PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

NEWTONS LAWS OF MOTION

Examples

1. A block of mass 5 kg is acted upon two perpendicular force 7 N and $24N$. Find the

magnitude and the direction of acceleration of the block.

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2. Three forces $\overrightarrow{F_1} = 23\hat{j} + 3\hat{j} - \hat{k}, \overrightarrow{F_2} = 4\hat{i} - \hat{j} - 2\hat{k}$ and $\overrightarrow{F_3} = 23\hat{j} + 3\hat{k}N$act on a block of mass $5kg$. Calculate the acceleration of the particle.

A. 10

B. 5

C. 15

D. 1.5

Answer: B

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3. A constant force acting on a block of mass 5 kg changes (a) its speed from $6m/s$ to $10m/s$ in travelling a distance $8m$ in a straight line, (b) its speed from $2m/s$ to

$8m/s$ in $3s$ a straight line. Find the magnitude and the direction of the force.

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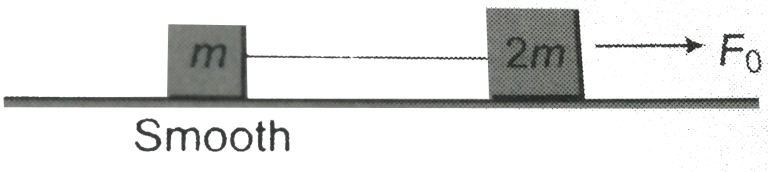
4. Two blocks are attached by a light inextensible string and the system is pulled by applying a force F_0 as shown in the diagram. Find the acceleration of each block and tension in the string.



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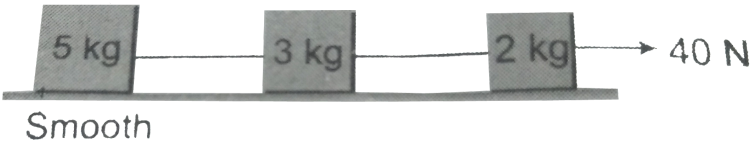
5.



Find the common acceleration and tension in each string.

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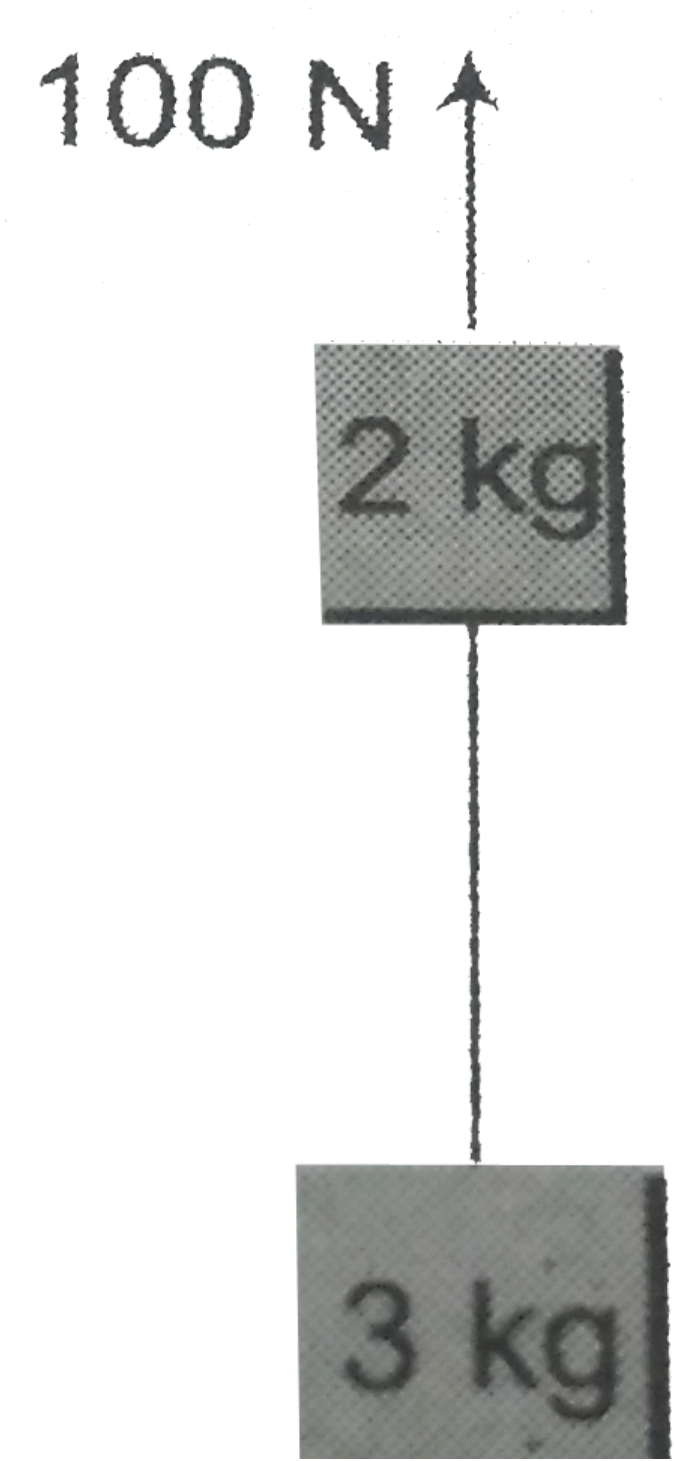
6. The blocks are attached by an inextensible light string and pulled vertically upward by force $100N$ as shows. Find the common

acceleration and tension in the string



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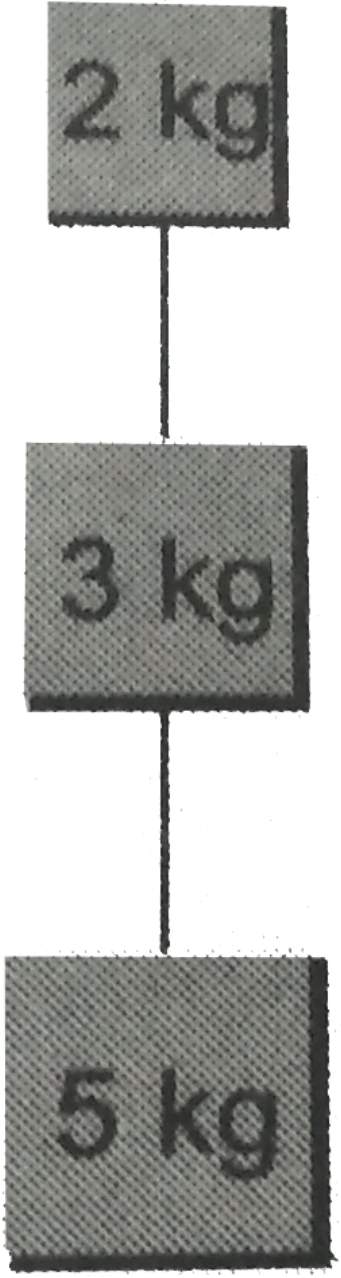
7. The blocks of masses $2kg$, $3kg$ and $5kg$ are connected by light inextensible strings as shown. The system of blocks is raised vertically upwards by appling a force $F_0 = 200N$. Find the common acceleration and tensions in the strings.



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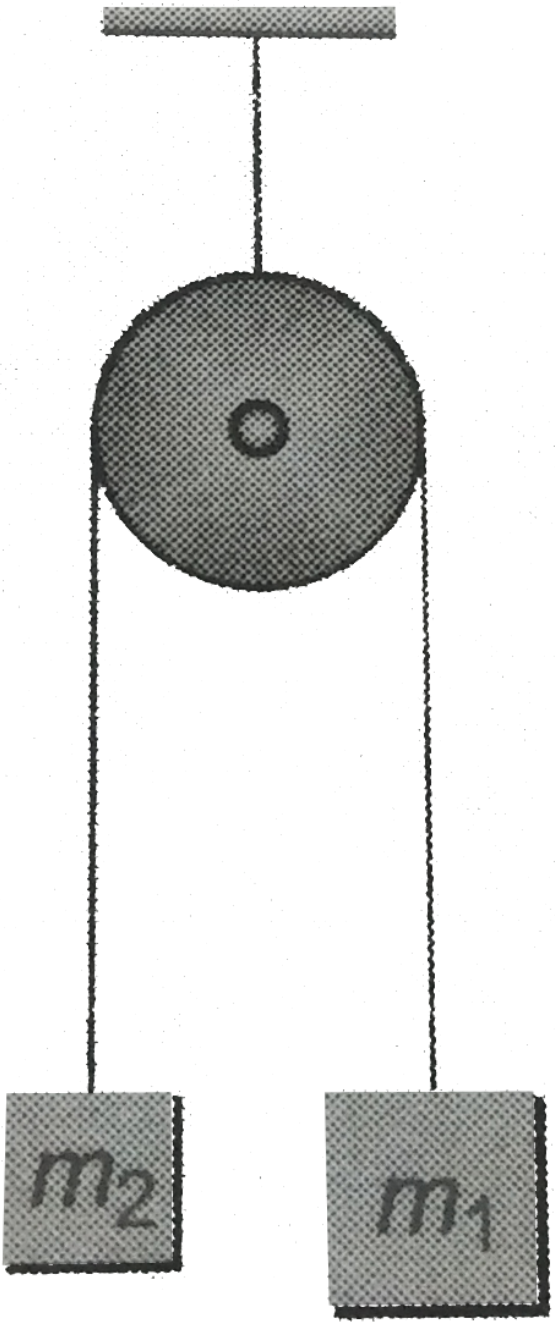
8. In the arrangement shown, find the acceleration of each block, tension in the string and reaction in the pulley. The string and pulley are light (massless) $(m_1 > m_2)$.

Neglect the friction in pulley.



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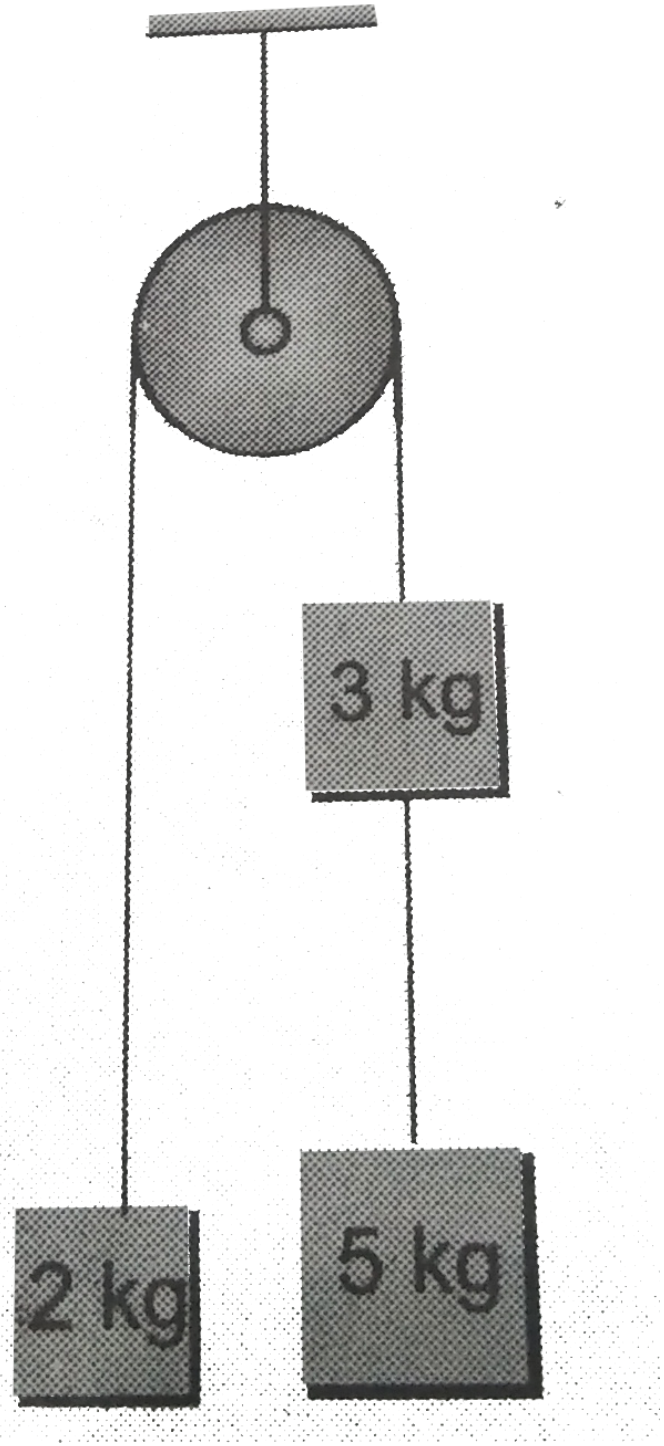
9. The pulley is light and smooth : the strings are inextensible and light. The system is released from rest, find the acceleration of each block, tensions in the strings and

reaction in pulley.


3 kg
2 kg
5 kg

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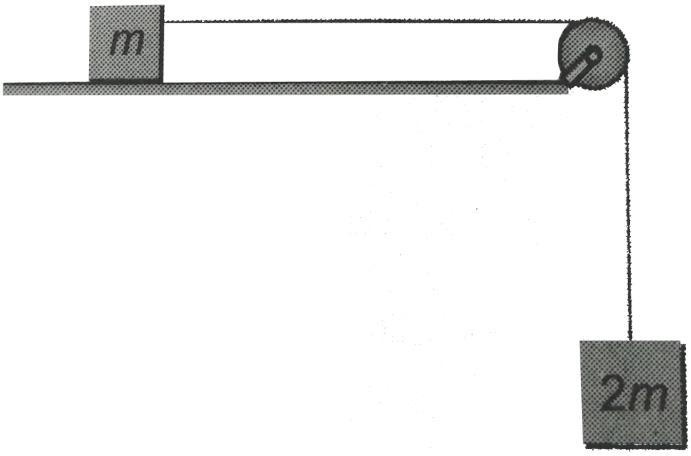
10. Two blocks are connected by an inextensible light string, the string is passing over smooth, light pulley as shown. Find the acceleration of blocks and tension in the string, reaction in pulley.



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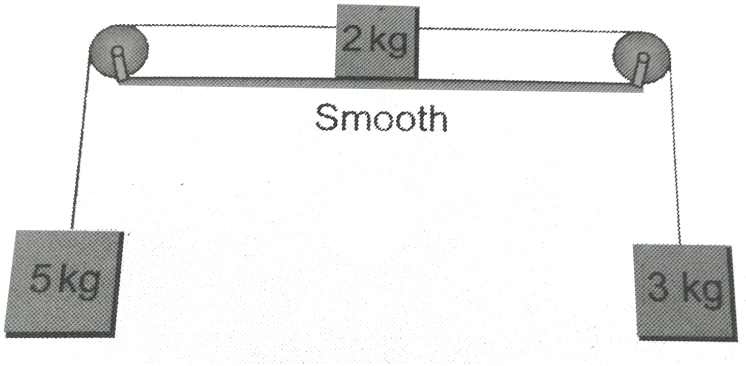
11. The strings are inextensible and light: the pulleys are smooth and light. Find the acceleration of each block and tensions in the strings.



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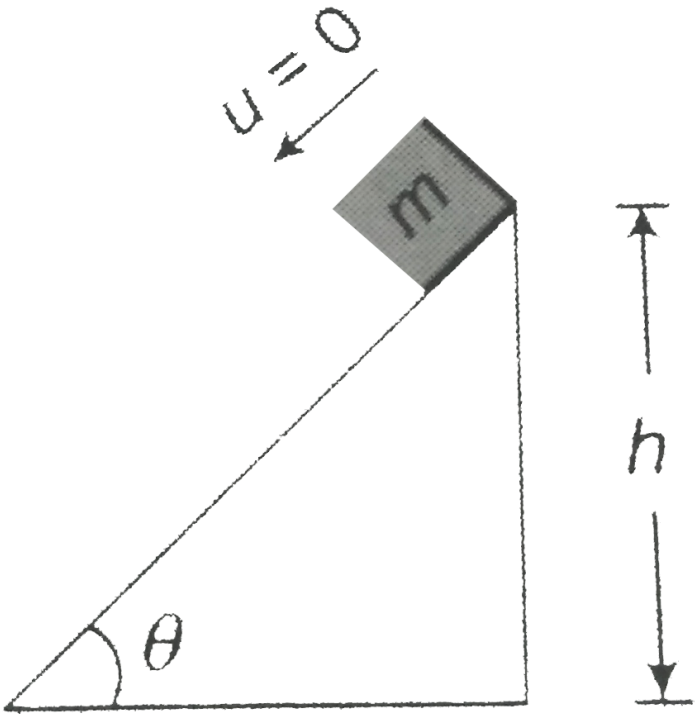
12. A block is released on an smooth inclined plane of inclination θ. After how much time it reaches to the bottom of the plane?



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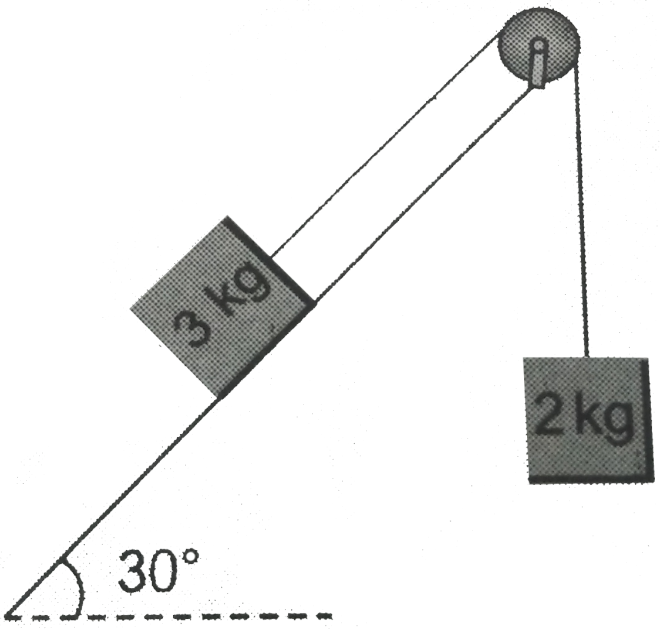
13. Consider the situation shown in the figure. The surface is smooth and the string and the pulley are light. Find the acceleration of each block and tension in the string.



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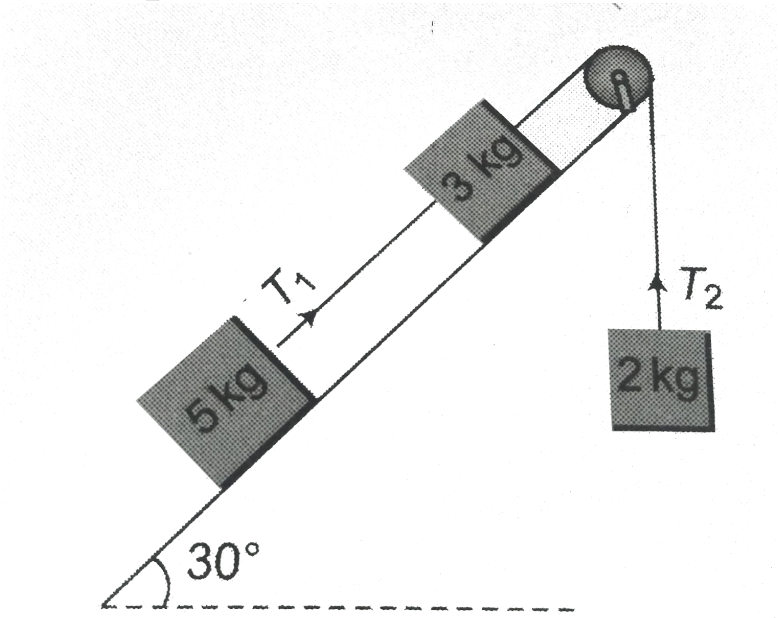
14. In the arrangement shown, inclined plane is smooth, strings and pulleys are massless. Find $\frac{T_1}{T_2}$



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15. In the arrangement shown, all the surfaces are smooth, strings and pulleys are light. Find the tension in the string.

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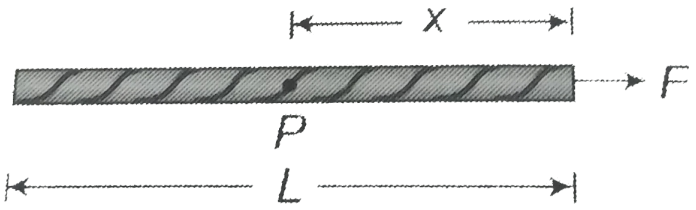
16. A uniform rope of length of length L is pulled by a force F on a smooth surface. Find tension in the rope at a distance x from the

end where force is applied.



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17. A block of mass M is attached to a uniform rope of mass m. This arrangement is pulled by applying a force F at the rope as shown. Find the tension in the rope (a) at the junction of the rope and the block (b) at the mid point of the rope.

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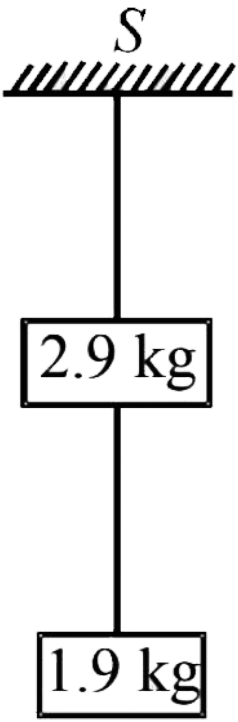
18. Two blocks of mass 2.9 kg and 1.9 kg are suspended from a rigid support S by two inextensible wires each of length 1 meter, see fig. The upper wire has negligible mass and the lower wire has a uniform mass of $0.2kg/m$. The whole system of blocks wires and support have an upward acceleration of $0.2m/s^2$. 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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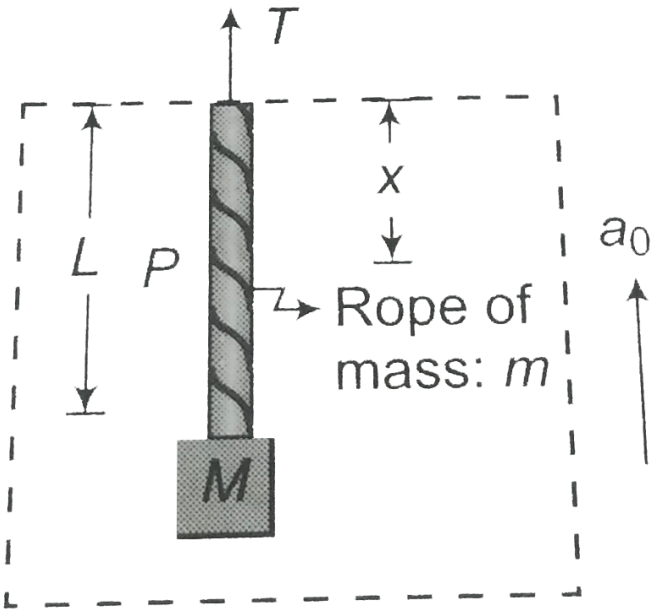
19. A uniform rope of mass m and length L is attached to the ceiling of a lift. The other end of the rope is attached to a block of mass M. The lift is moving up with a constant acceleration a_0. Find the tension in the rope at a distance x from the ceiling as shown in the

diagram.



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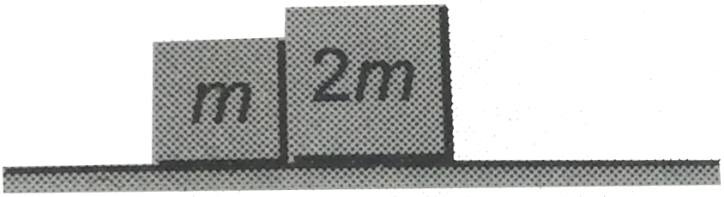
20. Two blocks of masses m and $2m$ are placed on a smooth horizontal surface as shown in

the figure. Find the acceleration of each block and normal reaction between two blocks if a horizontal force F_0 is applied on (a) m and (b) $2m$



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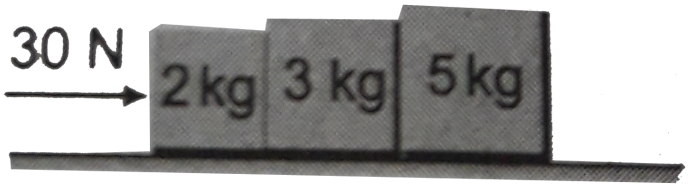
21. Three blocks of masses $2kg, 3kg$ and $5kg$ are placed in contact as shown in the diagram. A horizontal force of $30N$ is applied on $2kg$

block. Find the contact force between (a) $2kg$ and $3kg$ block and (b) $3kg$ and $5kg$ block.



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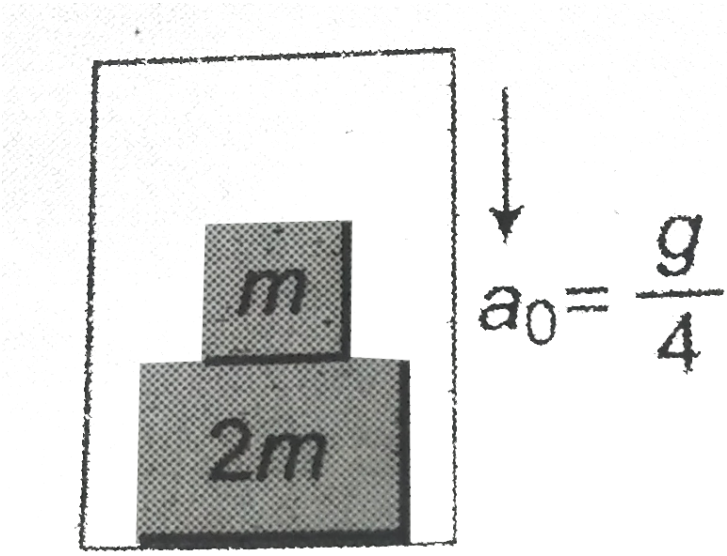
22. Consider the arrangement as shown in the figure. The lift is moving with acceleration $(g)/(4)$ in vertically downward direction. Find the contact force (a) between the blocks (b)

between the lower block and the floor of lift.



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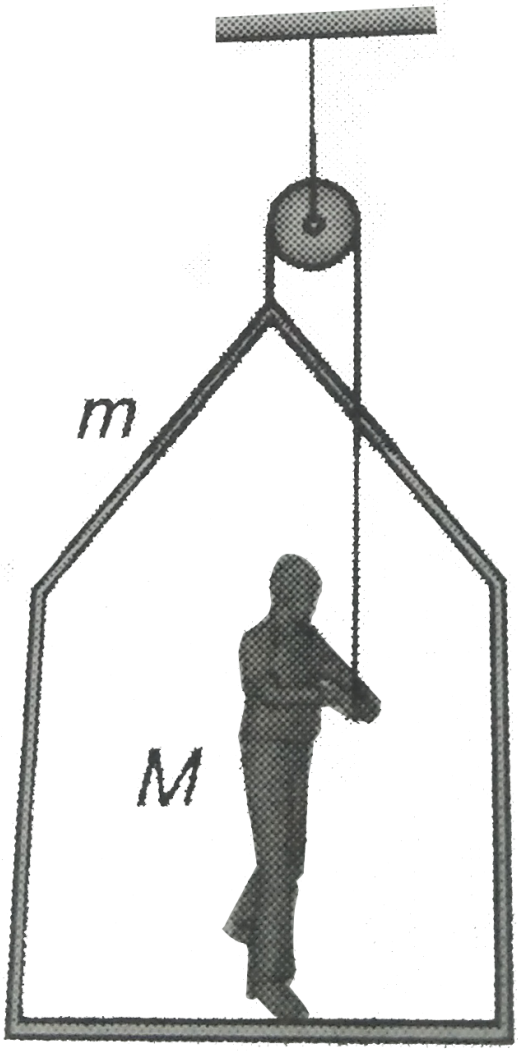
23. Consider the situation as shown in the figure. The boy of mass M holds the light rope and the system is at rest. If m is mass of the

box, find the force exerted by the boy on the rope and contact force beteween the boy and the box.



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24. In the previous problem if $M = 80kg$ and $m = 410kg$ and the boy pulls the rope such that the system (boy+box) moves upward with acceleration $5m/s^2$,find the force exerted by the boy and contact force between the boy and the box.

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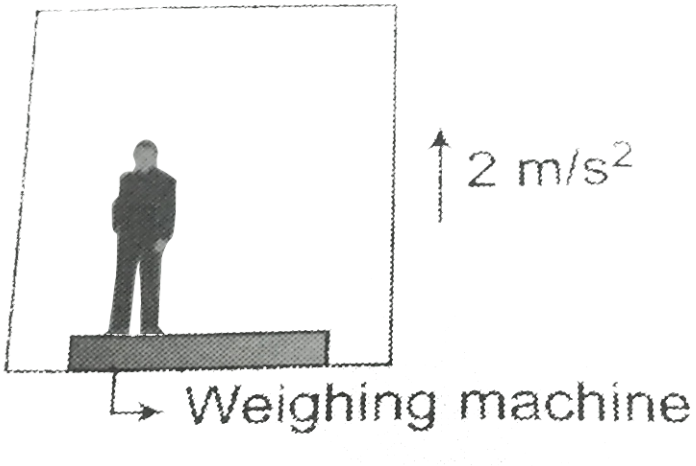
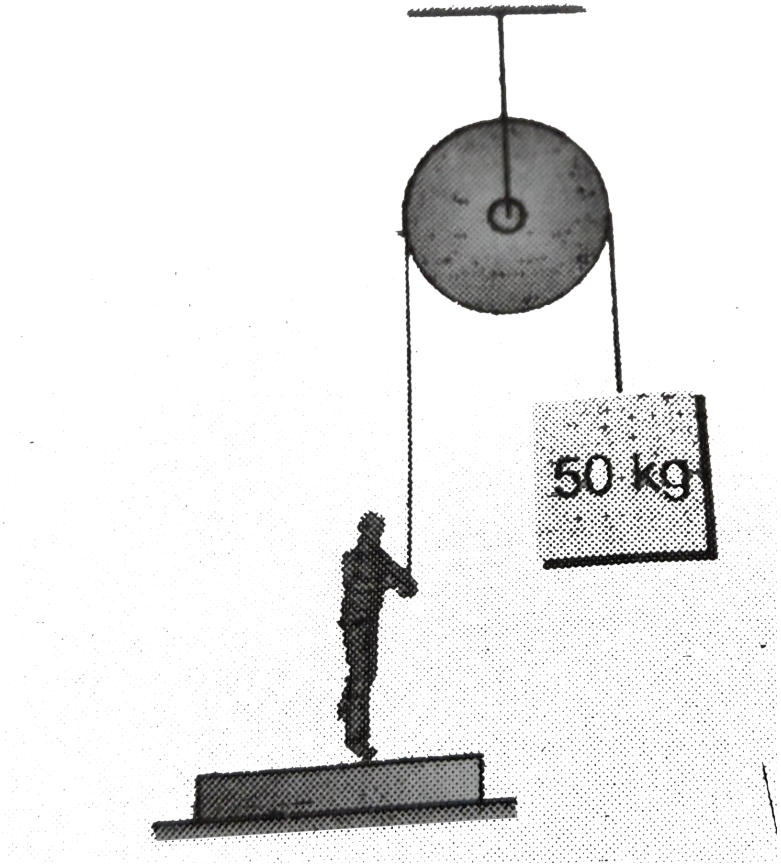
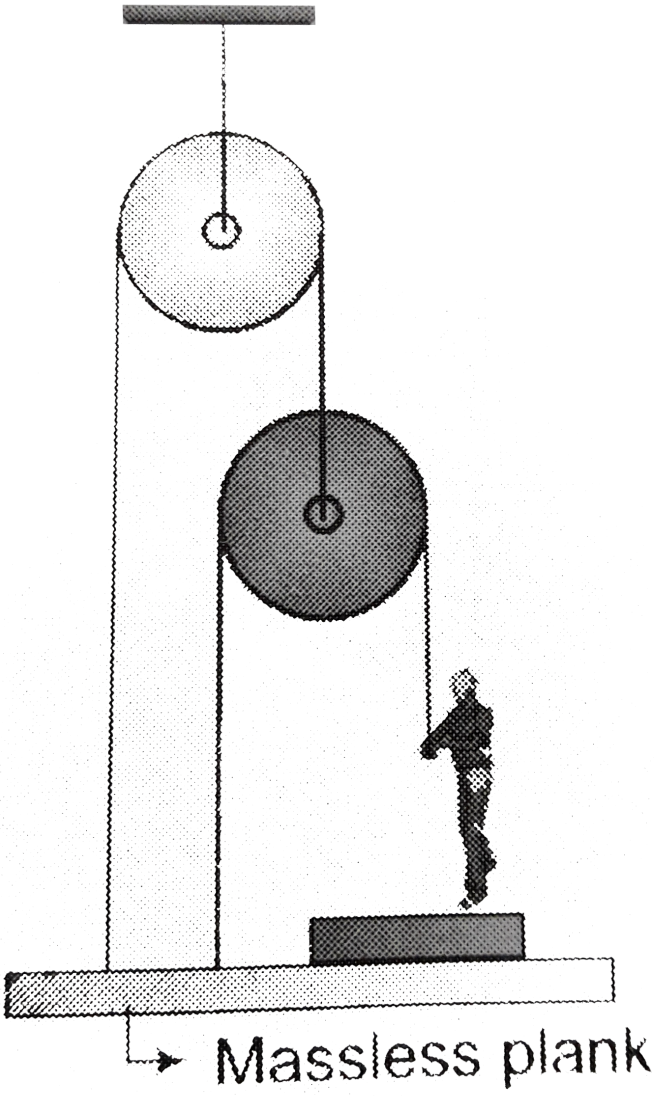
25. A man of mass $60kg$ is standing on a massless weighing machine. Find the weight of the man in different situations as shown in the following figures.



Man holds the rope and the block is at rest.



Man holds the rope and the system is at rest.



Man holds the rope and the system is at rest.

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26. A boy is standing on a weighing machine placed on the floor of an elevator. The elevator starts going down with some acceleration, moves with constant velocity for some time and finally decelerates to stop. The minimum and maximum weight recorded are $480N$ and $840N$ If the magnitude of reardation is double of acceleration, find (a) true weight of the boy and (b) magnitude of acceleration.

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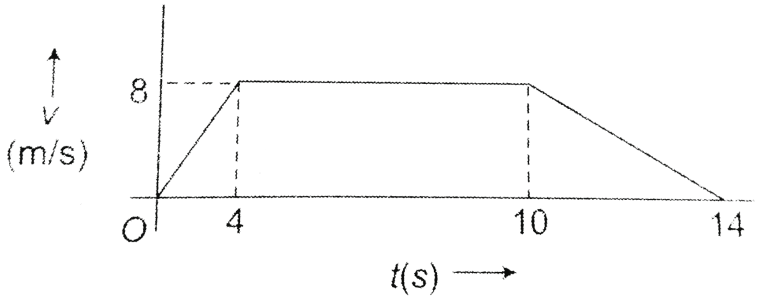
27. A lift is going up. The total mass of the lift and the passengers is $2000kg$. The variation of speed of the lift is as shown in the diagram



(a) What will be the tension in the rope pulling the lift at time equal to (i) $1s$ (ii) $6s$ (iii) $12s$?

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

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28. A block of mass m is placed on a smooth wedge of inclination θ. The while system is acceleration horizontally so that the block does not slip. Find (a) horizontal acceleration, (b) normal force between the block and the wedge and (c) the horizontal force applied on the wedge.

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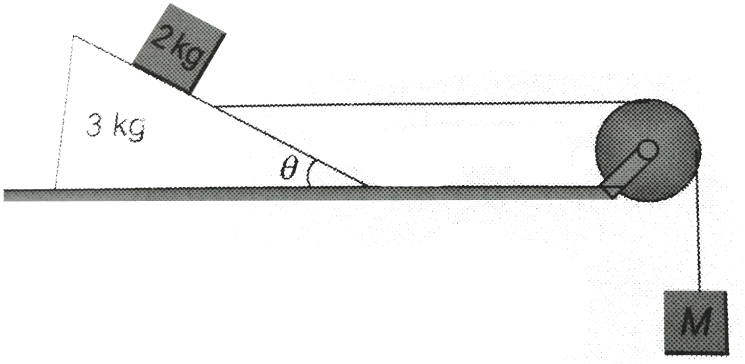
29. Consider the situation as shown in the figure. All the surface are smooth and the string and pulley are light. Find the mass of the hanging block which will prevent the smaller block form slipping over the triangular block.



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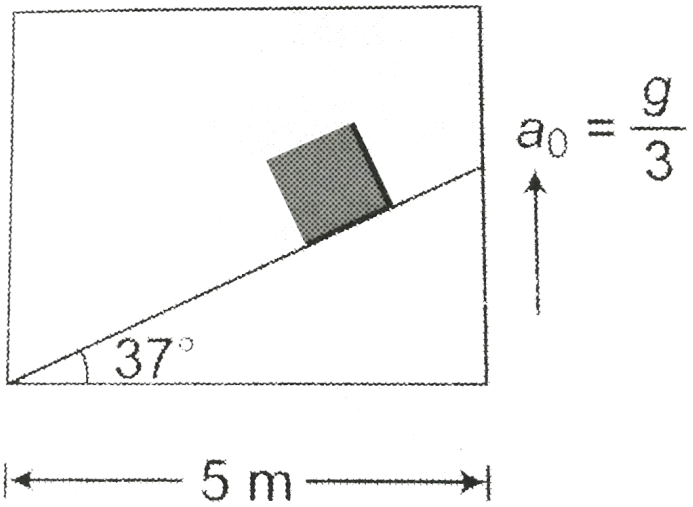
30. A particle slides down a smooth incline of inclination 37°, fixed in an elevator going up with an acceleration $(g)/3$. The base of incline has a length $5m$. Find the time taken by the particle to reach the bottom.



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31. A pendulum is hanging from the ceiling of a car having an acceleration a_0 with to the road. Find the angle made by the string with the verical and tension in the string.

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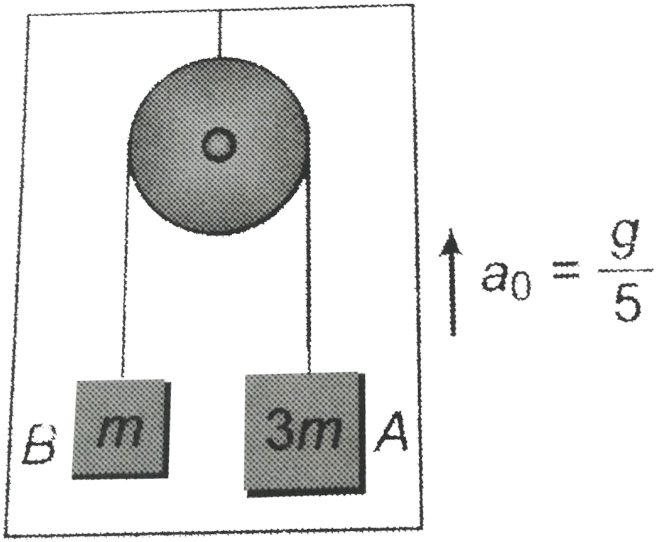
32. A pulley fixed to the ceiling of an elevator car carries a thread whose ends are attached to the loads of masses $3m$ and m . The car starts gong up with acceleration g/s. Assuming the masses of the pulley and the

thread, as well as friction, to be negligible, find the force exerted by the pulley on the ceiling of car.



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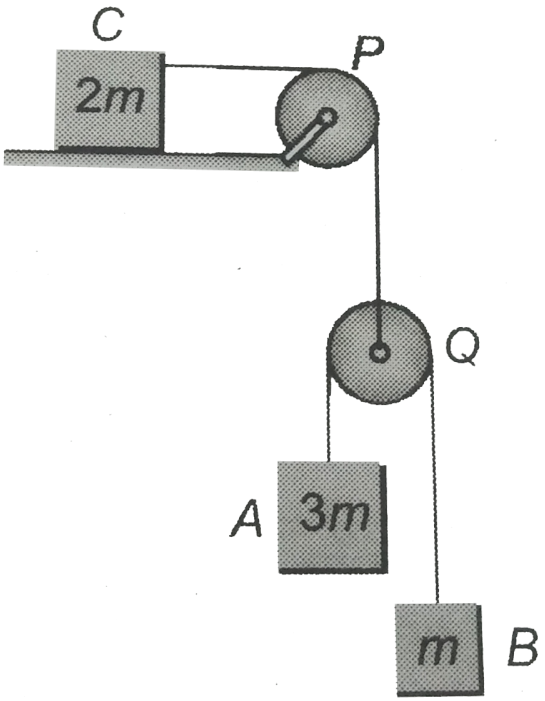
33. In the arrangement shown in the figure, the blocks have masses $3m, m$ and $2m$, the friction is absent, the masses of the pulleys and the threads are negligible. Find the acceleration of mass $3m$.



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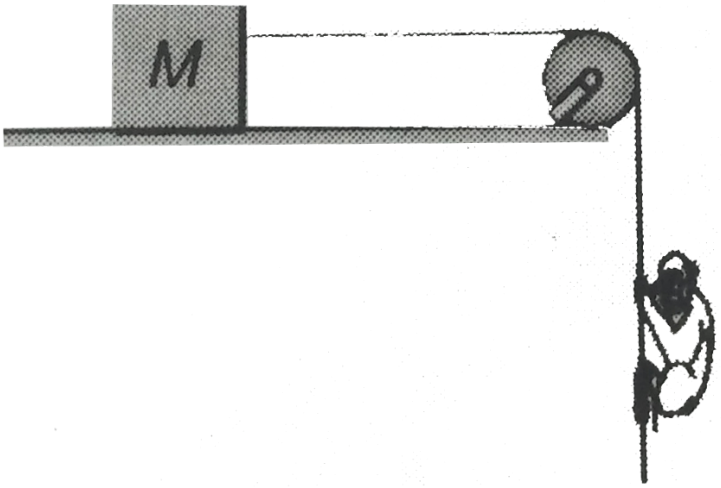
34. Consider the arrangement shown in the figure. Find the acceleration of the block

(a) A monkey moves upward with respect to the rope with acceleration a_0

(b) A monkey moves downward with respect to the rope with acceleration a_0

Assume the surface smooth, pulley and string

light.



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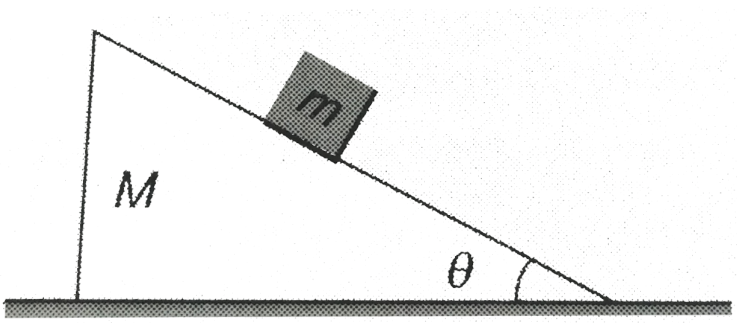
35. Assuming all the surfaces to be smooth, find the acceleration of the triangular block of mass M when the block of mass m slides on

it.



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36. With what minimum acceleration can monkey slide down a rope whose breaking strength is two third of his weight?

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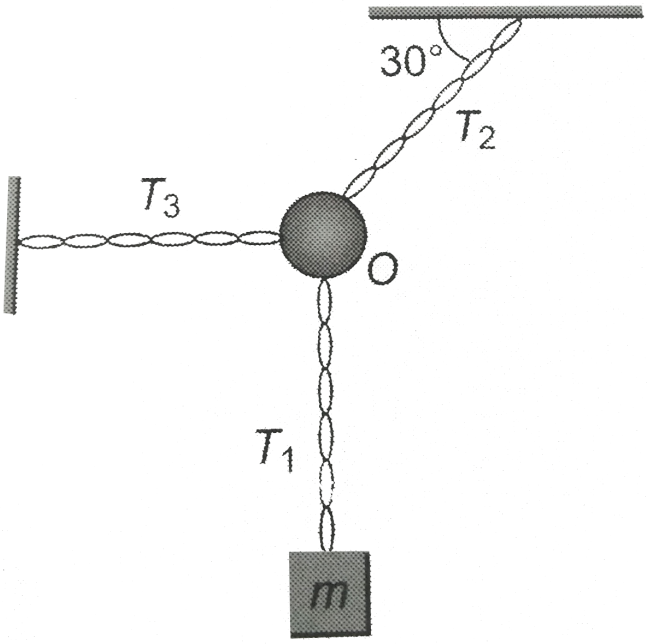
37. A block of mass m is attached to a chain as shown in the diagram. Find the tension in each of the three chains. The ring and chains are light.



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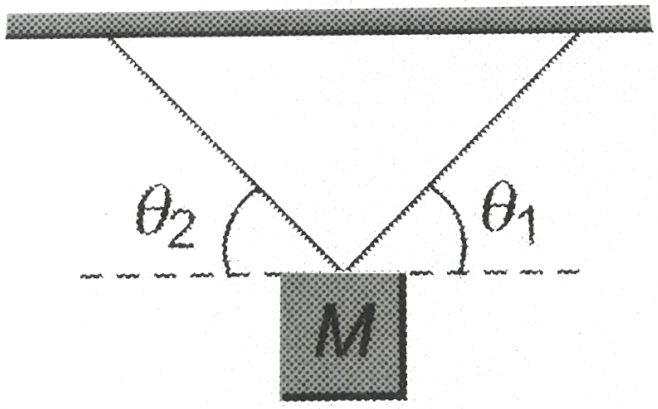
38. A block of mass M si suspended by two strings angles θ_1 and θ_2 with the horizontal. Find the tensions in the strings.



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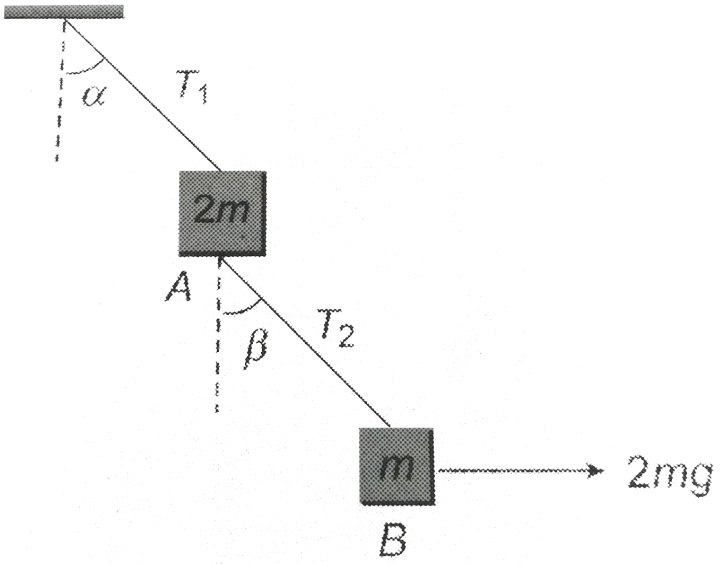
39. The blocks are in equilibrium with a constant horizontal force $2mg$ acting on block B. The strings are light, find tensions in the strings and values of angles α and β



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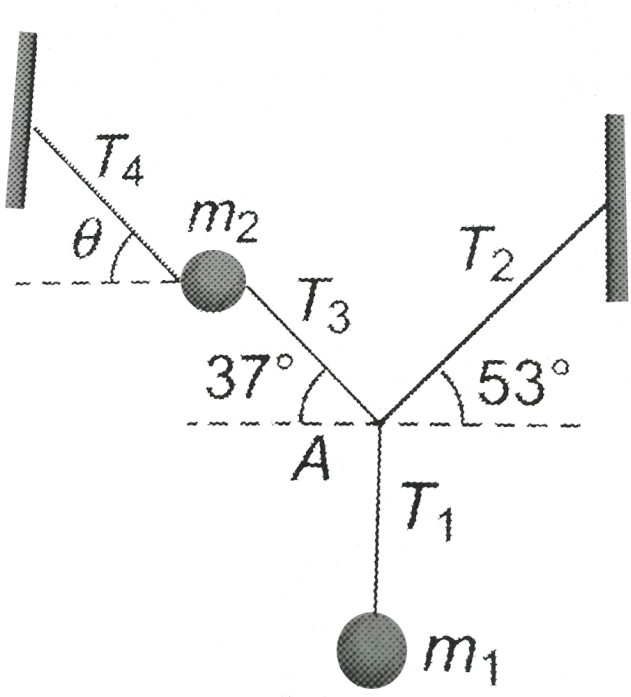
40. Two masses m_1 and m_2 are attached with light strings as shown. If the system is in equilibrium, find the value of θ



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41. A balloon carring some sand is moving down with a constant acceleration a_0. How much mass of sand should be removed, so that the balloon move up with same acceleration?

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42. A block is kept the floor of an elevator at rest. The elevator starts descending with an acceleration of $12m/s^2$. Find the

displacement of the block during the first $1s$ after the start.

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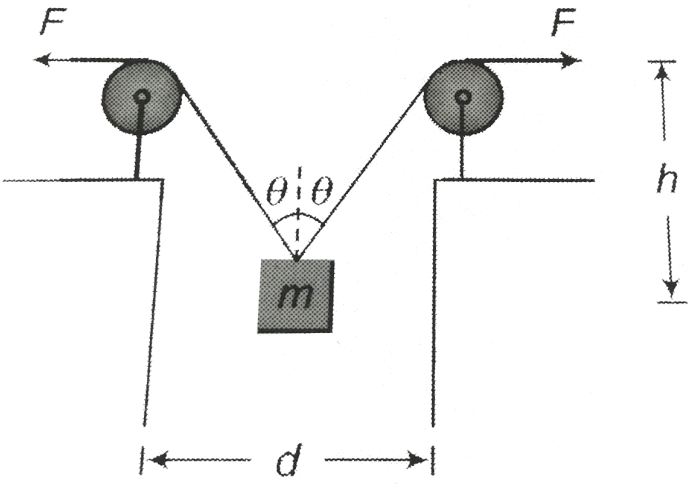
43. A block is pulled slowly as shown in the diagram. Show that force F increase as the block moves up. Find the force F when the

block is at depth h.



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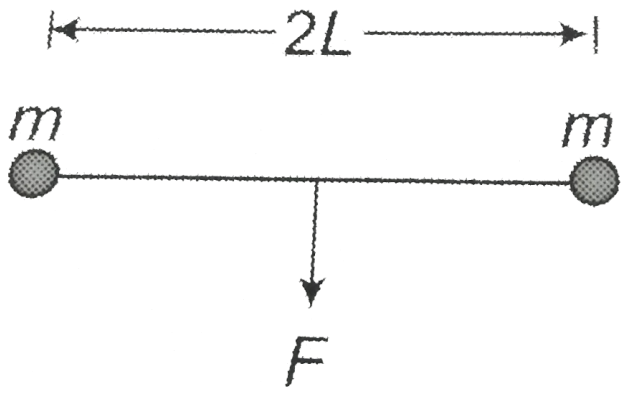
44. Two particles each of mass m are connected by a light string of length $2L$ as shown in the figure. A constant force F is applied continuoulsly at the mid – point of

the string at right $-$ angle to intial position of the string. Find the acceleration of each particle and the acceleration of approach between the particles when separation between them is $2x$



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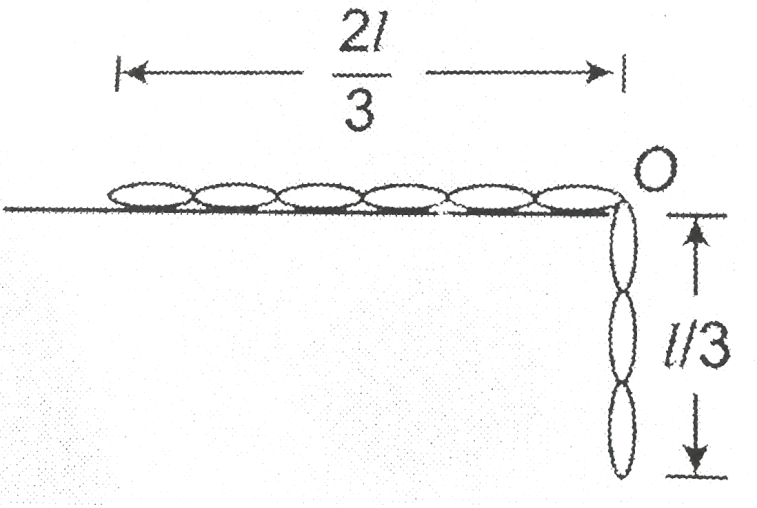
45. A uniform chain of mass m and length l is placed on a smooth table so that one $-$ third length hanges freely as shown in the figure. Now the chain is released, with what velocity chain slips off the table?



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46. A block of mass m resting on a smooth horizontal plane starts moving due to a constant force $F = mg/3$ of constant magnitude. In the process of its rectilinear motion the angle θ varies as $\theta = \lambda s$, where λ is constant and s is the distance traversed by the block from its intial position. Find the velocity of the block as a function of the angle θ. Also show that the block will never lose contact with the ground.

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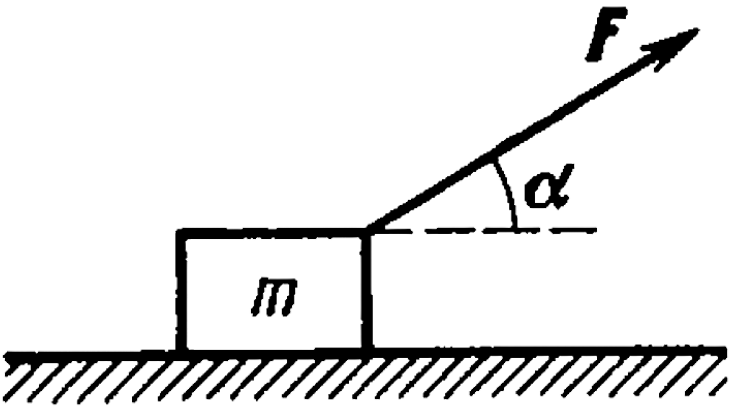
47. At the moment $t = 0$ the force $F = at$ is applied to a small body of mass m resting on a smooth horizontal plane (a is constant).

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.



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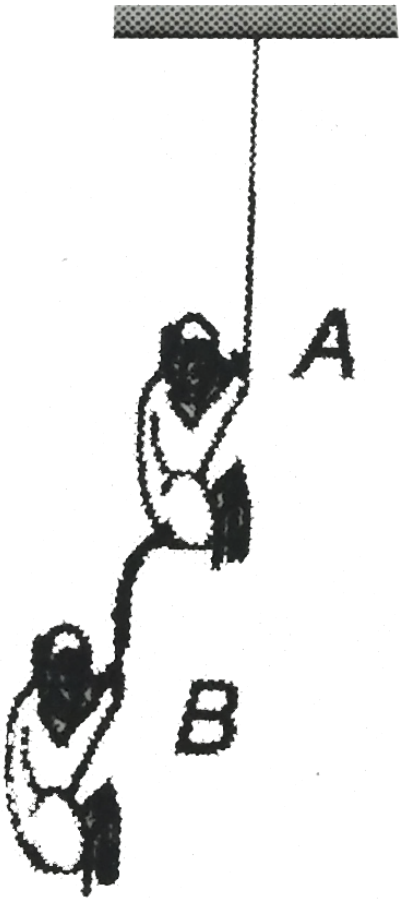
48. The monkey B shown in the figure is holding on the tail of the monkey. A which is climbing up a rope. The masses of the monkeys A and B are $40kg$ and $20kg$, respectively. If A can tolerate a tension of $300N$ in its fail, what force should it apply on the rope in order to carry the monkey B with

it?



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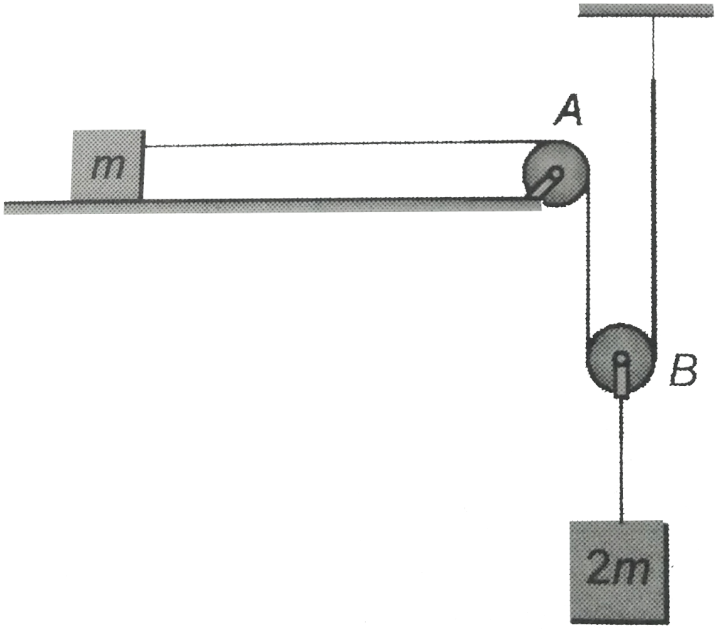
49. Find the acceleration of each block in the situation shown in the figure. All the surface are smooth and the pulleys and sttings are light.



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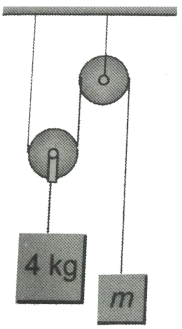
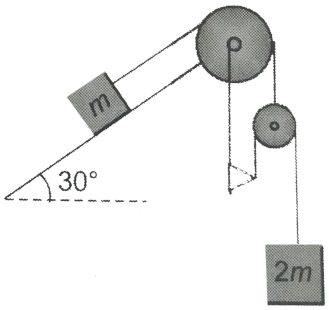
50. Find the acceleration of the block of mass m in the arrangement shown in the following figures. The masses of the pulleys and the threads, as well as the friction are assumed to be negligible.

(a)



(b)



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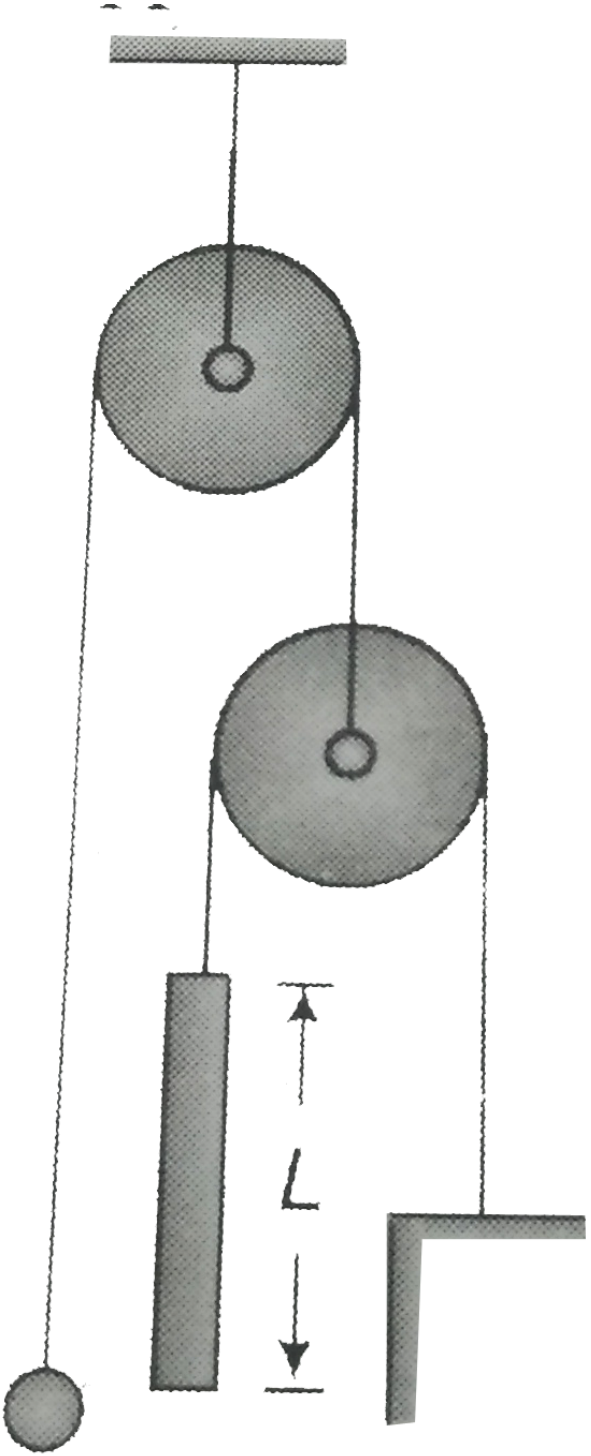

51.

if a mass of ball is m/2 and that of a rod is m the length of the rod is 20 cm the ball is set on the same level as the lower end of the rod and then released. If pulleys and strings are light, friction negligible how soon will the ball be opposite top the upper end of the rod?

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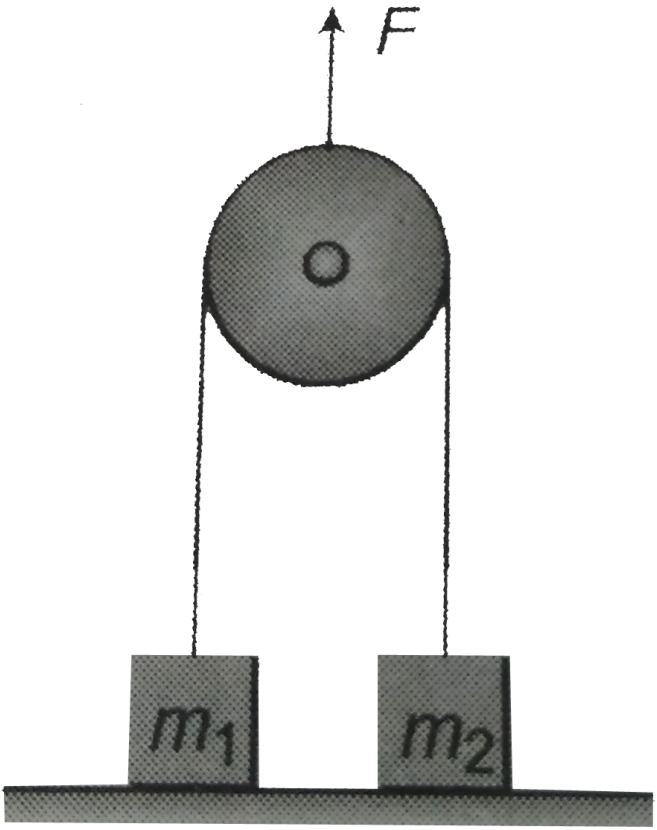

52. ltbr.

Consider the situation as shown in the figure. Initially blocks are at rest o the floor. A constant upward force F is applied on the pulley Assuing the pulley smooth and light

and the string massless, find the acceleration of each blocks and pullay if F is (a) 10N,

(b). 60 N

(c) 120 N

Given $m_1 = 2kg, m_2 = 4kg$

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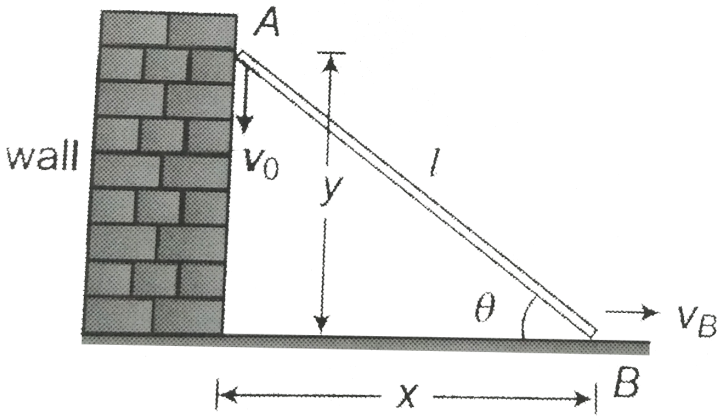

53.

Consider a rod of length l resting on a wall and the floor. If the velocity of the upper end of a rod A is v_0 in downward direction, find the velocity of the lower end B at this iinstant, when the rod makes an angle θ with horizontal

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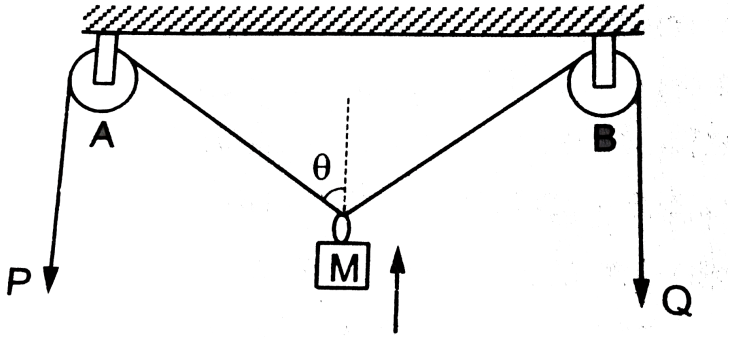
54. In the arrangement shown in figure the ends P and Q of an inextensible string move downwards with uniform speed u. Pulleys A and B are fixed. The mass M moves upwards with a speed



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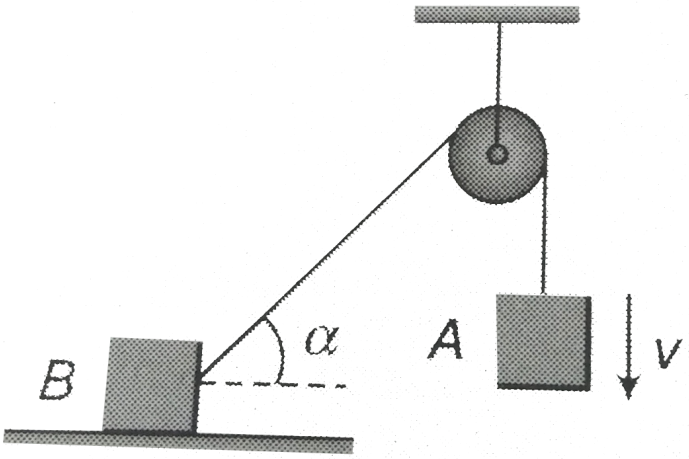

55.

Two blocks are connected by an inextensible string as shown. The pulley is fixed. If block A moves down with speed v, find the velocit of block B at instant.

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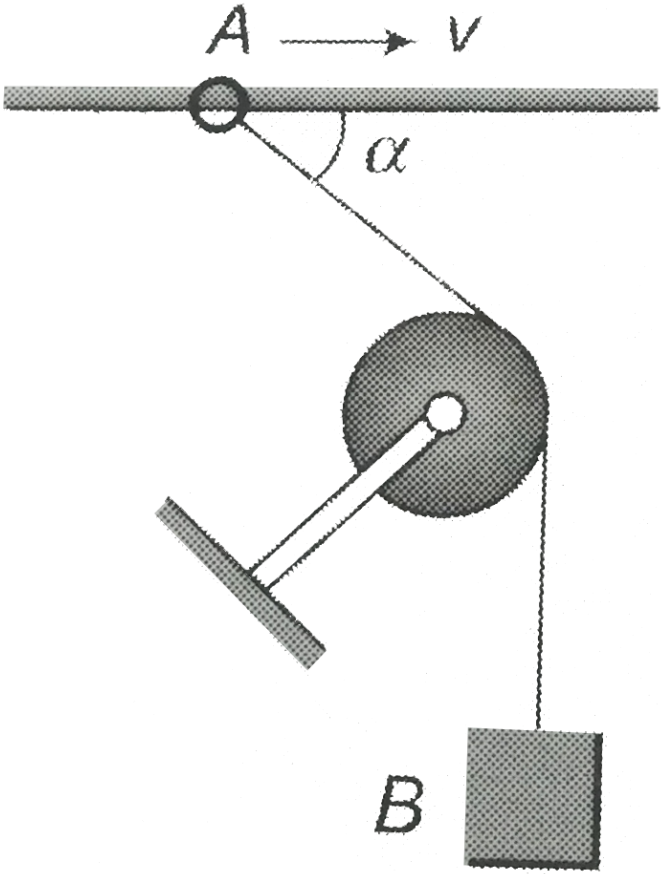

56.

The smooth ring A can slide on a fixed horizontal rod as shown the pulley is fixed. If some instant velocity of ring is v, find the velocity of block at that instant.

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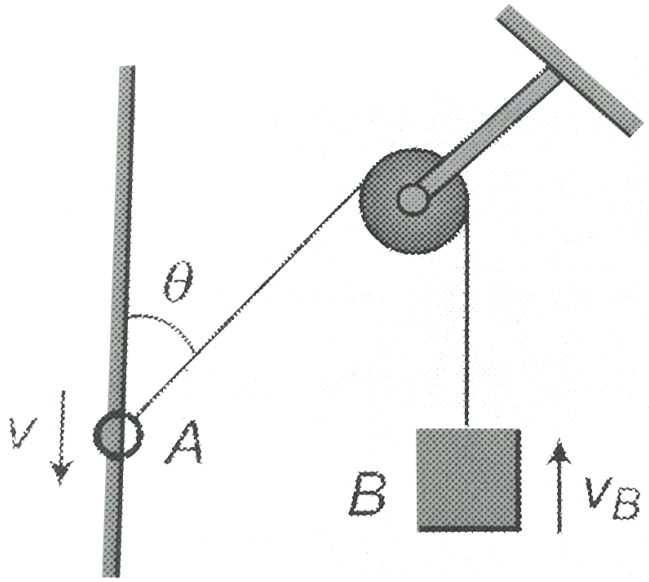

57. ltbgt

Find the velocity of block B when ring A is moving downward with velocity v.

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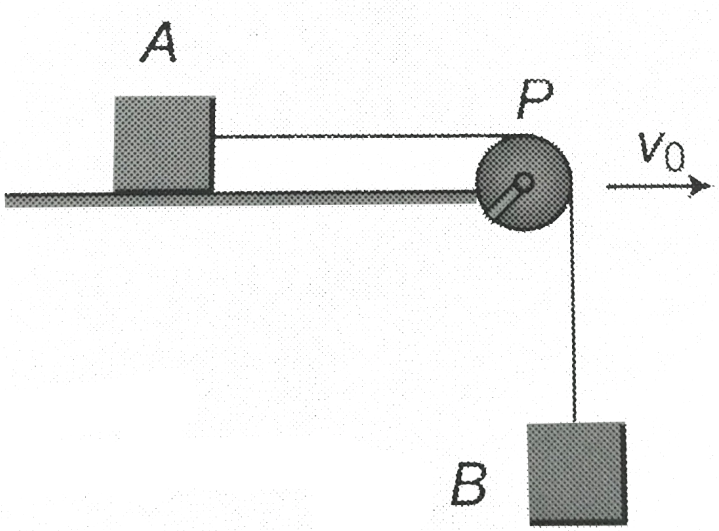

58.

In the figure, the pulley P moves to the right with a constant speed v_0. If the velocity of B is v in downward direction, find the velocity of A.

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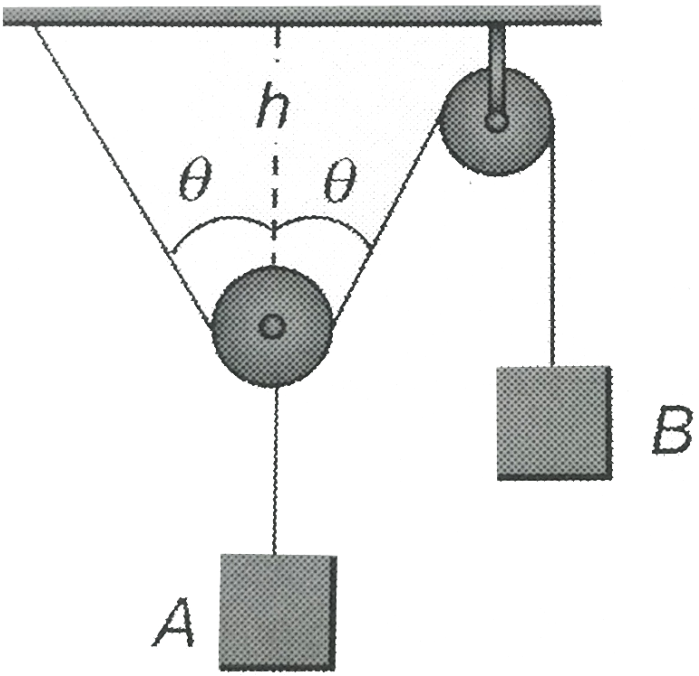

59.

Find the ratio of velcities of block A and B at the instant as shown

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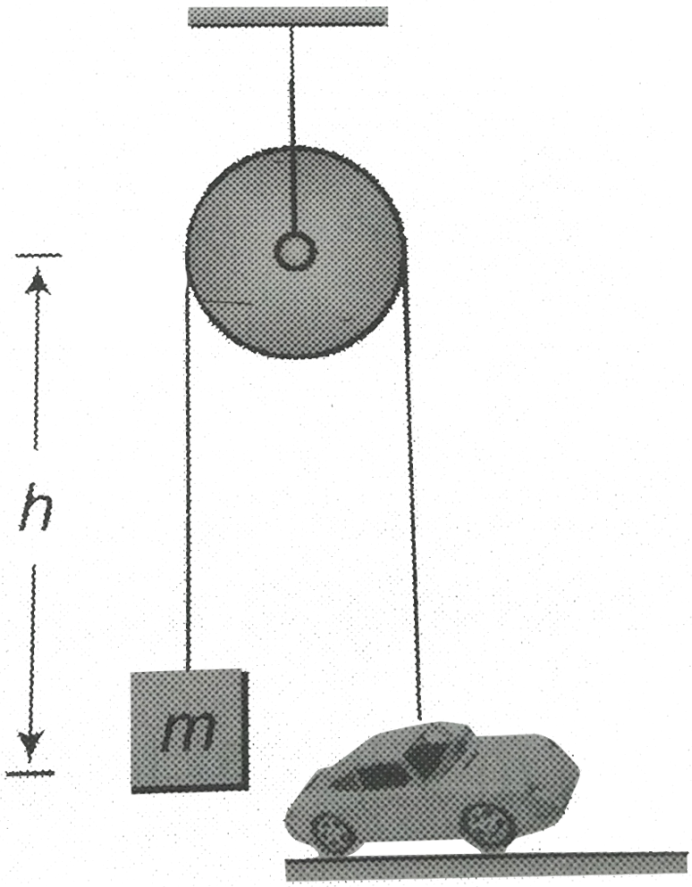

60.

Consider the situation as shown. If a vehicle moves towards right with constant velocity v_0, find the velocity and acceleration of the block

in terms of h and x, where x is the distance traveled by the vehicle towards right.

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61. A spring of force constant k and natural length 6l is broken in three parts of length ratio 1:2:3 find the spring constant of each part.

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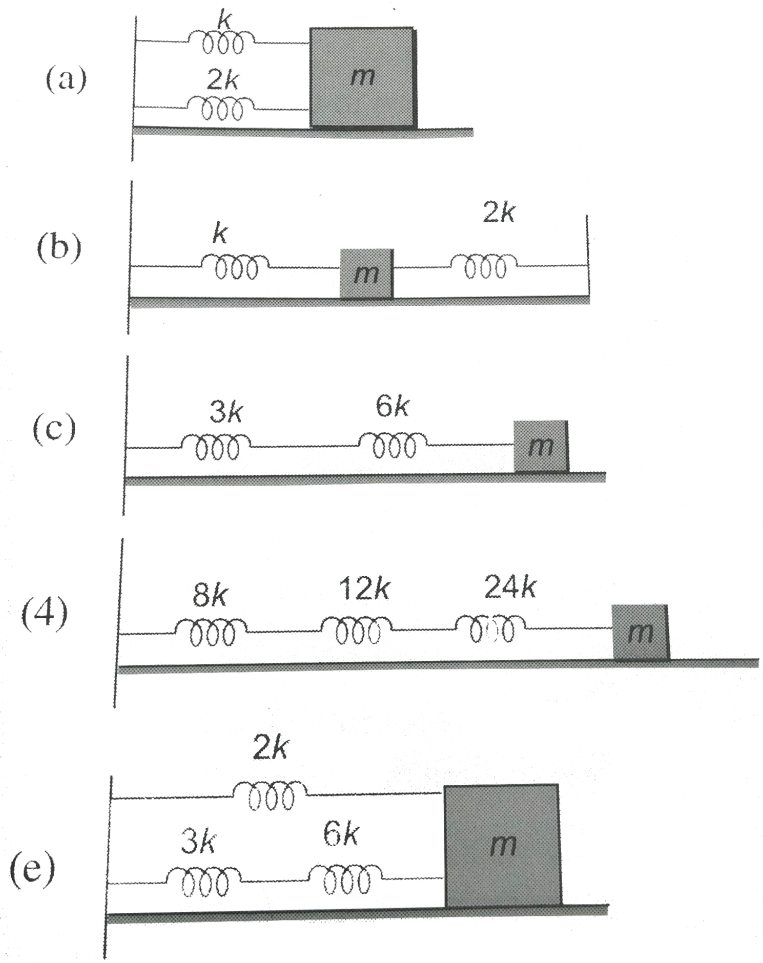

62.

Find the equivalent spring constant in the following cases:

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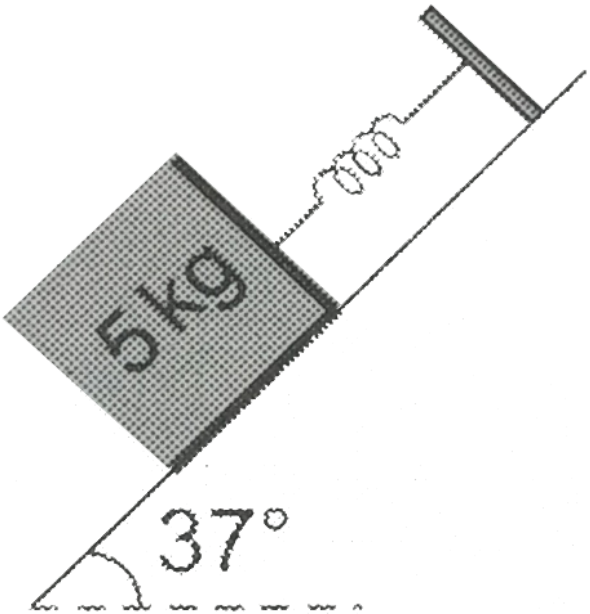

63.

A 5-kg block rests on a smooth inclined plane of inclination 37° as shown in the diagram if the extension of spring is 6cm, find (a) the spring constant (b). If the block is pulled dow the incline 4 cm from its equilibrium position

and released, find the initial acceleration of the block.

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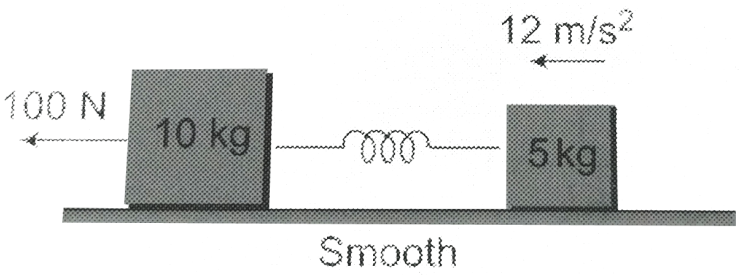
64.



Two blocks of masses 5 kg and 10 kg are connected by a massless spring as shown in the diagram. A force of 100 N acts on 10kg mass as shown. At a certain instant the acceleration of 5 kg mass is 12 m/s^2 find the

force in the spring and acceleration of 10 kg mass.

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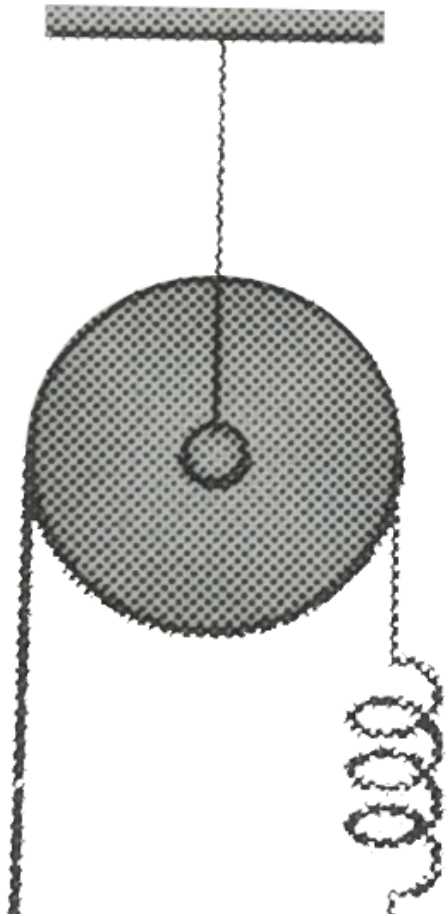

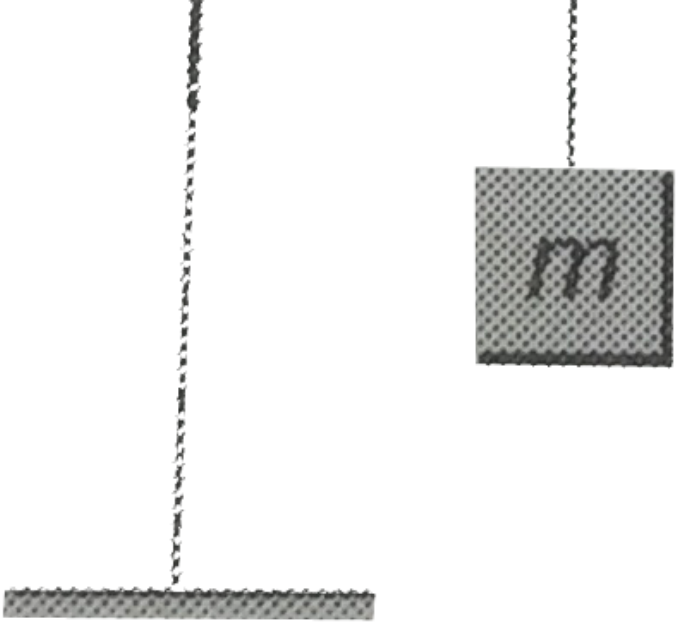

65.

Consider the situation as shown. Initially the spring is unstretched when the block of mass m is released from rest assuming the pulley frictionless and light the spring and string massless. Find the extension of sprinig when the block is in equilibrium also find the maximum extension of the spring.

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Exercises

1. Action and reaction

(i) act on two different objects

(ii) have equal magnitude

(iii) have opposite directions

(iv) have resultant zero

A. (i), (ii)

B. (ii),(iii)

C. (iii), (iv)

D. All options are correct

Answer: D

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2. A body of 5kg is moving with a velocity of 20m/s. If a force of 100N is applied on it for 10 s in the same direction as its velocity, what will now be the velocity of the body?

A. 2000m/s

B. 220m/s

C. 240m/s

D. 260m/s

Answer: B

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3. A car moving with a velocity of 10m/s can be stopped by the application of a constant force

F In a distance of 20m. If the velocity of the car is 30m/s. It can be stopped by this force in

A. $\frac{20}{3}m$

B. 20 m

C. 60 m

D. 180 m

Answer: D

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4. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force. (Consider $g = 10m/s^2$).

A. 16 N

B. 20 N

C. 22 N

D. 4 N

Answer: B

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5. A force vector applied on a mass is represented as $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ and acceleration with m/s^2. What will be the mass of the body in kg.

A. $10\sqrt{2}$

B. 20

C. $2\sqrt{10}$

D. 10

Answer: A

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6. 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. zero

B. 2 N

C. 4 N

D. 8 N

Answer: C

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7. A body of mass 1 kg is moving towards east with a uniform speed of 2m/s. A force of 2N is applied to it towards north. The magnitude of

the displacement of the body 2s after the force is applied is

A. 4 m

B. $4\sqrt{2}$m

C. 8 m

D. $8\sqrt{2}m$

Answer: B

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8. A force F_1 acts on a particle so as to accelerate it from rest to a velocity v. The force F_1 is then replaced by F_2 which decelerates it to rest

A. F_1 most be equal to F_2

B. F_1 may be equal to F_2

C. F_1 must be unequal to F_2

D. None of these

Answer: B

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9. which of the following is correct order fo forces?

A. Weak $<$ gravitational forces $<$ strong forces (nuclear) $<$ electrostatic

B. Gravitational $<$ weak $<$ (electrostatic) $<$ strong force

C. Gravitational $<$ electrostatic $<$ weak $<$ strong force

D. Weak $<$ gravitational $<$ electrostatic $<$ strong forces

Answer: D

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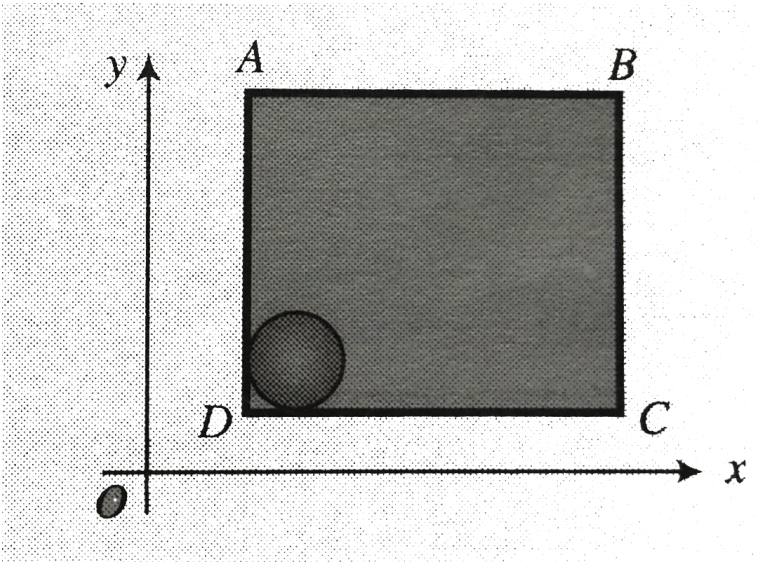
10. A solid sphere of mass 2 kg is resting inside a cube as shown in fig. The cube is moving with a velocity $\overrightarrow{v} = \left(5t\hat{i} + 2t\hat{j}\right)ms^{-1}$. Here t is time in seconds. All surface are smooth. The sphere is at rest with respect to the cube.

What is the total force exerted by the sphere on the cube?



A. $\sqrt{29}N$

B. $\sqrt{516}N$

C. $26N$

D. $\sqrt{89}N$

Answer: B

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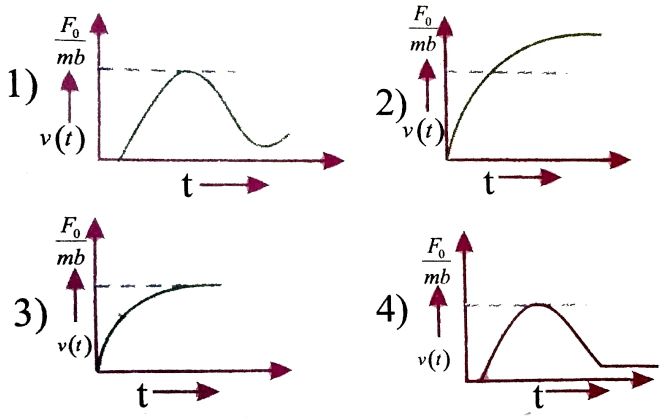
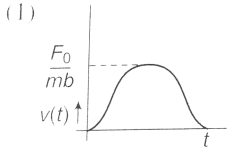
11. A particle of mass m is at rest at the origin at time $t = 0$ It is subjected to a force $F(t) = F_0 e^{-bt}$ in the X-direction. Its speed $V(t)$ is depicted by which of the following

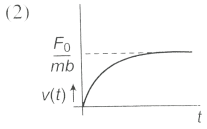
curves


1)
$\frac{F_0}{mb}$
$v(t)$
t
2)
$\frac{F_0}{mb}$
$v(t)$
t
3)
$\frac{F_0}{mb}$
$v(t)$
t
4)
$\frac{F_0}{mb}$
$v(t)$
t

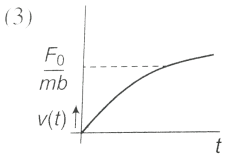
A.

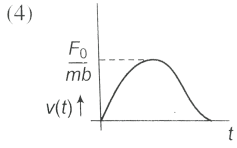

(1)
$\frac{F_0}{mb}$
$v(t)$
t

B.


(2)
$\frac{F_0}{mb}$
$v(t)$
t

C.


(3)
$\frac{F_0}{mb}$
$v(t)$
t

D. 

Answer: B

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12. Two bodies of mass 3kg and 4kg are suspended at the ends of massless string passing over a frictionless pulley. The acceleration of the system is $(g = 9.8m/s^2)$

A. $4.9m/s^2$

B. $2.45m / s^2$

C. $1.4m / s^2$

D. $9.5m / s^2$

Answer: C

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13. Two masses m_1 and m_2 are connected by a light string passing over a smooth pulley. When set free m_1 moves downward by 2 m in 2 s. The ratio m_1 / m_2 is

A. $9/7$

B. $11/9$

C. 13/11

D. 15/13

Answer: B

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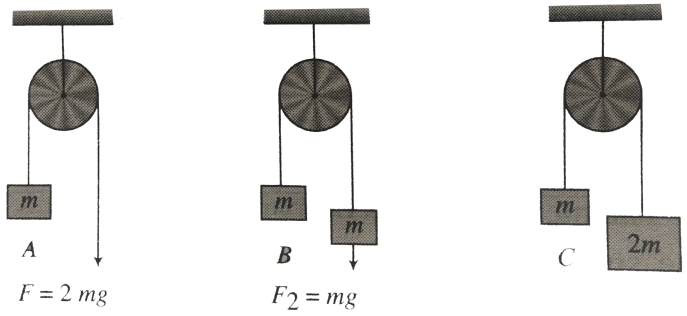
14. In fig the blocks A,B,and C of mass m each have acceleration $a_1, a_2,$ and a_3, repectively. F_1 and F_2 are external force of magnitude

$2mg$ and mg, respectively. Then



A. $a_1 = a_2 = a_3$

B. $a_1 > a_3 > a_2$

C. $a_1 = a_2, a_2 > a_3$

D. $a_1 > a_2, a_2 = a_3$

Answer: B

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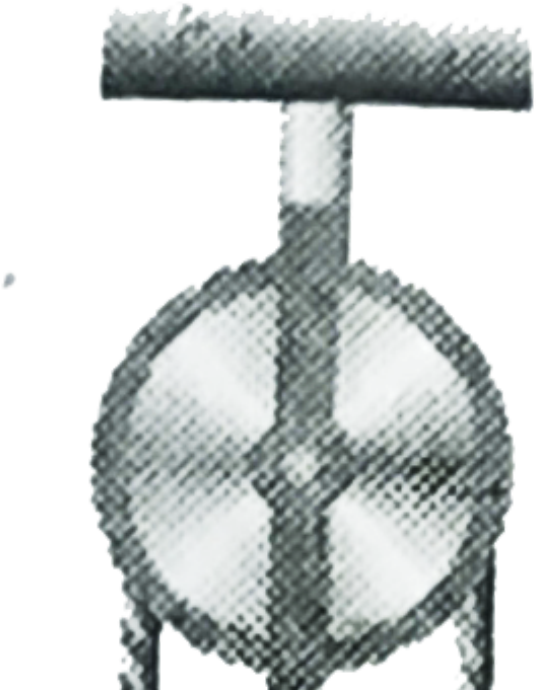
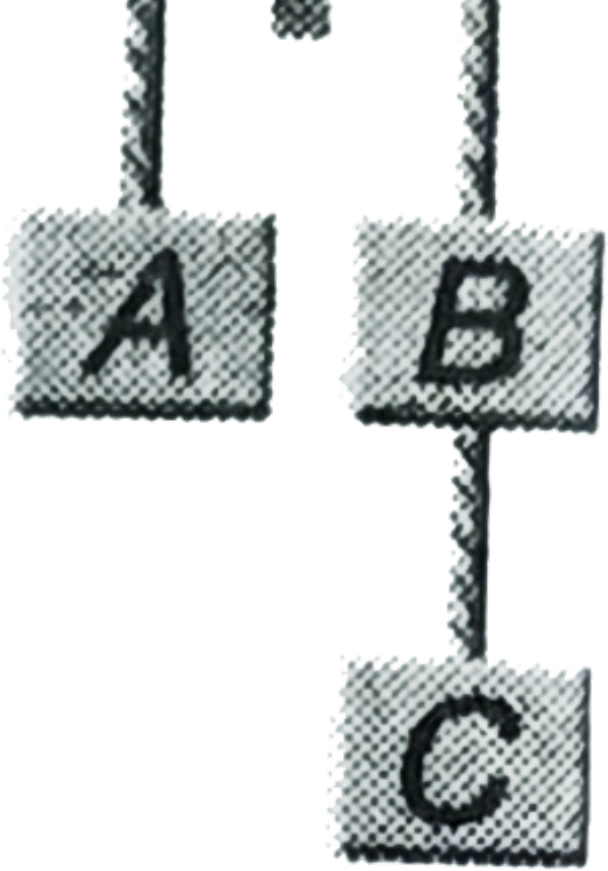
15. Three equal weight A, B and C of mass $2kg$ each are hanging on a string passing over a fixed frictionless pulley as shown in the figure. The tension in the string connecting weights B and C is approximately





A. zero

B. 3,3 N

C. 13,3 N

D. 19,6 N

Answer: C

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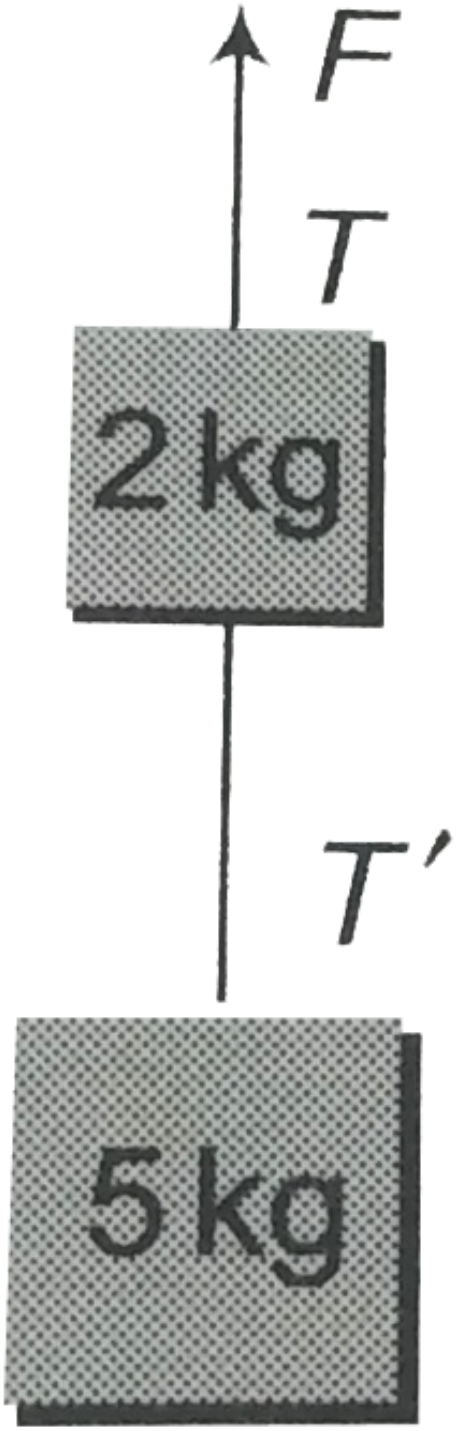
16. Two blocks are connected by a string as shown in the diagram. The upper block is hung by another string. A force F applied on the upper string produces an acceleration of $2m/s^2$ in the upward direction in both the blocks . If T and T' be the tensions in the two

parts of the string, then


F
T
2kg
T′
5kg

A. zero

B. 3,3 N

C. 13,3 N

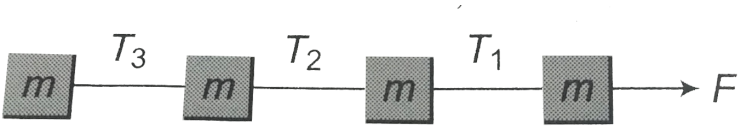
D. 19,6 N

Answer: C

Watch Video Solution

17. Four identical blocks each of mass m are linked by threads as shown. If the system moves with constant acceleration under the

influence of force F, the tension T_2 is



A. F

B. F/2

C. 2F

D. F/4

Answer: B

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18. A block of mass m_1 rests on a horizontal table. A string tied to the block is passed on a frictionless pulley fixed at the end of the table and to the other end of string is hung another block of mass m_2. The acceleration of the system is

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

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

C. g

D. $\frac{m_2 g}{m_1}$

Answer: A

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19. A uniform chain of mass 2 kg hangs from a light pulley with unequal lenghts of the chain hanging from the two sides of the pulley. The force exerted by the moving chain on the pulley is

A. 20 N

B. $> 20N$

C. $< 20N$

D. None

Answer: C

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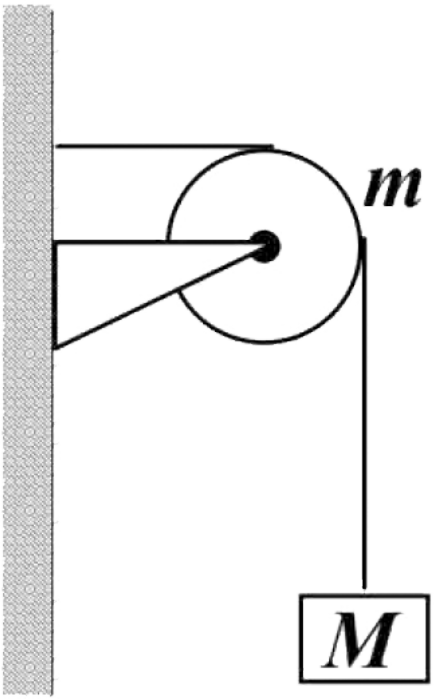
20. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on

the pulley by the clamp is given by



A. $\sqrt{2}Mg$

B. $\sqrt{2}mg$

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

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

Answer: D

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21. A body sliding on a smooth inclined plane requires $4s$ to reach the bottom, starting from rest at the at the top. How much time does it

take to cover ont-foruth the distance startion from rest at the top?

A. 1 s

B. 2 s

C. 4 s

D. 16 s

Answer: B

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22. A particle starts sliding down a frictionless inclined plane. If S_n is the distance travelled by it from time $t = n - 1\,\text{sec}$, to $t = n\,\text{sec}$, the ratio $\frac{S_n}{s_{n+1}}$ is

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

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

C. $\frac{2n-1}{2n+1}$

D. $\frac{2n+1}{2n-1}$

Answer: C

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23. A block of mass 10kg is pushed up on a smooth incline plane of inclination 30°, so that it has acceleration $2m/s^2$. The applied force is

A. 50 N

B. 60 N

C. 70 N

D. 80 N

Answer: C

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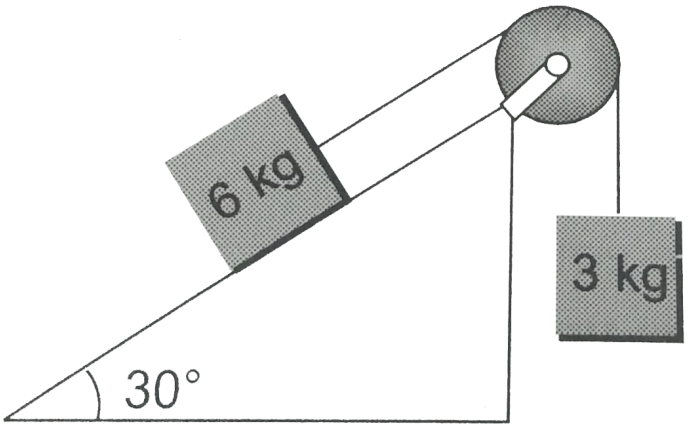
24. Two blocks of masses 3 kg and 6 kg are connected by a string as shown in the figure over a frictionless pulley. The acceleration of the system is



A. $4m / s^2$

B. $2m / s^2$

C. zero

D. $6m / s^2$

Answer: C

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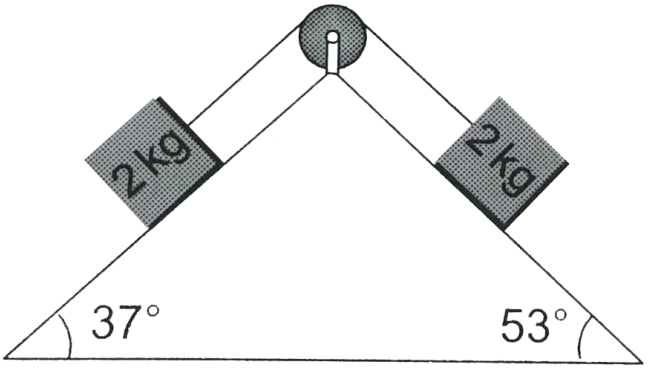
25. The acceleration of system over the wedge as shown in the figure is



A. $1m/s^2$

B. $2m/s^2$

C. $3m/s^2$

D. $4m/s^2$

Answer: A

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26. A rope of length 5 m is kept on frictionless surface and a force of 5 N is applied to one of its end. Find the tension in the rope at 1 m from this end

A. 1 N

B. 3 N

C. 4 N

D. 5 N

Answer: C

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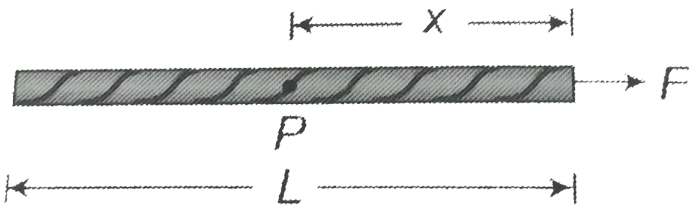
27. A uniform rope of length of length L is pulled by a force F on a smooth surface. Find tension in the rope at a distance x from the end where force is applied.



A. P

B. $P\left(1-\frac{x}{L}\right)$

C. $\left(\frac{Px}{L}\right)$

D. $P\left(1+\frac{x}{L}\right)$

Answer: B

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28. 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. $\frac{P}{M-m}$

B. $\frac{PM}{M-m}$

C. $\frac{Pm}{M-m}$

D. $\frac{PM}{M+m}$

Answer: D

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29. In the previous problem if M=2m, the tension in the middle of the rope is

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

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

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

D. $\frac{7F}{6}$

Answer: C

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30. Consider the situation as shown in the figure. The system is free to move.

The force by the rope on the block is

$FM/(M+m)$

A. Only if the rope is uniform

B. in gravity free space

C. only if $F > (M + m)g$

D. in all cases

Answer: D

Watch Video Solution

31. A monkey of mass $20kg$ is holding a vertical rope. The rope will not break when a mass of $25kg$ is suspended from it but will break it the mass exeeds $25kg$. What is the maximum

acceleration with which the monkey can climb up along the rope? $\left(g = 10m/s^2\right)$.

A. $10m/s^2$

B. $25m/s^2$

C. $2.5m/s^2$

D. $5m/s^2$

Answer: C

Watch Video Solution

32. A man slides down a light rope whose breaking strength is η times his weight ($\eta < 1$) . What should be his minimum acceleration so that the rope just breaks?

A. ηg

B. $g(1-\eta)$

C. $\frac{g}{1+\eta}$

D. $\frac{g}{2+\eta}$

Answer: B

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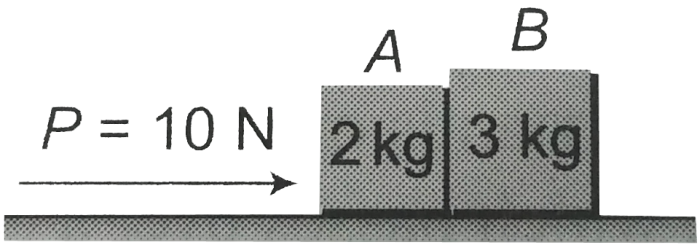
33. Blocks A and B have masses of 2 kg and 3 kg. respectively. The ground is smooth. P is an external force of 10 N. The force exerted by B on A is



A. 4 N

B. 6 N

C. 8 N

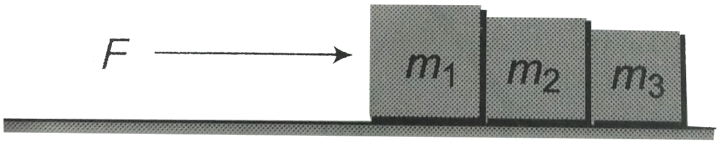
D. 10 N

Answer: B

Watch Video Solution

34. Three block of masses m_1, m_2 and m_3 kg are placed in contact with each other on a frictionless table. A force F is applied on the heaviest mass m_1, the acceleration of m_2 will

be



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

B. $\frac{F}{(m_1+m_2)}$

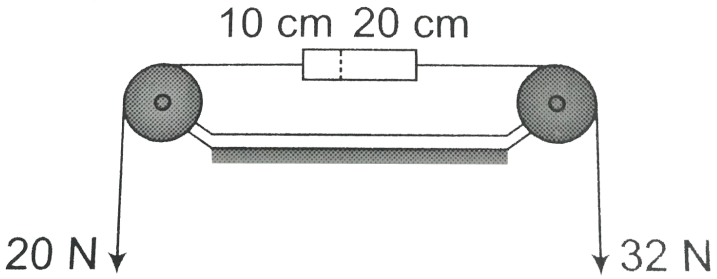
C. $\frac{F}{(m_1-m_2)}$

D. $\frac{F}{(m_1+m_2+m_3)}$

Answer: D

Watch Video Solution

35. All the surface are smooth and the strings ans pulleys are light. The force exerted by the 20 cm part of the rod on the 10 cm part is



A. 6 N

B. 12 N

C. 24 N

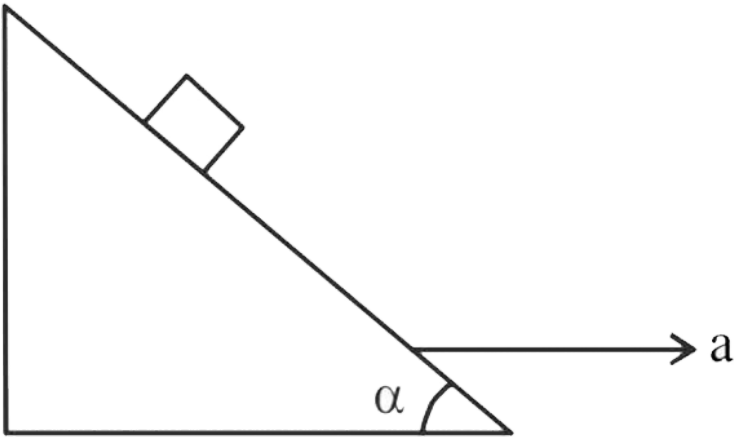
D. 36 N

Answer: C

 Watch Video Solution

36. A block is kept on a frictionless inclined surface with angle of inclination α. The incline is given an acceleration 'a' to keep the block

stationary. Then a is equal to



A. g

B. $g \tan \alpha$

C. $(g) / (\tan \alpha)$

D. $g \cos ec\alpha$

Answer: B

Watch Video Solution

37. A body kept on a smooth inclined plane having inclination 1 in x will remain stationary relative to the inclined plane if the plane is given a horizontal accelertion equal to

A. $\frac{g}{\sqrt{(x^2-1)}}$

B. $\frac{gx}{\sqrt{(x^2-1)}}$

C. $\frac{g\sqrt{(x^2-1)}}{x}$

D. $\sqrt{(x^2-1)g}$

Answer: A

Watch Video Solution

38. A block of mass m is placed on a smooth wedge of incination θ. The whole system s acelerated horizontally so tht the block does

not slip on the wedge. The force exerted by the wedge on the block has a magnitude

A. mg

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

C. $mg\cos\theta$

D. $mg\sin\theta$

Answer: B

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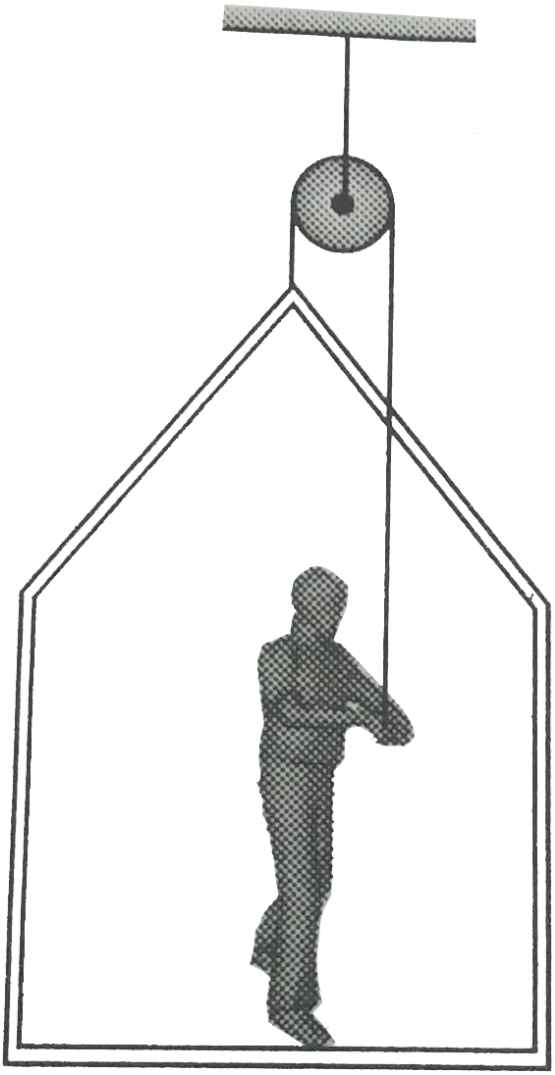
39. A man of mass m stands on a frame of mass M. He pulls on a light rope, which passes over a pulley. The other end of the rope is attached to the frame. For the system to be in equilibrium, what force must the man exert on

the rope?



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

B. $(M+m)g$

C. $(M-m)g$

D. $(M+2m)g$

Answer: A

Watch Video Solution

40. A painter is raising himself and the crate on which he stands with an acceleration of $5m/s^2$ by a massless rope and pulley arrangement. Mass of the painter is 100 kg

and that of the crate is 50 kg. If $g = 10m/s^2$, then the

(i) tension in the rope is 2250 N

(ii) tension in the rope is 1125 N

(iii) force of contact between the painter and the flow 750 N

(iv) force of contact between the painter the paniter and the floor 375 N.

A. (i), (iii)

B. (ii), (iv)

C. (i),(iv)

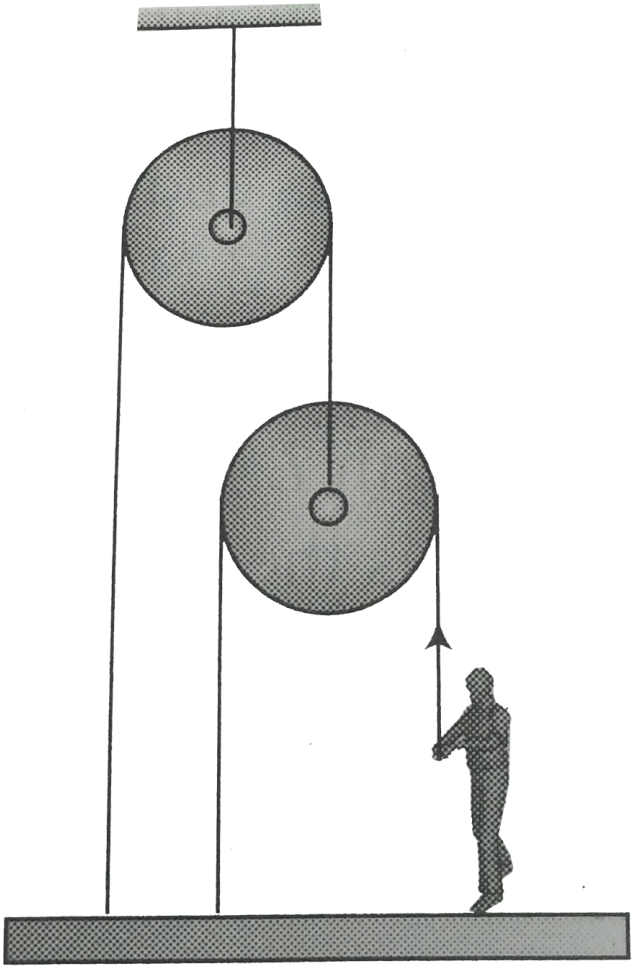
D. (ii), (iii)

Answer: B

Watch Video Solution

41. In the given diagram, with what force must the man pull the rope to hold the plank in position? Weight of the man is 60 kg. Neglect

the weight of plank, rope and pulley.



A. 150 N

B. 300 N

C. 600 N

D. 120 N

Answer: A

Watch Video Solution

42. The mass of a lift is $2000kg$. When the tensioon in the supporting cable is $28000N$, then its acceleration is.

A. $30ms^{-2}$ downwards

B. $4ms^{-2}$ upwards

C. $4ms^{-2}$ downwards

D. $14ms^{-2}$ upwards

Answer: B

 Watch Video Solution

43. In an elevator moving vertically up with an acceleration g, the force exerted on the floor by a passanger of mass M is

A. Mg

B. $\frac{1}{2}Mg$

C. zero

D. 2 Mg

Answer: D

Watch Video Solution

44. A man weighs $80kg$. He stands on a weighing scale in a lift which is moving upwords with a uniform acceleration of

$5m/s^2$. What would be the reading on the scale?

A. 400 N

B. 800 N

C. 1200 N

D. zero

Answer: C

Watch Video Solution

45. A person is standing in an elevator. In which situation he finds his weight less ?

A. The elevator moves upward with constant accleeration

B. The elevator moves downward with constant acceleration.

C. The elevator moves upward with uniform velocity

D. The elevator moves downward with uniform velocity

Answer: B

 Watch Video Solution

46. The force exerted by the floor of an elevator on the foot of a person standing there is more than the weight of the person if the elevator is

A. (i), (ii)

B. (ii), (iii)

C. (iiI), (iv)

D. (i), (iv)

Answer: B

 Watch Video Solution

47. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the

man in the lift and a man standing stationary on the ground are respectively

A. g,g

B. g-a,g-a

C. g-a,g

D. a,g

Answer: C

Watch Video Solution

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

A. $t_1 = t_2$

B. $t_1 < t_2$

C. $t_1 > t_2$

D. $t_1 < t_2$ or $t_1 < t_2$ depending on whether the lift is going up or down

Answer: A

Watch Video Solution

49. An elevator car whose floor to ceiling distance is equal to $2.7m$ starts ascending with constant acceleration $1.2m/s^2$, 2 sec after the start a bolt begins falling from the ceiling of the car. Answer the following question $(g = 9.8m/s^2)$

The bolt's free fall time is

A. $\sqrt{0.54}s$

B. $\sqrt{6}s$

C. 0.7 s

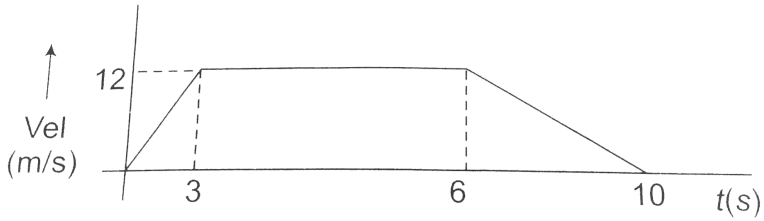
D. 1 s

Answer: C

Watch Video Solution

50. A lift is moving in upward direction. The totol mass of the lift an the passengers is 1600 kg. The variation of the velocity of the lift is as

shown in the figure. The tension in the rope at $t = 8^{th}$ second will be



A. 11200 N

B. 16000 N

C. 4800 N

D. 12000 N

Answer: A

Watch Video Solution

51. In the previous problem, the height to which the lift takes the passenger is

A. 50 m

B. 60 m

C. 70 m

D. 78 m

Answer: D

Watch Video Solution

52. An empty plastic box of mass m is found to accelerate up at the rate of g/6 when placed deep inside water. How much sand should be put inside the box so that it may accelerate down at the rate of g/6?

A. $\frac{2m}{3}$

B. $\frac{2m}{5}$

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

D. $\frac{3m}{5}$

Answer: B

Watch Video Solution

53. A balloon carring some sand is moving down with a constant acceleration a_0. How much mass of sand should be removed, so that the balloon move up with same acceleration?

A. $\left(\frac{2Ma}{g+a}\right)$

B. $\left(\frac{2Mg}{g+a}\right)$

C. $\left(\frac{Mg}{g+a}\right)$

D. $\left(\frac{Mg}{g+a}\right)$

Answer: A

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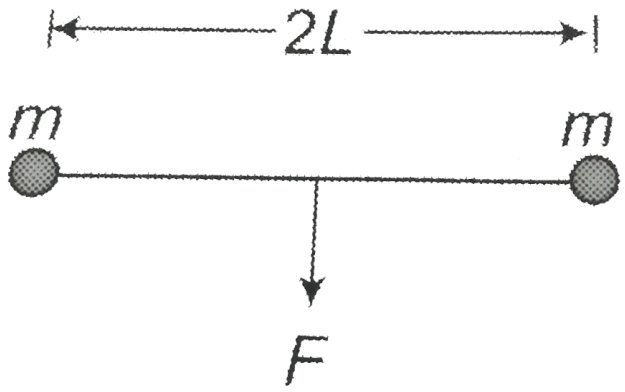
54. Two particles each of mass m are connected by a light string of length $2L$ as shown in the figure. A constant force F is applied continuoulsly at the mid $-$ point of the string at right $-$ angle to intial position of the string. Find the acceleration of each

particle and the acceleration of approach between the particles when separation between them is $2x$



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

Answer: B

Watch Video Solution

55. A force $\vec{F} = \vec{v} \times \vec{A}$ is exerted on a particle in addition to the force of gravity, where $\vec{v}$ is the veocity of the particle and $\vec{A}$ is a constant vector in the horizontal direction. With what minimum speed a particle of mass m be projected so that it continues to move undeflected with a constant velocity?

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

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

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

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

Answer: B

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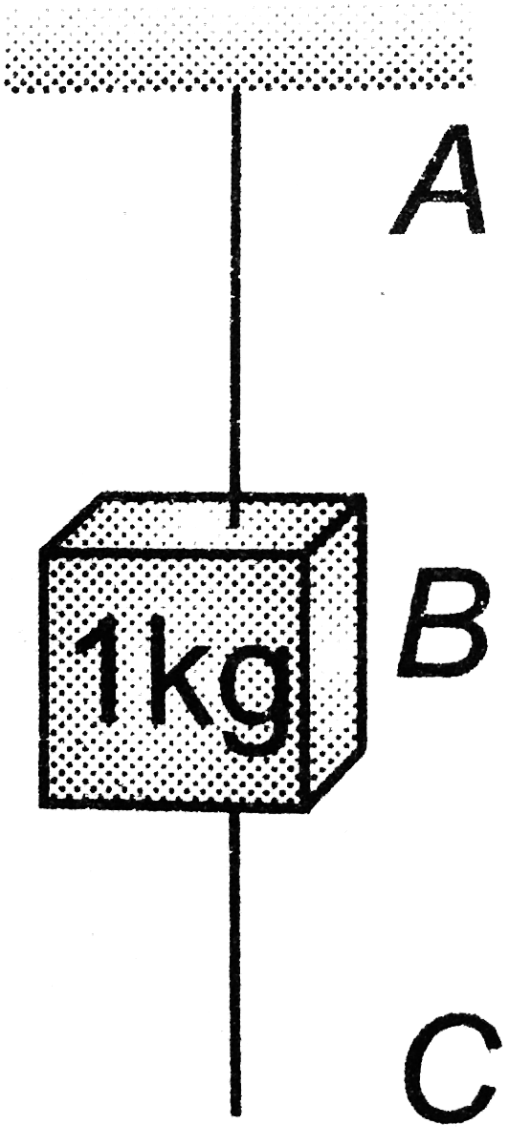
56. A mass of 1kg is suspended by a string A. Another string C is connected to its lower end (see figure). If a sunsudden jerk is given to C,

then



A. The portion AB of the string will break

B. The portion BC of the string will break

C. The mass will start rotating

D. None of the above

Answer: B

Watch Video Solution

57. In the previous problem, If the string C is stretched slowly, then

A. The portion AB of the string will break

B. The portion BC of the string will break

C. None of the strings will break

D. None of the above

Answer: A

Watch Video Solution

58. A stone is dropped from the top of a building in a high wind. The wind exerts a

steady horizontal force on the stone as it falls.

The path of the string is

A. a straight line

B. a parabola

C. a circle

D. another complicated path

Answer: A

Watch Video Solution

59. A smooth wedge A is fitted in a chamber hanging from a fixed ceiling near the earth's surface.A block B placed at the top of the wedge takes a time T to slide down the length of the wedge. If the block is placed at the top of the wedge and the cable supporting the chamber is broken at the same instant, the block will

A. take a time longer than T to slide down the wedge

B. take a time shorter than T to slide down the wedge

C. remain at the top of the wedge

D. jump off the wedge

Answer: C

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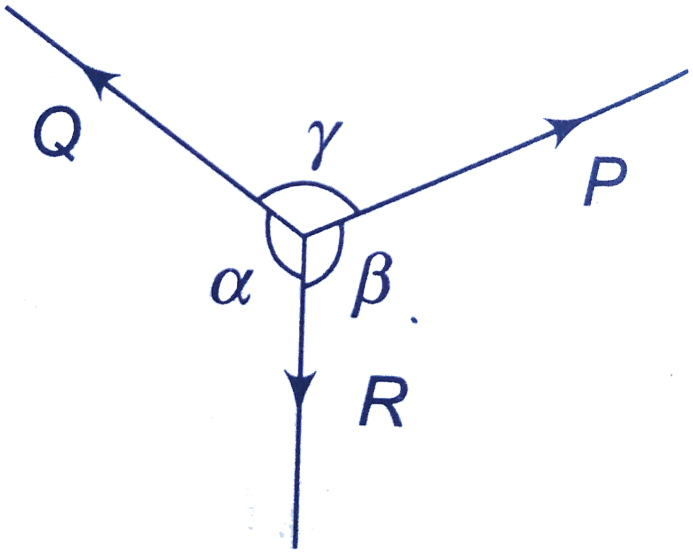
60. A body is in equilibrium under the action of three coplanar forces P, Q and R as

shown in figure. Select the correct statement.



A. $\frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$

B. $\frac{P}{\cos\alpha} = \frac{Q}{\cos\beta} = \frac{R}{\cos\gamma}$

C. $\frac{P}{\tan\alpha} = \frac{Q}{\tan\beta} = \frac{R}{\tan\gamma}$

D. $\frac{P}{\sin\beta} = \frac{Q}{\sin\gamma} = \frac{R}{\sin\alpha}$

Answer: A

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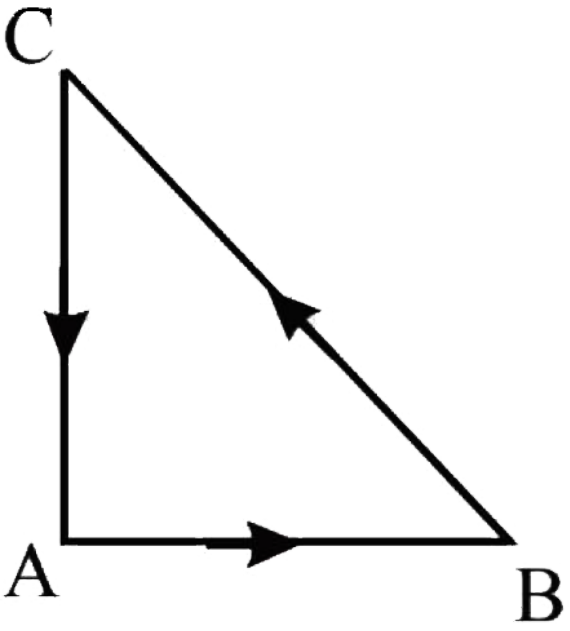
61. Three forces start acting simultaneously on a particle moving with velocity, $\bar{v}$. These forces are respresented in magnitude and direction by the three sides of a triangle ABC. The

particle will now move with velocity



A. $\overrightarrow{v}$ remaining unchanged

B. less than $\overrightarrow{v}$

C. greater than $\overrightarrow{v}$

D. $\overrightarrow{v}$ in the direction of the largest force

BC

Answer: A

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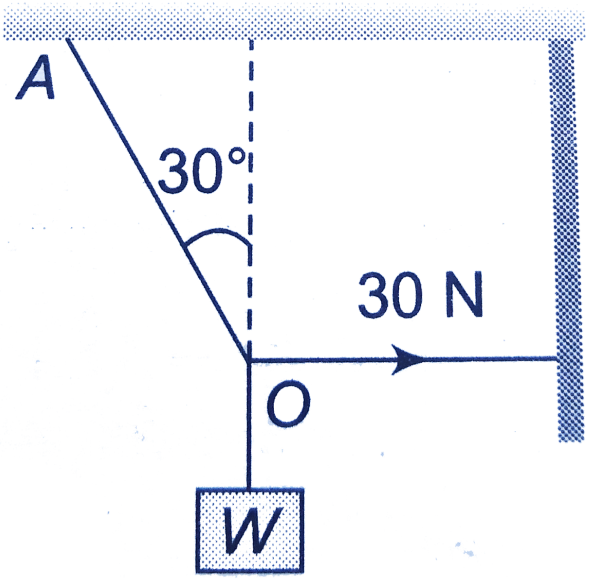
62. As shown in figure the tension in the horizontal cord is $30N$. The weight W and

tension in the string OA in Newton are



A. $30\sqrt{3}, 30$

B. $30\sqrt{3}, 60$

C. $60\sqrt{3}, 30$

D. None of these

Answer: B

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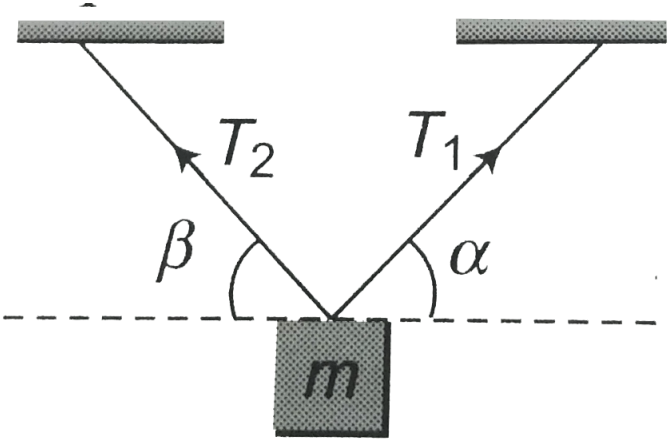
63. The block is in equilibrium



$(i) T_1 = \dfrac{mg\cos\beta}{\sin(\alpha+\beta)}$ $(ii) T_2 = \dfrac{mg\cos\alpha}{\sin(\alpha+\beta)}$

$(iii) \dfrac{T_1}{T_2} = \dfrac{\cos\beta}{\cos\alpha}$ $(iv) \dfrac{T_1}{T_2} = \dfrac{\cos\alpha}{\cos\beta}$

A. (i),(ii)

B. (i),(ii),(iii)

C. (ii),(iii)

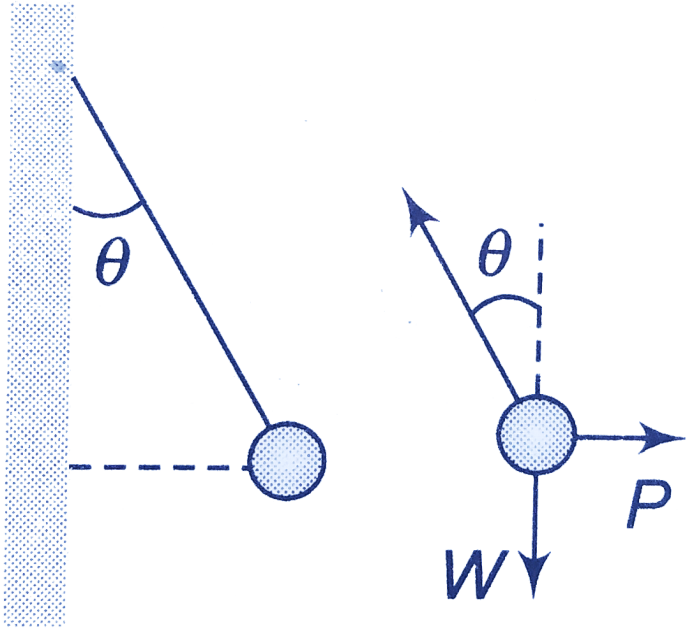
D. (iii),(iv)

Answer: B

Watch Video Solution

64. A metal sphere is hung by a string fixed to a wall. The sphere is pushed away from the wall by a stick. The forces acting on the sphere

are shown in the second diagram. Which of the following statements is wrong?



A. $P = W \tan\theta$

B. $\overrightarrow{T} + \overrightarrow{P} + \overrightarrow{W} = 0$

C. $T^2 = P^2 + W^2$

D. $T = P + W$

Answer: D

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

A. F_1 / m

B. $F_2 F_3 / m F_1$

C. $(F_2 - F_3) / m$

D. F_2 / m

Answer: A

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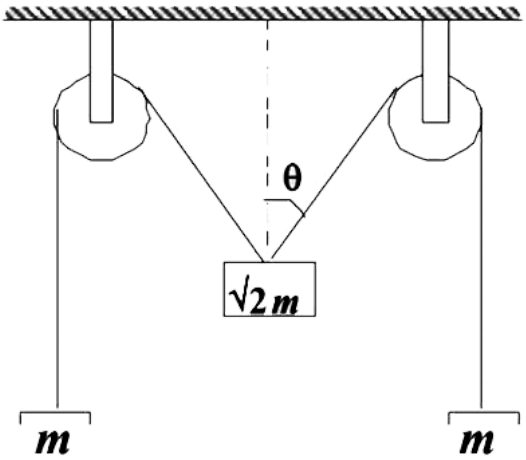
66. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ

should be



A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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67. A simple pendulum with a bob of mass m is suspended from the roof of a car moving with a horizontal accelertion a. The angle made by the string with verical is

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

B. $\tan^{-1}\left(1-\frac{a}{g}\right)$

C. $\cos^{-1}\left(\frac{a}{g}\right)$

D. $\sin^{-1}\left(\frac{a}{g}\right)$

Answer: A

 Watch Video Solution

68. If a body is in equilibrium under a set of non-collinear forces, then the minimum number of forces has to be

A. Four

B. Three

C. Two

D. Five

Answer: A

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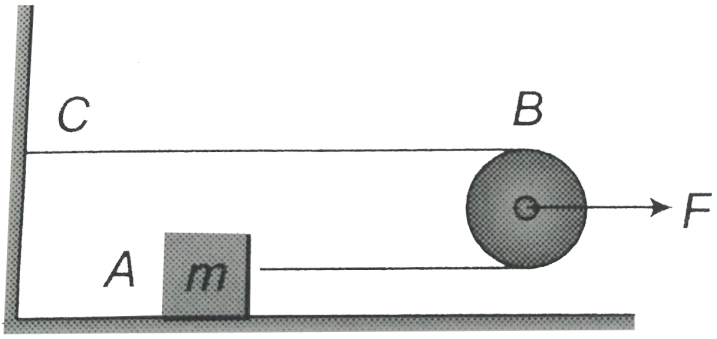
69. The acceleration of light pulley is



A. F/m

B. F/2m

C. F/4 m

D. F/8 m

Answer: C

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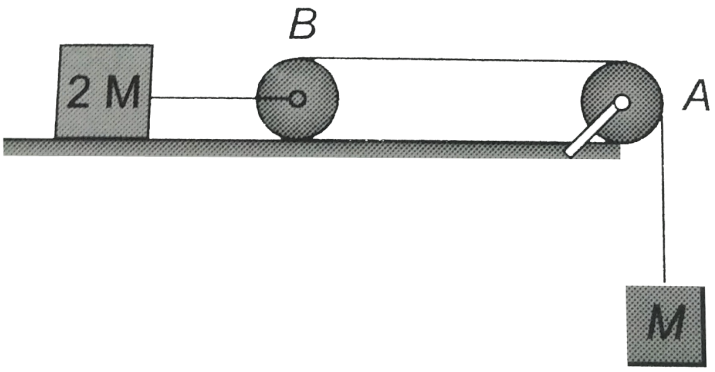
70. Consider the situation as shown in the firgure.



A. The accelaration of M is 2g/3.

B. The tension in the string connecting A and B is Mg/3

C. The reaction on pulley A is $\sqrt{2}$ Mg/3 at an angle 45° with the horizontal.

D. All the options are correct.

Answer: D

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71. The acceleration of the block A is

A. 2g/3 upward

B. g/3 upward

C. 2g/3 downward

D. g/3 downward

Answer: C

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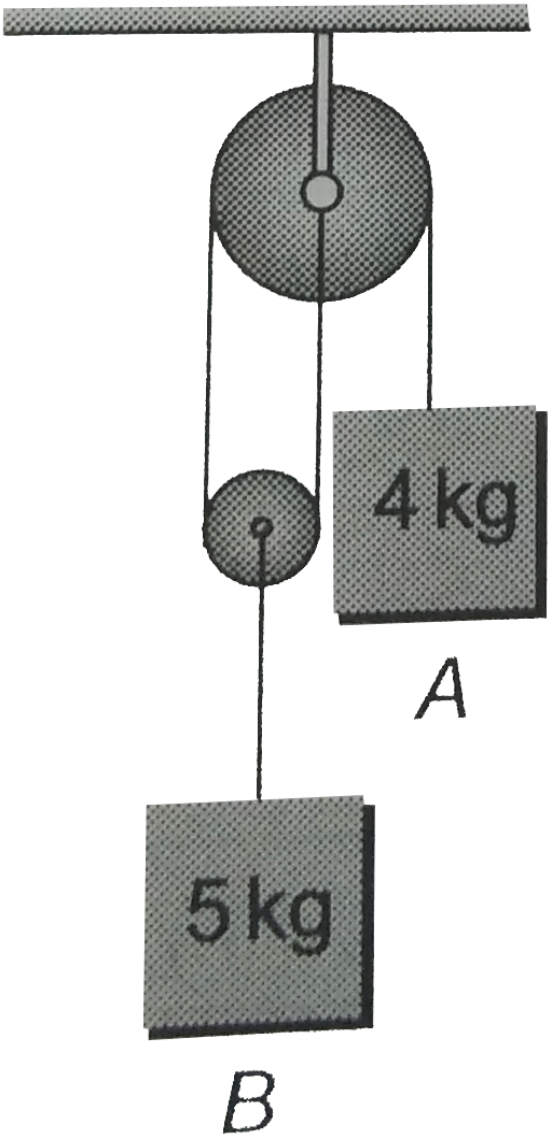
72. The acceleration of the block A and B are



A. g/7 downward, 2g/7 upward

B. 2g/7 downward, g/7 upward

C. 3g/7 downward, g/7upward

D. 4g/7 downward, 2g/7 upward

Answer: B

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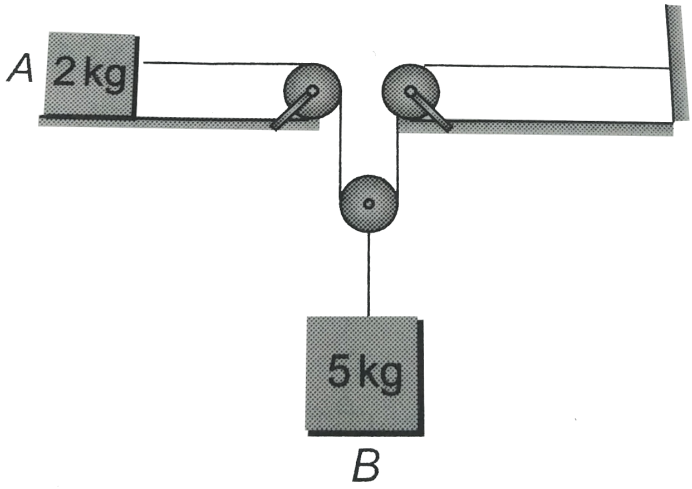
73. The acceleration of the block A and B are



A. 10g/13 forward, 5g/13 downward

B. 5g/13 downward, 10g/13 downward

C. 6g/13 forward, 9g/13 downward

D. 9g/13 forward, 6g/13 downward

Answer: A

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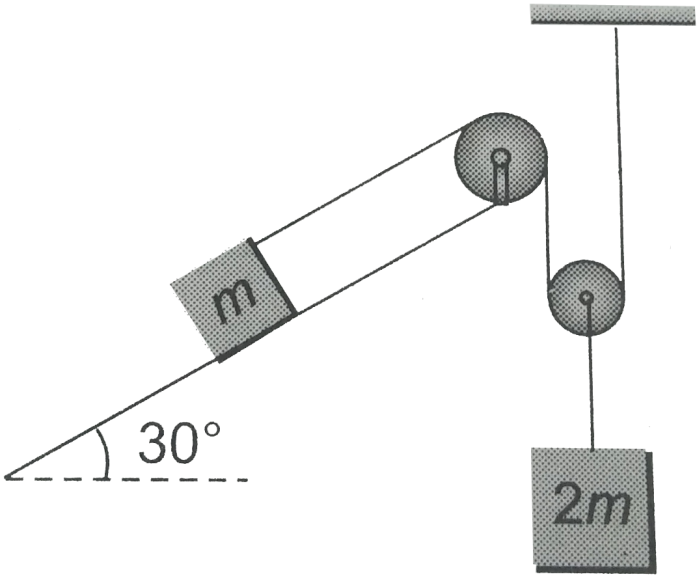
74. The acceleration of m is



A. g/3 up the plane

B. g/3 down the plane

C. 2g/3 up the plane

D. 2g/3 down the plane

Answer: A

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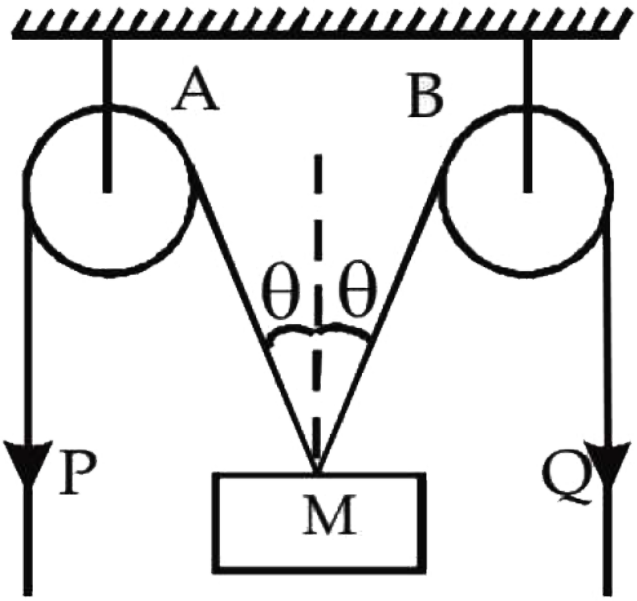
75. In the arrangement shown in the Fig, the ends P and Q of an unstretchable string move downwards with uniform speed U. Pulleys A and B are fixed.

Mass M moves upwards with a speed



A. $2u\cos\theta$

B. $u/\cos\theta$

C. $2u/\cos\theta$

D. $u \cos \theta$

Answer: B

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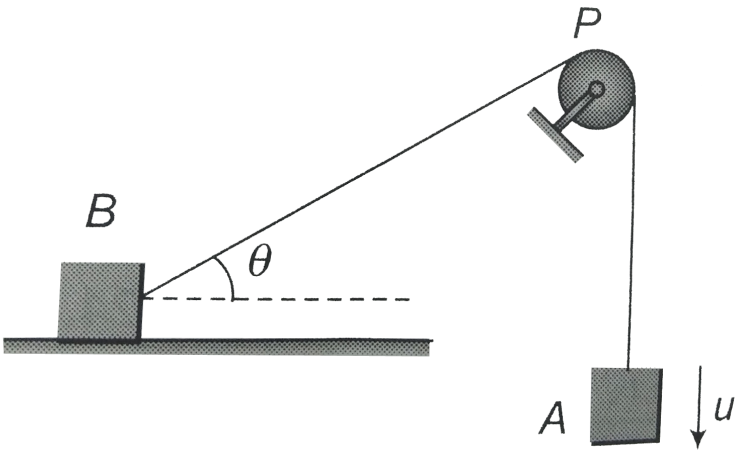
76. In the figure, the blocks are of equal mass. The pulley is fixed. In the position shown. A moves down with a speed u and $v_B =$ the speed of B.



(i) B will never lose contact with the ground.

(ii) The downward acceleration of A is equal in magnitude to the horizontal acceleration of B

(iii) $v_B = u\cos\theta$ (iv) $v_B = u/\cos\theta$

A. (i), (ii)

B. (ii), (iii)

C. (i),(iv)

D. (ii),(iv)

Answer: C

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77. A spring fo spring constant k is broken in the length ratio 1:3. The spring constant of larger part will be

A. 4k/3

B. 2k/3

C. k/3

D. 5k/3

Answer: A

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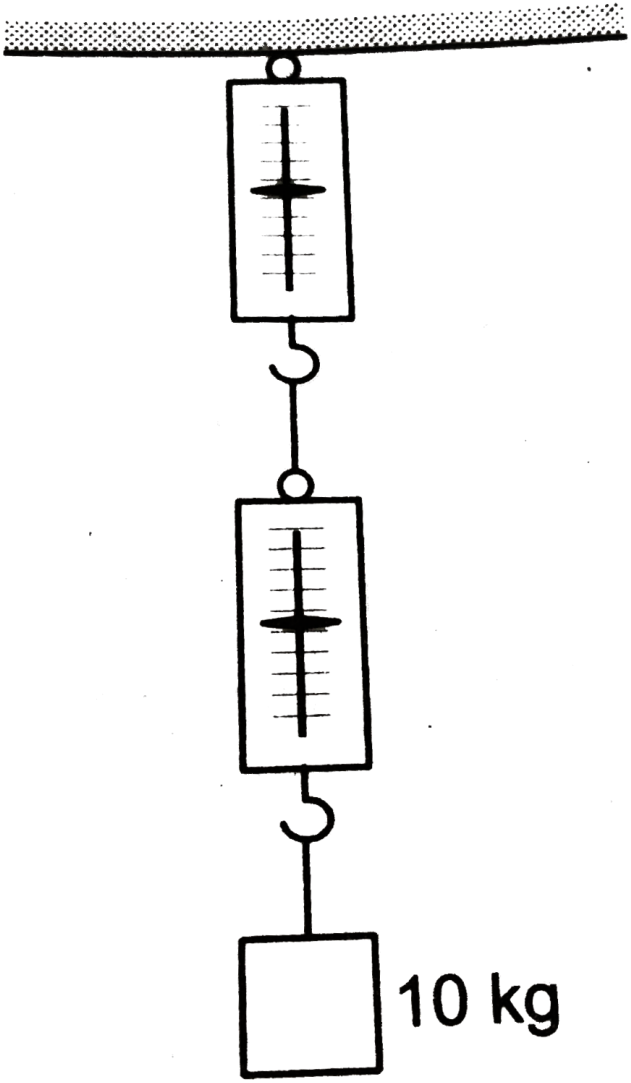
78. A block of mass 10 kg is suspended through two light spring balances as shown in figure



A. Both the scales will read 10 kg.

B. Both the scales will read 5kg

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

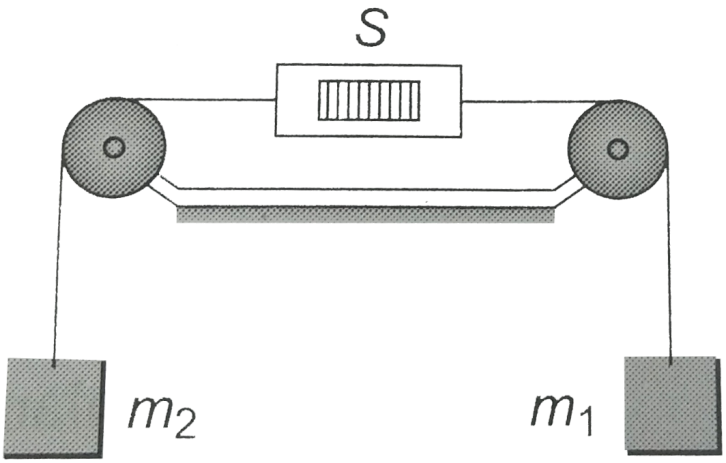
D. The readings may be anything but their sum will be 10 kg.

Answer: A

Watch Video Solution

79. In the arrangement shown, the pulleys are fixed and ideal, the strings are light, $m_1 > m_2$ and S is a spring balance which is itself

massless. The readings of S (in units of mass) is



A. $m_1 - m_2$

B. $\frac{1}{2}(m_1 + m_2)$

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

D. $\frac{2m_1 m_2}{m_1 + m_2}$

Answer: D

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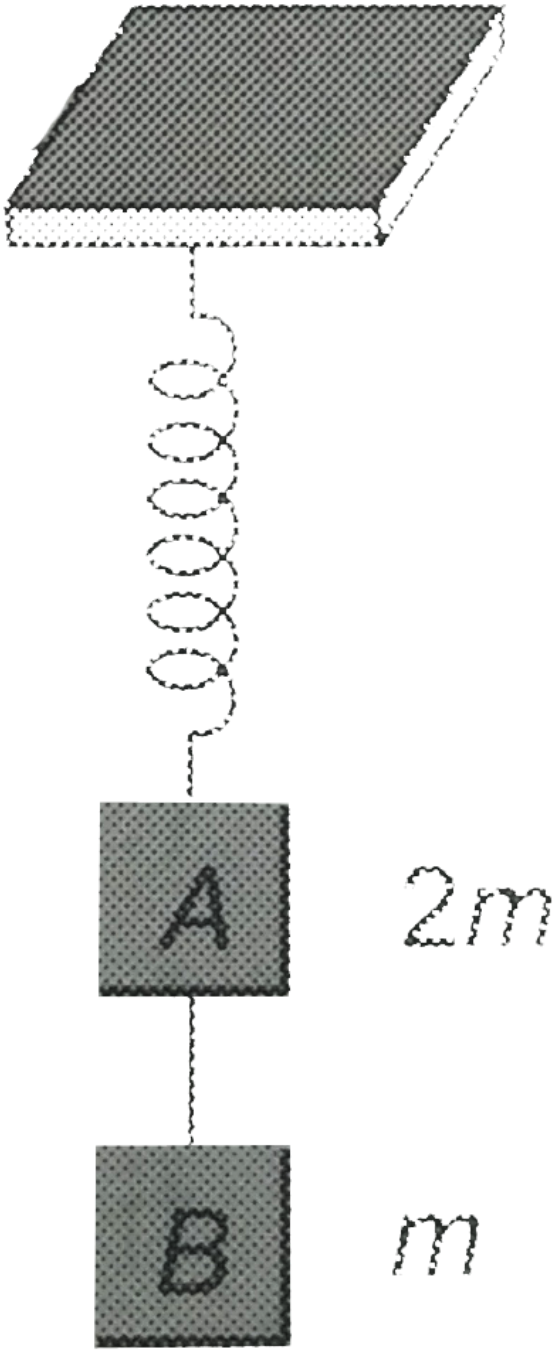
80. Two blocks A and B of masses 2m and respectively, are connected by a massless and inextensible string. The whole system is suspended by a masslessspring as shown in the figure. The magnitude of acceleration of A and B, immediately after the string is cut, are

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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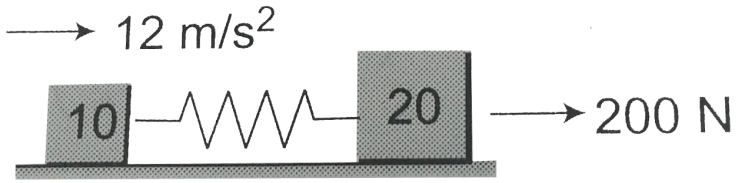
81. The masses of 10 kg and 20 kg, respectively, are connected by a light spring as shown in the figure. A force of 200 N acts upon the 20

kg mass. At the instant shown, the 10 kg mass the acceleration of $12m/s^2$. The acceleration of 20 kg mass is



A. $12m/s^2$

B. $4m/s^2$

C. $10m/s^2$

D. Zero

Answer: B

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82. For ordinary terrestrial experimants, the observer is an inertial frame in the following cases is

A. A child revolving in a giant wheel

B. A driver in a sports car moving with a constant high speed of 200 km/h on a straight road.

C. The pilot of an aeroplane which is taking off

D. A cyclist negotiating a sharp curve.

Answer: B

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83. A reference frame attached to the earth

A. is an inertial frame by definition

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

C. is an inertial frame because Newton's laws are applicable

D. is an inertial frame because the earth is rotating about its own axis.

Answer: B

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84. A balloon with mass m is descending down with an acceleration a $(wherea < g)$. How much mass should be removed from it so that it starts moving up with an acceleration a?

A. $\frac{2ma}{g-a}$

B. $\frac{ma}{g+a}$

C. $\frac{ma}{g-a}$

D. $\frac{2ma}{g+a}$

Answer: D

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