PHYSICS

BOOKS - GR BATHLA & SONS PHYSICS (HINGLISH)

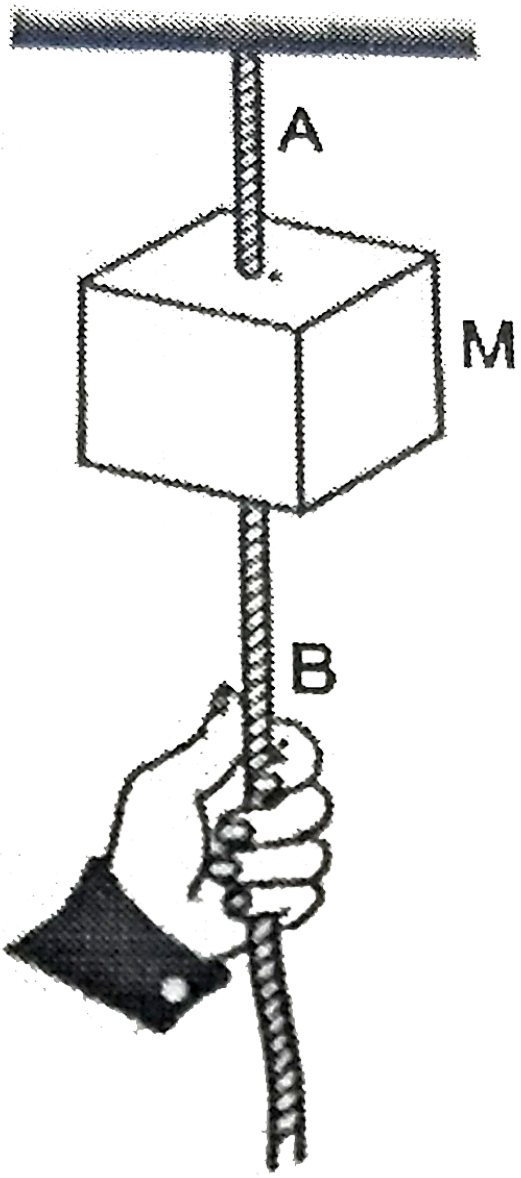
FORCE AND NEWTONS LAWS OF MOTION

Question

1. A block of mass M is suspended by a corf A from the ceiling and another cord B is attached to the bottom of the block as shown in Which string will break if we pull the string B

(a) with a sudden jerk,

(b) steadily ?



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2. When a horse pulls a cart, by Newton's III law the cart also pulls the horse with equal and opposite force, then how does the motion of horse, cart and system takes place?

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3. A force exerts an impulse J on a body changing its speed from u to v. The force and object's motion are along the same line. Show that the work done by the force is $J(u+v)/2$

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4. State whether the statement given below is true or false, giving reason in brief: "Two identical trains are moving on rails along the equator on the earth in opposite directions with the same speed. They will exert the same pressure on the rails"

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5. A spring of force constant k is cut into two pieces of lengths l_1 and l_2. Calculate force constant of each part.

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6. If stretch in a spring of force constant k is doubled, calculate

(a) ration of final to initial force in the spring.

(b) ratio of elastic energies stored in the two cases.

(c) work done in changing to the state of double stretch.

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7. If a body of mass m suspended by a spring comes to rest after a downward displacement y_0 find

(a) the force constant of the spring,

(b) loss in gravitational potential energy and

(c) gain in elastic potential energy.

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Problem

1. A cricket ball of mass 150 kg is moving with a velocity of $12m/s$ and is hit by a bat so that ball is turned back with a velocity of $20m/s$. The force of the blow acts for 0.01 s on the ball . Find the average force exerted by the bat on the ball.

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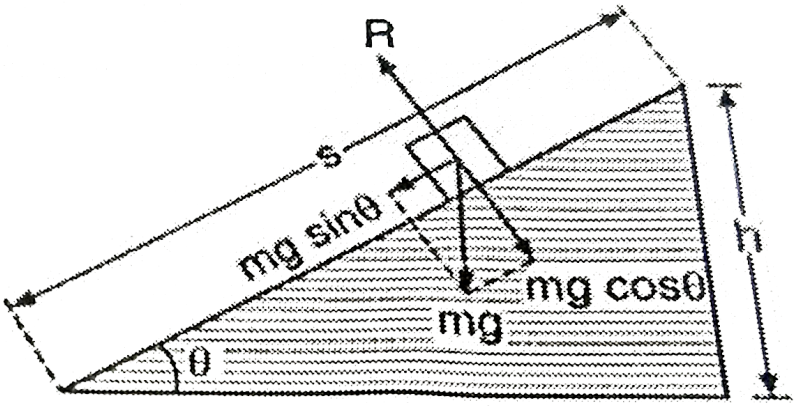
2. A body starting from rest slides on an inclined plane of lengths as shown in Calculate the time of descent and speed at the

bottom. Find also

(a) distance covered in half the time of descent and

(b) time taken to cover half the distance



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3. A mass A is released from the top of a frictionless inclined plane 18 m long and reaches the bottom 3 sec later. At the instant when A is released, a second mass B is projected upwards along the plane from the bottom with a certain initial velocity. The mass B travels a distance up the plane, stops and returns to the bottom

so that it arrives simultaneously with A. The two masses do not collide. Find the acc. and initial velocity of B. (How far up the inclined plane does B travel?)

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4. What should be the length of the day so that the weight of a body on the equator of earth becomes zero ? Given that radius of earth is 6400 km and acceleration due to gravity on its surface is $9.8m/s^2$

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

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6. Calculate the volume of the balloon filled with hydrogen gas, which will be sufficient to lift a load of 25 kg in air. Given that the densities of air and hydrogen are $0.00129 g/cc$ and $0.00009 g/cc$ respectively.

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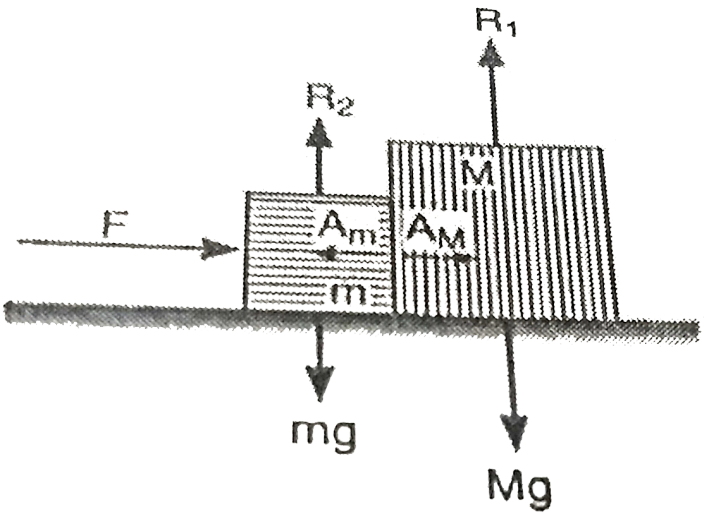
7. Two blocks of mass $m = 1$ kg and $M = 2$ kg are in contact on a frictionless table. A horizontal force $F(= 3N)$ is applied to m. Find the force of contact between the blocks. Will the force of

contact remain same if F is applied to M?



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8. A lift is going up, the total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as shown in

(a) What will be the tension in the rope pulling the lift at,

(i) 1s

(ii) 6 s

(iii) 11 s

(b) What is the height to which the lift takes the passenger?

(c) What will be the average velocity and acceleration during the course of the entire motion? $\left(g = 9.8m/s^2\right)$

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9. With what minimum acceleration can a fireman slide down a rope whose breaking strength is $(2/3)$ of his weight?

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10. A body of mass m is suspended by two strings making angles α and β with the horizontal. Find the tensions in the strings.

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11. Two particles, each of mass m, are connected by a light string of length $2L$ as shown in A continuous force F is applied at the mid point of the string $(x = 0)$ at right angles to the initial position of the string. Show that acceleration of m in the direction at right angles to F is given by

$$a_x = \frac{F}{2m} \frac{x}{\sqrt{L^2 - x^2}}$$

where x is the perpendicular distance of one of the particles from the line of action of F. Discuss the situation when $x = L$

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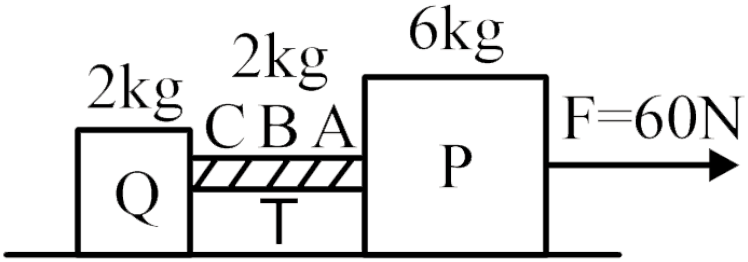
12. Two blocks of masses 6 kg and 4 kg connected by a rope of mass 2 kg are resting on frictionless floor as shown in fig. If a constant force of 60 N is applied to 6 kg block, tension in the rope

at A, B, and C will respectively be -



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13. Two blocks of masses 2.9 kg and 1.9 kg are suspended from a rigid support S by two inextensible wires each of length 1 m. The upper wire has negligible mass and the lower wire has a uniform mass of 0.2 kg/m. Thewhole system of block, wire and support have an upward acceleration of 0.2 m/s2. g = 9.8 m/s2. The tension at the mid-point of lower wire is-

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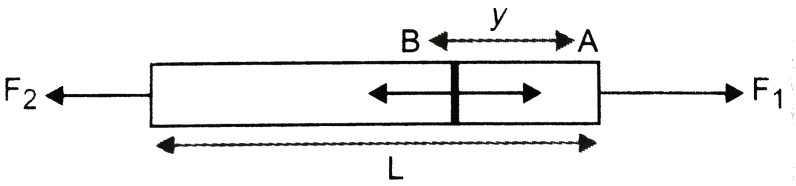
14. What is the tension in a rod of length length L and mass M at a distance y fromF_1 when the rod is acted on by two unequal force F_1 and $F_2(< F_1)$ as shown in.



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15. A small mirror of area A and mass m is suspended in a vertical plane by a weightless string. A beam of light of intensity I falls normally on the mirror and the string is deflected from the vertical by a very small angle θ Assuming the mirror to be perfectly reflecting, obtain an expression for θ

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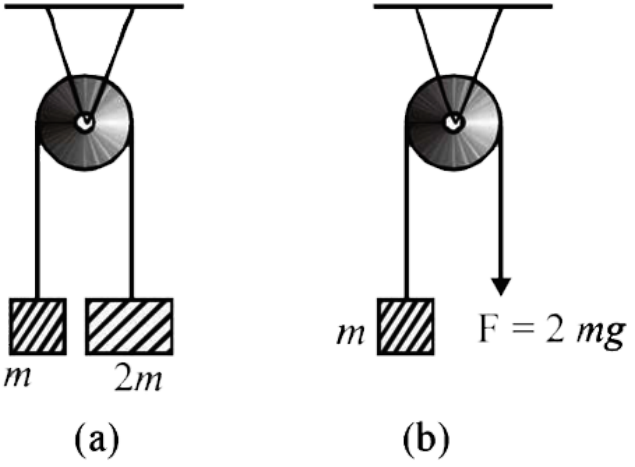
16. The pulley arrangements of Figs. (a) and (b) are identical. The mass of the rope is negligible. In (a) the mass m is lifted up by attaching a mass 2m to the other end of the rope. In (b), m is lifted up by pulling the other end of the rope with a constant downward force $F = 2mg$. The acceleration of m is the same in both cases



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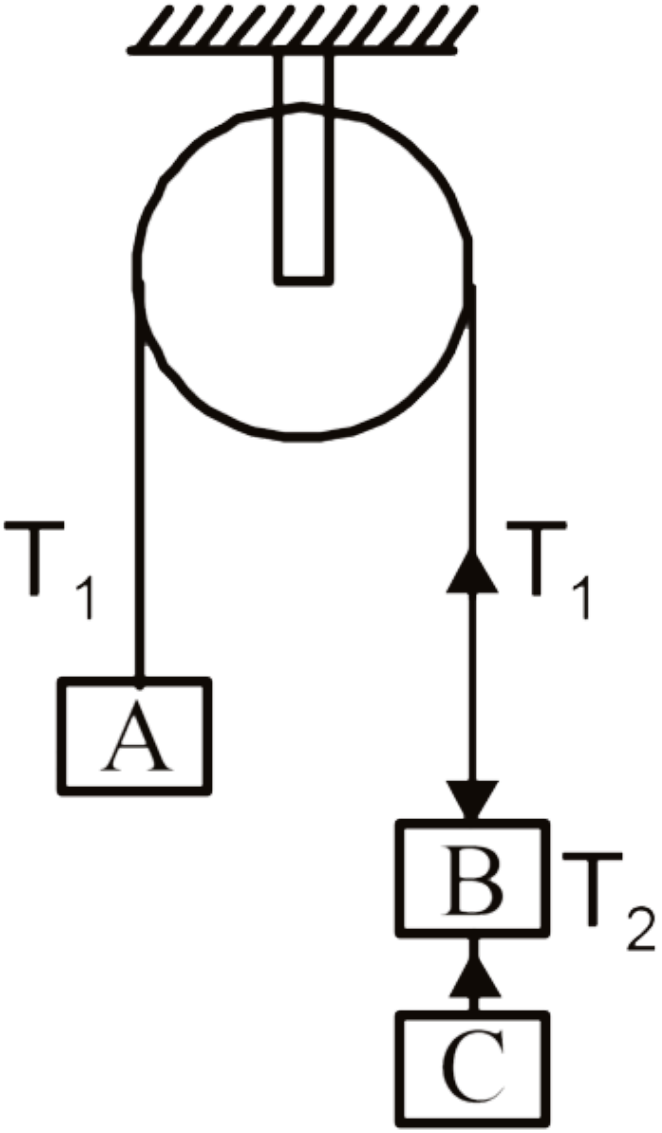
17. Three equal weights of mass m each are hanging on a string passing over a fixed pulley as shown in fig. The tensions in the

string connecting weights A to B and B to C will respectively be -



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18. An elevator and its load weigh a total of 166 kg. Find the tension T in the supporting cable when the elevator, originally moving downwards at $20m/s$ is brought to rest with constant acceleration in a distance of 50 m.

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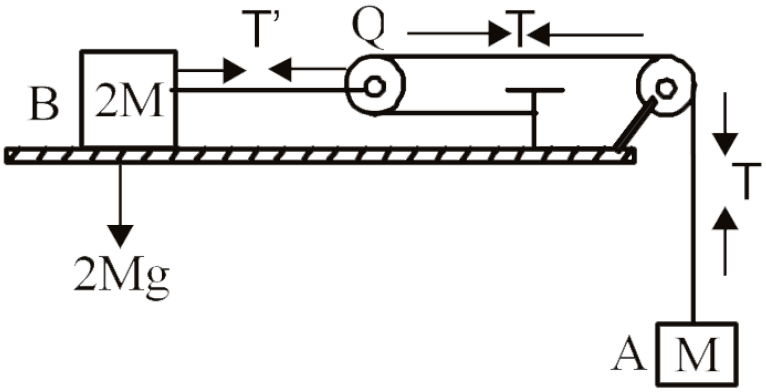
19. In the situation shown in figure, both the pulleys and the strings are light and all the surfaces are frictionless. The acceleration of mass M, tension in the string PQ and force exerted by the clamp on the pulley, will respectively be -



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20. A monkey of mass m climbs up to a rope hung over a fixed pulley. The opposite end of the rope is tied to a weight of mass M lying on a horizontal plane. Neglecting the friction, find the acceleration of both the bodies (relative to the plane) and the tension of the rope for the three cases:

(i) The monkey does not move with respect to the rope

(ii) The monkey moves upwards with respect to the rope with acceleration a.

(iii) The monkey moves downwards with respect to the rope, with acceleration a.

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21. Two 100 g blocks hang at the ends of a light flexible cord passing over a small frictionless pulley. A 40 g block rests on the block an right and removed after 2 sec.

(a) How far will each block move in the first second after the 40 g block is removed?

(b) What was the tension in the cord before the 40 g block was removed?

(c) What was the tension in the cord supporting the pulley after the 40 g block was removed?

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22. A dynomometer D (a force meter) is attached to two masses M = 10 kg and m = 1 kg . Force F = 2 kg f and f = 1 kgf are applied to the masses . What will applied to the masses . What will the dynamometer show if :

(a) F is applied to M and f ot m

(b) F is applied to m and f to M

(c) if M = m = 5 kg .

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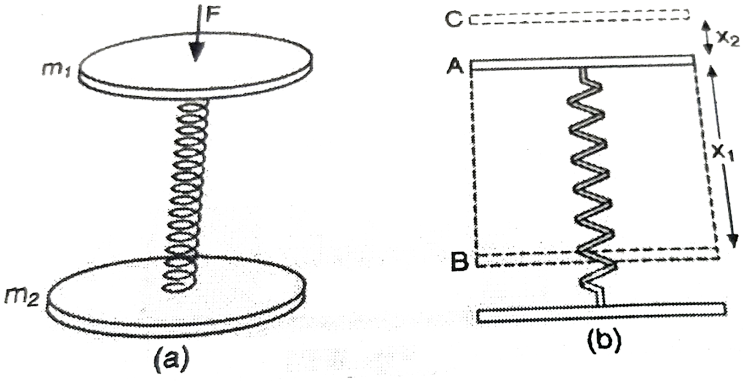
23. A disc of mass m_2 is placed on a table. A stiff spring is attached to it and is vertical. The other end of the spring is attached to a disc of mass m_1 What minimum force should be applied to the upper disc to press the spring such that the lower disc is lifted off the table when the external force is suddenly

removed?



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24. Two blocks A and B are connected to each other by a string and a spring, the string passes over a frictionless pulley as shown in Block B slides over the horizontal surface of a stationary block C and the block. A slides along the vertical side of C, both with same uniform speed. The coefficient of friction between the surface of the blocks is 0.2 Force constant of the spring is 1960 N/m if the mass of block A is 2 kg calculate the mass of the block B and the energy stored in the spring.

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25. On applying a force F the mass M is displaced vertically down by from equilibrium position, Find the force F in terms of the force constant k of the spring and displacement y for the cases (A) and (B) as shown in

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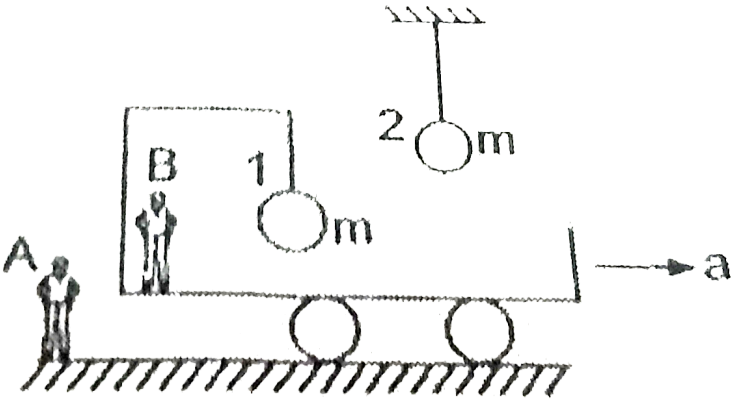
26. What are the rate of change of momenta of the pendulum bobs 1 and 2 as observed from the reference frames A and B respectively Find the net forces acting on the bobs relative to A and B in each case find the tension in the strings as viewed by

both observers.



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27. At wood machine is attached below the left hand pan of a physical balance while equal weight $(M+m)$ g is placed in the right hand pan. The beam is horizontal when the masses M and m on the left hand side are braked What will happen if the masses M and m are unbraked on the left hand side?

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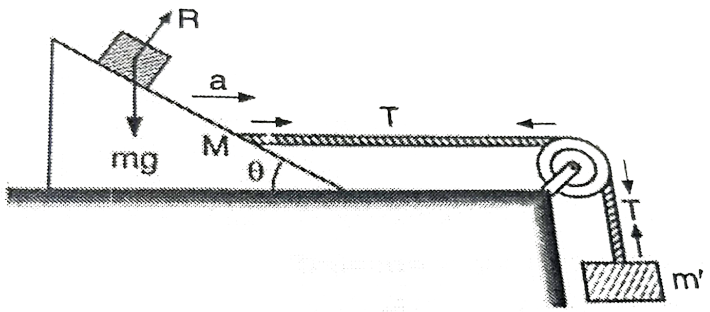
28. Find the mass of the hanging block in which will prevent the smaller block of mass m from slipping over the triangular block of mass M. All the surfaces are frictionless and the strings and the pulleys are light



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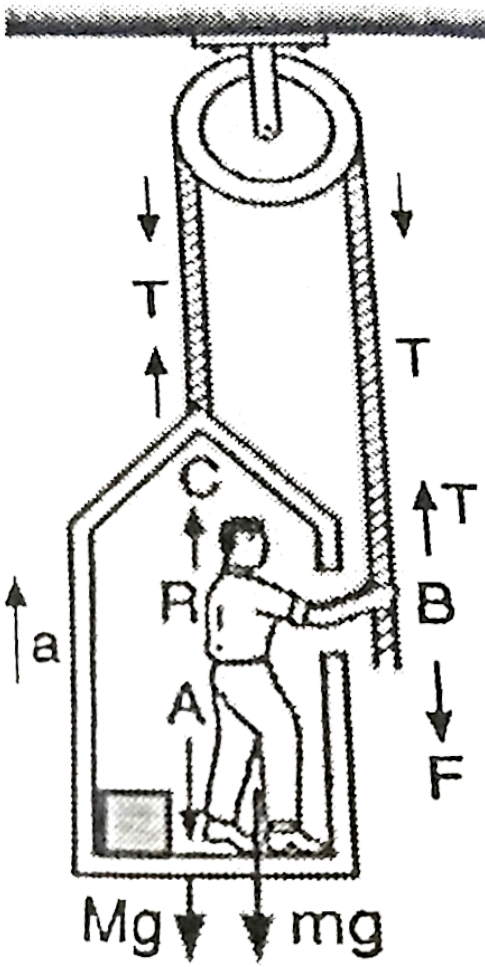
29. In the figure a painter of mass 100 kg pulls himself up with the crate of 25 kg with an acceleration. If the painter exerts an effective force of 450 N on the floor of the crate, find (a) the acceleration of the painter and

(b) the tension in the string taking $g = 10m/s^2$



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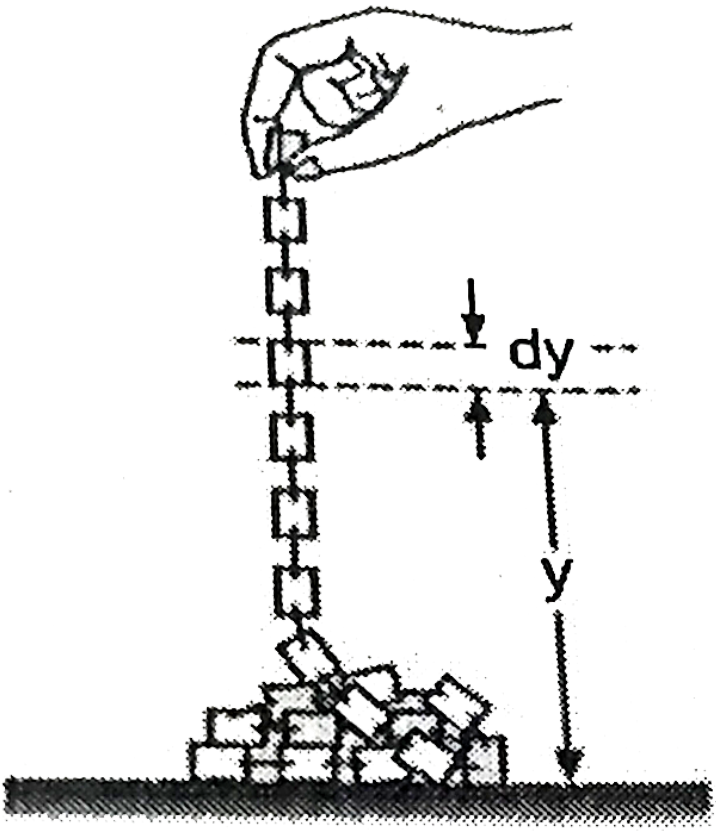
30. A very flexible uniform chain of mass M and length L is suspended vertically so that its lower and just touches the surface of a table. When the upper end of the chain is released it falls with each link coming to rest the instant it strikes the table. Find the force exerted by the chain on the table at the moment when y

part of the chain has already rested on the table.



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31. One end (say B) of a massless spring having force constant k is attached to a block lying on a smooth surface while the other end A is pulled by an external force At some instant the velocities of end A and B of the spring are v_A and v_B respectively. If the energy of the spring is increasing at the rate of PJ/s find the instantaneous tension and stretch in the spring.

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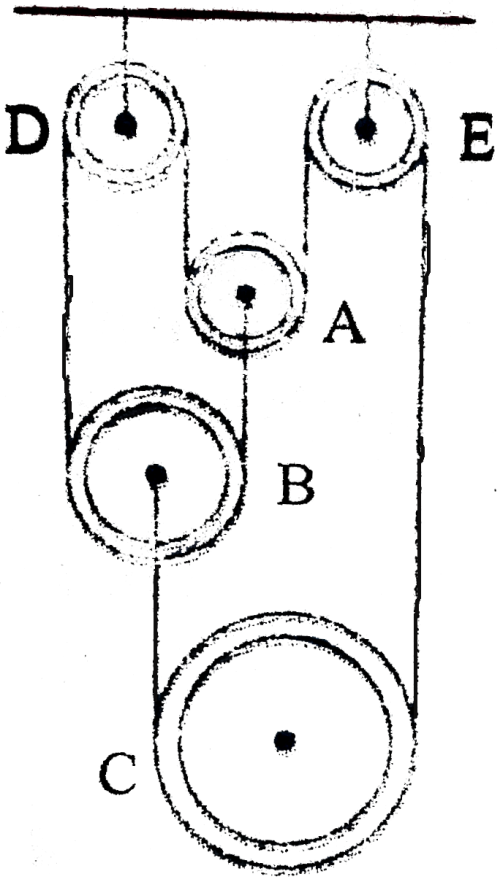
32. In the pulley system shown the movable pulleys A, B and C have mass m each, D and E are fixed pulleys. The strings are

vertical light and inextensible Then



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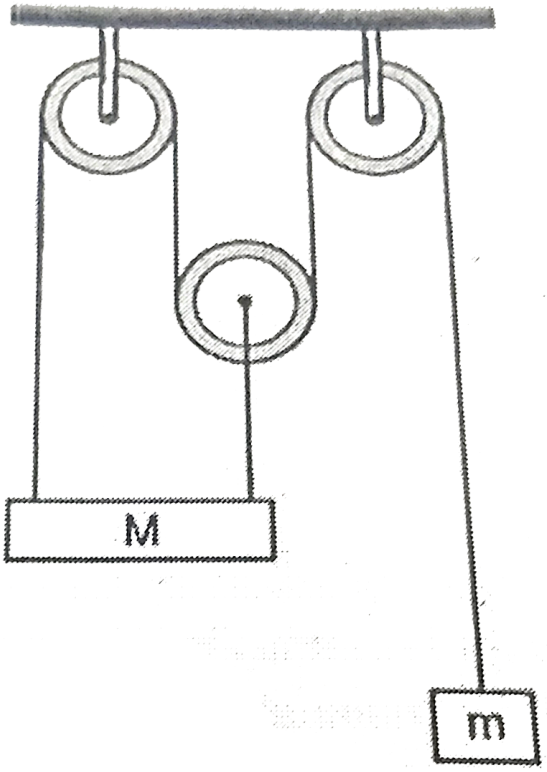
33. Write equations of forces in terms of the relative acceleration for the blocks shown in and find the relation between m and M so

that system remains at rest



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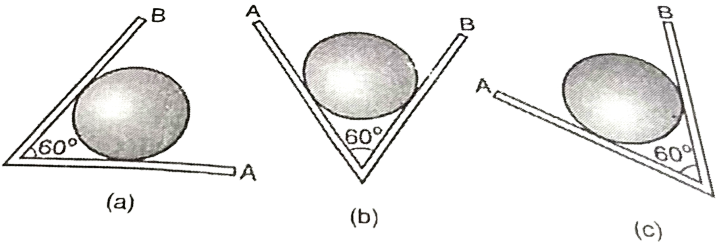
Problem For Practice

1. An iron sphere weights 10 N and rests in a V- shaped trough whose sides form an angle of 60° What are the normal forces exerted by the walls on the sphere in cases as shown in?



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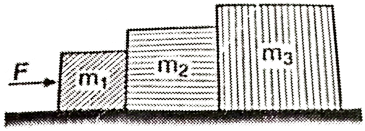
2. Three blocks of masses $m_1 = 2kg m_2 = 3kg$ and $m_3 = 4kg$ are in contact with each other on a frictionless horizontal surface as shown in

(a) Find

(a) horizontal force F needed to push the block as one unit with an acceleration of $2m/s^2$

(b) the resultant force on each block and

(c) the magnitude of contact forces between blocks.



(a)

(b)

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3. A string is wrapped around a log of wood and it is pulled with a force F as shown in

(b) How does the value of tension T in the string change with θ when will the tension T be greater than applied force?

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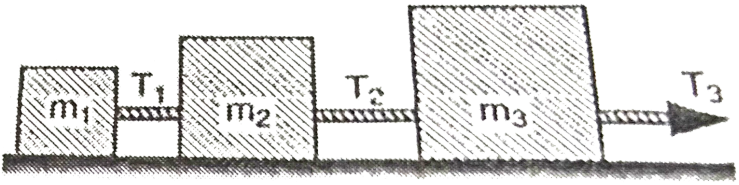
4. Three blocks are connected by strings as shown in and are pulled by a force $T_3 = 60N$ if $m_1 = 10kg, m_2 = 20$ kg and $m_3 = 30kg$ calculate the acceleration of the system and

T_1 and T_2



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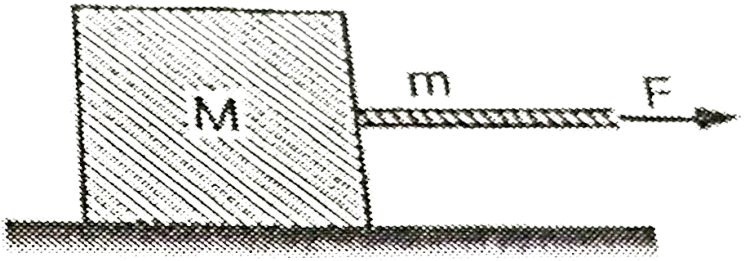
5. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m as shown in A horizontal force F is applied to one end of the rope. Find

(a) the acceleration of the rope and block

(b) the force that the rope exerts on the block

(c) the tension in the rope at its mid point



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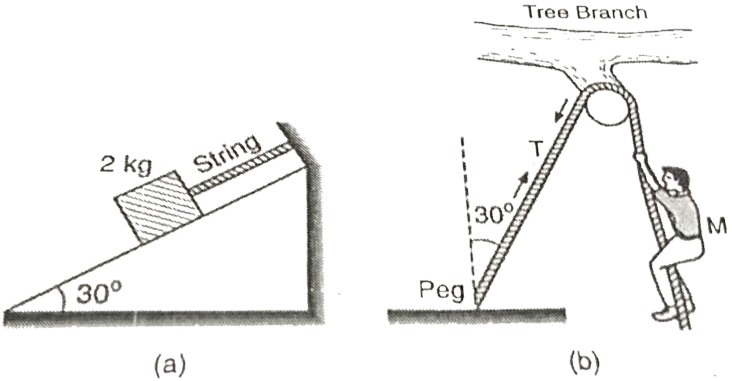
6. A block of mass 2 kg is kept at rest on a smooth inclied plane as shown in (a) with the help of a string Find the tension in the string and reaction on the block if the string is cut, find the acceleration of the block neglecting friction.



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7. A light rope fixed to a peg on the ground passes over a tree branch and hangs on the other side A man weighing 60 kg wants

to climb up the rope. If the peg comes out of the ground by a vertical force greater than $\left(360\sqrt{3}\right)$ N, with what maximum acceleration can the man climb up safely ? $\left(g = 10m/s^2\right)$

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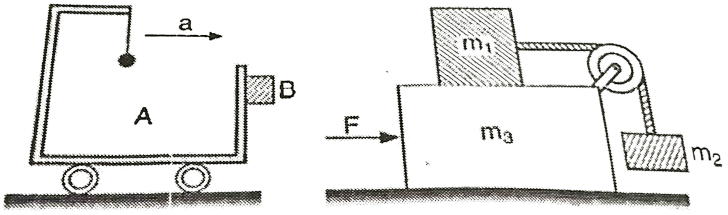
8. A trolley A has a simple pendulum suspended from a frame fixed to its deck A block B is in contact on its vertical side. The trolley is on horizontal rails and accelerates towards the right, such that the block is just



(a) (b)

prevented from falling. If the value of coefficient of friction between A and B is 0.5 find the value of the inclination of the pendulum to the vertical.

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9. What force F must be applied so that m_1 and m_2 are at rest on m_3 in

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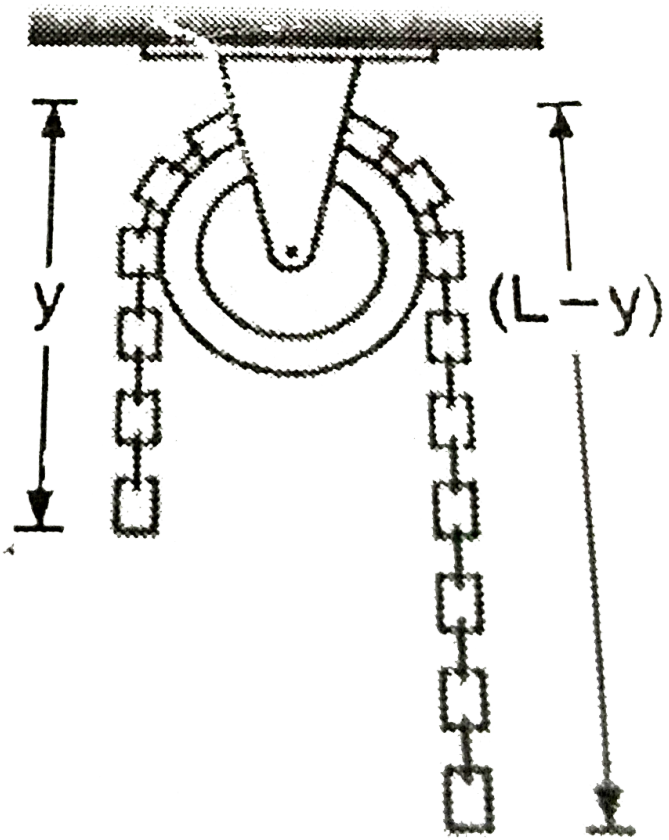
10. A unifrom flexible chain of length L with weight λ per unit length passes over a small frictionless massless pulley. It is released from rest position with length of chain y hanging from one side and $(L-y)$ from the other side

(a) Under what condition will it accelerate?

(b) assuming these circumstances find the acceleration as a

function of y.



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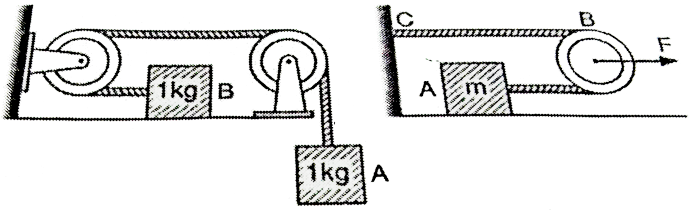
11. Calculate the tension in the string shown in

(a) The pulleys and the string are light and all surfaces are frictionless. $\left(g = 10m/s^2\right)$



(a) (b)

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12. A block A of mass m is tied to a fixed point C on a horizontal table through a string passing round a mass less smooth pulley B.A force F is applied by the pulley B as shown in

(b) Find the accelerations of the pulley and mass A.

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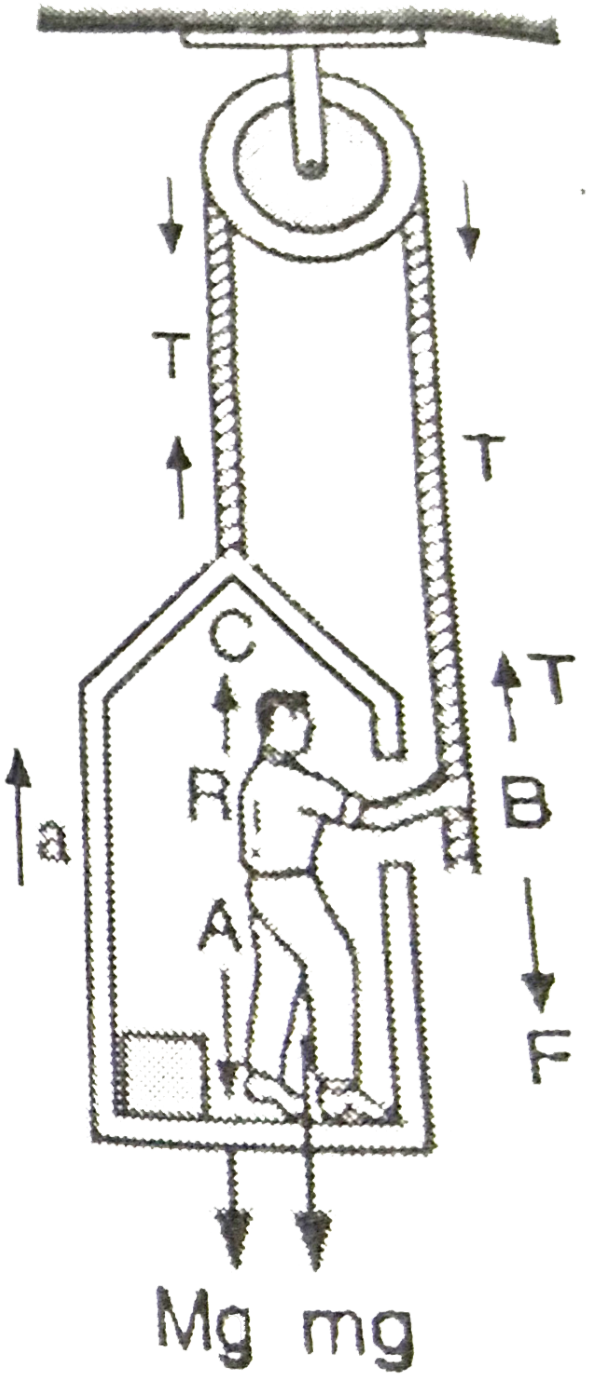
13. shows a man of mass 60 kg standing on a light weighing machine kept in a cabin of mass 40 kg The cabin is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself if the man manages to keep the cabin at rest, what is the weight shown by the machine? What force should he exert on the rope to get his correct weight on the

machine?



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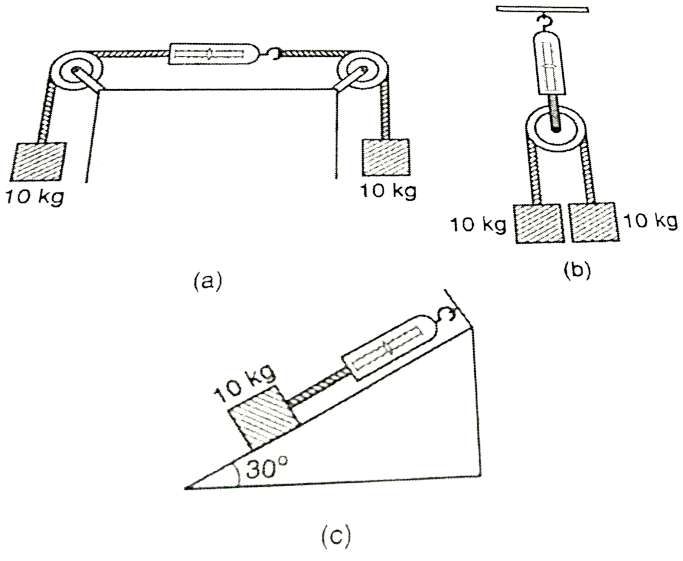
14. The systems shown in are in equilibrium if the spring balance is calibrated in newtons, what does it record in each case? $\left(g = 10m/s^2\right)$



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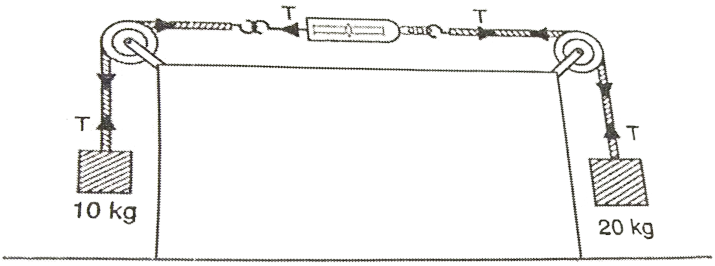
15. What is the reading of the spring balance in the following device?



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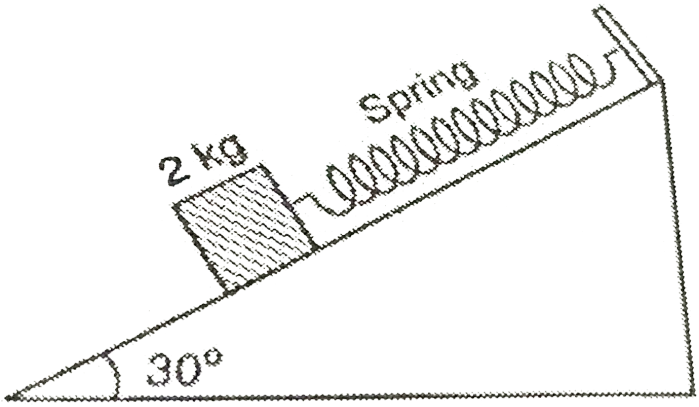
16. 2 kg box rests on a frictionless of angle 30° supported by a spring. The spring stretches by 3cm

(a) Find the force constant of the spring

(b) if the box is pulled down the incline 5 cm from its equilibrium position and released what will be its initial acceleration?

$(g = 10m/s^2)$



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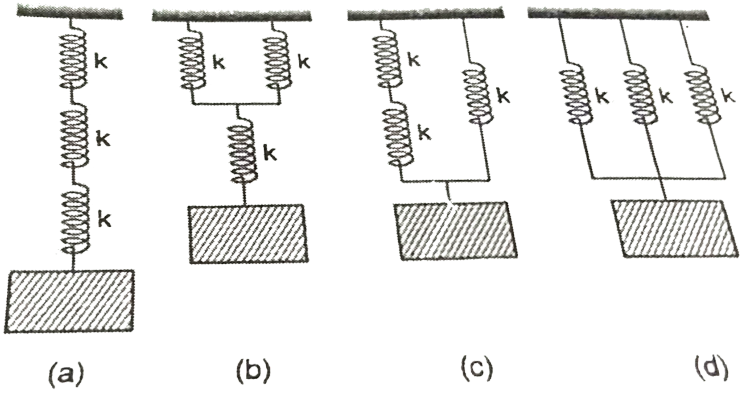
17. From three identical springs (each having force constant k) using all at the same time the following four combinations are

possible fig Calculate the equivalent force constant in each case



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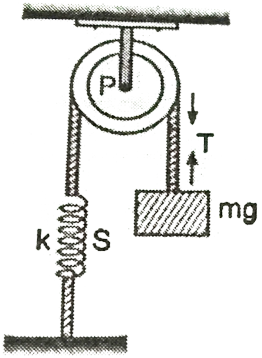
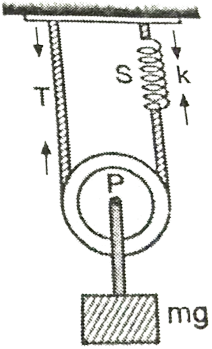
18. Consider the situations shown in fig (a) and (b) initially the spring is unstretched when the mass m is released from rest. Assuming no friction in the pulley find (a) the maximum stretch in the spring (b) stretch in the spring when the system is in

equilibium.



(a)



(b)

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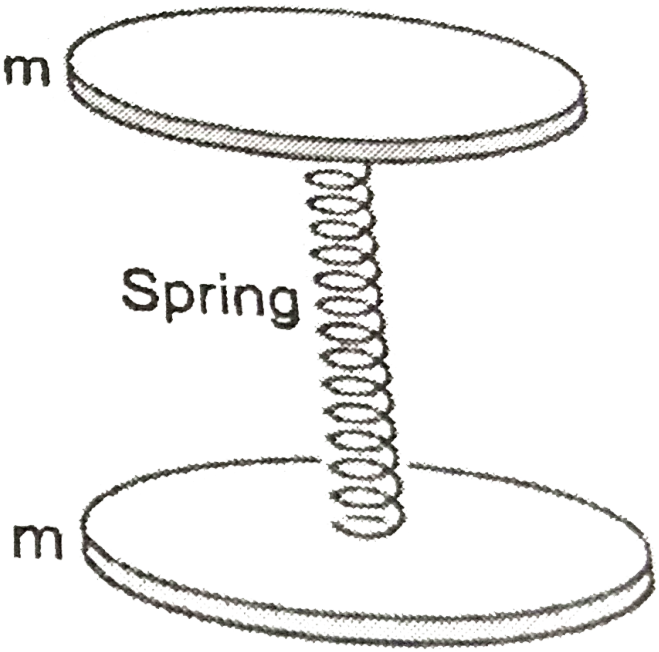
19. Two identical blocks, each of mass m, are connected through a massless spring of force constant k and arranged as shown in fig the spring is compressed by an amount y by applying an external force and released

(a) What is the velocity of upper block when the spring is relaxed

(b) What should be the initial compression of the spring so that

the lower block is just raised above the floor ?



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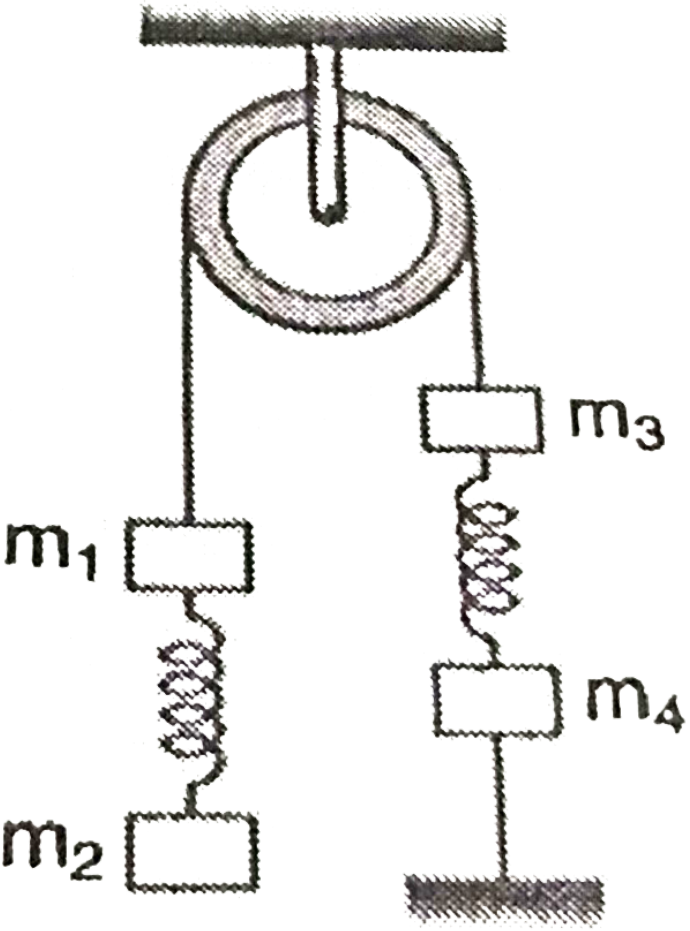
20. Masses m_1, m_2, m_3 and m_4 are arranged in a system as shown in fig where $m_1 + m_2 > m_3 + m_4$ The lower string keeping the system in equilibrium is burnt The masses start moving. Find the acceleration of masses if the threads are

weightless and inextensible the springs are also weightless and the mass of the pulley is negligible.



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21. A solid body moves through air, at very high speed V faster than the velocity of molecules Show that the drag force on the body is proportional to AV^2 where A is the frontal area of the body.

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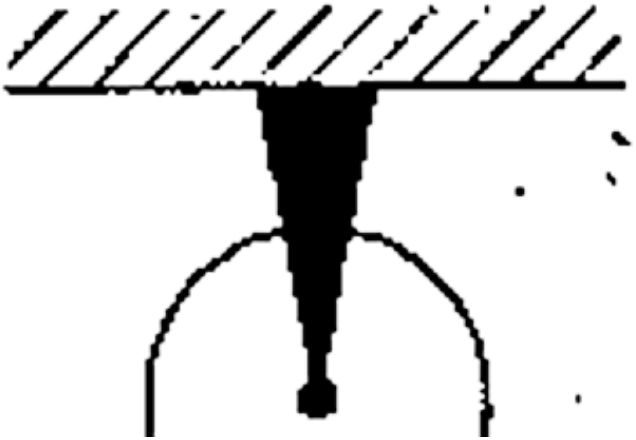
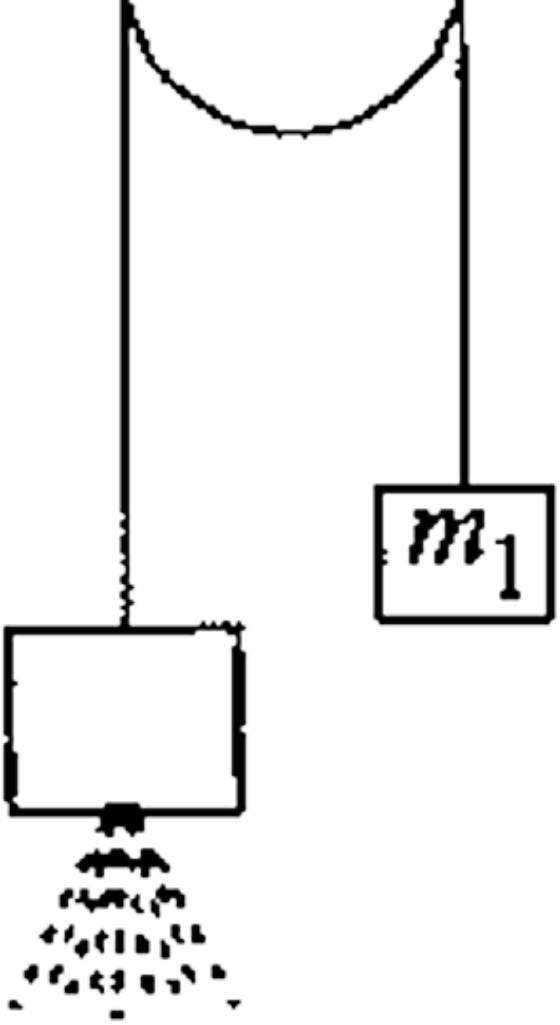
22. A mass m_1 is connected by a weghtless cable of water, whose mass is m_0 at $t = 0$. If the container release water in downward direction at constant rate b kg/s. with a velocity v_0 relative to the container, determine the acceleration of m_1 as a function of time.





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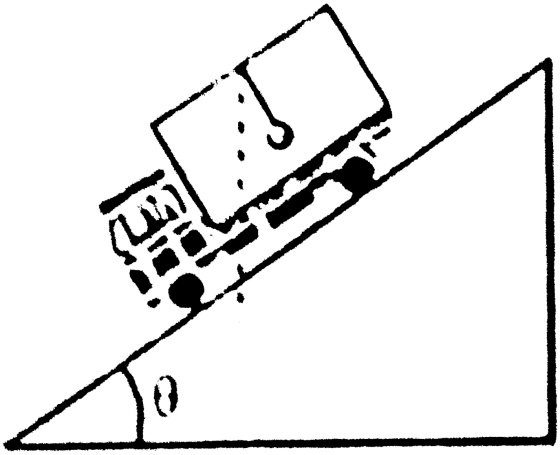
23. A van accelerates uniformly down an inclined hill going from reast to $30m/s$ in $6s$. During the acceleration , a toy of mass

$m = 0.1kg$ hangs by a light string from the van's ceiling . The acceleration is such that string remains perpendicular to the ceiling. (Take $g = 10m/s^2$)



The tension n the string is

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24. A very flexible chain of mass M and length l is suspended vertically in a lift so that its lower end is just touching the surface of the floor. When the upper end of the chain is released, it falls with each link coming to rest intantaneously find the force

exerted by the floor of the lift on the chain at the moment when one fourth of the chain has already landed on the floor Assume the lift is moving with acceleration $g/2$

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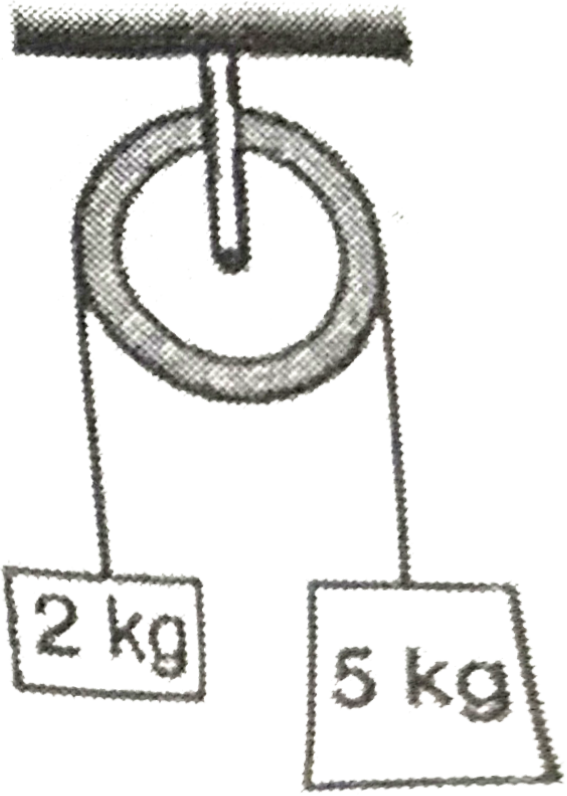
25. Two blocks of masses $m_1 = 2kg$ and $m_2 = 5kg$ hang over a massless pulley as shown in the fig A force $F_0 = 100N$ acting at the axis of the pulley accelerates the system upwards Find

(a) the acceleration of each mass

(b) the tension in the string.



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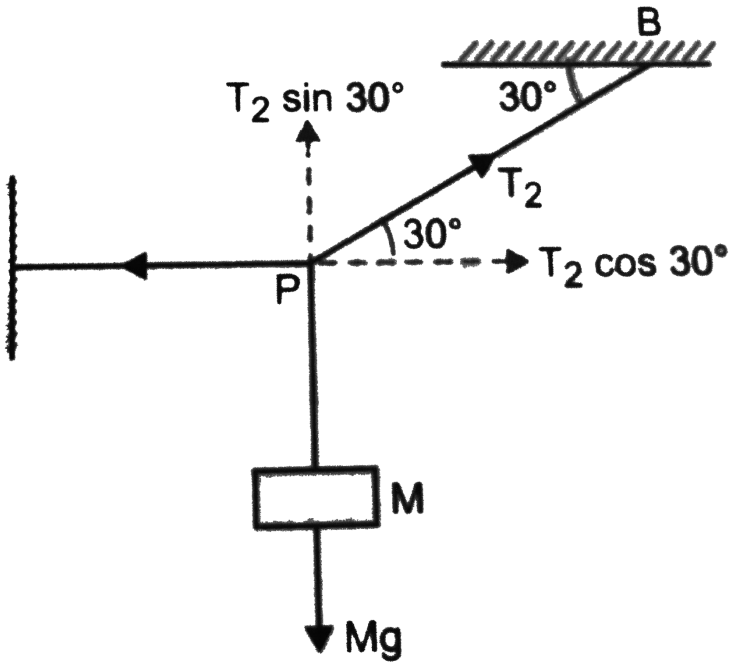
26. A mass M is hung with a light inextensible string as shown in

Find the tension in the horizontal part of the string .



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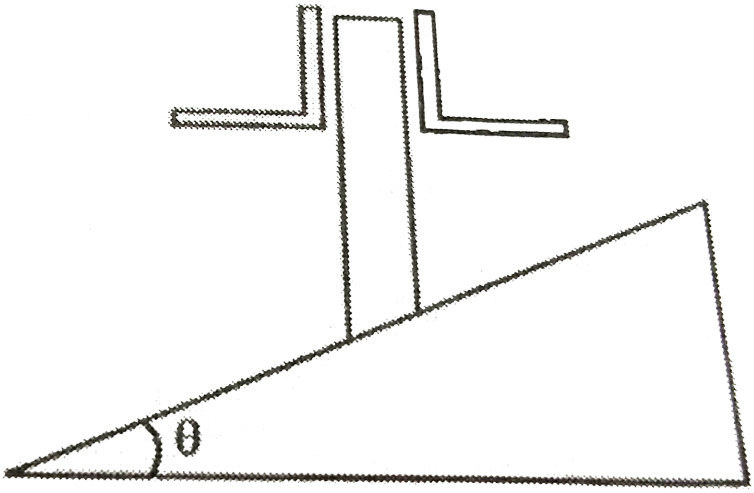
27. Find the acceleration of rod A and wedge B in the arrangement shown in fig if the ratio of the mass of wedge to that of the rod equals η and the friction between the contact surfaces are

negligible.



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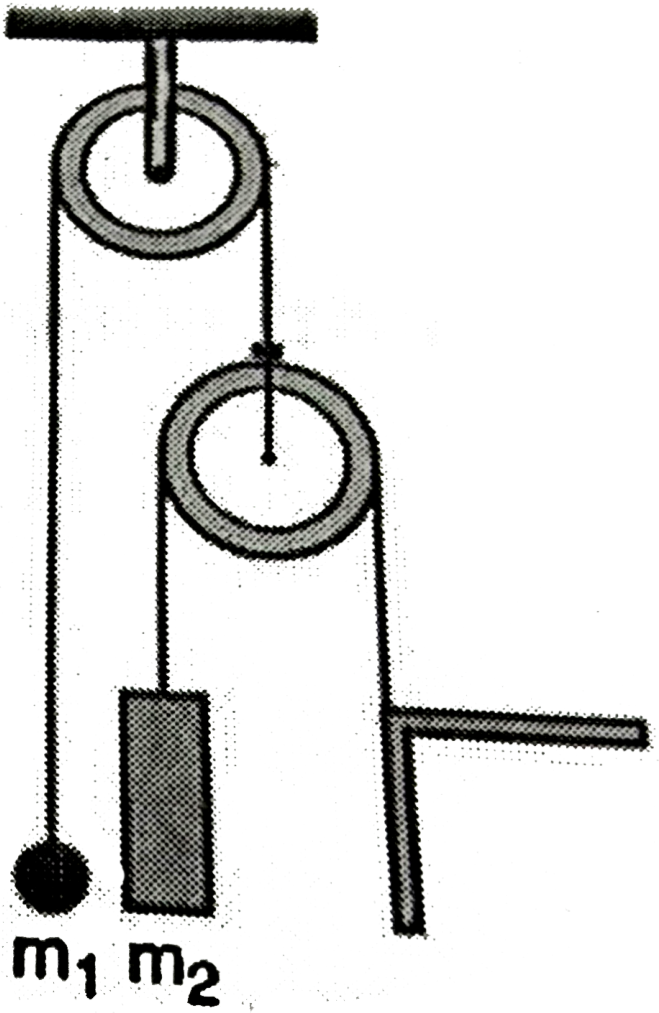
28. In the arrangement shown in fig the mass of the ball 1 is $\eta = 1.8$ times as great as that of rod 2 The length of the later is $l = 100$ cm The masses of the pulleys and the threads as well as the friction are negligible The ball is set on the same level as the lower end of the rod and then released How soon will the ball be

opposite to the other end of the rod



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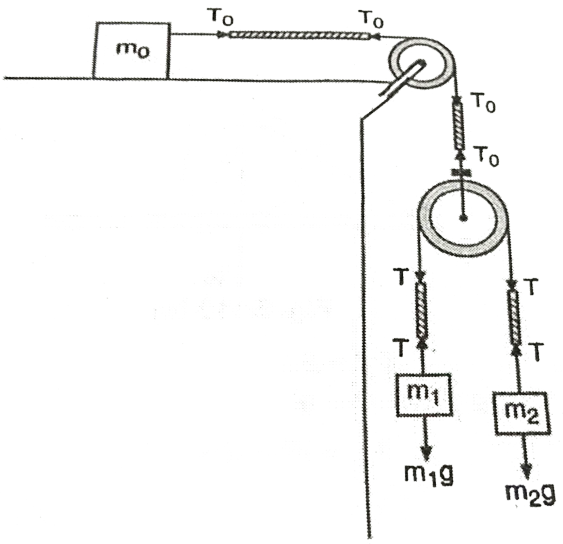
29. In the arrangement shown in fig the bodies have masses m_0, m_1 and m_2 the friction is absent the masses of pulleys and the threads are negligible find the acceleration of the body m_1



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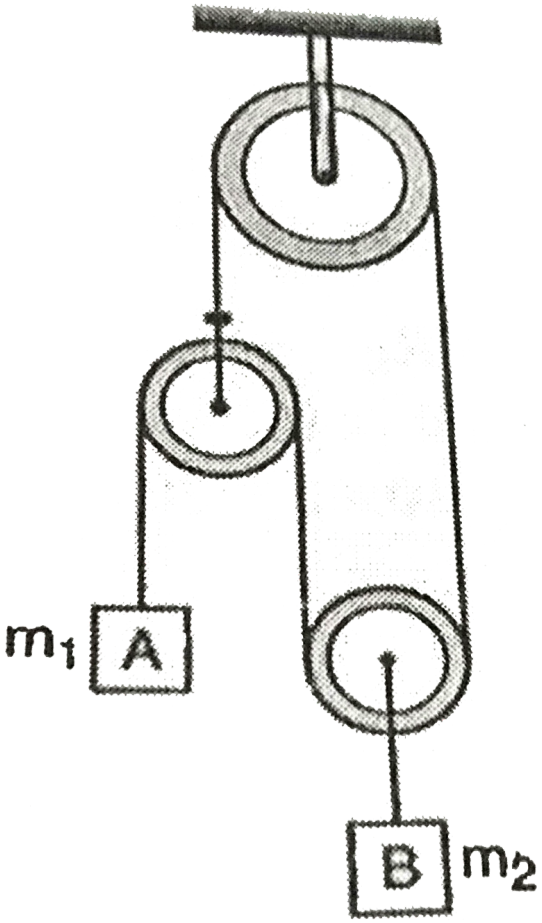
30. In the arrangement shown in fig neglect the masses of pulleys and string and also friction Calculate acceleration of blocks A and

B



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Objective Questions

1. When a body is stationary:

A. there is no force acting on it

B. the forces acting on it are not in contact with it

C. the combination of forces acting on it balance each other

D. the body is in vacuum

Answer: C

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2. A particle is in straight line motion with uniform velocity A force is not required

A. to increase the speed

B. to decrease the speed

C. to keep the same speed

D. to change the direction

Answer: C

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3. Essential characteristic of equilibrium is:

A. momentum equals zero

B. acceleration equals zero

C. K.E. equals zero

D. velcity equald zero

Answer: B

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4. When a constant force is applied to a body, it moves with unifrom

A. acceleration

B. velocity

C. speed

D. momentum

Answer: A

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5. An object will continue moving uniformly until

A. resultant force on it begins to decrease

B. its velocity changes direction

C. the resultant force on it is zero

D. the resultant force is at right angles to its direction of motion

Answer: C

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

A. velocity is constant

B. acceleration is constant

C. K.E. is constant

D. none of these

Answer: C

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7. A body of mass $2kg$ moving on a horizontal surface with an initial velocity of $4ms^{-1}$ comes to rest after 2 second. If one wants to keep this body moving on the same surface with a velocity of $4ms^{-1}$ the force required is

A. 8 N

B. 4 N

C. zero

D. 2 N

Answer: B

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8. Two blocks of masses 2 kg and 1 kg are in contact with each other on a frictionless table. When a horizontal force of 3.0 N is applied to the block of mass 2 kg the value of the force of contact between the two blocks is:

A. 4 N

B. 3 N

C. 2 N

D. 1 N

Answer: D

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9. Two persons are holding a rope of negligible weight tightly at its ends so that is horizontal. A 15kg weight is attached to the mid

point which how no longer remains horizontal. The minimum tension required to completely straighten the rope is:

A. 15 kg

B. $15/2$ kg

C. 5 kg

D. infinitely large

Answer: D

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10. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m . Force P is applied at one end of rope. The force which the rope exerts on the block is:

A. $F/(M+m)$

B. F

C. $FM/(m+M)$

D. zero

Answer: C

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11. A uniform rope of mass M and length L, on which a force F is applied at one end, then find stress in the ropw at a distance x form the end where force is applied?

A. zero

B. F

C. $F(L-x)/L$

D. $F(L-x)/M$

Answer: C

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12. A chain of mass M and length L is held vertical by fixing its upper end to a rigid support. The tension in the chain at a distance y from the rigid support is:

A. Mg

B. $Mg(L-y)/L$

C. $MgL/(L-y)$

D. Mgy/L

Answer: B

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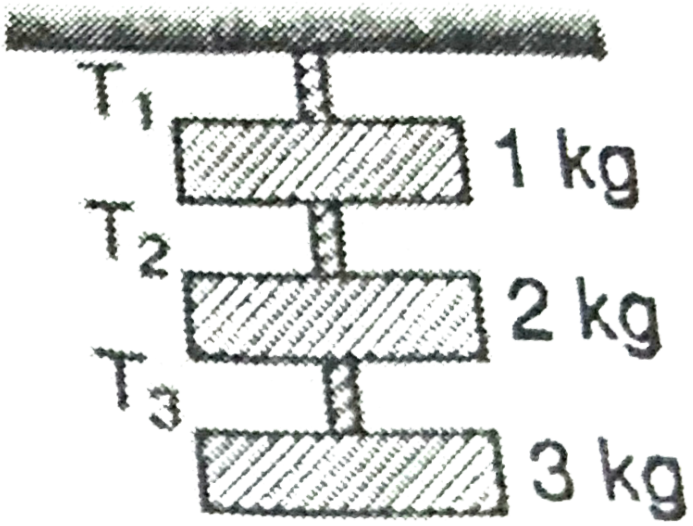
13. Find the tension T_2 in the system shown in fig



A. 1g N

B. 2g N

C. 5g N

D. 6g N

Answer: C

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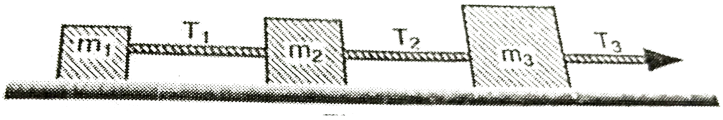
14. Three blocks are connected as shown in the fig on a horizontal frictionless table if $m_1 = 1kg, m_2 = 8kg, m_3 = 27kg$ and $T_3 = 36N, T_2$ will be:



A. 18 N

B. 9 N

C. $3.375N$

D. $1.75N$

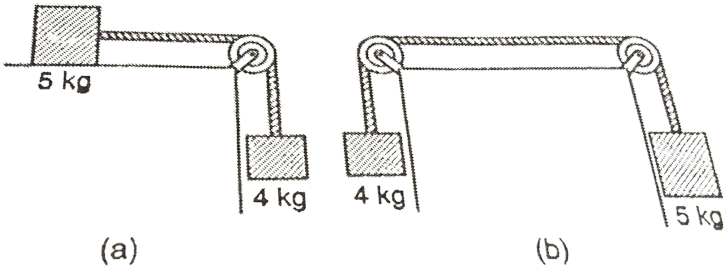
Answer: B

Watch Video Solution

15. Two bodies of masses 5 kg and 4 kg are arranged in two positions as shown in fig

(a) and

(b) if the pulleys and the table are perfectly smooth, the accelerations of the 5 kg body in case (a) and (b) are:



A. g and $(5/9)g$

B. $(4/9)g$ and $(1/9)g$

C. $g/5$ and $g/5$

D. $(5/9)g$ and $(1/9)g$

Answer: B

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16. If x, F and U denote the dispalcement, force acting on and potential energy of a particle then

A. $U = F$

B. $F = +\frac{dU}{dx}$

C. $F = -\frac{dU}{dx}$

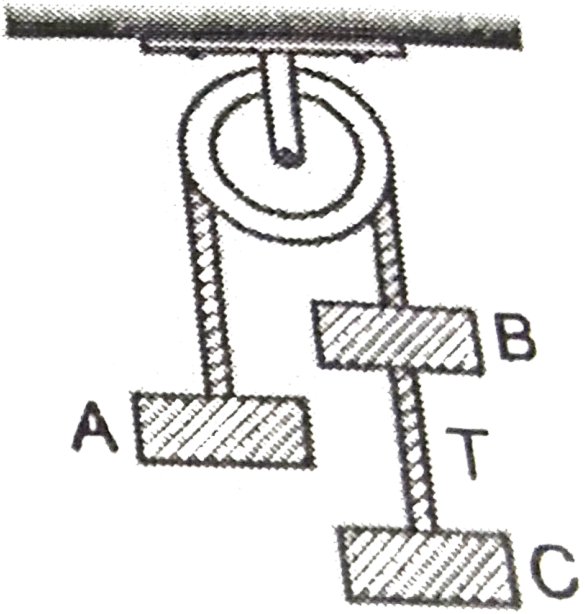
D. $F = \frac{1}{x}\left(\frac{dU}{dx}\right)$

Answer: C

Watch Video Solution

17. Three equal weights of mass 2 kg each are hanging on a string passing over a fixed pulley as shown in fig What is the tension in

the string connecting weights B and C?



A. zero

B. 13 N

C. $3.3N$

D. $19.6N$

Answer: B

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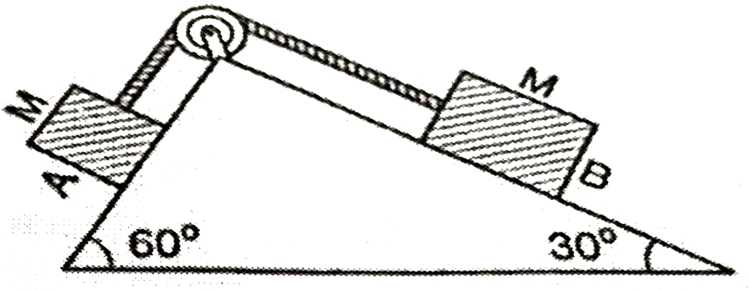
18. Two blocks each of mass M are resting on a frictionless inclined plane as shown in fig then:



A. the block A moves down the plane

B. the block B moves down the plane

C. both the blocks remain at rest

D. both the blocks move down the plane

Answer: A

Watch Video Solution

19. A small sphere is suspended by a string from the ceiling of a car. If the car beings to move with a constant acceleration a, the inclination of the string to the vertical is:

A. $\tan^{-1}(a/g)$ in the direction of motion

B. $\tan^{-1}(a/g)$ opposite to the direction of motion

C. $\tan^{-1}(g/a)$ in the direction of motion

D. $\tan^{-1}(g/a)$ opposite to the direction of motion

Answer: B

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20. A strectching force of 1000 newton is applied at one end of a spring balance and an equal stretching force is applied at the other end at the same time. The reading of the balance will be:

A. 2000 N

B. zero

C. 1000 N

D. 500 N

Answer: C

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21. A spring obeying Hooke's law has a force constant k. Now if the spring is cut in two equal parts, the force constant of each part is:

A. k

B. $k/2$

C. $2k$

D. zero

Answer: C

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

A. $(2/3)k$

B. $(3/2)k$

C. $3k$

D. $6k$

Answer: B

Watch Video Solution

23. A spring obeys Hooke's law. When loaded with 12 g its extension is 2 cm Which of the following will produce a 3 cm extension if $g = 10m/s^2$?

A. $12 \times (3/2) \times g$

B. $12 \times (2/3) \times g$

C. A force of 1.8 N

D. A force of 0.12 N

Answer: A

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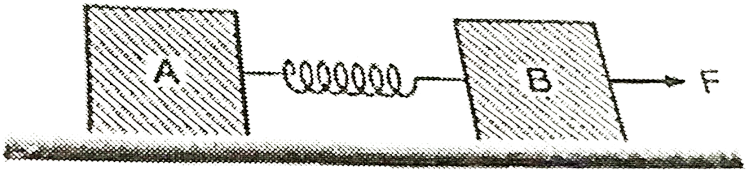
24. Two bodies A and B each of mass M are fixed together by a massless spring A force F acts on the mass B as shown in fig At the instant shown the mass A has acceleration a. What is the

acceleration of mass B?



A. $(F/M) - a$

B. a

C. $-a$

D. (F/M)

Answer: A

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25. In a cricket match the fielder draws his hands backward after receiving the ball in order to take a catch because:

A. his hands will be saved from getting hurt

B. he deceives the player

C. it is a fashion

D. he catches the ball firmly

Answer: A

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26. In a legend the hero kicked a baby pig so that he is projected with a speed greater than that of his cry. If the weight of the baby pig is assumed to be 5 kg and the time of contact 0.01 sec, the force with which the hero kicked him was:

A. $5 \times 10^{-2} N$

B. $2 \times 10^{5} N$

C. $1.65 \times 10^5 N$

D. $1.65 \times 10^3 N$

Answer: B

View Text Solution

27. The length of an elastic string is x when tension is 5N. Its length is y when tension is 7N What will be its length when tension is 9N?

A. $2y + x$

B. $2y - x$

C. $7x - 4y$

D. $7x + 5y$

Answer: B

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28. A rocket is fired from the earth's surface to put the pay load in the required orbit/ The motion of the rocket is given by:

A. $F = m\left(\frac{dv}{dt}\right)$

B. $F = \frac{dp}{dt}$

C. $F = v\left(\frac{dm}{dt}\right)$

D. F= constant

Answer: C

View Text Solution

29. An elevator starts from rest with a constant upward acceleration it moves 2m in the first 0.6 second. A passenger in

the elevator is holding a 3 kg package by a vertical string When the elevator is moving What is the tension in the string?

A. 4 N

B. $62.7N$

C. $29.4N$

D. $20.6N$

Answer: B

Watch Video Solution

30. A uniform thick string of length 5 m is resting on a horizontal friction-less surface. It is pulled by a horizontal force of 5 N from one end. The tension in the string at 1m from the force applied is :

A. zero

B. 5 N

C. 4 N

D. 1 N

Answer: C

Watch Video Solution

31. A body of mass M rests on a horizontal plane having coefficient of friction μ . At $t = 0$ a horizontal force $\overrightarrow{F}$ is applied that varies with time $\overrightarrow{F}(t) = \overrightarrow{F}_0$ t where $\overrightarrow{F}_0$ is a constant vector. The time instant t_0 at which motion starts and distance moved in t second will be:

A. $\frac{Mg}{\mu F_0}$ and $\frac{F_0}{M}(t - t_0)^2$

B. $\frac{\mu Mg}{F_0}$ and $\frac{1}{6}\frac{F_0}{M}(t - t_0)^3$

C. $\frac{\mu F_0}{Mg}$ and $\frac{F_0}{M}(t-t_0)^2$

D. $\frac{F_0}{Mg}$ and $\frac{F_0}{2Mg}(t-t_0)^2$

Answer: B

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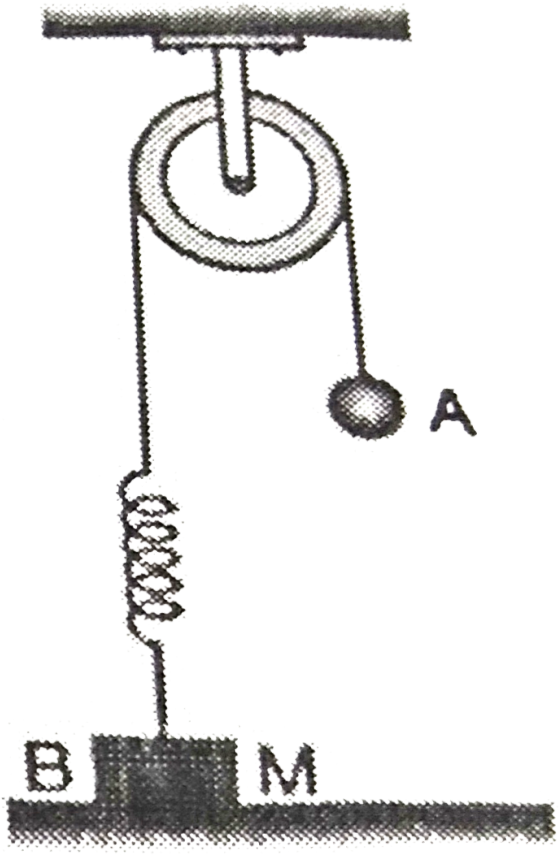
32. In the adjoining diagram the ball A is released from rest when the spring is at its natural length (neither stretched nor compressed) For the block B of mass M to leave contact with the

ground at some time, the minimum mass of A must be:



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

B. M

C. $2M$

D. a function of M and force constant k of spring

Answer: A

Watch Video Solution

33. A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is

A. same every where

B. lower in the front side

C. lower in the rear side

D. lower in the upper side

Answer: B

Watch Video Solution

34. A block of mass m is placed on a smooth wedge of wedge angle θ The whole system is accelerated horizontally so that the block does not slip on the wedge. The force (normal reaction) exerted by the wedge on the block has a magnitude:

A. $mg\tan\theta$

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

C. mg

D. $mg\cos\theta$

Answer: B

Watch Video Solution

35. Sand is being dropped on a conveyor belt at the rate of Mkg/s . The force necessary to kept the belt moving with a constant with a constant velocity of vm/s will be.

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

B. zero

C. Mv

D. $2Mv$

Answer: C

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36. The line of action of the resultant of two like parallel forces shifts by one-fourth of the distance between the forces when the two forces are interchanged. The ratio of the two forces is:

A. $1:2$

B. $3:2$

C. $3:4$

D. $3:5$

Answer: B

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37. If a particle is compelled to mvoe on a given smooth plane curve under the action of given forces in the plane $\vec{F} = x\vec{i} + y\vec{j}$, then:

A. $\vec{F} . d\vec{r} = xdx + ydy$

B. $\int \vec{F} . d\vec{r} \neq \frac{1}{2}mv^2$

C. $\vec{F} . d\vec{r} \neq xdx + ydy$

D. $\frac{1}{2}mv^2 \neq \int (xdx + ydy)$

Answer: A

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38. A ball of mass 150 gm starts moving at $20m/s$ and is hit by a force which acts for 0.1 second. The impulsive force is:

A. 75 N

B. 300 N

C. 3 N

D. 30 N

Answer: D

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39. If a man of ,mass M jumps to the ground from a height h and his centre of mass noves a distance x in the time taken by him to

'hit' the ground the average force acting on him (assuming his retardation to be constant during his impact with the ground) is :

A. $\frac{Mgh}{x}$

B. $\frac{Mgx}{h}$

C. $Mg\left(\frac{h}{x}\right)^2$

D. $Mg\left(\frac{x}{h}\right)^2$

Answer: A

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40. A bullet moving with a speed 'v' can just penetrate two planks of equal thickness. Number of such planks that the bullet will penetrate if its speed is doubled, is:

A. 8

B. 6

C. 9

D. 4

Answer: A

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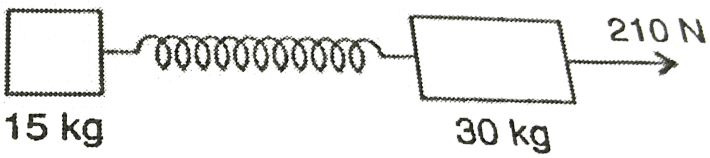
41. In the system shown in fig the mass 30 kg is pulled by a force 210 N At the instant when the 15 kg mass has acceleration $6m/s^2$ the acceleration of 30 kg mass will be: (Assume the spring to the massless)



A. $2m/s^2$

B. $3m/s^2$

C. $3.4m/s^2$

D. $4m/s^2$

Answer: D

Watch Video Solution

42. In the system shown in fig when both masses are moving with the same acceleration the extension in the spring, if its spring constant is $100N/m$ is:

A. 40 cm

B. 50 cm

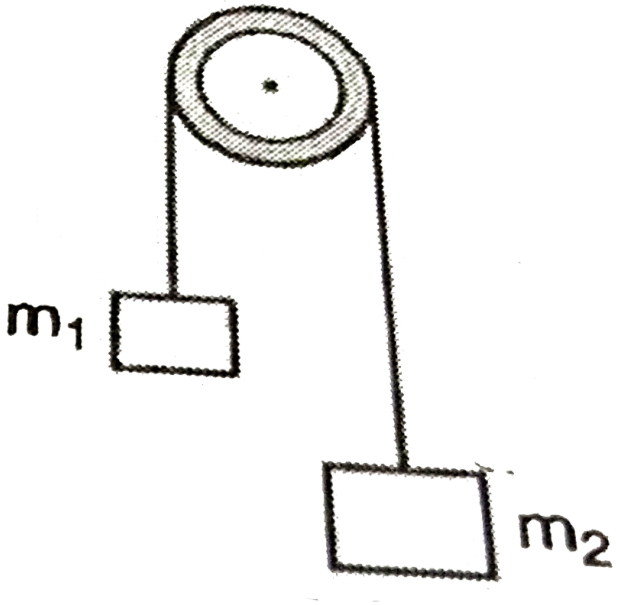
C. 70 cm

D. 62 cm

Answer: C

View Text Solution

43. In the system shown in fig the pulley is frictionless and the string massless if $m_1 = m_2$ thrust on the pulley will be:



A. less than $(m_1 + m_2)g$

B. greater than $(m_1 + m_2)g$

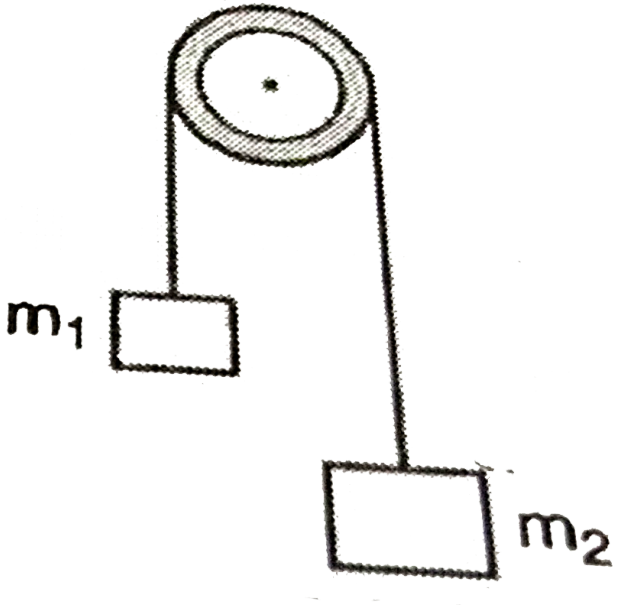
C. equal to $(m_1 + m_2)g$

D. none of the above

Answer: C

Watch Video Solution

44. In the system shown in fig the pulley is frictionless and the string massless if $m_1 = m_2$ thrust on the pulley will be:



A. less than $(m_1 + m_2)$ g

B. greater than $(m_1 + m_2)$ g

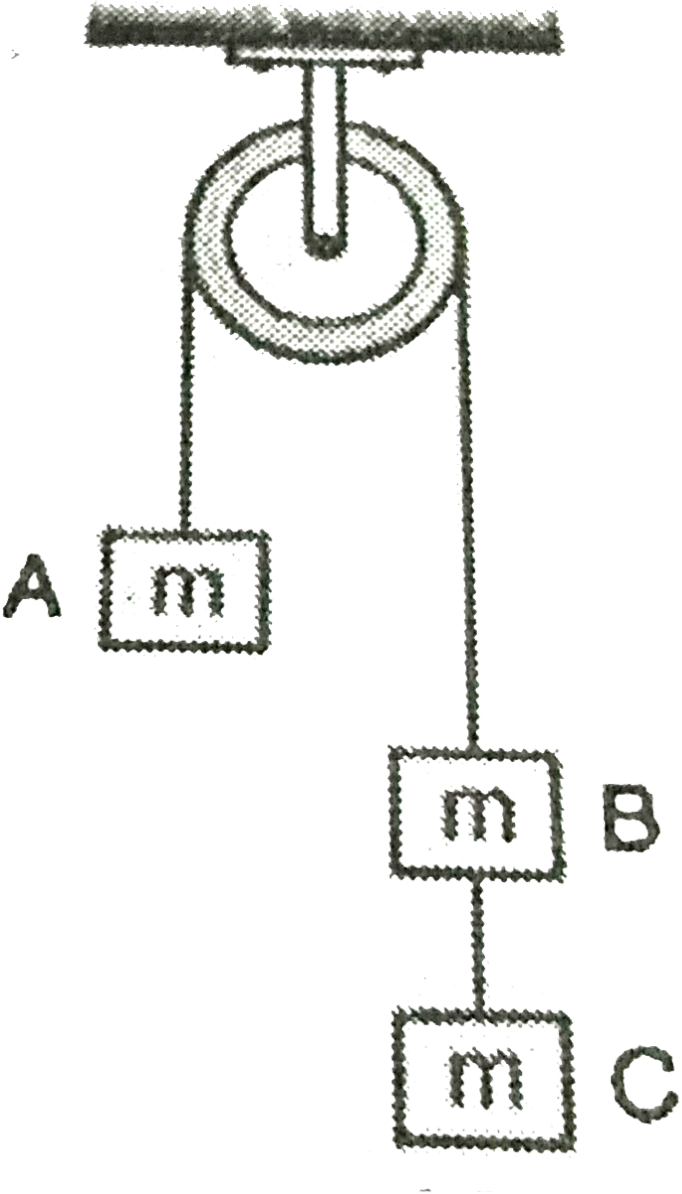
C. equal to $(m_1 + m_2)$ g

D. none of the above

Answer: A

Watch Video Solution

45. In fig tension in the string that connects the masses A and B is T_1 and that in the string connecting B and C is T_2 then $\frac{T_1}{T_2}$ is:



A. 2

B. 0.5

C. 4

D. 0.25

Answer: A

Watch Video Solution

46. In a conservative field at stable equilibrium potential energy is:

A. maximum

B. minimum

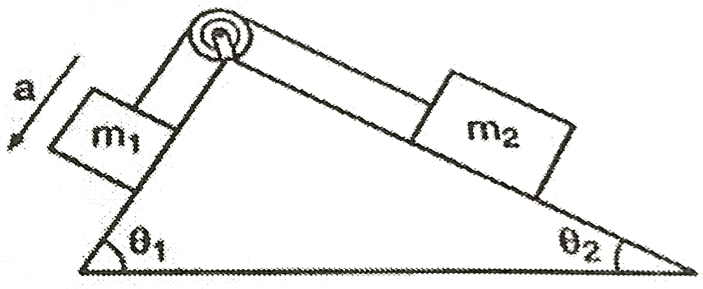
C. constant

D. maximum or minimum

Answer: B

Watch Video Solution

47. Two masses m_1 and m_2 are connected to the ends of a massless string that passes over a pulley fixed at the top of a double incline as shown. Assuming $m_1 > m_2$ acceleration of the system is:



A. $\frac{m_1 g \sin\theta_1 + m_2 g \sin\theta_2}{m_1 + m_2}$

B. $\frac{m_1 g \sin\theta_1 - m_2 g \sin\theta_2}{m_1 - m_2}$

C. $\frac{m_1 g \sin\theta_1 - m_2 g \sin\theta_2}{m_1 + m_2}$

D. $\frac{(m_1 + m_2)(\sin\theta_1 + \sin\theta_2) g}{m_1 - m_2}$

Answer: C

Watch Video Solution

48. Length of a spring is l_1 when it is loaded by 5 N its length is l_2 when loaded by 7N its length when loaded by 9N will be:

A. $2l_1 + 2l_2$

B. $2l_1 + l_2$

C. $2l_2 - l_1$

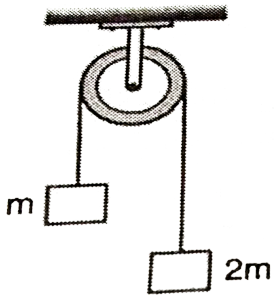
D. $2l_1 - l_2$

Answer: C

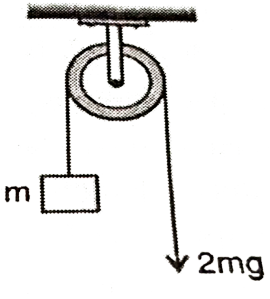
Watch Video Solution

49. In fig mass m is lifted up by attaching a mass 2m to the other end of the string while in fig

(b) m is lifted by pulling the other end of the string with a constant force $F = 2mg$ then:



(a)



(b)

A. acceleration of m in the two situations is same and non - zero

B. acceleration of m in situation

(a) is more than that of in situation(b)

C. acceleration of m in situation

(a) is less than that of in situation

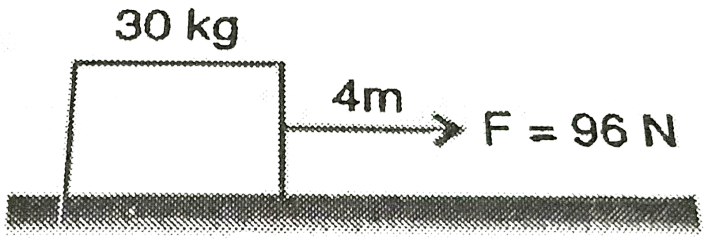
(b)

D. acceleration of m in the two situations is same and equals to zero

Answer: C

Watch Video Solution

50. A 30 kg body is pulled by a rope 4 m long on a frictionless horizontal surface by a force 96 N if mass of the rope is 2 kg, force acting on the body is:



A. 96 N

B. 94 N

C. 92 N

D. 90 N

Answer: D

Watch Video Solution

51. A block mass 'm' is placed on a frictionless inclined plane of inclination θ with horizontal. The inclined plane is accelerated horizontally so that the block does not slide down. In this situation vertical force exerted by the inclined plane on the block is:

A. $mg\sin\theta$

B. $mg\cos\theta$

C. mg

D. none of these

Answer: C

Watch Video Solution

52. In if the inclined plane is not accelerating and the block is then sliding down the plane, force exerted by the block on the plane is:

A. $mg\tan\theta$

B. $mg\sin\theta$

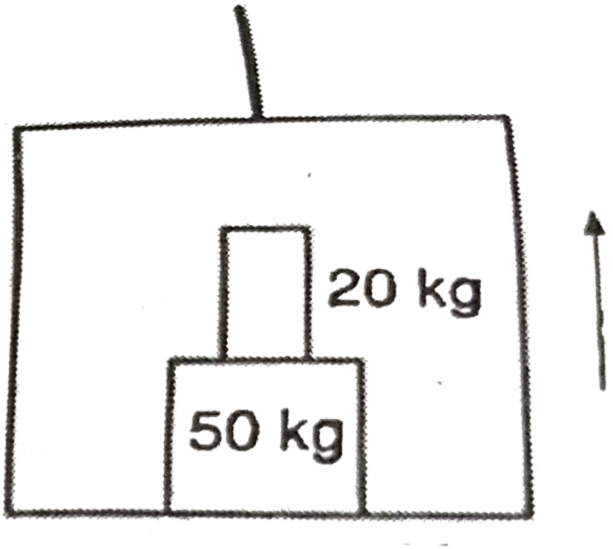
C. mg

D. none of these

Answer: D

Watch Video Solution

53. On the floor of an elevator a block of mass 50 kg is placed on which another block of mass 20 kg is also placed. The elevator is moving up with a constant acceleration $1.5m/s^2$ Force exerted by 20 kg block on the 50 kg block is nearly:



A. 250 N

B. 230 N

C. 170 N

D. 150 N

Answer: B

Watch Video Solution

54. A person wishes to slide down a rope whose breaking load is $\frac{3}{5}$ of the weight of the person Minimum acceleration by which the person should slide down without breaking the rope is:

A. $0.8g$

B. $1.2g$

C. $0.6g$

D. $0.4g$

Answer: D

Watch Video Solution

55. A gun is mounted on a vehicle which is at rest on a frictionless road Mass of vehicle+gun is 1600 kg The gun fires 20 bullets per sec, each with a velocity $400m/s$ Mass of each bullet is 20 gm Acceletaion produced in the vehicle is:

A. $12cm/s^2$

B. $14cm/s^2$

C. $8cm/s^2$

D. $10cm/s^2$

Answer: D

Watch Video Solution

56. An open knife of mass m is dropped from a height h on a wooden floor. If the blade penetrates up to the depth d into the

wood. The average resistance offered by the wood to the knife edge is .

A. Mg

B. $Mg\left(1+\frac{h}{S}\right)$

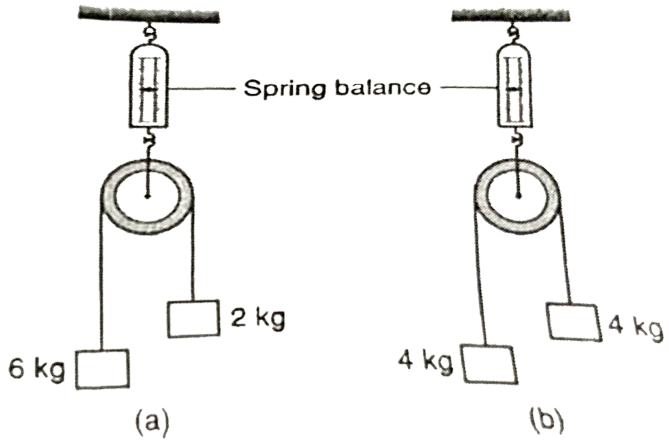
C. $Mg\left(1-\frac{h}{S}\right)$

D. $Mg\left(1+\frac{h}{S}\right)^2$

Answer: B

Watch Video Solution

57. Referring to fig (a) and (b)



A. reading of spring balance in (a) is 8 g and in (b) is also 8 g

B. reading of spring balance in (a) is 8 g and in (b), it is less than 8 g

C. reading in (a) is less than 8 g and in (b),it is 8 g

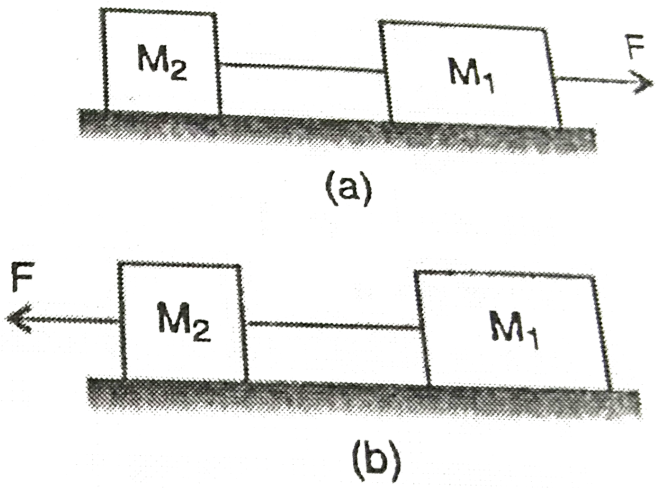
D. reading in both (a) and (b) is less than 8 g

Answer: C

Watch Video Solution

58. Consider a system of masses M_1 and $M_2(M_1 > M_2)$ connected by a massless string in fig the system is pulled by a force F from the side of mass M_1 and in fig

(b) the system is pulled by the same force F from the side of mass M_2 then:



A. acceleration in the two cases is same and tension in the string connecting M_1 and M_2 is also same

B. acceleration of system in (a) is more than in (b) while tension in the string is same in both cases

C. acceleration of system in both cases is same but tension in the string in (a) is more than in (b)

D. acceleration of system in both cases is same but tension in the string in (a) is less than in (b)

Answer: D

Watch Video Solution

59. The horizontal acceleration that should be given to a smooth inclined plane of angle $\sin^{-1}\left(\frac{1}{l}\right)$ to keep an object stationary on the plane relative to the inclined plane is .

A. $\frac{g}{\sqrt{l^2-1}}$

B. $g\sqrt{l^2-1}$

C. $\frac{\sqrt{l^2-1}}{g}N$

D. $\frac{g}{\sqrt{l^2+1}}$

Answer: A

Watch Video Solution

60. A train having 60 compartments is pulled by engine with a force 6×10^4 N. If mass of each compartment is 4000 kg the tension in the coupling between 40 th and 41st compartment is:

A. $4 \times 10^4 N$

B. $3 \times 10^4 N$

C. $2.5 \times 10^4 N$

D. $2 \times 10^4 N$

Answer: D

Watch Video Solution

61. A monkey of mass 30 kg climbs a rope which can withstand a maximum tension of 360 N. The maximum acceleration which this rope can tolerate for the climbing of monkey is:

$(g = 10m/s^2)$

A. $2m/s^2$

B. $3m/s^2$

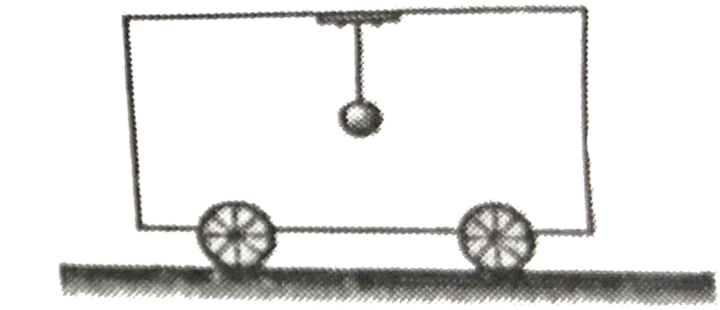
C. $4m/s^2$

D. $5m/s^2$

Answer: A

Watch Video Solution

62. In fig a sphere of mass 2 kg is suspended from the ceiling of a car which is initially at rest. Tension in the string in this situation is T_1 The car now moves to the right with a uniform acceleration and the tension in the string is now T_2 then: (Take $g = 10m/s^2$)



A. $T_1 = T_2 = 20N$

B. $T_1 = 20N, T_2 > 20N$

C. $T_1 = 20N, T_2 < 20N$

D. $T_1 < 20N, T_2 = 20N$

Answer: B

Watch Video Solution

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63. In if mass of the sphere be denoted as 'm' and the acceleration of car be 'a' then T_2 is given by:

A. mg

B. $m\left(g^2+a^2\right)^{1/2}$

C. $m\left(g^2-a^2\right)^{1/2}$

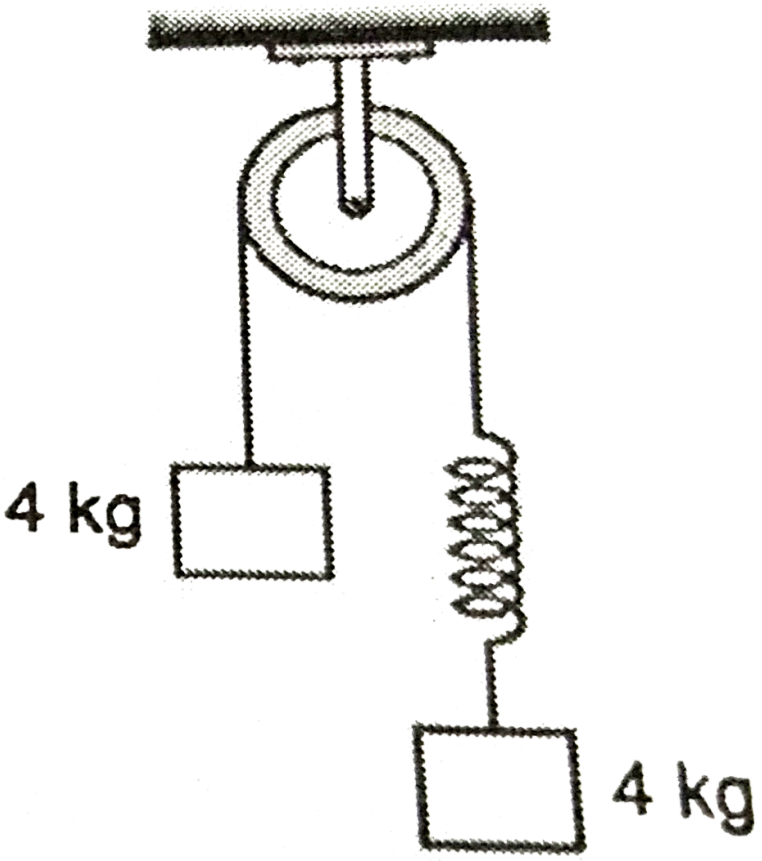
D. $m(g+a)$

Answer: B

Watch Video Solution

64. In spring constant of the spring is 100 N/m Extension produced in the spring is:

$\left(g = 10m / s^2\right)$



A. 10 cm

B. 20 cm

C. 30 cm

D. 40 cm

Answer: D

Watch Video Solution

65. A machine gun fires a bullet of mass 40 gm with a speed $1200m/s$ The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?

A. One

B. Four

C. Two

D. Three

Answer: D

Watch Video Solution

66. The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

A. $2\tan\phi$

B. $\tan\phi$

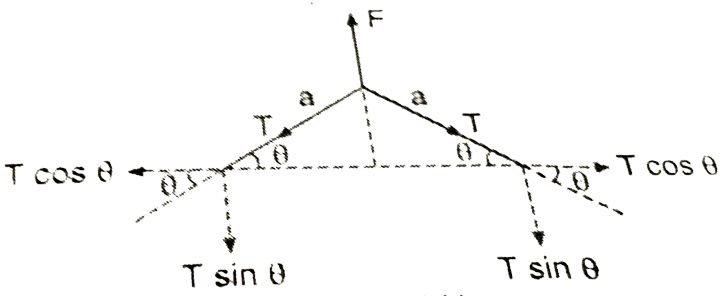
C. $2\sin\phi$

D. $2\cos\phi$

Answer: A

Watch Video Solution

67. Two particles of mass 'm' each are tied at eh ends of a light string of length '2a' The whole system is kept on frictionless horizontal surface with the string held tight so that each mass is at a distance 'a' from the centre P (as shown in 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:



A. $\frac{F}{2m}\frac{a}{\sqrt{a^2-x^2}}$

B. $\frac{F}{2m}\frac{x}{\sqrt{a^2-x^2}}$

C. $\frac{F}{2m}\frac{x}{a}$

D. $\frac{F}{2m}\sqrt{\frac{a^2-x^2}{x}}$

Answer: B

Watch Video Solution

68. A particle moves in the x-y plane under is influence of a force such that its linear momentum is $\vec{P}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$, where A and k are constants Angle between the force and the momentum is:

A. 0°

B. 30°

C. 45°

D. 90°

Answer: D

Watch Video Solution

69. A balloon of gross weight W newton descends with an acceleration fm/s^2 The weight that must be thrown out in order to give the balloon an equal upward acceleration will be:

A. $\frac{Wf}{g}$

B. $\frac{2Wf}{g}$

C. $\frac{2Wf}{g+f}$

D. $\frac{W(g+f)}{f}$

Answer: C

Watch Video Solution

70. A load W is to be raised by a rope from rest to rest through a height h The greatest tension the rope can safely bear is nW. The least time in which the ascent can be made will be:

A. $\left[\frac{2h}{(n-1)g}\right]^{1/2}$

B. $\sqrt{\frac{2h}{g}}$

C. $\left[\frac{2nh}{(n-1)g}\right]^{1/2}$

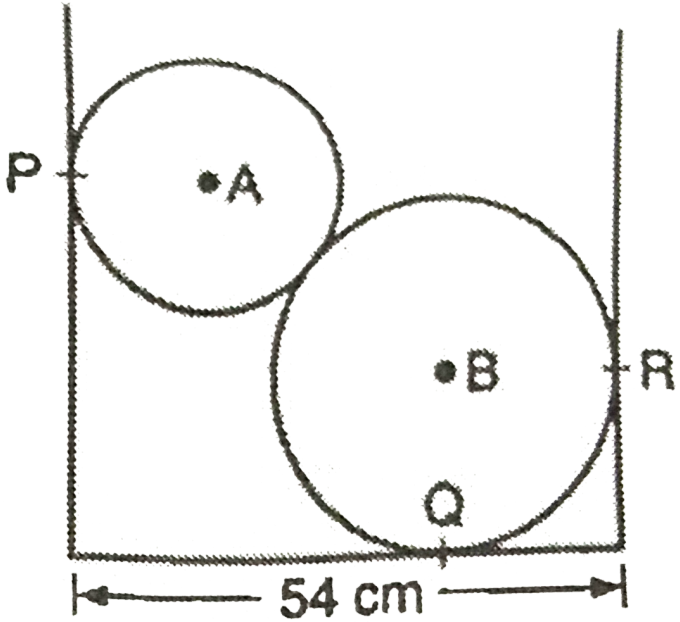
D. $\sqrt{\frac{2(n-1)h}{ng}}$

Answer: C

View Text Solution

71. Two steel balls A and B are placed inside a right circular cylinder of diameter 54 cm making contancts at point P,Q and R as shown. The radius $r_A = 12$ cm and $r_B = 18$ cm The masses are

$m_A = 15$ kg and $m_B = 60$ kg The forces exerted by the floor at the point Q and the wall at R are respectively (taking $g = 10m/s^2$)



A. $600N, 150N$

B. $750N, 150N$

C. $600N, 200N$

D. $750N, 200N$

Answer: D

Watch Video Solution

72. Two persons of equal weight are hanging by their hands from the ends of a rope hung over a frictionless pulley. They begin to climb the rope. One person can climb twice the speed of the other (with respect to the tope) Who will get to the top first?

A. The faster climber

B. The slower climber

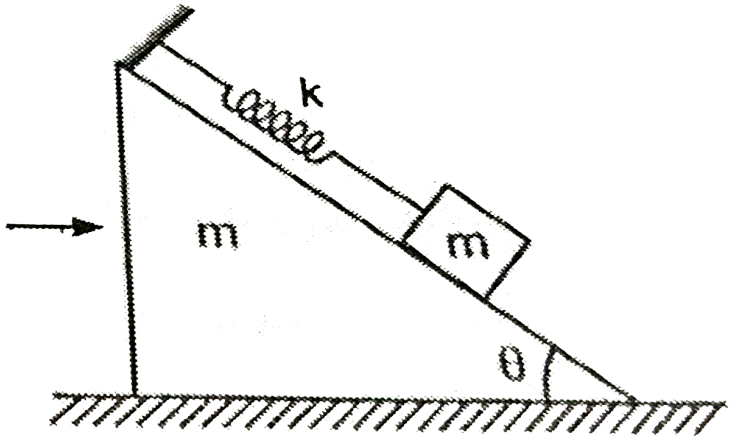
C. Both will get to the top simultaneously

D. Nothing can be said as it is indeterminate

Answer: C

View Text Solution

73. In the diagram given below all surfaces are frictionless. What horizontal force has to be applied on wedge such that in equilibium steady state spring is compressed by $\frac{mg\sin\theta}{k}$?



A. $2mg\tan\theta$

B. $2mg\sin\theta$

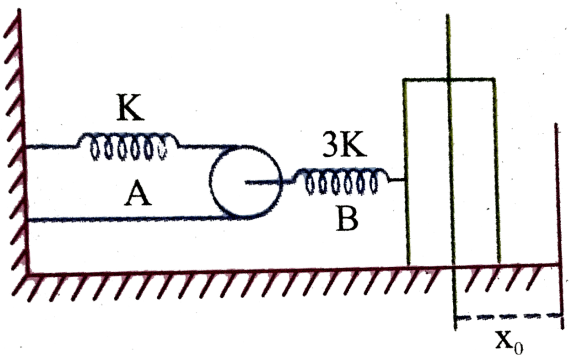
C. $4mg\tan\theta$

D. $2mg\tan\theta$

Answer: C

Watch Video Solution

74. If the above diagram initially there is no elongation in spring if the block is displaced towards right by x_0. Calculate the elongation of spring A.



A. $\frac{3}{7}x_0$

B. $\frac{x_0}{4}$

C. $\frac{x_0}{7}$

D. $\frac{x_0}{3}$

Answer: A

Watch Video Solution

75. A player caught a criket ball of mass 150 g moving at the rate of $20ms^{-1}$. If the catching process the completed in 0.1s , the force of the blow exerted by the ball on the hands of the player is

A. $0.3N$

B. $30N$

C. $300N$

D. $3000N$

Answer: B

Watch Video Solution

76. A block of mass 'm' is connected to another block of mass 'M' by a spring (massless) of spring constant 'k' The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched Then a constant force 'F' starts acting on the block of mass 'M' to pull it. Find the force on the block of mass 'm' :

A. $\frac{MF}{(m+M)}$

B. $\frac{mF}{M}$

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

D. $\frac{mF}{(m+M)}$

Answer: D

Watch Video Solution

77. A boy is hanging from a horizontal branch of a tree. The tension in the arms will be maximum when the angle between the arms is

A. 0°

B. 60°

C. 90°

D. 120°

Answer: D

Watch Video Solution

78. A bullet of mass 0.05 kg moving with a speed of $80m/s$ enters a wooden block and is stopped after a distance of 0.40 m The average resistive force exerted by the block on the bullet is:

A. 300 N

B. 20 N

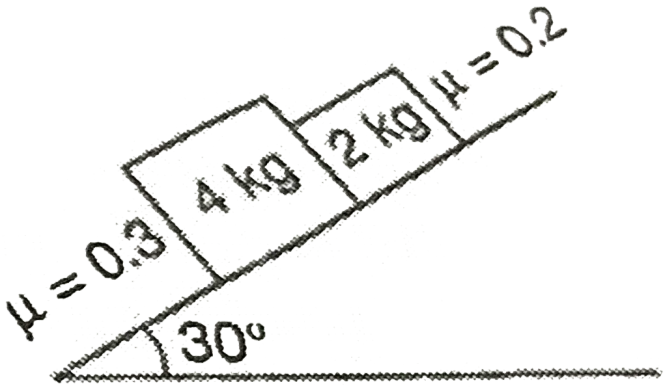
C. 400 N

D. 40 N

Answer: C

Watch Video Solution

79. Two blocks 4 kg and 2 kg are sliding down an incline plane as shown in fig The acceleration of 2 kg block is:



A. $1.6m/s^2$

B. $2.6m/s^2$

C. $3.6m/s^2$

D. $4.6m/s^2$

Answer: B

Watch Video Solution

80. Sand is being dropped on a conveyor belt at the rate of Mkg/s . The force necessary to kept the belt moving with a constant with a constant velocity of vm/s will be.

A. $\frac{Mv}{2}$ newton

B. zero

C. Mv newton

D. 2Mv newton

Answer: C

Watch Video Solution

81. A steel wire can withstand a load up to $2940N$. A load of $150kg$ is suspended from a rigid support. The maximum angle through which the wire can be displaced from the mean position, so that the wire does not break when the load passs through the position of equilibrium, is

A. 30°

B. 60°

C. 80°

D. 85°

Answer: B

Watch Video Solution

82. A mass of 10 kg is suspended from a spring balance, it is pulled aside by a horizontal string so that it makes an angle 60° with the vertical. The new reading of the balance is:

A. $10\sqrt{3}$ kg wt

B. $20\sqrt{3}$ kg wt

C. 20 kg wt

D. 10 kg wt

Answer: C

Watch Video Solution

83. Three concurrent co-planer force $1N$, $2N$ and $3N$ acting along different directions on a body

A. can keep the body in equilibrium if 2N and 3N act at right angle

B. can keep the body in equilibrium if 1N and 2N act at right angle

C. cannot keep the body in equilibium

D. can keep the body in equilibrium if 1N and 3N act at an acute angle

Answer: C

Watch Video Solution

84. A mass of 1 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is 60° The minima force necessary to pull the mass up the inclined plane is: $\left(g = 10m/s^2\right)$

A. $14.14N$

B. $17.32N$

C. 10 N

D. $16.66N$

Answer: B

Watch Video Solution

85. Assuming earth to be an intertial frame, an example for inertial frame observer is:

A. a driver in a train which is slowing down to stop

B. a person in a car moving with uniform velocity

C. a girl revolving in a merry go round

D. a passenger in an aircraft which is taking off

Answer: B

Watch Video Solution

86. Which of the following is not an illustration of Newton's third law?

A. Flight of a jet plane

B. A cricket player lowering his hands while catching a cricket ball

C. Walking on floor

D. Rebounding of a rubber ball

Answer: B

Watch Video Solution

87. The velocity of a body of mass 20 kg decreases from $20m/s$ to $5m/s$ in a distance of 100 m. Force on the body is:

A. $-27.5N$

B. $-47.5N$

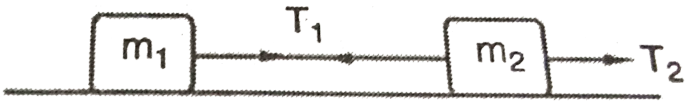
C. $-37.5N$

D. $-67.5N$

Answer: C

Watch Video Solution

88. Two masses m_1 and m_2 are accelerated uniformly on a frictionless surface as shown in figure given below. The ratio of the tensions $\frac{T_1}{T_2}$ is:



A. $\frac{m_1}{m_2}$

B. $\frac{m_2}{m_1}$

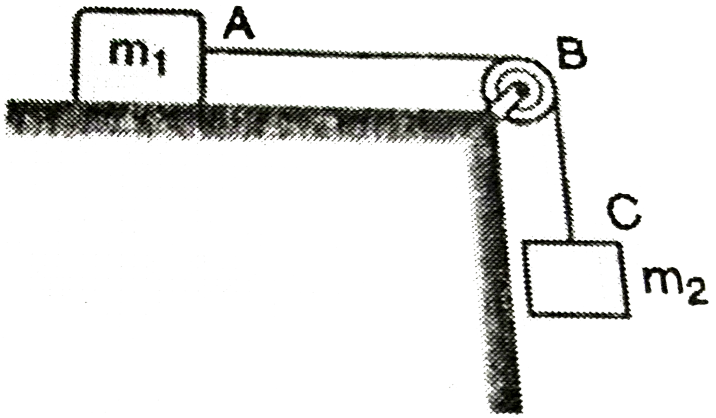
C. $\frac{(m_1+m_2)}{m_2}$

D. $\frac{m_1}{(m_1+m_2)}$

Answer: D

Watch Video Solution

89. A block of mass $m_1 = 5$ kg on a smooth table is pulled by a block of mass $m_2 = 2$ kg through a unifrom rope ABC of length 2m and mass 1kg. The pulley is smooth and massless As the block of mass m_2 falls from BC=0 to BC=2m its acceleration $(\text{in} m/s^2)$ changes from: $(Takeg = 10m/s^2)$



A. $\frac{20}{6}\text{to}\ \frac{30}{5}$

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

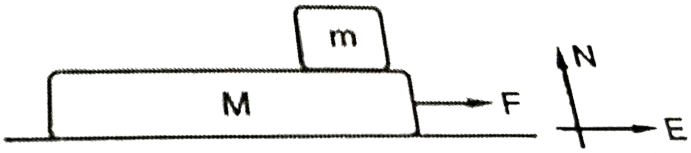
C. $\frac{20}{5}\text{to}\frac{30}{6}$

D. $\frac{30}{5}\text{to}\frac{20}{6}$

Answer: B

Watch Video Solution

90. A block of mass m is on the smooth horizontal surface of a plank of mass M The plank is on smooth horizontal surface Now, a constant horizontal force F acts on M. Now, for a person standing on the ground:



A. the acceleration of m is $\frac{F}{M}$ towards west

B. the acceleration of m is zero

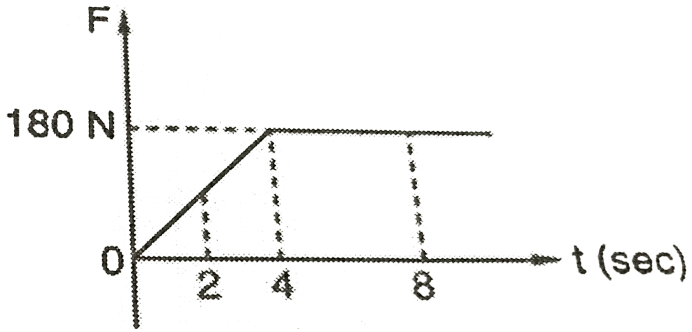
C. the acceleration of m is $\frac{F}{m}$ towards east

D. the acceleration of m is $\frac{F}{M+m}$ towards east

Answer: B

Watch Video Solution

91. A 45 kg box starts from rest and moves on a smooth plane the force that varies with time as shown. The velocity of the box at t=8 sec is:



A. $6m/s$

B. $8m/s$

C. $12m/s$

D. $24m/s$

Answer: D

Watch Video Solution

92. Three forces are acting on a particle of mass m initially in equilibrium if the first two forces $\left(\vec{R}_1 \text{ and } \vec{R}_2\right)$ are perpendicular to each other and suddenly the third force $\left(\vec{R}_3\right)$ is removed, then the magnitude of acceleration of the particle is:

A. $\frac{1}{m}\left|\vec{R}_2\right|$

B. $\frac{1}{m}\left|\vec{R}_1 + \vec{R}_2\right|$

C. $\frac{1}{m}\left|\vec{R}_1 - \vec{R}_2\right|$

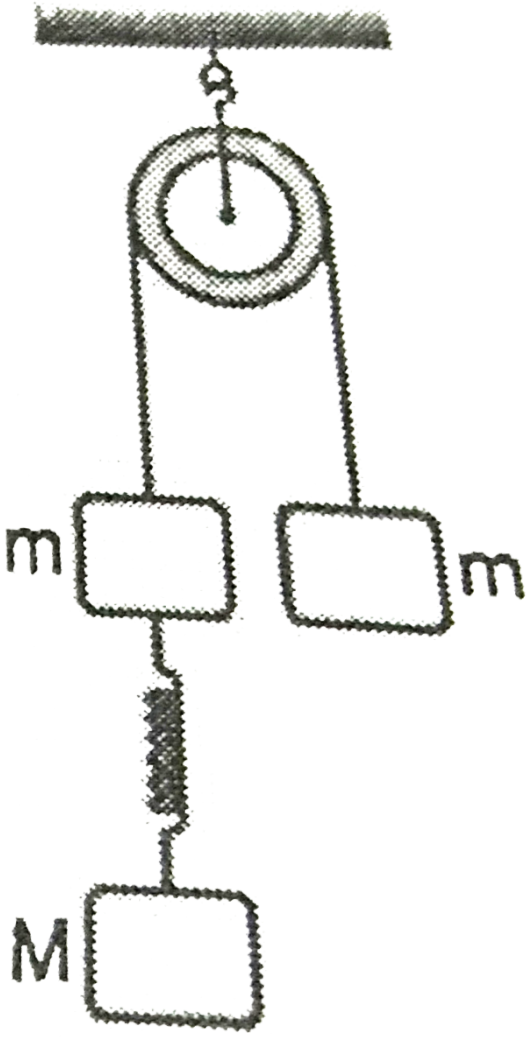
D. $\frac{1}{m}\left|\vec{R}_1\right|$

Answer: B

Watch Video Solution

93. The system shown in th fig is released from rest. (Neglecting friction and mass of the pulley, string and spring). The spring can

be elongated:



A. if $M > m$

B. if $M > 2m$

C. if $M > \frac{m}{2}$

D. for any value of M (M should be greater than zero)

Answer: D

Watch Video Solution

94. A particle moves in the x-y plane under is influence of a force such that its linear momentum is $\vec{P}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$, where A and k are constants Angle between the force and the momentum is:

A. 0°

B. 30°

C. 45°

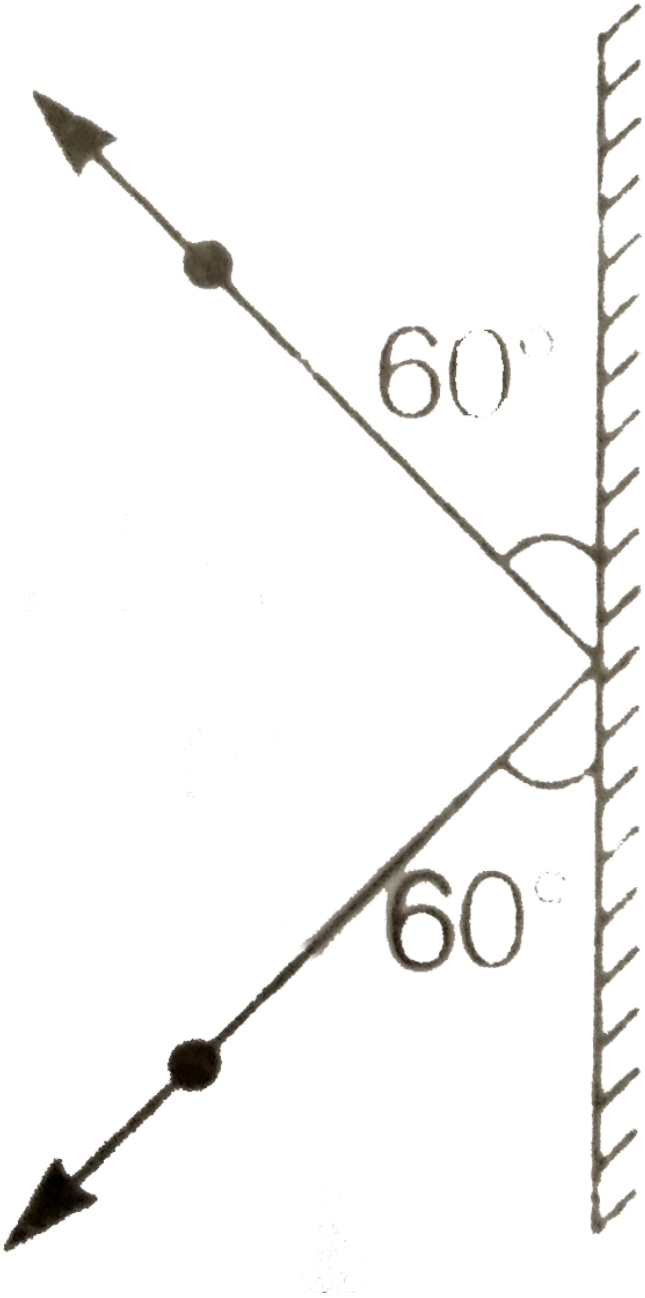
D. 90°

Answer: D

Watch Video Solution

95. A ball of mass 3kg moving with a speed of 100 m/s, strikes a wall at an angle 60° (as shown in figure). The ball rebounds at the same speed and remains in contact with the wall for 0.2 s, the

force exerted by the ball on the wall is



A. $1500\sqrt{3}N$

B. $1500N$

C. $300\sqrt{3}N$

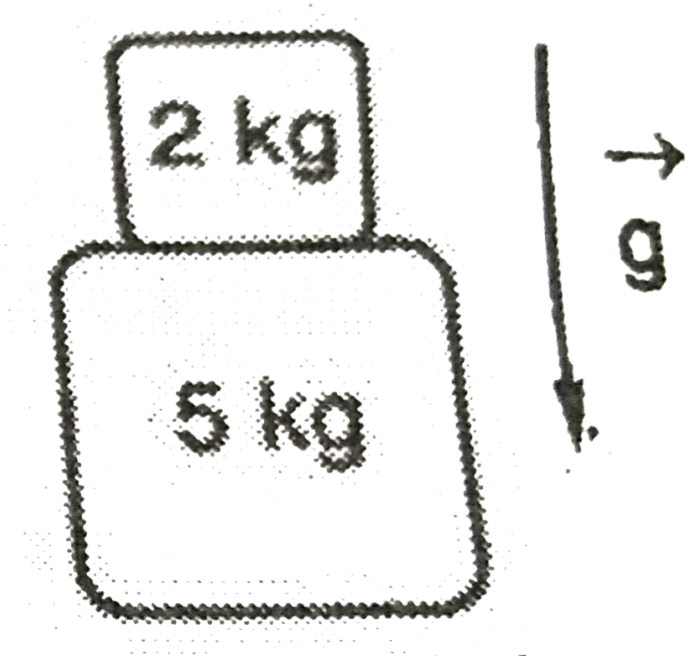
D. $300N$

Answer: A

Watch Video Solution

96. A 2kg block in on 5 kg block. The system of blocks falls freely due to gravity as shown. The net force on 5 kg block is:

$(Takeg = 10m/s^2)$



A. zero

B. 50 N

C. 70 N

D. 20 N

Answer: B

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97. Two blocks A and B connected by an ideal spring of spring constant $K = 1000\frac{N}{m}$ are moving on a smooth horizontal plane due to the action of a horizontal force F. Mass of A is 5 kg, mass of B is 2 kg and F=35 N. Find the extension of the spring at an instant when both A and B move with constant acceleration:

A. 1 cm

B. 2.5 cm

C. 1.5 cm

D. zero

Answer: A

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98. Two small balls of the same size and of masses m_1 and $m_2(m_1 > m_2)$ are tied by a thin weightless thread and dropped from a balloon. The tension T of the thread during the flight towards the ground after the motion of the balls has become steady state is (steady state means that the balls are coming down with uniform velocity due to the forces weight, air friction and upthrust). Consider that air is still without any wind below, during the motion of the balls through air:

A. zero

B. $\frac{(m_1 - m_2)g}{2}$

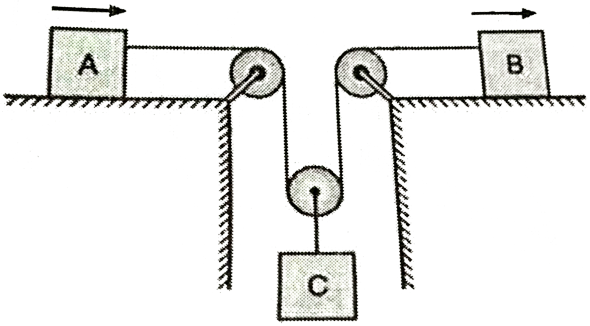
C. $\frac{(m_1 + m_2)g}{2}$

D. $m_1 g$

Answer: B

View Text Solution

99. Block A and C start from rest and move to the right with acceleration $a_A = 12tm/s^2$ and $a_C = 3m/s^2$ Here t is in seconds. The time when block B attain comes to rest is:



A. 2 s

B. 1 s

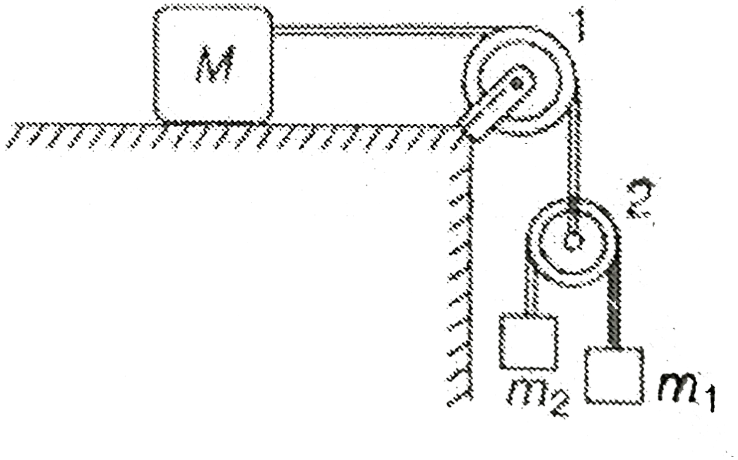
C. $3/2s$

D. $1/2s$

Answer: D

Watch Video Solution

100. In the arrangement shown in figure $m_1 = 1kg, m_2 = 2kg,$ pullyes are massless and strings are light. For what value of M the mass m_1 moves with constant velocity? (Neglect friction)



A. 6kg

B. 4 kg

C. 8 kg

D. 10 kg

Answer: C

Watch Video Solution

101. Assuming the gravity to be in negative z-direction, a force $F = v \times A$ is exerted on a particle in addition to the force of gravity where v is the velocity of the particle and A is a constant vector in positive x-direction. With what minimum speed a particle of mass m be projected so that it continues to move undeflected with constant velocity ?

A. $-\frac{A}{mg}\hat{j}$

B. $\frac{A}{mg}\hat{j}$

C. $\frac{mg}{A}\hat{j}$

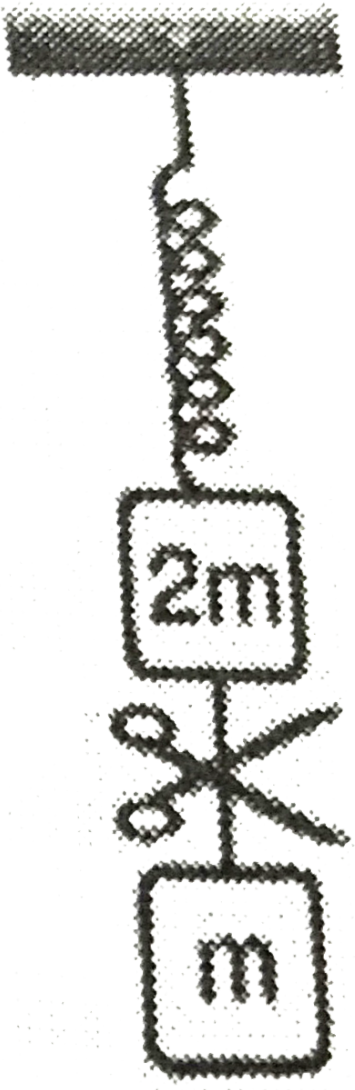
D. $-\frac{mg}{A}\hat{j}$

Answer: D

Watch Video Solution

102. System shown in fig is in equilibrium and at rest. The spring and string are massless now the string is cut. The acceleration of

mass 2m and m just after the string is cut will be:



A. $g/2$ upwards, g downwards

B. g upwards, $g/2$ downwards

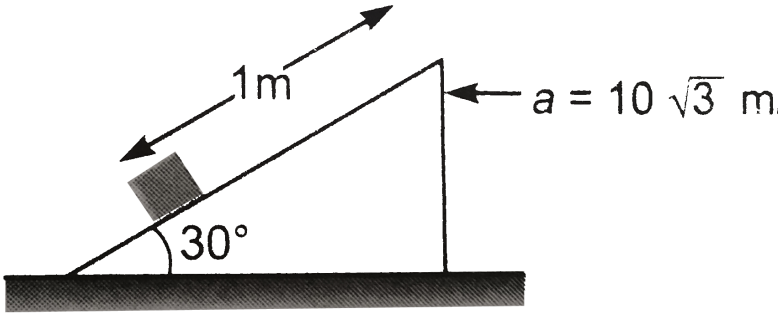
C. g upwards, 2g downwards

D. 2g upwards, g downwards

Answer: A

Watch Video Solution

103. In the figure the wedge is pushed with an acceleration of $\sqrt{3}m/s^2$. It is seen that the block start climbing up on the smooth inclined face of wedge . What will be the time taken by the block to reach the top?



A. $\frac{2}{\sqrt{5}}s$

B. $\sqrt{\frac{2}{5}}s$

C. $\sqrt{5}s$

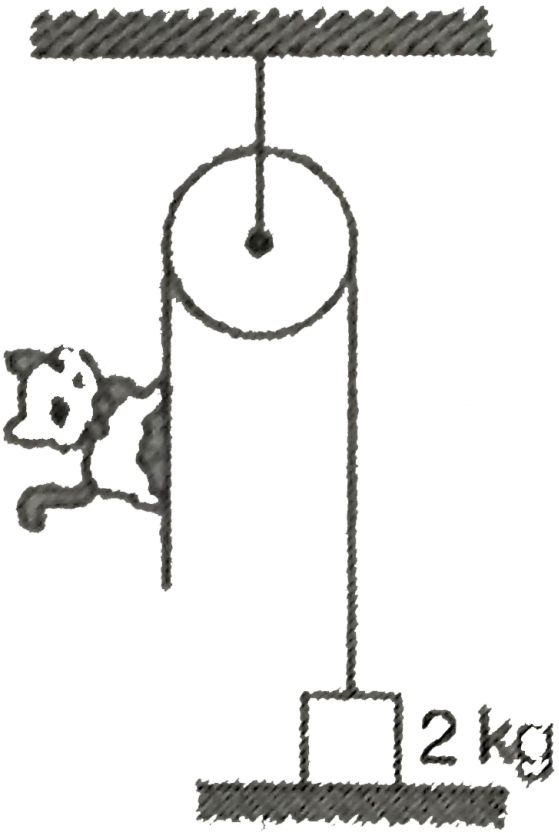
D. $\frac{\sqrt{5}}{2}s$

Answer: B

Watch Video Solution

104. The pulley shown in the diagram is frictionless. A cat of mass 1kg moves up on the massless string so as to just lift a block of mass 2kg. After some time, the cal stops moving with respect to

the string. The magnitude of the change in the cat's accelration is



A. g

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

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

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

Answer: C

Watch Video Solution

105. A particle is moving in a circular path. The acceleration and moment of the particle at a certain moment are $a = \left(4\hat{i} + 3\hat{j}\right) m/s^2$ and $p = \left(8\hat{i} - 6\hat{j}\right)$ kg-m/s. The motion of the particle is

A. uniform circular motion

B. accelerated circular motion

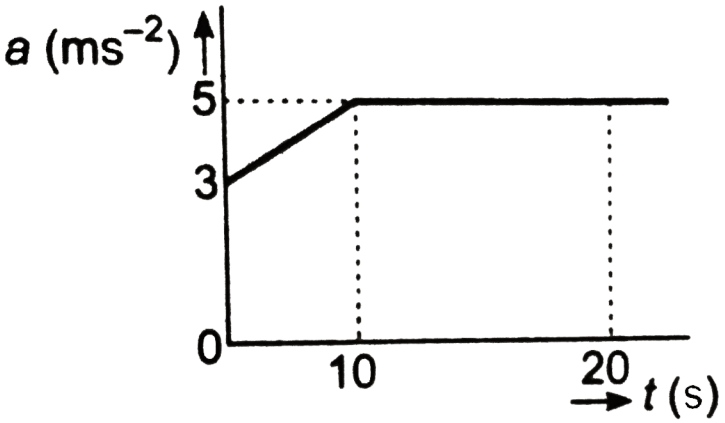
C. decelerated circular motion

D. we cannot say anything with $\vec{a}$ and $\vec{p}$ only

Answer: B

Watch Video Solution

106. The graph describes an airplane's acceleration during its take-off run. The airplane's velocity when it lifts oof at $t = 20s$ is



A. $40m / s$

B. $50m / s$

C. $90m / s$

D. $180m / s$

Answer: C

Watch Video Solution

107. A physics textbook of mass m rests flat on a horizontal table of mass M placed on the ground Let N_{a-b} be the contact Newton's 3 rd law, which of the following is an action reaction pair of forces?

A. mg and $N_{\text{table}\to\text{book}}$

B. $(m+M)$ g and $N_{\text{table}\to\text{book}}$

C. $N_{\text{ground}\to\text{table}}$ and $Mg+N_{\text{book}\to\text{table}}$

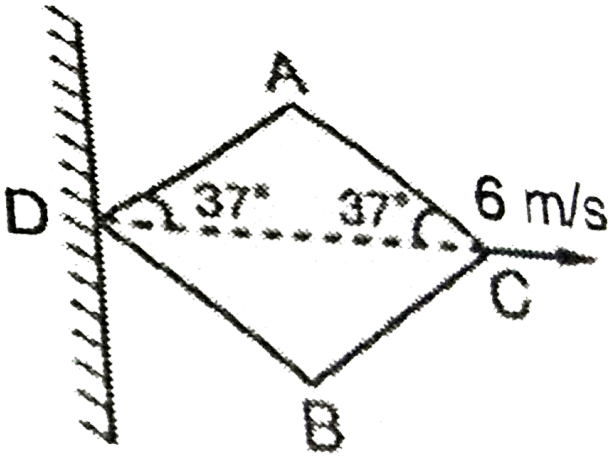
D. $N_{\text{ground}\to\text{table}}$ and $N_{\text{table}\to\text{ground}}$

Answer: D

View Text Solution

108. A rhombus ABCD is shown in the fig The sides of the rhombus can rotate about vectecc A, B, C and D velcity of $6m/s$ in

horizontal direction. Determine the veclocity of vertex A:



A. $4.8m/s$

B. $4.5m/s$

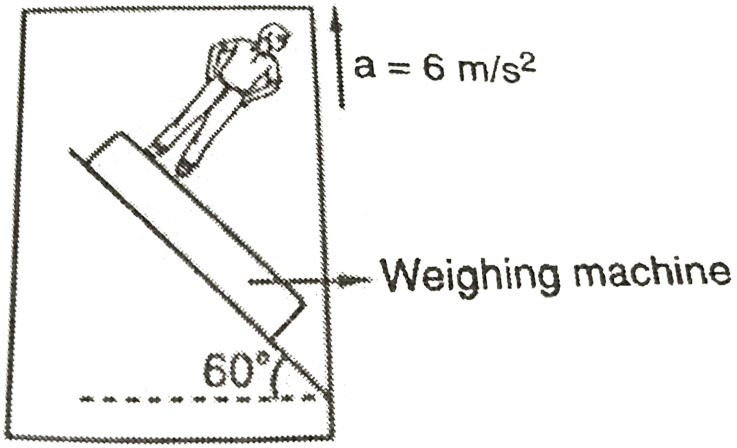
C. $5m/s$

D. none of these

Answer: C

View Text Solution

109. An elevator is accelerating upwards with an acceleration of $6m/s^2$ inside it a person of mass 50 kg is standing on a weighing machine which is kept on an inclined plane having angle of inclination 60° The reading of the weighing machine is:



A. 40 kg

B. 160 kg

C. 80 kg

D. 50 kg

Answer: A

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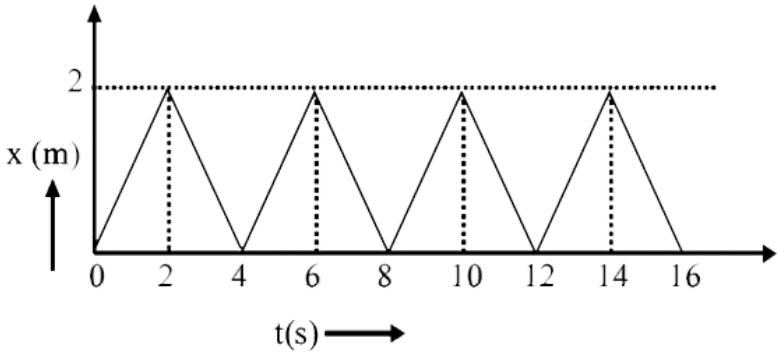
110. The figure shows the position-time (x-t) graph of one-dimensional motion of a body of mass 0.4kg. The magnitude of each impulse is



A. $0.2Ns$

B. $0.4Ns$

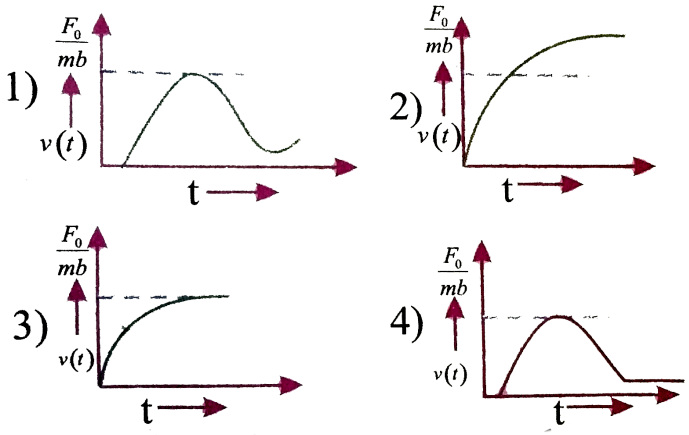
C. $0.8Ns$

D. $1.6Ns$

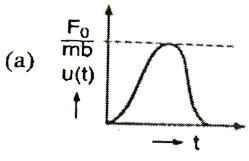
Answer: C

Watch Video Solution

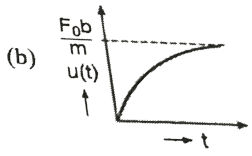
111. A particle of mass m is at rest at the origin at time $t = 0$ It is subjected to a force $F(t) = F_0 e^{-bt}$ in the X-direction. Its speed $V(t)$ is depicted by which of the following curves



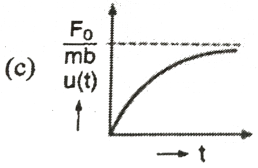
A.



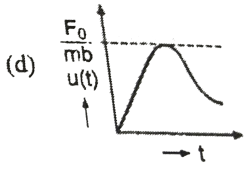
B.



C.



D.



Answer: C

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112. If a simple pendulum has significant amplitude (up to a factor of1//e of original) only in the period between $t - 0s \to t = \tau s$, then τ may be called the average life of the pendulum. When the sphetical bob of the pendulum suffers a retardation (due to viscous drag) proportional to its velocity with b as the constant of

propotional to average life time of the pendulum is (assuming damping is small) in seconds:

A. $\frac{0.693}{b}$

B. b

C. $\frac{1}{b}$

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

Answer: D

Watch Video Solution

113. A particle tied to a string describes a vertical circular motion of radius r continually if it has a velocity $\sqrt{3gr}$ at the highest point, then the ratio of the respective tensions in the string holding it at the highest point and lowest points is:

A. $4:3$

B. $5:4$

C. $1:4$

D. $3:2$

Answer: C

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114. A space- craft of mass 100 kg breaks into two, when its velocity is $10^4 ms^{-1}$ After the break a mass of 10 kg of the space craft is left stationary the velocity of the remaining part is:

A. $10^3 ms^{-1}$

B. $11.11 \times 10^3 ms^{-1}$

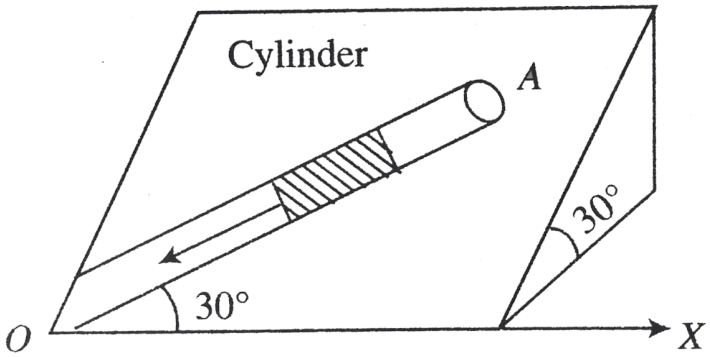
C. $11.11 \times 10^2 ms^{-1}$

D. $10^4 ms^{-1}$

Answer: B

Watch Video Solution

115. 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 $\left(g = 10ms^{-2}\right)$.



A. 4s

B. 2 s

C. 3 s

D. 1 s

Answer: B

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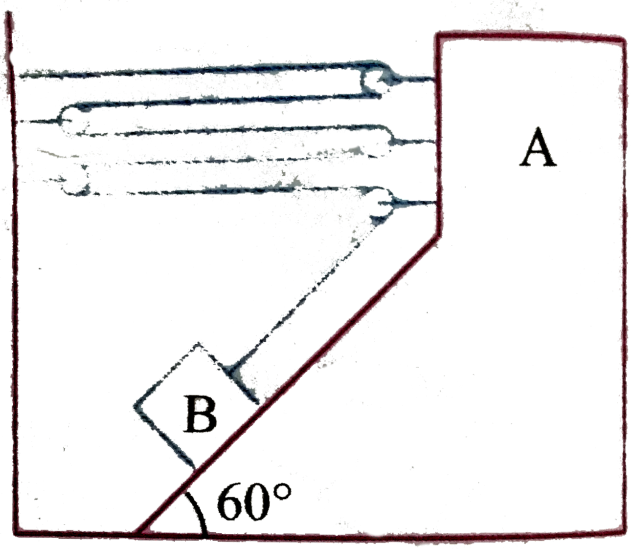
116. Find the acceleration of block B realtive to the ground if the block A moves to the left with an acceleration a_0



A. $\sqrt{31}a_0$

B. $\sqrt{25}a_0$

C. $\sqrt{30}a_0$

D. $30a_0$

Answer: A

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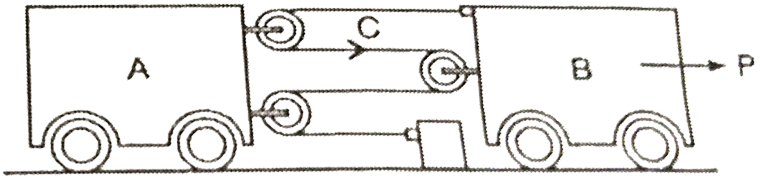
117. Under the action of force P, the constant acceleration of block B is $3ms^{-2}$ to the right. At the instant when the velocity of B is $2ms^{-1}$ to the right, determine the velocity of B relative to A, the acceleration of B relative to A and the absolute velocity of point C of the cable.



A. 2

B. 1

C. 3

D. 4

Answer: B

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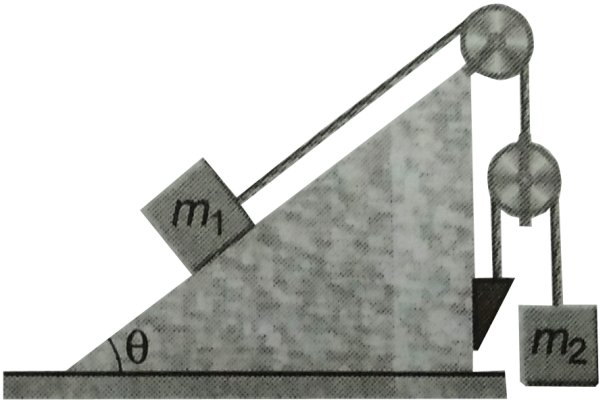
118. Find the acceleration of the body of mass m_2 in the arrangement shown in figure. If the massm_2 is η time great as the mass m_1 and the angle that the inclined plane forms with the horizontal is equal to θ. The masses of the pulley and threads, as well as the friction, are assumed to be negligible.



A. $\dfrac{2g(2\eta - \sin\theta)}{2\eta + 1}$

B. $\dfrac{2g(2\eta - \sin\theta)}{4\eta + 1}$

C. $\dfrac{2g(2\eta - \sin\theta)}{3\eta + 1}$

D. $\dfrac{4g(2\eta - \sin\theta)}{3\eta + 1}$

Answer: B

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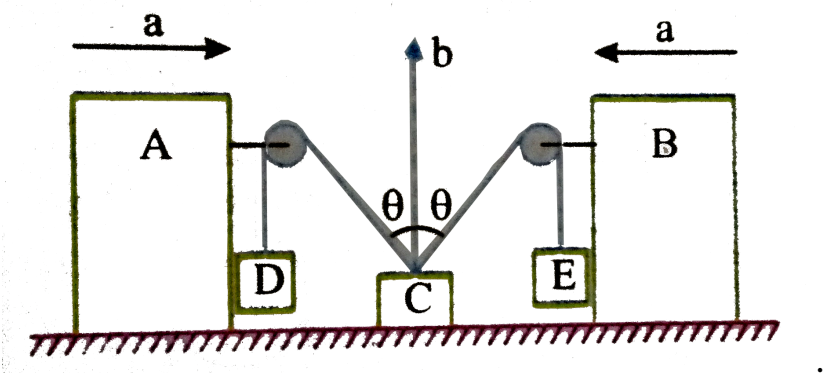
119. If A and B moves with acceleration a block c moves up with acceleration b calculate acceleration of D with respective A.



A. $2a + b$

B. $2a + b\cos\theta$

C. $b\cos\theta + a\sin\theta$

D. $b\sin\theta + a\cos\theta$

Answer: C

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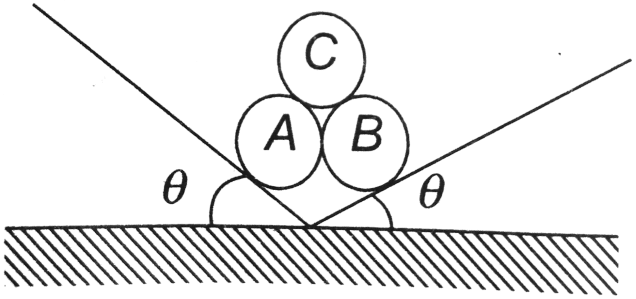
120. Three identical rigid circular cylinder A B and C are arrenged on smooth inclined surfaces as shown in figure. The laest value of theta that prevent the arrangement from collapes is.



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

B. $\tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$

C. $\tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)$

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

Answer: C

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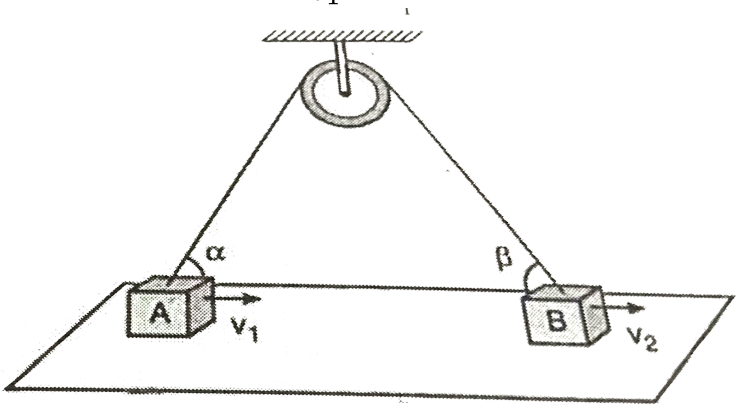
121. In the arrangement shown, blocks A and B connected with an inextensible string move with velocities v_1 and v_2 along horizontal direction. The ratio of $\frac{v_2}{v_1}$ is:



A. $\frac{\sin\alpha}{\sin\beta}$

B. $\frac{\sin\beta}{\sin\alpha}$

C. $\frac{\cos\beta}{\cos\alpha}$

D. $\frac{\cos\alpha}{\cos\beta}$

Answer: D

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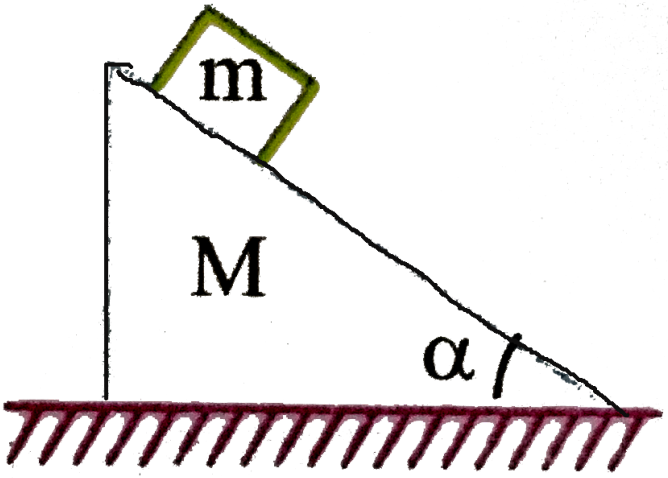
122. In the figure heavy mass m moves down the smooth surface of a wedge making an angle α with the horizontal. The wedge at rest $t = 0$ is on a smooth surface. The mass of the wedge is M the direaction of motion of the mass m makes an angle β with the

horizontal then, $\tan\beta$ is



A. $\frac{m}{M}\tan\alpha$

B. $\frac{M}{m}\tan\alpha$

C. $\left(1+\frac{m}{M}\right)\tan\alpha$

D. $\left(1+\frac{M}{m}\right)\tan\alpha$

Answer: C

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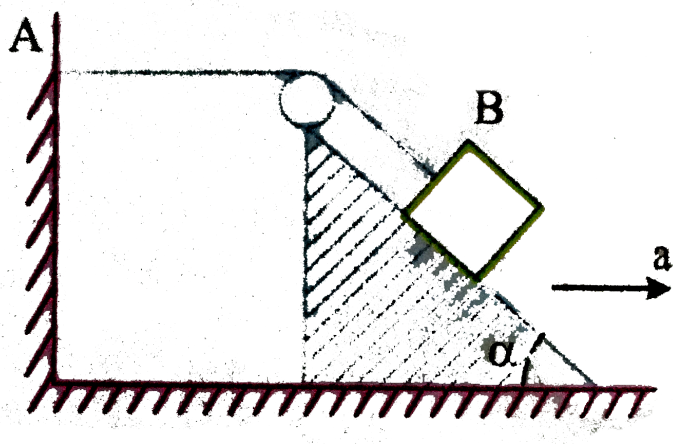
123. A weightless inextensible rope rests on a stationary wedge forming an angle α with a horizontal One end of the rope is fixed to the wall to point A.A small load is attached to the rope at point B The wedge starts moving to the right with a constant acceleration a The acceleration of the load is given by



A. a

B. $2a\sin\left(\frac{\alpha}{2}\right)$

C. $a\sin\alpha$

D. $\sin\left(\frac{\alpha}{2}\right)$

Answer: B

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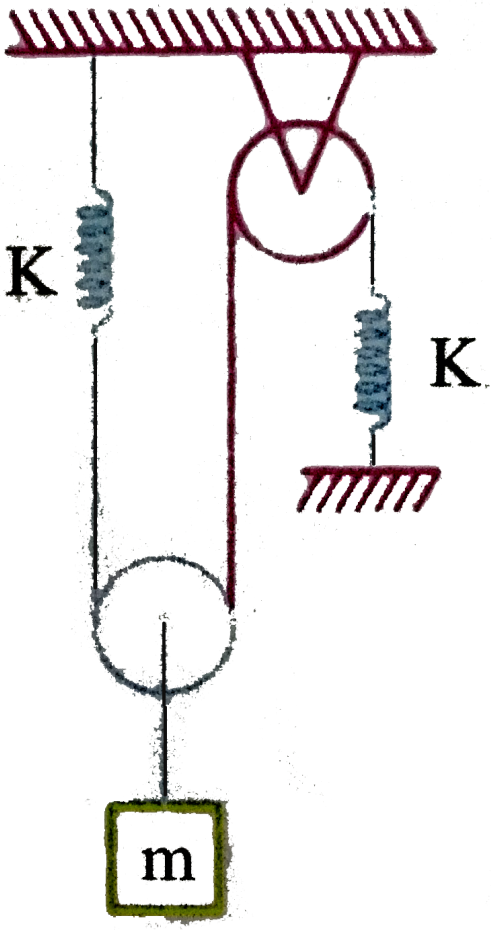
124. Block is attached to system of springs. Calculate equivalent spring constant.



A. K

B. $2K$

C. $3K$

D. $4K$

Answer: B

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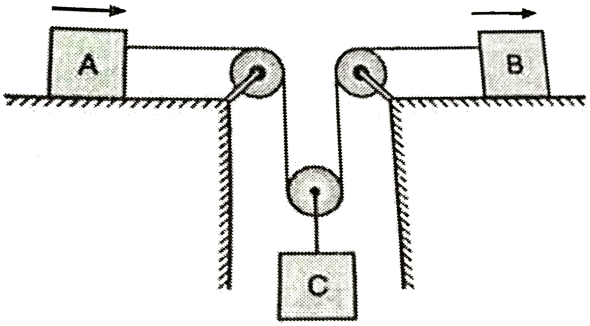
125. Block A and C start from rest and move to the right with acceleration $a_A = 12tm/s^2$ and $a_C = 3m/s^2$ Here t is in seconds. The time when block B attain comes to rest is:



A. 2s

B. 1s

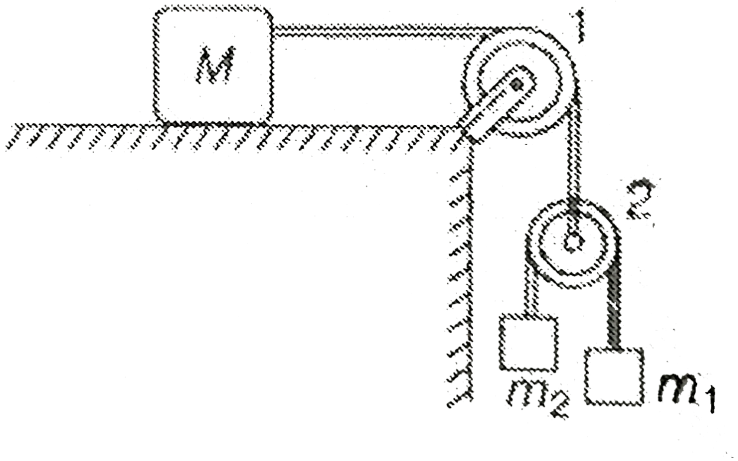
C. $3/2s$

D. $1/2s$

Answer: D

Watch Video Solution

126. In the arrangement shown in figure $m_1 = 1kg, m_2 = 2kg,$ pullyes are massless and strings are light. For what value of M the mass m_1 moves with constant velocity? (Neglect friction)



A. 6 kg

B. 4 kg

C. 8 kg

D. 10 kg

Answer: C

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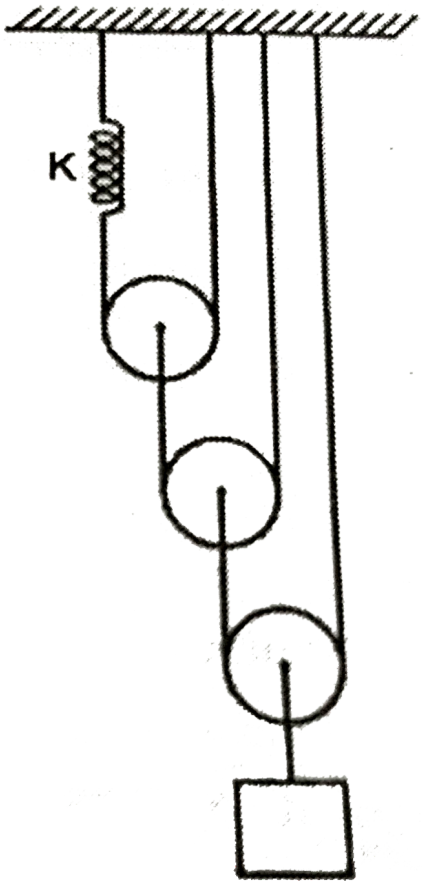
127. Find equivalent spring constant for the system:



A. K

B. 2 K

C. 64 K

D. 8 K

Answer: C

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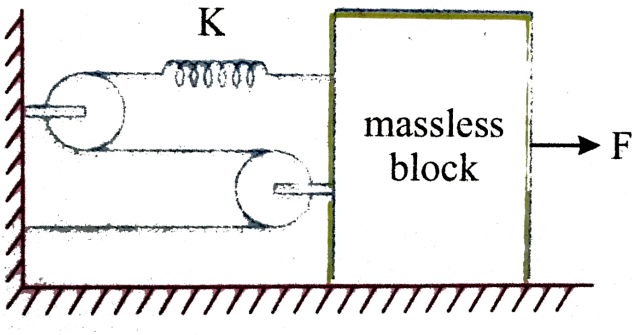
128. In the above diagram system is in equilibrium if applied force F is doubled how much mass less block will more towards right before new equilibrium is achieved



A. $\frac{F}{K}$

B. $\frac{2F}{K}$

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

D. $\frac{F}{9K}$

Answer: D

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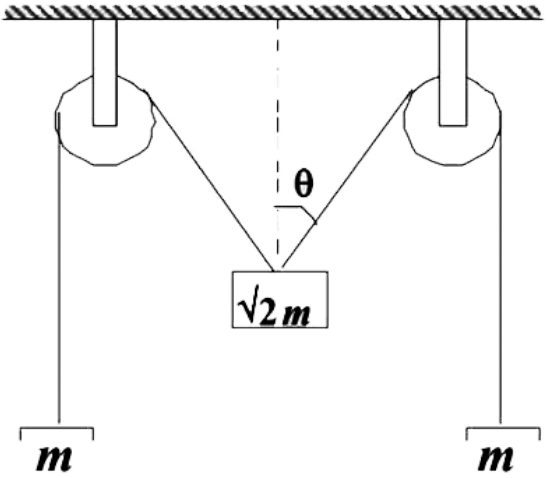
129. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be



A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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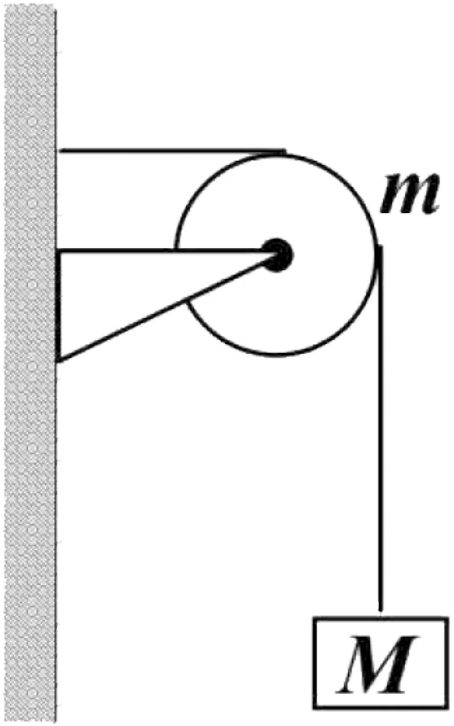
130. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The

force on the pulley by the clamp is given by



A. $\sqrt{2}Mg$

B. $\sqrt{2}mg$

C. $\left(\sqrt{(M+m)^2+m^2}\right)g$

D. $\left(\sqrt{(M+m)^2+M^2}\right)g$

Answer: D

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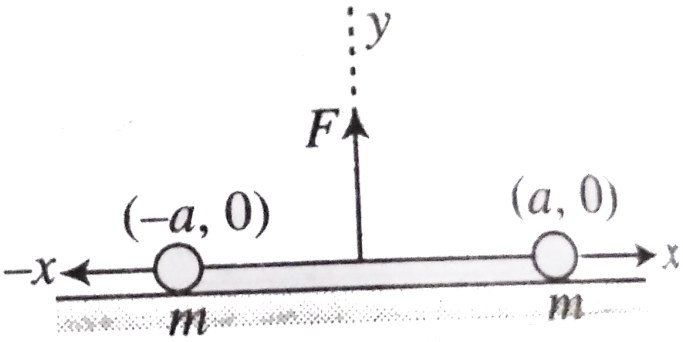
131. Two masses each equal to m are lying on x-axis at $(-a,0)(+a,0)$ respectively as shown in figure They are connected by a light string A force F is applied at the origin along vertical direction As a result the masses move toward each other without loosing contact with ground What is the acceleration of each mass? Assume the instantanceous position of the masses as

$(-x, 0)$ and $(x, 0)$



A. $\frac{2F}{m}\frac{\sqrt{a^2-x^2}}{x}$

B. $\frac{2F}{m}\frac{x}{\sqrt{a^2-x^2}}$

C. $\frac{F}{2m}\frac{x}{\sqrt{a^2-x^2}}$

D. $\frac{F}{m}\frac{x}{\sqrt{a^2-x^2}}$

Answer: D

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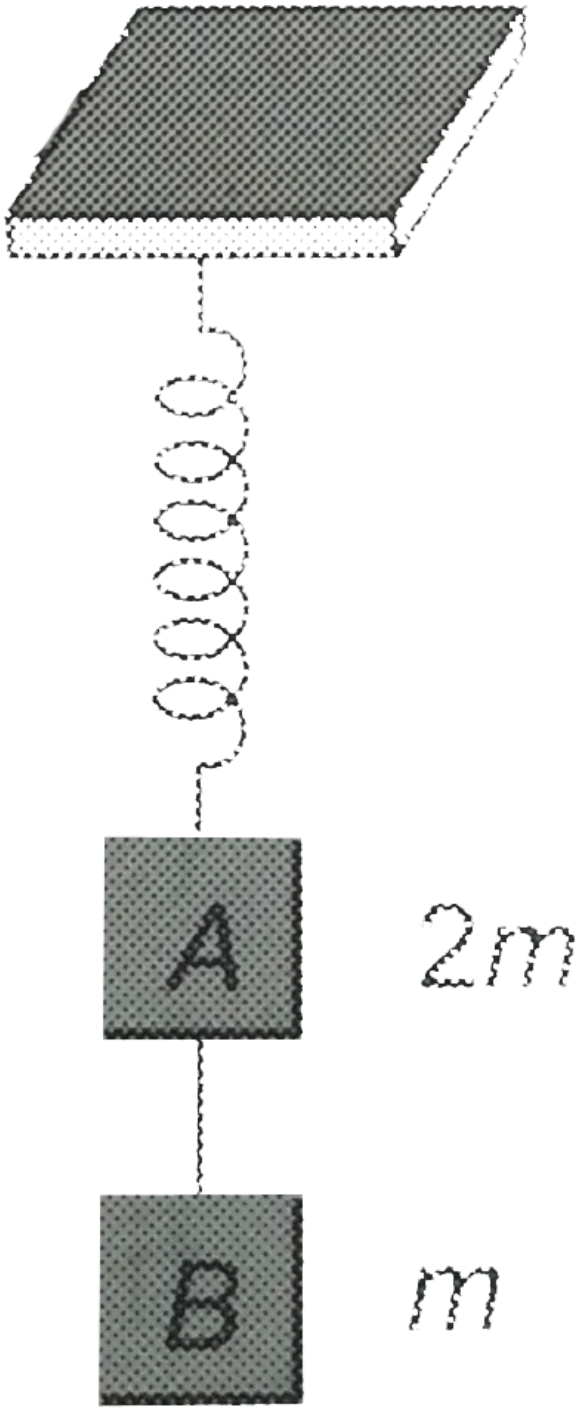
132. Two blocks A and B of masses 2m and respectively, are connected by a massless and inextensible string. The whole system is suspended by a masslessspring as shown in the figure. The magnitude of acceleration of A and B, immediately after the

string is cut, are respectively


A
2m
B
m

A. $g, g/2$

B. $g/2, g$

C. g, g

D. $g/2, g/2$

Answer: B

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133. A piece of wire is bent in the shape of a parabola $y = kx^2$ (y-axis vertical) with a bead of mass m on it. The bead can slide on the wire without friction. It stays at the lowest point of the parabola when the wire is at rest. The wire is now accelerated parallel to the x-axis with a constant acceleration a. The distance of the new equilibrium position of the bead, where the bead can stay at rest with respect to the wire, from the y-axis is:

A. $\frac{a}{gk}$

B. $\frac{a}{2gk}$

C. $\frac{2a}{gk}$

D. $\frac{a}{4gk}$

Answer: B

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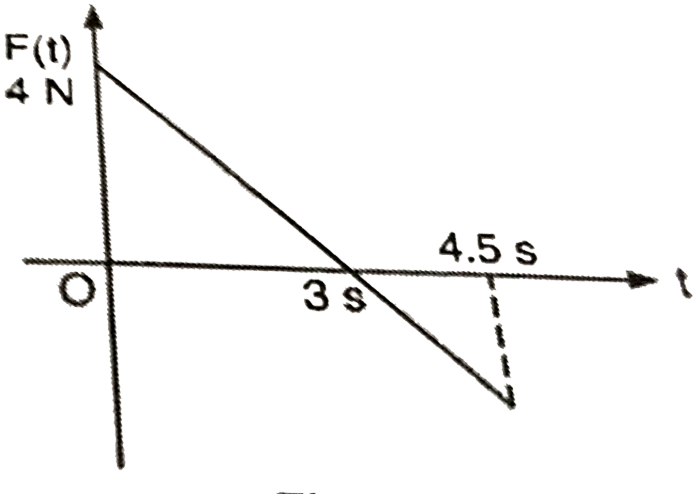
134. A block of mass 2 kg is free to move along the x-axis it is at rset and from t=0 onwards it is subjected to a time dependent force F(t) in the x-direction The force F(t) varies with t as shown in

the figure The kinetic energy of the block after 4.5 seconds, is:



A. $4.50J$

B. $7.50J$

C. $5.06J$

D. $14.06J$

Answer: C

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More Than One Choice Is Correct

1. A body is in translatory equilibium if:

A. resultant force on it is zero

B. it is at rest

C. it is in uniform motion

D. it is in accelerated motion

Answer: A::B::C

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2. In which of the following cases the net force is zero?

A. A drop of rain falling down with terminal velocity

B. A cork of mass 10 g floating on water

C. A car moving with constant speed of 30 km/hr on a rough road

D. A charged particle moving parallel to the magnetic field

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

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3. A body will not be in equilibrium if:

A. $\Sigma\vec{F} = 0$ and $\Sigma\vec{\tau} = 0$

B. $\Sigma\vec{F} \neq 0$ but $\Sigma\vec{\tau} = 0$

C. $\Sigma\vec{F} = 0$ but $\Sigma\vec{\tau} \neq 0$

D. $\Sigma\vec{F} \neq 0$ and $\Sigma\vec{\tau} \neq 0$

Answer: B::C::D

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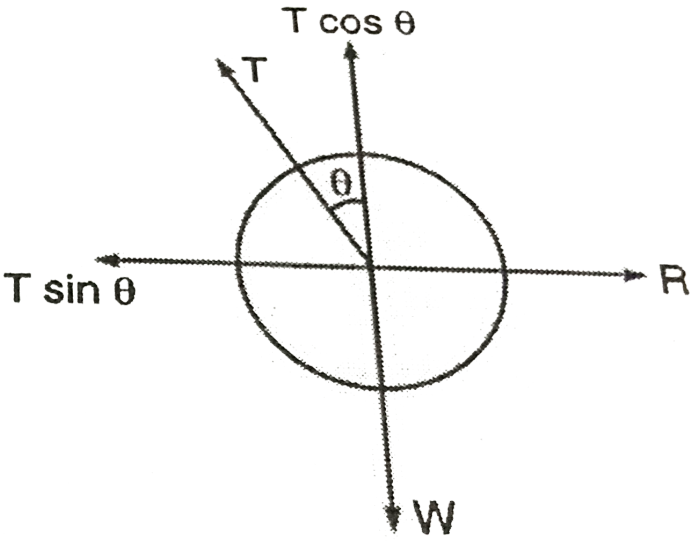
4. A metal sphere is hung by a string fixed to a wall. The forces acting on the sphere are shown in fig Which of the following statements are correct?



A. $\vec{R} + \vec{T} + \vec{W} = 0$

B. $T^2 = R^2 + W^2$

C. $T = R + W$

D. $R = W \tan \theta$

Answer: A::B::D

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

A. The acceleration of the system is $5P/m$

B. The resultant force acting on each cube is $P/5$

C. The force exerted by C and D is $2P/5$

D. The acceleration of the cube $Dis\frac{P}{5}m$

Answer: B::C::D

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6. A reference frame attached to the earth:

A. is an inertial frame by definition

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

C. is an inertial frame because Newton's law are applicable in this frame

D. cannot be an inertial frame because the earth is rotating about is axis

Answer: B::D

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7. Action and reaction

A. act on two different objects

B. have equal magnitude

C. have opposite directions

D. have resultant zero

Answer: A::B::C

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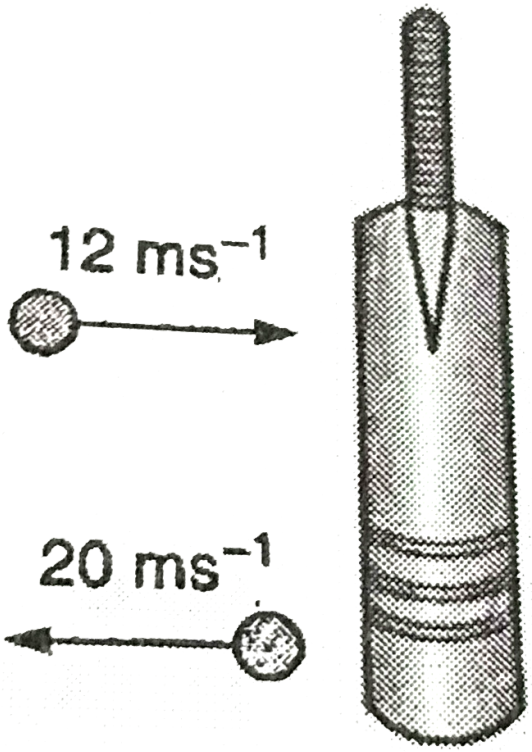
8. A cricket ball of mass 150 g is moving with a speed of $12ms^{-1}$ and is hit by a bat so that the ball is turned back with velocity of $20ms^{-1}$ if duration of contact between bat and ball is 0.01 s then:



A. impulse of force is 4.8 Ns

B. average force exerted by bat is 480 N

C. retarding of the ball is $3200ms^{-2}$

D. change in momentum of the ball is $1.2 kgms^{-1}$

Answer: A::B::C

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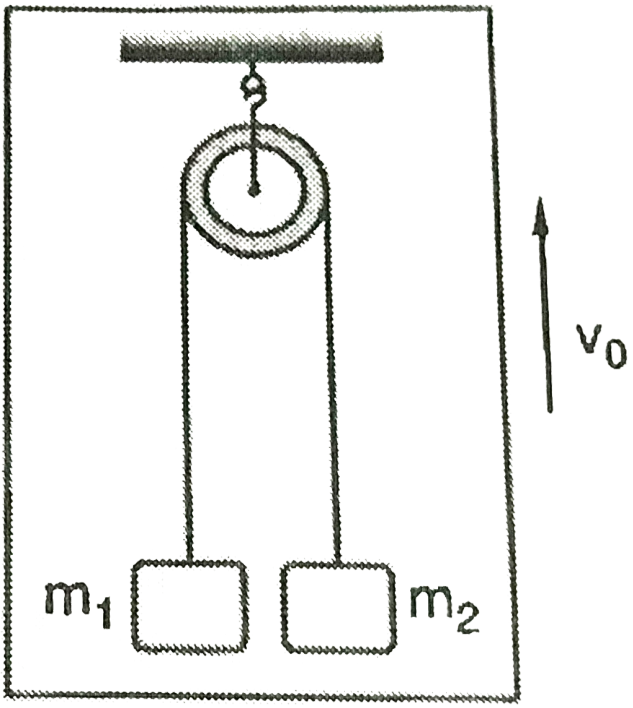
9. Two blocks of masses m_1 and $m_2(m_1 > m_2)$ are connected by a massless threads, that passes over a massless smooth pulley. The pulley is suspended from the ceiling of an elevator. Now the elevator moves up with uniform velocity v_0 Now, select the correct

options:



A. Magnitude of acceleration of m_1 with respect to ground is greater than $\frac{(m_1 - m_2)g}{m_1 + m_2}$

B. Magnitude of acceleration of m_1 with respect to ground is equal to $\frac{(m_1 - m_2)g}{m_1 + m_2}$

C. Tension in the thread that connects m_1 and m_2 is equal to

$$\frac{2m_1m_2g}{m_1+m_2}$$

D. Tension in the thread that connects m_1 and m_2 is greater than $\frac{2m_1m_2g}{m_1+m_2}$

Answer: B::C

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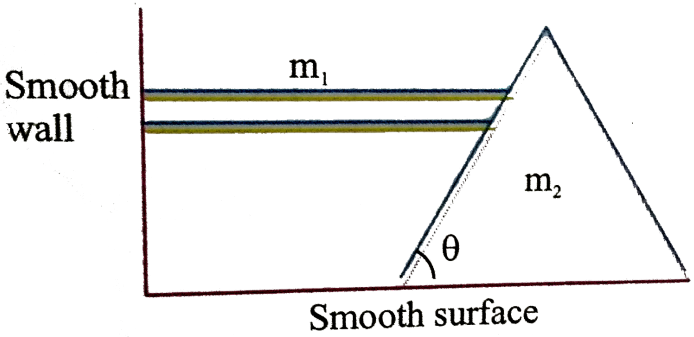
10. A horizontal bar of mass m_1 Prism of mass m_2 can move as shown. There is no friction at any contact point. During the motion the length of the rod is always horizontal Now, magnitude

valuse of



A. acceleration of m_1 is $g/\left(1+\eta\cot^2\theta\right)$, where $\eta = m_2/m_1$

B. acceleration of m_1 is $\dfrac{g\tan\theta}{\eta\left[1+\tan^2\theta\right]}$ where $\eta = m_2/m_1$

C. acceleration of m_2 is

$g/(\tan\theta+\eta\cot\theta)$, where $\eta = m_2/m_1$

D. acceleration of m_2 is $\dfrac{g\tan^2\theta}{\eta\left[1+\tan^2\theta\right]}$, where $\eta = m_2/m_1$

Answer: A::C

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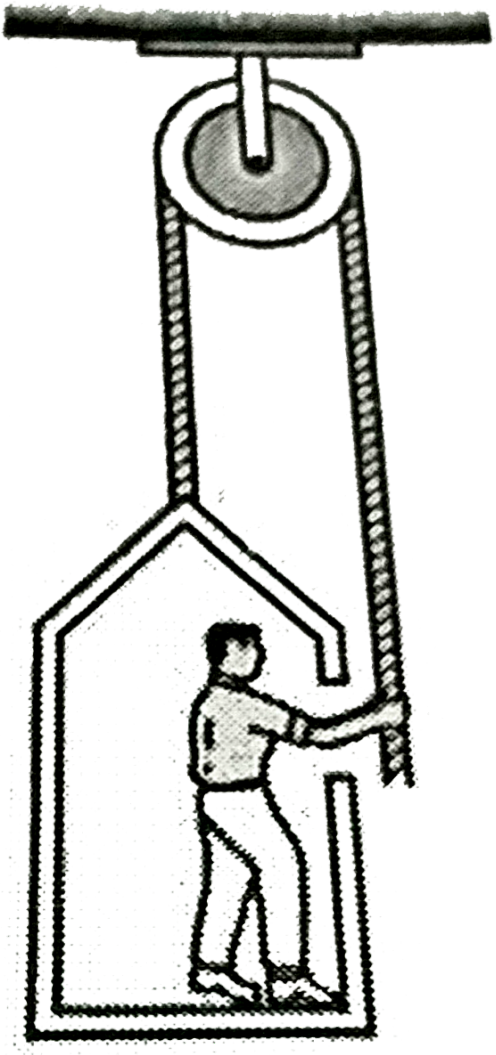
11. A painter is applying force himself to raise him and the box with an acceleration of $5m/s^2$ by a massless rope and pulley arrangement as shown in fig Mass of painter is 100 kg and that of box is 50 kg if $g = 10m/s^2$ then:



A. tension in the rope is 1125 N

B. tension in the rope is 2250 N

C. force of contact between the painter and the floor is 375 N

D. none of these

Answer: A::C

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12. Which of the following is statement (s) is/are incorrect?

A. Friction force always acts opposite to the net applied force

B. if net force on a body is zero its acceleration will be same in all frames

C. A person is pushing a box. The force exerted by box on person is less than the force by person on box

D. A moving object can move with a constant velocity by a push less than the limiting static friction.

Answer: A

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13. The motion of a particle of mass m is given by x=0 for $t < 0$ s, x (t) = $A \sin 4\pi t f$ or $0 < t(1/4)s(A > 0)$ and x=0 for $t > (1/4)$ s Which of the following statement(s) is (are) true?

A. The force at $t = (1/8)$ s on particle is $-16\pi^2$ A-m

B. The particle is acted upon by an impulse of magnitude $\left(4\pi^2 A - m\right)$ at t=0 s and $t = (1/4)$ s.

C. The particle is not acted upon by any force

D. The particle is not acted upon by a constant force

Answer: A::B::D

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14. Two billiard balls A and B each of mass 50 g and moving in opposite directions with speed of $5m/s$ each, collide and rebound with the same speed if the collision lasts for 10^{-3} s which of the following statement(s) is (are) true?

A. The impulse imparted to each ball is 0.25 kg m/s and te force on each ball is 250N

B. The impulse imparted to each ball is 0.25 kg m/s and the force exerted on each ball is $25 \times 10^{-5}N$

C. The impulse imparted to each ball is 0.5 N

D. The impulse and the force on each ball are equal in magnitude and opposite in direction

Answer: C::D

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15. A body of mass 10 kg is acted upon by two perpendicular forces , 6 N and 8 N . The resultant acceleration of the body is

A. $1m/s^2$ at an angle of $\tan^{-1}(4/3)$ w.r.t. 6 N force

B. $0.2m/s^2$ at an angle of $\tan^{-1}(4/3)$ w.r.t. 6 N force

C. $1m/s^2$ at an angle of $\tan^{-1}(3/4)$ w.r.t. 8 N force

D. $0.2m/s^2$ at an angle of $\tan^{-1}(3/4)$ w.r.t. 8 N force

Answer: A::C

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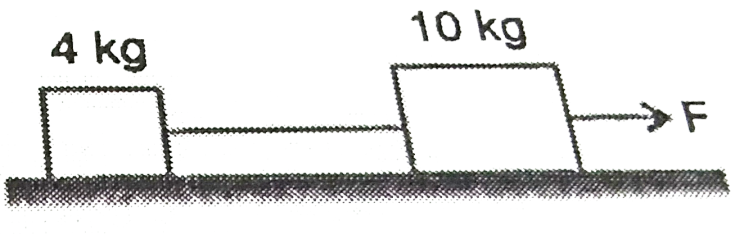
Assertion Reason

1. (A): In the given fig tension in the string that connects the two blocks is 10N so that the force F will be 35 N

(R): Forces of tension, each of magnitude 10 N here, which of the two blocks exert on each other through the string, balance each other.



A. If both A and R are true and R is the correct explanation of A

B. If both A and R are true but R is not correct explanation of A

C. If A is true but R is false

D. If A is false but R is true

Answer: C

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2. A frame of reference A is moving rectilinearly and uniformly with a velocity $\vec{u}$ with respect to an inertial frame B. A body is moving with velocity $\vec{v}$ and acceleration $\vec{a}$ in an inertial system.

(A): When we use Newton's second law in frame B we write $\Sigma \vec{F}_{\text{net}} = m\vec{a}$ Now, when we use the same in frame A we will write exactly same $\vec{F}_{\text{net}}$ and $\vec{a}$

(R): All inertial systems are equally suitable for the description of physical phenomenon.

A. If both A and R are true and R is the correct explanation of A

B. If both A and R are true but R is not correct explanation of A

C. If A is true but R is false

D. If A is false but R is true

Answer: A

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3. (A): Centrifugal force is reactionary force of centripetal force

(R): A simple pendulum is oscillating in vertical plane then mean position net force on pendulum is zero.

A. If both A and R are true and R is the correct explanation of A

B. If both A and R are true but R is not correct explanation of A

C. If A is true but R is false

D. If A is false but R is true

Answer: D

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4. STATEMENT-1: A cloth covers a table. Some dishes are kept on it. The cloth can be pulled out without dislodging the dishes from the table.

STATEMENT-2: For every action there is an equal and opposite reaction.

A. If both A and R are true and R is the correct explanation of A

B. If both A and R are true but R is not correct explanation of A

C. If A is true but R is false

D. If A is false but R is true

Answer: B

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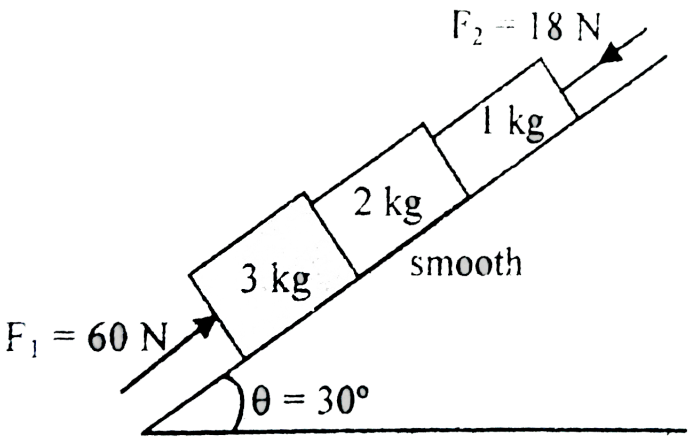
Matrix Match

1. In the diagram shown in figure, match the following $(g = 10m/s^2)$



	Column-I		Coloumn-II
(A)	Acceleration of 2kg block	(P)	8 Si unit
(B)	Net force on 3kg block	(Q)	25 SI unit
(C)	Normal reaction between 2 kg and 1kg	(R)	2 SI unit
(D)	Normal reaction between 3 kg and 2kg	(S)	45 SI unit
		(T)	None

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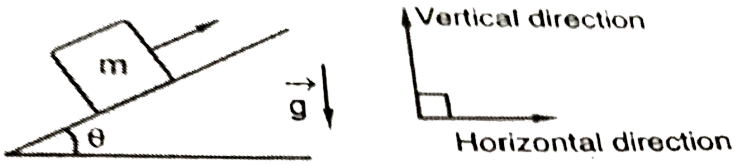
2. Block of mass m is sliding up on the smooth inclined plane with some initial velocity Now on the block match the magnitude value of the forced on 'm' in the given directions (take the component of

all the forces in the given direction)



	Column -I	Column -II
(a)	Net force component in horizontal direction	(p) Zero
(b)	Net force component in vertical direction	$(q) mg \sin\theta \cos\theta$
(c)	Net force component along the inclined plane	$(r) mg \sin\theta$
(d)	Net force component penpendicular to the inclined plane	$(s) mg(1 - \cos^2\theta)$

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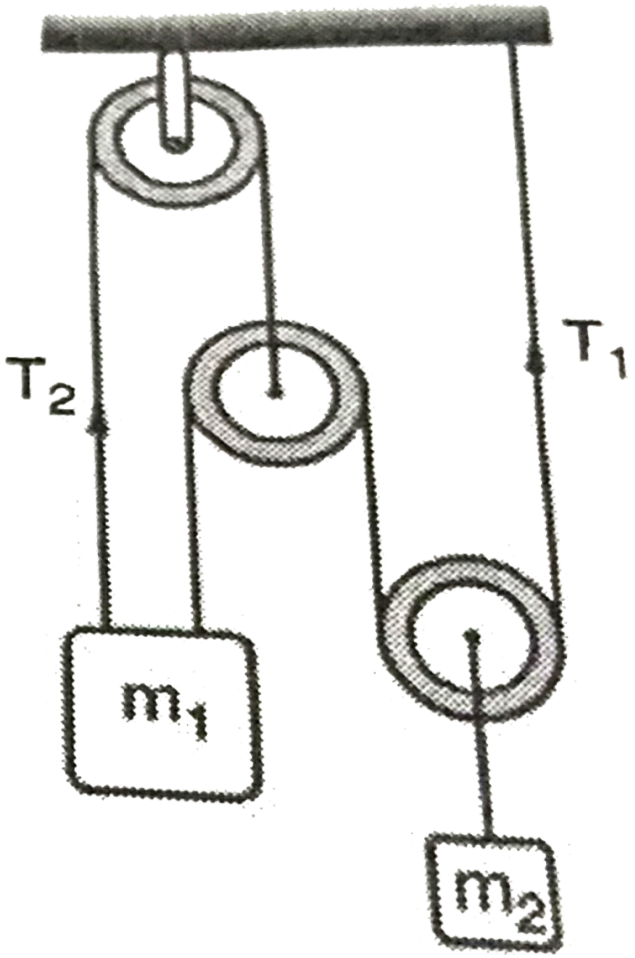
3. Two blocks of masses $m_1 = 5$ kg and $m_2 = 2$ kg are connected by threads which pass over the pulleys as shown in the figure. The threads are massless and the pulleys are massless and smooth. The blocks can move only along the vertical direction T_1 and T_2 are the tensions in the string as shown. Now match the following:

$(Takeg = 10m/s^2)$



	Column -I	Column -II
(a)	Magnitude value of acceleration of m_1 with respect to ground	$(p)\ \frac{500}{19}$ SI units
(b)	Magnitude value of acceleration of m_2 with respect to ground	$(q)\ \frac{250}{19}$ SI units
(c)	The value of tension T_1	$(r)\ \frac{60}{19}$ SI units
(d)	The value of tension T_2	$(s)\ \frac{40}{19}$ SI units
		(t) None of the above

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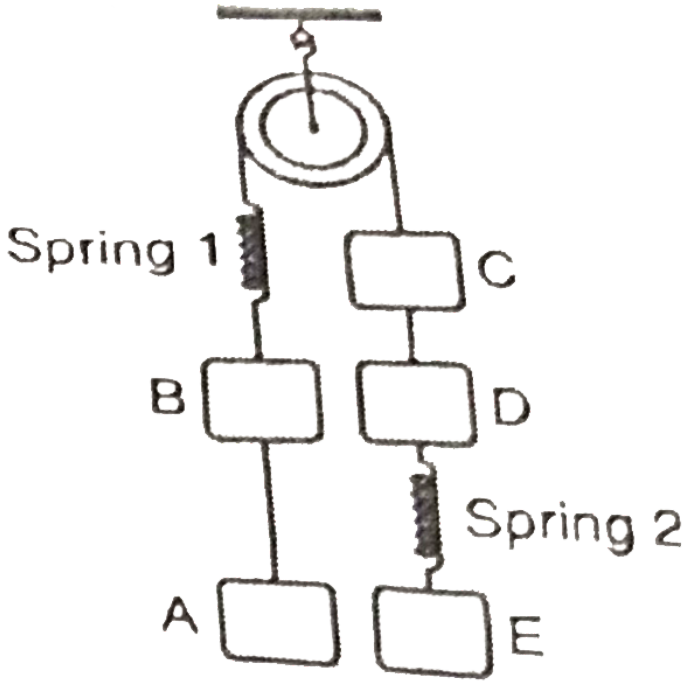
4. The system shown in initially in equilibrium Masses of the blocks A, B, C, D and E are respectively 3m, 3m, 2m, 2m and 2m. Match the conditions in column -I with the effects in column -II



Column -I	Column -II
(a) After spring 2 is cut tension in string AB	(p) Increases
(b) After spring 2 is cut tension in string CD	(q) Decreases
(c) After spring between C and pulley is cut tension in string AB	(r) Remains constant
(d) After spring between C and pulley is cut tension in string CD	(s) Zero

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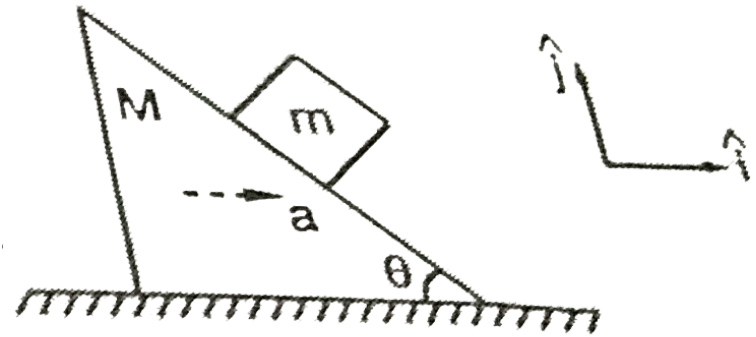
5. A block of mass m is kept on a smooth moving wedge If the acceleration of the wedge is equal to a, then match the following:



	Column -I	Column -II
(a)	Acceleration of m	$(p)\,Ma + m(g\cos\theta + a\sin\theta)\sin\theta$
(b)	Acceleration of m relative to the wedge	$(q)\,(g\sin\theta - a\cos\theta)$
(c)	Force on the wedge exerted by ground	$(r)\left(\sqrt{g^2+a^2}\right)\sin\theta$
(d)	Force on the wedge exerted by external agent	$(s)\left(M + m\cos^2\theta\right)g + ma\sin\theta\cos\theta$

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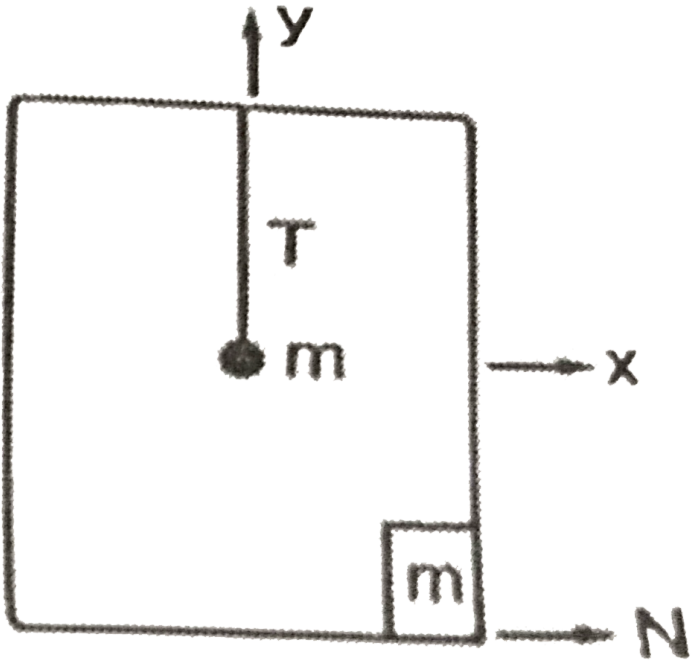
6. Lift can move in y-axis as well as along x-axis A ball of mass m is attached to ceiling of lift with inextensible light rope and box of

mass m is placed against a wall as shown in figure. Neglect friction everywhere.



	Column -I	Column -II
(a)	In figure lift is moving along x-axis then value of T may be	(p) Zero
(b)	Lift is moving toward right along x-axis with decreasing speed then value of N may be	$(q) > mg$
(c)	Lift is moving in upward direction(y-axis)then value of T may be	$(r) < mg$
(d)	Lift is moving in downward direction with constant velocity then value of T may be	$(s) = mg$

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7. Match column - I with column -II

	Column -I	Column -II
(a)	Gravitational force	(p) Central
(b)	Viscous force	(q) Non-conservative
(c)	Electric force	(r) Conservative
(d)	Friction	(s) Mechanical energy is conserved

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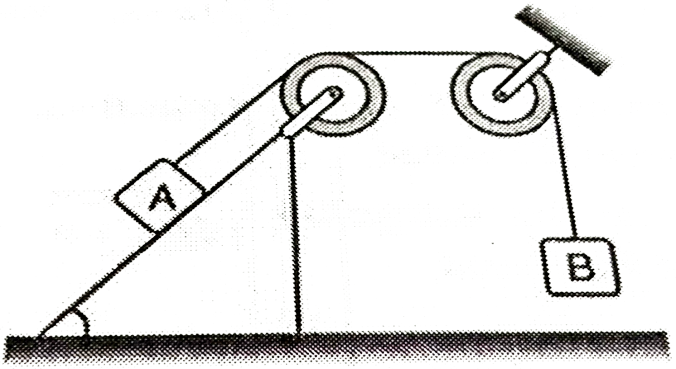
Integer Question

1. The pulleys and string are massless No friction on the inclined plane. The inclined plane is fixed. The mass of block A is 0.4 kg. The mass of block B is 0.3 kg. The angle of inclination of the inclined plane is 60° Find the normal reaction on A offered by inclined

surface during its motion.



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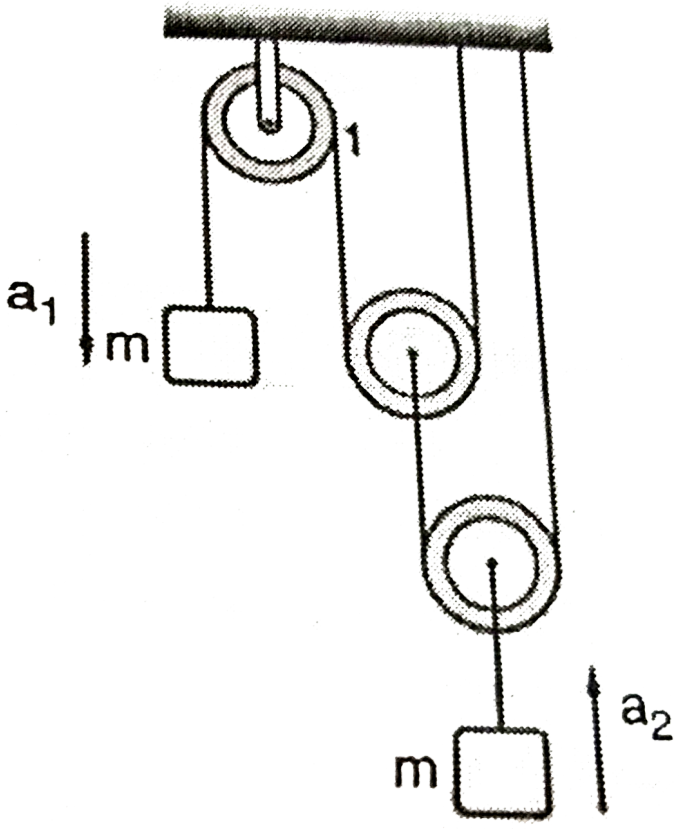
2. Two blocks of masses m_1 and m_2 are connected by massless threads. The pulleys are massless and smooth if a_1 is the magnitude value of acceleration of m_1 and a_2 is the magnitude

value of acceleration of m_2 find the ratio of $\frac{a_1}{a_2}$



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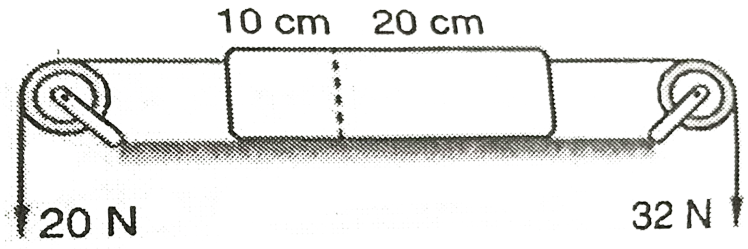
3. fig shows a uniform rod of length of 3.0 kg The string shown in the figure are pulled by constant forces of 20 N and 32 N. The force exerted by the 20 cm part of the rod on the 10 cm part is

found to be 8T. Find out value of T (all the surfaces are smooth and the strings and the pulleys are light).



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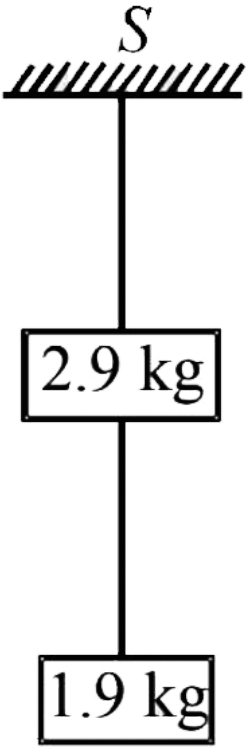
4. Two blocks of mass 2.9 kg and 1.9 kg are suspended from a rigid support S by two inextensible wires each of length 1 meter, see fig. The upper wire has negligible mass and the lower wire has a uniform mass of $0.2kg/m$. The whole system of blocks wires and support have an upward acceleration of $0.2m/s^2$. Acceleration due to gravity is $9.8m/s^2$.



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

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

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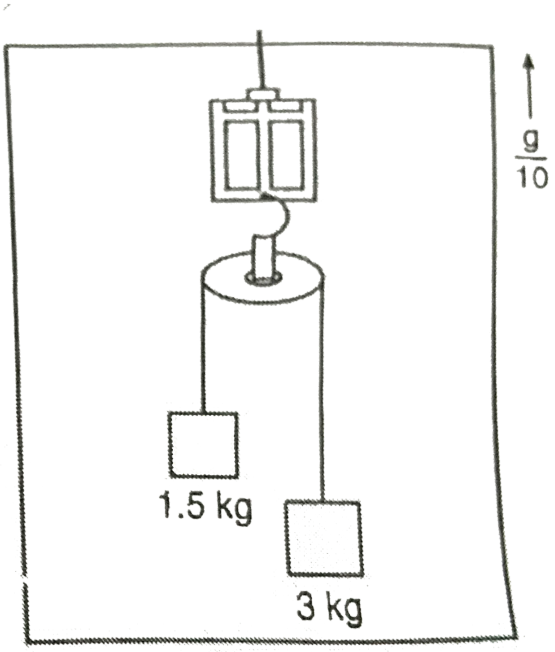
5. The elevator is going up with an acceleration of $g/10$ the pulley and the string are light and the pulley is smooth. If reading of

spring balance shown is $0.8x$ Calculate x. (Take $g = 10m/s^2$)



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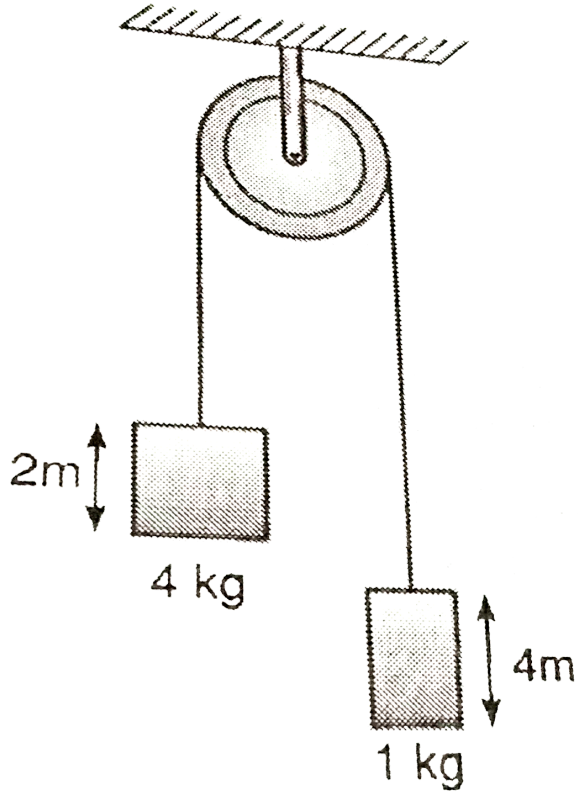
6. In fig shown, both blocks are released from rest Length of 4 kg block is 2m and of 1kg is 4m. Find the time they take to cross each other? Assume pulley to be light and string to be light and

inelastic.



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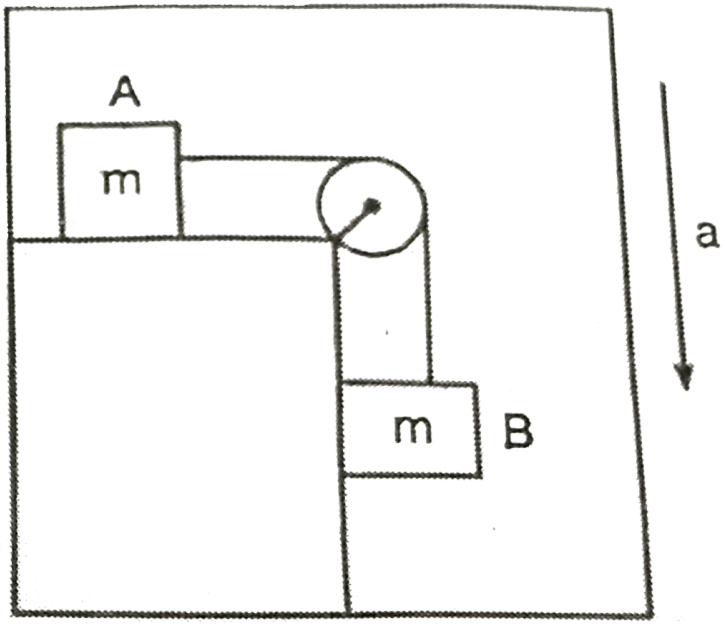
7. Two smooth blocks of same mass are connected by an inextensible and massless string which is passing over a smooth pulley are kept in a lift is going down with



acceleration 'a' as shown in the fig What should be the value of a (in m/s^2) so that acceleration of block A w.r.t. ground will be minimum? $(g = 10m/s^2)$

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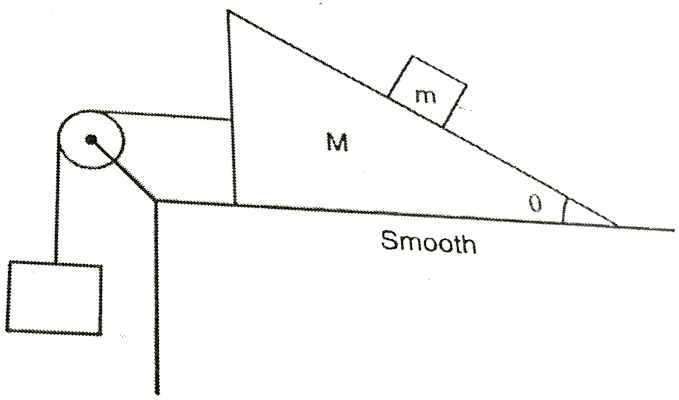
8. Fig shows a block of mass $0.1kg$ placed on a smooth wedge of mass $\frac{1}{5\sqrt{3}}$ kg if the block of mass m will move vertically

downward with acceleration $10m/s^2$ Then the value of tension (in newton) in the string is $(\theta = 30^\circ)$:



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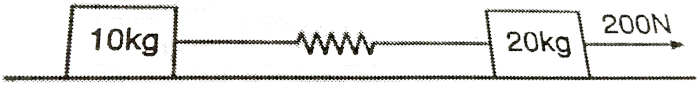
9. Two blocks of masses 10 kg and 20 kg are connected by a massless spring and are placed on a smooth horizontal surface. A force of 200 N is applied on 20 kg mass as shown in the diagram. At the instant, the acceleration of 10 kg mass is $12ms^{-2}$, the acceleration of 20 kg mass is:



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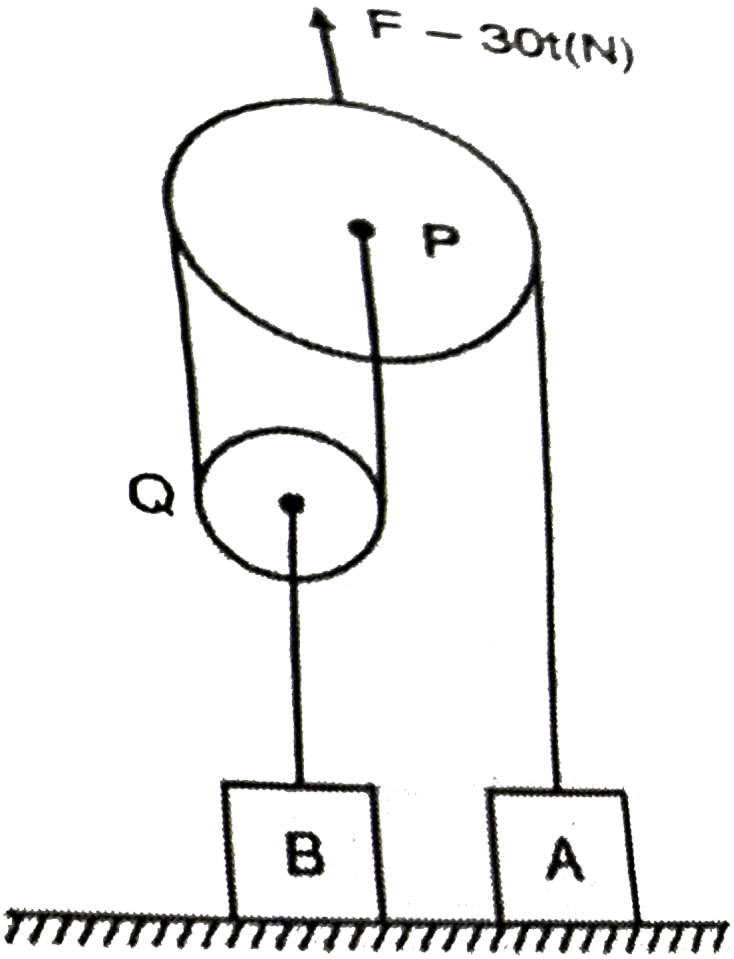
10. Two blocks A and B having masses $m_1 = 1kgm_2 = 4kg$ are arranged as shown in the figure The pulleys P and Q are light and frictionless. All the blocks are resting on a horizontal floor and the pulleys are held such that strings remains just taut. At moment t=0 a force F=30 t (N) starts acting on the pulley P along vertically upward direction as shown in the figure The time when the blocks

A and B loose contact with ground is $4/x$ sec then x is:



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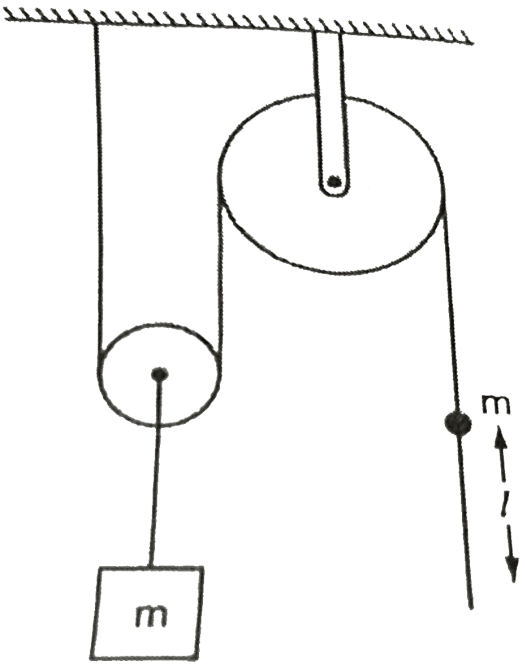
11. In the fig shown below, friction force between the bead and the light string is $\frac{mg}{4}$ if $t = \sqrt{\frac{nl}{7g}}$ where t is the time in which the bead loose contact with the string after the system is released from rest, find n



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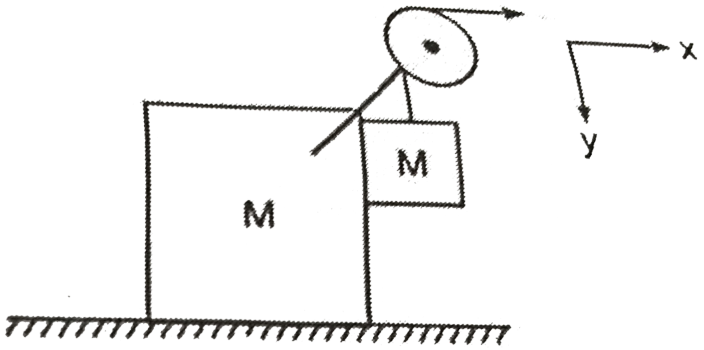
12. In the situation given, all surfaces are frictionless. Pulley is ideal and string is light if $F = mg/2$ the acceleration of the big block is g/x then x is:



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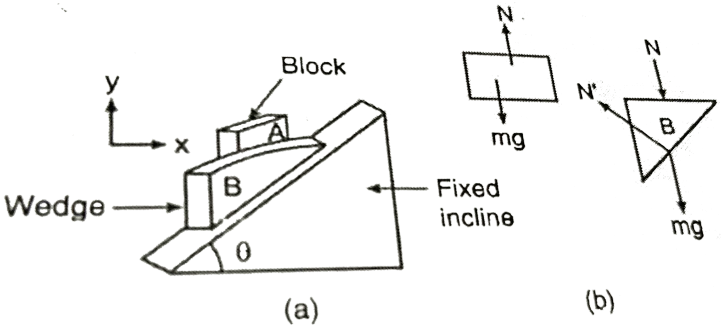
13. Block A of mass m is placed over a wedge of same mass m. Both the block and wedge are placed on a fixed inclined plane. Assuming all surfaces to be smooth, the displacement of the block

A in ground frame in 1s is $\frac{g\sin^2\theta}{x+\sin^2\theta}$ then the value of x is:



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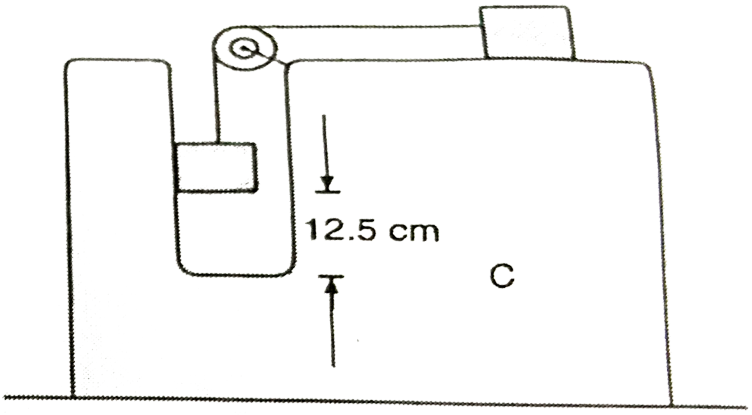
14. A small, light pulley is attached with a block C of mass 4 kg as shown in fig A block B of mass $1.5kg$ is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction,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

the system is released from rest is $x/4$ calculate x.



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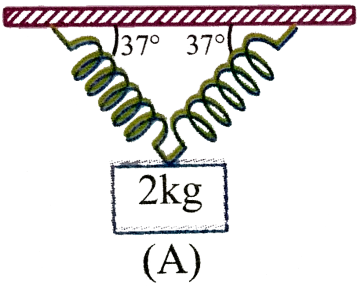
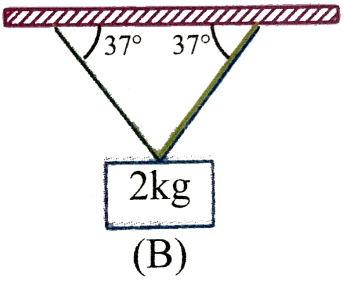
15. If at $t = 0$ right spring in (A) and right string in (B) breaks The ratio of magnitudes of instantaneous acceleration of blocks A & B is $\frac{5x}{24}$ calculate x





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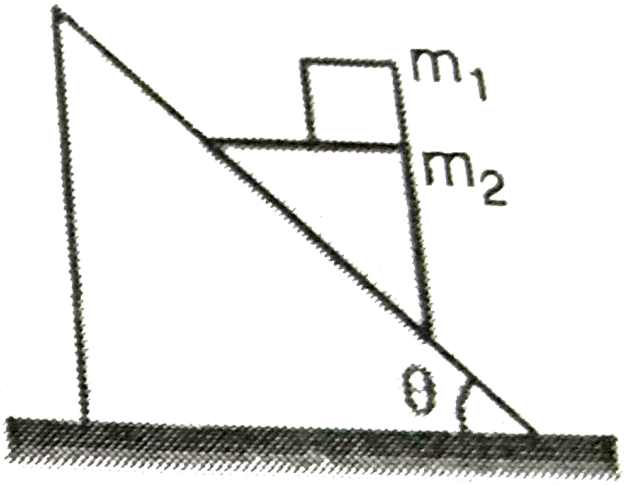
Comprehension

1. Two blocks m_1 and m_2 are allowed to move without friction. Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown. The angle of inclination of inclined plane is θ



The acceleration of m_1 with respect to ground is:

A. $\dfrac{(m_1+m_2)g\sin^2\theta}{m_2+m_1\sin^2\theta}$

B. $\frac{(m_1+m_2)g\sin^2\theta}{m_1+m_2\sin^2\theta}$

C. $\frac{(m_1+m_2)g\sin^2\theta}{m_2-m_1\sin^2\theta}$

D. $\frac{(m_1+m_2)g\sin^2\theta}{m_1-m_2\sin^2\theta}$

Answer: A

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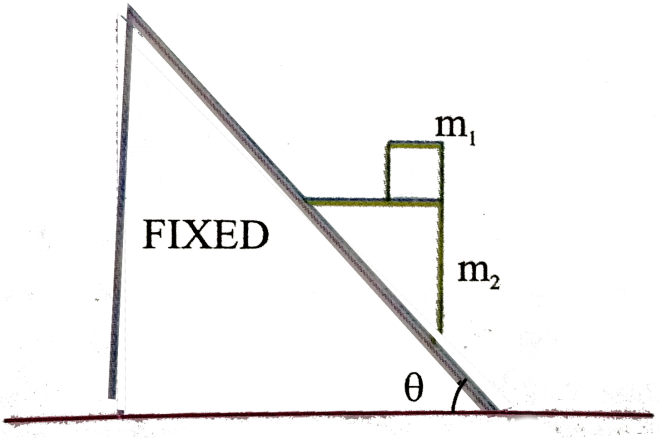
2. Two blocks m_1 and m_2 are allowed to move without friction Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown The angle of inclination of inclined plane is θ



The acceleration of m_2 with respect to ground is .

A. $\frac{(m_1+m_2)g\sin^2\theta}{m_2+m_1\sin^2\theta}$

B. $\frac{(m_1+m_2)g\sin\theta}{m_1+m_2\sin^2\theta}$

C. $\frac{(m_1+m_2)g\sin^2\theta}{m_2-m_1\sin^2\theta}$

D. $\frac{(m_1+m_2)g\sin^2\theta}{m_1-m_2\sin^2\theta}$

Answer: D

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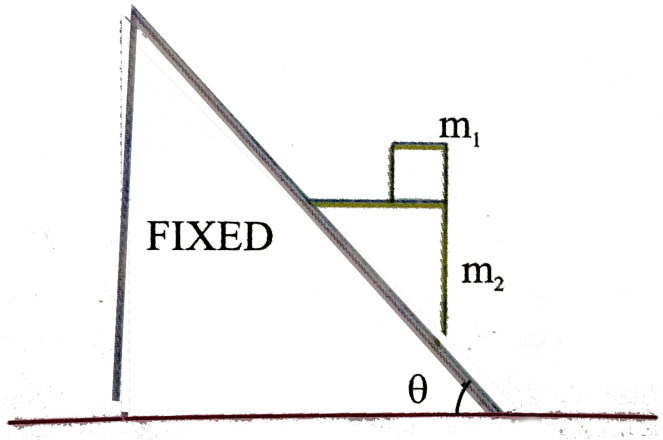
3. Two blocks m_1 and m_2 are allowed to move without friction Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown The angle of inclination of inclined plane is θ



Normal reaction on m_1 is .

A. $m_1 g$

B. $(m_1 + m_2)g$

C. $\dfrac{m_1 m_2 g \cos^2\theta}{m_2 + m_1 \sin^2\theta}$

D. $\dfrac{m_1 g\left[1 - (m_1 + m_2)\sin^2\theta\right]}{m_1 + m_2 \sin^2\theta}$

Answer: C

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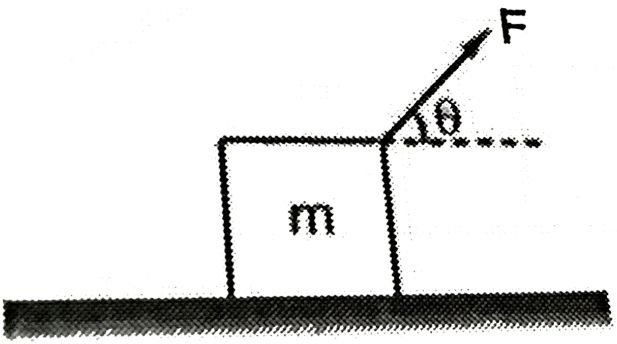
4. At the moment t=0 force F=kt is applied to a small body of mass m resting on a smooth horizontal plane (k is a constant) The direction of this force always forms an angle θ with the horizontal as shown.



Find the time t at which moment, the body breaks off the plane:

A. $\frac{mg}{2k\sin\theta}$

B. $\frac{mg}{k\sin\theta}$

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

D. $\frac{2mg}{k\sin\theta}$

Answer: B

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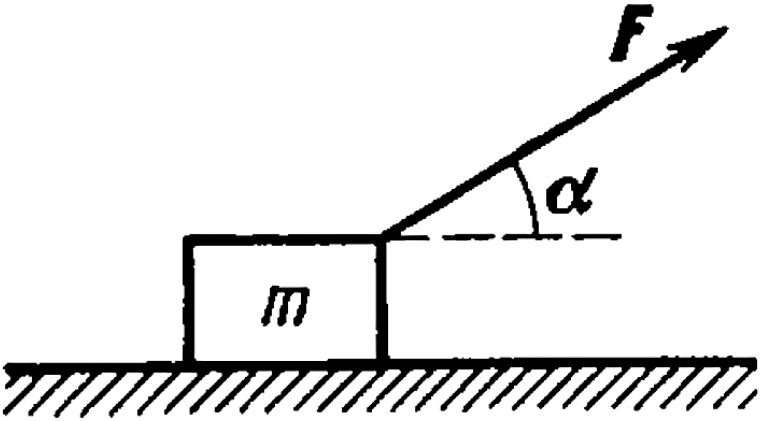
5. At the moment $t = 0$ the force $F = at$ is applied to a small body of mass m resting on a smooth horizontal plane (a is constant).

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

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

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



A. $\frac{mg^2 \cos\theta}{2k \sin^2\theta}$

B. $\frac{mg \cos\theta}{2k \sin^2\theta}$

C. $\frac{2mg^2 \cos\theta}{k \sin^2\theta}$

D. $\frac{2mg \cos\theta}{k \sin^2\theta}$

Answer: A

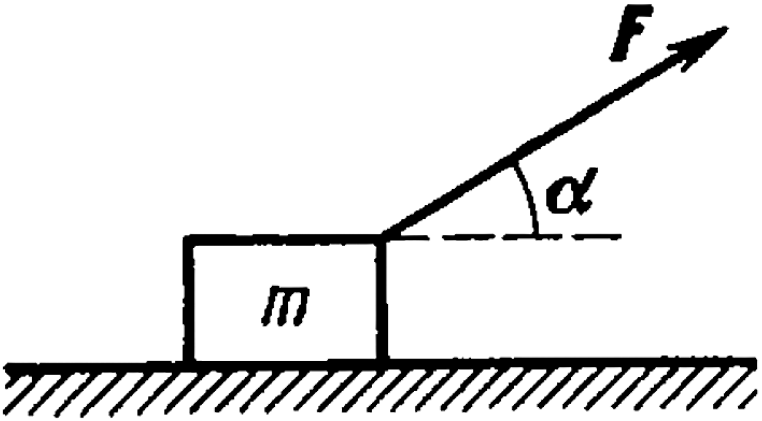
Watch Video Solution

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

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

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

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



A. $\dfrac{m^2 g^3 \cos\theta}{6k^2 \sin^3\theta}$

B. $\dfrac{m^2 g^3 \cos\theta}{3k^2 \sin^3\theta}$

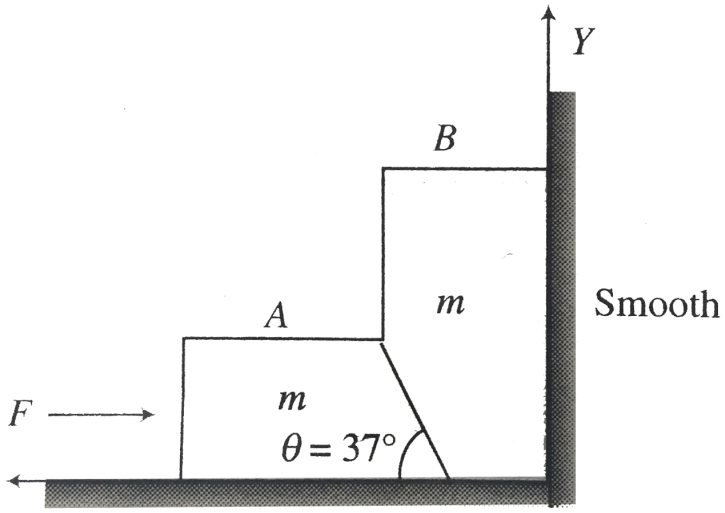
C. $\dfrac{m^2 g^2 \cos\theta}{6k^2 \sin^3\theta}$

D. $\dfrac{m^2 g^2 \cos\theta}{3k^2 \sin^3\theta}$

Answer: A

Watch Video Solution

7. 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. $\frac{5}{4}$ mg

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

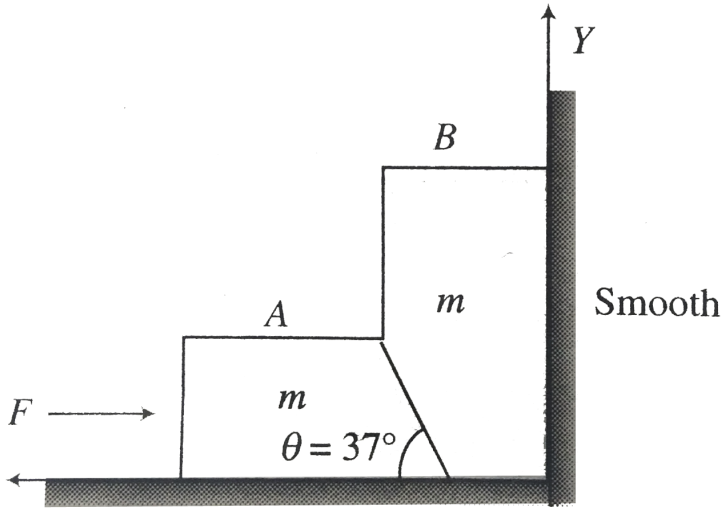
D. $\frac{4}{3}$ mg

Answer: C

Watch Video Solution

8. 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 both the blocks are stationary, the force exerted by ground of block A is

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

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

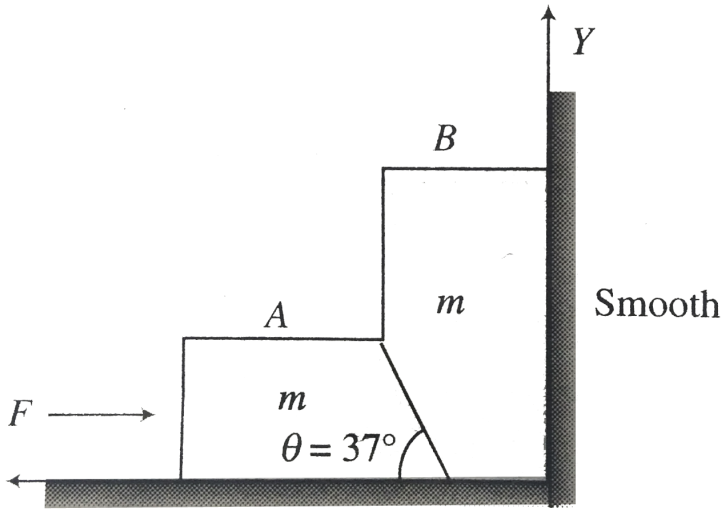
C. $mg + \frac{4F}{3}$

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

Answer: C

Watch Video Solution

9. 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

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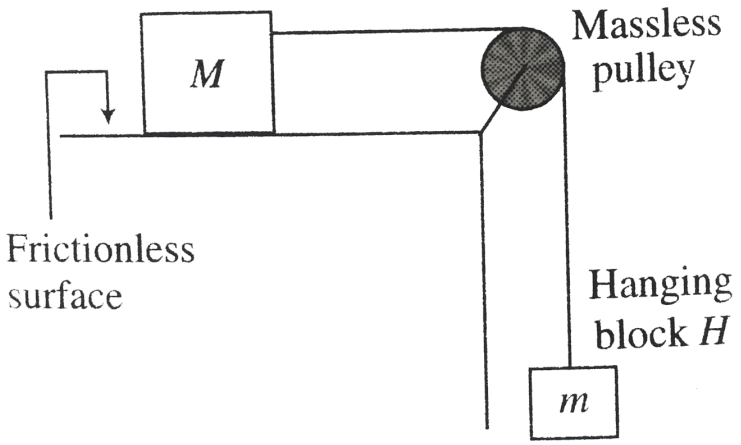
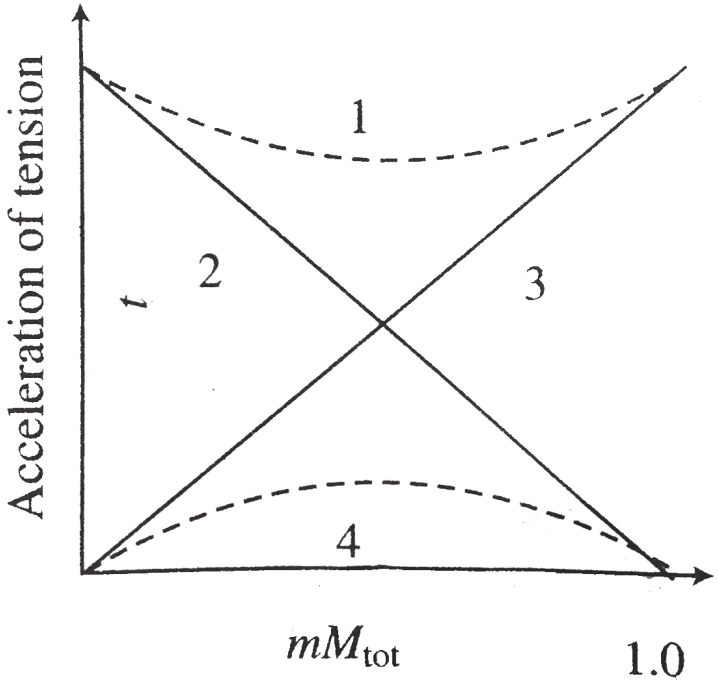
10. Two containers of sand are arranged like the block as shown in fig. the containers alone have negligible mass, the sand in them has a total mass M_{tot} , the sand in the hanging container H hs mass m.



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. 2

B. 3

C. 4

D. 5

Answer: C

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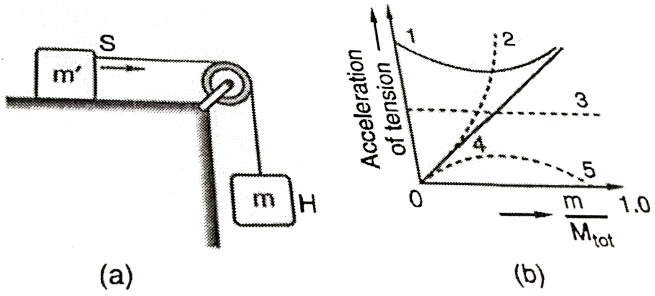
11. Two containers of sand S and H are arranged like the blocks figure (a) The container alone have negligible mass, the sand in them has a total mass M_{tot} , the sand in the hanging container H has mass m. You are to measure the magnitude a of the acceleration of the system in a series of experiments where m varies from experiment to experiment by M_{tot} does not, that is, you will shift sand between the containers before each trial $\frac{m}{M_{\text{tot}}}$ is taken on the horizontal axis for all the plots.



The curve which gives tension in the connecting string (taken on y-axis) as a function of ratio $\left(\frac{m}{M_{\text{tot}}}\right)$ is:

A. 1

B. 2

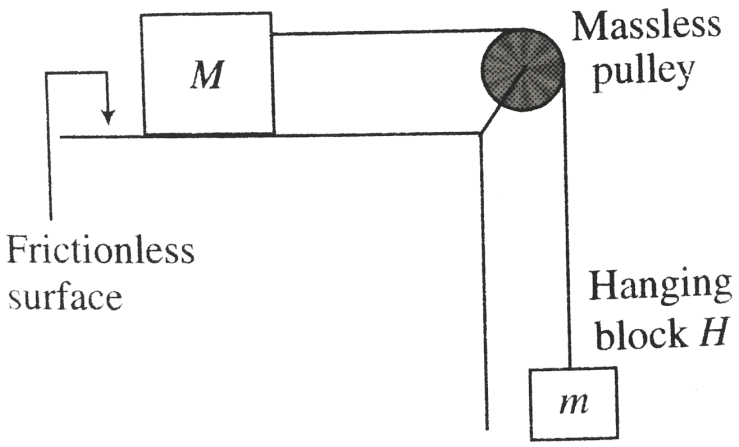
C. 4

D. 5

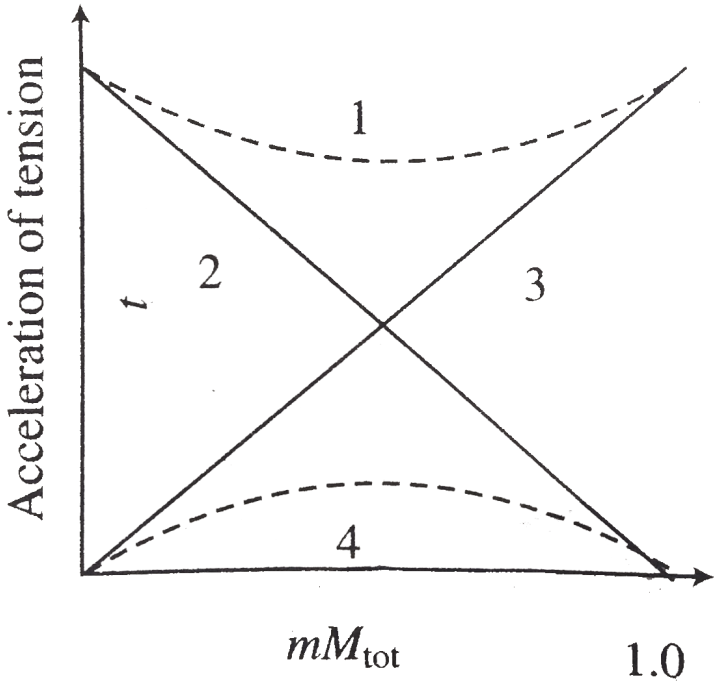
Answer: D

View Text Solution

12. 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. 4

D. 5

Answer: B