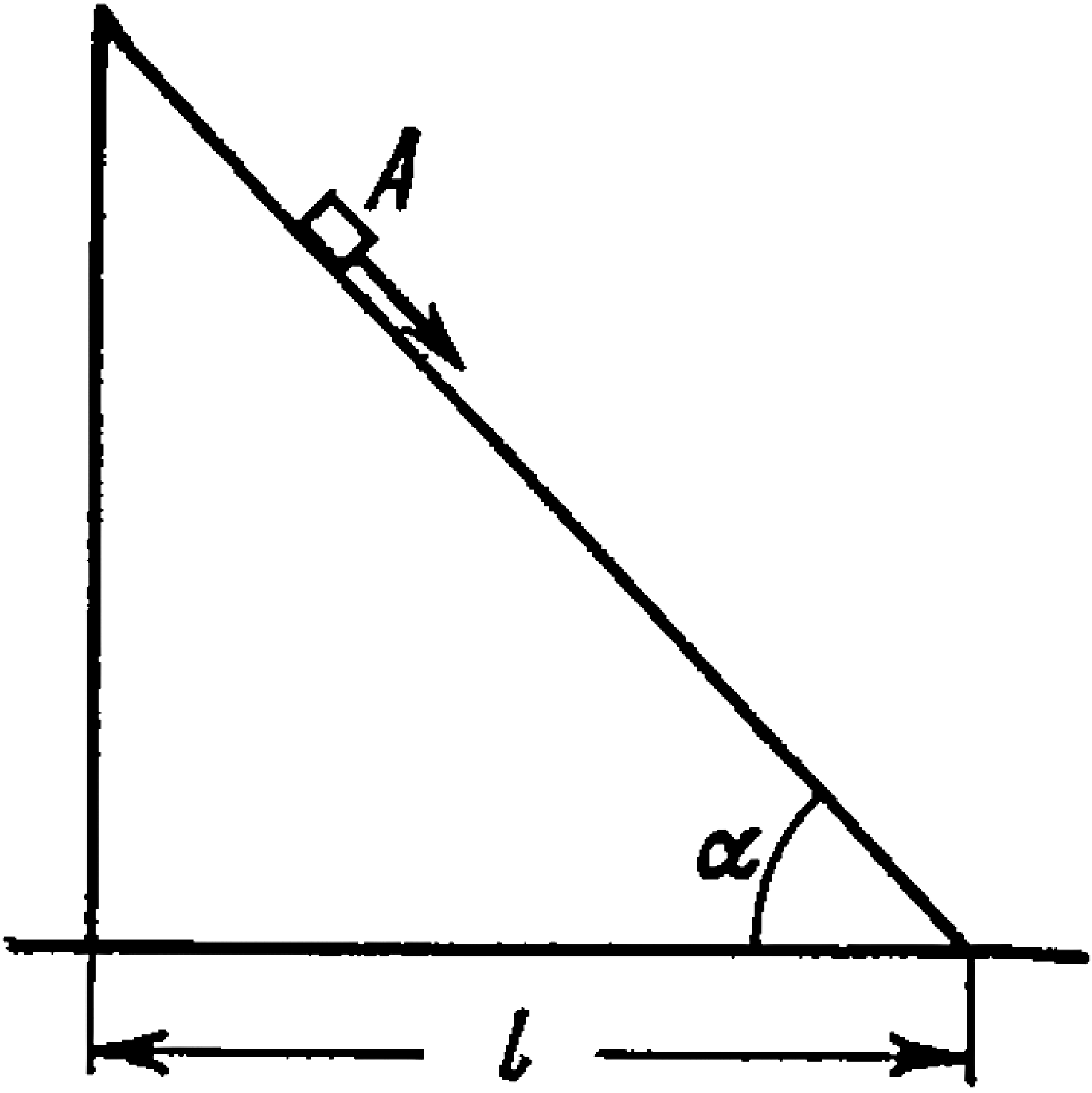
Watch Video Solution

23. Consider the situation shown in figure. The block `B` moves on a frictionless surface ,while the coefficient of friction between `A` and the surface on which it moves is `0.2`. Find the acceleration with which the masses move and also the tension in the strings. `(Take g = 10 m//s^(2))`.



Watch Video Solution

24. A small body A starts sliding down from the top of a wedge (figure) whose base is equal to `l=2.10m`. The coefficient of friction between the body and the wedge surface is `k=0.140`. At what value of the angle `alpha` will the time of sliding be the least? What will it be equal to?

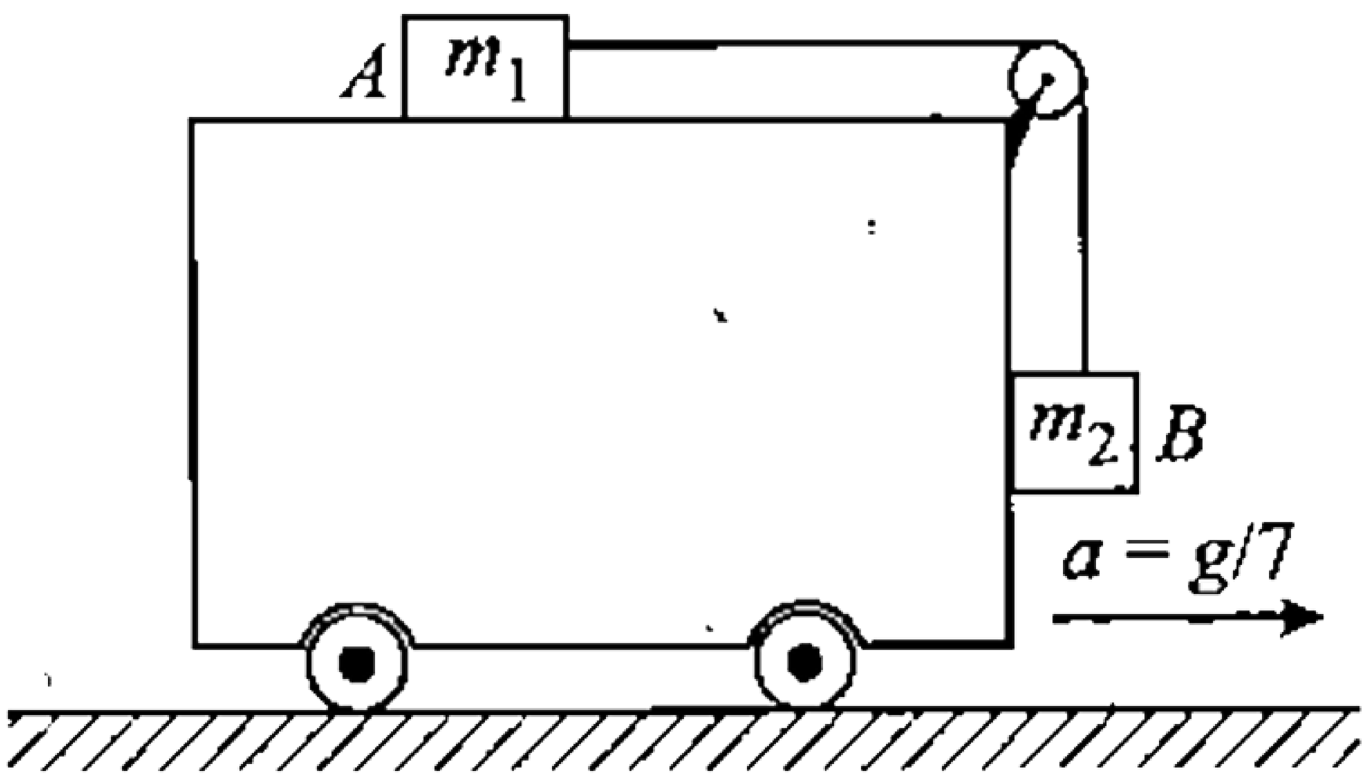


Watch Video Solution

25. A block slides down a rough inclined plane of slope angle `theta` with a constnat velocity. It is then projected up the same plane with an intial velocity v the distance travelled by the block up the plane coming to rest is .

Watch Video Solution

26. Two blocks of masses `m_(1)` and `m_(2)` respectively are connected by an inextensible and weight less string which passes over a smooth and light pulley fixed at the top comer of a long carriage.The upper surface of the carriage is friction less and the body `Å` rests on it. B hangs vertically in contact with the rough vertical side of the carriage. The carriage moves with an acceleration gH towards right hand side as shown in figure-2.79. If the blocks remain stationary with respect to the carriage and `m_(1) = 7.5 m_(2)`, calculate the coefficient of friction between the block B and vertical side of the carriage.

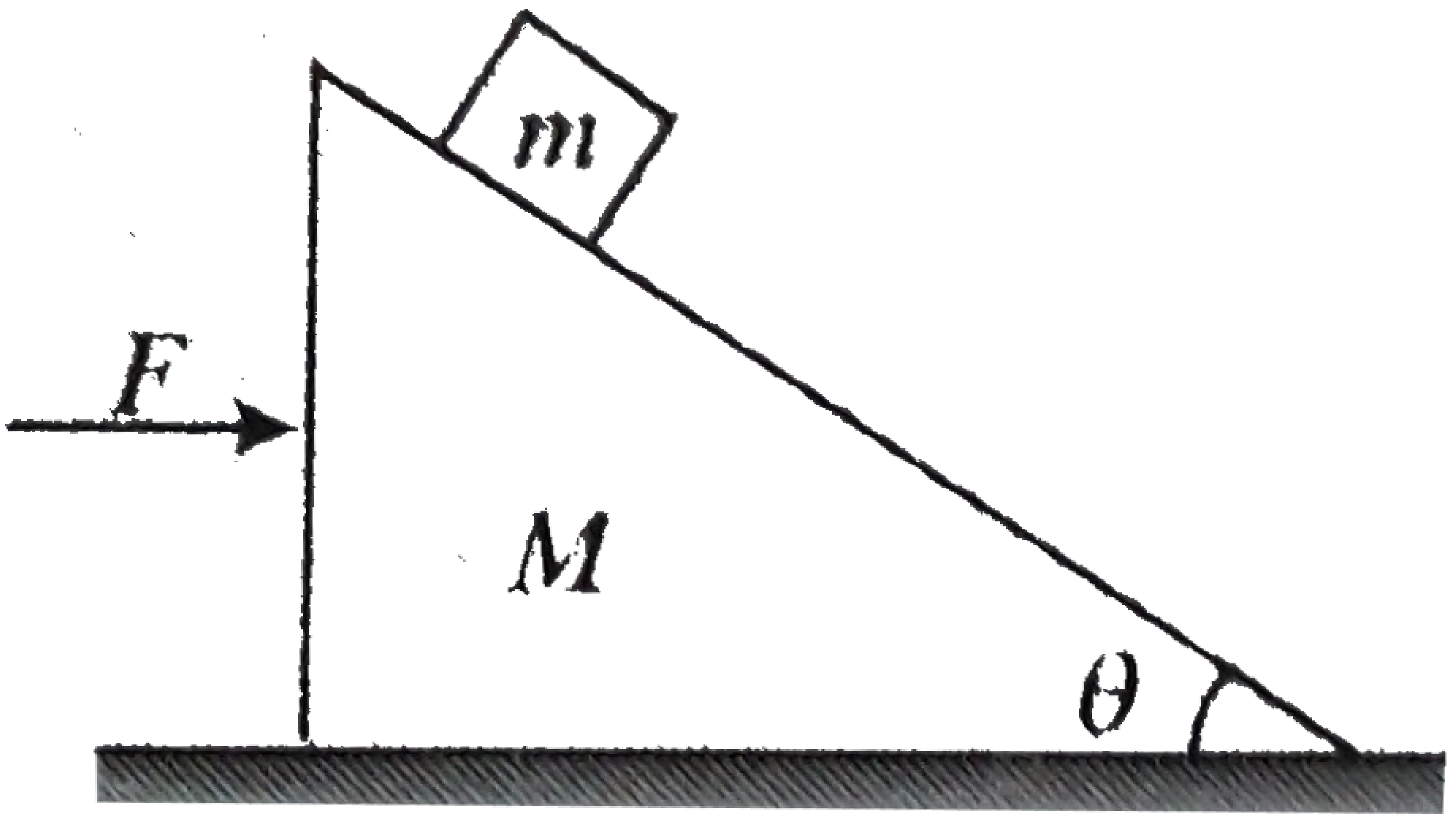


Watch Video Solution

27. A plank of mass `m_1` with a bar of mass `m_2` placed on it lies on a smooth horizontal plane. A horizontal force growing with time t as `F^'=at` (a is constant) is applied to the bar. Find how the accelerations of the plank `w_1` and of the bar `w_2` depend on t, if the coefficient of friction between the plank and the bar is equal to k. Draw the approximate plots of these dependences.

Watch Video Solution

28. A bar of mass `m` is placed on a triangular block of mass `M` as shown in figure The friction coefficient between the two surface is `mu` and ground is smooth find the minimum and maximum horizontal force `F` required to be applied on block so that the bar will not slip on the inclined surface of block

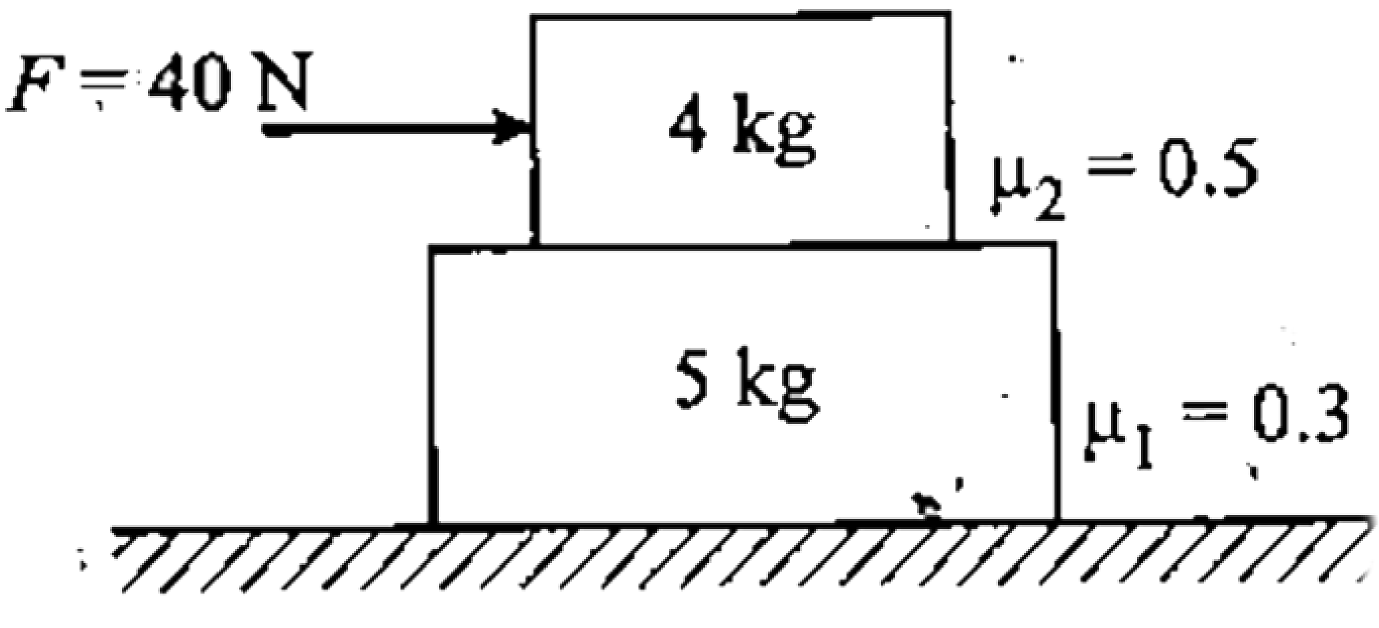


Watch Video Solution

29. Two masses `m_(1)` kg and `m_(2)` kg passes over an atwoods machine. Find the ratio of masses `m_(1)` and `m_(2)` so that string passing over the pulley will just start slipping over its surface. The friction coefficient between the string and pulley surface is 0.2.

Watch Video Solution

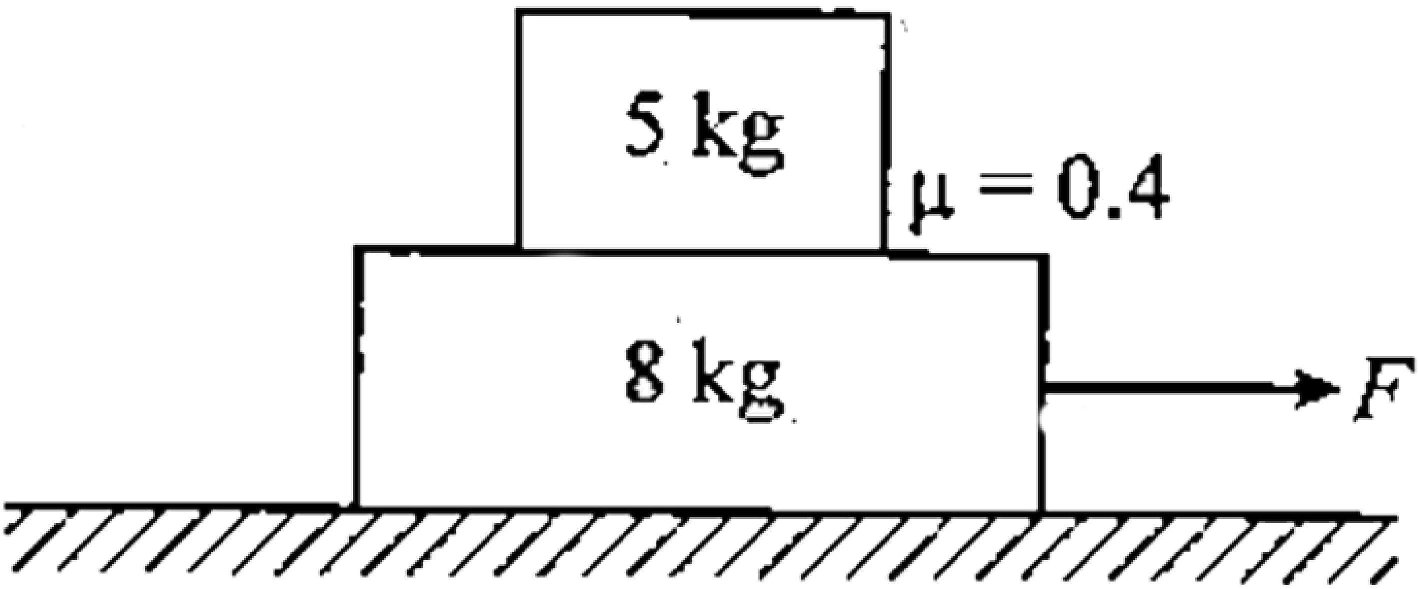
30. Find the acceleration of the two blocks of 4 kg and 5 kg mass if a force of 40 N is applied on 4 kg block. Friction coefficients between the respective surface are shown in figure-2.92. Take `g = 10 m//s^(2)`



Watch Video Solution

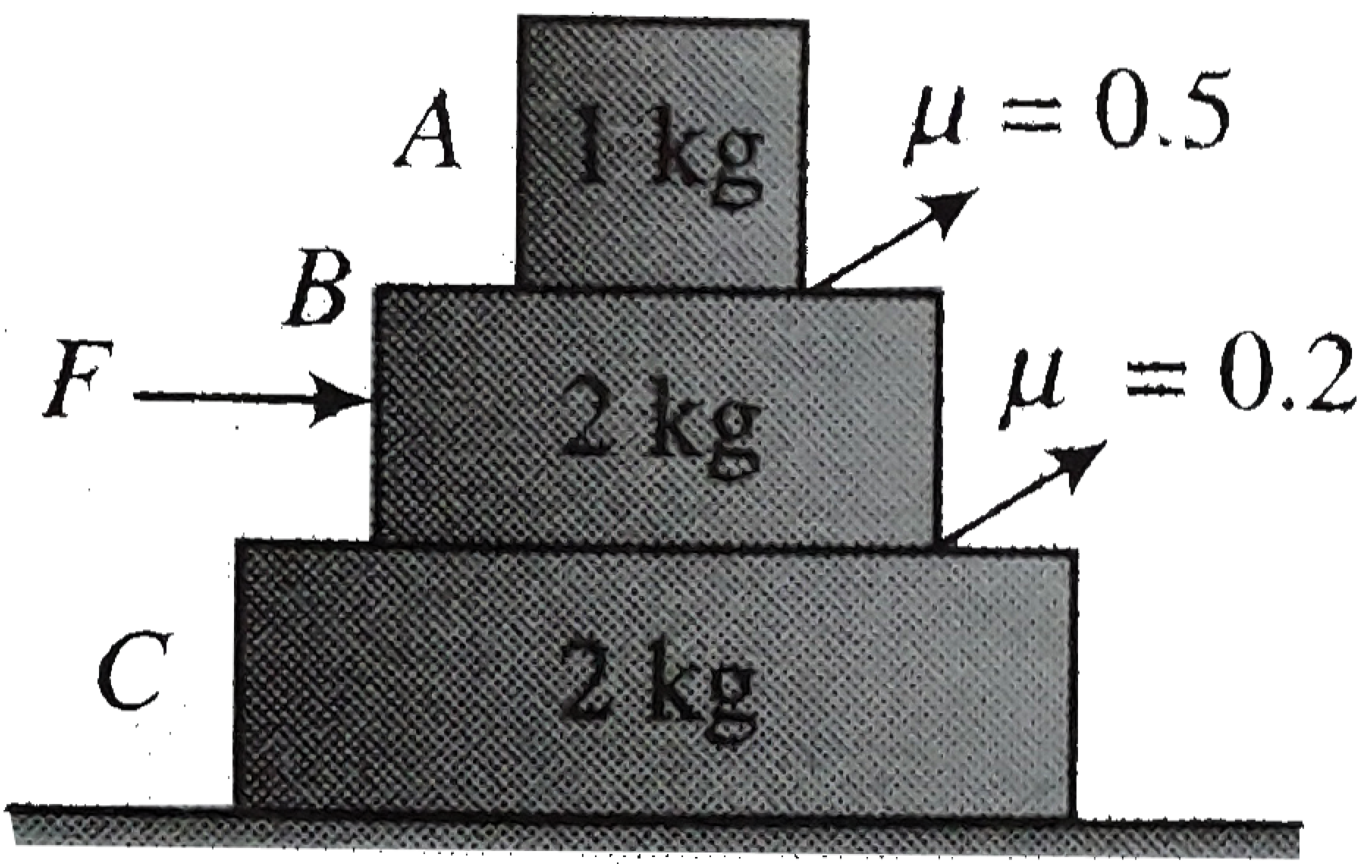
31. Find the maximum possible force which can be applied to the 8 kg block shown in figure-2.94 to move both the blocks together if bottom surface is (a) frictionless, (b) having friction coefficient 0.3. Take `g =

10m//s^(2)`



Watch Video Solution

32. In the sitution shown in figure there is no friction between `2 kg` and ground.



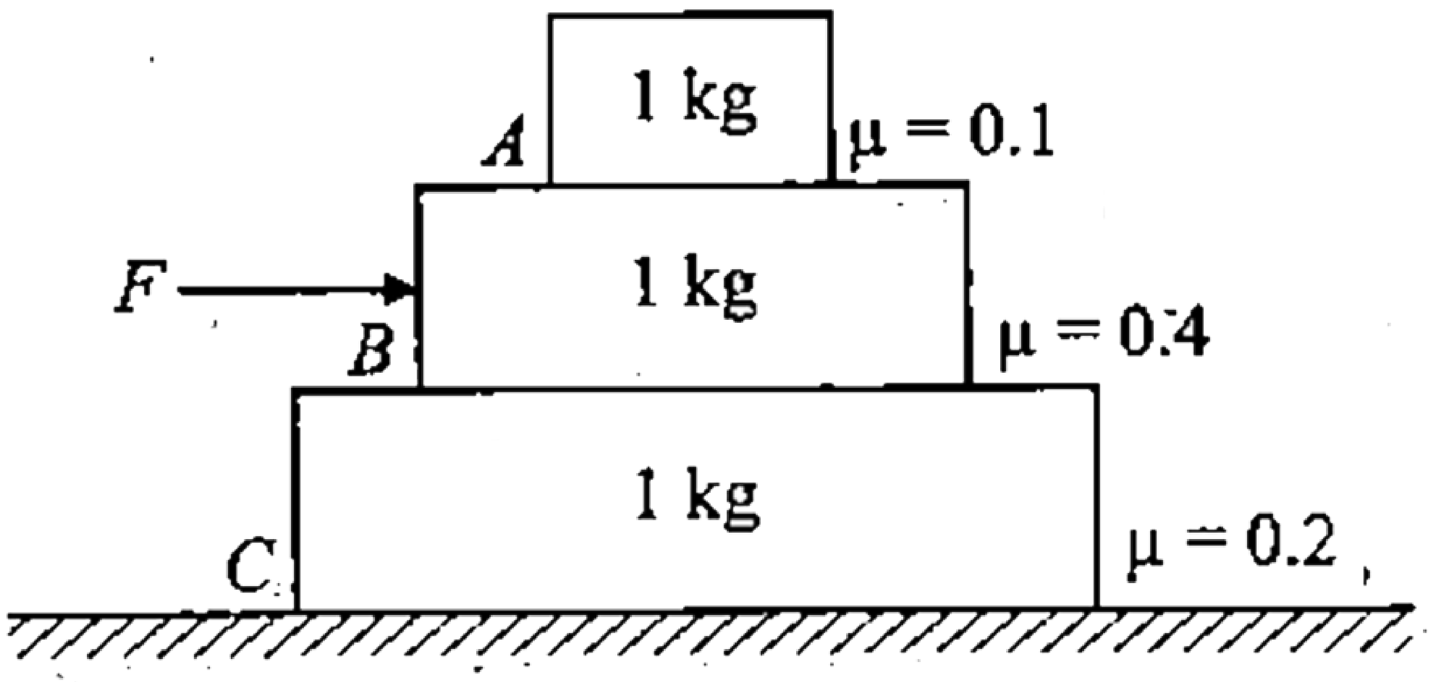
a. For what maximum value of force `F` can all three blocks move together?

b. Find the value of force `F` at which sliding starts at other rough surfaces.

c. Find acceleration of all blocks, nature and value of friction force for the following values of force `F` (i) `10N` (ii) `N` and (iii) `25 N`

Watch Video Solution

33. In the situation shown in figure-2.99.

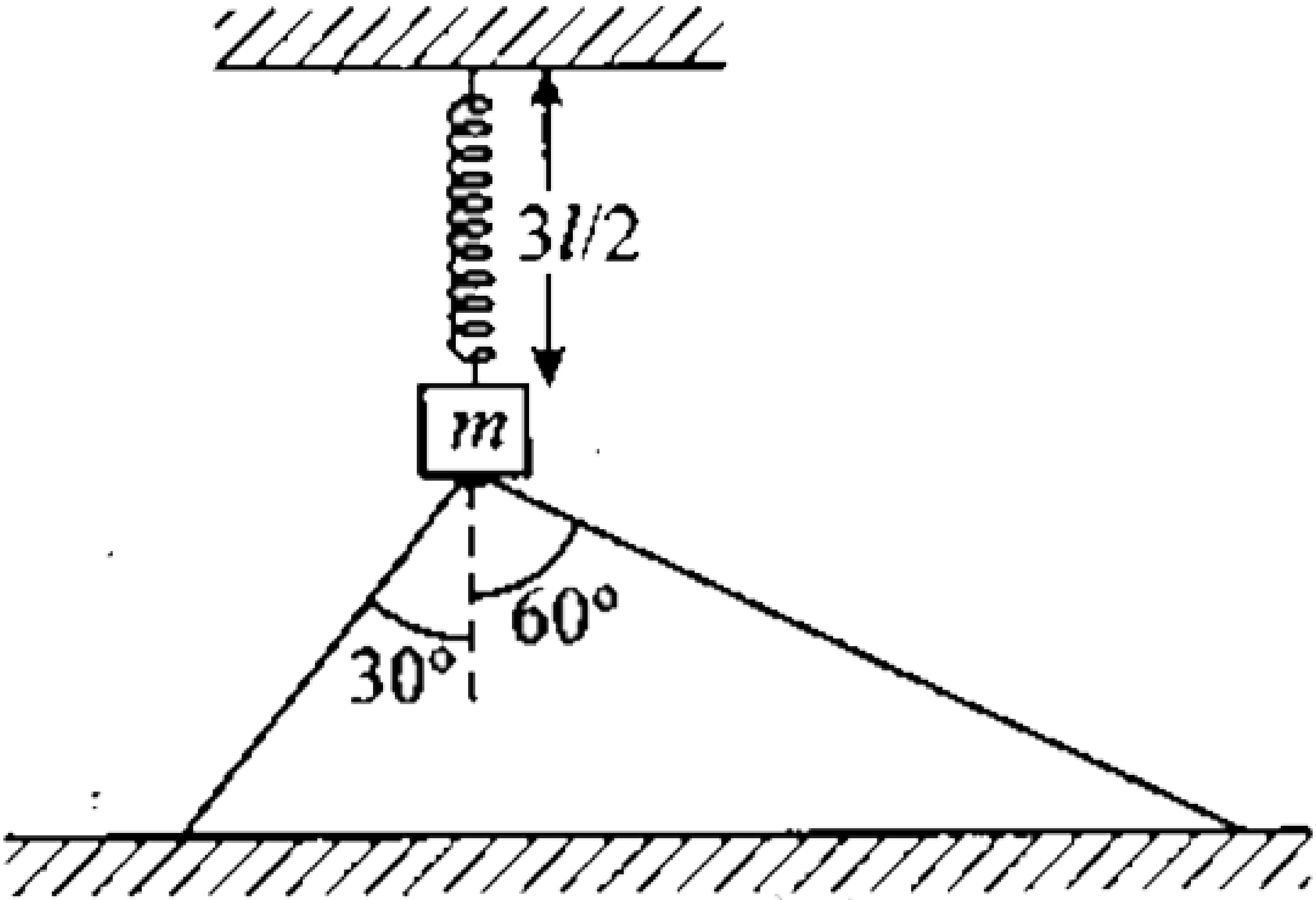


(a) For what minimum value of the force F will the system or any part of it start to move ?

(b) Find the values of force F when slipping starts between (i) A and B and (ii) B and C. Take `g = 10m//s^(2)`

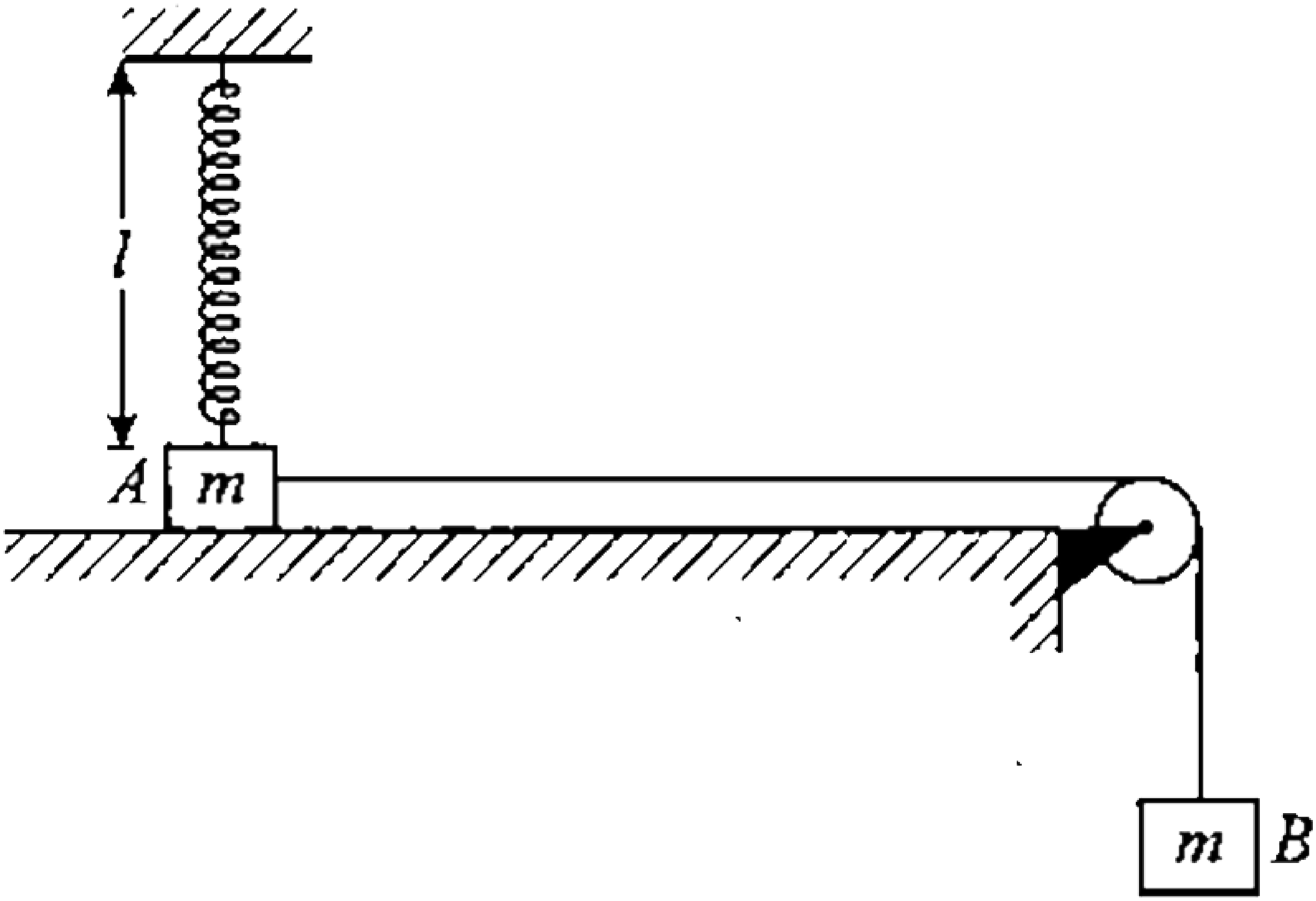
Watch Video Solution

34. Figure-2.107 shows a block of mass m attached to a spring of force constant k and connected to ground by two string of equal lengths making an angle `90^(@)` with each other. In relaxed state natural length of the spring is l. In the situation shown in figure, find the tensions in the two strings.



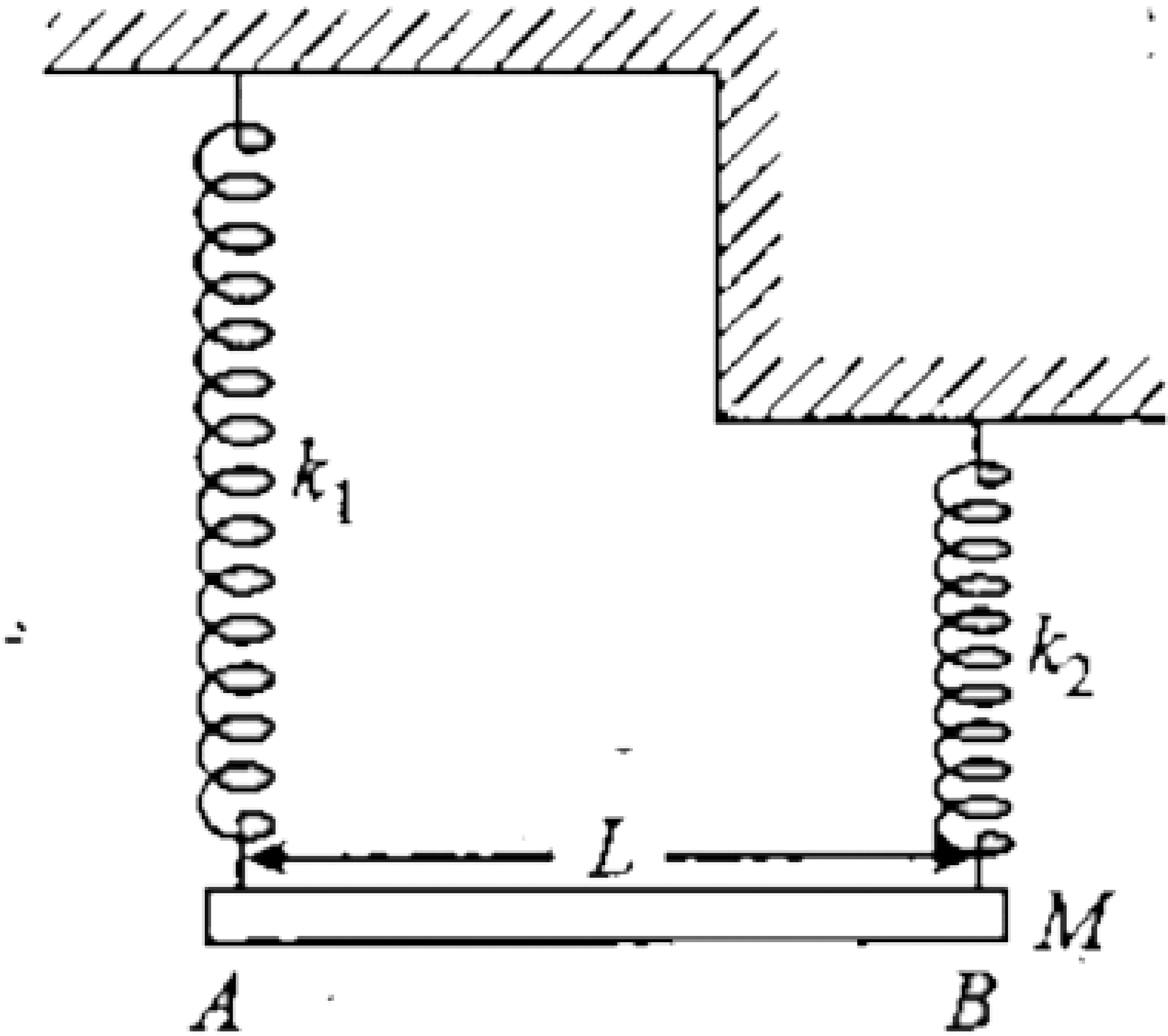
Watch Video Solution

35. Figure-2.109 shows a block A on a smooth surface attached with a spring of force constant k to the ceiling. In this state spring is in its natural lengthl. The block A is connected with a massless and frictionless string to another identical mass B hanging over a light and smooth pulley. Find the distance moved by A before it leaves contact with the ground



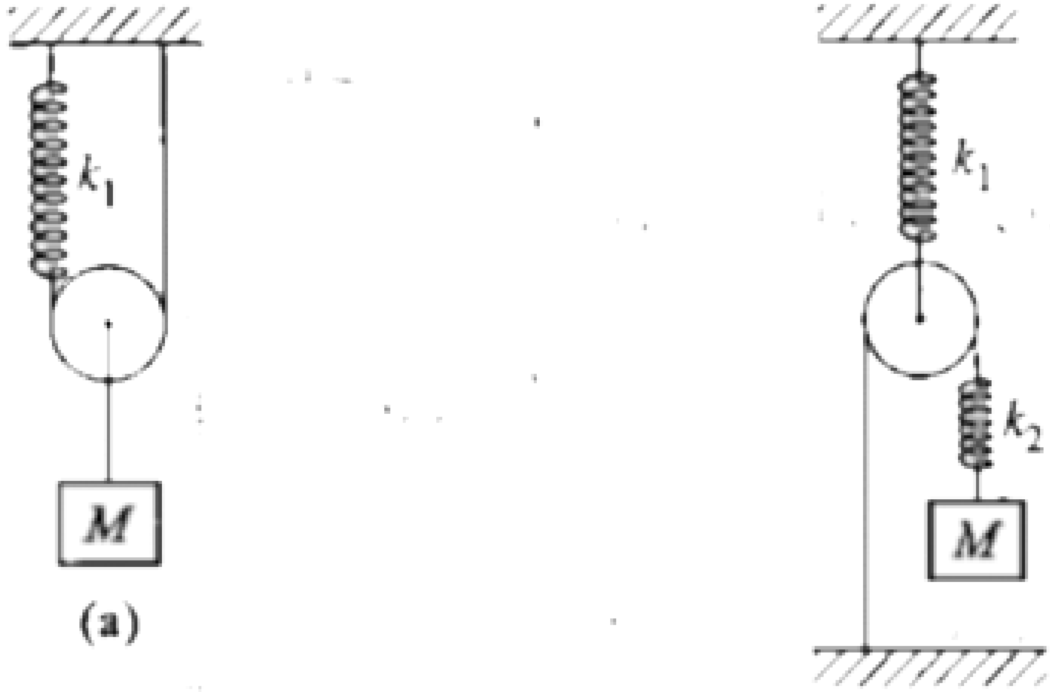
Watch Video Solution

36. When a mass M hangs from a spring of length l, it stretches the spring by a distance x. Now the spring is cut in two parts of lengths `l//3` and `2l//3`, and the two springs thus formed are connected to a straight rod of mass M which is horizontal in the configuration shown in figure-2.111. Find the stretch in each of the spring.



Watch Video Solution

37. Find the stretch in the springs shown in figure-2.112. The respective data are given in the figure. The friction and masses in pulleys are negligible.



(a)

(b)

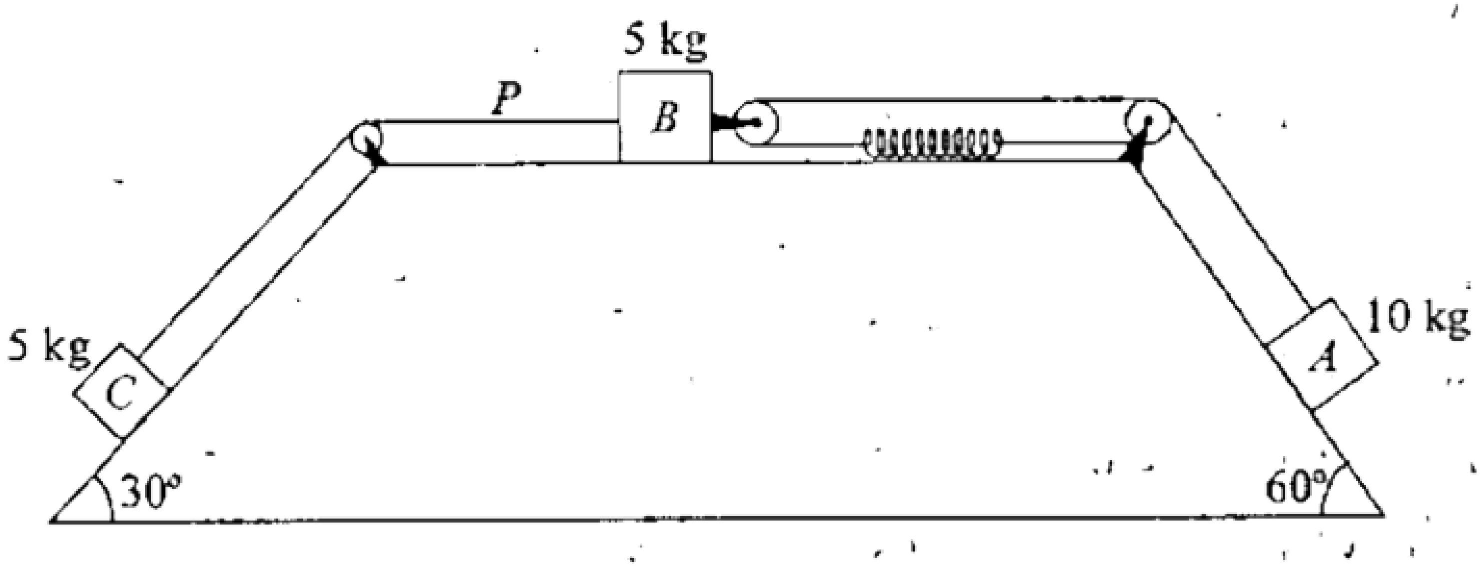
Watch Video Solution

38. Find the readings of spring balances `S_(1),S_(2)` and `S_(3)` of the springs shown in figure-2.115(a). If the string snaps at point A find the readings of the three spring balances just after the string snaps. All pulleys and strings are ideal.

Watch Video Solution

39. (a) Find the acceleration of the three masses shown in figure-2.116(a) and the extension in the spring. The force constant of the spring is 100 N/m. Assume all strings and pullies are ideal.

(b) Find the acceleration of the masses A and B just after the string snaps at P but in this case the spring is replaced by a string. Take `g = 10m//s^(2)`



Watch Video Solution