doubtnut
India's Number 1 Education App

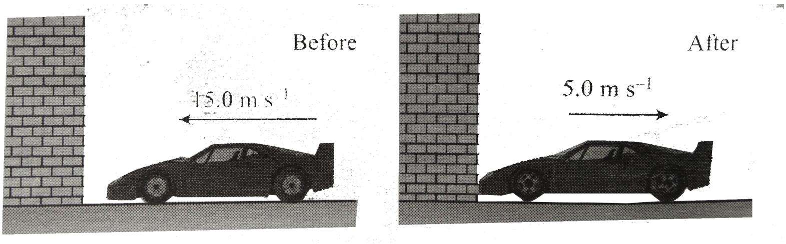
PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

NEWTON'S LAWS OF MOTION 1

Illustrations

1. In a particular crash test, a car of mass 1500 kg collies with a wall as shown in fig. The initial and final velocities on the car are $\overrightarrow{v_i} = -15.0\hat{i}ms^{-1}$ and $\overrightarrow{v_f} = 5.00\hat{i}ms^{-1}$, respectively. If the collision lasts $0.150s$, find the impulse caused by the collision and the average force exerted on the car.



Watch Video Solution

2. A body of mass m=1kg falls from a height h=20m from the ground level .

(a) What is the magnitude of total change in momentum of the body before it strikes the ground?

(b) What is the corresponding average force experienced by it ? $(g = 10ms^{-1})$

Watch Video Solution

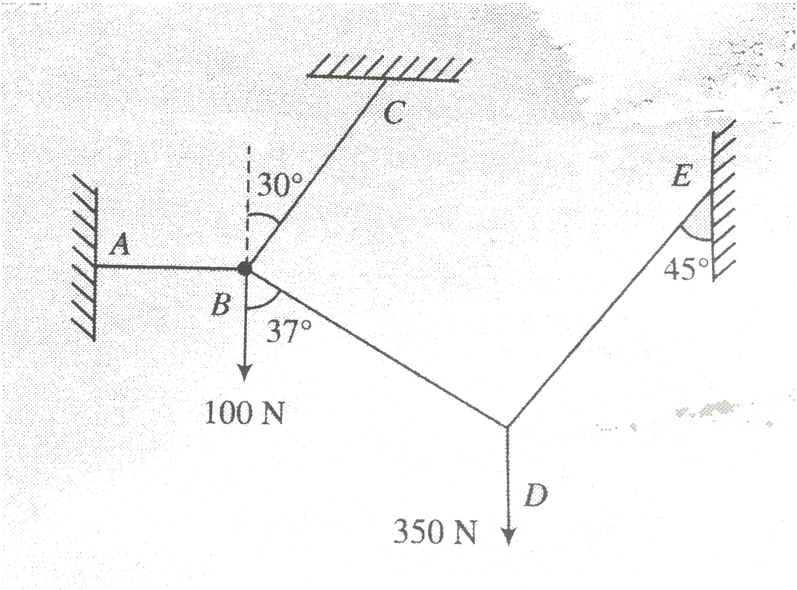
3. An iron ball of mass m=50 g falls from a height of $(h_1) = 5m$ and rises upto $h_2 = 3.2m$ after colliding with the horizontal surface. If the time of contant of the glass half is $\Delta t = 0.02s$, find the average contact force exerted on the ball by the horizontal surface.

Watch Video Solution

4. A block of mass $m = 10kg$ is suspended with the help of three strings as shown in fig. Find the tensions T_1 and T_2.

Watch Video Solution

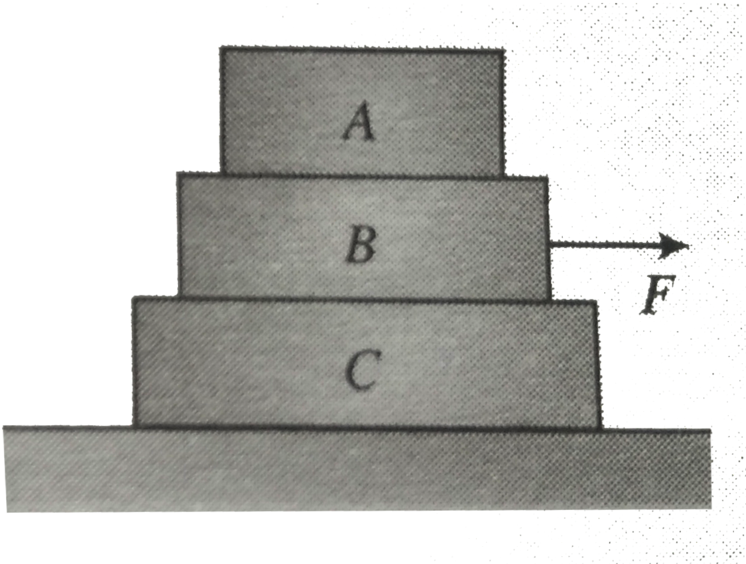
5. Two particle of masses 10 kg and 35 kg are connected with four strings at points B and D as shown in fig.



Determine the tension in various segments of the string.

Watch Video Solution

6. Three block A,B,and C of mass m_1, m_2 and m_3, respectively are resting one on top of the other as shown in fig. A horizontal force F is applied on block B. Assuming all the surfaces are frictionless, calculate (1) acceleration of block A, block B, and block C, (2) normal reactions between A and B, B and C, and between C and ground .



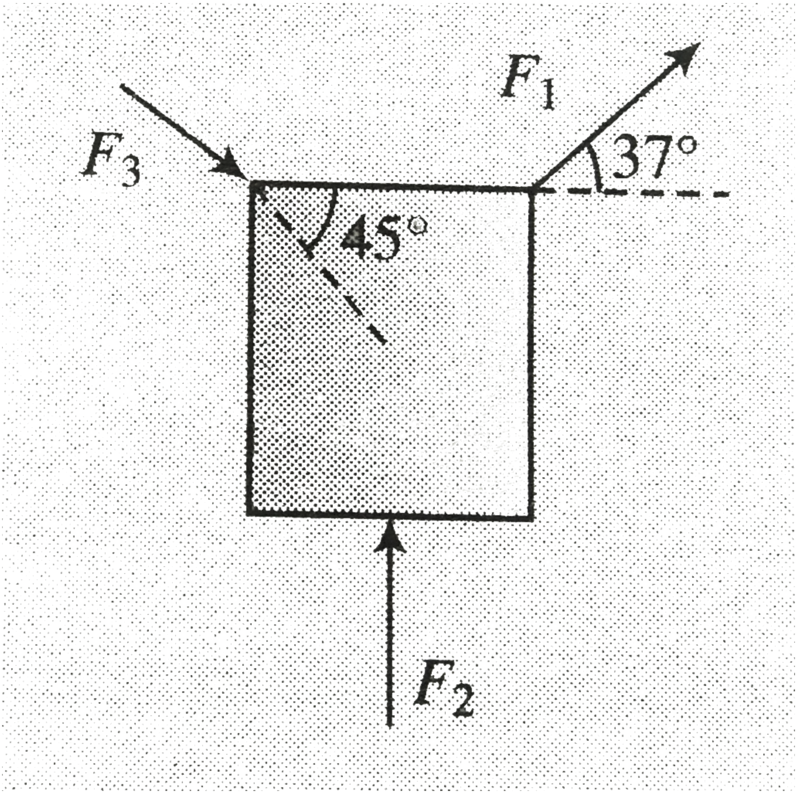
Watch Video Solution

7. Three boys, each of mass 45 kg, pull simlutaneously a block on a smooth surface. The mass of block is 20.0 kg.

(a) Find the acceleration of the block.

(b) Find the acceleration of the boy exerting force F_1 .

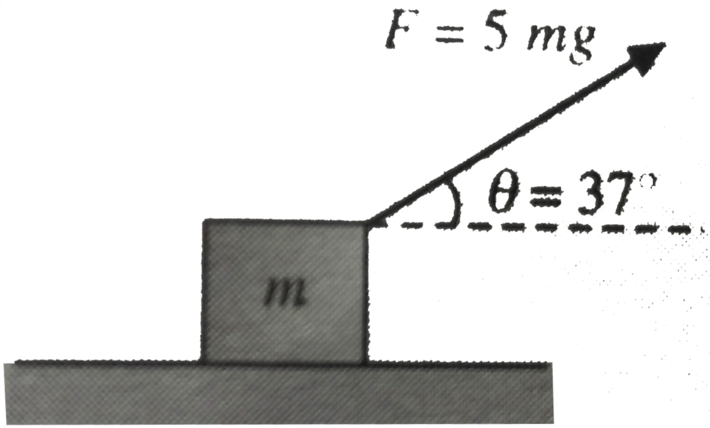
Assume no friction between the boy and the surface .



(Given $F_1 = 90N$, $F_2 = 114N$, and $F_3 = 128\sqrt{2}N$].

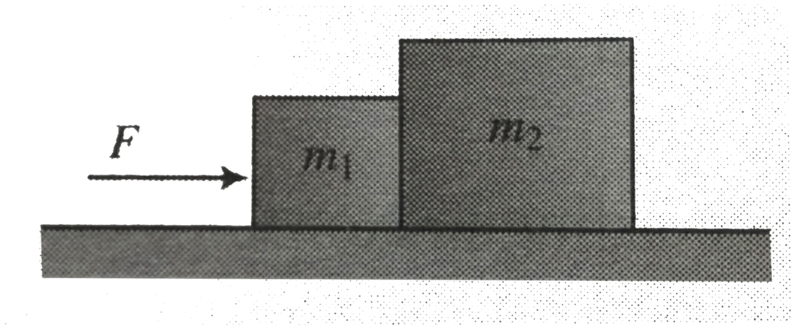
Watch Video Solution

8. A block of mass m is placed on a horizontla surface. If the block is pulled by applying a force of magnitude F=5mg at an angle $\theta = 37^\circ$, with horizontal as shown in fig. find the acceleration of the block at the given instant.



Watch Video Solution

9. Two block of masses m_1 and m_2 are placed side by side on a smooth horizontal surface as shown in fig. A horizontal force F is applied on the block .

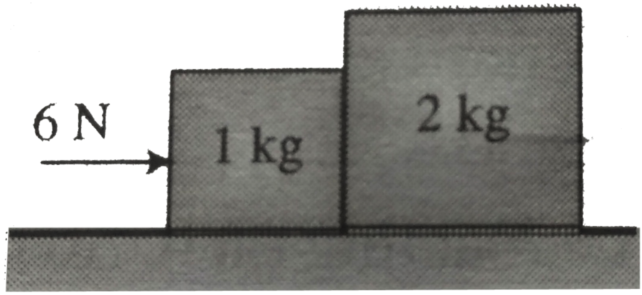


(a) Find the acceleration of each block.

(b) Find the normal reaction between the two blocks.

Watch Video Solution

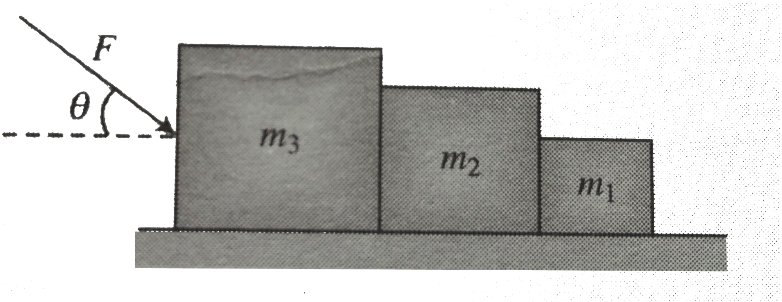
10. Two blocks of masses 1 kg and 2 kg are placed in contact on a smooth horizontal surface as shown in fig. A horizontal force of 6N is applied d(a) on a 1-kg block. Find the force of interaction of the blocks.



.

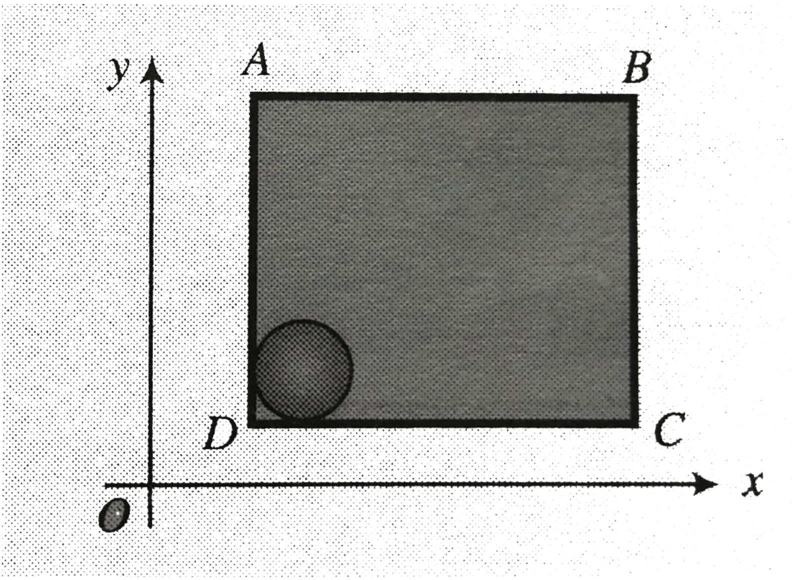
Watch Video Solution

11. Find the force of interaction between the bodies as shown in fig. Blocks are in contact.



Watch Video Solution

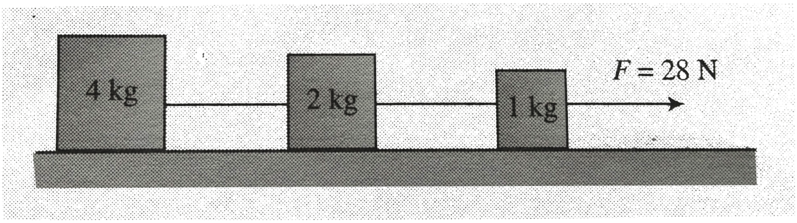
12. A solid sphere of mass 2 kg is resting inside a cube as shown in fig. The cube is moving with a velocity $\overrightarrow{v} = \left(5t\hat{i} + 2t\hat{j}\right)ms^{-1}$. Here t is time in seconds. All surface are smooth. The sphere is at rest with respect to the cube. What is the total force exerted by the sphere on the cube?



Watch Video Solution

Watch Video Solution

13. In the arrangement shown in fig. The strings are light and inextensible. The surface over which blocks are placed is smooth. Find:

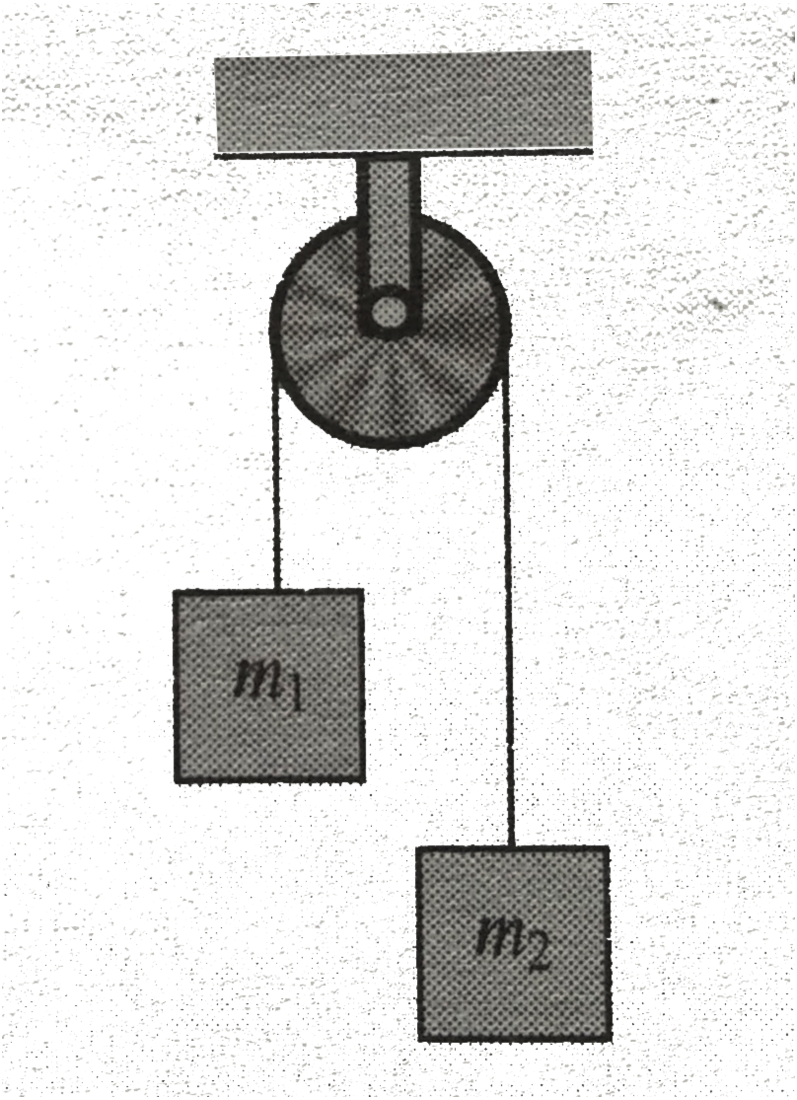


(a) the acceleration of each block.

(b) the tension in each string.

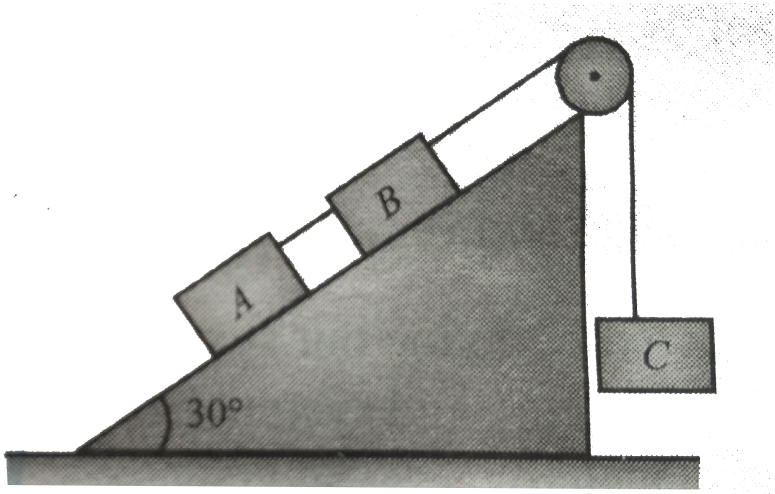
Watch Video Solution

14. Two mass m_1 and m_2 are attached to a flexible inextensible massless rope, which passes over a frictionless and massless pully. Find the accelerations of the masses and tension in the rope.



Watch Video Solution

15. In fig.block A and B are connected together by a string and placed on a smooth inclined plane. B is connected to C(which is suspended vertically) by another string which passes over a smooth pulley fixed to th plane. The mass A is $m_A = 1$ kg and mass of B is $m_B = 2kg$.

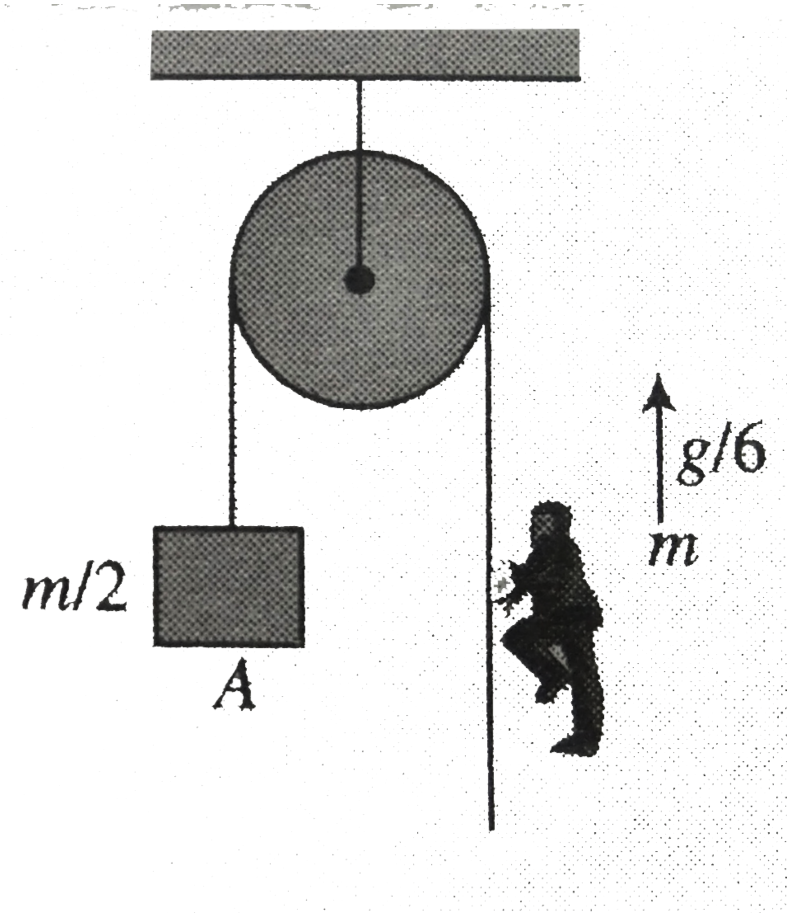


(a) If the system is at rest, find the mass of C.

(b) If the mass of C is twice the mass calculate in (a) then find the acceleration of the system.

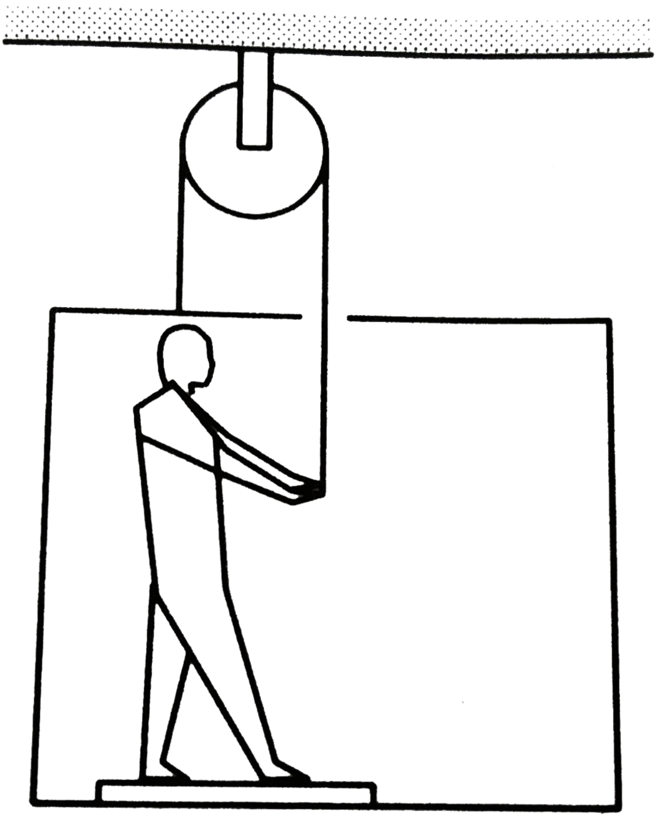
Watch Video Solution

16. Block A of mass $m/2$ is connected to one end of light rope which passes over a pulley as shown in fig. A man of mass m climbs the other end of rope with a relative acceleration of $g/6$ with respect to rope. Find the acceleration of block A and tension in the rope.



Watch Video Solution

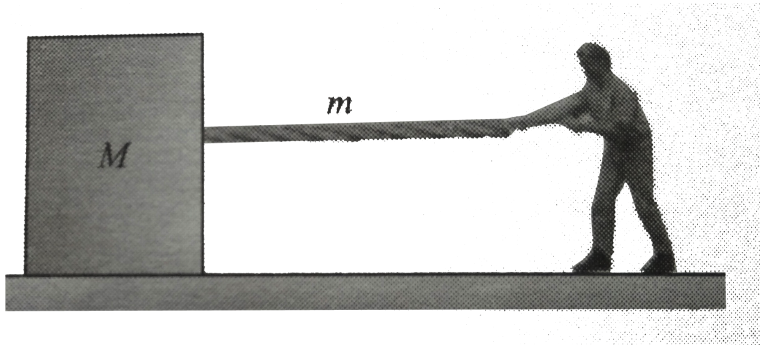
17. Figure shows a man of mass 60 kg standing on a light weighting machine kept in a box of mass 30 kg. The box is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself. If the man manages to keep the box at rest, what is the weight shown by the machine? What force should he exert on the rope to get his correct weight on the machine?



Watch Video Solution

18. A block of mass M is being pulled with the help of a string of mass m and length L. the horizontal force

applied by the man on the string is F.



Determine

(a) Find the force exerted by the string on the block and acceleration of system.

(b) Find the tension at the mid point of the string.

(c) Find the tension at a distance x from the end at which force is applied.

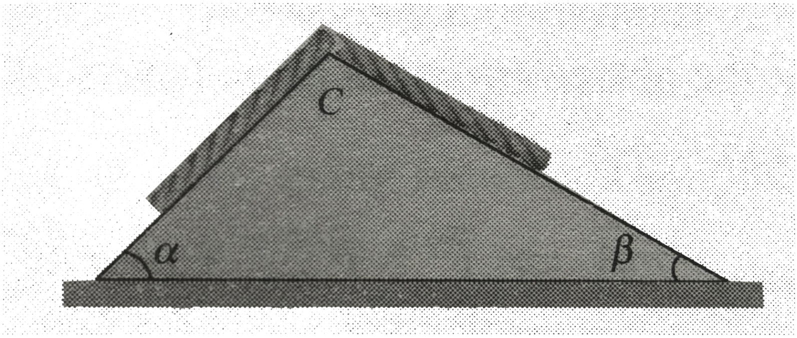
Assume that the block is kept on a frictionless horizontal surface and the mass is uniformly distributed in the string.

Watch Video Solution

19. A body of mass M is hanging by an inextensible string of mass m. If the free end of the string accelerates up with constant acceleration a. find the variation of tension in the string a function of the distance measured from the mass M (bottom of the string).

Watch Video Solution

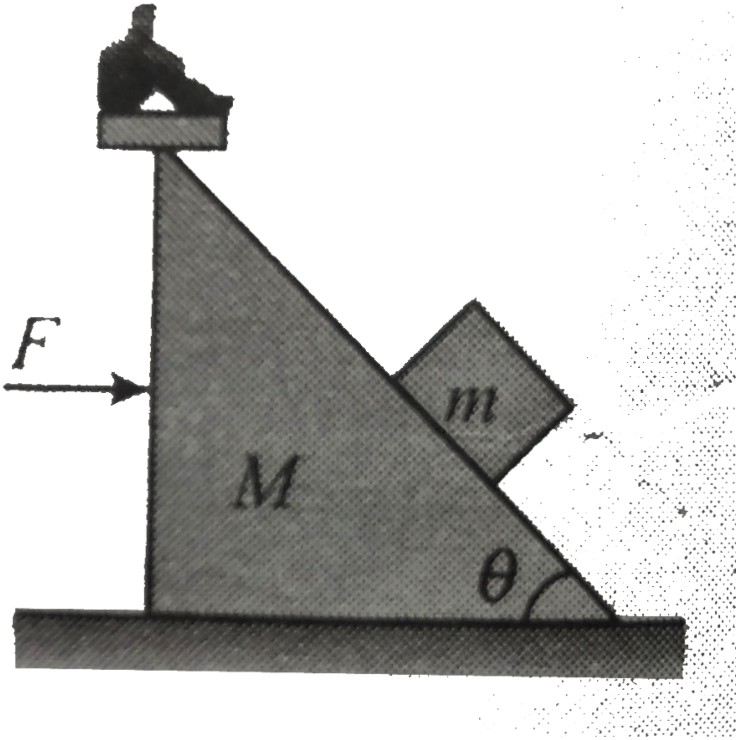
20. A homogeneous flexible rope rests on a wedge whose side edges make angles α and β with the horizontal. The central part of the rope lies on the upper rib C of the wedge. With what acceleration should the wedge be pulled to the left along the horizontal plane in order to prevent the displacement of the rope with respect to the wedge? [Consider all surfaces to be smooth]



Watch Video Solution

21. The block of mass m is in equilibrium relative to the smooth wedge of mass M which is pushed by a horizontal force F. Find pseudo force acting on (a) m, (b)M as viewed by the observer sitting on the wedge. Will these pseudo forces (c) equal and opposite, action

reaction pairs? Explain.



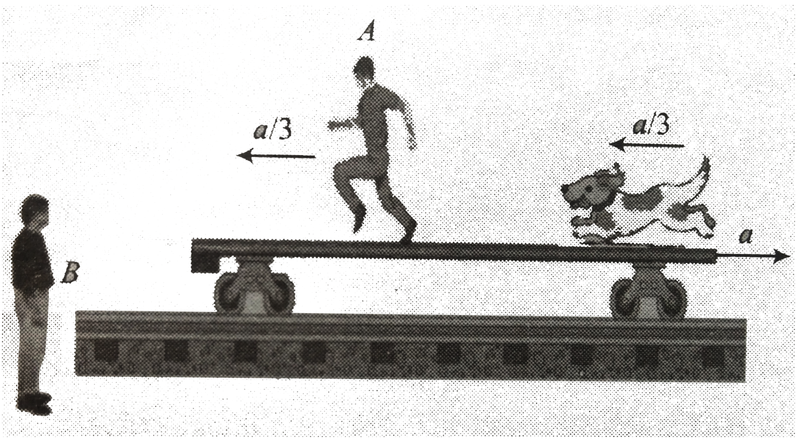
Watch Video Solution

22. A rail-road car is moving towards right with acceleration a. A man accelerating toward left with an acceleration of magnitude $a/3$ w.r.t to car. A dog of mass m is following man A with an acceleration $a/3$ relative to the car. Observer B on ground is observing the dog and man A. Find the

(a) net force experienced by the dog as seen by observer B standing on ground.

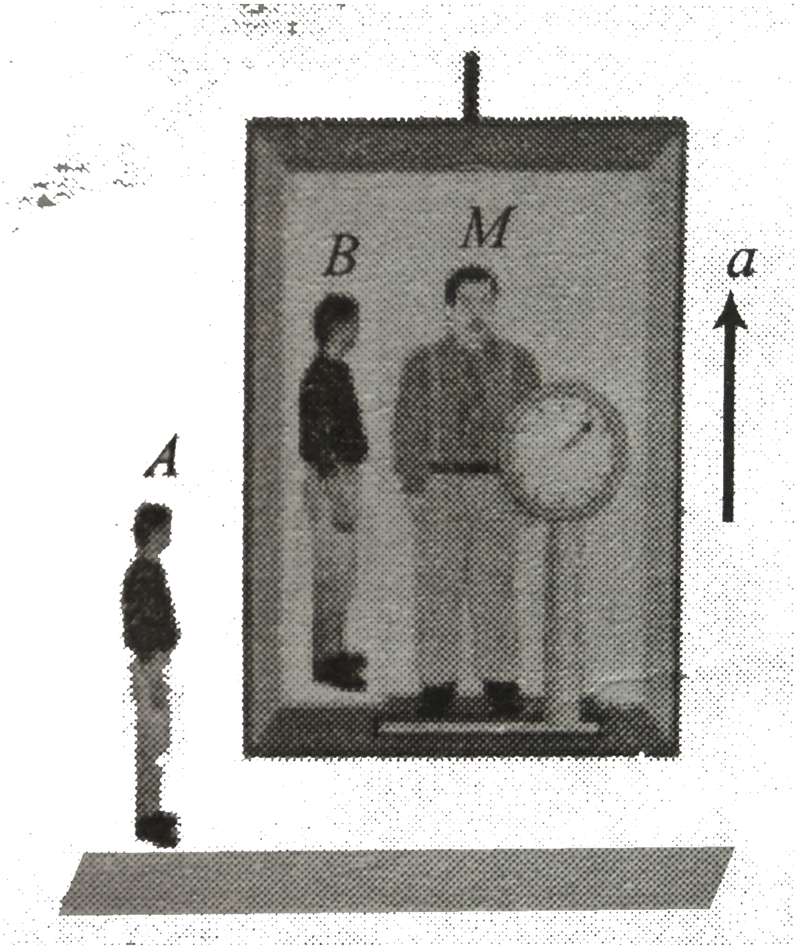
(b) rate of change of linear momentum of the dog relative to the man A moving on trolley.

(c) pseudo-free on the dog as seen from man A.



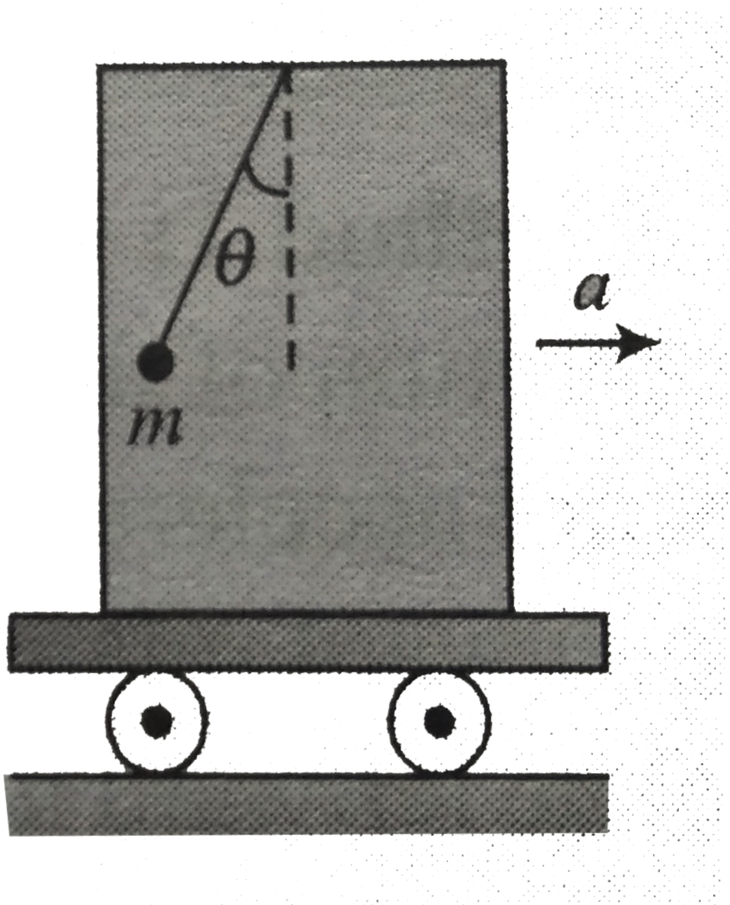
Watch Video Solution

23. A man of mass M stands on a weighing machine in an elevator accelerating upwards with an acceleration a. Draw the free-body diagram of the man as observed by the observer A (stationary on the ground) and observer B (stationary on the elevator). Also, calculate the reading of the weighing machine.



Watch Video Solution

24. A bob of mass m=50g is suspended form the ceiling of a trolley by a light inextensible string. If the trolley accelerates horizontally, the string makes an angle 37° with the vertical. Find the acceleration of the trolley.



Watch Video Solution

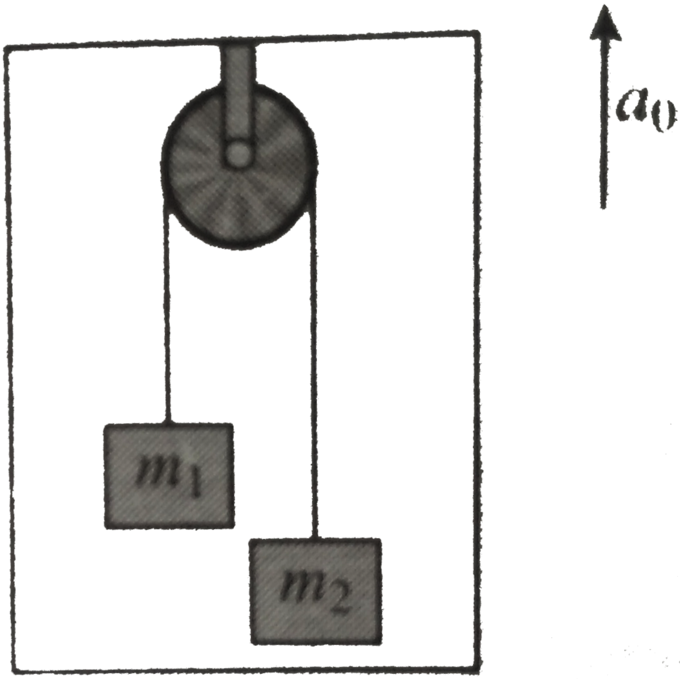
25. A bead of mass m is fitted on a rod and can move on it without friction. Initially the bead is at the middle of the rod moves transitionally in the vertical plane with an accleration a_0 in direction forming angle α with the rod as shown. The acceleration of bead with respect to rod is:

z

Watch Video Solution

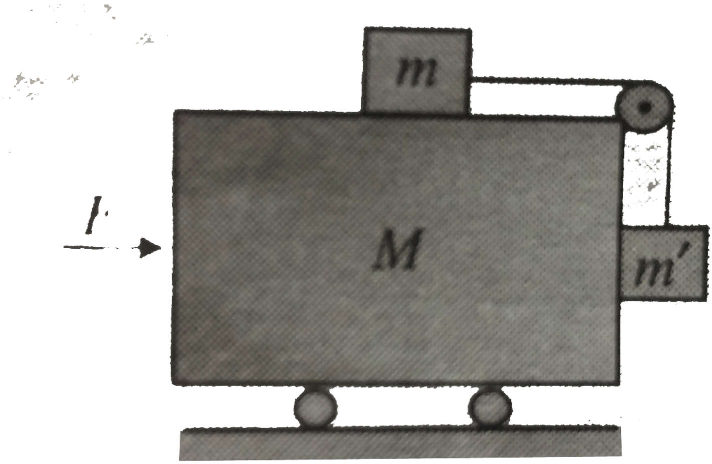
26. If the pulley is massles and moves with an upward acceleration a_0. Find the acceleration of (m_1) and (m_2)

w.r.t to elevator.



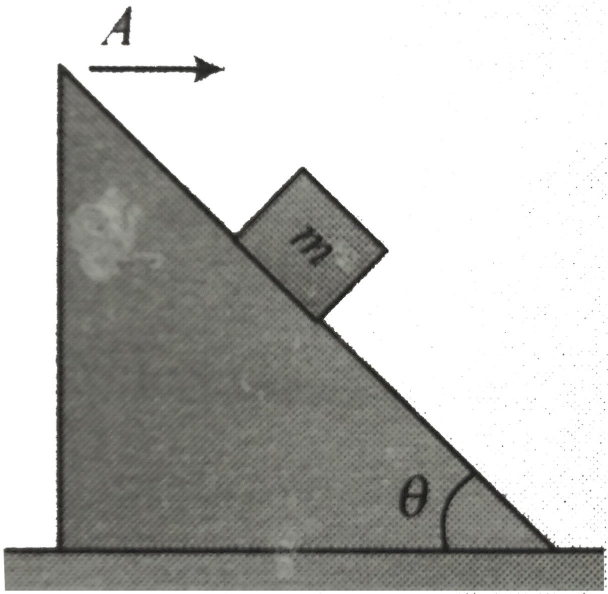
Watch Video Solution

27. Two smooth blocks of masses m and m' connected by a light inextensible strings are moving on a smooth wedge of mass M. If a force F acts on the wedge the blocks do not slide relative to the wedge. Find the (a) acceleration of the wedge and (b) value of F.



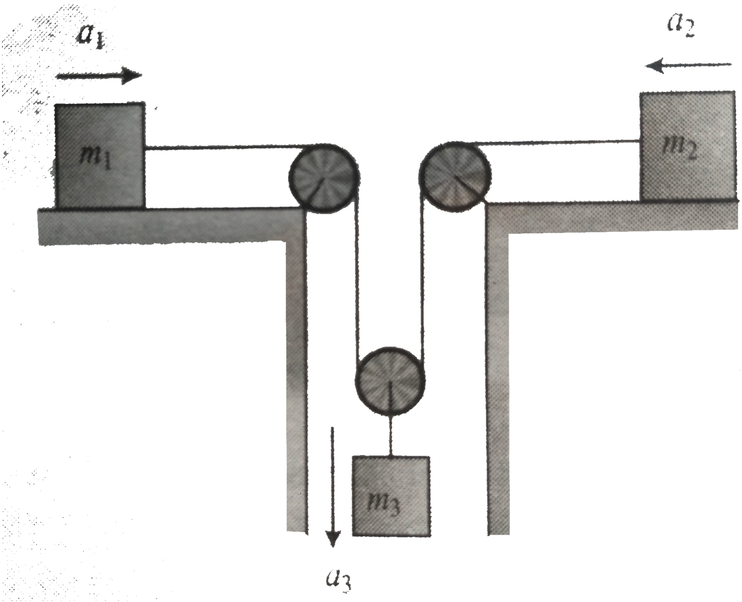
Watch Video Solution

28. A block of mass m is placed on an inclined plane. With what acceleration A towards right should the system move on a horizontal surface so that m does not slide on the surface of inclined plane? Also calculate the force supplied by wedge on the block. Assume all surfaces are smooth.



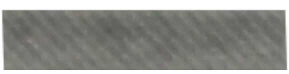
Watch Video Solution

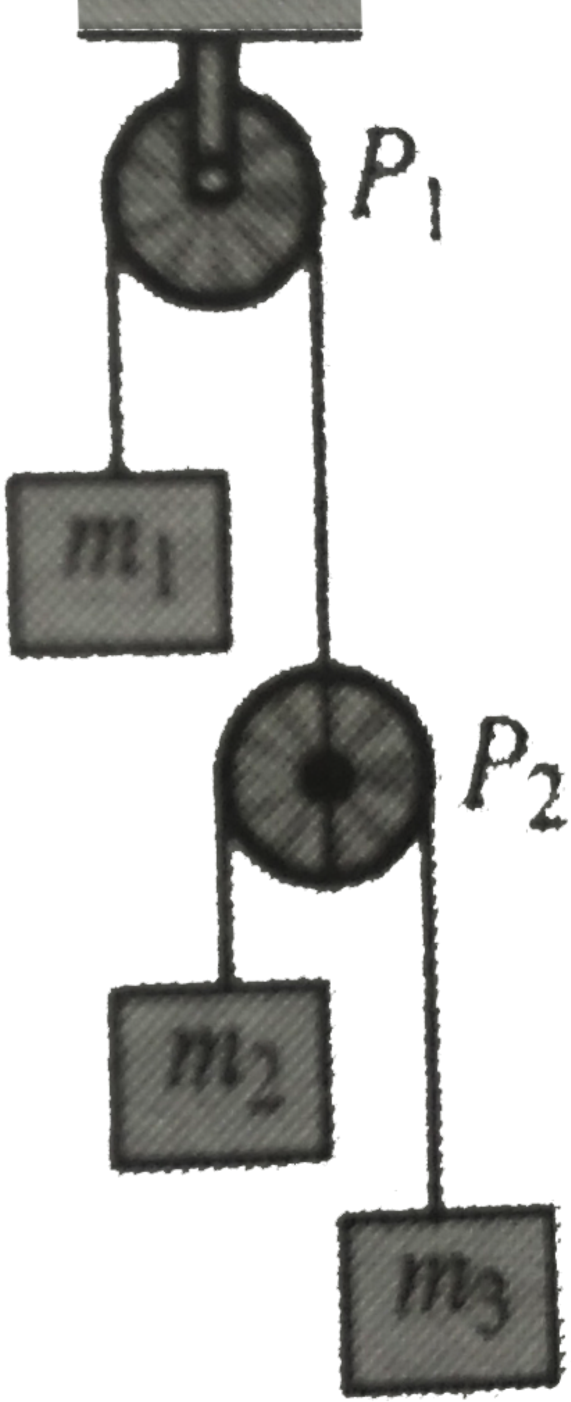
29. In the arrangement of three block as shown in fig. the string is inextensible. If the direction of accelerations are as shown in the figure, then determine the constraint relation.



Watch Video Solution

30. A pulley-rope-mass arrangement is shown in fig. Find the acceleration of block m_1 when the masses are set free to move. Assume that the pulley and the ropes are ideal.

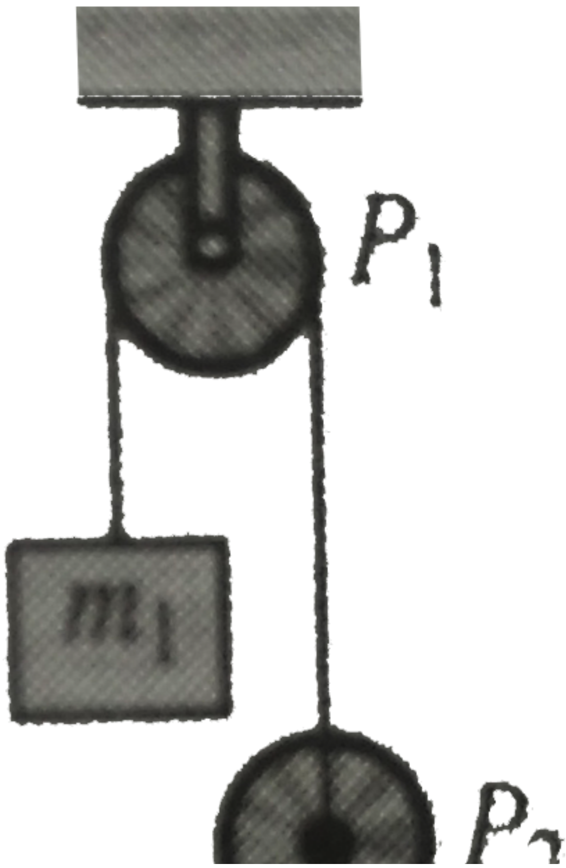


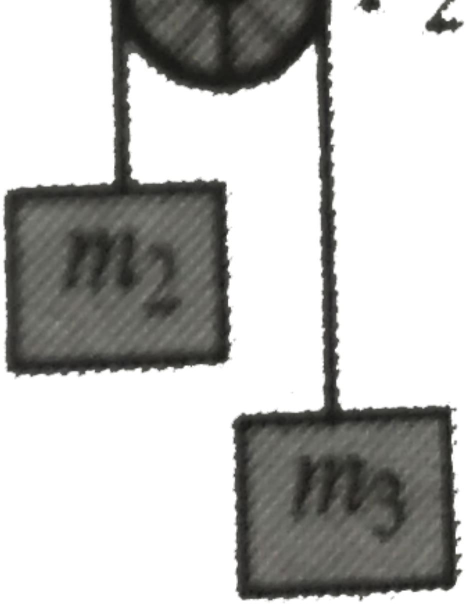


P_1
m_1
P_2
m_2
m_3

Watch Video Solution

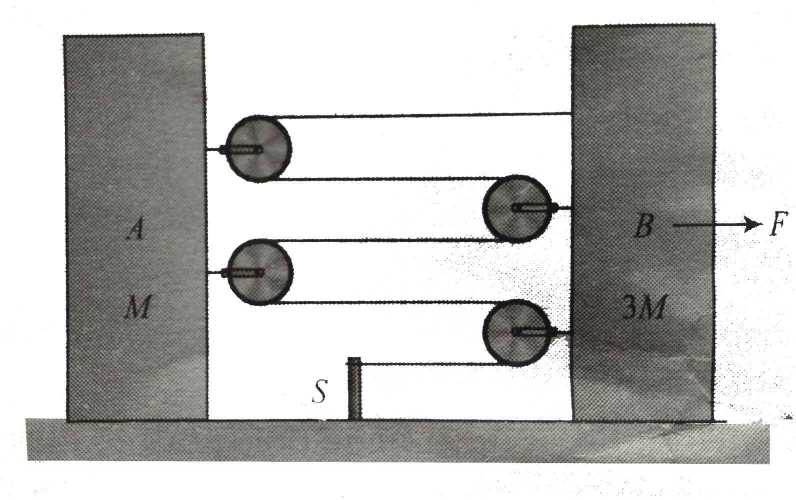
31. A pulley-rope-mass arrangement is shown in fig. Find the acceleration of block m_1 when the masses are set free to move. Assume that the pulley and the ropes are ideal.





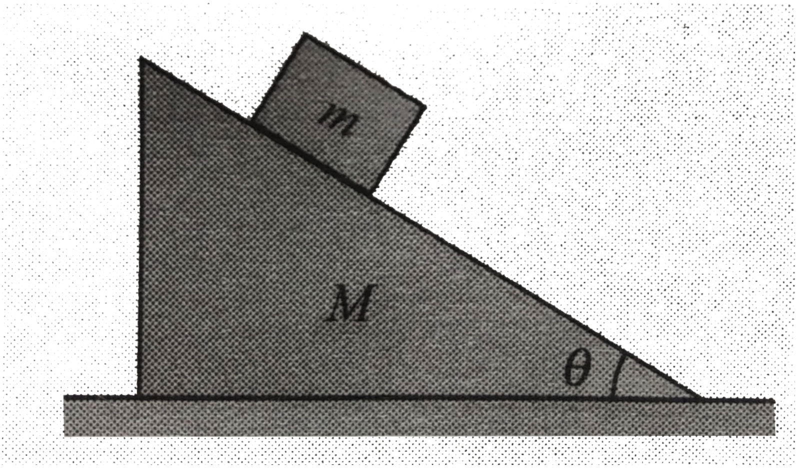
Watch Video Solution

32. Two block A and B of mass M & 3M are connected through a light string. One end of the string is connected to the blcok B and its other end is connected to a fixed point S as shown in fig. Now a force F is applied to block B. find the acceleration of block A & B.



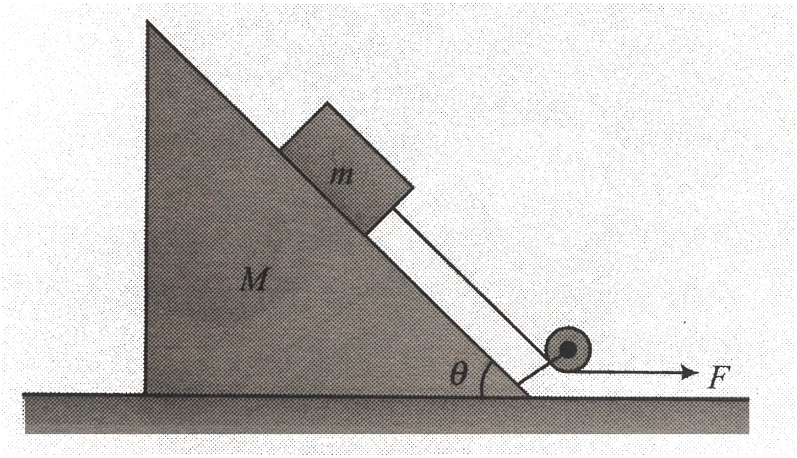
Watch Video Solution

33. A block of mass m is placed on the inclined sufrace of a wedge as shown in fig. Calculate the acceleration of the wedge and the block when the block is released. Assume all surfaces are frictionless.



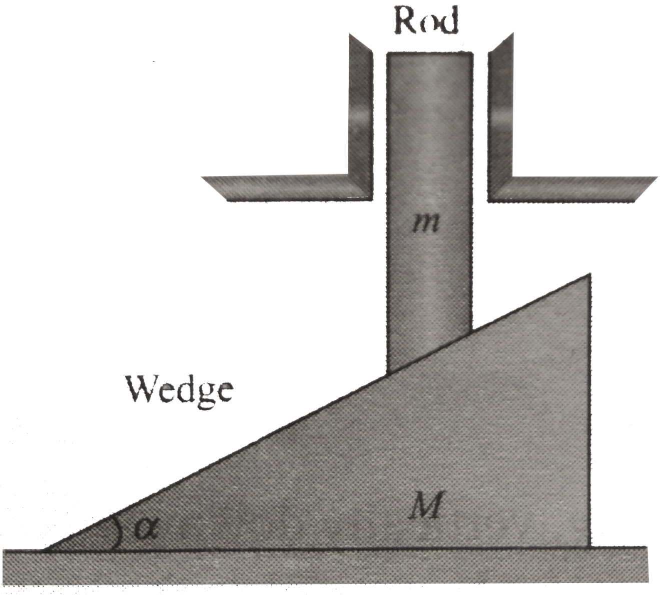
Watch Video Solution

34. In fig. mass m is being pulled on the incline of a wedge of mass M. All the surfaces are smooth. Find the acceleration of the wedge.



Watch Video Solution

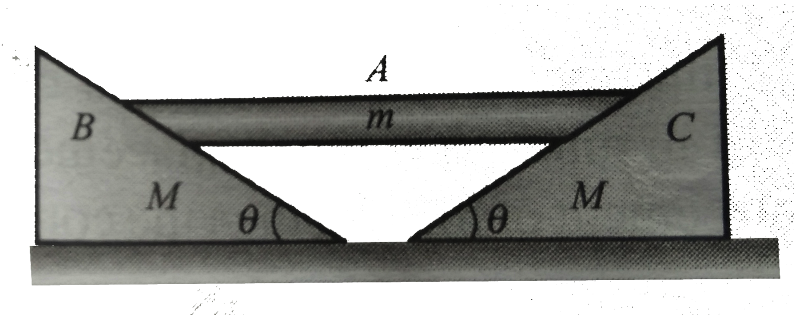
35. A rod of mass m is supported on a wedge of mass M shown in fig. Find the accelerations of rod and wedge in the arrangement. The friction between all contact surfaces in negligible.



Watch Video Solution

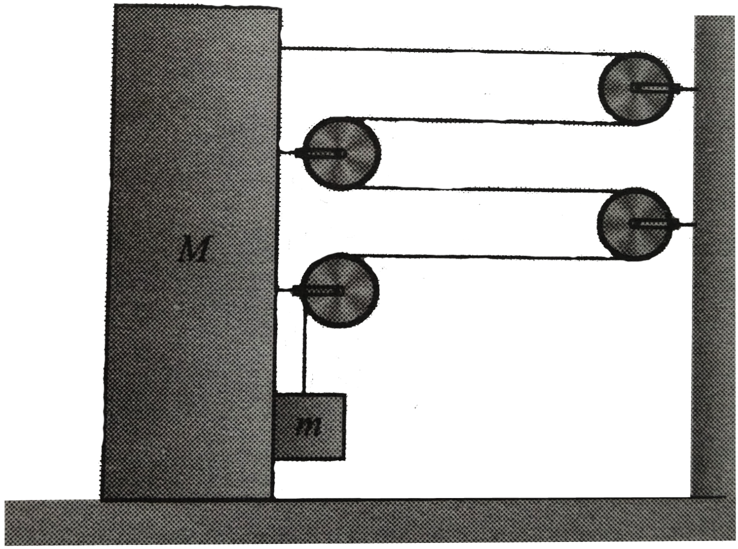
36. A plank of mass m rests symmetrically on two wedges B and C of mass M. What is the acceleration of the plank?

Neglect friction between all the contact surfaces.



Watch Video Solution

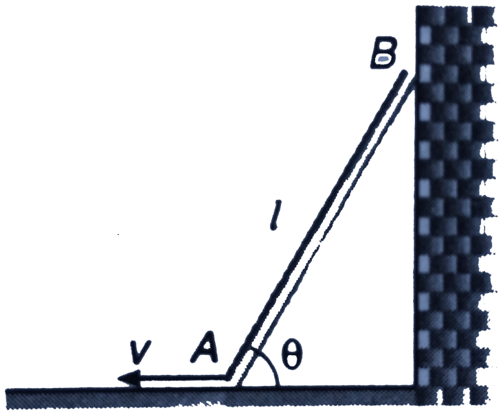
37. A block of mass M is connected with a particle of mass m by a light inextensible string as shown in fig. Assuming all contaction surfaces as smooth, find the acceleration of the wedge after releasing the system.



Watch Video Solution

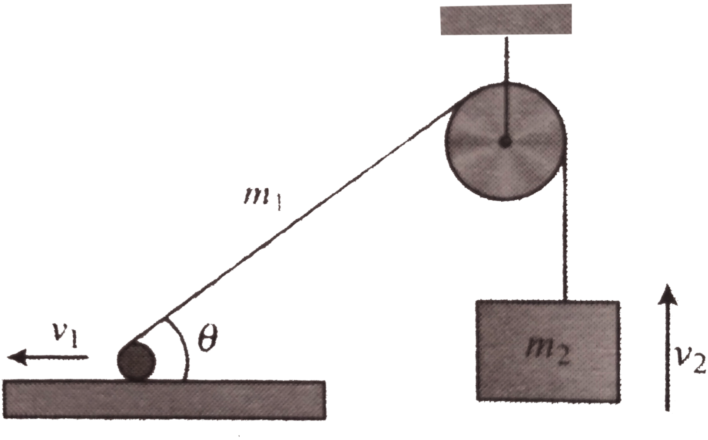
38. Figure shows a rod of length l resting on a wall and the floor. Its lower end A is pulled towards left with a constant velocity v. Find the velocity of the other end B downward when the rod makes an angle θ with the

horizontal.



Watch Video Solution

39. In fig. a ball of mass m_1 and a block of mass m_2 are joined together with an inextensible string. The ball can slide on a smooth horizontal surface. If v_1 and v_2 are the respective speeds of the ball and the block, then determine the constraint relation between the two.

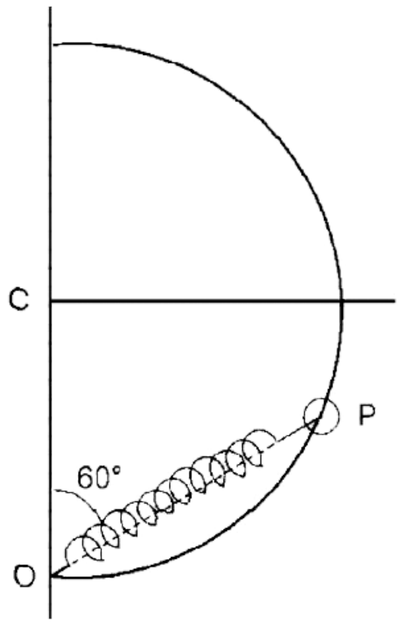


Watch Video Solution

40. The ring M_1 and block M_2 are held in the position shown in fig. Now the system is released. If $M_1 > M_2$, find V_1 / V_2 wheb the ring m_1 slides down along the smooth fixed vertical rod by the distance h.

Watch Video Solution

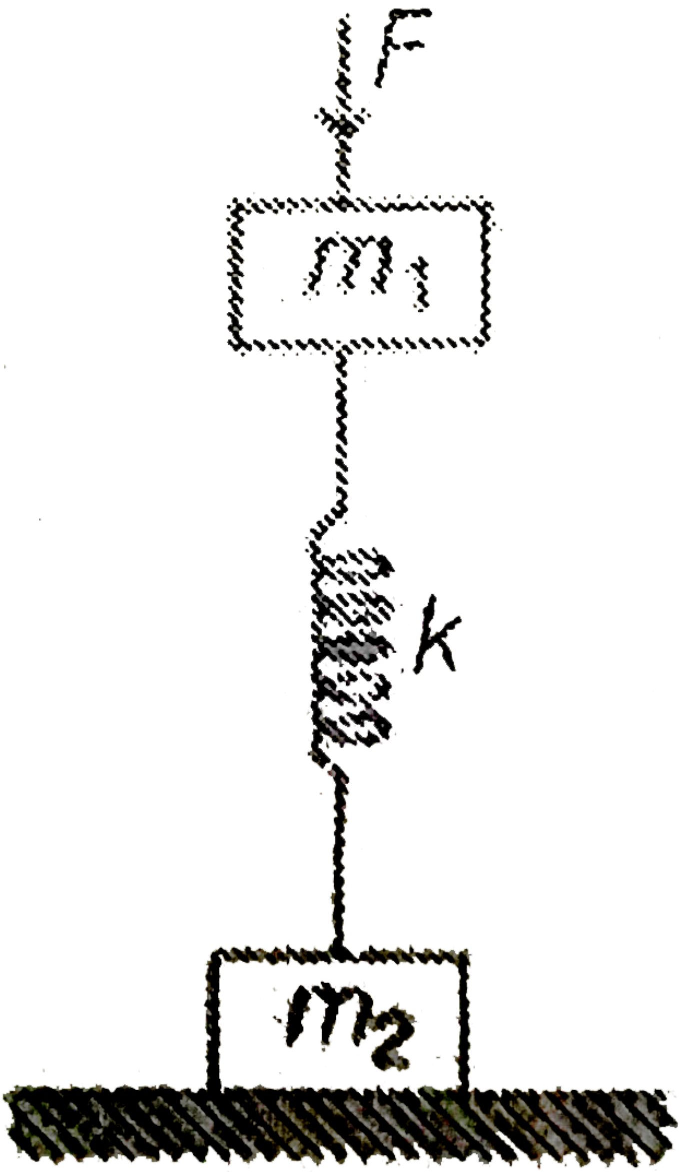
41. A smooth semicircular wire-track of radius R is fixed in a vertical plane. One end of a massless spring of natural length $3R/4$ is attached to the lowest point O of the wire-track. A small ring of mass m, which can slide on the track, is attached to the other end of the spring. The ring is held 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

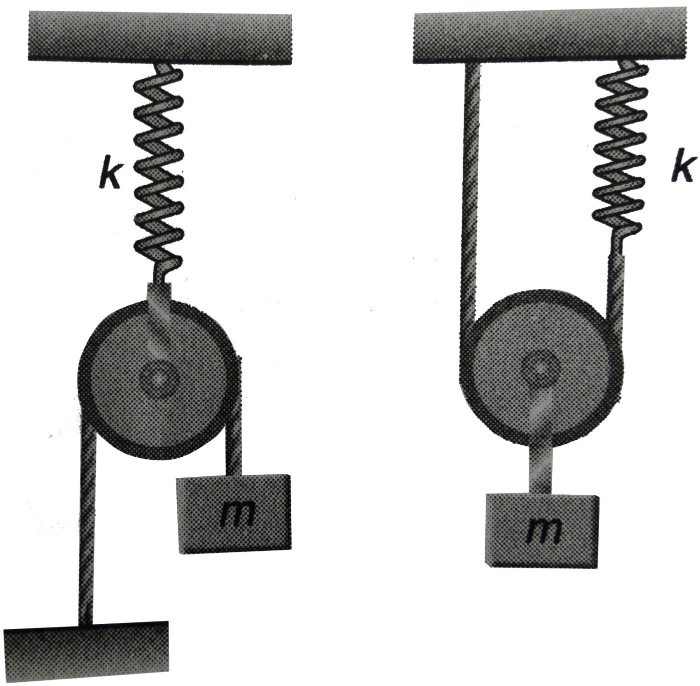
42. A system consists of two cubes of masses m_1 and m_2 respectively connected by a spring of force constant k. The force (F) that should be applied to the upper cube to

keep it at rest for which the lower one just lifts after the force is removed is



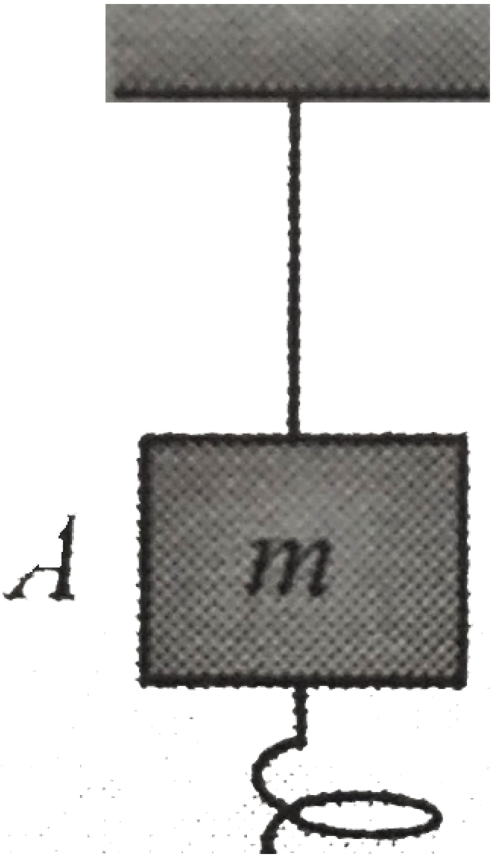
Watch Video Solution

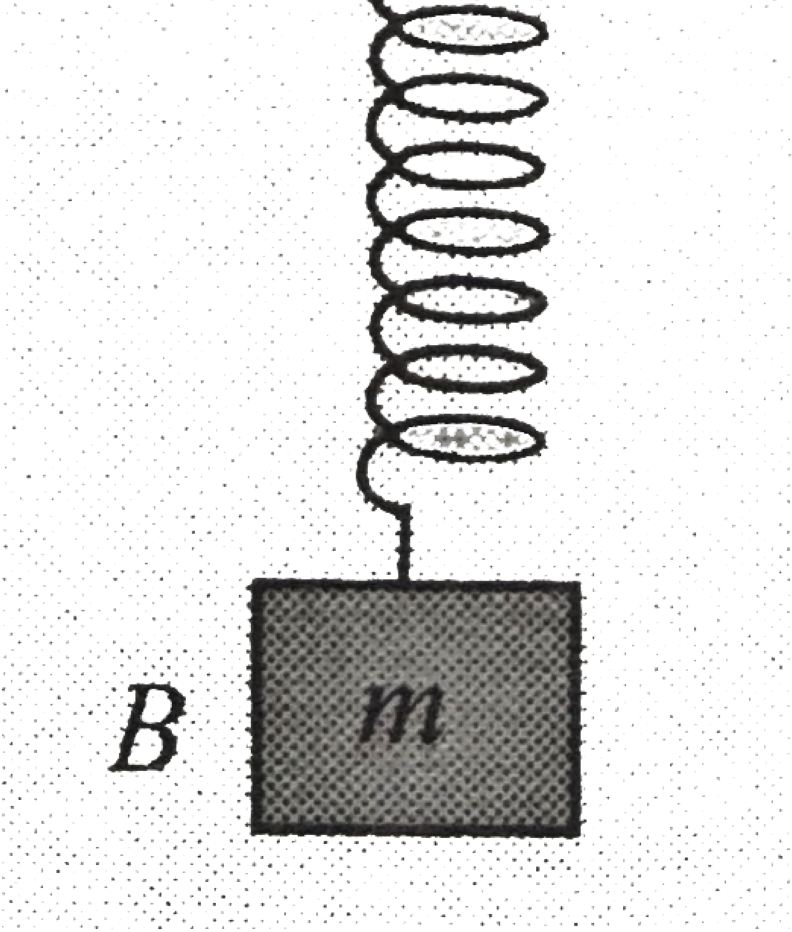
43. Figure shows a system consisting of a massles pulley, a spring of force constant k and a block of mass m. If the block is sligthtly displaced vertically down from its equilibrium and released, find the period of its vertical oscillation in cases (a) and (b).



Watch Video Solution

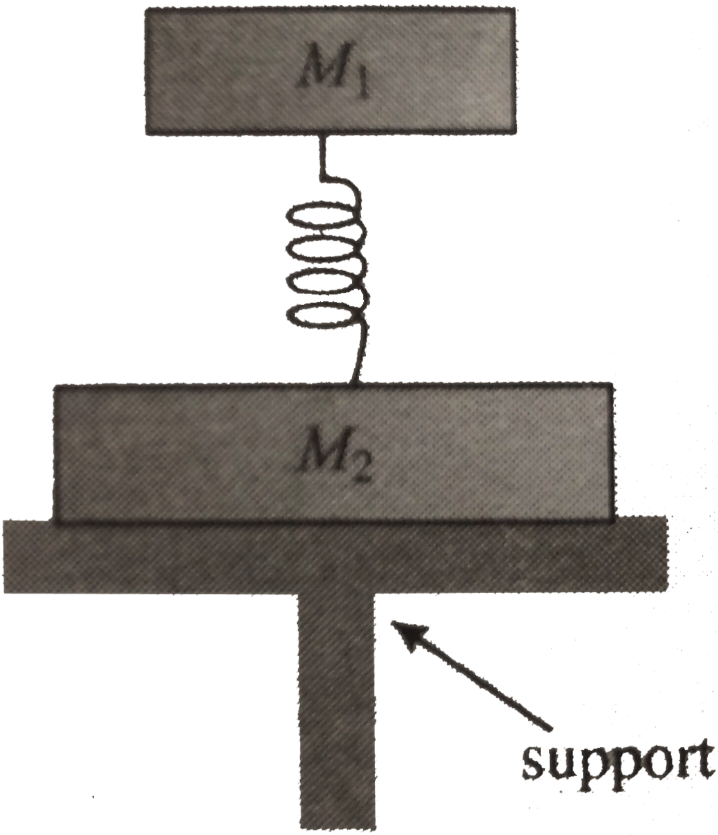
44. Two blocks A and B of same mass m attached with a light spring are suspended by a string as shown in fig. Find the acceleration of block A and B just after the string is cut.





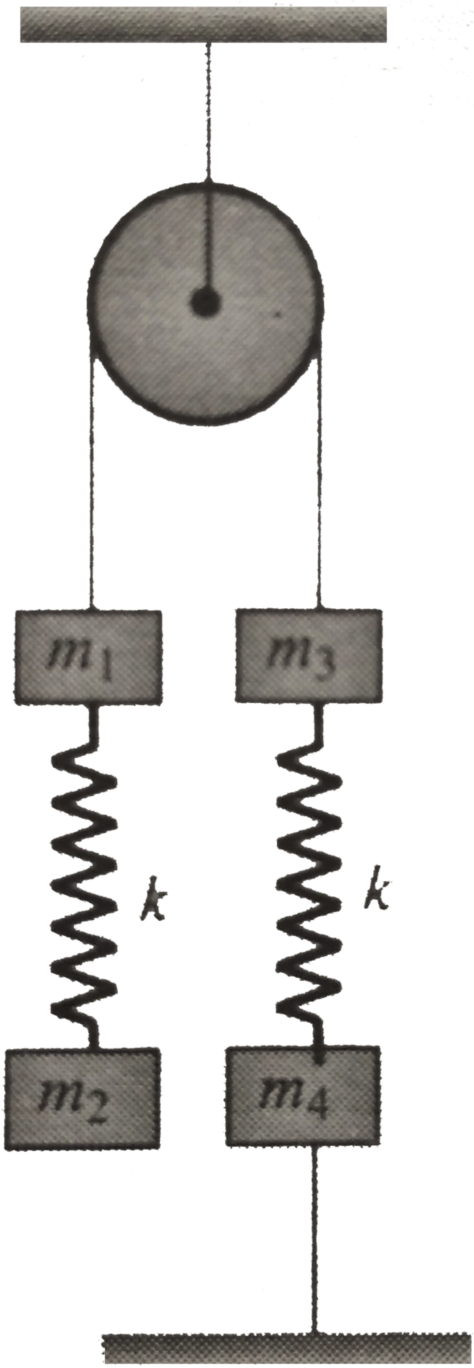
Watch Video Solution

45. The system of two weights with masses M_1 and M_2 are connected with weightless spring as shown in fig. The system is resting on the support S. Find the acceleration of each of the weights just after the support S is quickly removed.



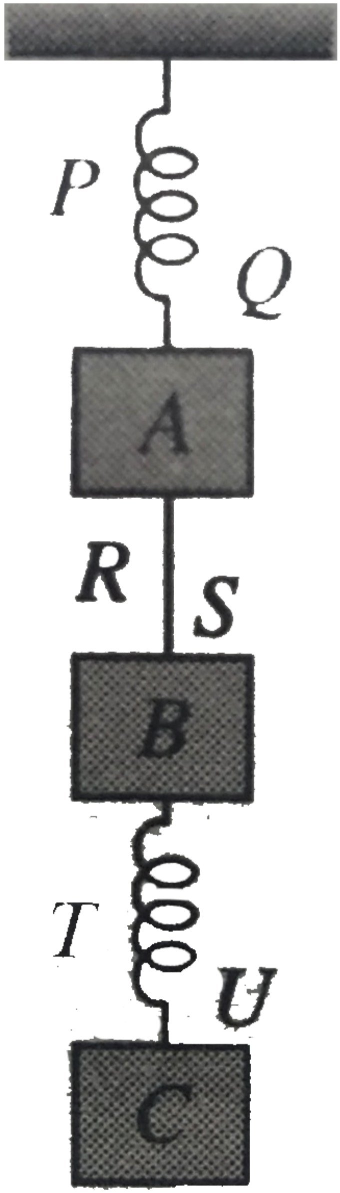
Watch Video Solution

46. Four blocks and two springs are arranged as shown in fig. The system at rest, determine the accelration of all the loads immedialtely after the lower thread keeping the system in equilibrium has been cut. Assume that the threads are weightless, the mass of the pulley is negligible small, and there is no friction at the point of suspension.



Watch Video Solution

47. Three blocks A, B, and C of masses $3M$, $2M$, and M are suspended vertically with the help of spring PQ and TU, and a string RS as shown in fig. If the acceleration of blocks A, B and C is a_1, a_2 and a_3 , respectively, then



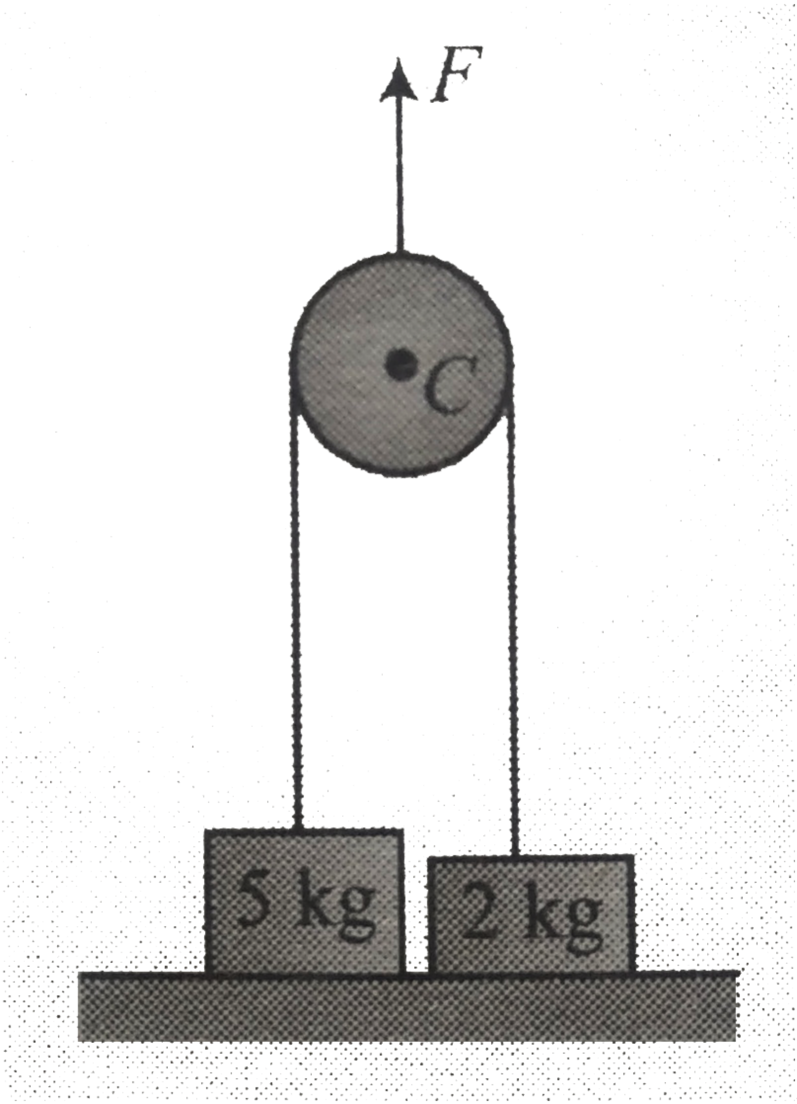
The value of acceleration a_3 at the moment spring PQ is cut is

Watch Video Solution

Solved Examples

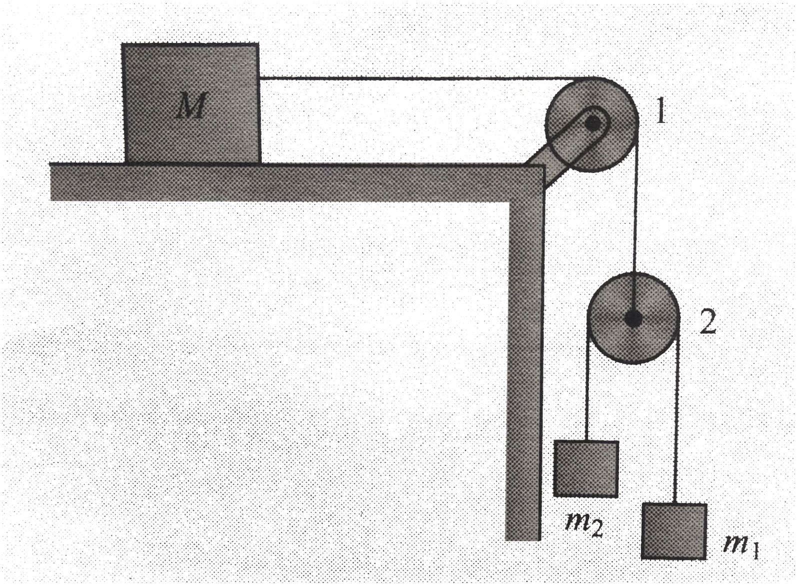
1. Two blocks of masses 5kg and 2 kg are initially at rest on the floor. They are connected by a light string. Passing over a light frictionless pulley. An upwards force F is applied on the pulley and maintained at a constant value. Calculate the acceleration a_1 and a_2 of the 5-kg and 2-kg masses, respectively, when F is (take $g = 10ms^{-2}$)

(a) 30N, (b) 60N , (c) 140N



Watch Video Solution

2. In the arrangement shown in fig. $m_1 = 1kg, m_2 = 2kg$. Pulleys are massless and strings are light. For what value of M, the mass m_1 moves with constant velocity.



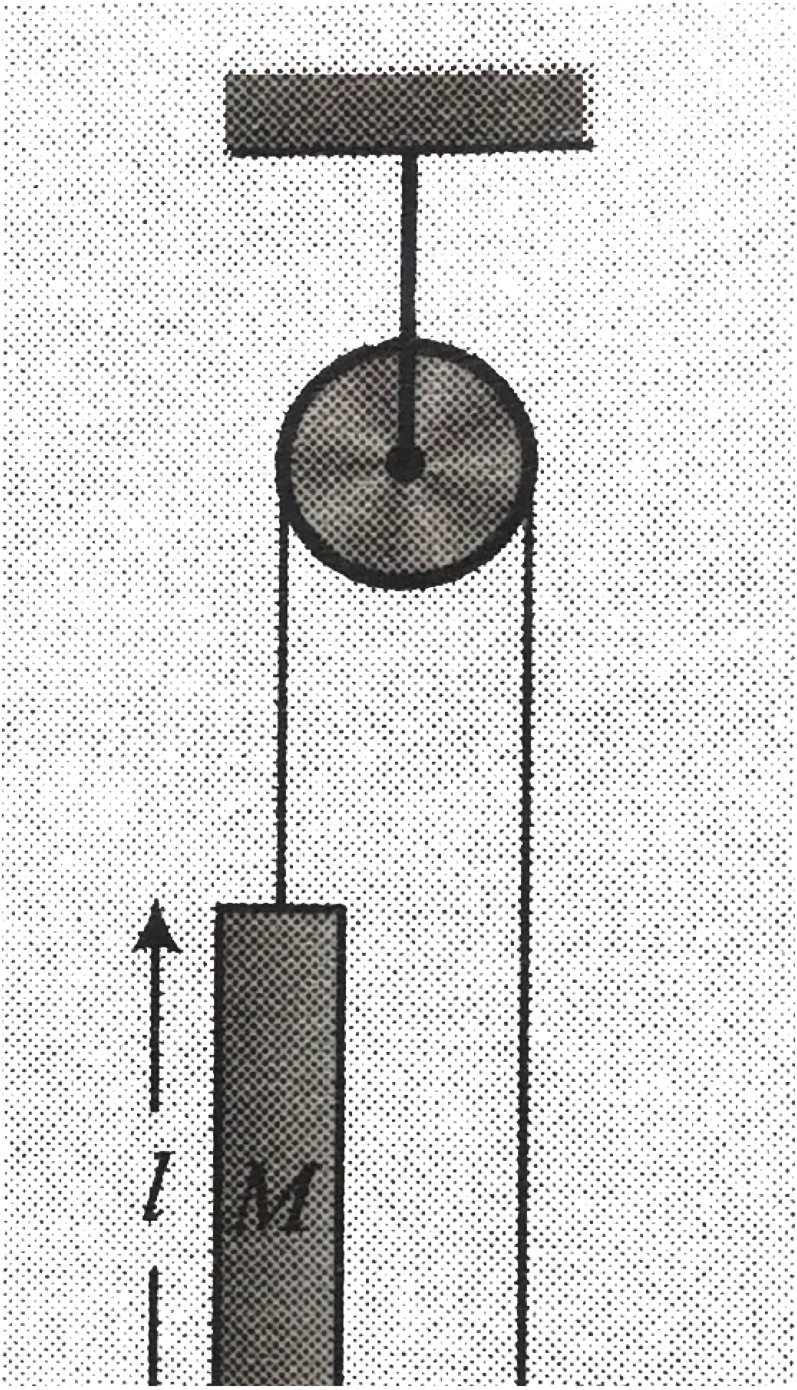
Watch Video Solution

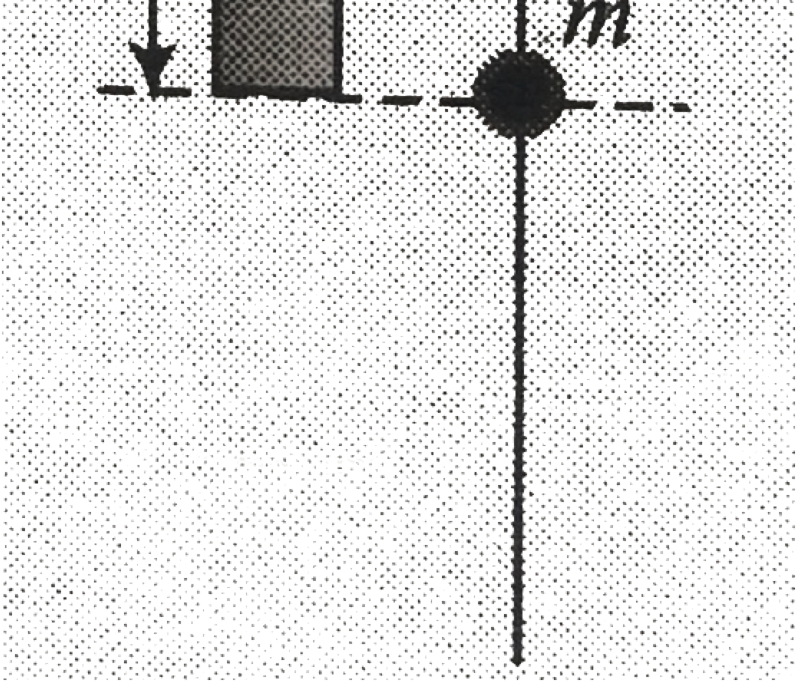
3. Pulleys shown in the system are massless and fricionless. Threads are inextensible. The mass of blocks

A, B, and C are $m_1 = 2kg$, $m_2 = 4kg$, and $(m_3) = 2.75kg$, respectively. Calculate the acceleration of each block.

View Text Solution

4. In the arrangement shown in fig., mass of the rod M exceeds the mass m of the ball. The ball has an opening permitting it to slide along the thread with some friction. The mass of the pulley and the friction in its axle are negligible. At the initial moment, the ball was located opposite the lower end of the rod. When set free, both bodies began moving with constant accelerations. Find the friction force between the ball and the thread if t seconds after the beginning of motion, the ball got opposite to the upper end of the rod. The rod length equals l.

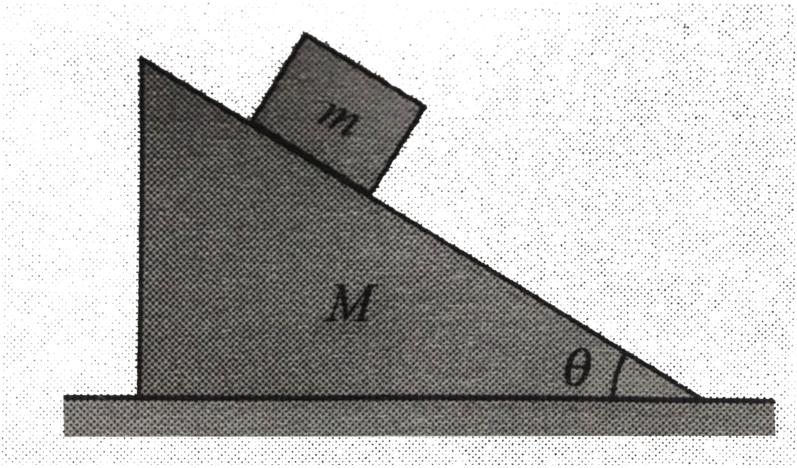




Watch Video Solution

5. A block of mass m is placed on the inclined sufrace of a wedge as shown in fig. Calculate the acceleration of the wedge and the block when the block is released. Assume

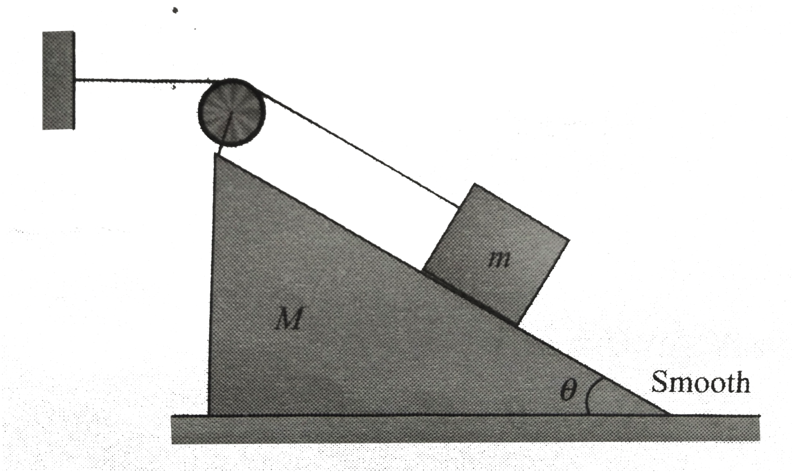
all surfaces are frictionless.



Watch Video Solution

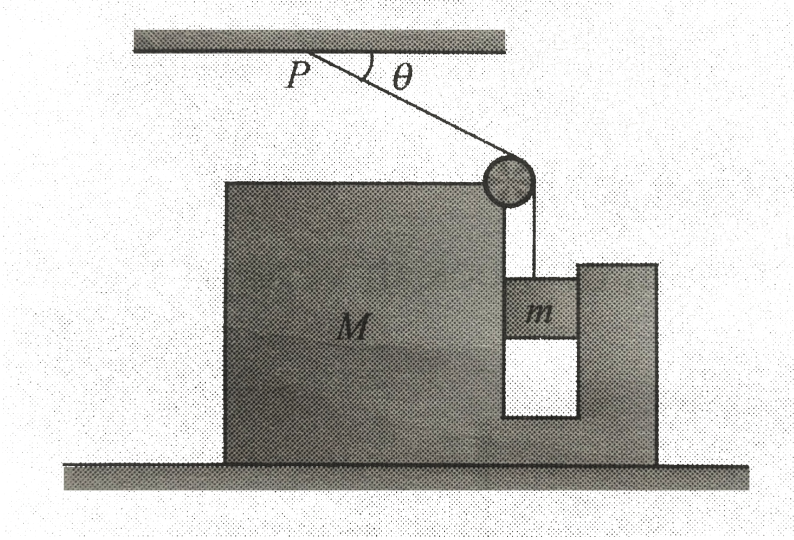
6. The mass of wedge, shown in figure is M and that of the block is m. Neglecting friction at all the places and mass of the pulley. Calculate the acceleration of wedge.

Thread is inextensible.



Watch Video Solution

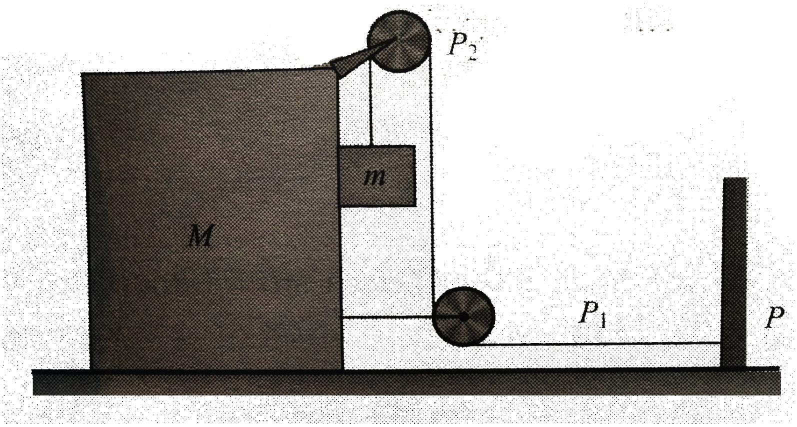
7. A block of mass m can slide freely in a slot made in a bigger of mass M as shown in fig. There is no friction anywhere in the system.



The block m is connected to one end of a string whose other end is fixed at point P. system is released from rest when the string at P makes an angle θ with horizontal. Find the acceleration of m and M after release.

Watch Video Solution

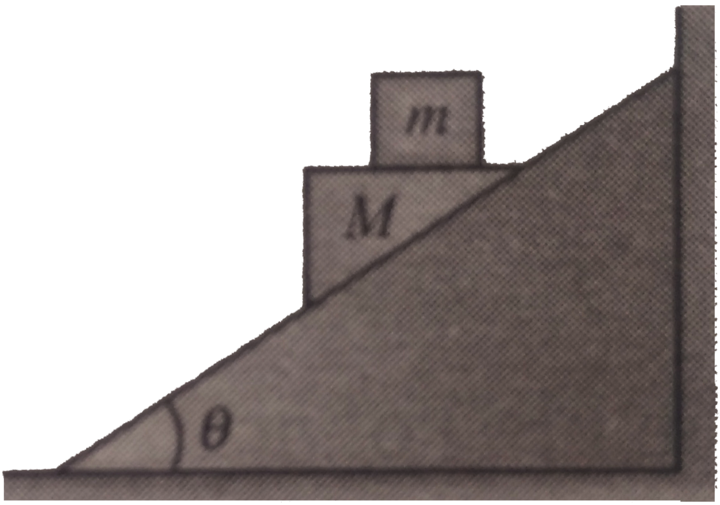
8. A block of mass m can slide freely along the verticle surface of a bigger block of mass M as shown in fig. There is no friction anywhere in the system. The block m is connected to one end is fixed at point P.



The string between P_1 and P is horizontal and other parts of the string are vertical. system is released from rest. Find the acceleration of m and M during their subsequent motion.

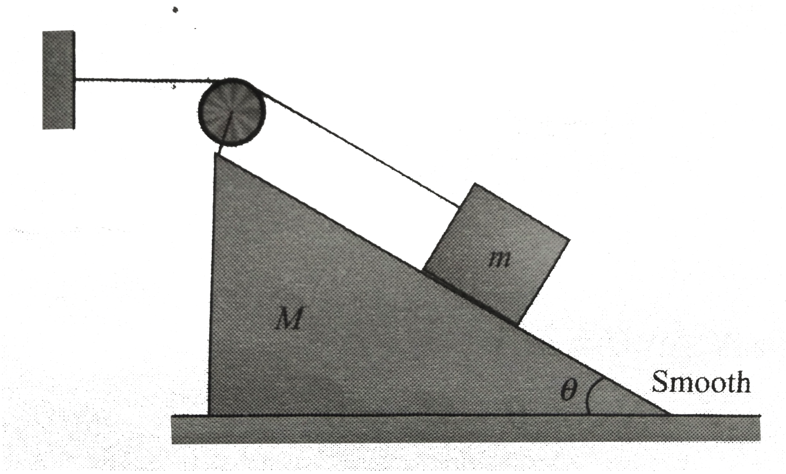
Watch Video Solution

9. Consider a system of a small body of mass m kept on a large body of mass M placed over an inclined plane of the angle of inclination θ to the horizontal. Find the acceleration of m when the system is set in motion. Assume an inclined plane to be fixed. all the contact surfaces are smooth.



Watch Video Solution

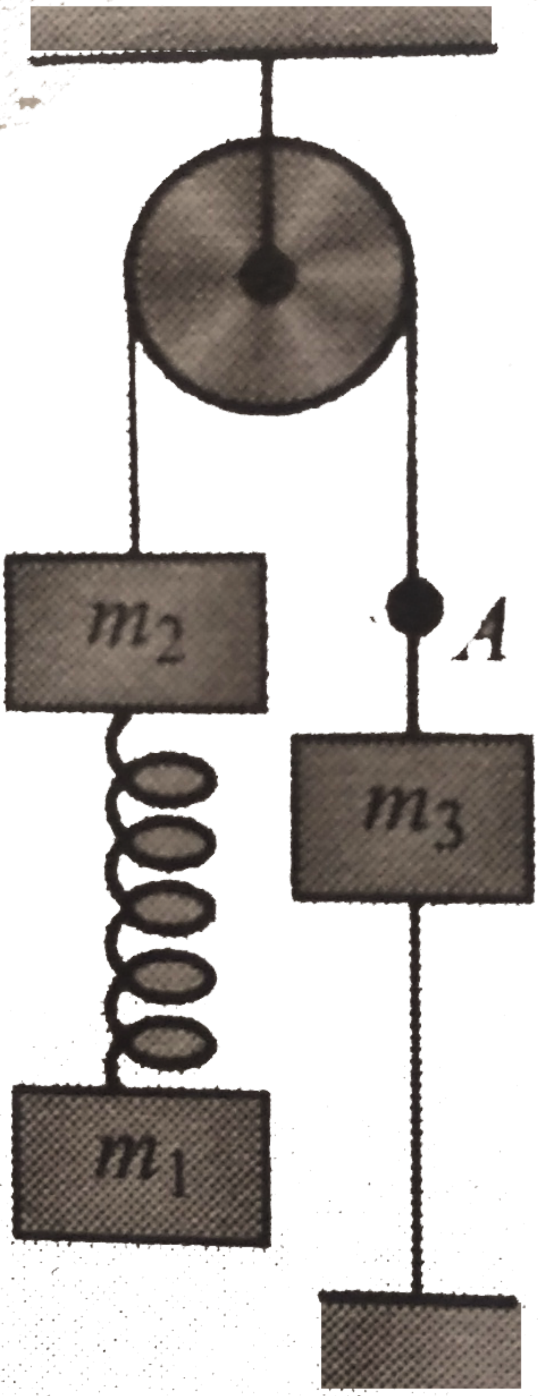
10. The mass of wedge, shown in figure is M and that of the block is m. Neglecting friction at all the places and mass of the pulley. Calculate the acceleration of wedge. Thread is inextensible.



Watch Video Solution

11. Three blocks arranged with pullwy and spring as shown in fig. If the string connecting blocks m_2 and m_3

is cut at point A, find the acceleration of masses m_1, m_2 and m_3. Just after the string is cut at point A.


m_2
A
m_3
m_1

Watch Video Solution

Exercise 6.1

1. Explain why

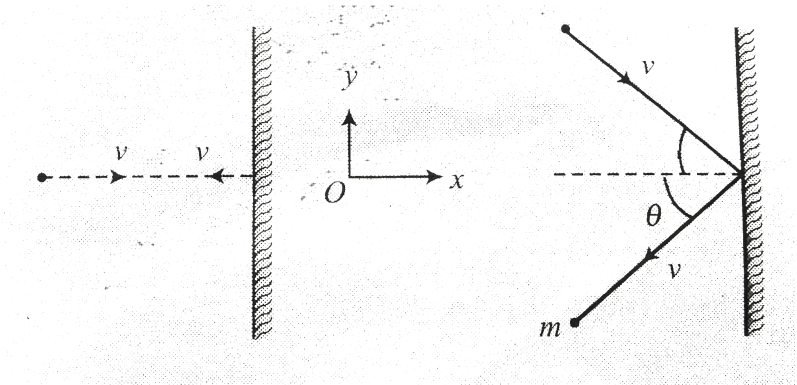
(a) A horse cannot pull a cart and run in empty space.

(b) Passengers are thrown forward from their seats when a speeding bus stops suddenly.

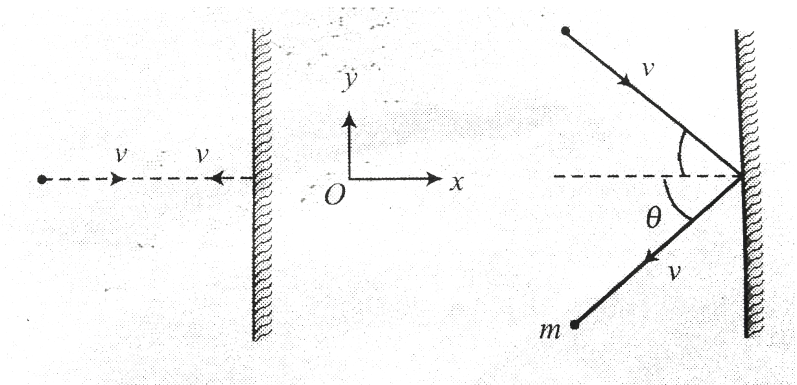
(c) A cricketer moves his hands backwards when holding a catch.

Watch Video Solution

2. As shown in fig. two identical balls strike a rigid wall with equal speeds but a different angles of incidence. They are reflected back without any lose in speed.



(a) (b)



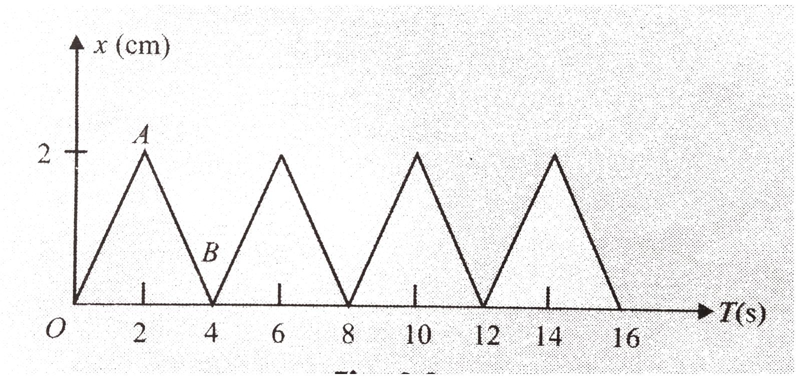
(a) (b)

(a) Determine the direction of force exerted by each ball on the wall.

(b) Determine the ratio of impulse imparted by the two balls on the wall in both cases.

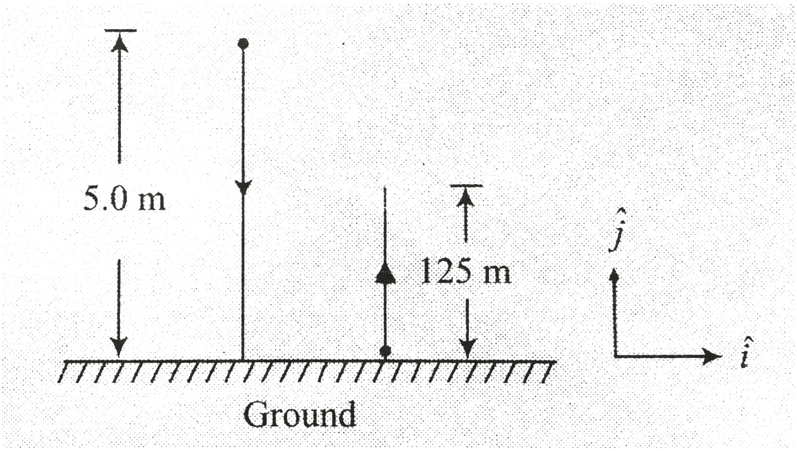
Watch Video Solution

3. Figure shows the position-time graph of a particle of mass $0.04 kg$. Suggest a suitable physical context for this motion. What is the time between two consecutive impulses received by the particle? What is the magnitude of each impluse?



Watch Video Solution

4. A rubber ball of mass 50 g falls from a height of 5m and rebounds to a height of 1.25 m. Find the impulse and the average force between the ball and the ground if the time for which they are in contact was $0.1s$



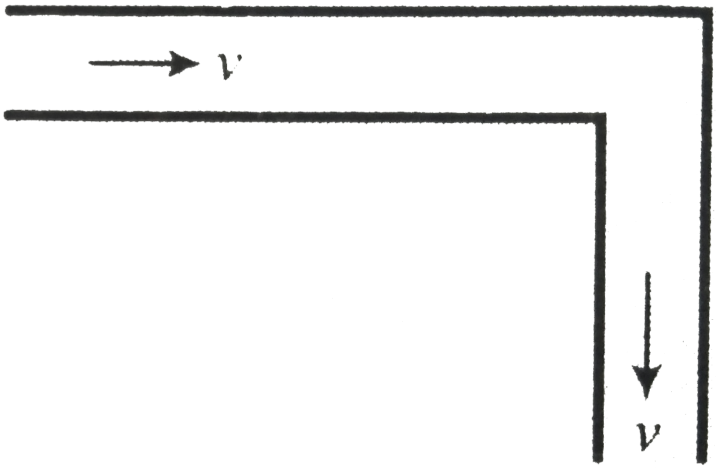
Watch Video Solution

5. Water falls without splashing at a rate of $0.250Ls^{-1}$ from a height of 2.60 m into a 0.750kg bucket on a scale. If the bucket is originally empty, what does the scale read 3s after water starts to accumulate in it?

Watch Video Solution

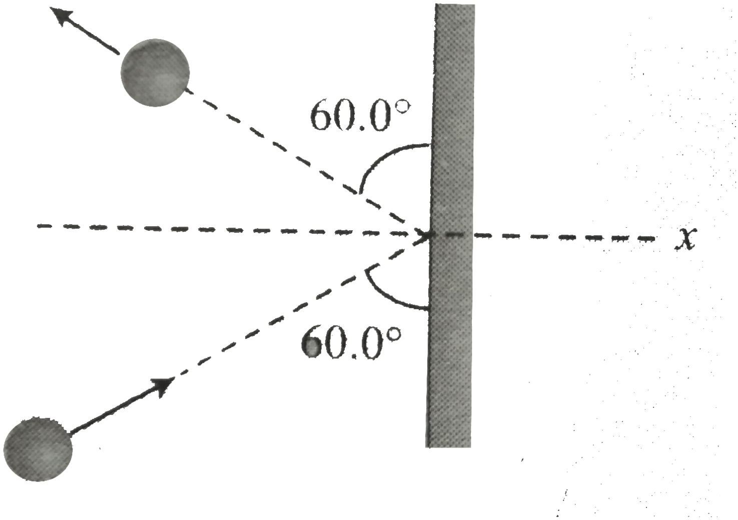
6. A liquid of density ρ is flowing with a speed v through a pipe of cross sectional area A. The pipe is bent in the shape of a right angles as shown. What force should be

exerted on the pipe at the corner to keep it fixed?



Watch Video Solution

7. A 3-kg steel ball strikes a wall with a speed of $10.0ms^{-1}$ at an angle of 60.0° with the surfaces of the wall. The ball bounces off with the same speed and same angle. If the ball was in contact with the wall for 0.2s, find the average force exerted by the wall on the ball.

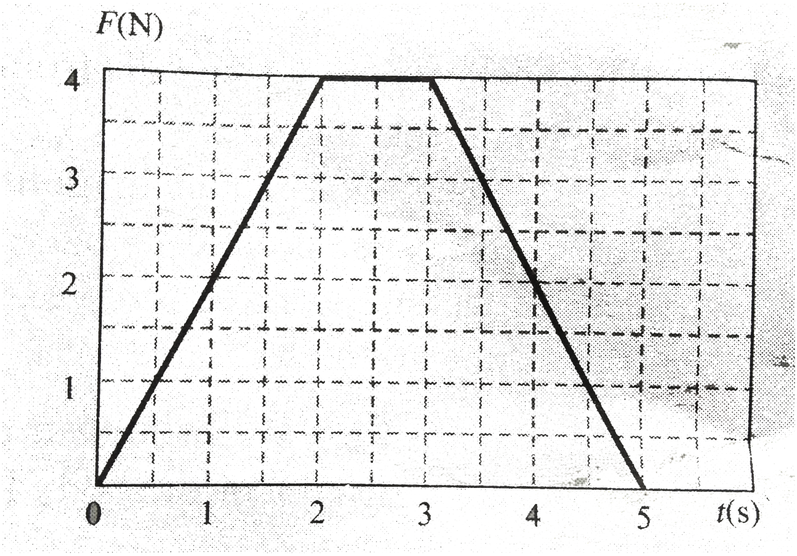


Watch Video Solution

8. The magnitude of the net force exerted in the x direction on a 2.50-kg particle varies with the time as shown in fig., find (a) the impules of the force. (b) the final velocity the particle attains if it is originally at rest, (c) its final velocity if its original velocity is $-2.0ms^{-1}$,

and

(d) the average force exerted on the particle for the time interval between 0 and 5 s.



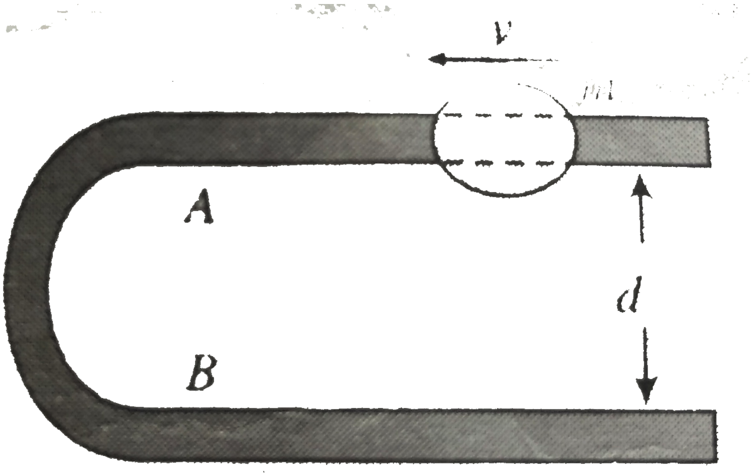
Watch Video Solution

9. During a heavy rain hailstones of average size 1.0 cm in diameter fall with an average speed of 20 m/s. Suppose 2000 hailstones strike every square meter of a

$10m \times 10m$ roof perpendicularly in one second and assume that the hailstones do not rebound. Calculate the average force exerted by the falling hailstones on the roof. Density of a hailstone is $900k\frac{g}{m^3}$

Watch Video Solution

10. A U-shaped smooth wire has a semi-circular bending between A and B as shown in fig. A bead of mass m moving with uniform speed v through the wire enters the semiculcular bent at A and leaves at B. Find the average force exerted by the bead on the part AB of the wire.



Watch Video Solution

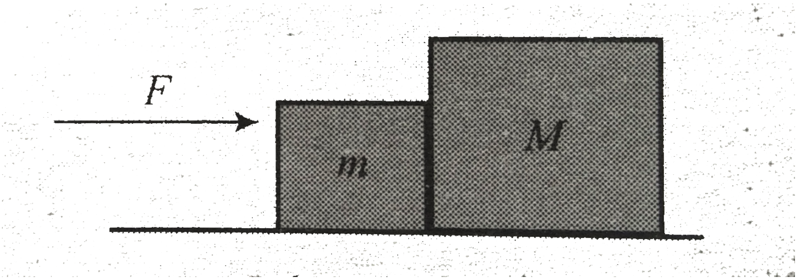
11. Wind with a velocity $100 km h^{-1}$ blows normally against one of the walls of a house with an area of $108 m^2$. Calculate the force exerted on the wall if the air moves parallel to the wall after striking it and has a density of $1.2 kg m^{-3}$.

Watch Video Solution

Watch Video Solution

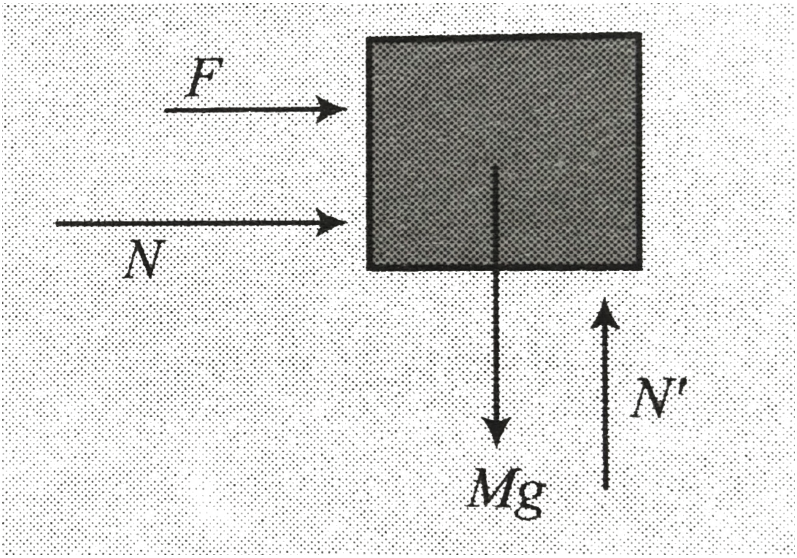
Exercise 6.2

1. As per the diagram given in fig.



The free-body diagram of M is fig. (correct or incorrect).

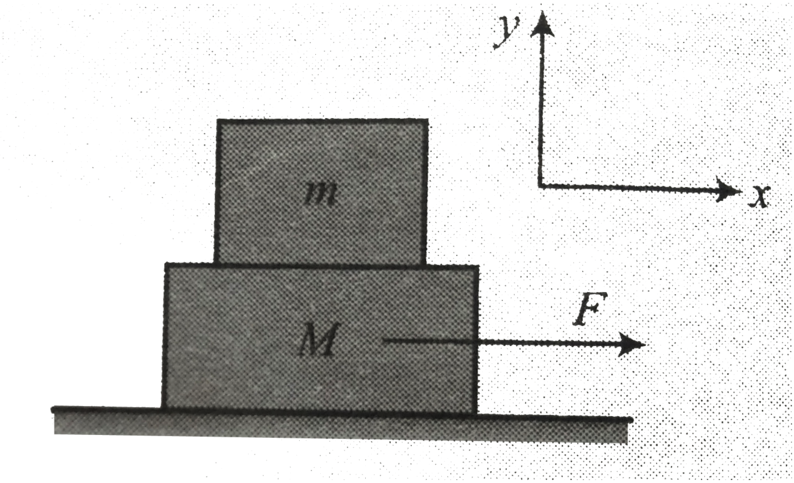
Assume all surface are frictionless.



Watch Video Solution

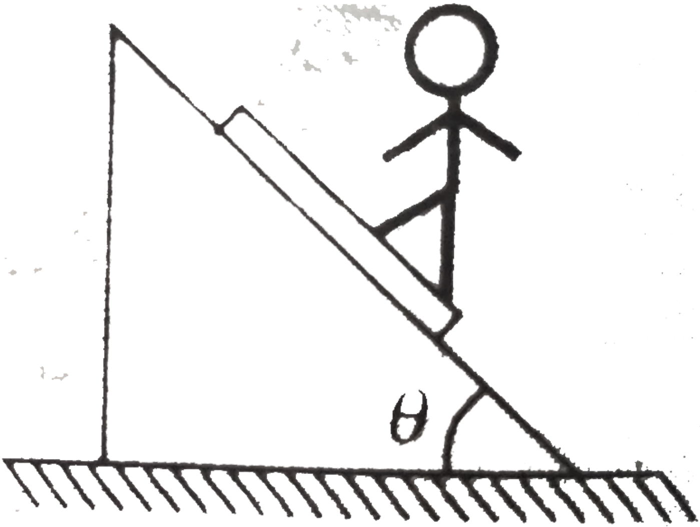
2. A mass m is palced on a body of mass M. There is no friction anywhere. Force F is applied on M and it moves with acceleration a. Find the force (along x-axis) on the

top body.



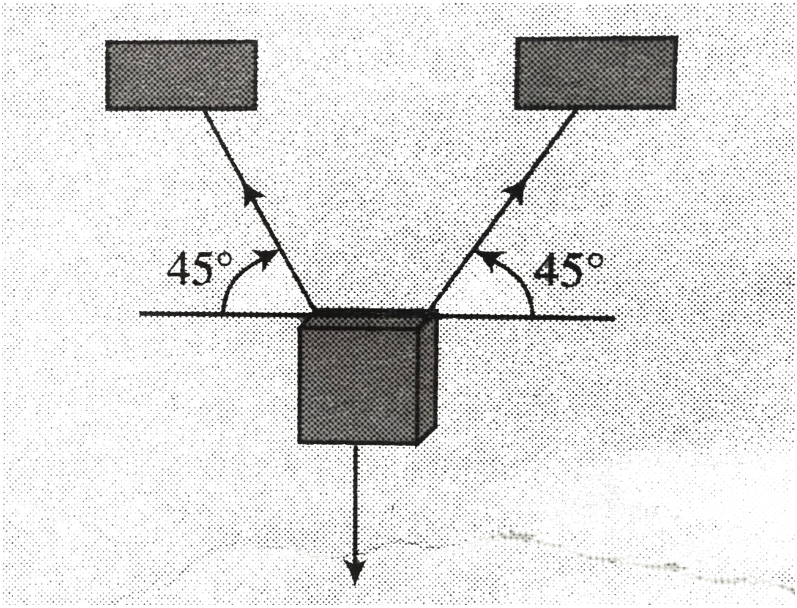
Watch Video Solution

3. In fig., the mass of the man is M. Calculate the mass of the man as registered by weighing machine. Assume weighing machine, man, and wedge all are stationary.



Watch Video Solution

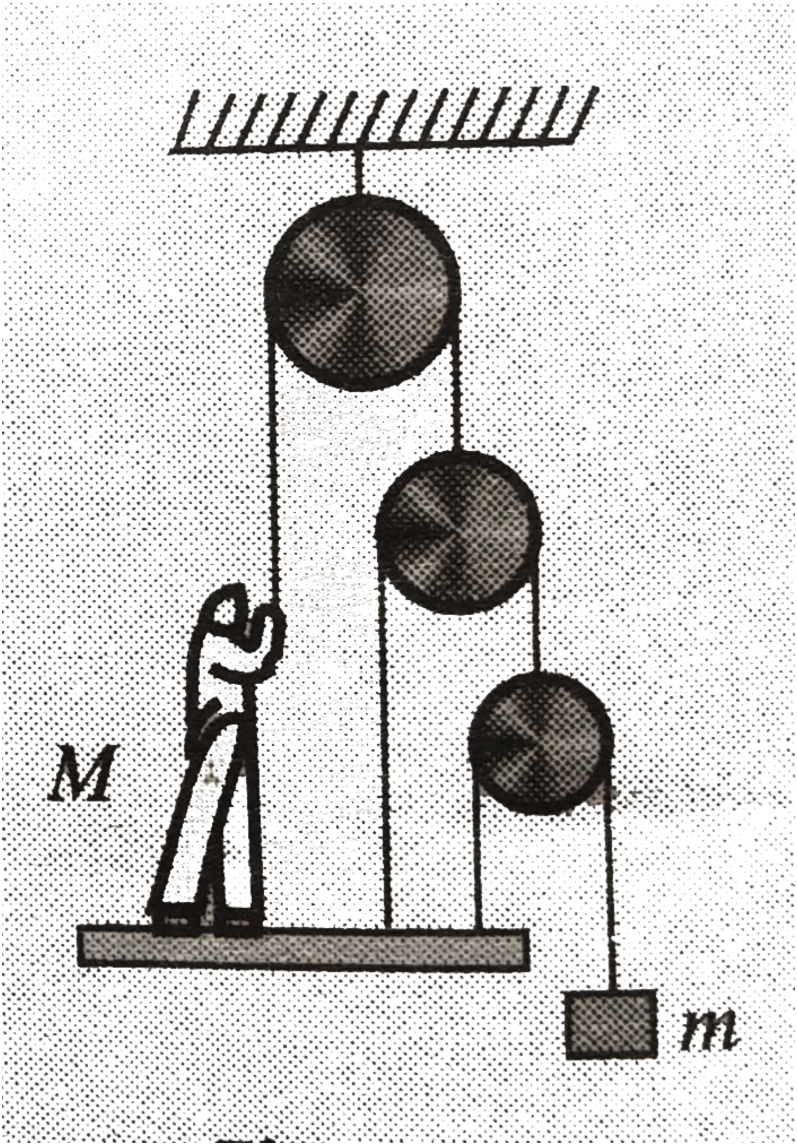
4. A small object is suspended at rest from two strings as shown in fig. The magnitude of the force exerted by each string on the object is $10\sqrt{2}N$. Find the magnitude of the mass of the object.



Watch Video Solution

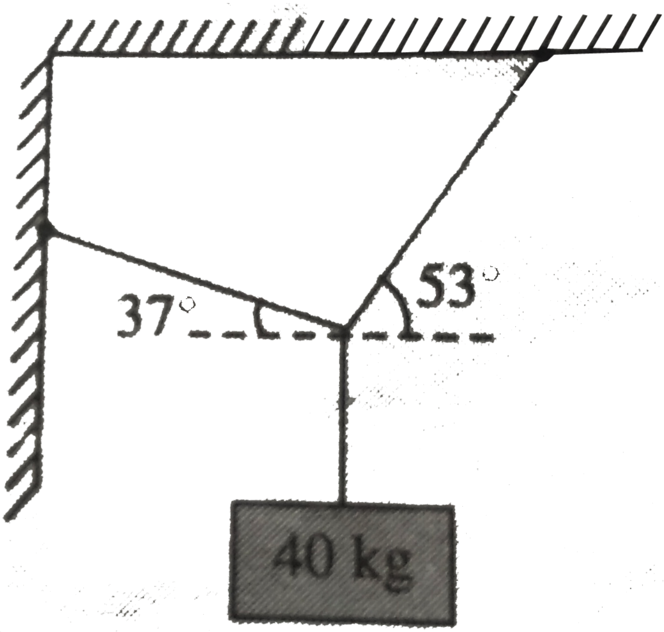
5. Figure shows a light platform on which a man of mass M is standing and holding a string passing over a system of ideal pulleys. Another mass m is hanging as shown in fig. Find the force the man has to exert to maintain the

equlibrium of system, and find the force exerted by the platform on the man. Also find the ratio of M/m.



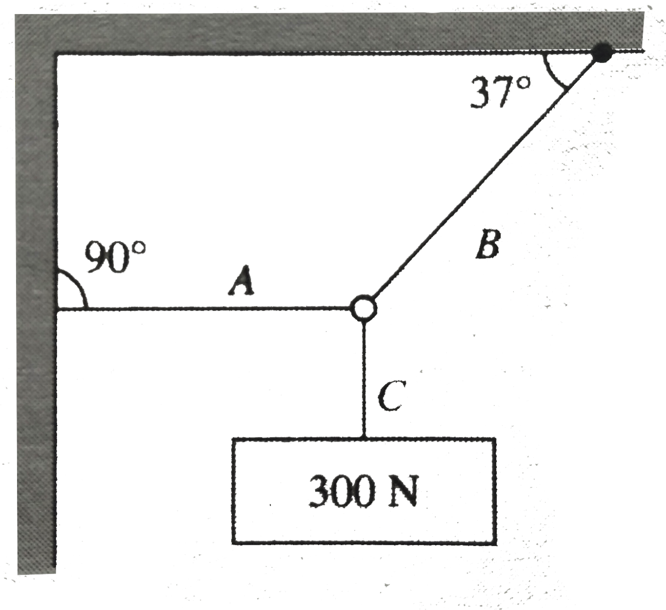
Watch Video Solution

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



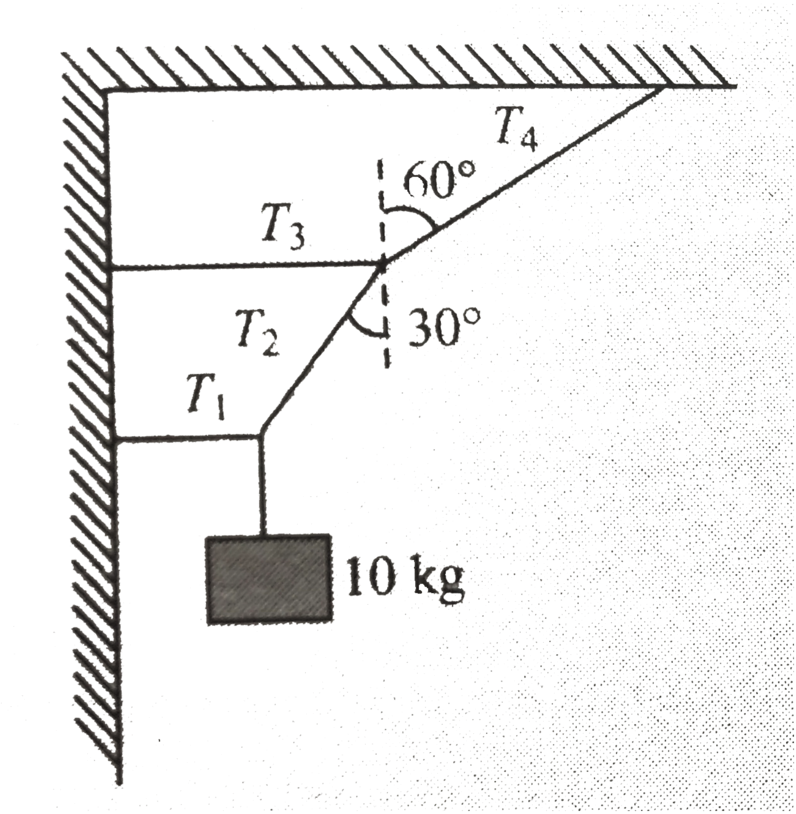
Watch Video Solution

7. A block of mass 30 kg is suspended by three string as shown in fig, Find the tension in each string.



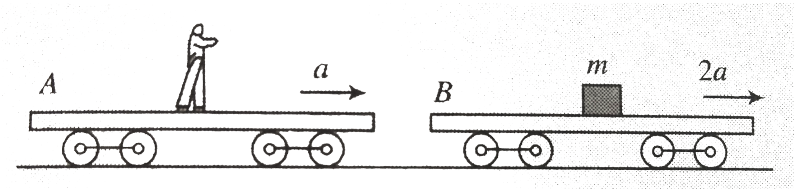
Watch Video Solution

8. Determine tension T_4 in fig.



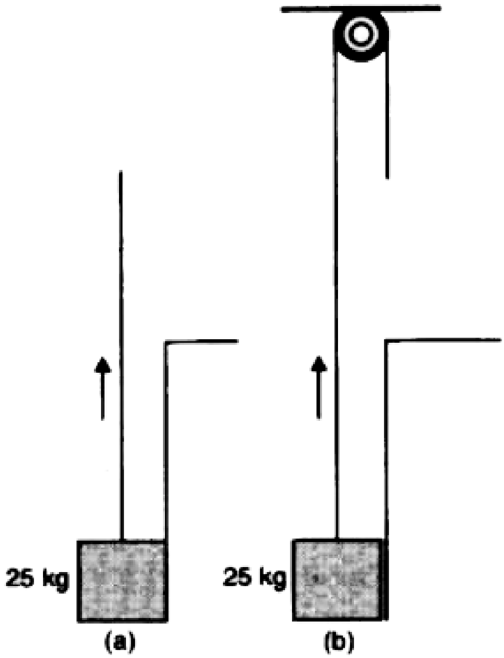
Watch Video Solution

9. Two trolleys A and B are moving with accelerations a and 2a, respectively, in the same direction. To an observer in trolley A. Find the magnitude of the pseudo force acting on a block of mass m on trolley B.



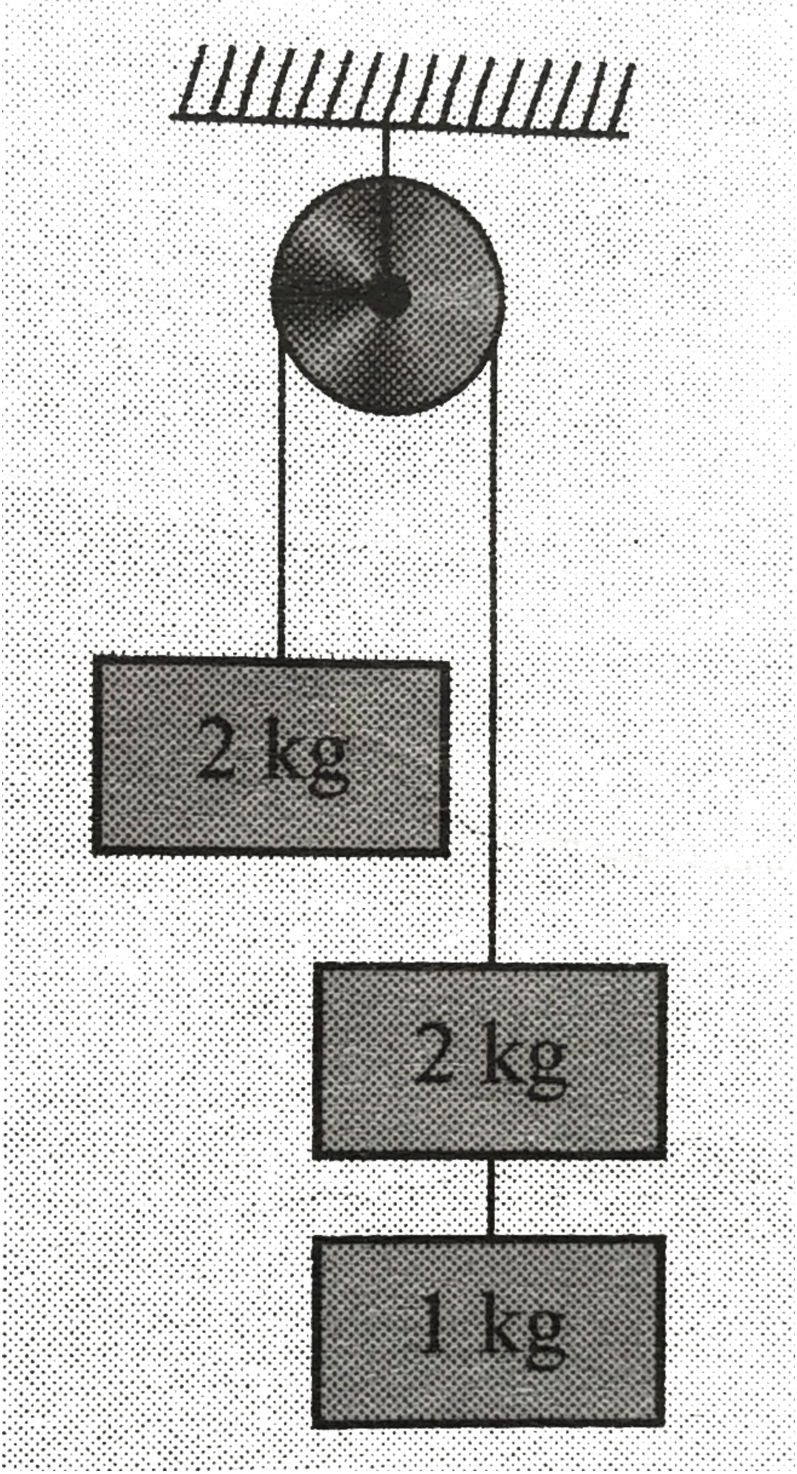
Watch Video Solution

10. A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in Fig. 5.19. What is the action on the floor by the man in the two cases ? If the floor yields to a normal force of 700 N , which mode should the man adopt to lift the block without the floor yielding ?



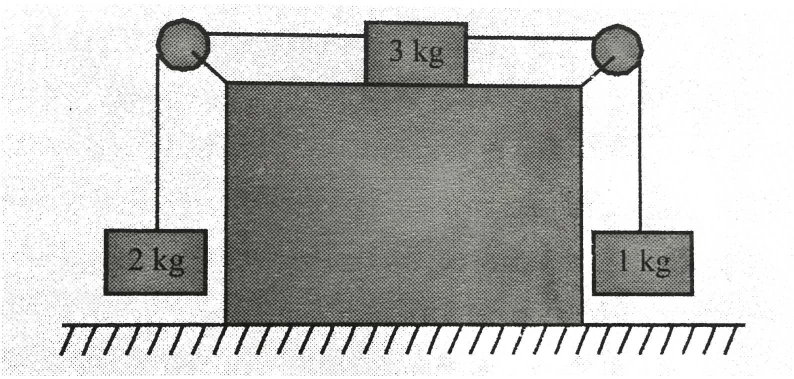
Watch Video Solution

11. Consider the system shown in fig. the system os released from rest, find the tension in the cord connected between 1kg and 2 kg blocks.


2 kg
2 kg
1 kg

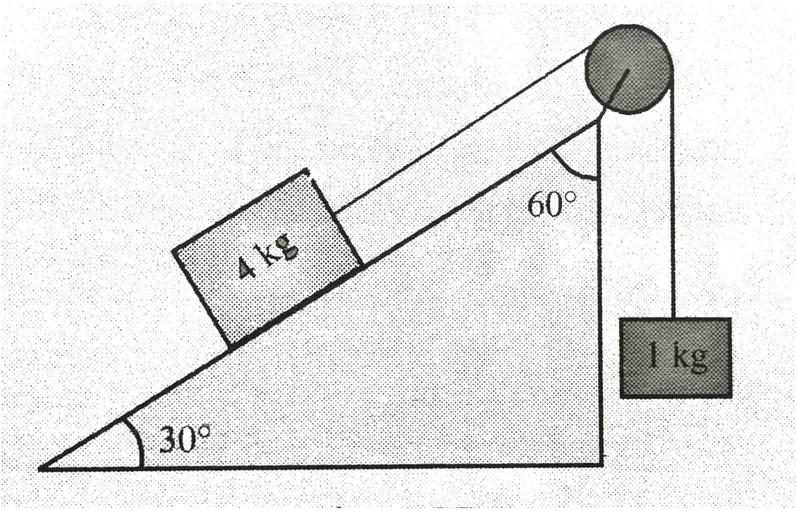
Watch Video Solution

12. The system shown in fig, is released from rest. Calculate the tension in the string and the force exerted by the string on the pulleys, assuming pulleys and strings are massless.



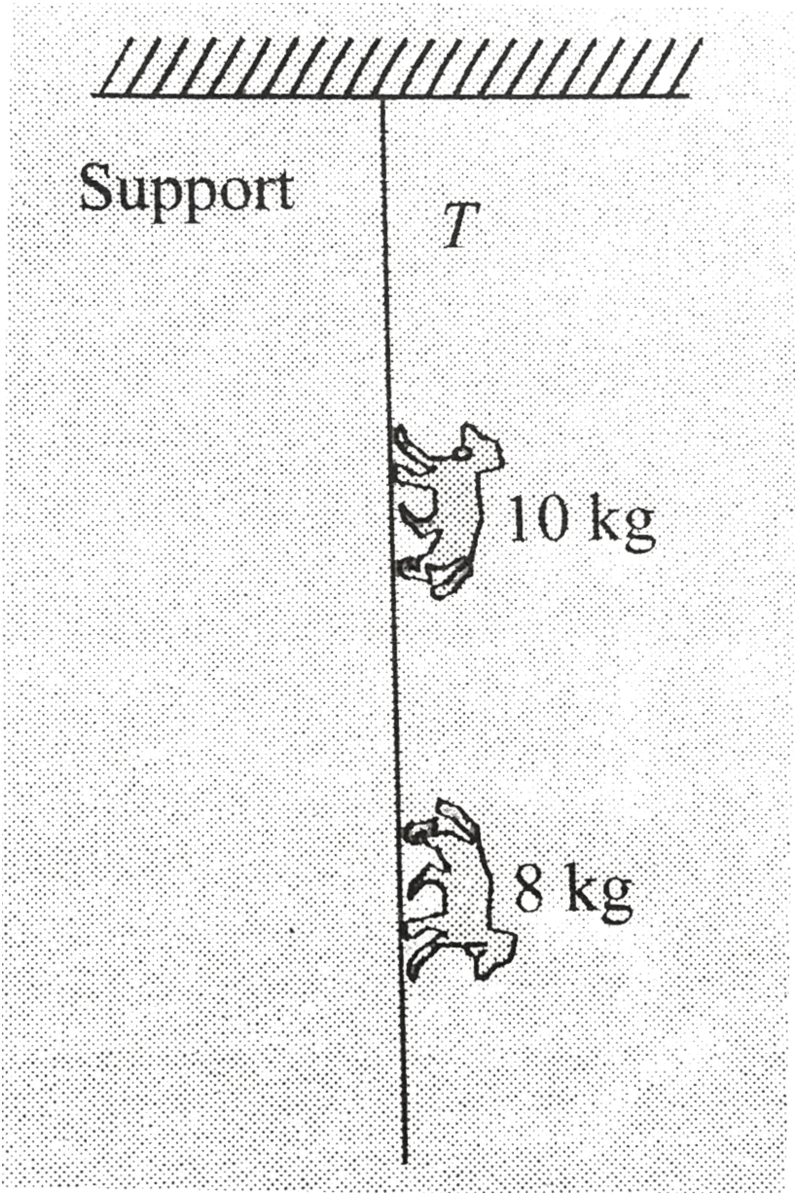
Watch Video Solution

13. Find the acceleration of blocks and tension in the cord in the device shown in fig. Assume no friction anywhere.



Watch Video Solution

14. Two monkey of masses 10 kg and 8 kg are moving along a verticle rope as shown in fig. the former climbing up with an acceleration of $2ms^{-2}$, while the later coming down with a uniform velocity of $2ms^{-2}$. Find the tension in the rope at the fixed support.



Watch Video Solution

15. A homogeneous rod of length L is acted upon by two forces F_1 and F_2 applied to its ends and directed opposite to each other. With what force F will the rod be stretched at the cross section at a distance l from the end where F_1 is applied?

Watch Video Solution

16. A $20kg$ monkey has a firm hold on a light rope that passes over a frictionless pulley and is attached to a $20kg$ bunch of bananas. The monkey looks upwards , sees the bananas and starts to climb the rope to get them.

(a) As the monkey climbs ,do the bananas move up , move down or remain at rest?

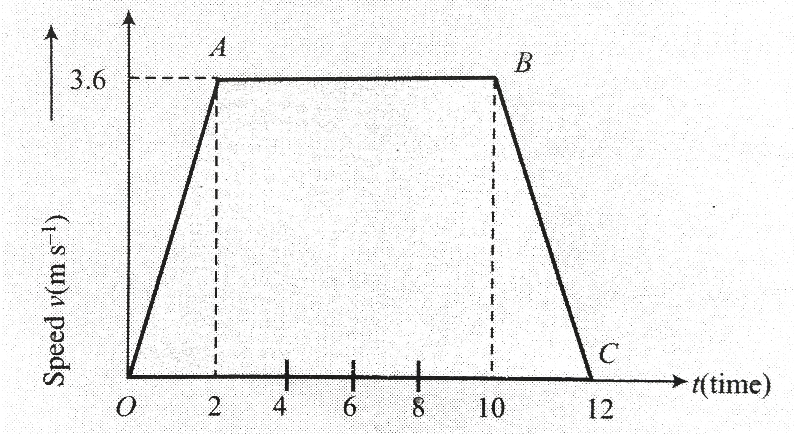
(b) As the monkey climbs ,does the distance between the monkey and the banana decrease, increase or remain same?

(c) The monkey releases her hold on the rope .What happens to the distance between the monkey and the bananas while she is falling ?

(d) Before reaching the ground , the monkey grabs the rope to stop her fall. What will happen to bananas ?

Watch Video Solution

17. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph.



(a) What will be the tension in the rope pulling the lift at time t equal to

(i) 1a, (ii) 6s, (iii)11s ?

(b) What will be the average velocity and the average acceleration during the course of the entire motion?

Watch Video Solution

18. A body hangs from a spring balance supported from the roof of an elevator.

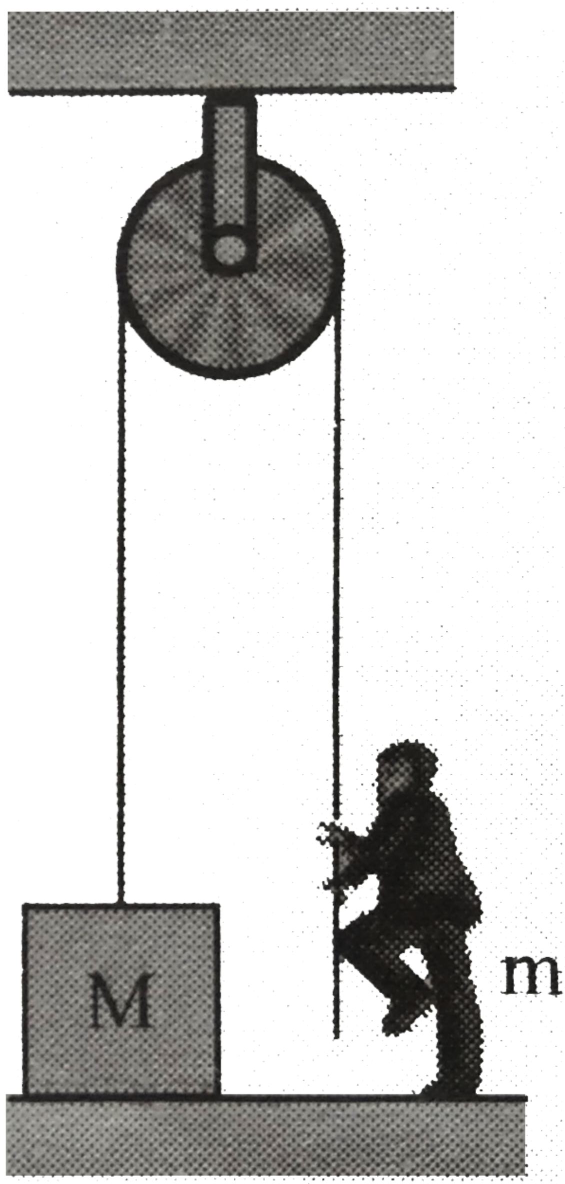
(a) If the elevator has an upward acceleration of $2.45ms^{-2}$ and the balance reads 50N, what is the true weight of the body?

(b) Under what circumstances will the balance read 30N?

(c) What will be the balance reading if the elevator, cable breaks?

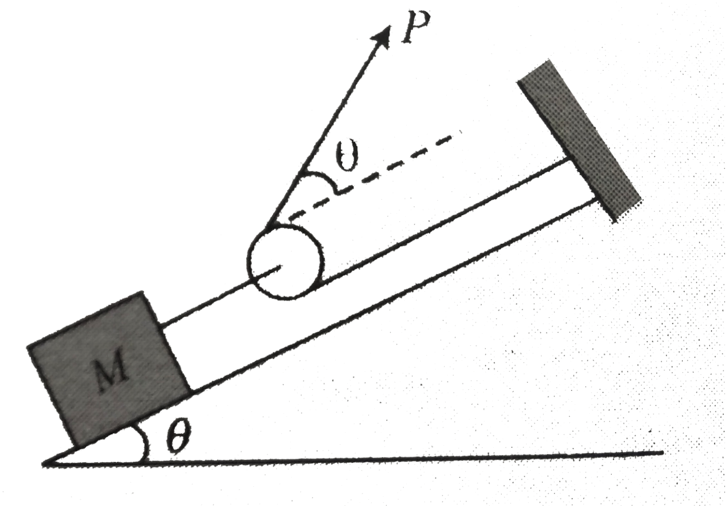
Watch Video Solution

19. In fig. the block of mass M is at rest on the floor . At what acceleration with which should a boy of mass m climb along the rope of negligible mass so as to lift the block from the floor?



Watch Video Solution

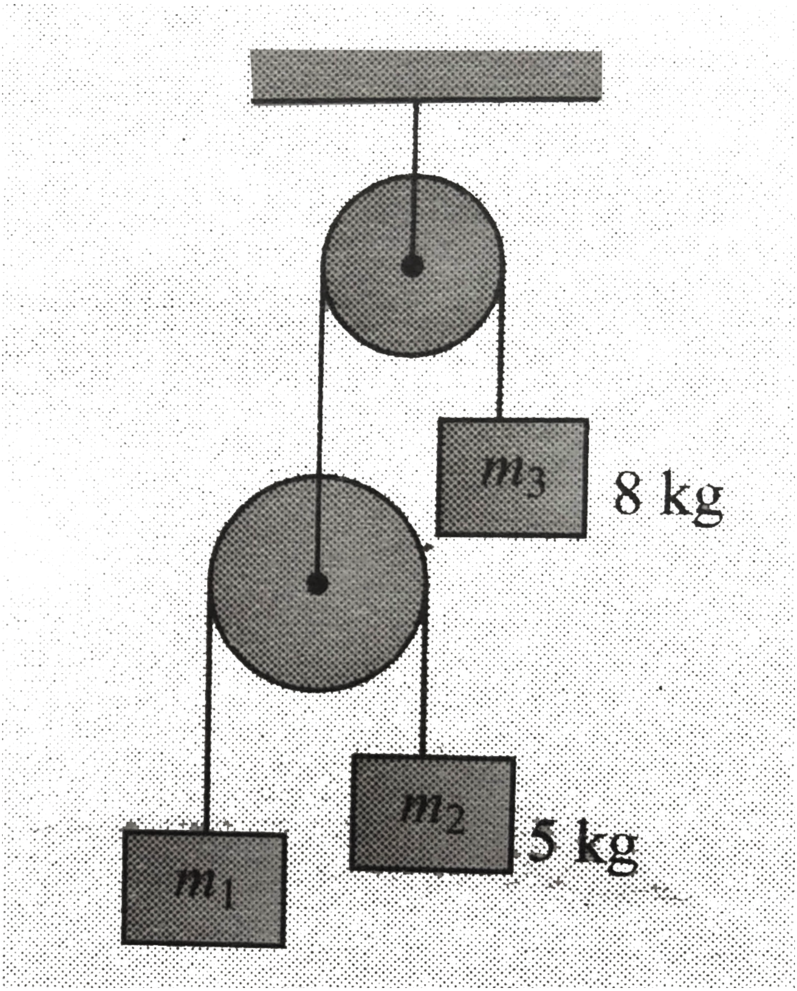
20. What should be the minimum force P to be applied to the string so that block of mass m just begins to move up the frictionless plane?



Watch Video Solution

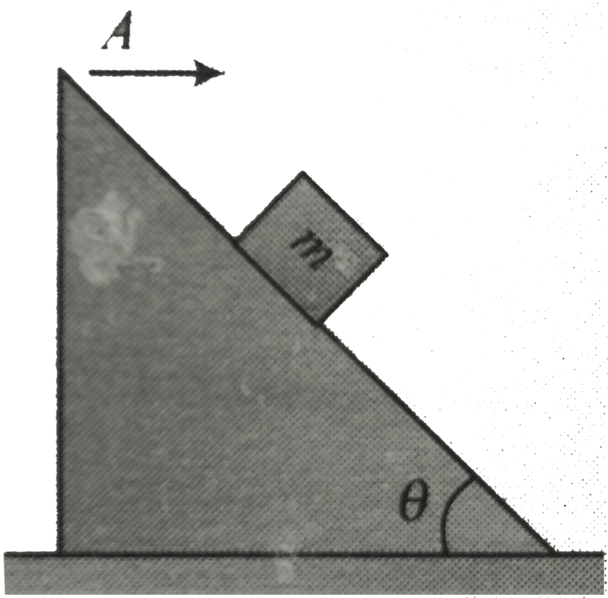
21. Three blocks m_1, m_2, and m_3 are arranged as shown in fig. if $m_2 = 5kg$ and $m_3 = 8kg$, at what value of m_1

will $8kg$ mass be at rest?



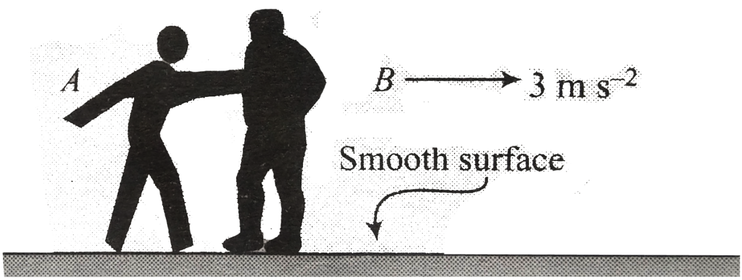
Watch Video Solution

22. A block of mass m is placed on an inclined plane. With what acceleration A towards right should the system move on a horizontal surface so that m does not slide on the surface of inclined plane? Also calculate the force supplied by wedge on the block. Assume all surfaces are smooth.



Watch Video Solution

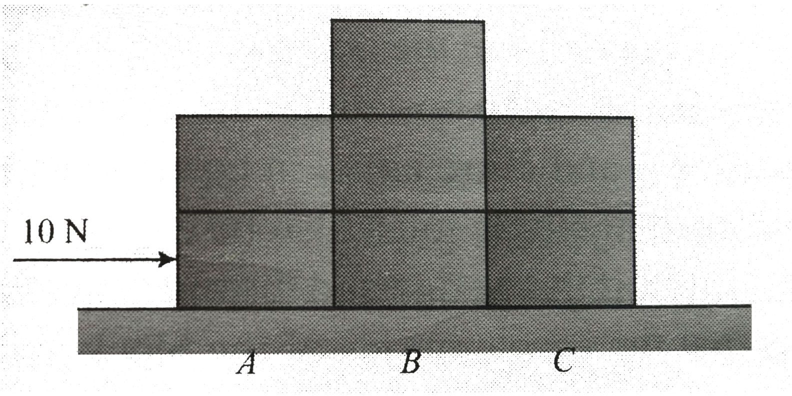
23. Man A of mass 60 kg pushes the other man B of mass 75 kg due to which man B starts moving with acceleration $3ms^{-2}$. Calculate the acceleration of man A at that instant.



Watch Video Solution

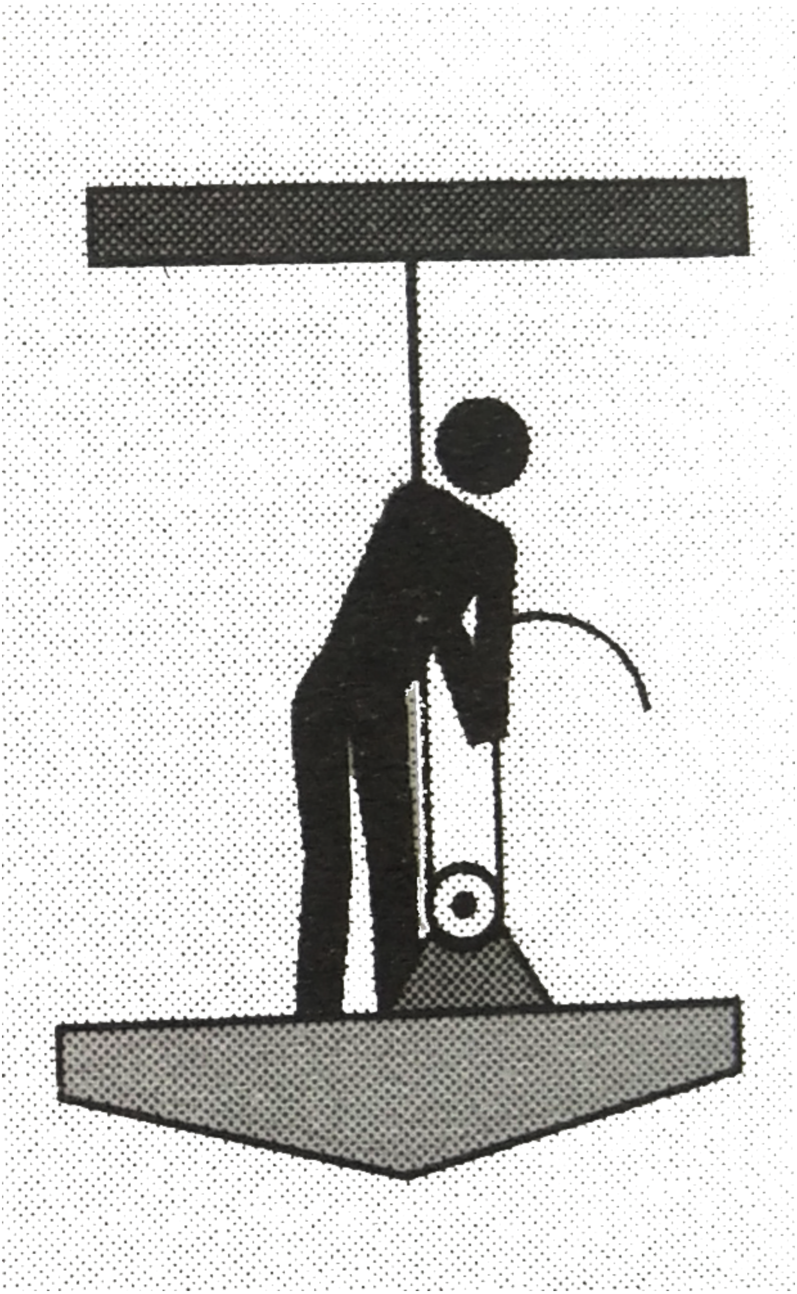
24. Seven identical dominoes (i.., blocks) each of mass m=1kg are to be stacked in three columns and pushed across a frictionless ice rink by a horizontal 10-N

force.Assume dominoes do not slip w.r.t. each other. How many dominoes should be in each column, with a minimum of one, (a) to maximize the acceleration of the dominoes, (b) to maximize the force on column C due to column B, (c) to maximize the net force on column B due to column A and C, and (d) to maximize the force on column B due to column A?



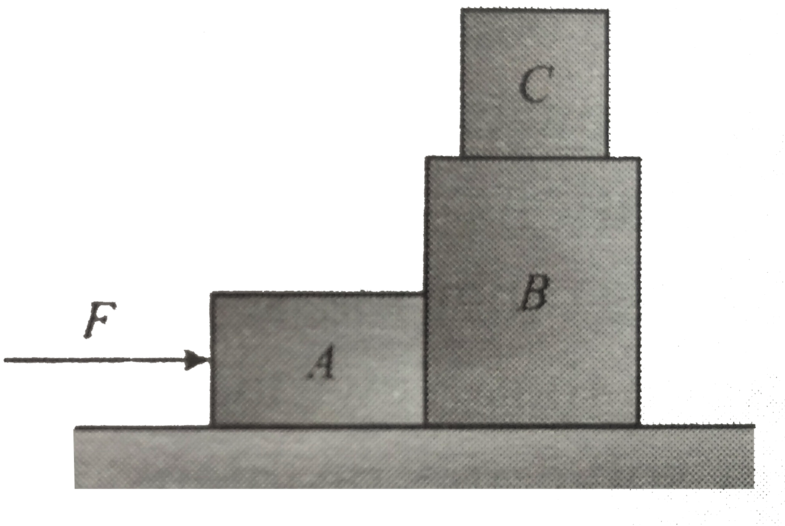
Watch Video Solution

25. In fig. the man and the platform together weight 950N. The pulley can be treated as frictionless. Determine how hard the man has to pull on the rope to lift himself upward above the ground with constant velocity. If the weight of man is 550 N, what is the normal reaction between them?



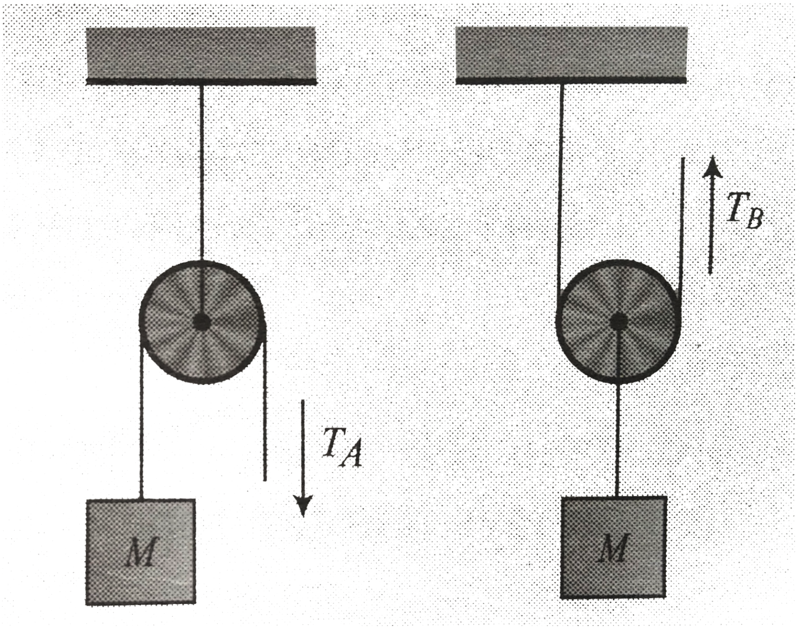
Watch Video Solution

26. The masses of blocks A,B,and C are 1kg, 2kg,and 0.5kg, respectively. All surfaces are smooth. If force $F = 50N$ acts as shown in fig. at the instant shown, find the force which A exerts on B and the acceleration of C.



Watch Video Solution

27. Consider the two configurations shown in equlibrium. Find the ratio of T_A / T_B. (Ignore the mass of the rope and the pulley).

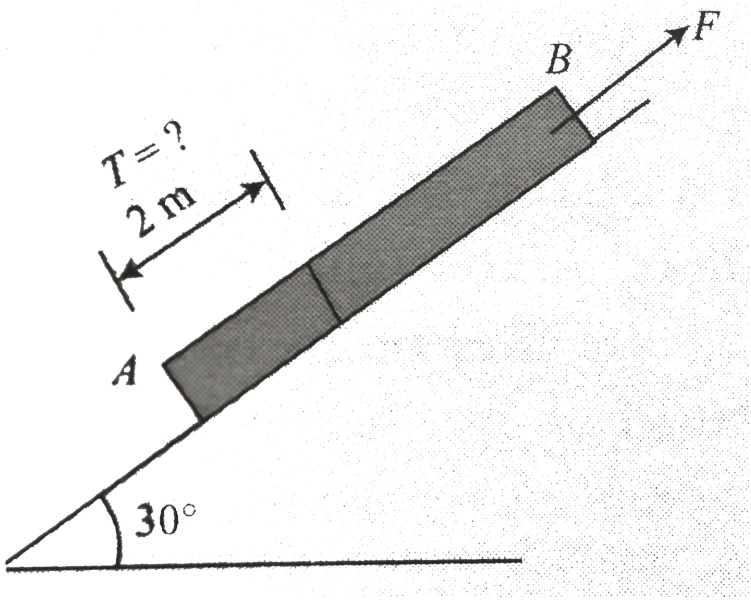


Watch Video Solution

28. A locomotive accelerates a train of identical railway carts. The carts are numbered consecutively with the cart next to locomotive having the number 1. The tension in the connection between the carts with numbers 4 and 5 is three times begger than the tension in the connection between the carts with numbers 14 and 15. What is the number of the last cart? there is no resistance to the train's motion.

Watch Video Solution

29. A uniform string of length 10m and mass 20 kg lies on a smooth frictionless inclined plane. A force of 200N is applied as shown in the figure.

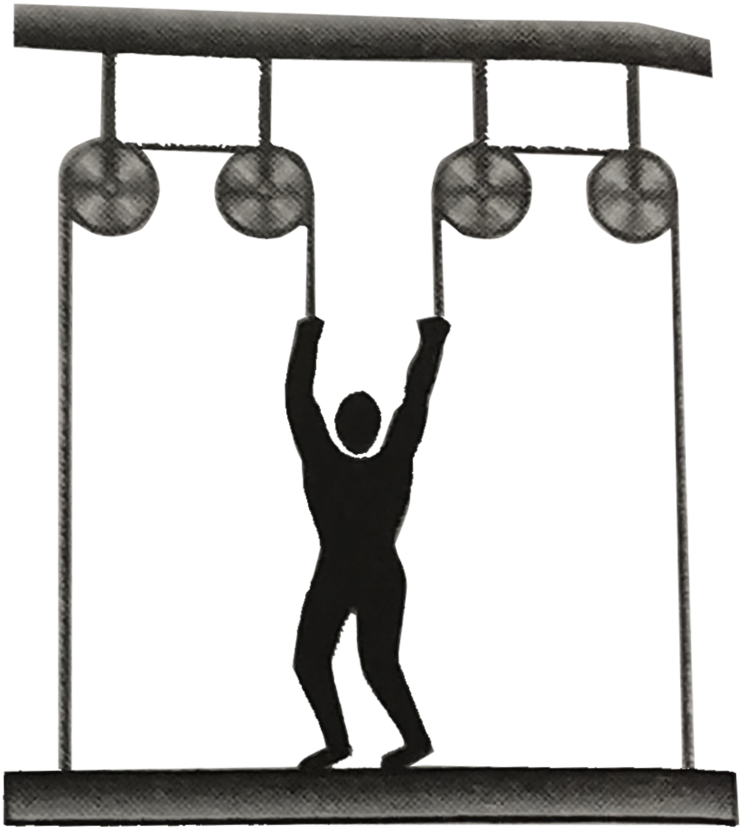


(a) Find the acceleration of the string.

(b) Find the tension in the string at 2m from end A.

Watch Video Solution

30. A man of mass m stands on a platform of equal mass m and pulls himself by two ropes passing over pulleys as shown in figure.If he pulls each rope with a force equal to half his weight ,his upwards acceleration would be

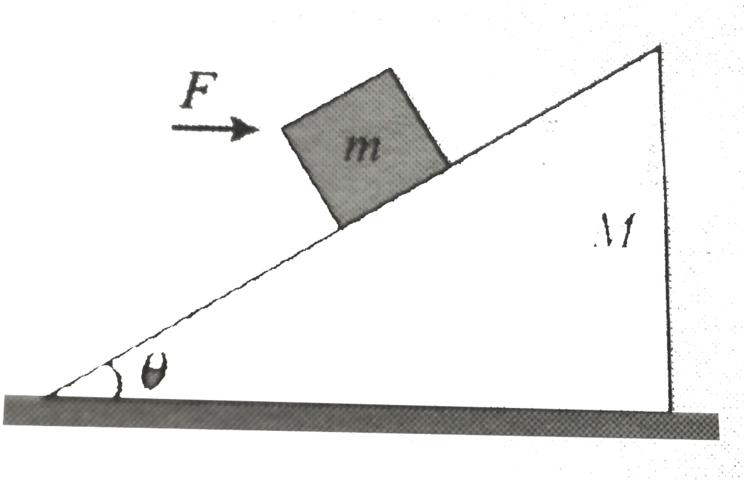


Watch Video Solution

31. A small cubical block is placed on a triangular block M so that they touch each other along a smooth inclined contact plane as shown in fig. The inclined surface makes an angle θ with the horizontal. A force F is to be appled on the block m in horizontal direction so that the two bodies move without slipping against each other assuming the floor to be smooth also. determine the

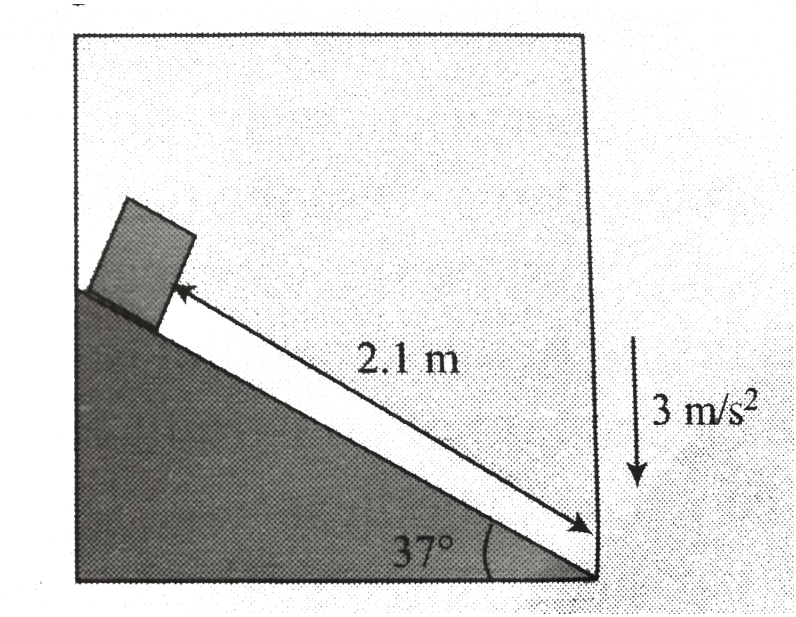
(a) normal force with which m and M press against each other.

(b) magnitude of external force F. Express your answer in terms of m, M, θ,and g.



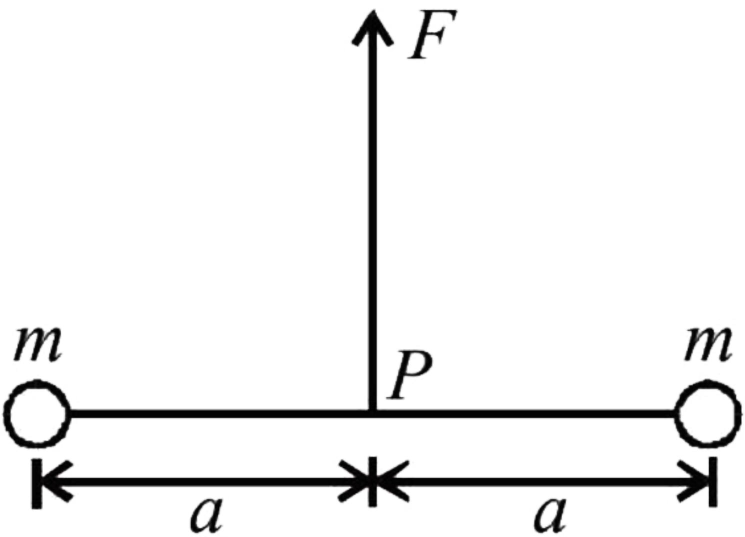
Watch Video Solution

32. A block of mass 1kg is kept on the tilted floor of a lift moving down with acceleration $3ms^{-2}$. If the block is released from rest as shown, what will be the time taken by block to reach the bottom? What is the normal reaction on the block during the motion?



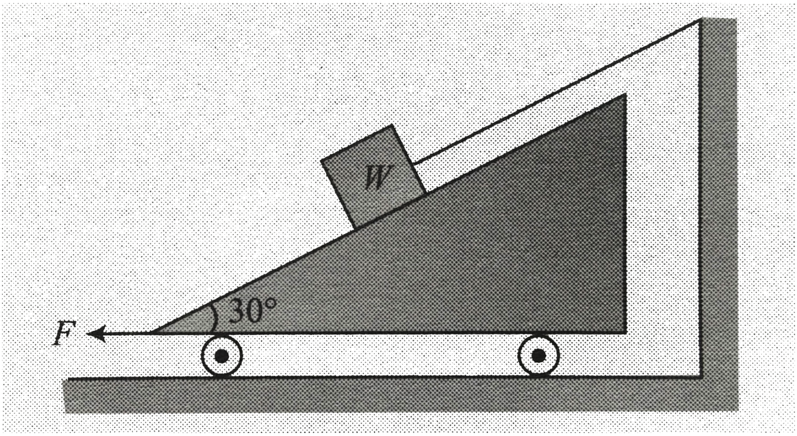
Watch Video Solution

33. Two particles of mass m each are tied at the ends of a light string of length 2a. The whole system is kept on a frictionless horizontal surface with the string held tight so that each mass is at a distance a from the centre P (as shown in the figure). Now, the mid-point of the string is pulled vertically upwards with a small but constant force F. As a result, the particles move towards each other on the surface. The magnitude of acceleration, when the separation between them becomes 2x, is



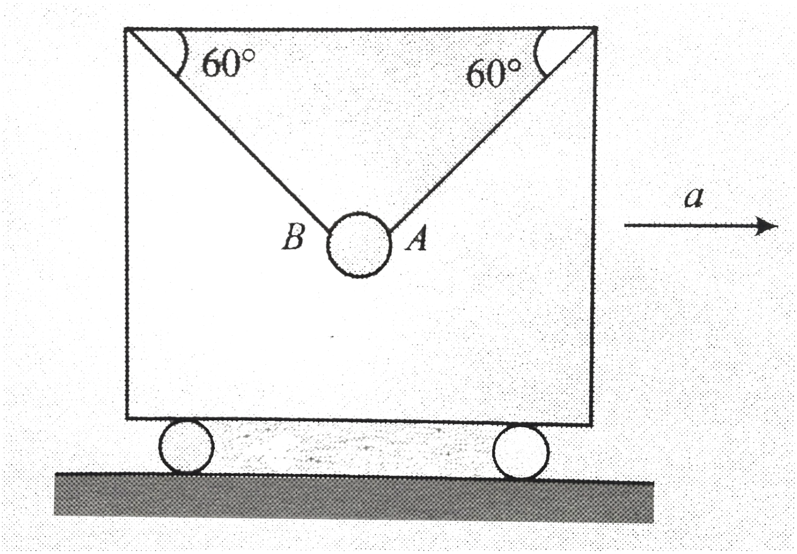
Watch Video Solution

34. A block of weight W is placed on a wedge and arranged as shown in fig. find the force F needed to hold the cart equilibrium if there is no friction.



Watch Video Solution

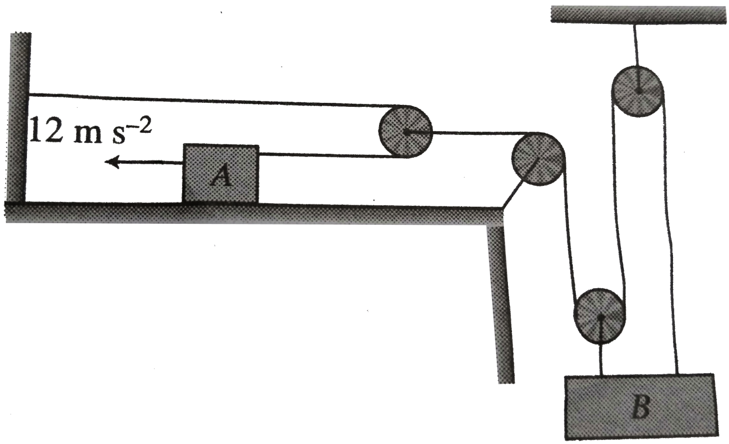
35. A steel ball is suspended from the ceiling of an acceleration carriage by means of two cords A and B. Determine the acceleration a of the carriage which will cause the tension in A to be twice that in B.



Watch Video Solution

Exercise 6.3

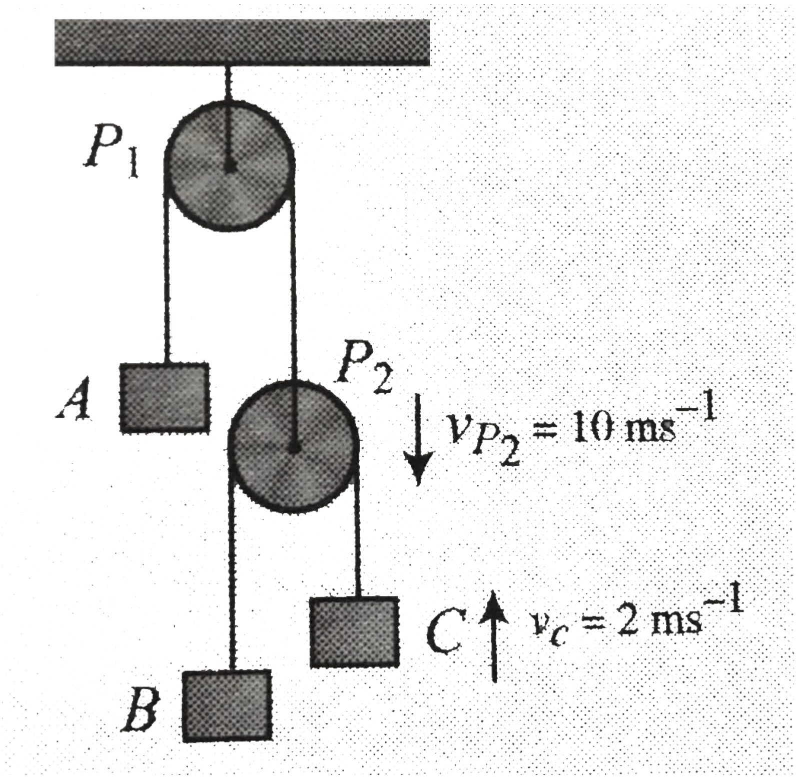
1. Block A is given an acceleration $12ms^{-2}$ towards left as shown in fig. Assuming block B always remains horizontal, find the acceleration (in ms^{-2}) of B.



Watch Video Solution

2. The three block shown in fig. move with constant velocities. Find the velocity of blocks A and B. given

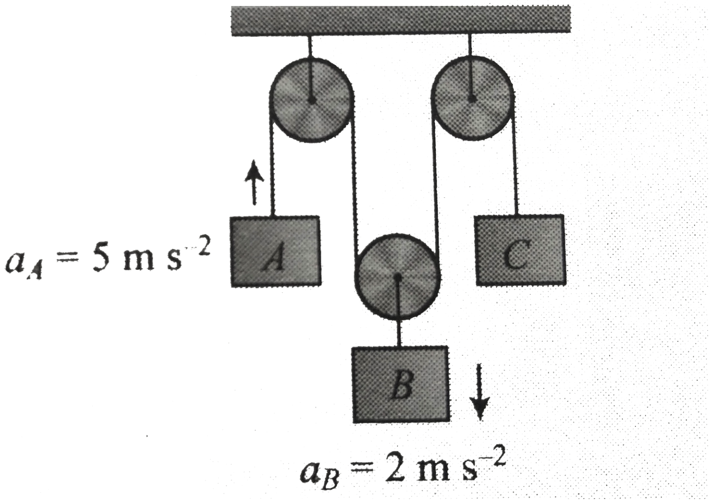
$V_{P2} = 10ms^{-1} \downarrow, V_C = 2ms^{-1} \uparrow$.



Watch Video Solution

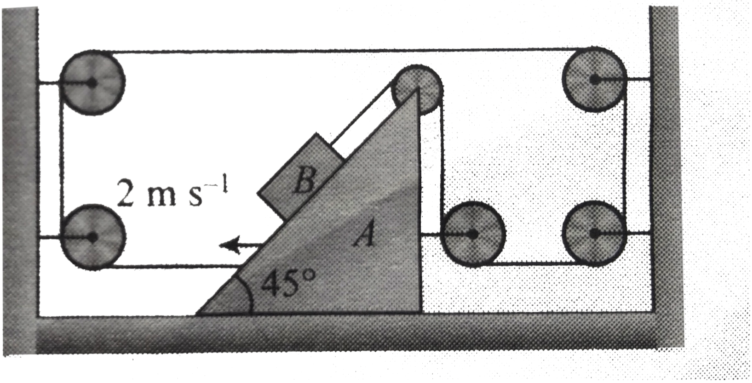
3. For the system as shown in fig. find the acceleration of

C. the accelerations of A and B with respect to ground are marked.



Watch Video Solution

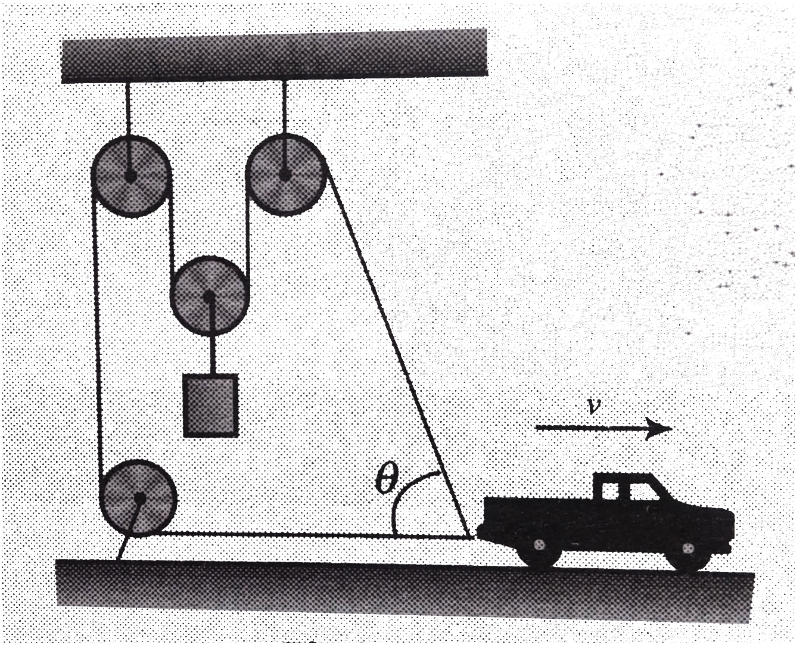
4. System is shown in fig. and wedge is moving toward left with speed $2ms^{-1}$. Find the velocity of the block B.



Watch Video Solution

5. In fig. shown, the speed of the truck is v to the right. Find the speed with which the block is moving up at

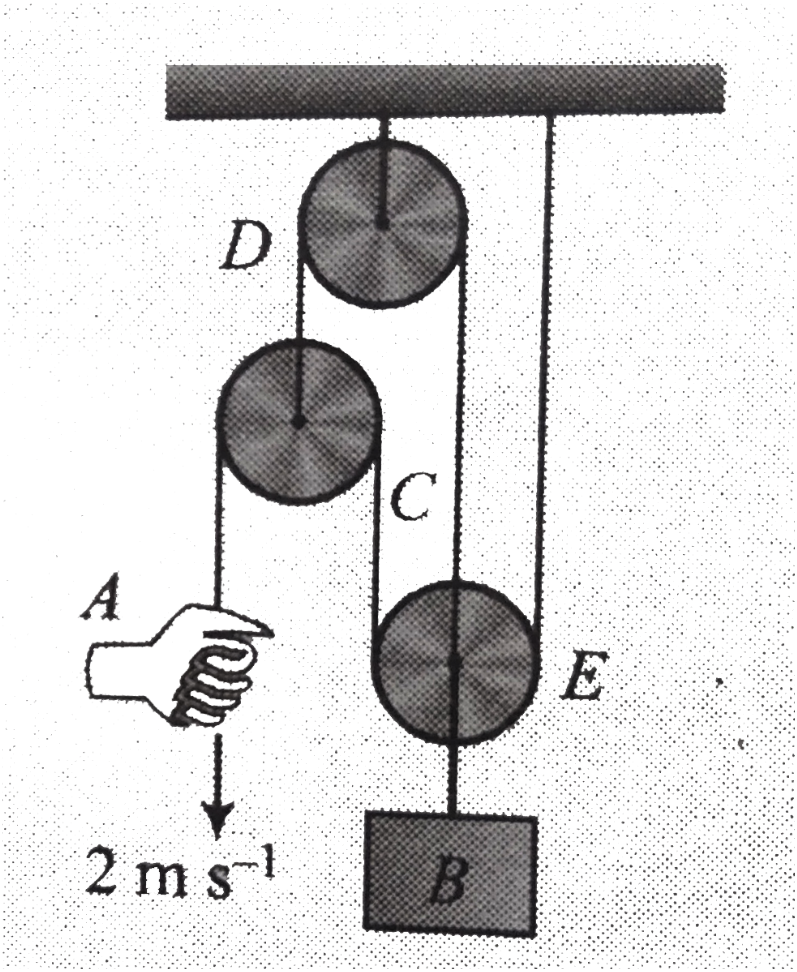
$\theta = 60^\circ$.



Watch Video Solution

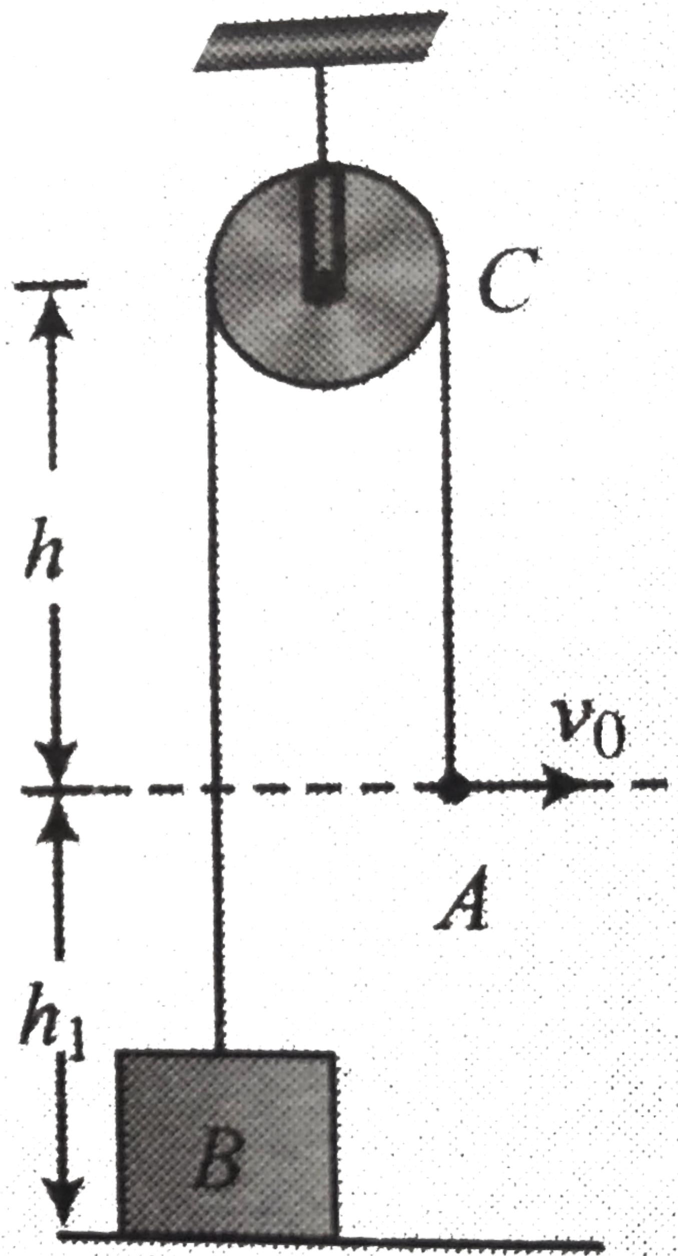
6. Determine the speed with which block B rises in fig. if the end of the cord at A is pulled down with a speed of

$2ms^{-1}$.



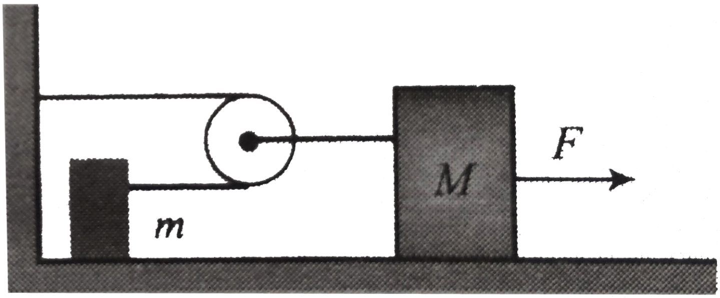
Watch Video Solution

7. An inextensible string AB is tied to a block B of negligible dimensions and passes over a small pulley C so that free end A hangs h unit above the ground on which the block B rests. In this initial position shown in fig. The free end A is h unit below C. if now end A moves horizontally with a velocity v_0, obtain an expression for the velocity of the block at any time t.



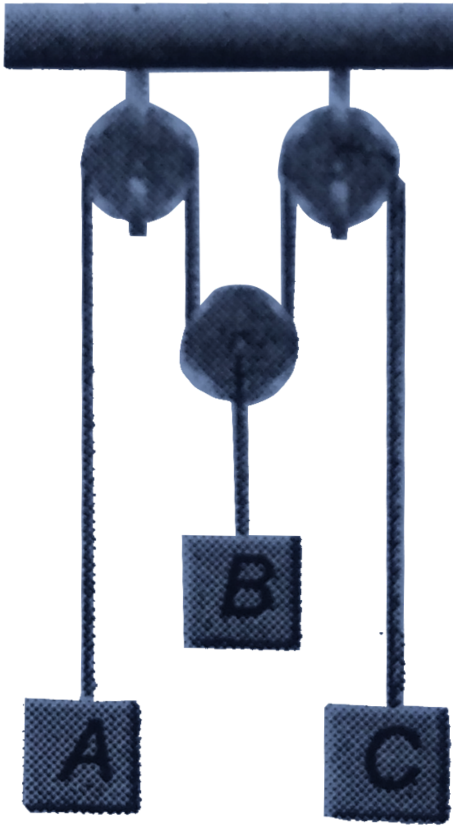
Watch Video Solution

8. Find the acceleration of blocks in fig. The pulley and the string are massless.



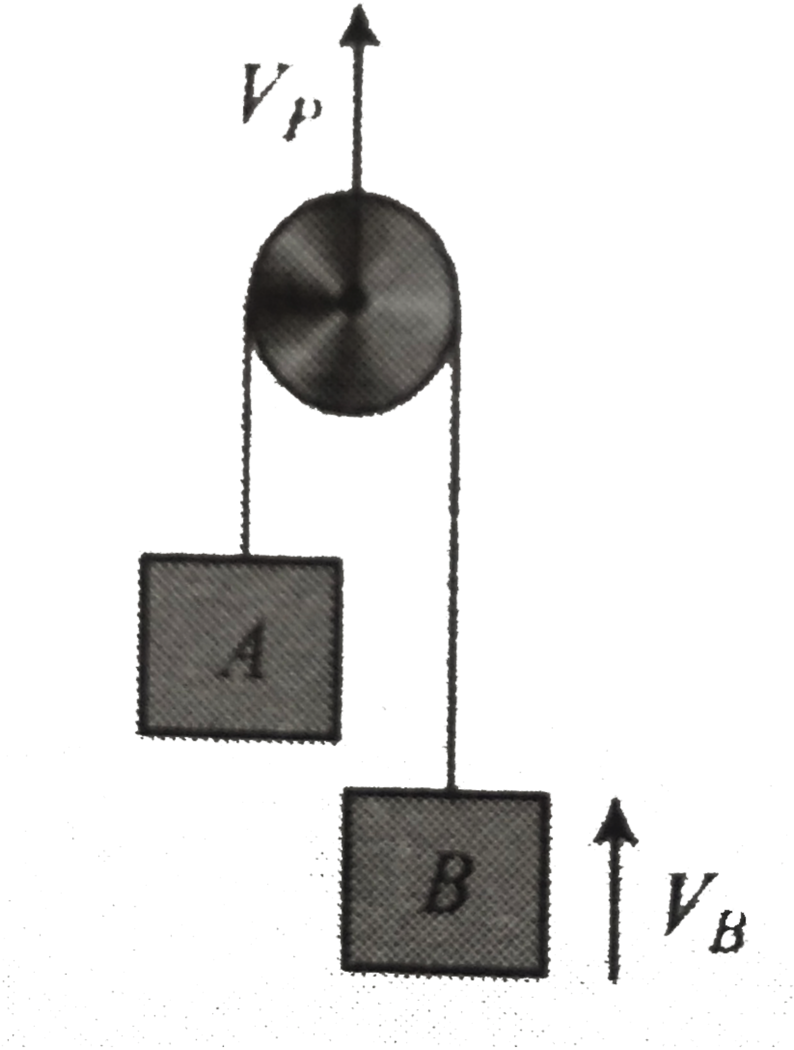
Watch Video Solution

9. In the pulley-block arrangement shown in figure , find the relation between a_A, a_B and a_C



Watch Video Solution

10. Figure shows a pulley over which is string passes and connected to two masses A and B. Pulley moves up with a velocity V_P and mass B is also going up at a velocity V_B.



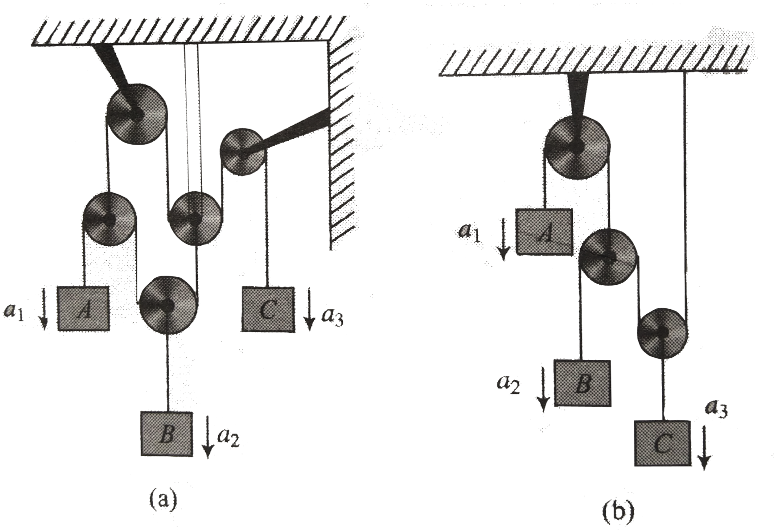
Find the velocity of mass A if

(a) $V_P = 5ms^{-1}$ and $V_B = 10ms^{-1}$

(b) $V_P = 5ms^{-1}$ and $V_B = -20ms_{-1}$.

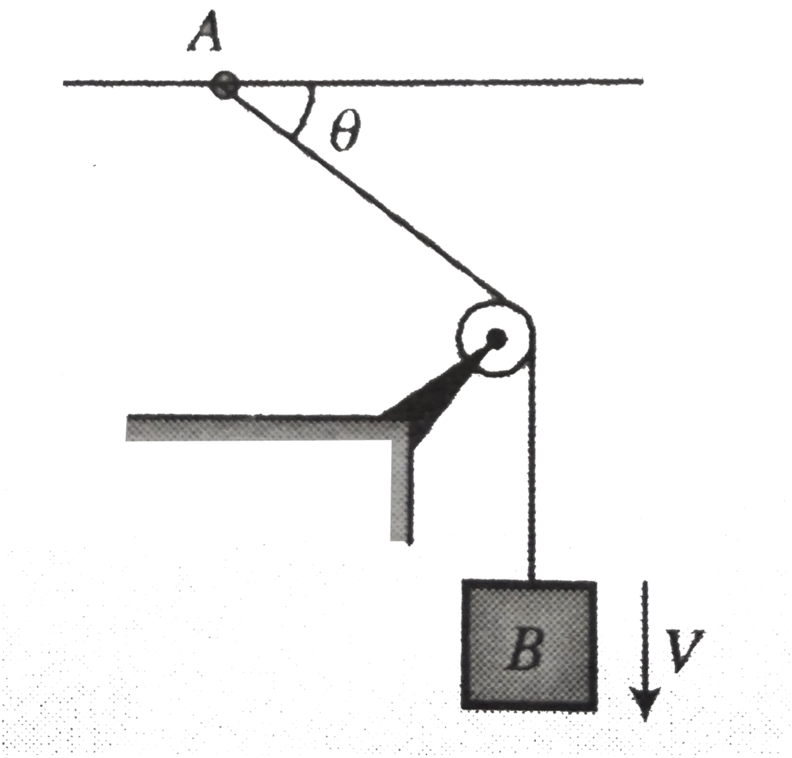
Watch Video Solution

11. Find the relation in the accelerations of the three masses shown in fig.



Watch Video Solution

12. A ring A which can slide on a smooth wire is connected to one end of a string as shown in fig. Other end of the string is connected to a hanging mass B. Find the speed of the ring when the string makes an angle θ with the wire and mass B is going down with a velocity v.

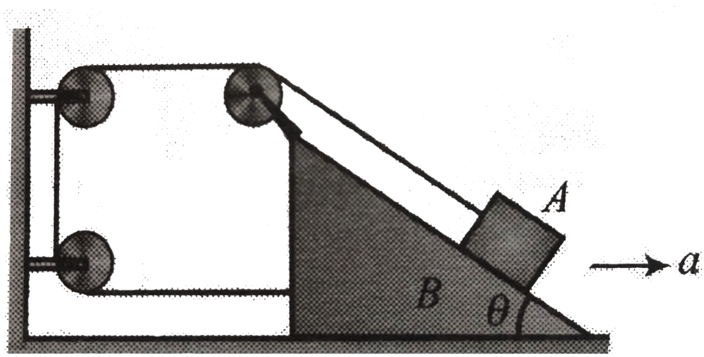


Watch Video Solution

13. Figure shows a block A constrained to slide along the inclined plane of the wedge B shown. Block A is attached with a string which passes through three ideal pulleys and connected to the wedge B. If wedge is pulled toward right with an acceleration a, find

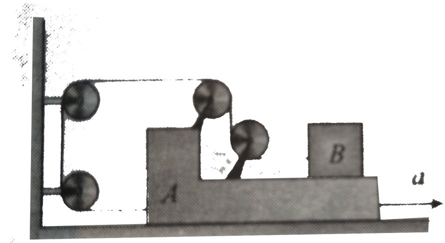
(a) the acceleration of the block with respect to wedge

(b) the acceleration of the block with respect to ground.

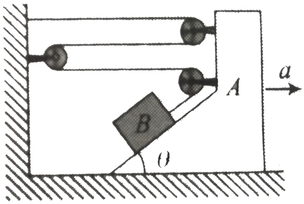


Watch Video Solution

14. Find the acceleration of block B as shown in fig. (a) and (b) relative to block A and relative to ground if block A is moving toward right with acceleration a.



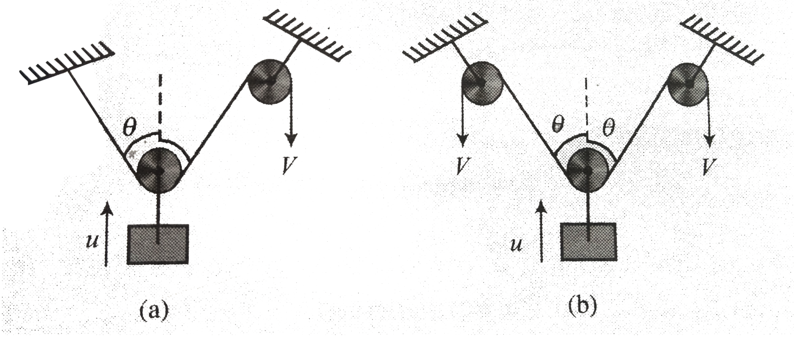
(a)



(b)

Watch Video Solution

15. If the string is inextensible, determine the velocity u of each block in terms of v and θ.

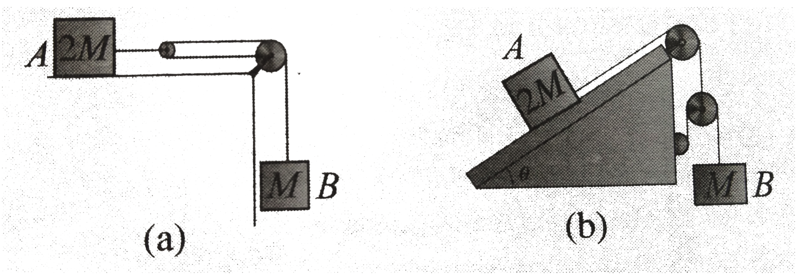


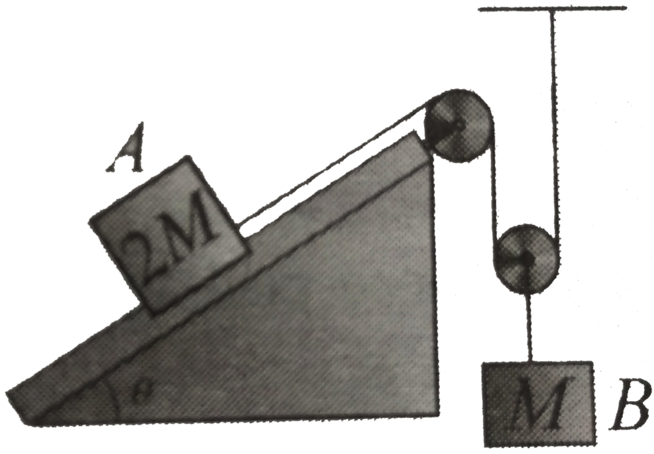
(a) fig a: u=...

(b) fig.(b): u=....

Watch Video Solution

16. Calculate the acceleration of block A and B in cases (a),(b), and (c).

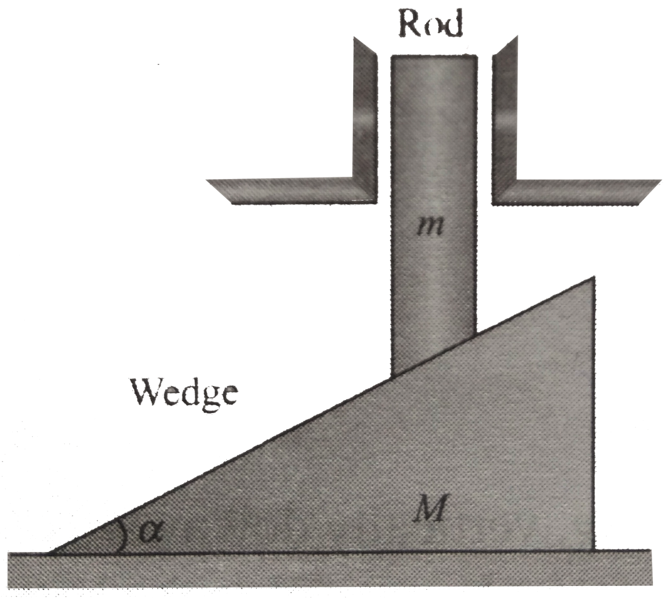




(c)

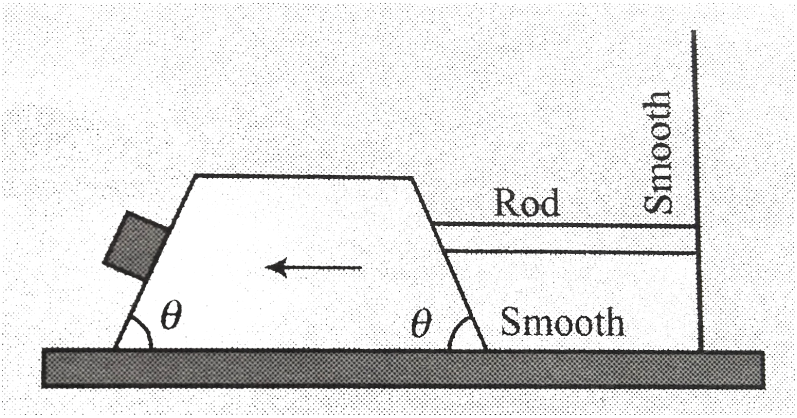
Watch Video Solution

17. A rod of mass m is supported on a wedge of mass M shown in fig. Find the accelerations of rod and wedge in the arrangement. The friction between all contact surfaces in negligible.



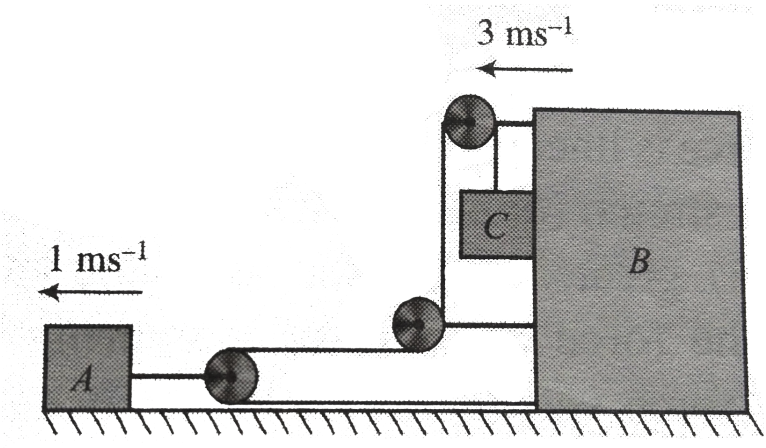
Watch Video Solution

18. In fig, no relative motion takes place between the wedge and the block placed on it. The rod slides down wards over the wedge and pushes the wedge to move in horizontal direction, The mass of wedge is same as that of the block and is equal to M. If $\tan\theta = (1/\sqrt{3})$, find the mass of rod. (Neglect rotation of the rod).



Watch Video Solution

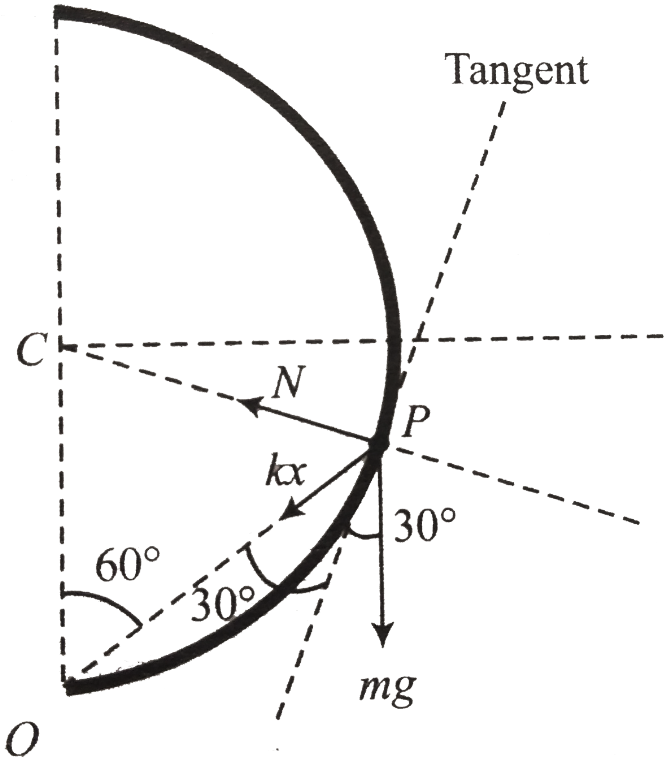
19. The velocities of A and B shown in fig. Find the speed (in ms^{-1}) of block C. (Assume that the pulleys and string are ideal).



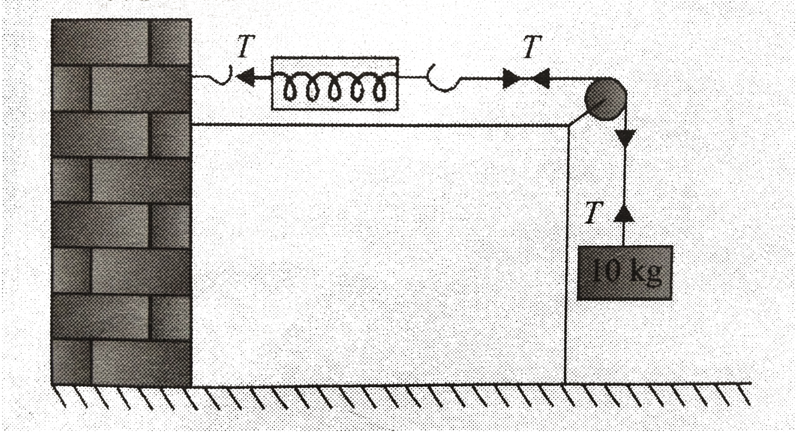
Watch Video Solution

Exercise 6.4

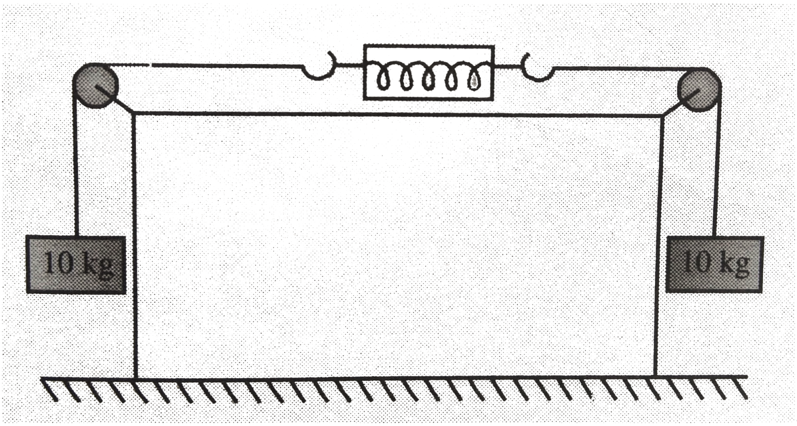
1. (a) A 10-kg block is supported by cord that runs to a spring scale, which is supported by another cord from the ceiling as shown in fig. What is the reading on the scale?



(b) In Fig. the block is supported by a cord that runs around a pulley and to a scale. The opposite end of the scale is attached by a cord to a wall. What is the reading of the scale?



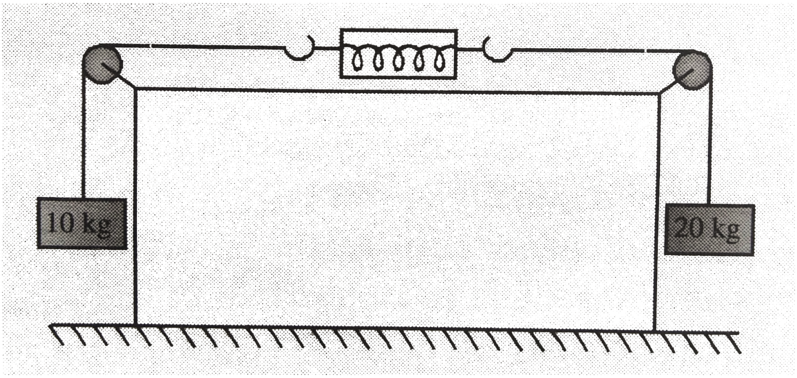
(c) In fig. the wall has been replaced with a second 10-kg block, what is the reading on the scale now?



.

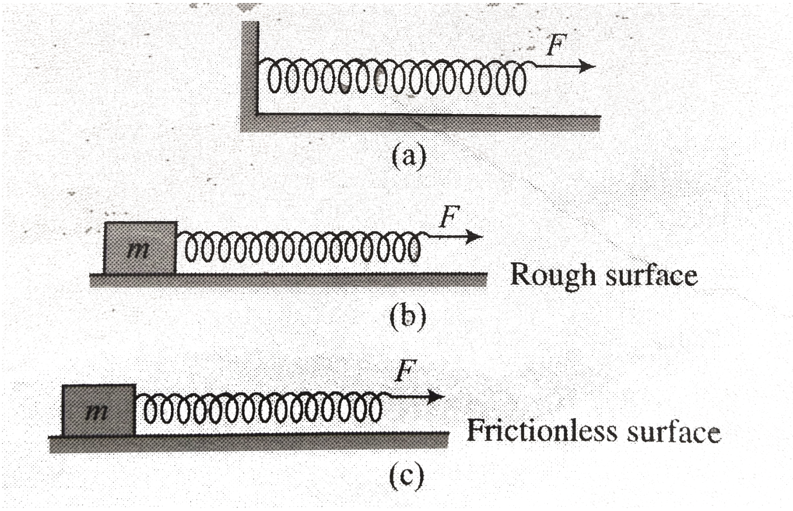
Watch Video Solution

2. What is the reading of the spring balance in the following device?



Watch Video Solution

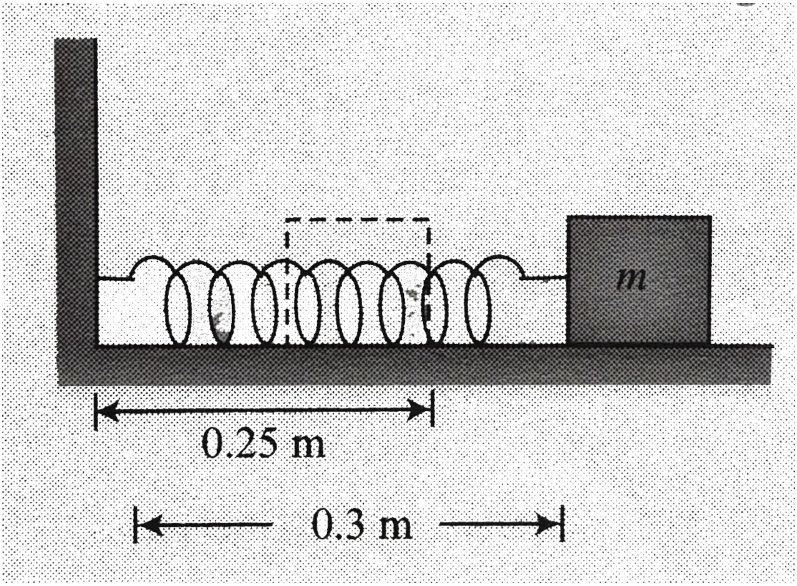
3. In Fig. three identical massless springs are kept horizontal. The left end of the first is tied to a wall. The left end of the second spring is tied to a block of mass m placed on rough ground and the ,eft end of the third spring is tied to a block of mass m placed frictionless ground. The right end of each spring is pulled by a force that is increased gradually from zero to F. Extensions in these springs are x_1, x_2 and x_3, respectively. Find the relationship between x_1, x_2, and x_3



Watch Video Solution

4. A smooth block of mass m is connected with a spring of stiffness $k(=20Nm^{-1})$and natural length

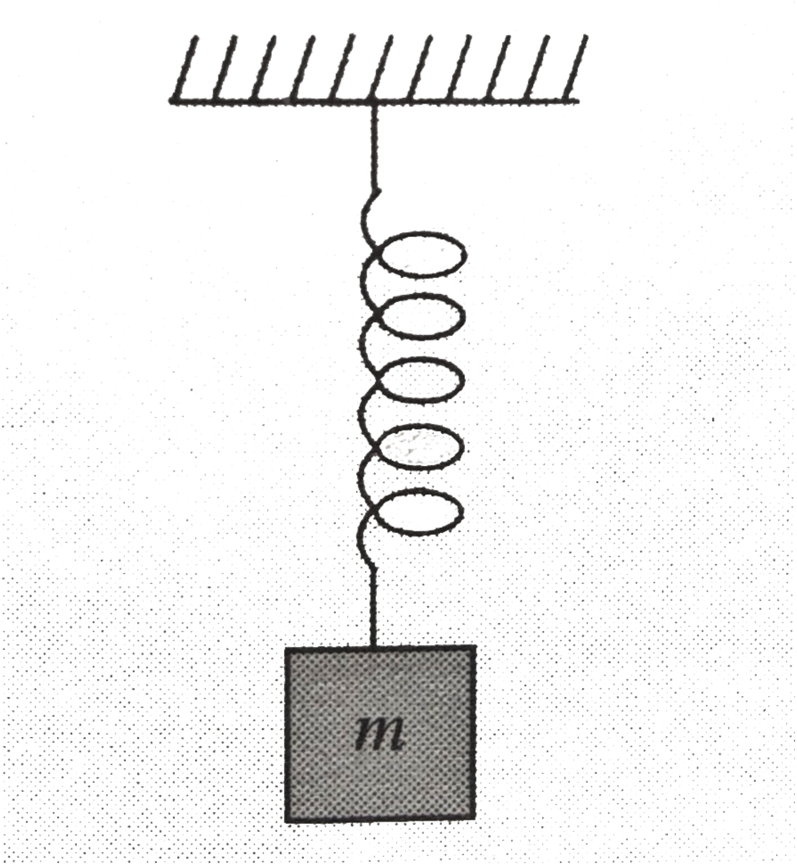
$l_0 = 0.25m$. If the block is pulled such that the new length of the spring becomes $l = 0.3m$, find the acceleration of the block at the moment when it is released from given positon.



Watch Video Solution

5. A sand bag of mass m is hanging from a light spring of stiffness k. Find the elongation of the spring. If we pull

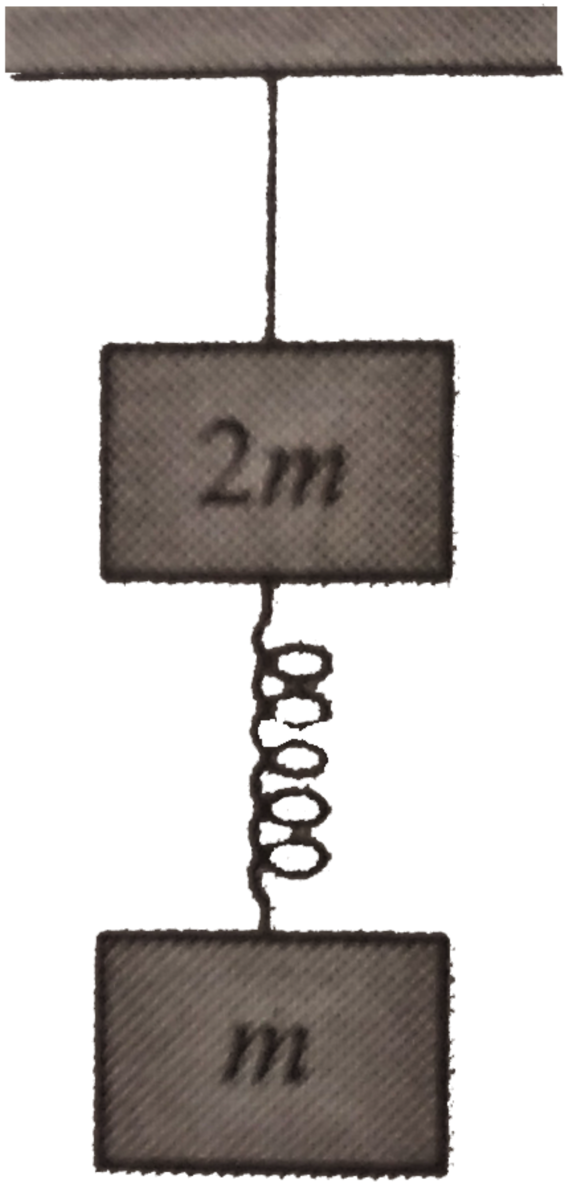
the sand bag down by an additional distance x and release it, find its acceleration and maximum velocity of block.



Watch Video Solution

6. Two blocks are connected by a spring. The combination is suspended, at rest, from a string attached to the ceiling, as shown in fig. The string breaks suddenly.

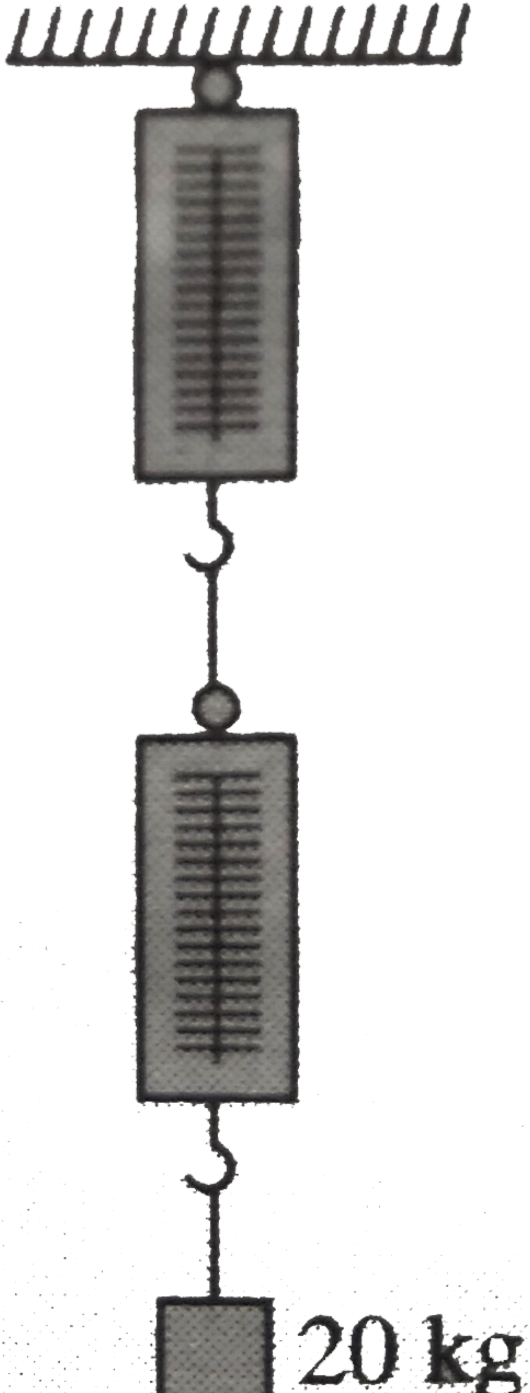
Immediately after the string breaks, what is the initial downward acceleration of the upper block of mass 2m?



Watch Video Solution

Watch Video Solution

7. A block of mass 20 kg is suspended through two light spring balances as shown in fig. Calculate the:

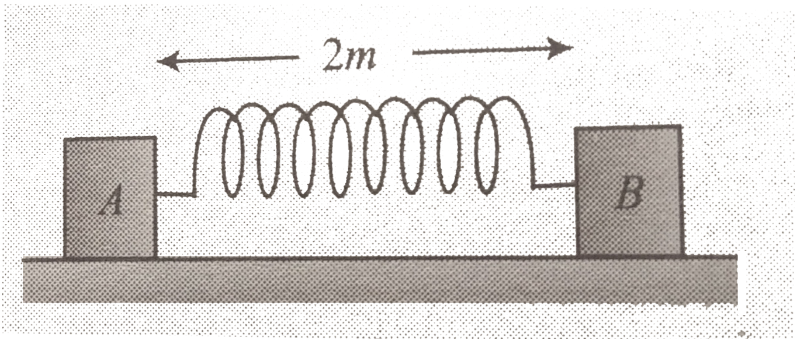

20 kg

(a) reading of spring balance (1),

(b) reading of spring balance (2).

Watch Video Solution

8. Two block are connected by a spring of natural length 2m. The force constant of spring is $200 N m^{-1}$.



Find the spring force in the following situations:

(a) A is kept at rest and B is displaced by 1m in right direction.

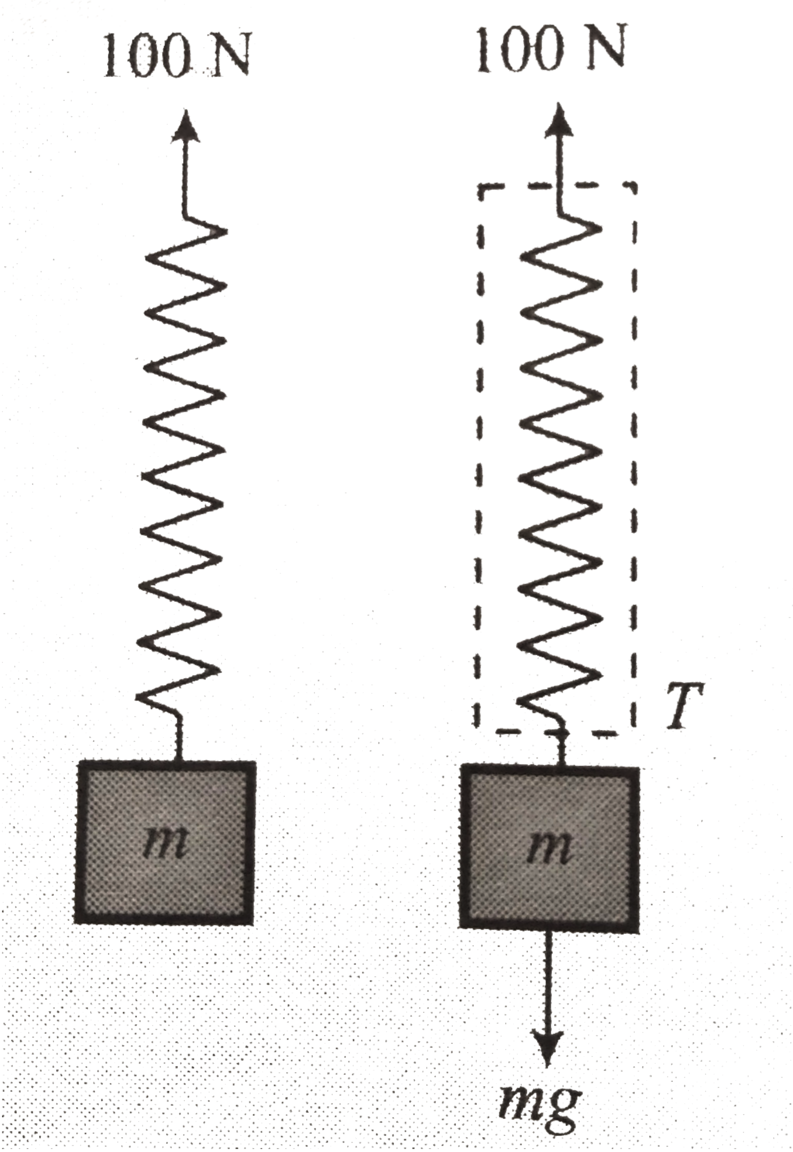
(b) B is kept at rest and A is displaced by 1m in left direction.

(c) A is displaced by $0.75m$ in right direction and B is $0.25m$ in left direction.

Watch Video Solution

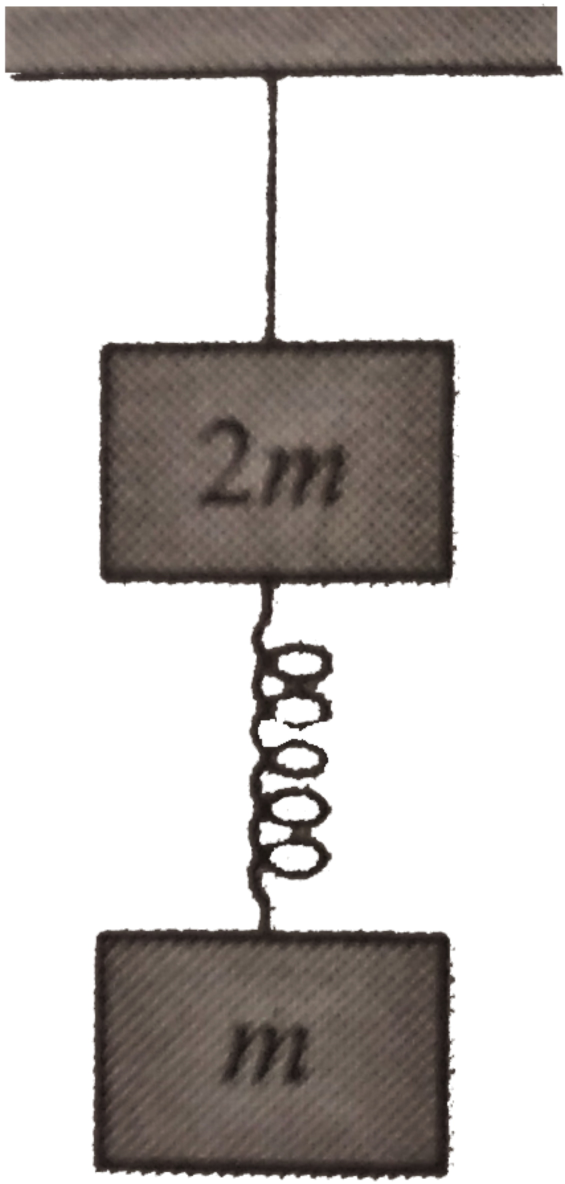
9. If the force constant of spring is $50Nm^{-1}$, find mass of the block, if it an rests in the given situation

$(g = 10ms^{-2})$.



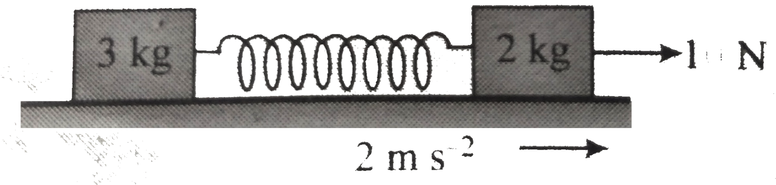
Watch Video Solution

10. Two blocks are connected by a spring. The combination is suspended, at rest, from a string attached to the ceiling, as shown in fig. The string breaks suddenly. Immediately after the string breaks, what is the initial downward acceleration of the upper block of mass 2m?



Watch Video Solution

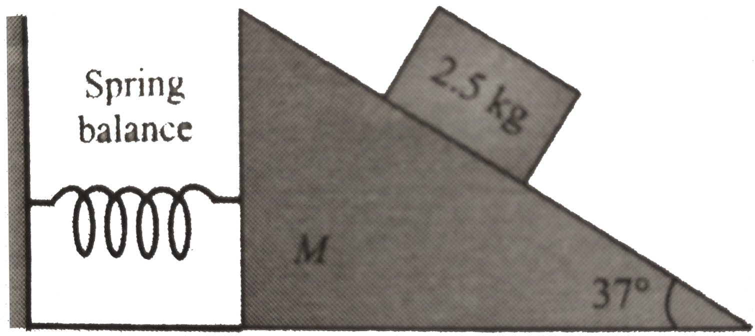
11. Find the acceleration of $3kg$ mass when acceleration of 2kg mass is ms^{-2} as shwon in fig.



Watch Video Solution

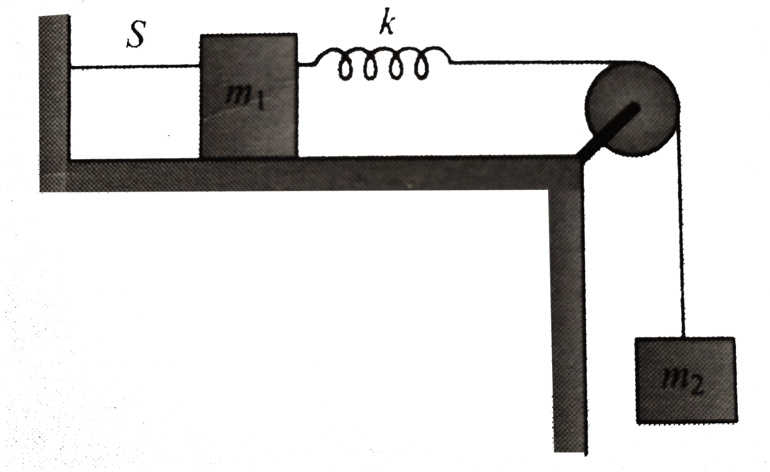
12. Find the reading of spring balance as shown in fig. Assume that mass M in equilibrium. (All surfaces are

smooth).



Watch Video Solution

13. Two block of masses m_1 and m_2 are in equilibrium. The block m_2 hangs from a fixed smooth pulley by an inextensible string that is fitted with a light spring of stiffness k as shown in fig. Neglecting friction and mass of the string, find the acceleration of the bodies just after the string S is cut.



Watch Video Solution

Subjective

1. A hot- air balloon consists of a basket, one passenger, and some carge. Let the total mass be M. Even though there is an upward lift force on the balloon, the balloon is initially acceleration downwards at a rate of $g/3$.

(a) Draw a free-body diagram for the descending balloon.

(b) Find the upward lift force in terms of the initial total weight Mg.

(c) The passenger notices that he is heading straight for a waterfall and decides he needs to go up. What fraction of the total weight must he drop overboard so that the balloon accelerates upward at a rate of $g/2$? Assume that the upward lift force remains the same.

Watch Video Solution

2. A student tries to raise a chain consisting of three identical links. Each link has a mass of 300g. The three-piece chain is connected to a string and then suspended vertically, with the student holding the upper end of the string and pulling upward. Because of the student's pull, an upward force of 12 N is applied to the chain by the string.

(a) Draw a free-body diagram for each of the links in the chain and also for the entire-chain considered a single body.

(b) Use the results of part(a) Newton's laws to find (i) the acceleration of the chain and (ii) the force exerted by the top link on the middle link.

Watch Video Solution

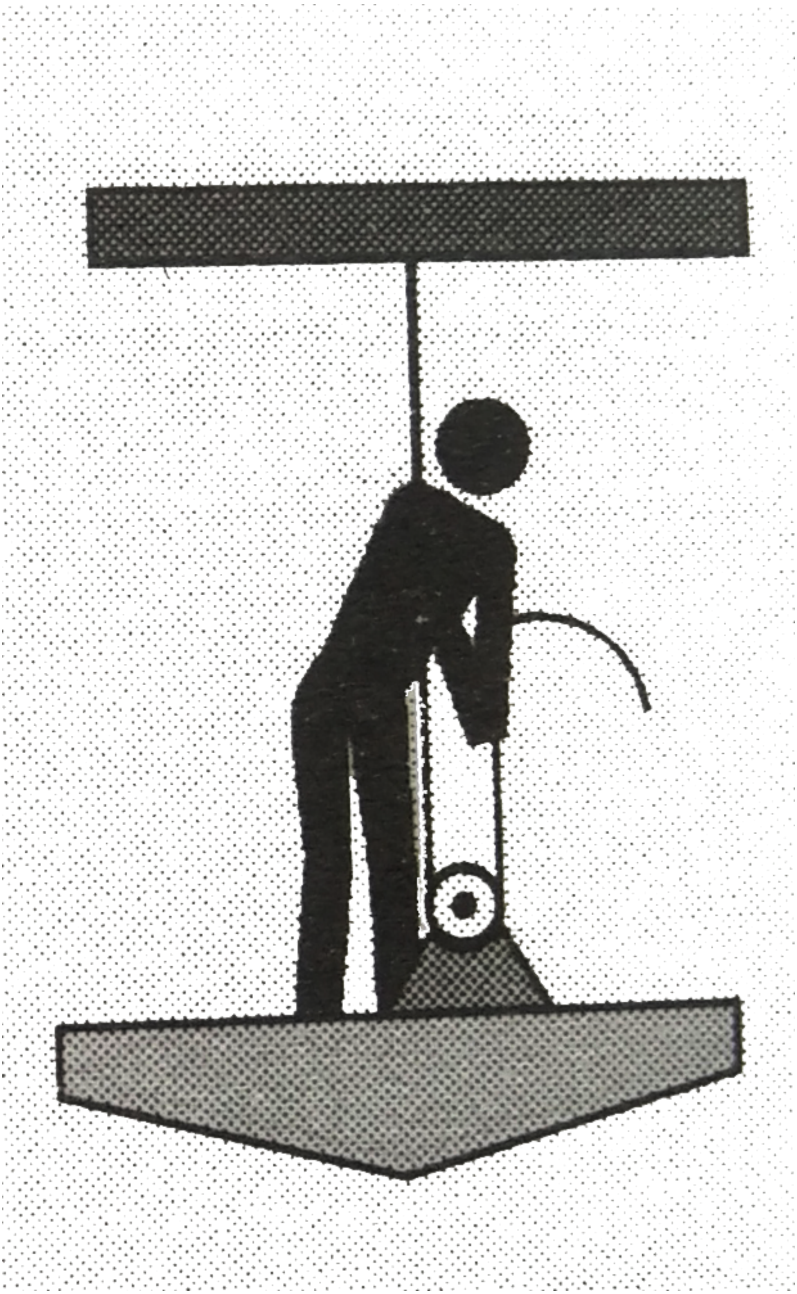
3. Two men of masses M and $M+m$ start simultaneously from the ground and climb with uniform accelerations up from the free ends of a massless inextensible rope whick passes over a smooth pulley at a height h from the ground.

(a) Which man reaches the pulley first?

(b) If the mam who reaches first takes time t to reach the pulley, then find the distance of the second man from the pulley at this instant.

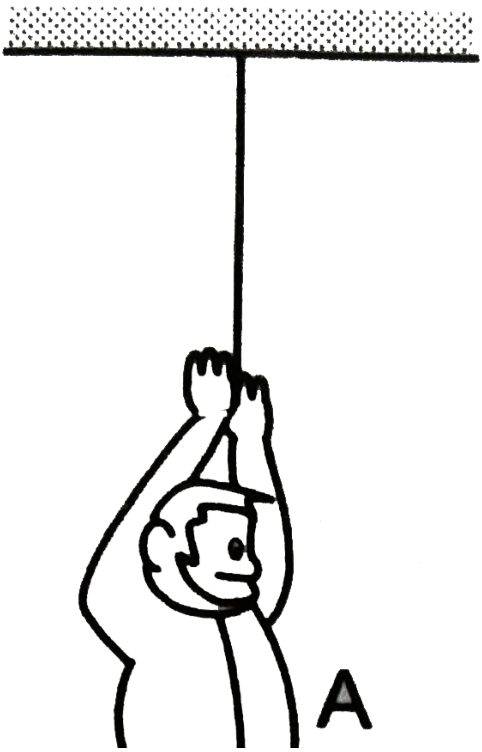
Watch Video Solution

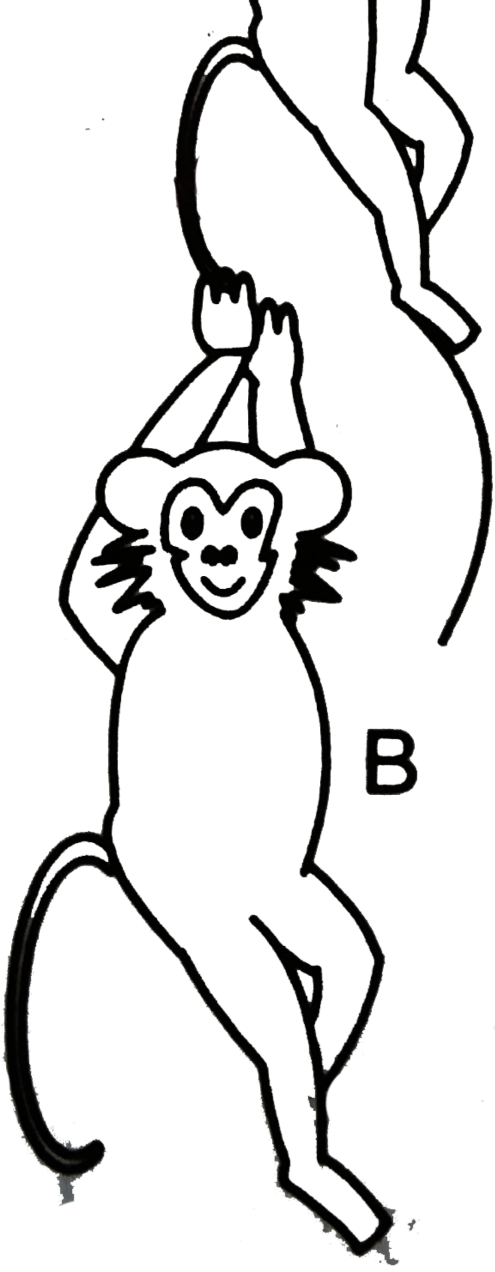
4. In fig. the man and the platform together weight 950N. The pulley can be treated as frictionless. Determine how hard the man has to pull on the rope to lift himself upward above the ground with constant velocity. If the weight of man is 550 N, what is the normal reaction between them?



Watch Video Solution

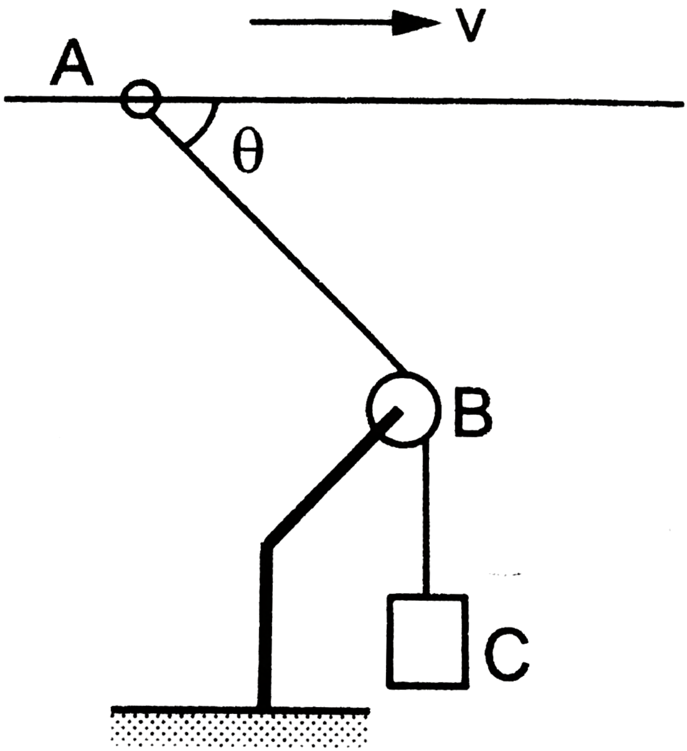
5. The monkey B shown in figure is holding on to the tail of the monkey A which is climbing up a rope. The masses of the monkeys A and B are 5 kg and 2kg respectively. If A can tolerate a tension of 30 N in its tail what force should it apply on the rope in order to carry the monkey B with it? Take g=10 ,m/s^2.





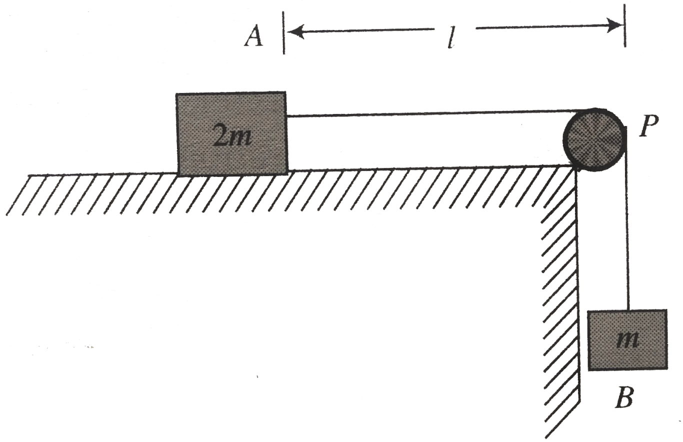
Watch Video Solution

6. 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 θ 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 $\theta = 30^0$



Watch Video Solution

7. A particle A of mass 2m is held on a smooth horizontal table and is attached to one end of an inelastic string which runs over a smooth light pulley at the edge of the table. At the other end of the string there hangs another particle B of mass m, the distance from A to the pulley is l. The particle A is then projected towards the pulley with velocity u.

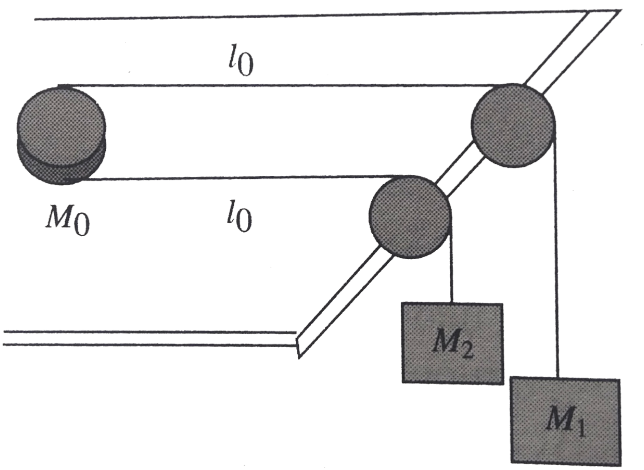


(a) Find the time before the string becomes taut, and shown that after the string becomes taut, the initial velocity of A and B is $4u/3$.

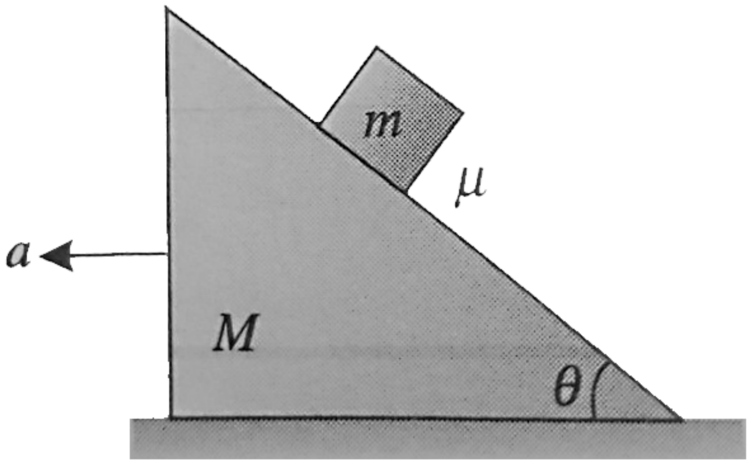
(b) Find the common velocity when A reaches the pulley (assume that B has not yet reached the ground).

Watch Video Solution

8. A smooth pulley A of mass M_0 is lying on a frictionless table. A massless rope passes round the pulley and has masses M_1 and M_2 tied to its ends, the two portions of the string being perpendicular to the edge of the table so that the masses hang vertically. Find the acceleration of the pulley.



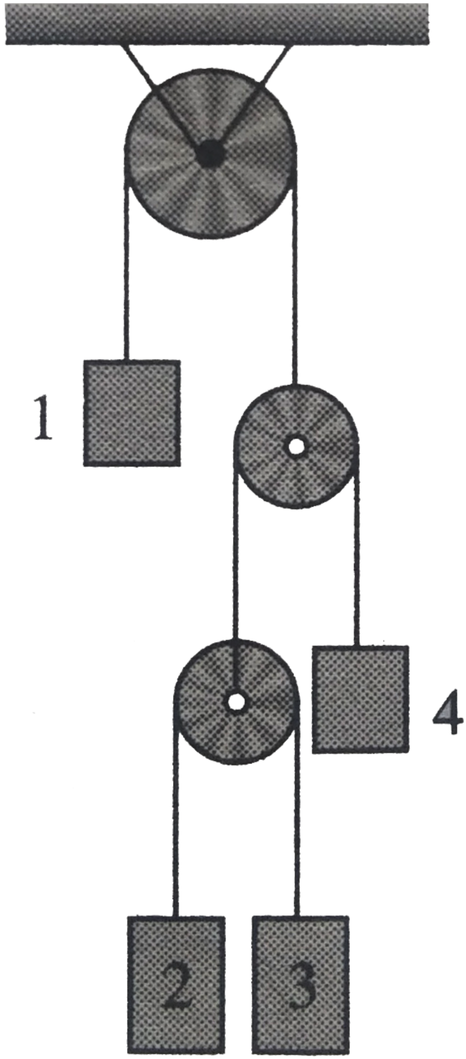
Watch Video Solution

9. 

A block of mass m is at rest relative to the stationary wedge of mass M. The coefficient of friction between block and wedge is μ. The wedge is now pulled horizontally with acceleration a as shown in figure. Then the minimum magnitude of a for the friction between block and wedge to be zero is:

Watch Video Solution

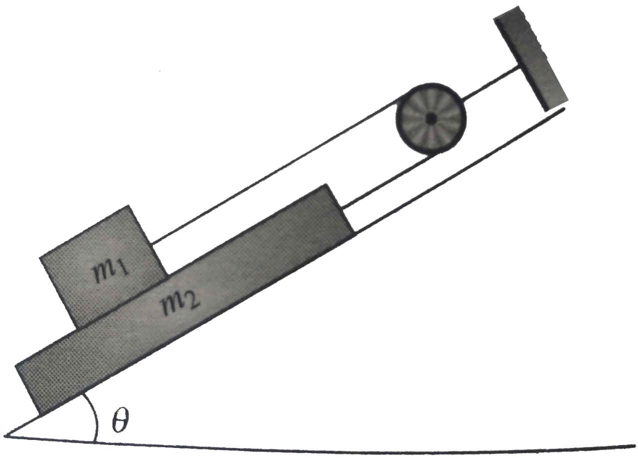
10. In the arrangement shown in fig., all pulleys are smooth and massless. When the system is released from the rest, acceleration of block 2 and 3 relative to 1 are $1ms^{-2}$ downwards and $5ms^{-2}$ downwards, respectively. Acceleration of block 3 relative to 4 is zero.



Find the absoulte acceleration of block 2.

Watch Video Solution

11. Figure shows a block of mass m_1 sliding on a block of mass m_2, with $m_1 > m_2$. Find the



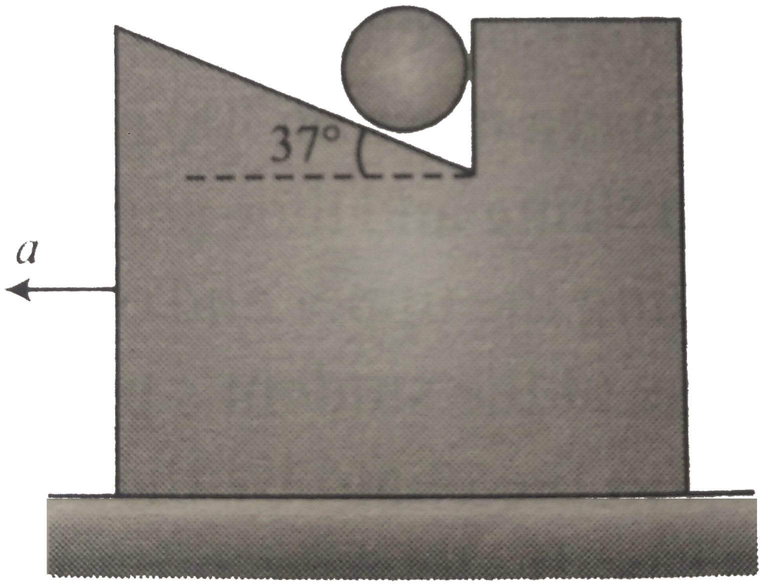
(a) acceleration of each block

(b) tension in the string

(c) force exerted by m_1 on m_2. ltbr. (d) force exerted by m_2 on the incline.

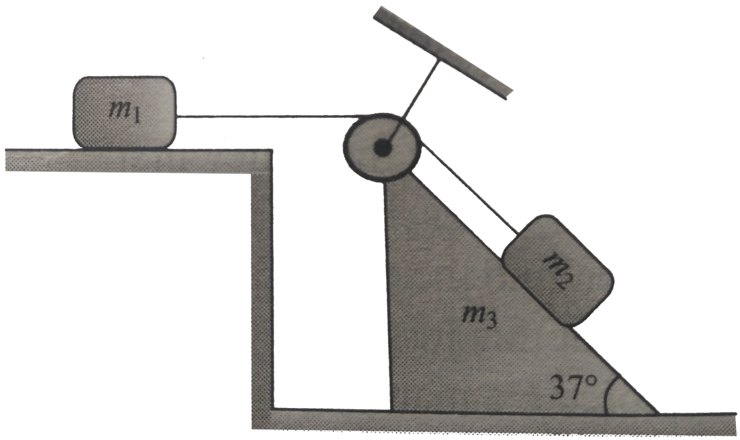
Watch Video Solution

12. The system shown in fig. is given an acceleration a towards left. Assuming all the surfaces to be frictionless, find the normal reactions applied by wedge on the sphere.



Watch Video Solution

13. In the arrangement shown in fig. a wedge of mass $m_3 = 3.45kg$ is placed on a smooth horizontal surface. Small and light pulley is connected on its top edge, as shown. A light, flexible thread passes over the pulley. Two block having mass $m_1 = 1.3kg$ and $m_2 = 1.5kg$ are connected at the ends of the thread.



m_1 is on smooth horizontal surface and m_2 rests on inclined smooth surface of the wedge. the base length of wedge is 2m and inclination is 37°. m_2 is initially near the top edge of the wedge.

If the whole system is released from rest, calculate:

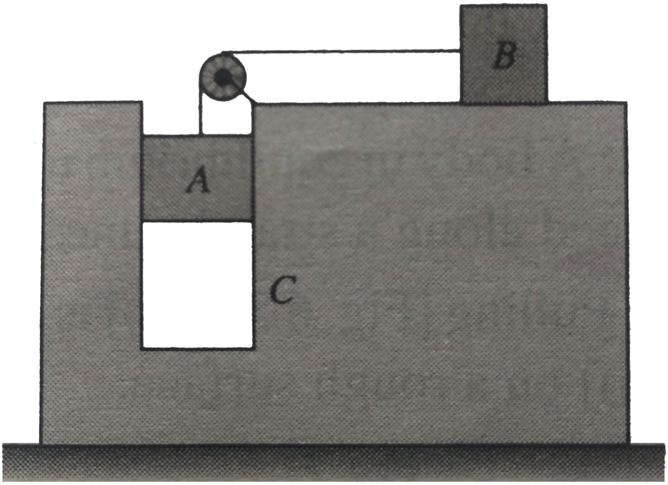
(a) velocity of wedge when m_2 reaches its bottom.

(b) velocity of m_2 at that instant.

$(g = 10ms^{-2})$.

Watch Video Solution

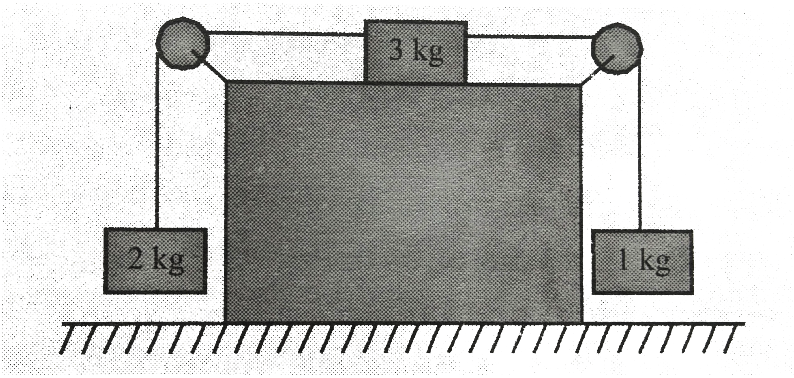
14. In the system shown in fig., $m_A = 4m$, $m_B = 3m$, and $m_c = 8m$. Friction is absent everywhere. String is inextensible and light. If the system is released from rest, then



Acceleration of Block B is

Watch Video Solution

15. The system shown in fig, is released from rest. Calculate the tension in the string and the force exerted by the string on the pulleys, assuming pulleys and strings are massless.



Watch Video Solution

Single Correct

1. Two skaters have weight in the ratio $4:5$ and are 9m apart, on a smooth frictionless surface. They pull on a rope stretched between them. The ratio of the distance covered by them when they meet each other will be

A. $5:4$

B. $4:5$

C. $25:16$

D. $16:25$

Answer: A

Watch Video Solution

2. When forces F_1, F_2, F_3, are acting on a particle of mass m such that F_2 and F_3 are mutually perpendicular, then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is

A. $\frac{R_3}{m}$

B. $\frac{R_1 + R_2}{m}$

C. $\frac{R_1 - R_2}{m}$

D. $\frac{R_1}{m}$

Answer: A

Watch Video Solution

3. n balls each of mass m impinge elastically each second on a surface with velocity u. The average force experienced by the surface will be

A. mn u

B. 2 mn u

C. 4mn u

D. $mnu/2$

Answer: B

Watch Video Solution

4. A particle of mass m moving with velocity u makes an elastic one dimensional collision with a stationary particle of mass m. They are in contat for brief time T. Their force of interaction increases from zero to F_0 linearly inn time $\frac{T}{2}$ and decreases linearly to zero in further time $\frac{T}{2}$. the magnitutde of F_0 is

A. mu/T

B. $2mu/T$

C. $4mu/T$

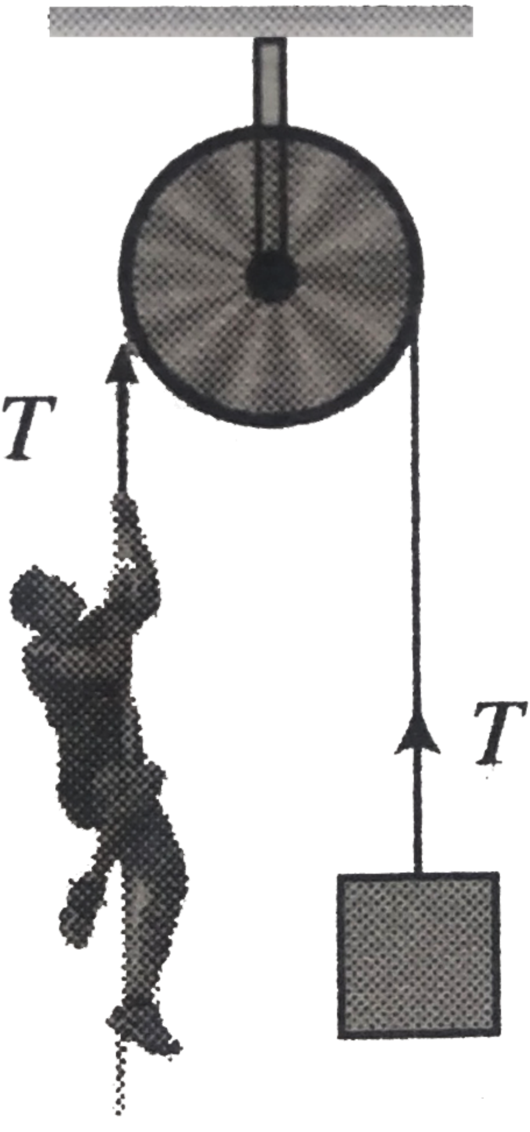
D. $mu/2T$

Answer: C

Watch Video Solution

5. In order to raise a mass of 100 kg, a man of mass 60 kg fastens a rope to it and passes the rope over a smooth pulley. He climbs the rope with acceleration $5g/4$ relative to the rope. The tension in the rope is (take $g = 10ms^{-2}$

)



A. $\frac{4875}{8}N$

B. $\frac{4875}{2}N$

C. $\frac{4875}{4}N$

D. $\frac{4875}{6}N$

Answer: C

Watch Video Solution

6. A plumb bob of mass $1kg$ is hung from the ceiling of a train compartment.The train moves on an inclined plane with constant velocity. If the angle of inclined is 30°.Find the angle made by the string with the normal to the ceiling .Also ,Find the tension in the string $(g = 10m/s^2)$

A. 30°

B. $\tan^{-1}(2/\sqrt{3})$

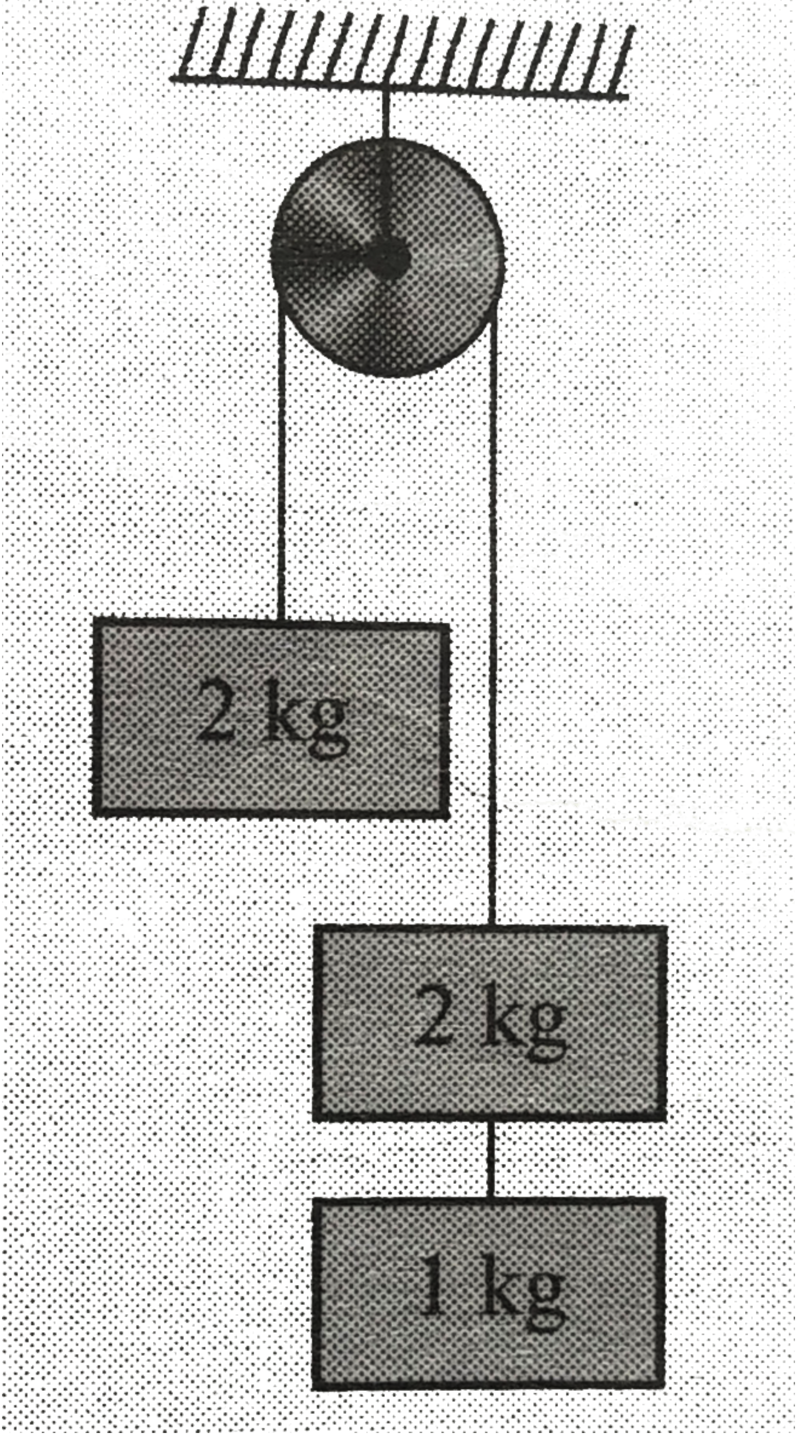
C. $\tan^{-1}(\sqrt{3}/2)$

D. $\tan^{-1}(2)$

Answer: B

Watch Video Solution

7. Consider the system shown in fig. the system is released from rest, find the tension in the cord connected between 1kg and 2 kg blocks.


2 kg
2 kg
1 kg

A. If $M > m$

B. If $M > 2m$

C. If $M > m/2$

D. For any value of M

Answer: D

Watch Video Solution

8. A balloons of mass M is descending at a constant acceleration α. When a mass m is released from the balloon, it starts rising. With the same acceleration α. Assuming that its volumes does not change, what is the valule of m?

A. $\frac{\alpha}{\alpha + g}M$

B. $\frac{2\alpha}{\alpha + g}M$

C. $\frac{\alpha + g}{\alpha}M$

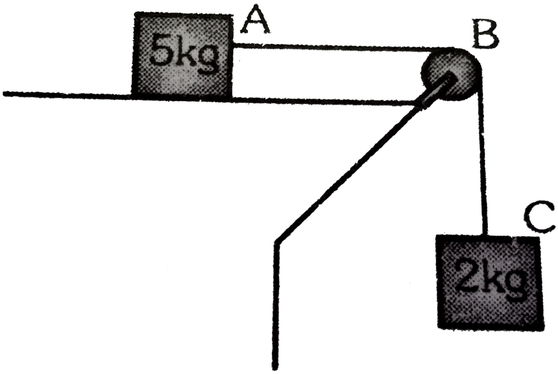
D. $\frac{\alpha + g}{2\alpha}M$

Answer: B

Watch Video Solution

9. A trolley of mass 5 kg on a horizontal smooth surface is pulled by a load of mass 2 kg by means of uniform rope ABC of length 2 m and mass 1kg. As the load falls from

BC=0 to BC=2m. Its accerleration in m/s^2 change-



A. $\frac{20}{6}$ to $\frac{30}{6}$

B. $\frac{20}{8}$ to $\frac{30}{8}$

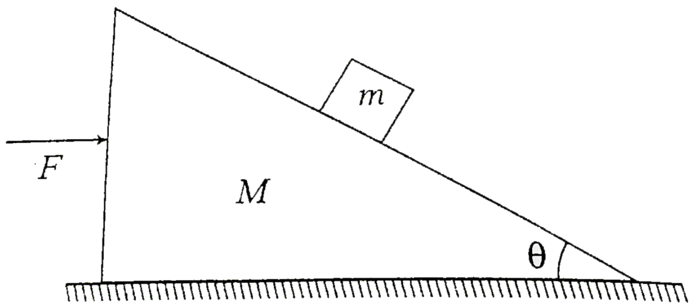
C. $\frac{20}{5}$ to $\frac{30}{6}$

D. None of these

Answer: A

Watch Video Solution

10. All surfaces are smooth in following figure. Find F such that block remains stationary with respect to wedge.



A. $(M+m)g\tan\beta$

B. $g\tan\beta$

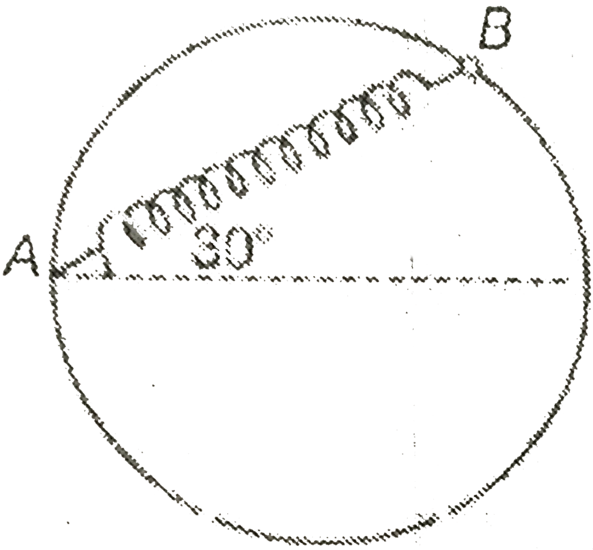
C. $mg\cos\beta$

D. $(M+m)g\cos ec\beta$

Answer: A

Watch Video Solution

11. A bead of mass m is attached to one end of a spring of natural length R and spring is fixed at point A on a smooth vertical ring of radius R as shown in figure. The normal reaction at B just after it is released to move is



A. a. $mg/2$

B. $\sqrt{3}mg$

C. $3\sqrt{3}mg$

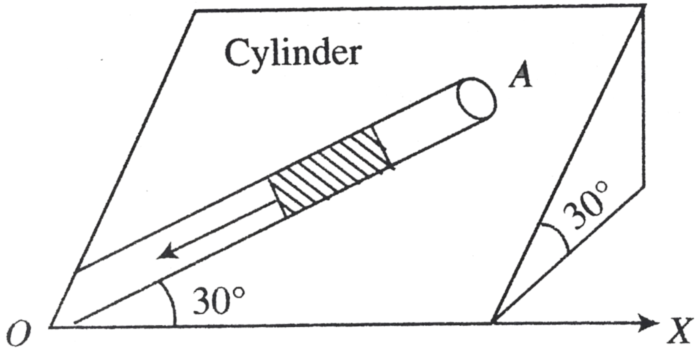
D. $\dfrac{3\sqrt{3}mg}{2}$

Answer: D

Watch Video Solution

12. An inclined plane makes an angle 30° with the horizontal. A groove (OA) of length 5m cut in the plane makes an angle 30° with OX. A short smooth cylinder is free to slide down under the influence of gravity. The time taken by the cylinder to reach from A to O is

$(g = 10ms^{-2})$.



A. 4s

B. 2s

C. 3s

D. 1s

Answer: B

Watch Video Solution

13. In the above problem, the contact force between the man and the crate is

A. 2250N

B. 1125N

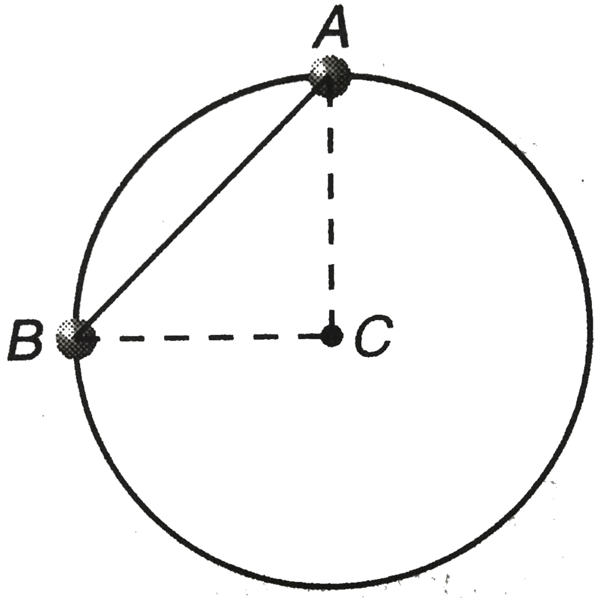
C. 750N

D. 375N

Answer: D

View Text Solution

14. Two beads of equal masses m are attached by a string of length $\sqrt{2}a$ and are free to move in a smooth circular ring lying in a vertical plane as shown in figure. Here a is the radius of the ring. Find the tension and acceleration of B just offer the heads are released to move.



A. Zero

B. mg

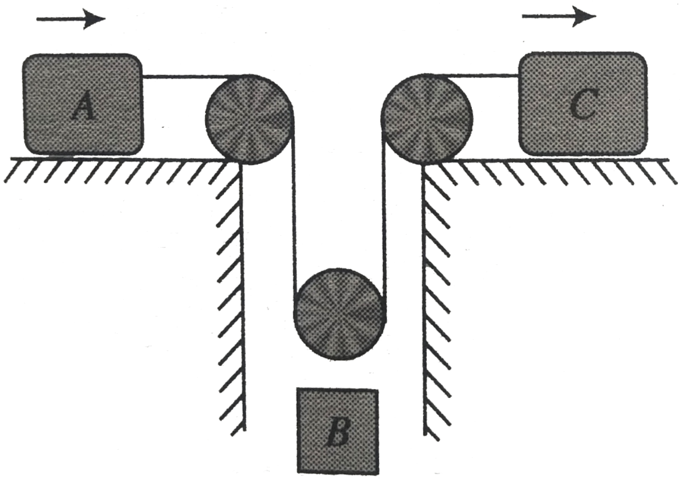
C. $\sqrt{2}mg$

D. $mg/\sqrt{2}$

Answer: D

Watch Video Solution

15. Block A and C starts from rest and move to the right with acceleration $a_A = 12t ms^{-2}$ and $a_C = 3ms^{-2}$. Here t is in second. The time when block B again comes to rest is



A. 2s

B. 1s

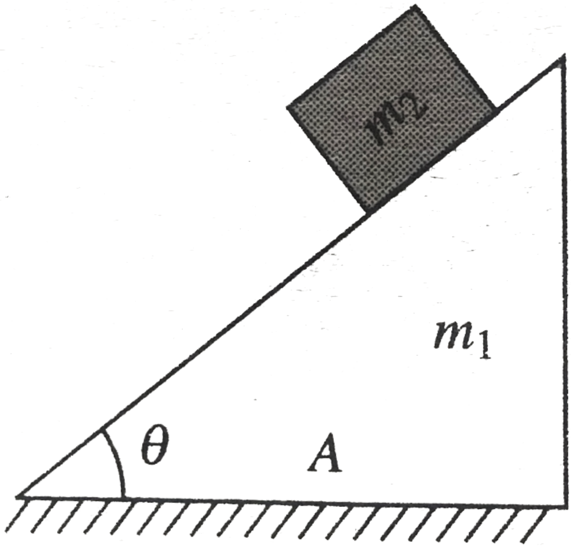
C. $3/2s$

D. $1/2s$

Answer: D

View Text Solution

16. In fig., the mass m_2 starts with velocity v_0 and moves with constant velocity on the surface. During motion, the normal reaction between the horizontal surface and fixed triangle block m_1 is N. Then during motion.



A. $N = (m_1 + m_2)g$

B. $N = m_1 g$

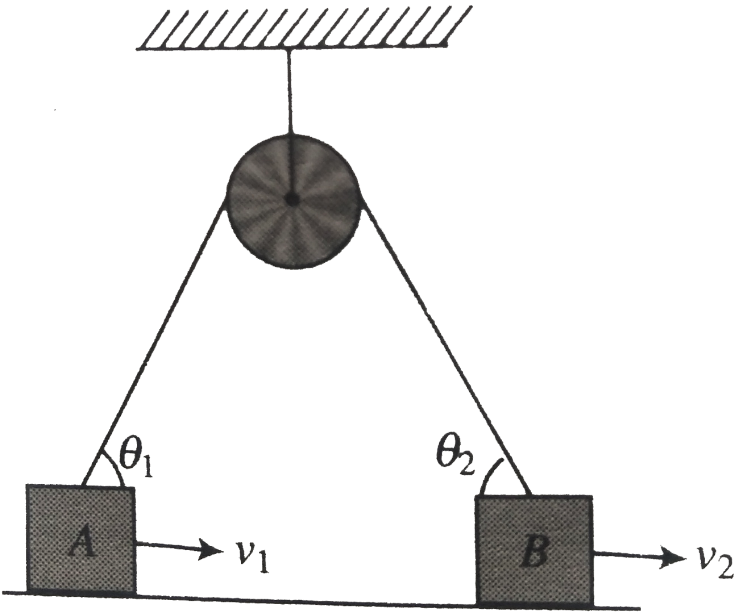
C. $N < (m_1 + m_2)g$

D. $N > (m_1 + m_2)g$

Answer: A

Watch Video Solution

17. In fig., blocks A and B move with velocities v_1 and v_2 along horizontal direction. Find the ratio of v_1 / v_2



A. $\dfrac{\sin\theta_1}{\sin\theta_2}$

B. $\dfrac{\sin\theta_2}{\sin\theta_1}$

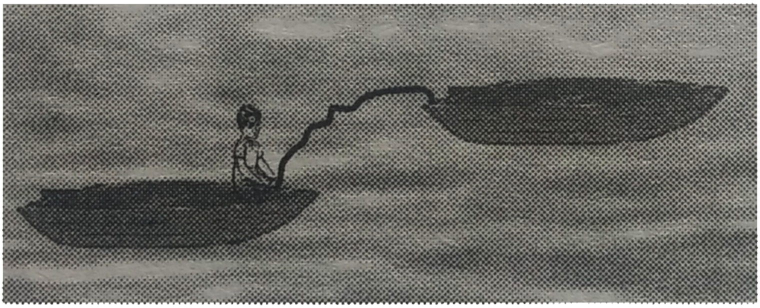
C. $\dfrac{\cos\theta_2}{\cos\theta_1}$

D. $\frac{\cos\theta_1}{\cos\theta_2}$

Answer: C

Watch Video Solution

18. A rope is strecthed between two boats at rest. A sailor in the first boat pulls the rope with a constant force of 100N. First boat with the sailor has mass of 250kg. Whereas the mass of second boat is double of this mass. If the initial distance between the boats was 100m. The time taken for two boats to meet each other is (neglect water resistance between boats and water)



A. 13.8s

B. 18.3s

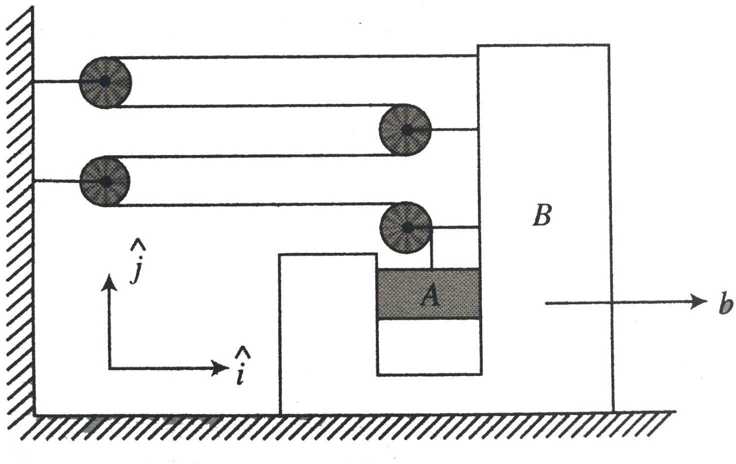
C. 3.18s

D. 31.8s

Answer: B

Watch Video Solution

19. If block B moves towards right with acceleration b, find the net acceleration of block A.



A. $b\hat{i} + 4b\hat{j}$

B. $b\hat{i} + b\hat{j}$

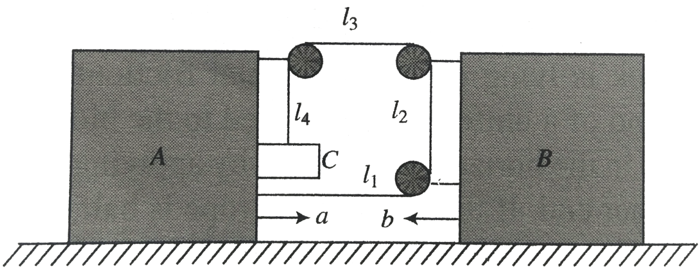
C. $b\hat{i} + 2b\hat{j}$

D. None of these

Answer: A

Watch Video Solution

20. If the blocks A and B are moving towards each other with accelerations a and b shown in fig. find the net acceleration of block C.



A. $a\hat{i} - 2(a+b)\hat{j}$

B. $-(a+b)\hat{j}$

C. $a\hat{i} - (a+b)\hat{j}$

D. None of these

Answer: A

Watch Video Solution

21. A small marble is projected with a velocity of $10 m / s$ in a direction 45° from the y-direction on the smooth inclined plane. Calculate the magnitude v of its velocity of after $2s$ (Take $g = 10 m / s^2$)

A. $10\sqrt{2} ms^{-1}$

B. $5 ms^{-1}$

C. $10 ms^{-1}$

D. $5\sqrt{2} ms^{-1}$

Answer: C

Watch Video Solution

22. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing on the ground are, respectively:

A. a,g

B. $(g-a), g$

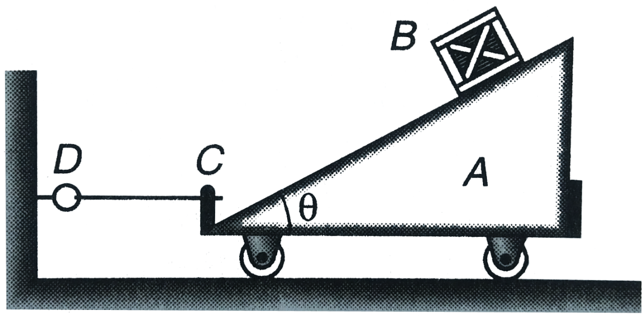
C. a,a

D. g,g

Answer: B

Watch Video Solution

23. Block B a mass m and is released from rest when it is no top of wedge A ,which has a mass $3m$. Determine the tension in cord CD while B is sliding down A . Neglect friction



A. $2mg\cos\theta$

B. $\frac{mg}{2}\cos\theta$

C. $\frac{mg}{2}\sin\theta$

D. $mg\sin 2\theta$

Answer: C

Watch Video Solution

24. A particle of mass 2kg moves with an initial velocity of $\overrightarrow{v} = 4\hat{i} + 4\hat{j} ms^{-1}$. A constant force of $\overrightarrow{F} = 20\hat{j}N$ is applied on the particle. Initially, the particle was at (0,0). The x-coordinates of the particle when its y-coordinates again becomes zero is given by

A. 1.2m

B. 4.8m

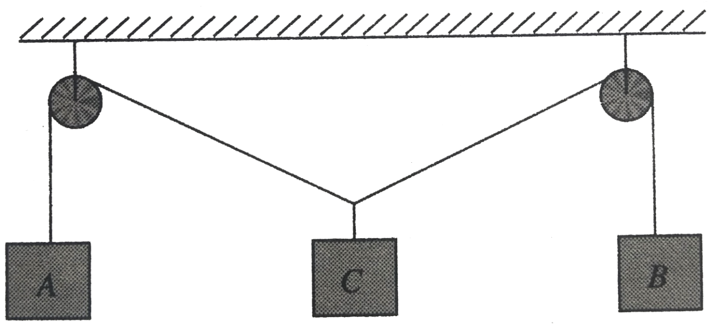
C. 6.0m

D. 3.2m

Answer: D

Watch Video Solution

25. Three blocks A,B, and C are suspended as shown in fig. Mass of each of blocks A and B is m. If the system is in equilibrium, and mass of C is M then



A. $M > 2m$

B. $M = 2m$

C. $M < 2m$

D. None of these

Answer: C

Watch Video Solution

26. 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. $4mg$

C. $2mg$

D. mg

Answer: B

Watch Video Solution

27. An object is suspended from a spring balance in a lift. The reading is 240 N when the lift is at rest. If the spring balance reading now change to 220N, then the lift is moving

A. Downward with constant speed

B. Downward with decreasing speed

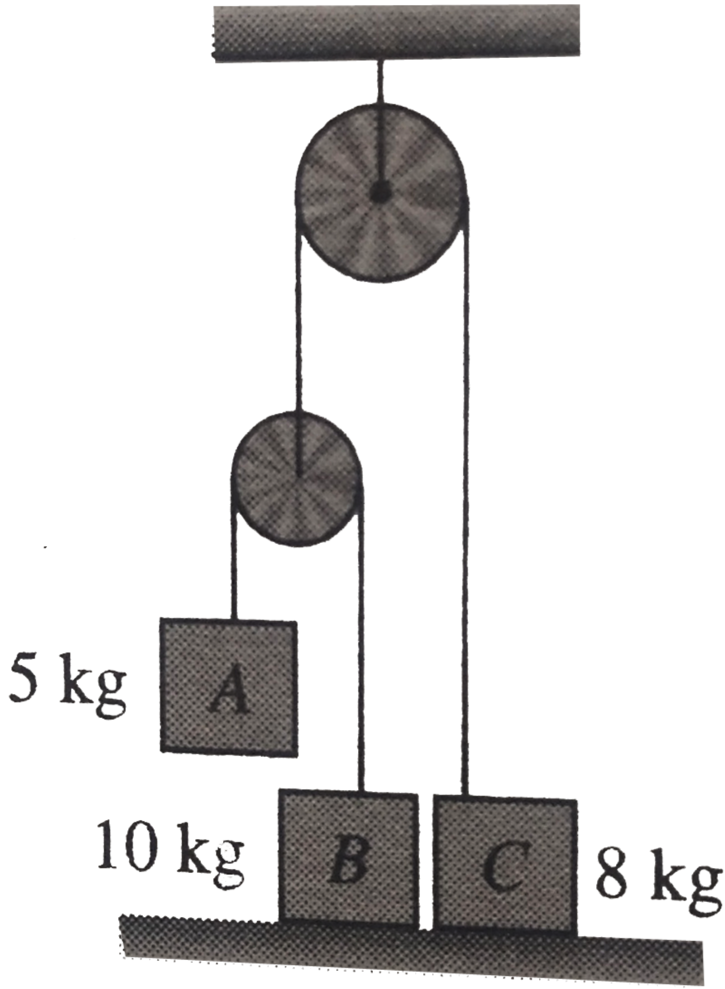
C. Downward with increasing speed

D. Upward with increasing speed

Answer: C

Watch Video Solution

28. In the following arrangement, the system is initially at rest. The 5-kg block is now released. Assuming the pulley and string to be massless and smooth, the acceleration of block C will be



A. zero

B. $2.5ms^{-2}$

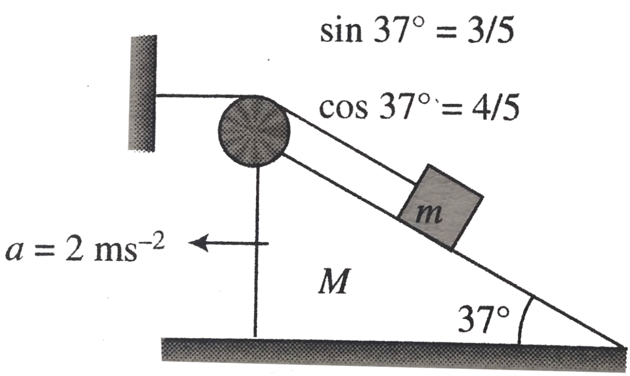
C. $10/7ms^{-2}$

D. $5/7ms^{-2}$

Answer: B

Watch Video Solution

29. As shown in fig, if acceleration of M with respect to ground is $2ms^{-2}$, then



A. Acceleration of m with respect to M is $5ms^{-2}$

B. Acceleration of m with respect to ground is $5ms^{-2}$

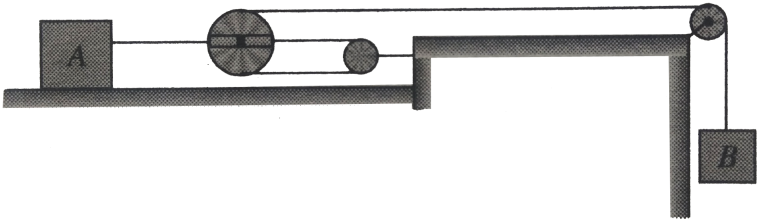
C. Acceleration of m with respect M is $2ms^{-2}$

D. Acceleration of m with respect to ground is $10ms^{-2}$

Answer: C

Watch Video Solution

30. A block A has a velocity of $0.6ms^{-1}$ the right. Determine the velocity of cylinder B.



A. $1.2ms^{-1}$

B. $2.4ms^{-1}$

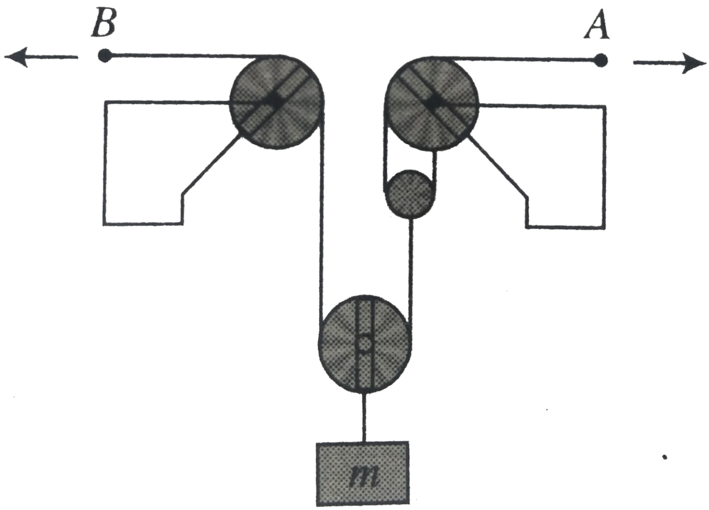
C. $1.8ms^{-1}$

D. $3.6ms^{-1}$

Answer: C

Watch Video Solution

31. For the pulley system shown in fig. each of the cables at A and B is given a velocity of $2ms^{-1}$ in the direction of the arrow. Determine the upward velocity v of the load m.



A. $1.5ms^{-1}$

B. $3ms^{-1}$

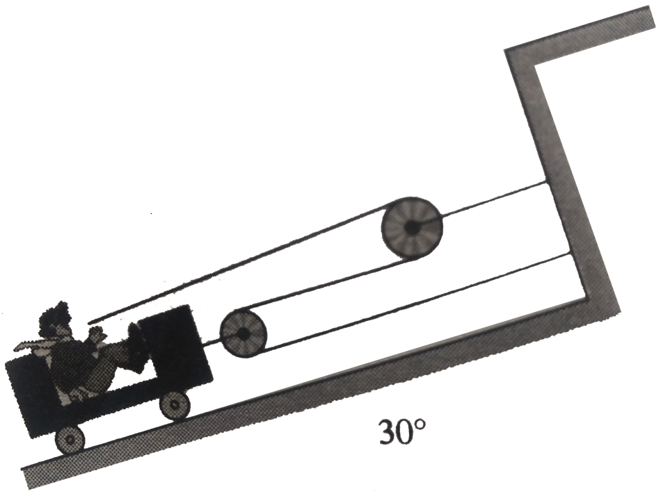
C. $6ms^{-1}$

D. $4.5ms^{-1}$

Answer: A

Watch Video Solution

32. A man pulls himself up the 30° incline by the method shown in fig. if the combined mass of the man and cart is 100kg, determine the acceleration of the cart if the man exerts a pull of 250N on the rope. Neglect all friction and the mass of rope , pulleys and wheels.



A. $4.5ms^{-2}$

B. $2.5ms^{-2}$

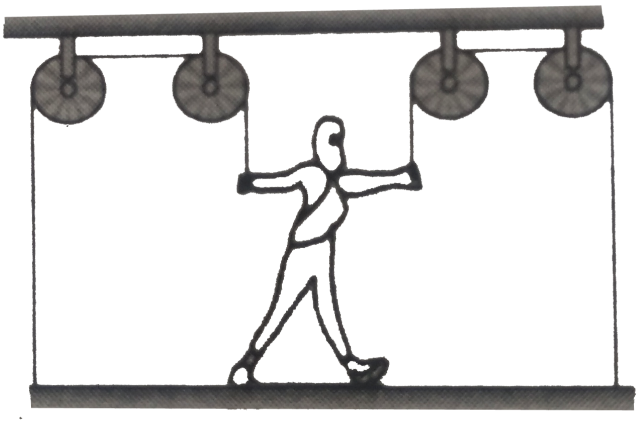
C. $3.5 ms^{-2}$

D. $1.5 ms^{-2}$

Answer: B

Watch Video Solution

33. A painter of mass M stands on a platfrom of mass m and pulls himself up by two ropes which hang over pulley as shown in fig. He pulls each rope with force F and moves upward with a uniform acceleration a. find a, neglecting the fact that no one could do this for long time.



A. $\frac{4F+(2M+m)g}{M+2m}$

B. $\frac{4F+(M+m)g}{M+2m}$

C. $\frac{4F-(M+m)g}{M+m}$

D. $\frac{4F-(M+m)g}{2M+m}$

Answer: C

Watch Video Solution

34. A block is lying on the horizontal frictionless surface. One end of a uniform rope is fixed to the block which is pulled in the horizontal direction by applying a force F at the other end. If the mass of the rope is half the mass of the block. The tension in the middle of the rope will be

A. F

B. $2F/3$

C. $3F/5$

D. $5F/6$

Answer: D

Watch Video Solution

35. A 60kg man stands on a spring scales in a lift. At some instant. He finds that the scale reading has changed from 60kg to 50 kg for a while and then comes back to original mark. What should be concluded?

A. The lift was in constant motion upward.

B. The lift was in constant motion downward.

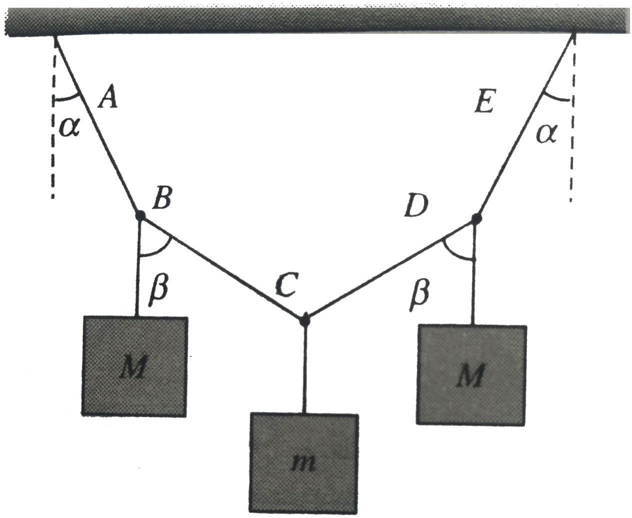
C. The lift while in motion downward suddenly stopped.

D. The lift while in motion upward suddenly stopped.

Answer: D

Watch Video Solution

36. Figure, represents a light inextensible string ABCDE in which $AB = BC = CD = DE$ and to which are attached masses M,m, and M at the point B,C and D, respectively. The system hangs freely in equilibrium with ends A and E of the string fixed in the same horizontal line. it is given that $\tan\alpha = 3/4$ and $\tan\beta = 12/5$. Then the tension in the string BC is



A. $2mg$

B. $(13/10)mg$

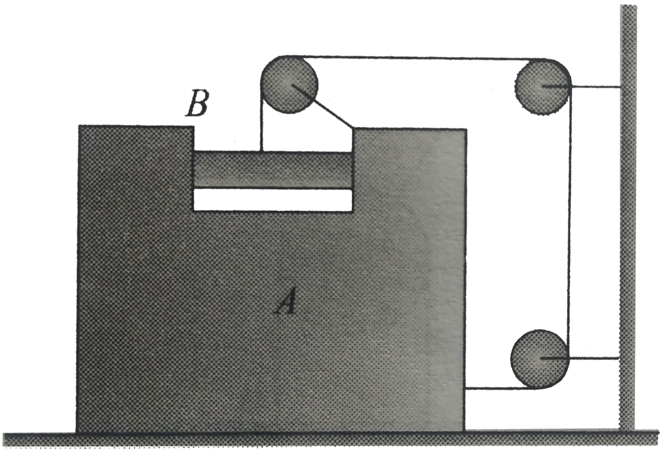
C. $(3/10)mg$

D. $(20/11)mg$

Answer: B

Watch Video Solution

37. If block A is moving with an acceleration of $5ms^{-2}$, the acceleration of B w.r.t. ground is



A. $5ms^{-2}$

B. $5\sqrt{2}ms^{-2}$

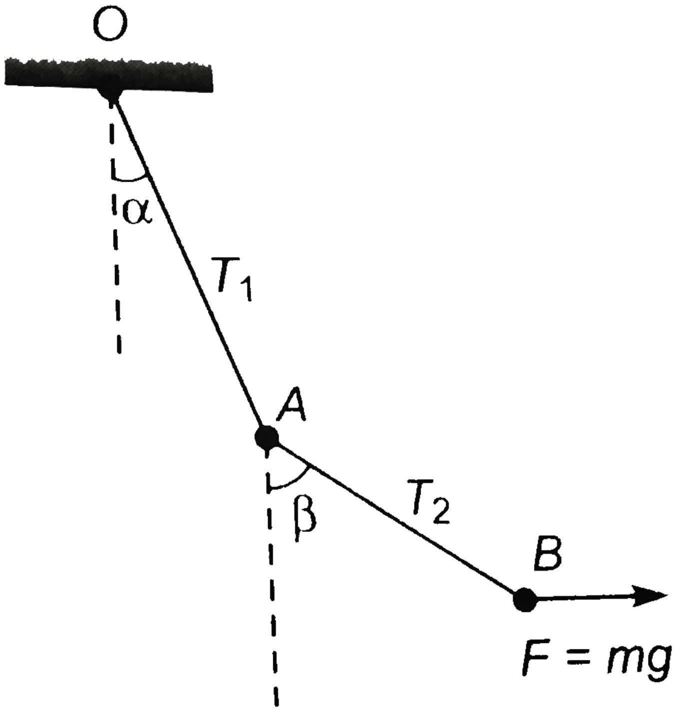
C. $5\sqrt{5}ms^{-2}$

D. $10ms^{-2}$

Answer: C

Watch Video Solution

38. Two particles A and B each of mass m are kept stationary by applying a horizontal force $F = mg$ on particle B as show in figure .Then



A. $2\tan\beta = \tan\alpha$

B. $2T_1 = 5T_2$

C. $T_1\sqrt{2} = T_2\sqrt{5}$

D. None of these

Answer: C

Watch Video Solution

39. A block of 5 kg is resting on a frictionaless plane. It is struck by a jet releasing water at a rate of $3kgs^{-1}$ at a speed of $4ms^{-1}$. Calculate the acceleration of the block.

A. $\frac{5}{3}ms^{-2}$

B. $\frac{25}{4}ms^{-2}$

C. $\frac{26}{6}ms^{-2}$

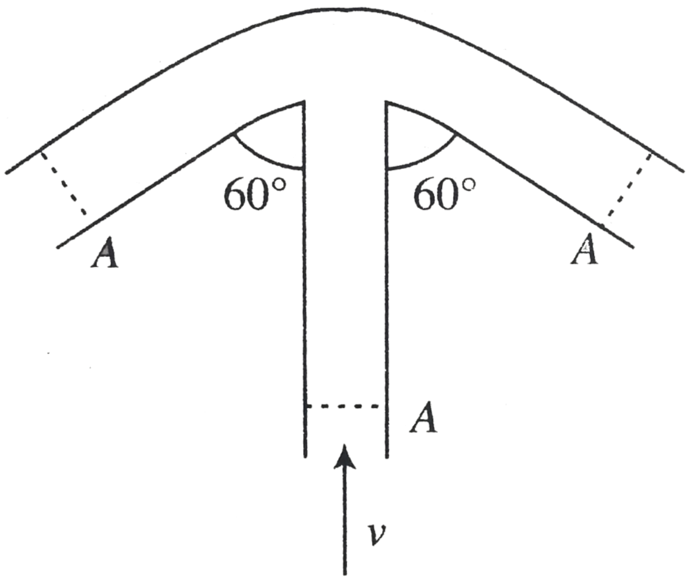
D. $\frac{5}{2}ms^{-2}$

Answer: D

Watch Video Solution

40. An ideal liquid of density ρ is pushed with velocity v through the central limb of the tube shown in fig. What force does the liquid exert on the tube? The cross sectional areas of the three limbs are equal to A each.

Assume stream-line flow.



A. $\frac{9}{8}\rho A v^2$

B. $\frac{5}{4}\rho A v^2$

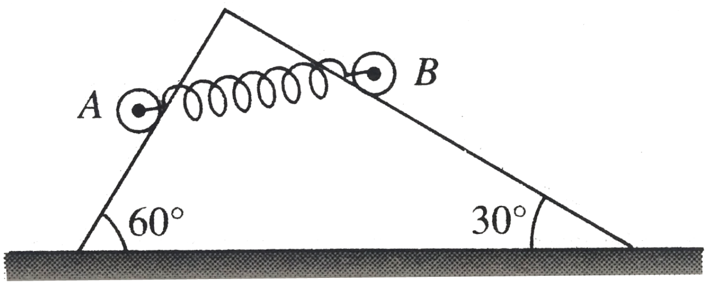
C. $\frac{3}{2}\rho A v^2$

D. $\rho A v^2$

Answer: B

Watch Video Solution

41. Two uniform solid cylinders A and B each of mass 1 kg are connected by a spring of constant $200Nm^{-1}$ at their axles and are placed on a fixed wedge as shown in fig.There is no friction between cylinders and wedge. The angle made by the line AB with the horizontal, in equilibirum is



A. 0°

B. 15°

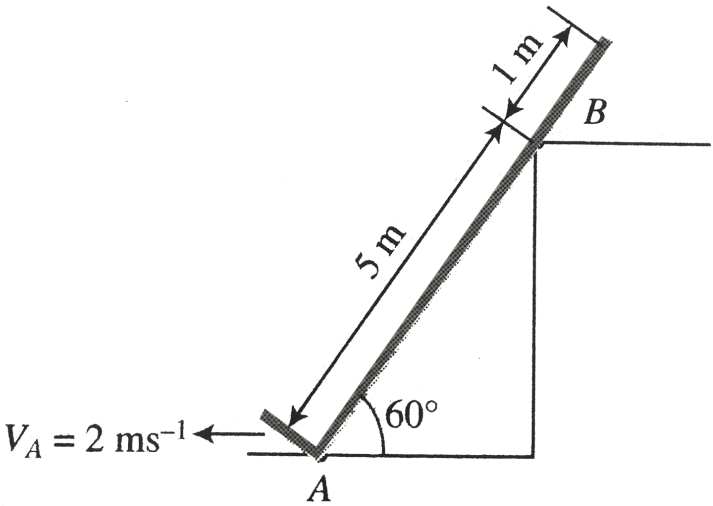
C. 30°

D. None of these

Answer: C

Watch Video Solution

42. The velocity of point A on the rod is $2ms^{-1}$ (leftwards) at the instant shown in fig. The velocity of the point B on the rod at this instant is



A. $\frac{2}{\sqrt{3}} ms^{-1}$

B. $1 ms^{-1}$

C. $\frac{1}{2\sqrt{3}} ms^{-1}$

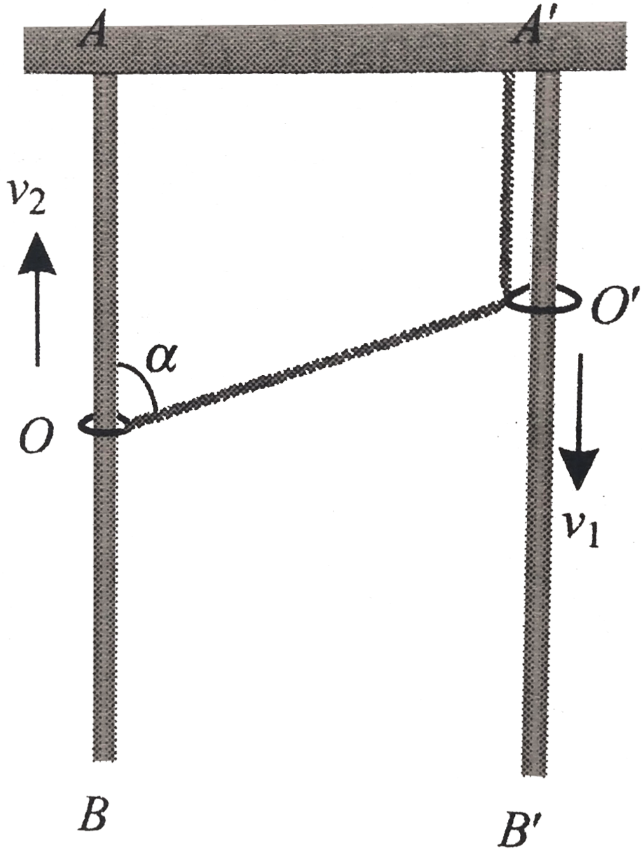
D. $\frac{\sqrt{3}}{2} ms^{-1}$

Answer: B

Watch Video Solution

43. Two small rings O and O' are put on two vertical stationary rods AB and A'B', respectively. One end of an inextensible thread is tied at point A'. The thread passes through ring O' and its other end is tied to ring O. Assuming that ring O' moves downwards at a constant velocity v_1, then velocity v_2 of the ring O, when

$\angle AOO' = \alpha$ is



A. $v_1 \left[\dfrac{2\sin^2 \alpha/2}{\cos\alpha} \right]$

B. $v_1 \left[\dfrac{2\sin^2 \alpha/2}{\sin\alpha} \right]$

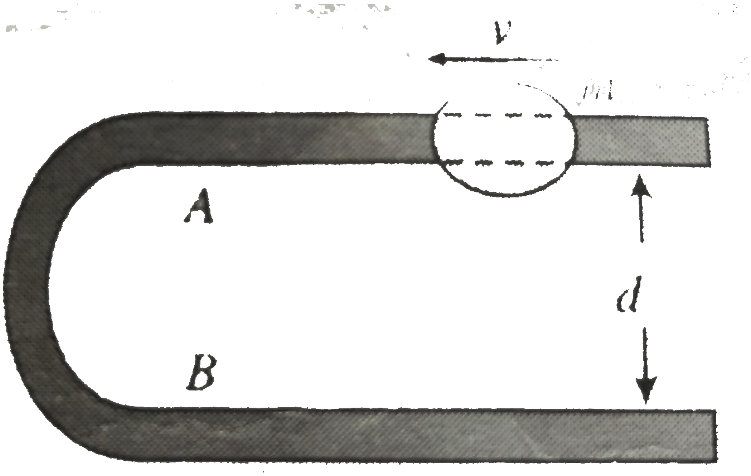
C. $v_1 \left[\dfrac{3\sin^2 \alpha/2}{\sin\alpha} \right]$

D. None of these

Answer: A

Watch Video Solution

44. A U-shaped smooth wire has a semi-circular bending between A and B as shown in fig. A bead of mass m moving with uniform speed v through the wire enters the semiculcular bent at A and leaves at B. Find the average force exerted by the bead on the part AB of the wire.



A. 0

B. $\dfrac{4mv^2}{\pi d}$

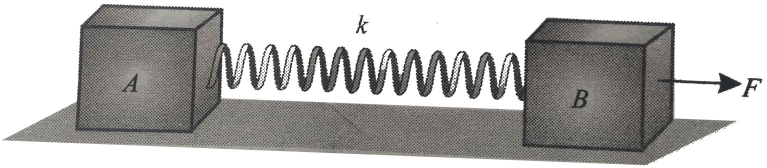
C. $\dfrac{2mv^2}{\pi d}$

D. None of these

Answer: B

Watch Video Solution

45. Two identicle particles A and B, each of mass m, are interconnected by a spring of stiffness k. If particle B experiences a forec F and the elongation of the spring is x, the acceleration of particle B relative to particle A is equal to



A. $\dfrac{F}{2m}$

B. $\dfrac{F - kx}{m}$

C. $\dfrac{F - 2kx}{m}$

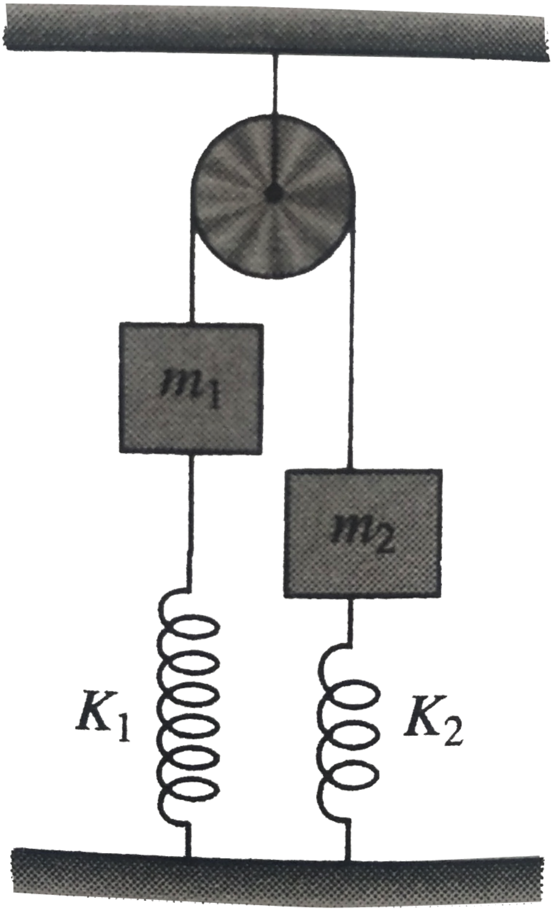
D. $\dfrac{kx}{m}$

Answer: C

Watch Video Solution

46. The system shown in fig is in equilibrium . Masses m_1 and m_2 are 2kg and 8kg, Respectively. Spring constants k_1 and k_2 ro $50Nm^{-1}$ and $70Nm^{-1}$, respectively. If the compression in second spring is 0.5m.

What is the compression in first spring?



A. 1.3m

B. $-0.5m$

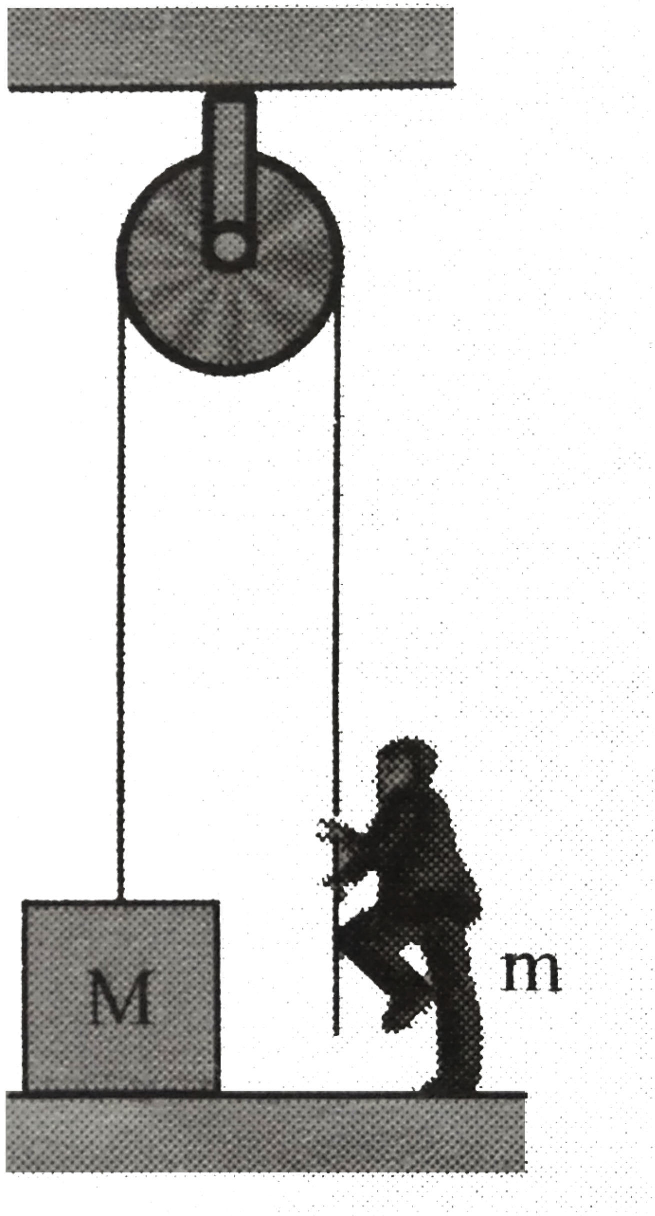
C. $0.5m$

D. $0.9m$

Answer: B

Watch Video Solution

47. In fig. the block of mass M is at rest on the floor . At what acceleration with which should a boy of mass m climb along the rope of negligible mass so as to lift the block from the floor?



A. $\left(\frac{M}{m}-1\right)g$

B. $\left(\frac{M}{m} - 1\right)g$

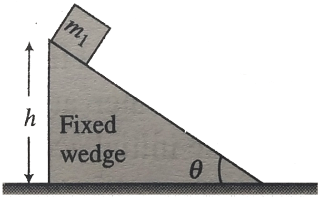
C. $\frac{M}{m}g$

D. $> \frac{M}{m}g$

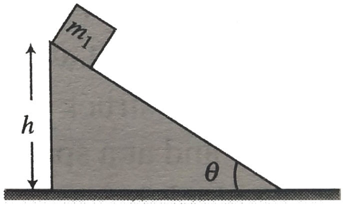
Answer: B

Watch Video Solution

48. A block of mass m_1 lies on the top of fixed wedge as shown in fig. and another block of mass m_2 lies on top of wedge which is free to move as shown in fig. At time t=0 both the blocks are released from rest from a vertical height h above the respective horizontal surface on which the wedge is placed as shown. There is no friction between block and wedge in both the figures. Let T_1 and T_2 be the time taken by the blocks respectively to just reach the horizontal surface. then



(a) Horizontal surface



(b) Smooth horizontal surface

A. $T_1 > T_2$

B. $T_1 < T_2$

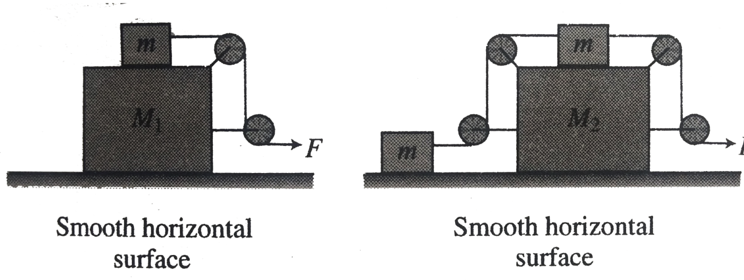
C. $T_1 = T_2$

D. Data insufficient

Answer: A

Watch Video Solution

49. In the situation shown in fig., all the strings are light and inextensible and pullies are light. There is no friction at any surface and all blocks are of cuboidal shape. A horizontal force of magnitude F si applied to right most free end of string in both cases shown in the figure. At the instant shown, the tension in all strings are non-zero. Let the magnitudes of acceleration of large blocks (of mass M) in fig. be a_1 and a_2 respectively. Then,



(a) (b)

A. $a_1 = a_2 \neq 0$

B. $a_1 = a_2 = 0$

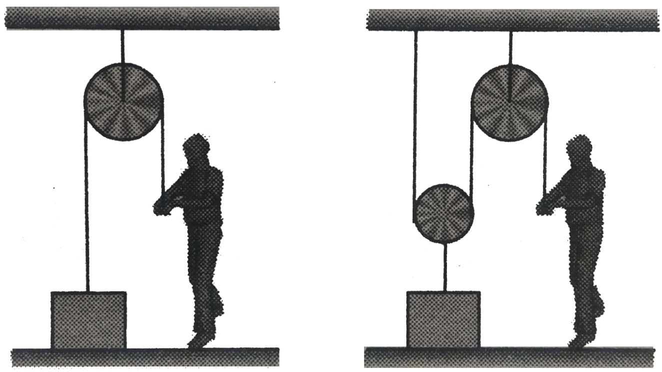
C. $a_1 > a_2$

D. $a_1 < a_2$

Answer: B

Watch Video Solution

50. In fig., a person wants to rise a block lying on the ground to a height h. In both the cases, if the time required is same, then in which case he has to exert more force? Assuem pulleys and strigns light.



A. (i)

B. (ii)

C. Same in both

D. Cannot be determined

Answer: A

Watch Video Solution

51. A wooden box is placed on a table. The normal force on the box from the table is N_1. Now another identical box is kept on first box and the normal force on lower block due to upper block is N_2 and normal force on lower block by the table is N_3. For this situtation, mark out the correct statement (s).

A. $N_1 = N_2 = N_3$

B. $N_1 < N_2 = N_3$

C. $N_1 = N_2 < N_3$

D. $N_1 = N_2 > N_3$

Answer: C

Watch Video Solution

52. In the arrangement shown in fig., if the acceleration of B is $\overrightarrow{a}$. Then find the acceleration of A.

A. A) $a \sin \alpha$

B. B) $a \cot \theta$

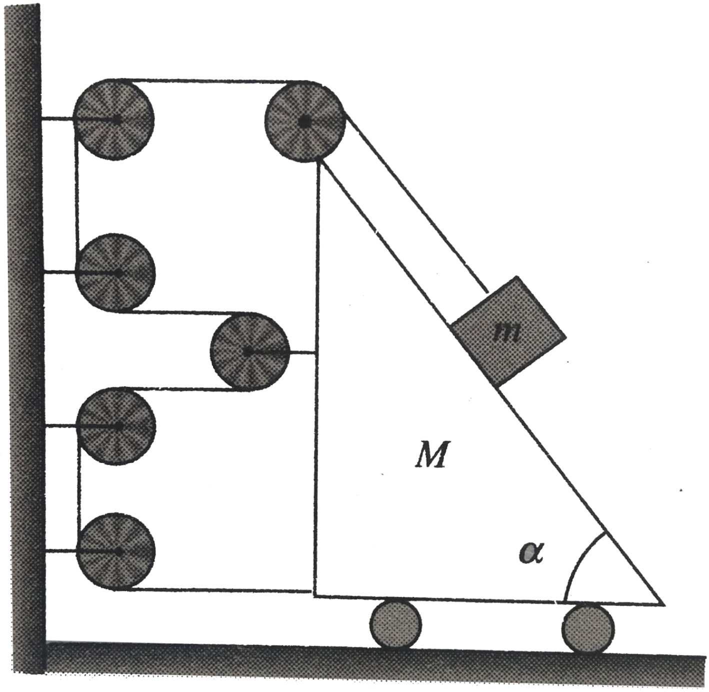
C. C) $a \tan \theta$

D. D) $a(\sin \alpha \cot \theta + \cos \alpha)$

Answer: D

Watch Video Solution

53. If the acceleration of wedge in the shown arrangement is a ms^{-2} towards left, then at this instant, acceleration of the block (magnitude only) would be



A. $4ams^{-2}$

B. $a\sqrt{17-8\cos\alpha}ms^{-2}$

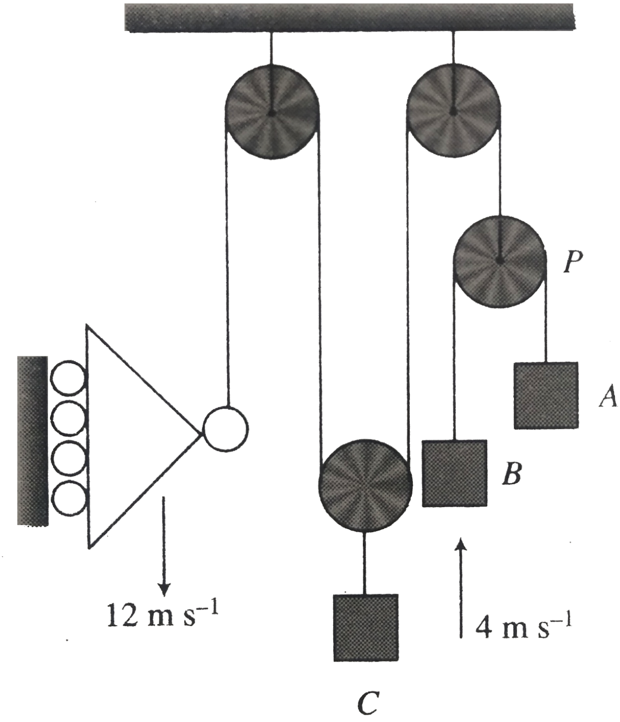
C. $(\sqrt{17})ams^{-2}$

D. $\sqrt{17}\cos.\frac{\alpha}{2}\times ams^{-2}$

Answer: B

Watch Video Solution

54. In the arrangement shown in fig., at a particular instant, the roller is coming down with a speed of $12ms^{-1}$ and C is moving up with $4ms^{-1}$. At the same instant, it is also known that w.r.t. pulley P, block A is moving down with speed $3ms^{-1}$. Determine the motion of block B (velocity) w.r.t. ground.



A. $4ms^{-1}$ in downward direction

B. $3ms^{-1}$ in upward direction

C. $7ms^{-1}$ in downward direction

D. $7ms^{-1}$ in upward direction

Answer: D

Watch Video Solution

55. A particle of mass 2kg moves with an initial velocity of $\overrightarrow{v} = 4\hat{i} + 4\hat{j}ms^{-1}$. A constant force of $\overrightarrow{F} = 20\hat{j}N$ is applied on the particle. Initially, the particle was at (0,0). The x-coordinates of the particle when its y-coordinates again becomes zero is given by

A. Possible value of x is only x=2m

B. Possible value of x is not only x=2m, but there exists some other value of x also

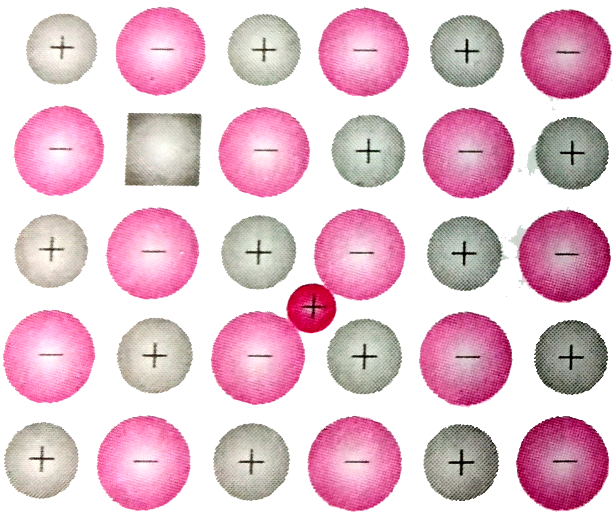
C. Time taken is 2s

D. All of the above

Answer: B

Watch Video Solution

56. Which is the defect represented by the given figure ?



A.

B.

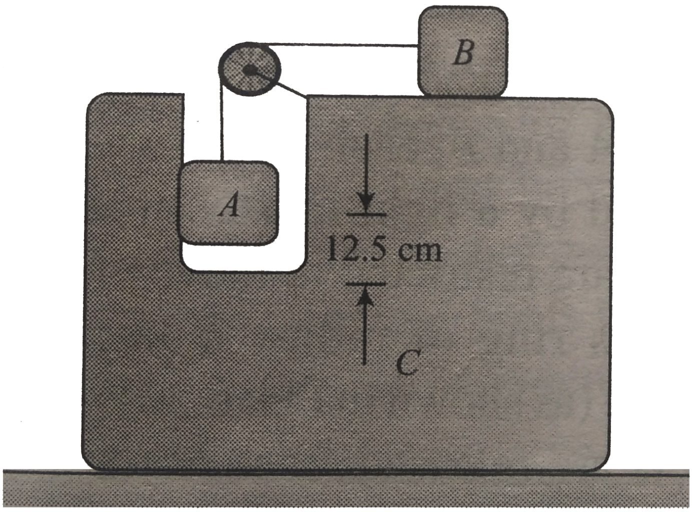
C.

D.

Answer: C

Watch Video Solution

57. A small, light pulley is attached with a block C of mass 4 kg as shown in fig. Block B of mass 1.5 kg is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction, calculate the acceleration of each block when the system is released from rest.



A. All the statement are correct.

B. Only I, II and IV are correct.

C. Only I,and II are correct.

D. Only II and IV are correct.

Answer: B

Watch Video Solution

58. A particle is moving in the x-y plane. At certain instant of time, the components of its velocity and acceleration are as follows: $v_x = 3ms^{-1}, v_y = 4ms^{-1}, a_x = 2ms^{-2}$ and $a_y = 1ms^{-2}$. The rate of change of speed at this moment is

A. $\sqrt{10}ms^{-2}$

B. $4ms^{-2}$

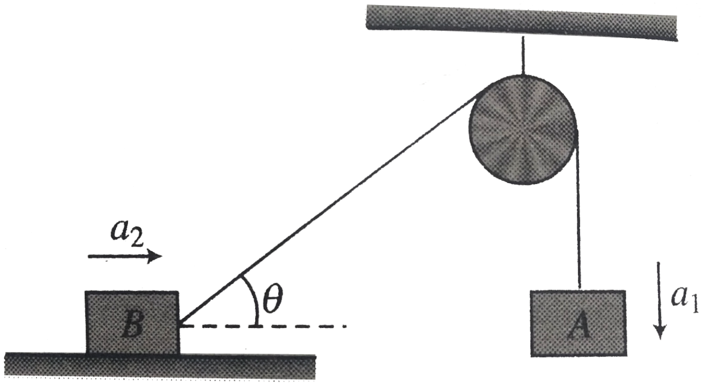
C. $\sqrt{5}ms^{-2}$

D. $2ms^{-2}$

Answer: D

Watch Video Solution

59. Figure shows two blocks each of mass m system is released from rest. If acceleration of blocks A and B at any instant (not initially) are a_1 and a_2, respectively. Then



A. $a_1 = a_2 \cos\theta$

B. $a_2 = a_1 \cos\theta$

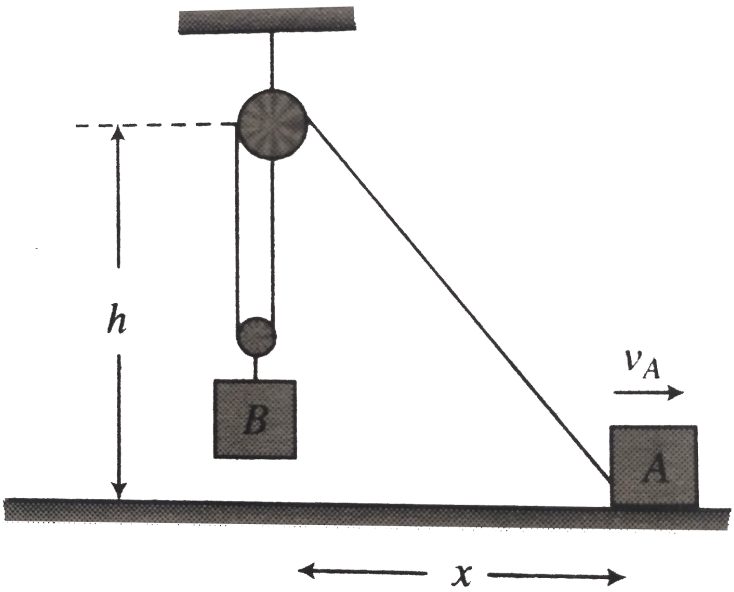
C. $a_1 = a_2$

D. None of these

Answer: D

Watch Video Solution

60. If block A is moving horizontally with velocity v_A, then find the velocity of block B at the instant as shown in fig.



A. $\dfrac{hv_A}{2\sqrt{x^2+h^2}}$

B. $\dfrac{xv_A}{\sqrt{x^2+h^2}}$

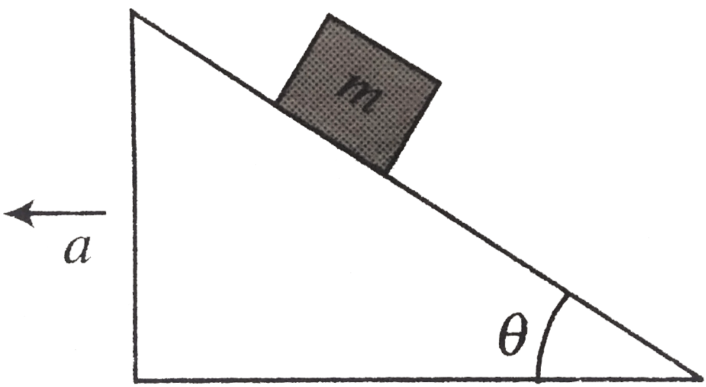
C. $\dfrac{xv_A}{2\sqrt{x^2+h^2}}$

D. $\frac{hv_A}{\sqrt{x^2 + h^2}}$

Answer: C

Watch Video Solution

61. A small block of mass m rests on a smooth wedge of angle θ. With what horizontal accelaration a should the wedge be pulled, as shown in fig, so that the block falls freely?



A. (a)$g \cos \theta$

B. (b) $g \sin \theta$

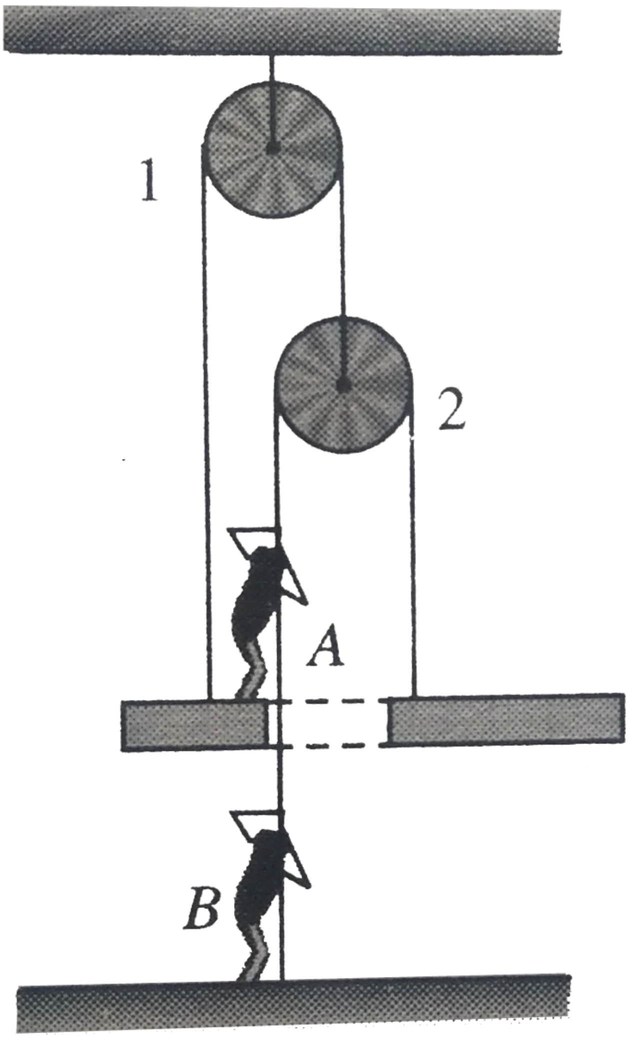
C. (c) $g \cot \theta$

D. (d) $g \tan \theta$

Answer: C

Watch Video Solution

62. In fig. man A is standing on a movable plank while man B is standing on a stationary platform. Both are pulling the string down such that the plank moves slowly up. As a result of this the string slops through the hands of the men, find the ratio of length of the string that slips through the hands of A and B.



A. $3/2$

B. $3/4$

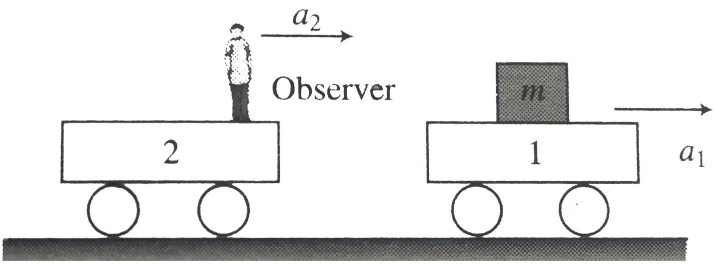
C. $4/3$

D. $2/3$

Answer: C

Watch Video Solution

63. Two trolley 1 and 2 are moving with acceleration a_1 and a_2 respectively, in the same direction. A block of mass m on trolley 1 is in equilibrium from the frame of observer stationary with respect to trolley 2. the magnitude of friction force on block due to trolley is (assume taht no horizontal force other than friction force is acting on block).



A. $m(a_1 - a_2)$

B. ma_2

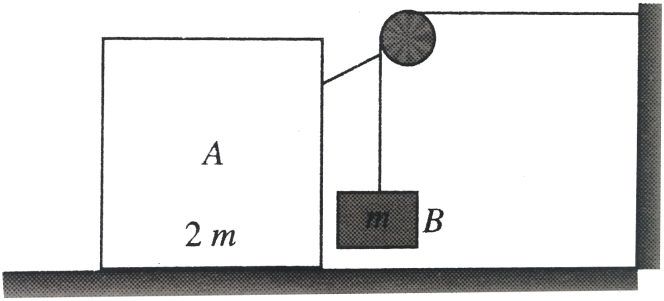
C. ma_1

D. Data insufficient

Answer: B

Watch Video Solution

64. In the system shown all the surfaces are frictionless while pulley and string are massless. The mass of block A is 2m and that of block B is m. The acceleration of block B immediately after system is released from rest is



A. $g/2$

B. g

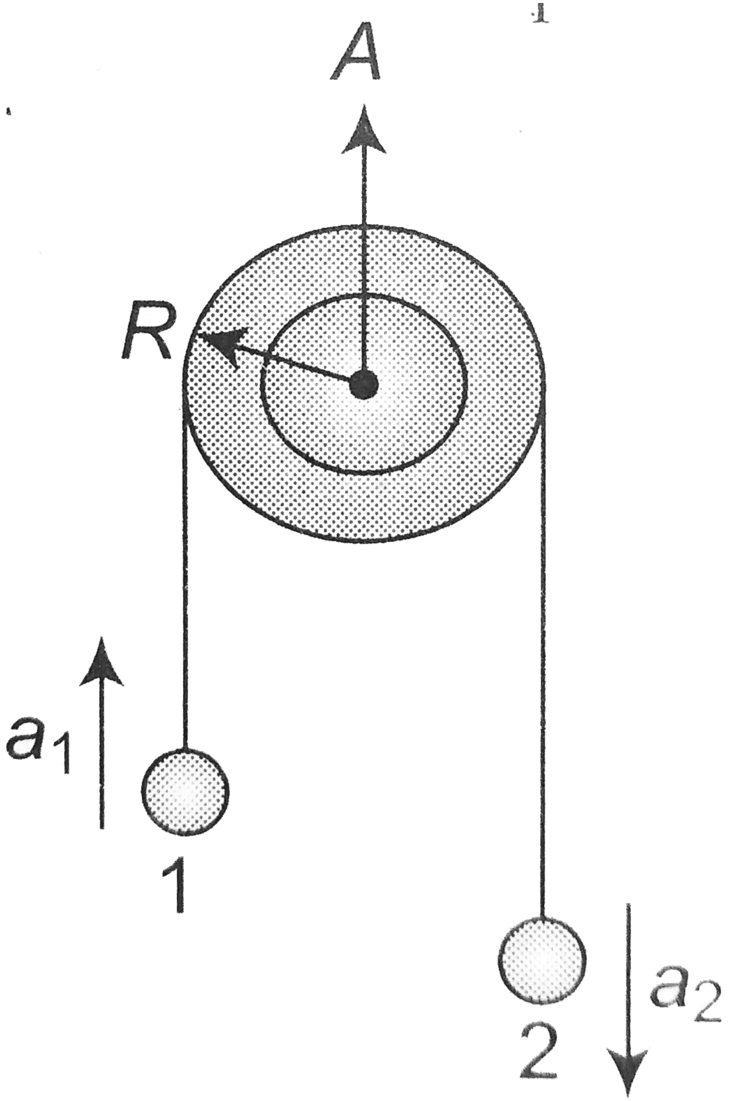
C. $g/3$

D. None of these

Answer: C

Watch Video Solution

65. Two masses are connected by a string which passes over a pulley acceleration upward at a rate A shown. If a_1 and a_2 be the accelerations of bodies 1 and 2 respectively then,



A. Relation (ii) and (iii) always follow.

B. Relations (ii) and (iv) always follow.

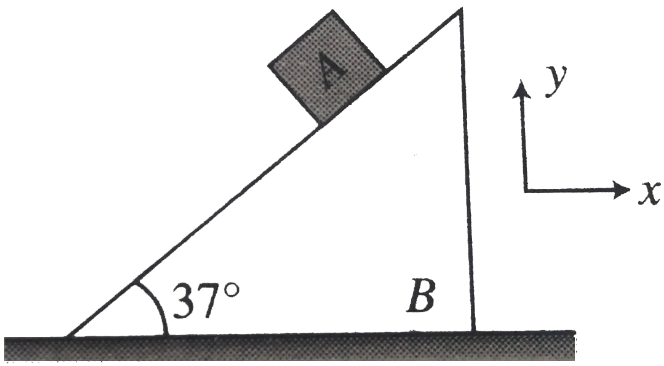
C. Only relation (i) always follows.

D. Only relation (iv) always follows.

Answer: D

Watch Video Solution

66. In fig, the acceleration of A is $\vec{a}_A = 15\hat{i} + 15\hat{j}$. Then the acceleration of B is (A remains in constact with B)



A. $6\hat{i}$

B. $-15\hat{i}$

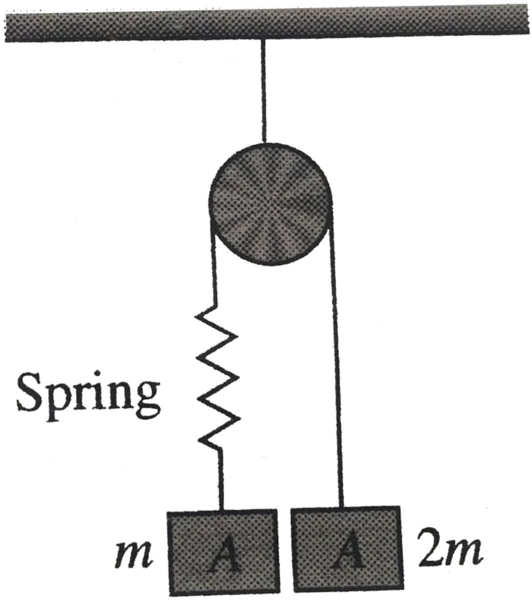
C. $-10\hat{i}$

D. $-5\hat{i}$

Answer: D

Watch Video Solution

67. Two blocks A and B of masses m and 2m, respectively , are held at rest such that the spring is in natural length. Find out the acceleration of both the blocks just after relese.



A. a. $g \downarrow , g \downarrow$

B. b. $\frac{g}{3} \downarrow , \frac{g}{3} \uparrow$

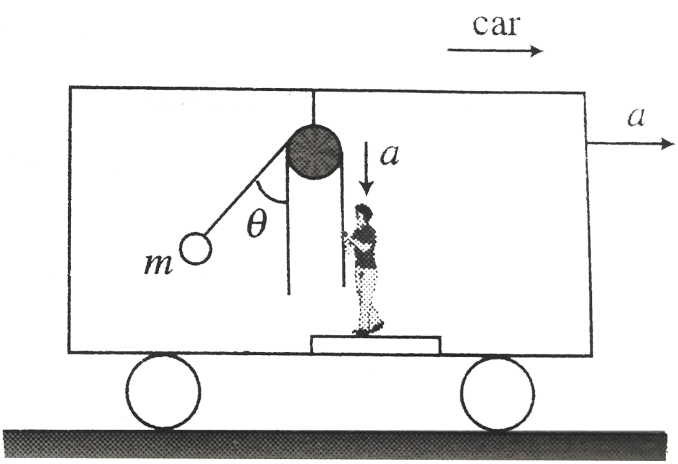
C. c. 0,0

D. d. $g \downarrow , c$

Answer: A

Watch Video Solution

68. A bob is hanging over a pulley inside a car through a string. The second end of the string is in the hands of a person standing in the car. The car is moving with constant acceleration a directed horizontally as shown in fig. The other end of the string is pulled with constant acceleration a vertically. The tension in the string is equal to



A. a. $m\sqrt{g^2+a^2}$

B. a. $m\sqrt{g^2+a^2}-ma$

C. c. $m\sqrt{g^2+a^2}+ma$

D. d. $m(g+a)$

Answer: C

Watch Video Solution

69. Inside a horizontal moving box, an experimenter finds that when an object is placed on a smooth horizontal table and is released, it moves with an acceleration of $10ms^{-2}$, in this box. If 1-kg body is suspended with a light string. The tension in the string in equilibrium position. (w.r.t. experimenter) will be (take $g = 10ms^{-2}$)

A. $10ms^{-2}$

B. $10\sqrt{2}ms^{-2}$

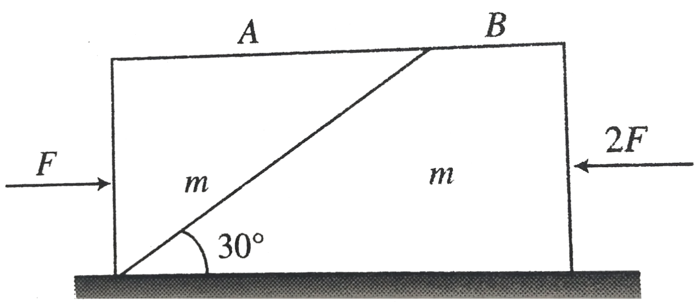
C. $20ms^{-2}$

D. Zero

Answer: B

Watch Video Solution

70. Two blocks A and B each of mass m are placed on a smooth horizontal surface. Two horizontal force F and 2F are applied on blocks A and B, respectively, as shown in fig. Block A does not slide on block B. Then then the normal reaction acting between the two blocks is (assume no friction between the blocks)



A. F

B. $F/2$

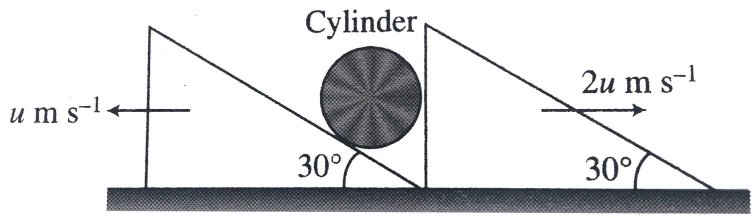
C. $\frac{F}{\sqrt{3}}$

D. $3F$

Answer: D

Watch Video Solution

71. A system is shown in fig. Assume that the cylinder remains in contact with the two wedge. Then the velocity of cylinder is



A. $\sqrt{19-4\sqrt{3}}ms^{-1}$

B. $\frac{\sqrt{13}u}{2}ms^{-1}$

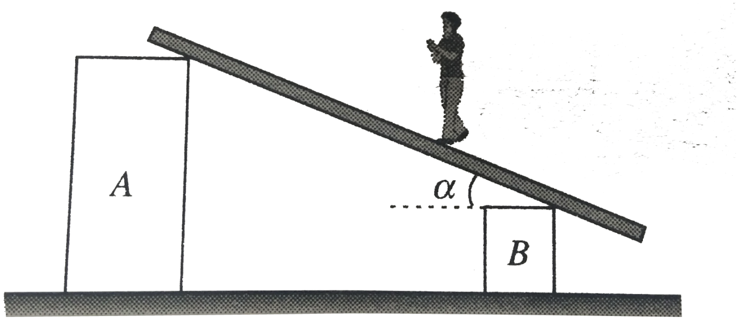
C. $\sqrt{3}ums^{-1}$

D. $\sqrt{7}ms^{-1}$

Answer: D

Watch Video Solution

72. A plank is held at an angle α to the horizontal on two fixed supports A and B. The plank can slide against the supports (without friction) because of the weight Mg $\sin\alpha$. The acceleration and direction in which a man of mass m should move so that the plank does not move are



A. a. $g\sin\alpha\left(1+\frac{m}{M}\right)$ down the incline

B. b. $g\sin\alpha\left(1+\frac{M}{m}\right)$ down the incline

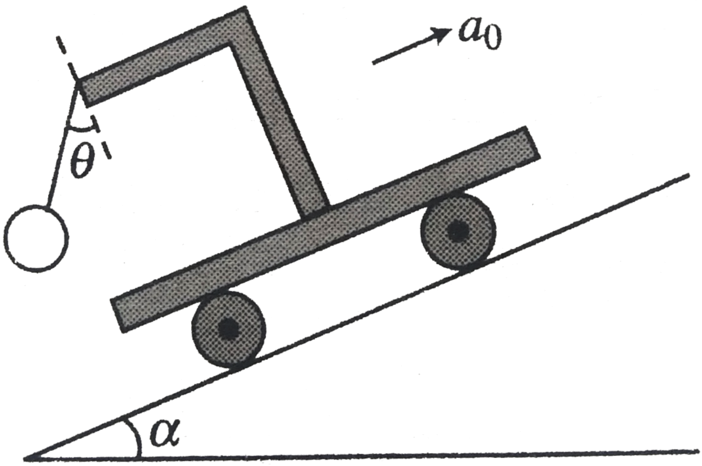
C. c. $g\sin\alpha\left(1+\frac{m}{M}\right)$ up the incline

D. d. $g\sin\alpha\left(1+\frac{M}{m}\right)$ up the incline

Answer: B

Watch Video Solution

73. A pendulum of mass m hangs from a support fixed to a trolley. The direction of the string when the trolley rolls up a plane of inclination α with acceleration a_0 is



A. $\theta = \tan^{-1}\alpha$

B. $\theta = \tan^{1}\left(\frac{a_0}{g}\right)$

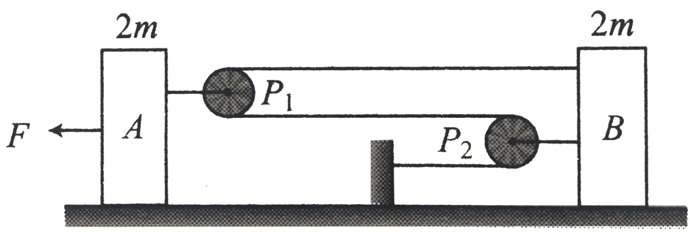
C. $\theta = \tan^{1}\left(\frac{g}{a_0}\right)$

D. $\theta = \tan^{1}\left(\frac{a_0 + g\sin\alpha}{g\cos\alpha}\right)$

Answer: D

Watch Video Solution

74. The acceleration of the block B in fig. Assuming the surfaces and the pulley P_1 and P_2 are all smooth, is



A. $\dfrac{F}{4m}$

B. $\dfrac{3F}{13m}$

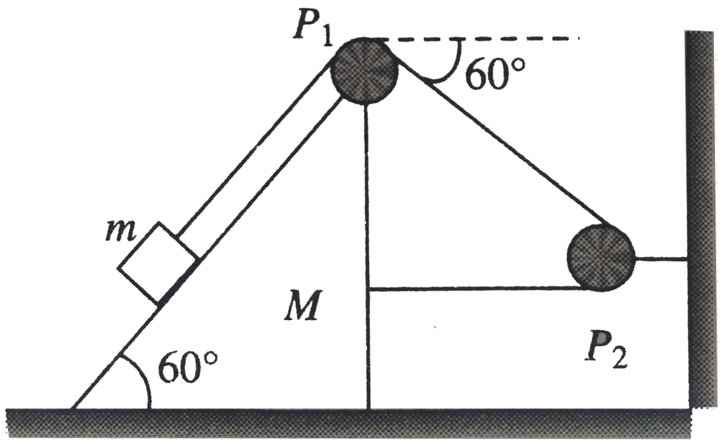
C. $\dfrac{F}{2m}$

D. $\dfrac{3F}{17m}$

Answer: B

Watch Video Solution

75. In the arrangement shown in fig. the block of mass $m = 2kg$ lies on the wedge of mass $M = 8kg$. The initial acceleration of the wedge, if the surfaces are smooth, is



A. $\frac{\sqrt{3}g}{23} ms^{-2}$

B. $\frac{3\sqrt{3}g}{23} ms^{-2}$

C. $\frac{3g}{23} ms^{-2}$

D. $\frac{g}{23} ms^{-2}$

Answer: B

Watch Video Solution

Multiple Correct

1. A block of mass $m = 10kg$ is suspended with the help of three strings as shown in fig. Find the tensions T_1 and T_2.

A. $T_1 = 25N$

B. $T_2 = 25N$

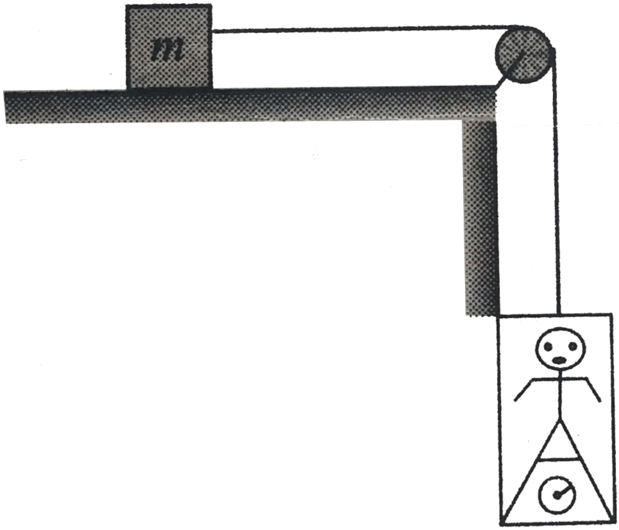
C. $T_1 = 25\sqrt{3}N$

D. $T_2 = 25\sqrt{3}N$

Answer: A::D

Watch Video Solution

2. 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. The measured mass of man is $\frac{Mm}{(M+m)}$

B. The acceleration of man is $\frac{mg}{(M+m)}$.

C. The acceleration of man is $\frac{Mg}{(M+m)}$.

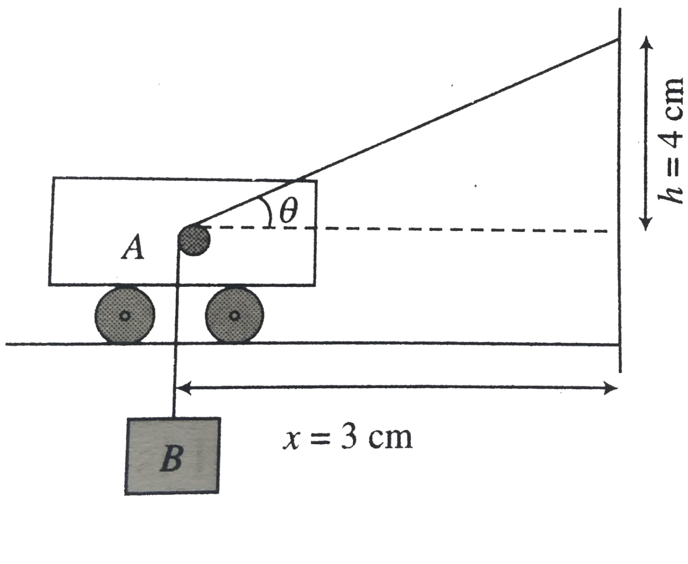
D. The measured mass of man is M

Answer: A::C

Watch Video Solution

3. Choose the correct option:

The string in fig. is passing over small smooth pulley rigidly attached to trolley A. If the speed of trolley is constant and equal to v_A towards right, speed of block B at the instant shown in figure are



A. $v_B = v_A$, $a_B = 0$

B. $a_B = 0$

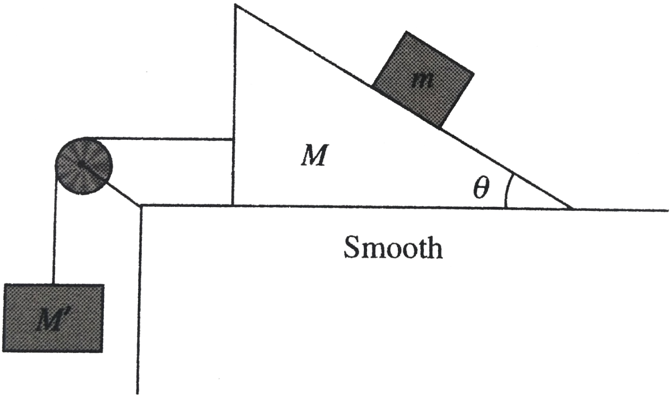
C. $v_B = \frac{3}{5} v_A$

D. $a_B = \frac{16 v_A^2}{125}$

Answer: C::D

Watch Video Solution

4. 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 of M' is $\dfrac{M\cot\theta}{1-\cot\theta}$

B. The value of M' is $\dfrac{M\tan\theta}{1-\tan\theta}$

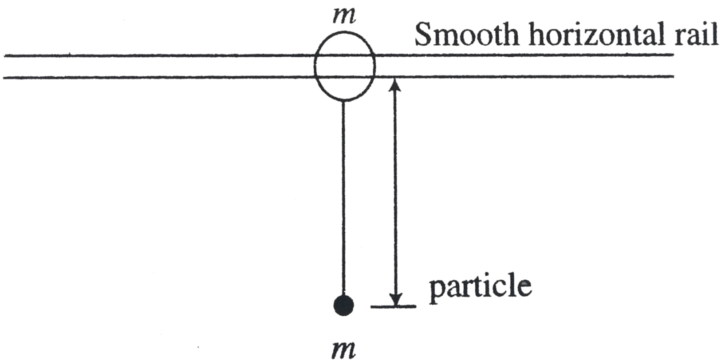
C. The value of tension in the string is $\dfrac{Mg}{\tan\theta}$

D. The value of tension is $\dfrac{Mg}{\cot\theta}$

Answer: A::C

Watch Video Solution

5. The ring shown in fig. is given a constant horizontal acceleration $\left(a_0 = \frac{g}{\sqrt{3}}\right)$. The maximum deflection of the string from the vertical is θ_0. Then



A. a. $\theta_0 = 30^\circ$

B. b. $\theta_0 = 60^\circ$

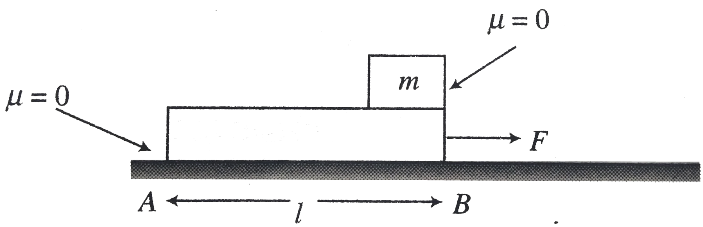
C. c. At maximum deflection, tension in string is equal to mg.

D. d. At maximum deflection, tension in string is equal to $\frac{2mg}{\sqrt{3}}$

Answer: A::D

Watch Video Solution

6. In fig. a small block is kept on m. then



A. a. The acceleration of m w.r.t. ground is F/m.

B. b. The acceleration of m w.r.t ground is zero.

C. c. The time taken by m to separted from M is

$$\sqrt{\frac{2lm}{F}}.$$

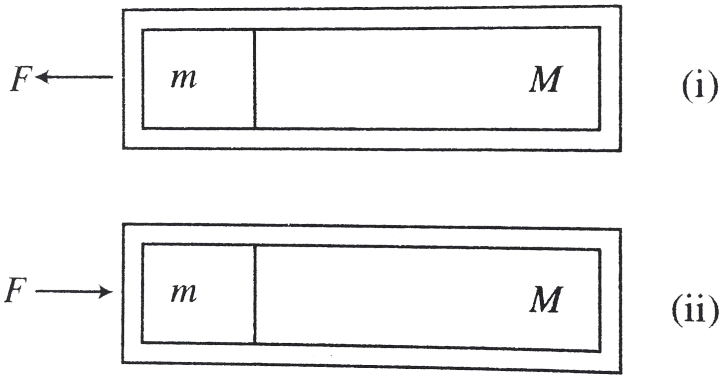
D. d. The time taken by m to separted from M is

$$\sqrt{\frac{2lM}{F}}.$$

Answer: B::D

Watch Video Solution

7. A block of mass m is placed in contact with one end of a smooth tube of mass M. A horizontal force F acts on the tube in each case (i) and (ii). Then,



A. a. $a_m = 0$ and $a_M = \frac{F}{M}$ in (i)

B. b. $a_m = a_M = \frac{F}{M+m}$ in (i)

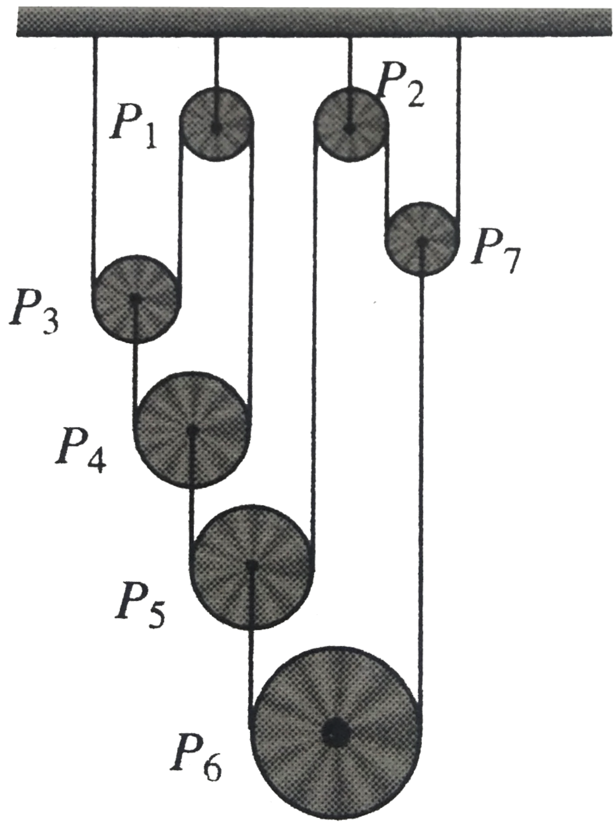
C. c. $a_m = a_M = \frac{F}{M+m}$ in (ii)

D. d. Force on m is `(mF)/(M+m) in (ii)

Answer: A::C::D

Watch Video Solution

8. Seven pulleys are connected with the help of three light string as shown in fig.Consider P_3, P_4, P_5 as light pulleys and pulleys P_6 and P_7 have masses m each. For this arrangement, mark the correct statement(s)



A. Tension in the string connecting P_1, P_3 and P_4 is zero.

B. Tension in the string connecting P_1, P_3 and P_4 is $mg/3$

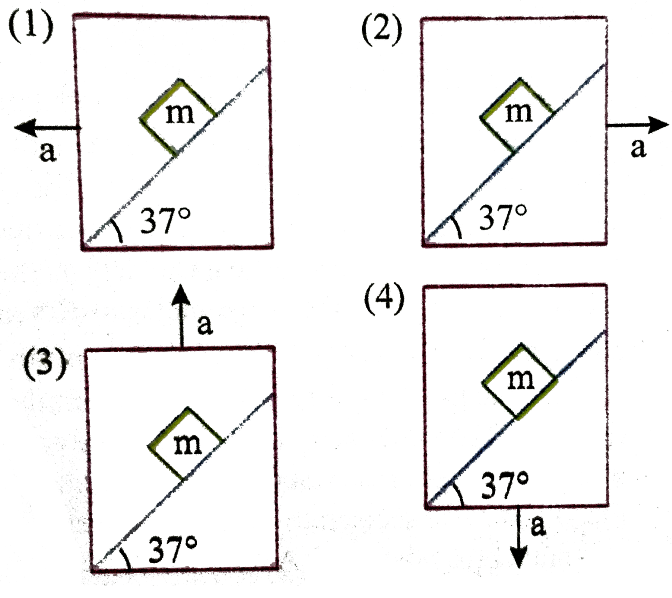
C. Tension in all the three strings are same and equal to zero.

D. Acceleration of P_6 is g downwards and that of P_7 is g upwards.

Answer: A::C

Watch Video Solution

9. A block of mass m is placed on a wedge The wedge can be accelerated in four manners marked as $(1), (2), (3)$ and (4) as shown. If the normal reactions in situation $(1), (2), (3)$ and (4) are N_1, N_2, N_3 and N_4 respectively and acceleration with which the block slides on the wedge in situation are b_1, b_2, b_3 and b_4 respectively then



A. $N_3 > N_1 > N_2 > N_4$

B. $N_4 > N_3 > N_1 > N_2$

C. $b_2 > b_3 > b_4 > b_1$

D. $b_2 > b_3 > b_1 > b_4$

Answer: A::C

Watch Video Solution

10. Two frame S_1 and S_2 are non-inertial. Then frame S_2 when observed from S_1 is inertial.

A frame in motion is not necessarily a non-inertial frame

A. The relative acceleration of the frame may either be zero or $4ms^{-2}$

B. Their relative acceleration may have any value between 0 and $4ms^{-2}$.

C. Both the frames may be stationary with respect to earth.

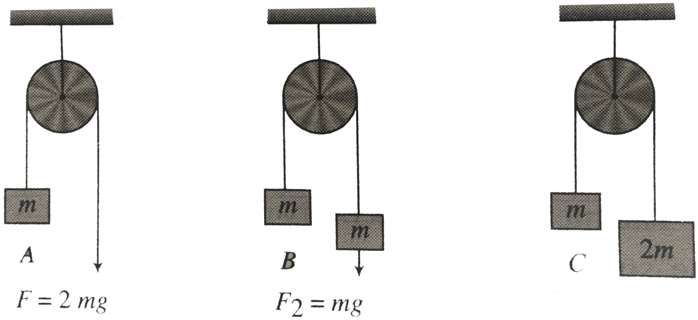
D. The frames may be moving with same acceleration in same direction.

Answer: B::C::D

Watch Video Solution

11. In fig the blocks A,B,and C of mass m each have acceleration $a_1, a_2,$ and a_3, repectively. F_1 and F_2 are external force of magnitude $2mg$ and mg, respectively.

Then



A. $a_1 \neq a_2 \neq a_3$

B. $a_1 = a_2 \neq a_3$

C. $a_1 > a_2 > a_3$

D. $a_1 \neq a_2 = a_3$

Answer: A::C

Watch Video Solution

Assertion-reasoning

1. Statement I: The driver of a moving car sees a wall in front of him. To avoid collision, he should apply brakes rather than taking a turn away from the wall.

Statement II: Frictional force is needed to stop the car or taking a turn on a horizontal road.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: B

Watch Video Solution

2. Statement I: A block of mass m is placed on a smooth inclined plane of inclinaton θ with the horizontal. The force exerted by the plane on the block has a magnitude $mg \cos \theta$.

Statement II: Normal reaction always acts perpendicular to the contact surface.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

3. Statement I: A particle is found to be a rest when seen from a frame S_1 and moving with a constant velocity when seen from another frame S_2. We can say both the frames are inertial.

Statement II: All frames moving uniformly with respect to an inertial frame are themselves inertial.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: B

Watch Video Solution

4. Statement I: The coefficient of friction can be greater than unity.

Statement II: The force of friction is dependent on normal reaction and the ration of force of friction and normal reaction cannot exceed unity.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.
B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I
C. Statement I is True, Statement II is False.
D. Statement I is False, Statement II is true

Answer: C

Watch Video Solution

5. Statement I: In high jump, it hurts less when an athlete lands on a heap of sand.

Statement II: Because of greater distance and hence greater time over which the motion of an athlete is stopped, the athlete experieces less force when lands on the heap of sand.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

6. Statement I: A body in equilibrium has to be at reat only.

Statement II: A body in equilibrium may be moving with a constant speed along a straight line path.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

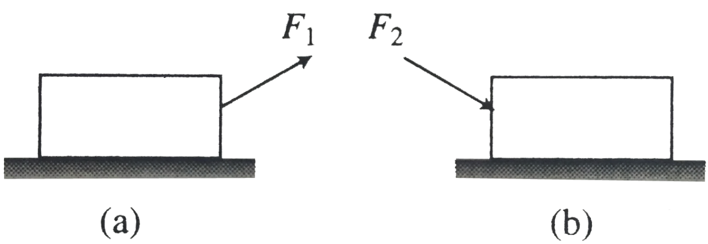
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

7. Statement I: Pulling is easier than pushing on a rough surface.



Statement II: Normal reaction is less in pulling than in pushing.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

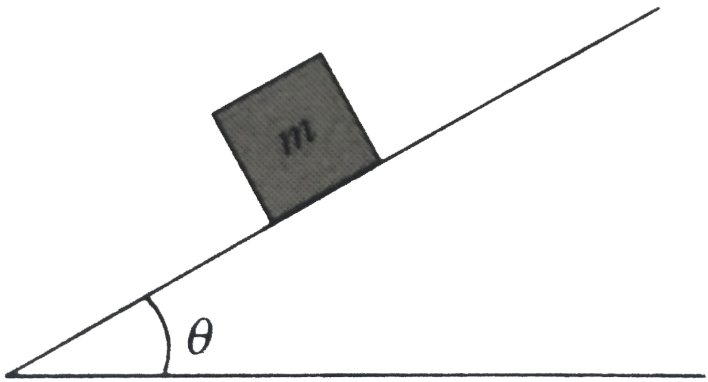
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

8. Statement I: A block is lying stationary as on inclined plane and coefficient of friction is μ. Friction on block is $\mu mg \cos\theta$.



Statement II: Contact force on block is mg.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: D

Watch Video Solution

9. Statement I: Two particle are moving towards each other due to mutual gravitational attraction. The momentum of each particle will increase.

Statement II: The rate of change of momentum depends upon F_{ext}.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

10. Statement I: A concept of pseudo force is valid both for inertial as well as non-inertial frame of reference.

Statement II: A frame accelerated with respect to an inertial frame is a non-inertial frame.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

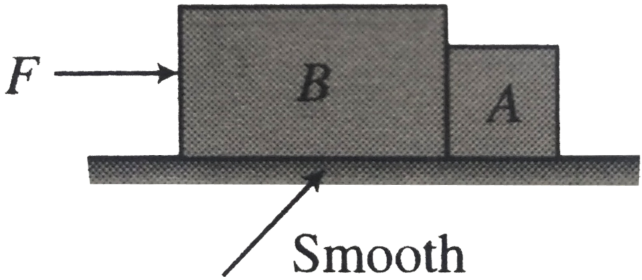
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: D

Watch Video Solution

11. Statement I: In fig., ground is smooth and masses of both the block are differents. The net force acting on each of the block is not same.



Statement II: Acceleration of both will be different.

A. a. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. b. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. c. Statement I is True, Statement II is False.

D. d. Statement I is False, Statement II is true

Answer: C

Watch Video Solution

12. Statement I: The greater the rate of the change in the momentum vector, the greater the force applied.

Statement II: Newton's second law is $\overrightarrow{F} = \frac{d\overrightarrow{p}}{dt}$.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

13. Statement I: Frictional heat generated by the moving ski is the chief factor which promotes sliding in skiing while waxing the ski makes skiing more easy.

Statement II: Due to friction, energy dissipates in the form of heat. As a result, it melts the snow below it. Wax is water repellent.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: A

Watch Video Solution

14. A relerence frame atteched to the Earth

A. (a). Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

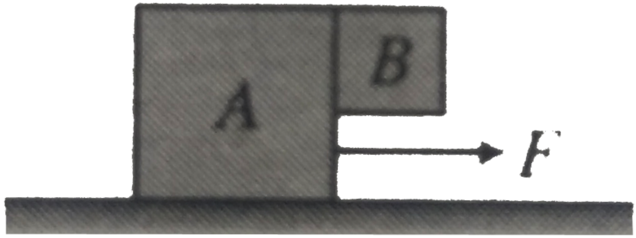
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is true

Answer: D

Watch Video Solution

15. Statement I: Block A is moving on the horizontal surface towards right under action of force F. All surfaces are smooth. At the instant shown the force exerted by block A on block B is equal to net force on block B.



Statement II: From Newton's third law, the force exerted by block A on B is equal in magnitude to force exerted by block B on A.

A. Statement I is true, statement II is true, Statement II is the correct explanation for statement I.

B. Statemet I is true, Statement II is true , Statement II is NOT the correct explanation for Statement I

C. Statement I is True, Statement II is False.

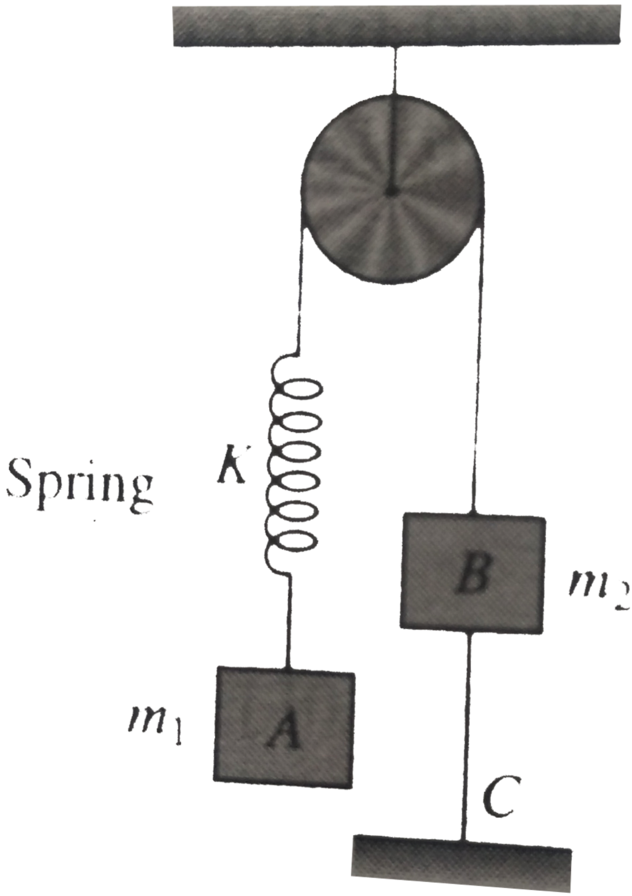
D. Statement I is False, Statement II is true

Answer: D

Watch Video Solution

Linked Comperhension

1. In the system shown in fig. $m_1 > m_2$. The system is held at rest by thread BC. Now thread BC is burnt. Answer the following:



Before burnig the thread, what are the tensions in spring and thread BC, respectively?

A. m_1g, m_2g

B. $m_1g, m_1g - m_2g$

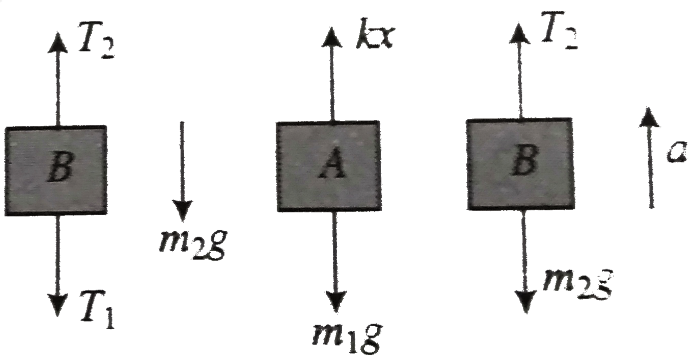
C. m_2g, m_1g

D. $m_1g, m_1g + m_2g$

Answer: B

Watch Video Solution

2. In the system shown in fig. $m_1 > m_2$. The system is held at rest by thread BC. Now thread BC is burnt. Answer the following:



Just after burning the thread, what is the acceleration of m_2?

A. $m_1 g$

B. $m_2 g$

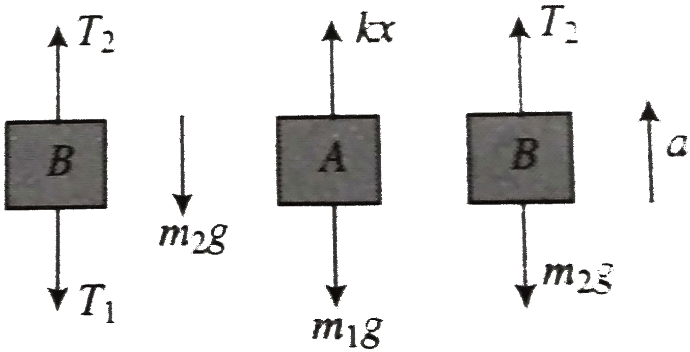
C. Zero

D. Cannot say

Answer: A

Watch Video Solution

3. In the system shown in fig. $m_1 > m_2$. The system is held at rest by thread BC. Now thread BC is burnt. Answer the following:



Just after burning the thread, what is the acceleration of m_2?

A. $\left(\frac{m_2 - m_1}{m_2}\right)g$

B. $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)g$

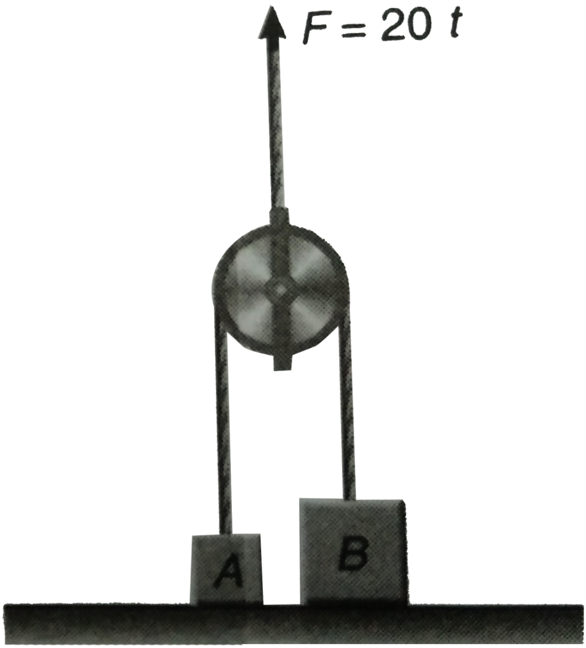
C. Zero

D. $\left(\frac{m_1 - m_2}{m_2}\right)g$

Answer: D

Watch Video Solution

4. Two block A and B of masses $1kg$ and$2kg$ respectively are connected by a string, passing over a light frictionless pulley B 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 $F=20t$ 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 =$g = 10m/s^2$)

A. A loses contact at $t = 2s$.

B. C loses contact at $t = 1.5s$.

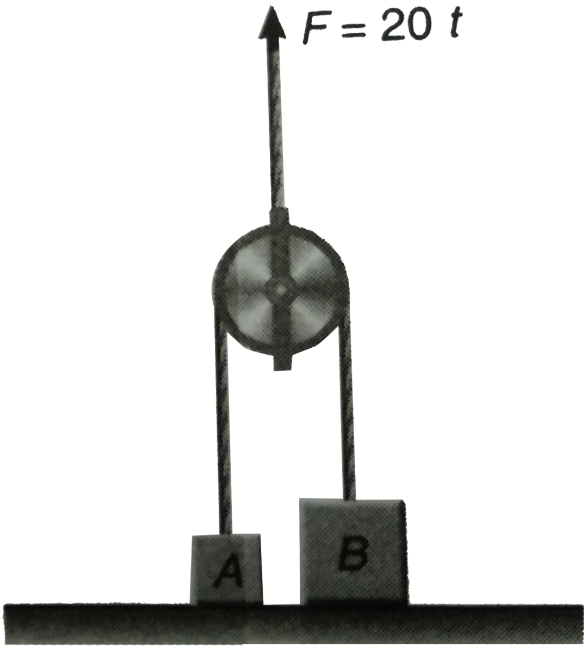
C. A and B lose contact at the same time.

D. All three blocks lose contact at the same time.

Answer: B

Watch Video Solution

5. Two block A and B of masses $1kg$ and$2kg$ respectively are connected by a string, passing over a light frictionless pulley B 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 $F=20t$ 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 =$g = 10m/s^2$)

A. $5ms^{-1}$

B. $5/4ms^{-1}$

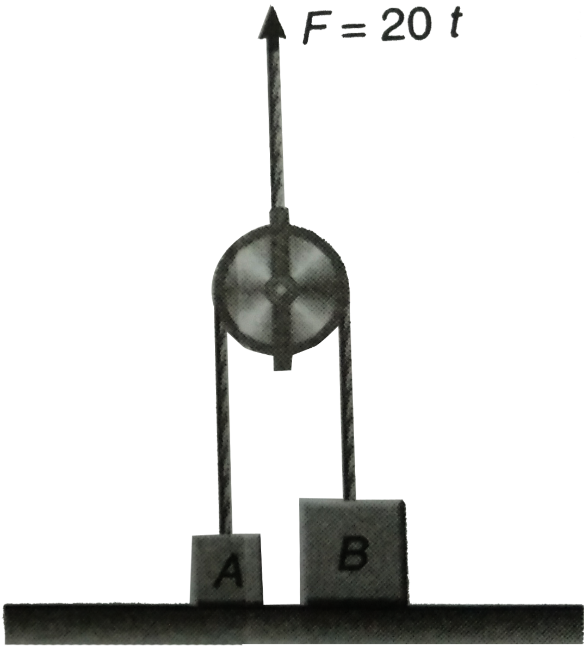
C. $4ms^{-1}$

D. $7/3ms^{-1}$

Answer: A

Watch Video Solution

6. Two block A and B of masses $1kg$ and $2kg$ respectively are connected by a string, passing over a light frictionless pulley B 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 $F=20t$ 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 =$g = 10m/s^2$)

A. $15ms^{-1}$

B. $5ms^{-1}$

C. $20ms^{-1}$

D. $10ms^{-1}$

Answer: D

Watch Video Solution

7. A ball of mass 0.2 kg travelling in a straight line with a speed of m/s along negative x- axis id deflected by a bat $15m/s$ along negative x - axis is deflected by a bat at an angle of 30° If the speed of the ball after deflection is $10m/s$, find the impulse on the ball.

A. $4000N$

B. $5000N$

C. $3000N$

D. $2500N$

Answer: A

Watch Video Solution

8. A ball of mass 200g is thrown with a speed $20ms^{-1}$. The ball strikes a bat and rebounds along the same line at a speed $40ms^{-1}$. Variation of he interaction force, as long the ball remains in contact with the bat, is as shown in fig.

Maximum force F_0 exerted by the bat on the ball is

A. a. $5000N$

B. b. $2000N$

C. c. $2500N$

D. d. $6000N$

Answer: B

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. $40ms^{-1}$

B. $30ms^{-1}$

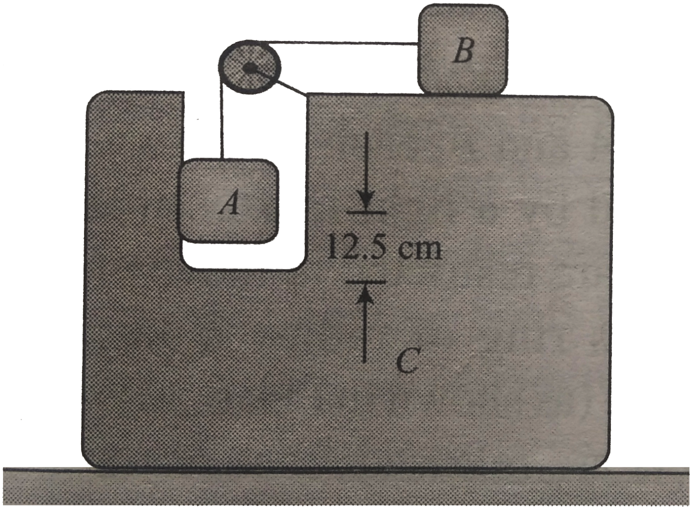
C. $20ms^{-1}$

D. $10ms^{-1}$

Answer: C

Watch Video Solution

10. A small, light pulley is attached with a block C of mass 4 kg as shown in fig. Block B of mass 1.5 kg is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction, calculate the acceleration of each block when the system is released from rest.



A. $1.5mg$

B. $5.8mg$

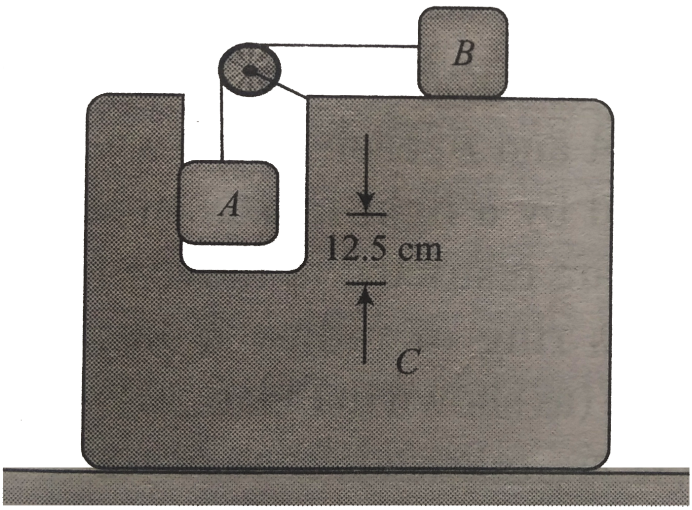
C. $4.7mg$

D. $3.2mg$

Answer: A

Watch Video Solution

11. A small, light pulley is attached with a block C of mass 4 kg as shown in fig. Block B of mass 1.5 kg is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction, calculate the acceleration of each block when the system is released from rest.



A. $1/4ms^{-2}$

B. $2/7ms^{-2}$

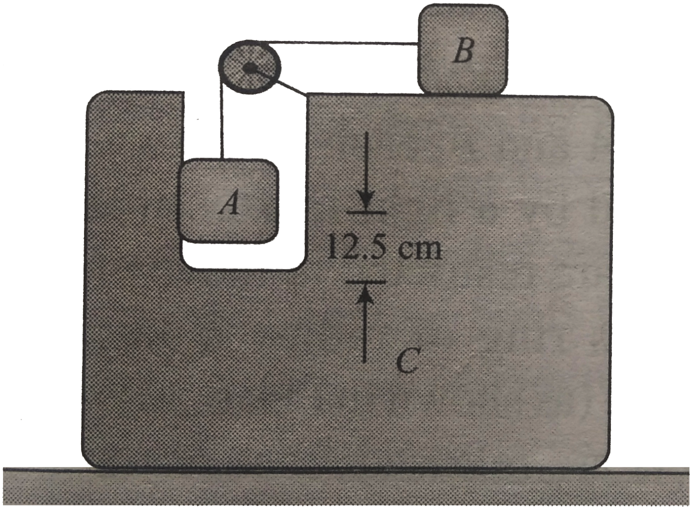
C. $5/4ms^{-2}$

D. $1/3ms^{-2}$

Answer: C

Watch Video Solution

12. A small, light pulley is attached with a block C of mass 4 kg as shown in fig. Block B of mass 1.5 kg is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction, calculate the acceleration of each block when the system is released from rest.



A. $20 ms^{-2}$

B. $5 ms^{-2}$

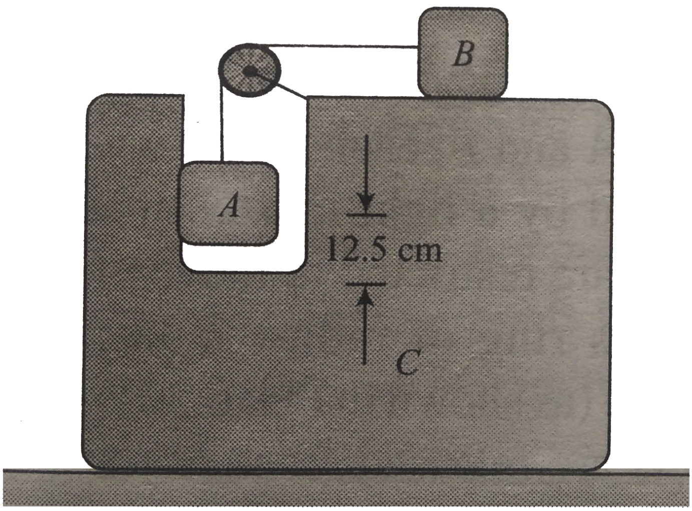
C. $15 ms^{-2}$

D. $10 ms^{-2}$

Answer: B

Watch Video Solution

13. A small, light pulley is attached with a block C of mass 4 kg as shown in fig. Block B of mass 1.5 kg is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction, calculate the acceleration of each block when the system is released from rest.



A. $5/4ms^{-2}$

B. $21/2ms^{-2}$

C. $11/7ms^{-2}$

D. $27/5ms^{-2}$

Answer: A

Watch Video Solution

14. Study the following table

	Endocrine gland	Hormone	Deficiency disorder
A	Neurohypo-physis	Vasopressin	Diabetes insipidus
B	Adrenal cortex	Corticoste-roids	Addison's disease
C	Parathyroid glands	Parathor-mone	Myxoedema
D	Thyroid gland	Calcitonin	Acromegaly

A. $\frac{700}{11}N$

B. $\frac{450}{11}N$

C. $\frac{500}{11}N$

D. $\frac{900}{11}N$

Answer: D

Watch Video Solution

15. Study the following table

	Endocrine gland	Hormone	Deficiency disorder
A	Neurohypophysis	Vasopressin	Diabetes insipidus
B	Adrenal cortex	Corticosteroids	Addison's disease
C	Parathyroid glands	Parathormone	Myxoedema
D	Thyroid gland	Calcitonin	Acromegaly

A. $30/77 m s^{-2}$

B. $60/77 m s^{-2}$

C. $80/77 m s^{-2}$

D. $120/77 m s^{-2}$

Answer: D

Watch Video Solution

16. Study in fig. and answer the following questions accordingly. Neglect all friction and masses of the pulleys.

What is the acceleration of Block A?

A. A. $60/77ms^{-2}$

B. B. $80/77ms^{-2}$

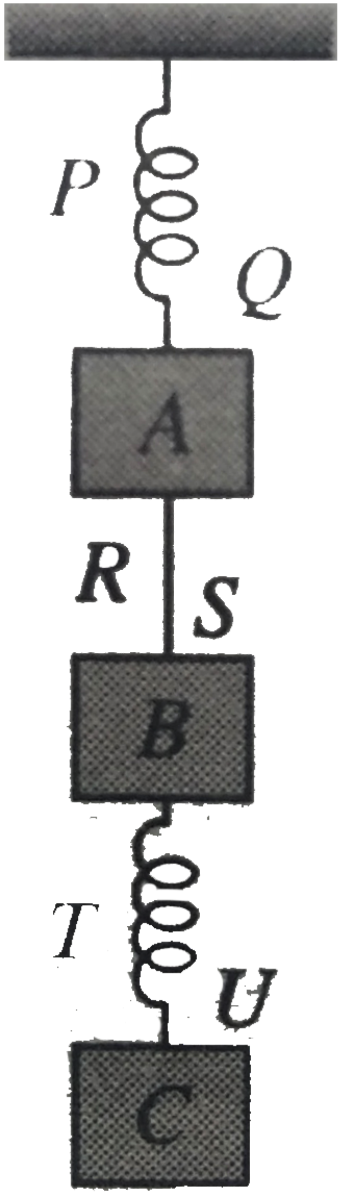
C. C. $180/77ms^{-2}$

D. D. $60/77ms^{-2}$

Answer: C

Watch Video Solution

17. Three blocks A, B, and C of masses $3M$, $2M$, and M are suspended vertically with the help of spring PQ and TU, and a string RS as shown in fig. If the acceleration of blocks A, B and C is a_1, a_2 and a_3 , respectively, then



The value of acceleration a_3 at the moment spring PQ is cut is

A. g, downward

B. g, upward

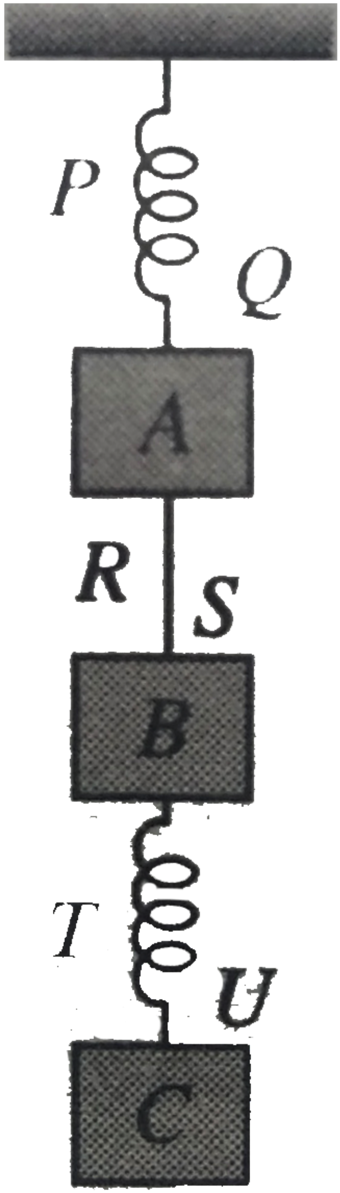
C. More than g, downwards

D. Zero

Answer: D

Watch Video Solution

18. Three blocks A, B, and C of masses $3M$, $2M$, and M are suspended vertically with the help of spring PQ and TU, and a string RS as shown in fig. If the acceleration of blocks A, B and C is a_1, a_2 and a_3 , respectively, then



The value of acceleration a_1 at the moment string RS is cut is

A. a. g, downward

B. g, upward

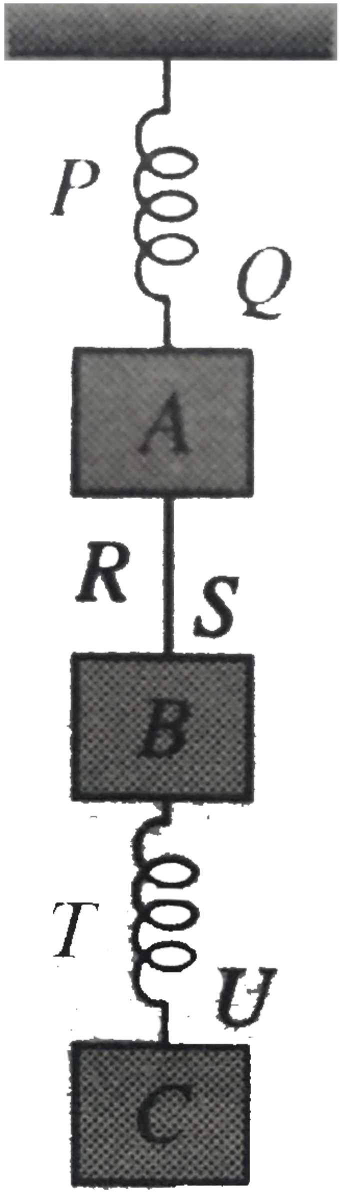
C. More than g, downwards

D. Zero

Answer: B

Watch Video Solution

19. Three blocks A, B, and C of masses $3M$, $2M$, and M are suspended vertically with the help of spring PQ and TU, and a string RS as shown in fig. If the acceleration of blocks A, B and C is a_1, a_2 and a_3 , respectively, then



The value of acceleration a_2 at the moment spring TU is cut is

A. $g/5$, upward

B. $g/5$ downward

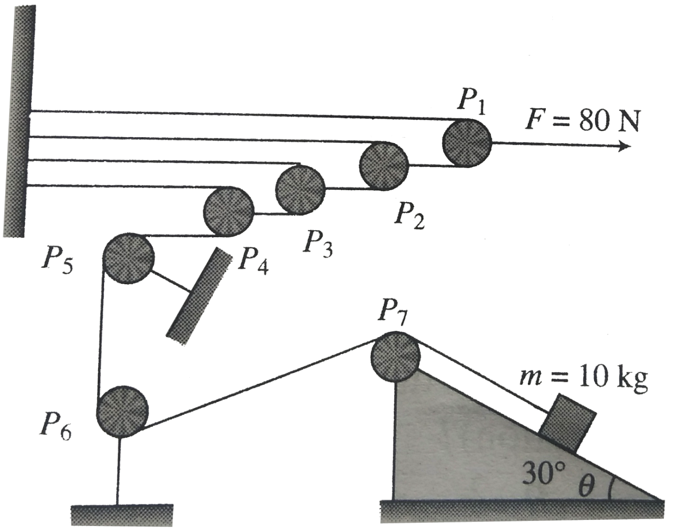
C. $g/3$, upward

D. Zero

Answer: D

Watch Video Solution

20. In fig, all the pulleys and strings are massless and all the surfaces are frictionless. A small block of mass m is placed on fixed wedge (take $f = 10ms^{-2}$).



The tension in the string attached to m is

A. 40 N

B. 10 N

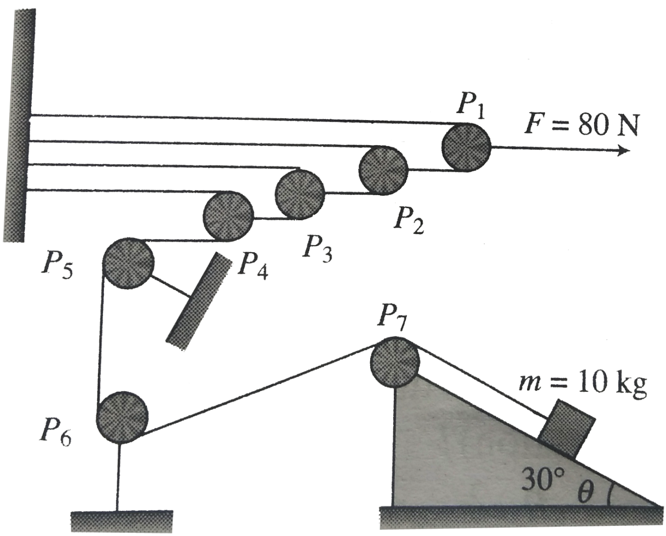
C. 20 N

D. 5 N

Answer: D

Watch Video Solution

21. In fig, all the pulleys and strings are massless and all the surfaces are frictionless. A small block of mass m is placed on fixed wedge (take $g = 10ms^{-2}$).



The tension in the string attached to m is

A. $4.5ms^{-2}$ down the incline

B. $4.5ms^{-2}$ up the incline

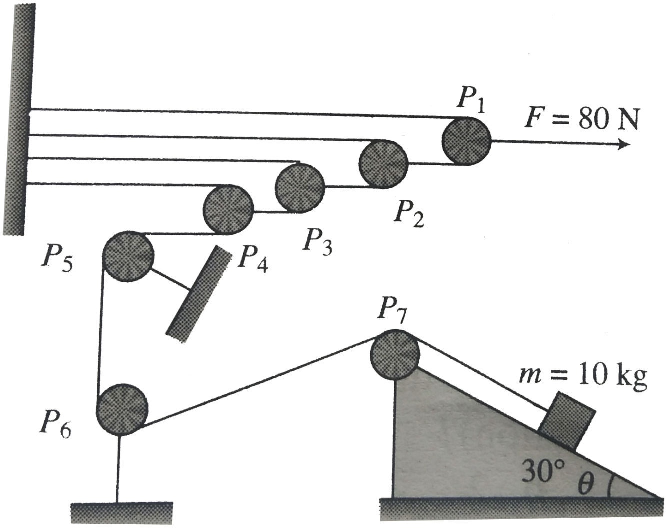
C. $5ms^{-2}$ down the incline

D. $5ms^{-2}$ up the incline

Answer: A

Watch Video Solution

22. In fig, all the pulleys and strings are massless and all the surfaces are frictionless. A small block of mass m is placed on fixed wedge (take $f = 10ms^{-2}$).



The acceleration of pulley p_4 is

A. $2.25ms^{-2}$ towards left

B. $2.25ms^{-2}$ towards right

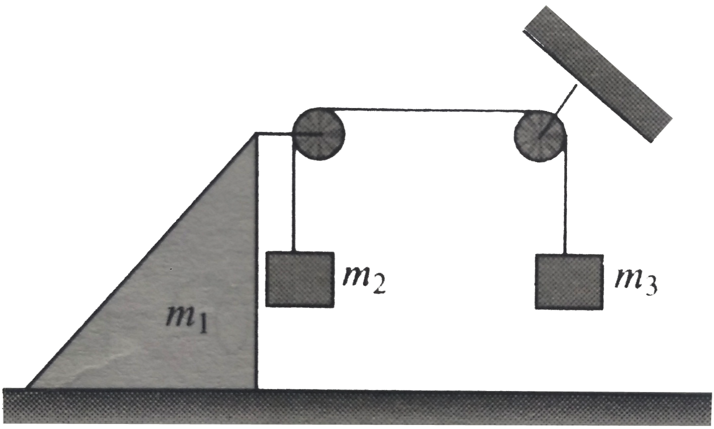
C. $9ms^{-2}$ towards left

D. $9ms^{-2}$ towards right

Answer: A

Watch Video Solution

23. In fig. both pulleys and the string are massless and all the surfaces are frictionless.



Given $m_1 = 1kg, m_2 = 2kg, m_3 = 3kg.$

Find the tension in the string

A. $\frac{120}{7}N$

B. $\frac{240}{7}N$

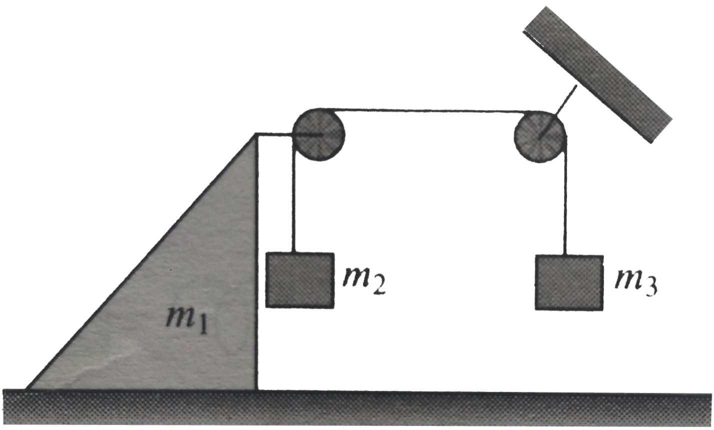
C. $\frac{130}{7}N$

D. None of these

Answer: A

Watch Video Solution

24. In fig. both pulleys and the string are massless and all the surfaces are frictionless.



Given $m_1 = 1kg, m_2 = 2kg, m_3 = 3kg.$

The acceleration of m_1 is

A. $\frac{40}{7}ms^{-2}$

B. $\frac{30}{7}ms^{-2}$

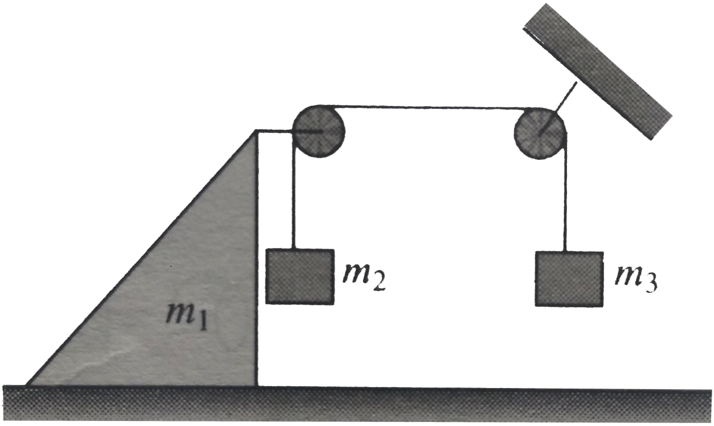
C. $\frac{20}{7}ms^{-2}$

D. $\frac{\sqrt{17}g}{7}ms^{-2}$

Answer: D

Watch Video Solution

25. In fig. both pulleys and the string are massless and all the surfaces are frictionless.



Given $m_1 = 1kg, m_2 = 2kg, m_3 = 3kg.$

The acceleration of m_3 is

A. $\frac{40}{7} ms^{-2}$

B. $\frac{30}{7} ms^{-2}$

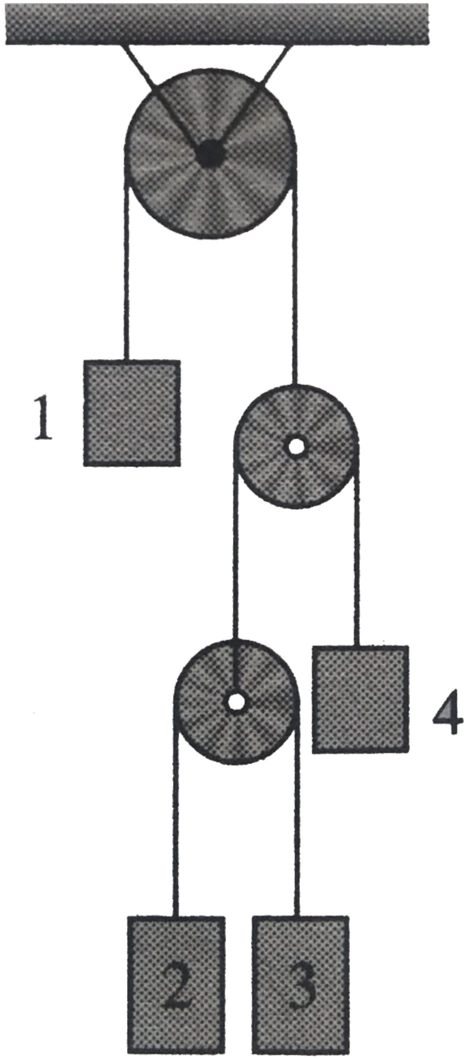
C. $\frac{20}{7} ms^{-2}$

D. None of these

Answer: B

Watch Video Solution

26. In the arrangement shown in fig., all pulleys are smooth and massless. When the system is released from the rest, acceleration of block 2 and 3 relative to 1 are $1ms^{-2}$ downwards and $5ms^{-2}$ downwards, respectively. Acceleration of block 3 relative to 4 is zero.



Find the absolute acceleration of block 1.

A. $2ms^{-2}$ upwards

B. $1ms^{-2}$ downwards

C. $3ms^{-2}$ upwards

D. $1.5ms^{-2}$ downwards

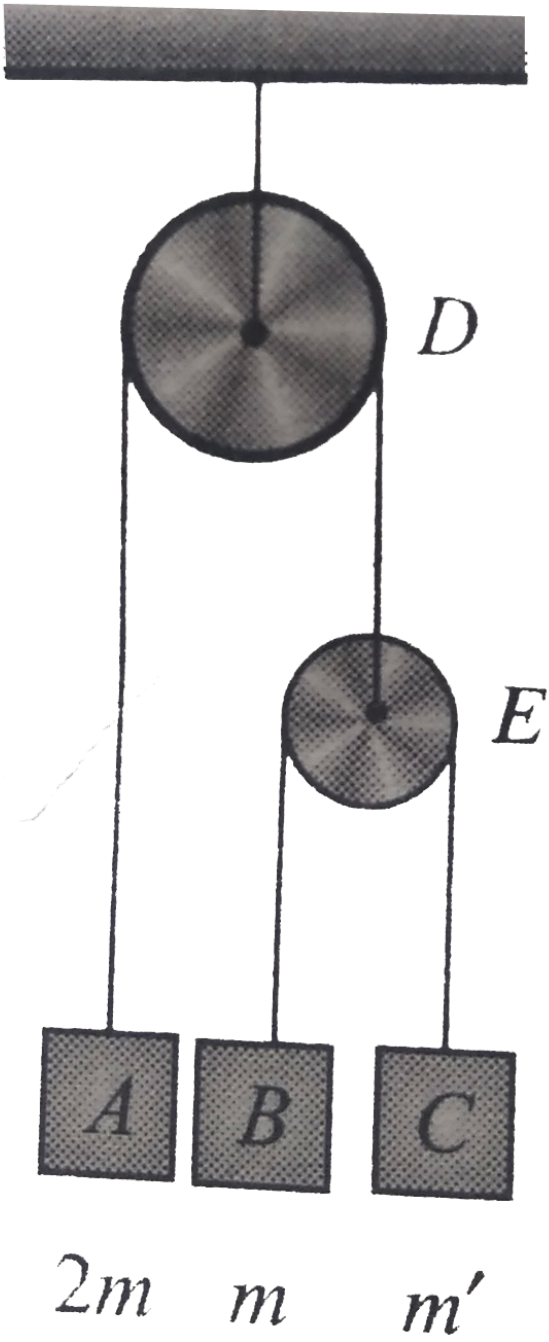
Answer: A

Watch Video Solution

27. In the arrangement shown in fig, pulleys D and E are small and frictionless. They do not rotate byt threads slip over then without friction and their masses being 4kg and 11.25 kg, respectively. While the masses of blocks A,B, and C, are $2m, m$ and m',respectively. when the system is released from rest, downward accelerations of blocks B and C relative to A are found to be $5ms^{-2}$ and $3ms^{-2}$, respectively. Calculate:

a. Acceleration of blocks B and C, relative to the ground.

b. Mass of each block $(g = 10ms^{-2})$


D
E
A
B
C
2m
m
m′

A. $2ms^{-2}$ downwards

B. $1ms^{-2}$ upwards

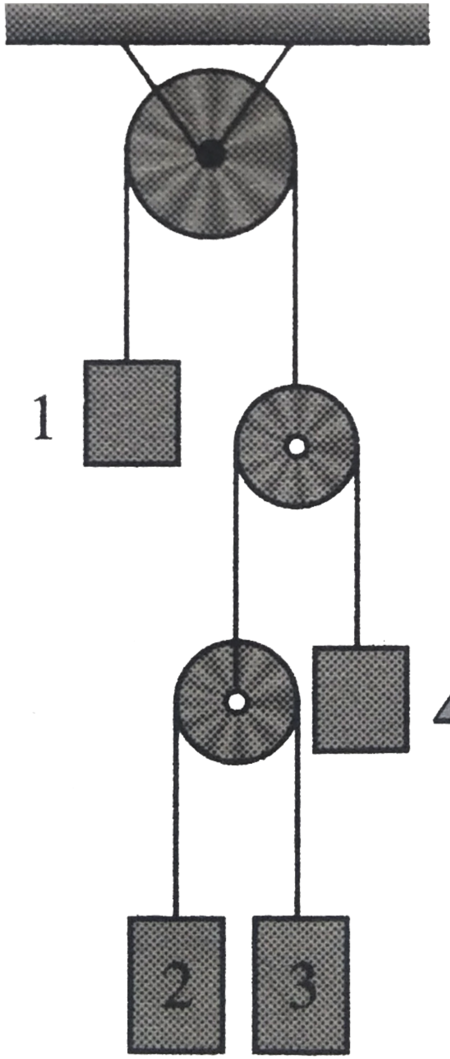
C. $3ms^{-2}$ upwards

D. $1.5ms^{-2}$ downwards

Answer: B

Watch Video Solution

28. In the arrangement shown in fig., all pulleys are smooth and massless. When the system is released from the rest, acceleration of block 2 and 3 relative to 1 are $1ms^{-2}$ downwards and $5ms^{-2}$ downwards, respectively. Acceleration of block 3 relative to 4 is zero.



Find the absoulte acceleration of block 4.

A. $2ms^{-2}$ upwards

B. $1ms^{-2}$ downwards

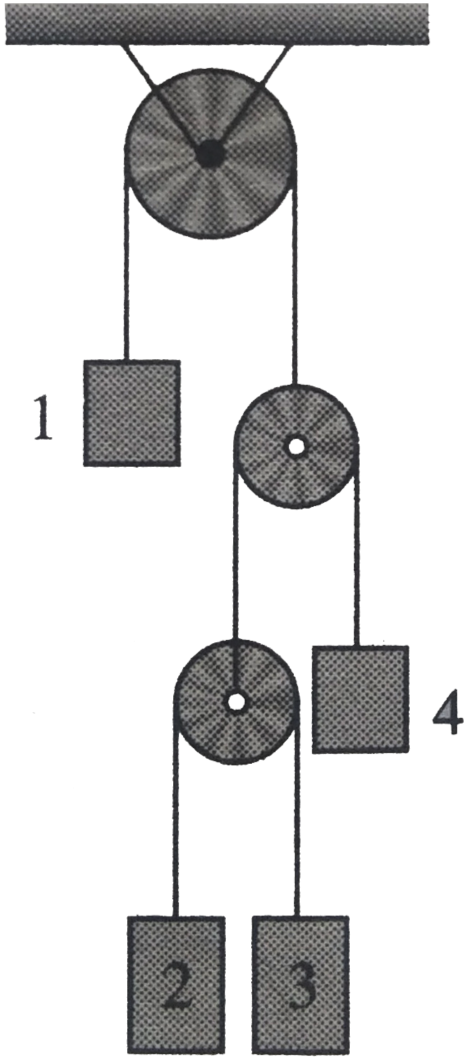
C. $3ms^{-2}$ downwards

D. $1.5ms^{-2}$ upwards

Answer: C

Watch Video Solution

29. In the arrangement shown in fig., all pulleys are smooth and massless. When the system is released from the rest, acceleration of block 2 and 3 relative to 1 are $1ms^{-2}$ downwards and $5ms^{-2}$ downwards, respectively. Acceleration of block 3 relative to 4 is zero.



Find the absoulte acceleration of block 4.

A. $2 m s^{-2}$ upwards

B. $1 m s^{-2}$ downwards

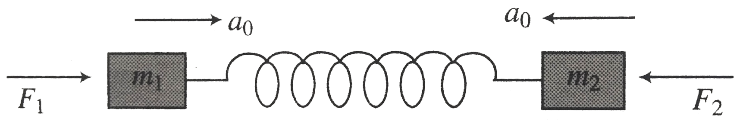
C. $3ms^{-2}$ downwards

D. $1.5ms^{-2}$ upwards

Answer: C

Watch Video Solution

30. Two blocks of masses m_1 and m_2 are connected with a light spring of force constant k and the whole system is kept on a frictionless horizontal surface. The masses are applied forces F_1 and F_2 as shown in fig. At any time the blocks have same acceleration a_0 but in opposite direction. Now answer the following :



The value of a_0 is

A. $\dfrac{F_1 - F_2}{m_1 + m_2}$

B. $\dfrac{F_1 - F_2}{m_1 - m_2}$

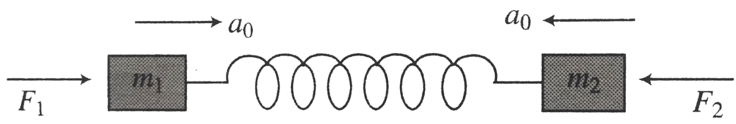
C. $\dfrac{F_1 + F_2}{m_1 - m_2}$

D. $\dfrac{F_1 + F_2}{m_1 + m_2}$

Answer: B

Watch Video Solution

31. Two blocks of masses m_1 and m_2 are connected with a light spring of force constant k and the whole system is kept on a frictionless horizontal surface. The masses are applied forces F_1 and F_2 as shown in fig. At any time the blocks have same acceleration a_0 but in opposite direction. Now answer the following :



the value of spring force is

A. $\dfrac{m_1F_2 + F_1m_2}{m_1 - m_2}$

B. $\dfrac{m_1F_2 - F_1m_2}{m_1 + m_2}$

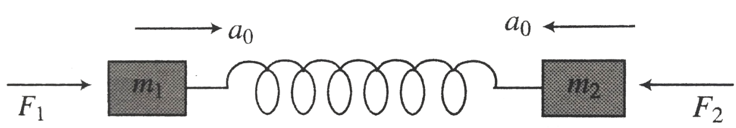
C. $\dfrac{m_1F_2 + F_1m_2}{m_1 + m_2}$

D. $\dfrac{m_1F_2 - F_1m_2}{m_1 - m_2}$

Answer: D

Watch Video Solution

32. Two blocks of masses m_1 and m_2 are connected with a light spring of force constant k and the whole system is kept on a frictionless horizontal surface. The masses are applied forces F_1 and F_2 as shown in fig. At any time the blocks have same acceleration a_0 but in opposite direction. Now answer the following :



If F_2 is removed at this moment, then just after the acceleration of m_2 is

A. $\dfrac{F_1}{m_2}$

B. $a_0 + \dfrac{F_1}{m_2}$

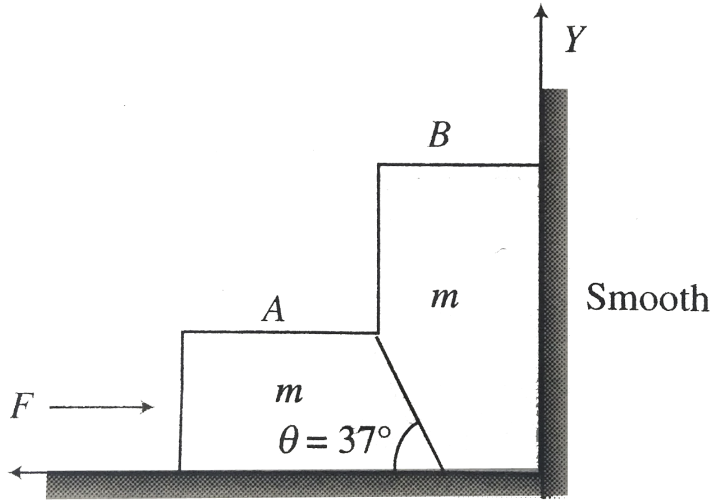
C. $\frac{F_2}{m_2} - a_0$

D. $a_0 + \frac{F_2}{m_2}$

Answer: C

Watch Video Solution

33. Two smooth block are placed at a smooth corner as shown in fig. Both the bloks are having mass m. We apply a force F on the block m. Block A presses block B in the normal direction, due to which pressing force on vertical wall will increase, and pressing force on the horizontal wall decreases, as we increases $F(\theta = 37^\circ$ with horizontal).



As soon as the pressing force on the horizontal wall by block B become zero, it will lose contact with ground. If the value of F further increases, block B will accelerate in the upward direction and simulaneously block A will towards right.

What is the minimum value of F to lift block B from ground?

A. $\frac{25}{12}mg$

B. $\frac{5}{3}mg$

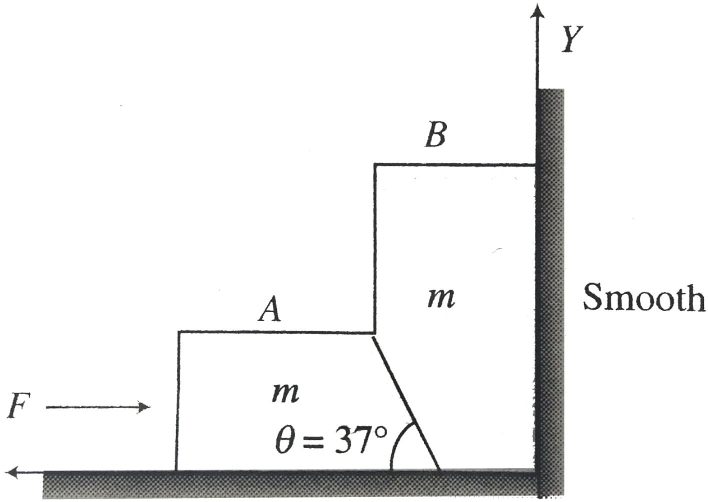
C. $\frac{3}{4}mg$

D. $\frac{4}{3}mg$

Answer: C

Watch Video Solution

34. Two smooth block are placed at a smooth corner as shown in fig. Both the bloks are having mass m. We apply a force F on the block m. Block A presses block B in the normal direction, due to which pressing force on vertical wall will increase, and pressing force on the horizontal wall decreases, as we increases $F(\theta = 37^\circ$ with horizontal).



As soon as the pressing force on the horizontal wall by block B become zero, it will lose contact with ground. If the value of F further increases, block B will accelerate in the upward direction and simulaneously block A will towards right.

If the acceleration of block A is a rightwards, then the acceleration of block B will be

A. $mg + \frac{3F}{4}$

B. $mg-\frac{3F}{4}$

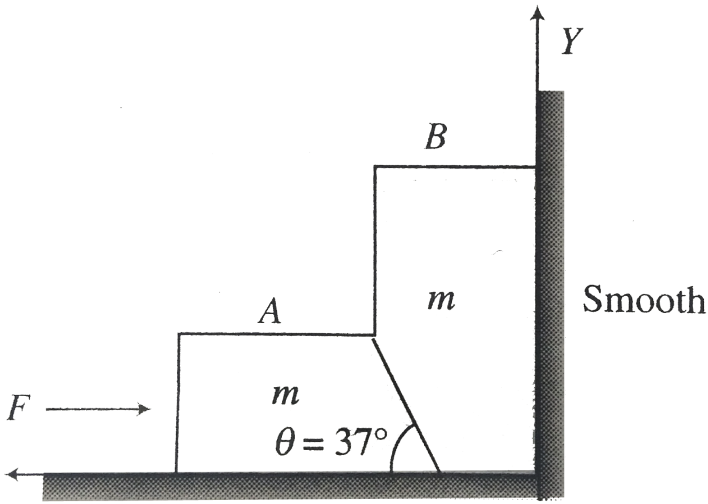
C. $mg+\frac{4F}{3}$

D. $mg-\frac{4F}{3}$

Answer: C

Watch Video Solution

35. Two smooth block are placed at a smooth corner as shown in fig. Both the bloks are having mass m. We apply a force F on the block m. Block A presses block B in the normal direction, due to which pressing force on vertical wall will increase, and pressing force on the horizontal wall decreases, as we increases $F(\theta=37^{\circ}$ with horizontal).



As soon as the pressing force on the horizontal wall by block B become zero, it will lose contact with ground. If the value of F further increases, block B will accelerate in the upward direction and simulaneously block A will towards right.

If the acceleration of block A is a rightwards, then the acceleration of block B will be

A. $\frac{3a}{4}$, upwards

B. $\frac{4a}{3}$, upwards

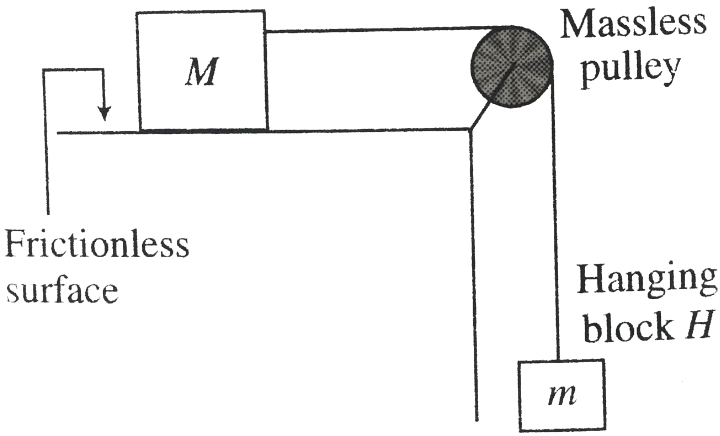
C. $\frac{3a}{5}$, upwards

D. $\frac{4a}{5}$, upwards

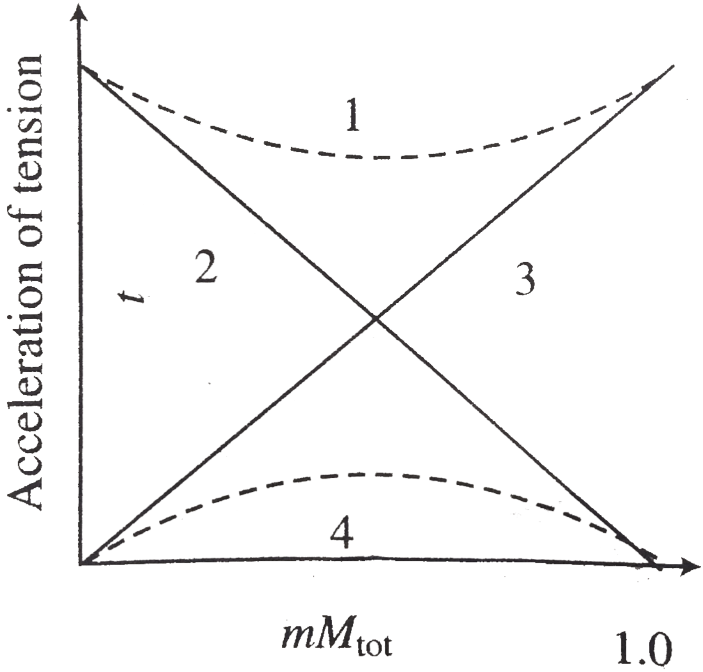
Answer: A

Watch Video Solution

36. Two containers of sand are arranged like the block as shown in fig. the containers alone have negligible mass, the sand in them has a total mass M_{tot}, the sand in the hanging container H hs mass m.



To measure the magnitude a of the acceleration of the system, a large number of experiments carried out where m varies from experiment to experiment but M_{tot} does not, that is, sand in shifted between the containers before each trial .



Which of the curves in graph correctly gives acceleration magnitude as a function of the ratio m / M_{tot} (vertical axis is for acceleration)?

A. 1

B. 2

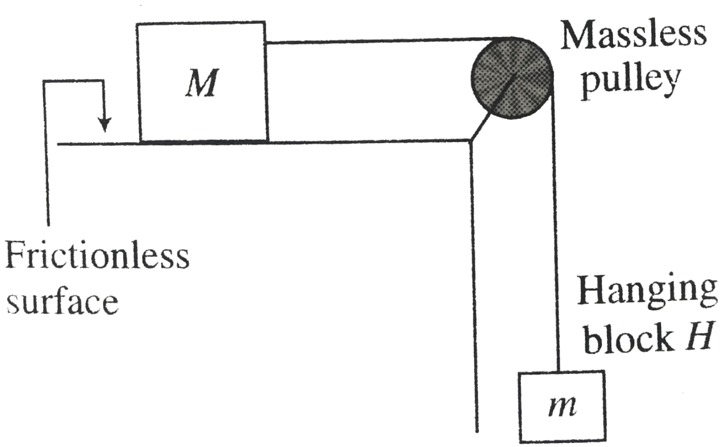
C. 3

D. 4

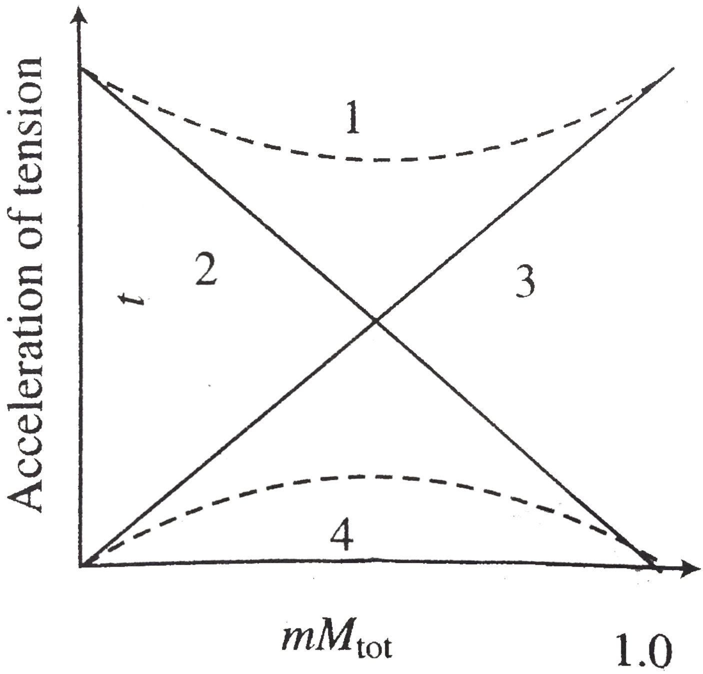
Answer: c

Watch Video Solution

37. Two containers of sand are arranged like the block as shown in fig. the containers alone have negligible mass, the sand in them has a total mass M_{tot} , the sand in the hanging container H hs mass m.



To measure the magnitude a of the acceleration of the system, a large number of experiments carried out where m varies from experiment to experiment but M_{tot} does not, that is, sand in shifted between the containers before each trial .



Which of them gives the tension in the connecting cord (vertical axis is for tension) ?

A. 1

B. 2

C. 3

D. 4

Answer: D

Watch Video Solution

38. A time varying force $F = 6t - 2t^2 N$, at t=0 starts acting on a body of mass 2kg initially at rest, where t is in second. The force is withdrawn just at the instant when the body comes to rest again. We can see that at $t = 0$ the force $F = 0$. Now answer the following:

Find the duration for which the force acts on the body.

A. 2s

B. 3s

C. 3.5s

D. 4.5s

Answer: D

Watch Video Solution

39. A time varying force $F = 6t - 2t^2 N$, at t=0 starts acting on a body of mass 2kg initially at rest, where t is in second. The force is withdrawn just at the instant when the body comes to rest again. We can see that at $t = 0$ the force $F = 0$. Now answer the following:

Find the time when the velocity attained by the body is maximum.

A. 2s

B. 3s

C. 3.5s

D. 4.5s

Answer: B

Watch Video Solution

40. A time varying force $F = 6t - 2t^2 N$, at t=0 starts acting on a body of mass 2kg initially at rest, where t is in second. The force is withdrawn just at the instant when the body comes to rest again. We can see that at $t = 0$ the force $F = 0$. Now answer the following:

Mark the correct statement:

A. Velocity of the body is maximum when force acting on the body is maximum for the first time.

B. The velocity of the body becomes maximum when force acting on the body becomes zero again.

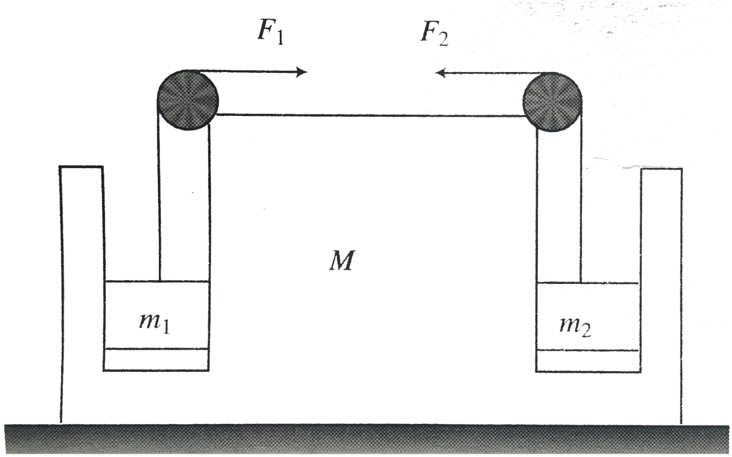
C. When force becomes zero again, velocity of the body also becomes zero at that instant.

D. All of the above

Answer: B

Watch Video Solution

41. For the system shown in fig, there is no friction anywhere. Masses m_1 and m_2 can move up or down in the slots cut in mass M. Two non-zero horizontal force F_1 and F_2 are applied as shown. The pulleys are massles and frictionless. Given $m_1 \neq m_2$



According to the above passage, which is correct?

A. It is not possible for the entire system to be in equilibrium.

B. For some values F_1 and F_2, it is possible that the entire system is in equilibrium.

C. It is possble that F_1 and F_2 are applied in such a way that m_1 and m_2 remain in equilibrium but M does not.

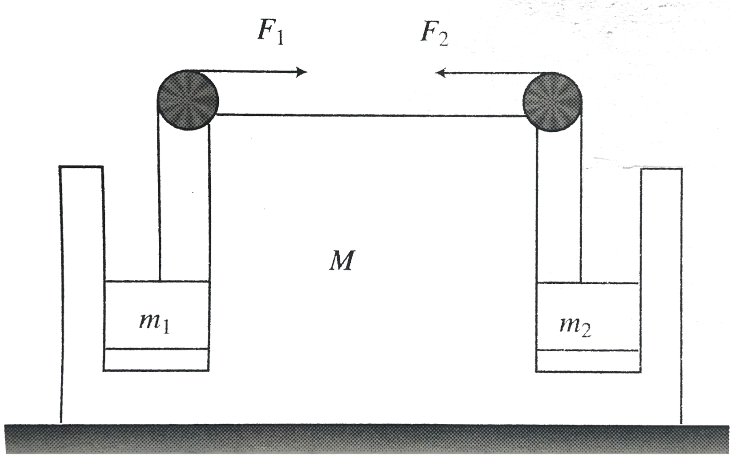
D. None of the above

Answer: A

Watch Video Solution

42. For the system shown in fig, there is no friction anywhere. Masses m_1 and m_2 can move up or down in the slots cut in mass M. Two non-zero horizontal force F_1

and F_2 are applied as shown. The pulleys are massles and frictionless. Given $m_1 \neq m_2$



Let F_1 and F_2 are applied in such a way that m_1 and m_2 do not move w.r.t. M. then what is the magnitude of the acceleration of M? Let $m_1 > m_2$.

A. $\frac{(m_1 + m_2)g}{M + m_1 + m_2}$

B. $\frac{(m_1 - m_2)g}{M}$

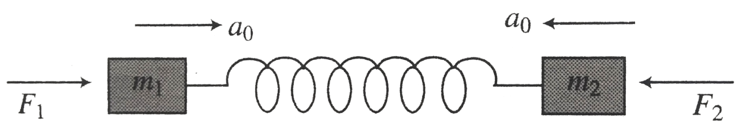
C. $\frac{(m_1 - m_2)g}{M + m_1 + m_2}$

D. $\frac{F_1 - F_2}{M}$

Answer: C

Watch Video Solution

43. Two blocks of masses m_1 and m_2 are connected with a light spring of force constant k and the whole system is kept on a frictionless horizontal surface. The masses are applied forces F_1 and F_2 as shown in fig. At any time the blocks have same acceleration a_0 but in opposite direction. Now answer the following :



The value of a_0 is

A. $\dfrac{F_1}{m_1} - \dfrac{m_2 g}{m_1} = \dfrac{F_2}{m_2} - \dfrac{m_1 g}{m_2}$

B. $\frac{F_1}{m_2} = \frac{F_2}{m_1}$

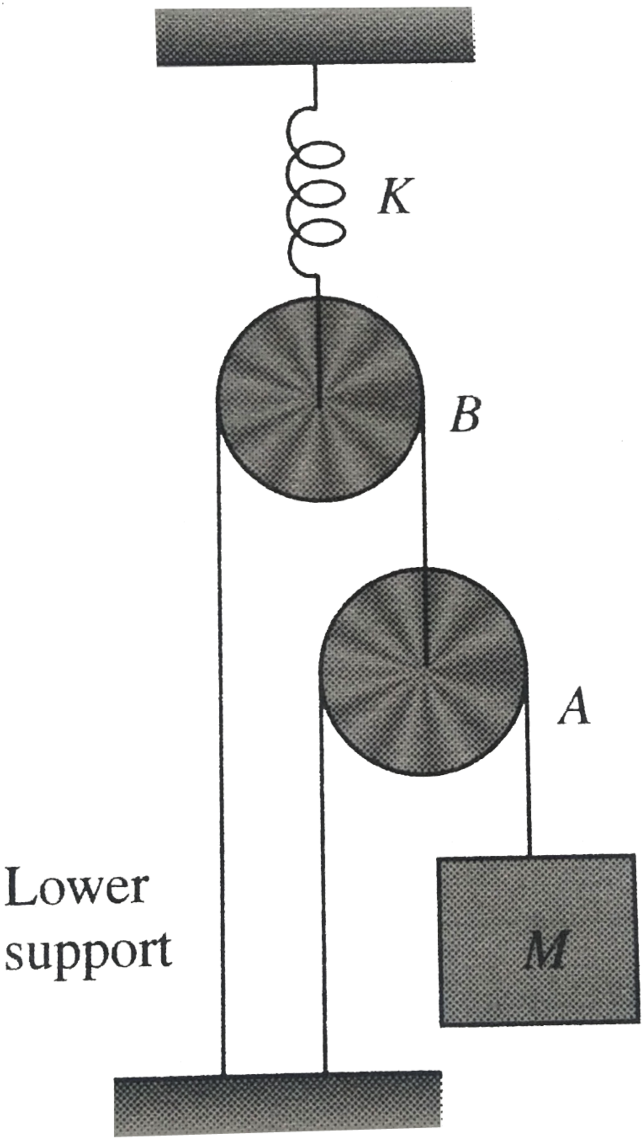
C. $\frac{F_1}{m_1} + \frac{m_2 g}{m_1} = \frac{F_2}{m_2} + \frac{m_1 g}{m_2}$

D. $\frac{F_1}{m_1} = \frac{F_2}{m_2}$

Answer: D

Watch Video Solution

44. A mass M is suspended as shown in fig. The system is in equilibrium. Assume pulleys to be massless. K is the force constant of the spring.



The extension produced in the spring is given by

A. $4Mg / K$

B. Mg/K

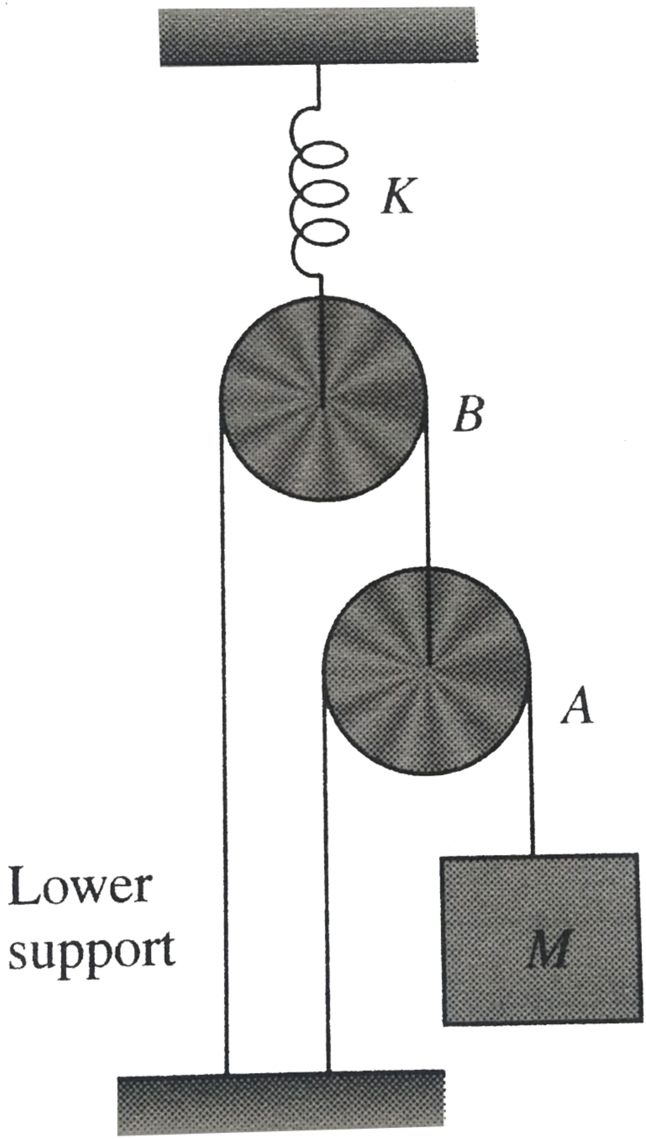
C. $2Mg/K$

D. $3Mg/K$

Answer: A

Watch Video Solution

45. A mass M is suspended as shown in fig. The system is in equilibrium. Assume pulleys to be massless. K is the force constant of the spring.



Find the net tension force acting on the lower support.

A. Mg

B. $2Mg$

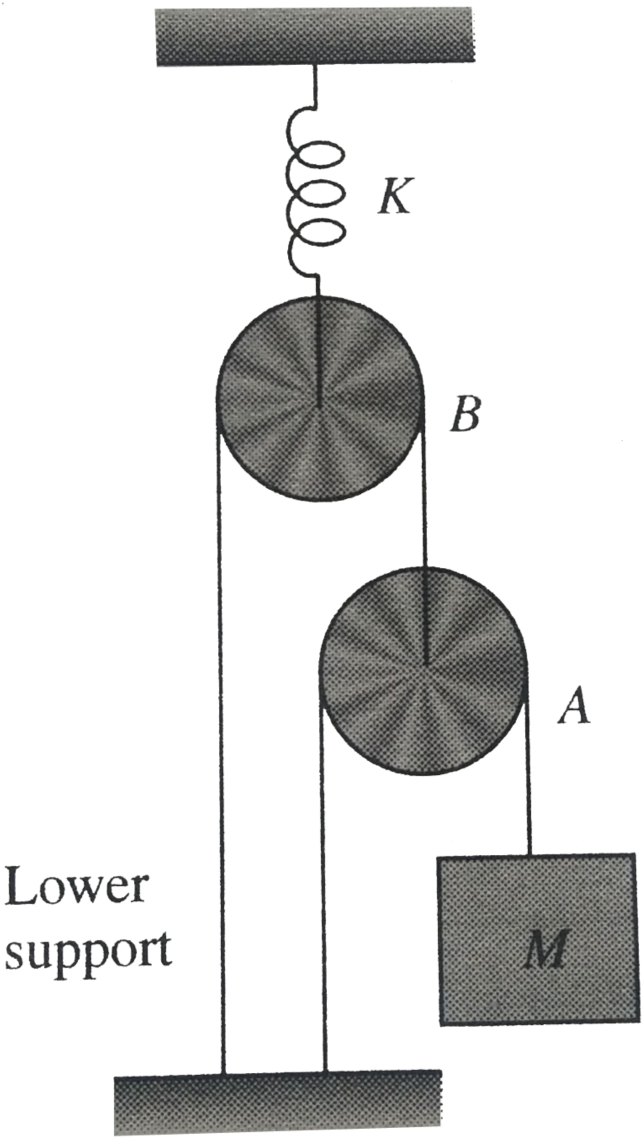
C. $3Mg$

D. $4Mg$

Answer: C

Watch Video Solution

46. A mass M is suspended as shown in fig. The system is in equilibrium. Assume pulleys to be massless. K is the force constant of the spring.



If each of the pullies A and B has mass M, then find the net tension force acting on the lower support. Asumme pulleys to be frictionaless.

A. $2Mg$

B. $6Mg$

C. $3Mg$

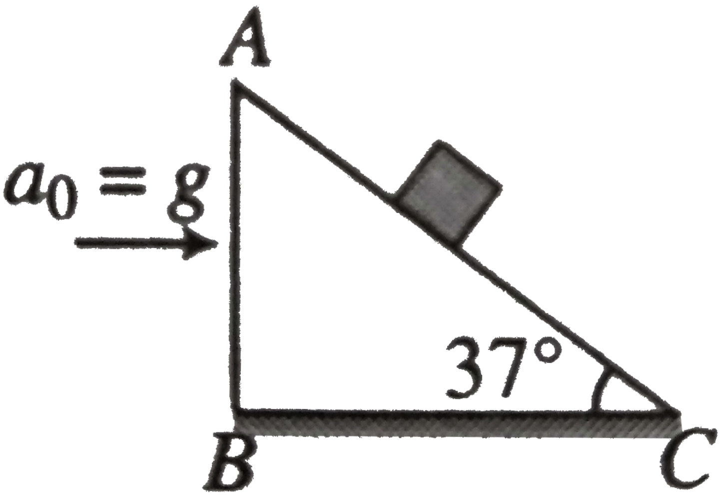
D. $4Mg$

Answer: D

Watch Video Solution

Integer

1. A block is placed on an inclined plane moving towards right horizontally with an acceleration $a_0 = g$. The length of the plane $AC = 1m$. Friction is absent everywhere. Find the time taken (in seconds) by the block to reach from C to A.



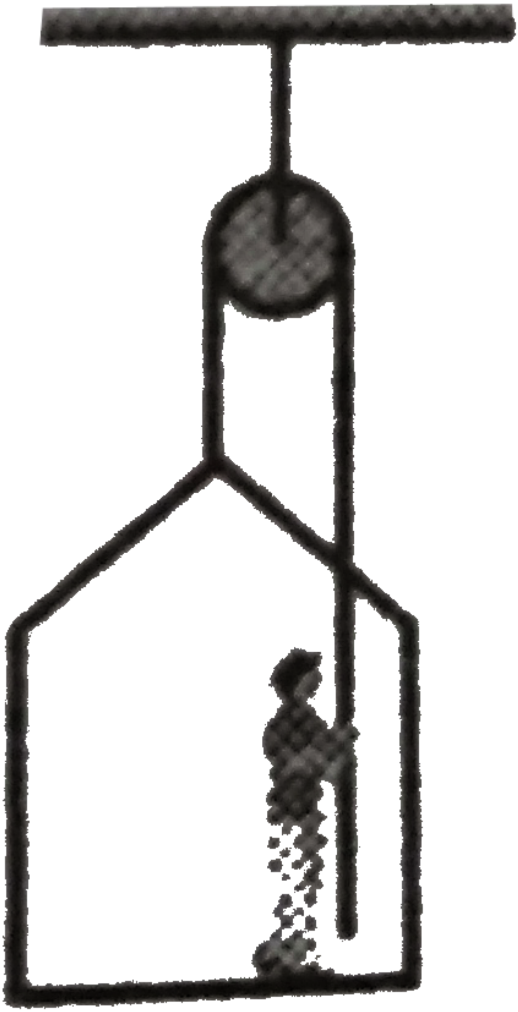
Watch Video Solution

2. You are designing an elevator for a hospital. The force exerted on a passenger by the floor of the elevator is not to exceed 1.60 times the passenger's weight. The elevator accelerates upwards with constant accelerates upwards

with constant acceleration for a distance of 3.0 m and then starts to slow down. What is the maximum speed (in ms^{-1}) of the elevator?

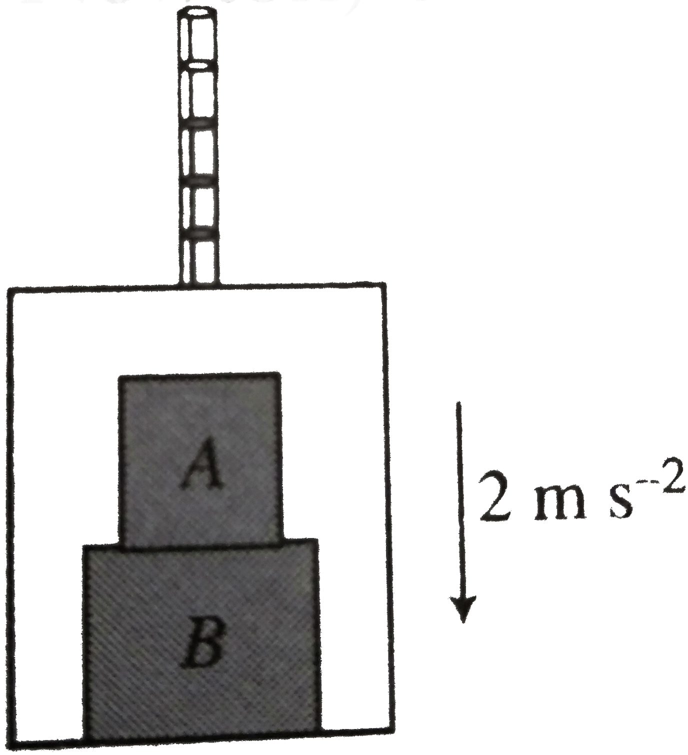
Watch Video Solution

3. Figure represents a painter in a crate which hangs alongside a building. When the painter of mass 100kg pulls the rope, the force exerted by him on the floor of the crate is $450N$. If the crate weighs 25 kg. find the acceleration (in ms^{-2}) of the painter.



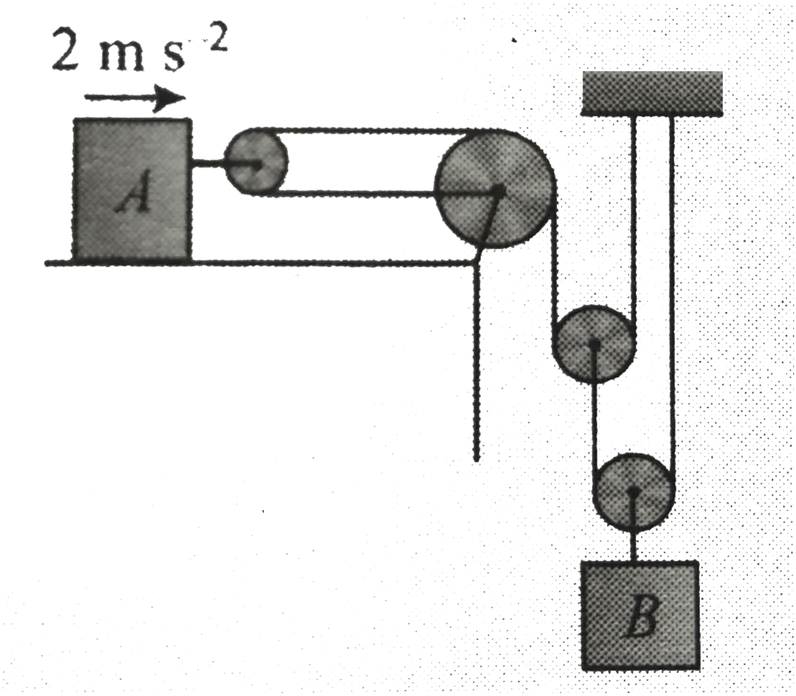
Watch Video Solution

4. The elevator shown in fig. is descending with an acceleration of $2ms^{-2}$. The mass of the block $A = 0.5kg$. Find the force (in Newton) exerted by block A on block B.



Watch Video Solution

5. In fig. find the acceleration of B if acceleration of A is $2ms^{-2}$.



Watch Video Solution