PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

NEWTONS LAWS OF MOTION

Solved Example

1. A force produces an acceleration $16m^{-2}$ in a mass $0.5kg$ and an acceleration $4ms^{-2}$ in an unknown mass when appied separately If both the masses are tied together what will be the acceleration under same force ? .

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

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3. A body of mass $m = 3.513kg$ is moving along the x-axis with a speed of $5.00ms^{-1}$. The magnetude of its momentum is recorded as

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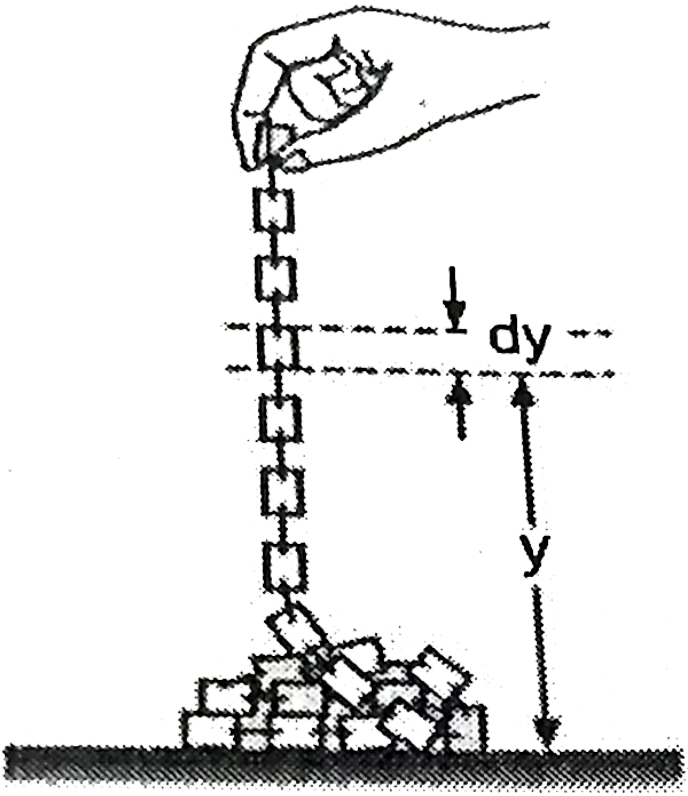
4. A very flexible uniform chain of mass M and length L is suspended vertically so that its lower and just touches the surface of a table.

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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5. A body of mass $8kg$ is moved by a force $F = (3x)N$, where x is the disatance covered Initial position is $x = 2m$ and final position is $x = 10m$ If initially the body is at rest find the final speed .

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6. Sum of magnitudes of the two forces acting at a point is $16N$ if their resultant is normal to the smaller forces and has a magnitude $8N$ then the forces are .

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7. A particle is at rest at $x = a$. A force $\overrightarrow{F} = \frac{b}{x^2}\overrightarrow{i}$ begins to act on the particle. The particle starts its motion, towards the origin, along X-axis. Find the velocity of the particle, when it reaches a distance x from the origin .

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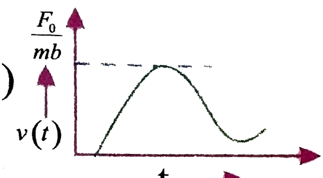
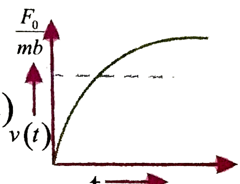
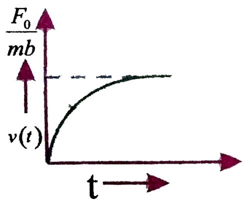
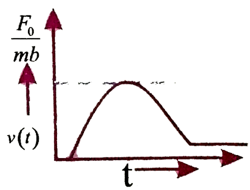
8. A particle of mass m is at rest at the origin at time $t = 0$ It is subjected to a force $F(t) = F_0 e^{-bt}$ in the X-direction. Its speed $V(t)$ is depicted by which of the following curves

1) 

2) 

3) 

4) 

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9. A bus moving on a level road with a velocity v can be stopped at a distance of x by the application of a retarding force F The load on the bus is increased by 25% by boarding the passengers. Now if the bus is moving with the same speed and if the same retarding force is applied the distance travelled by the bus before it stops is .

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10. A gardener is watering plants at the rate $0. \, litre / \sec$ using a pipe of cross-sectional area $1cm^2$ What additional force he has to exert if he desires to increase the rate of watering two times ? .

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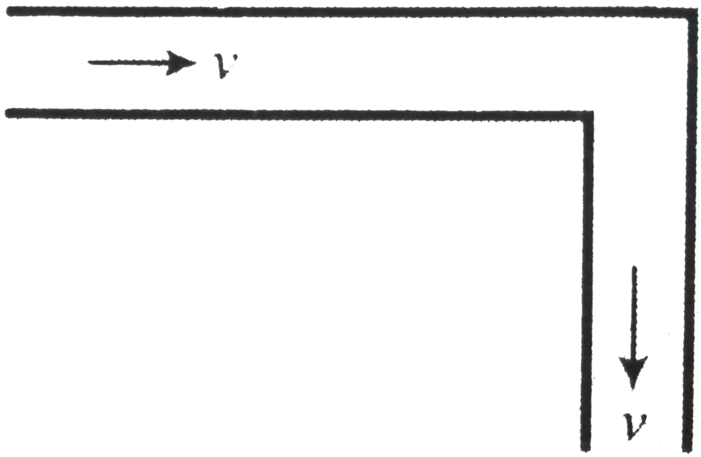
11. A liquid of density ρ is flowing with a speed v through a pipe of cross sectional area A. The pipe is bent in the shape of a right angles as shown. What force should be exerted on the pipe at the corner to keep it fixed?



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12. A plate moves normally with the speed v_1 towads a horizontal jet of uniform area of

cross-section. The jet discharge water at the rate of volume V per second at a speed of v_2. The density of water is ρ. Assume that water splashes along the surface of the plate ar right angles to the original motion. The magnitude of the force action on the plate due to the jet of water is

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13. Find the impulse due to the force $\overrightarrow{F} = a\hat{i} + bt\hat{j}$,where $a = 2N$ and $b = 4Ns^{-1}$

if this force acts from $t_i = 0$ to $t_f = 0.3s$.

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14. A ball falling with velocity $\overrightarrow{v}_i = \left(-0.65\hat{i} - 0.35\hat{j}\right)ms^{-1}$ is subjected to a net impulse $\overrightarrow{I} = \left(0.6\hat{i} + 0.18\hat{j}\right)$ Ns. If the ball has a mass of $0.275kg$ calculate its velocity immediately following the impulse .

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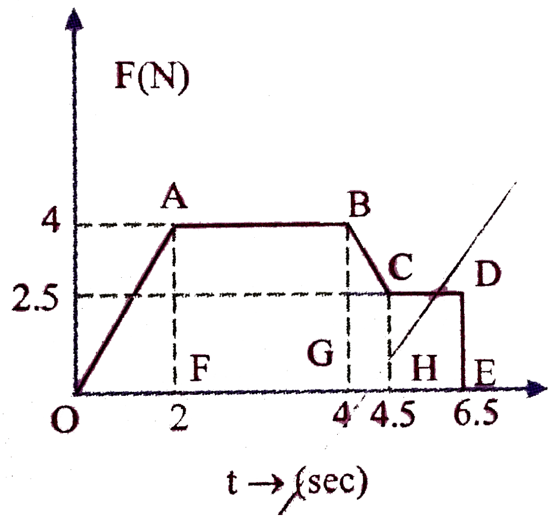
15. A body of mas $2kg$ has an initial speed $5ms^{-1}$ A force acts on it for some time in the direction of motion The force-time graph is shown. Find the final speed of the body



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16. A bullet is fired from a gun The force on a bullet is $F = 600 - 2 \times 10^5 t$ newton. The force reduces to zero just when the bullet leaves barrel Find the impulse imparted to the bullet .

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17. A mass of $3kg$ is suspended by a rope of length $2m$ from the ceilling A force of $40N$ in the horizontal direction is applied atmidpoint

P of the rope the as shown. What is the angle the rope makes with the vertical in equilibrium and the tension in part of string attached to the ceiling ? (Neglect the mass of the rope, $g = 10m/s^2)$.

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18. A mass M is suspended by a weightless string The horizontal force required to hold the mass 60° with the vertical is .

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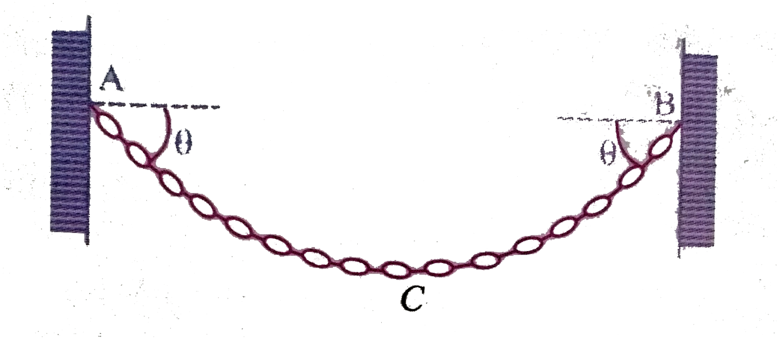
19. A chain of mass 'm' is attached at two points A and B of two fixed walls as shown in the Find the tension in the chain near the walls at point A and at the mid point C



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20. A mass of $1kg$ attached to one end of a string is first lifted up with an acceleration $4.9m/s^2$ and then lowered with same acceleration What is the ratio of tension in string in two cases .

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21. The apparent weight of a man in a lift is W_1 when lift moves upwards with some acceleration and is W_2 when it is accerating down with same acceleration. Find the true weight of the man and acceleration of lift .

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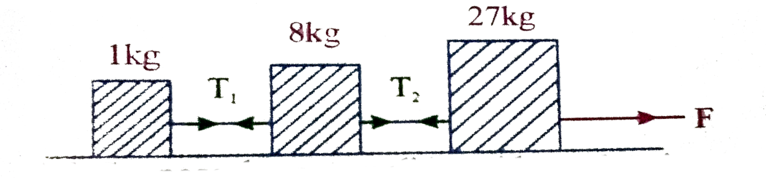
22. Three blocks connected together by strings are pulled along a horizontal surface by applying a force $F. If F = 36N$ What is the tension T_2 ?.



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23. The maximum tension a rope can withstand is $60kg - wt$ The ratio of maximum accelertion with which two boys of masses $20kg$ and $3kg$ can climb up the rope at the same time is .

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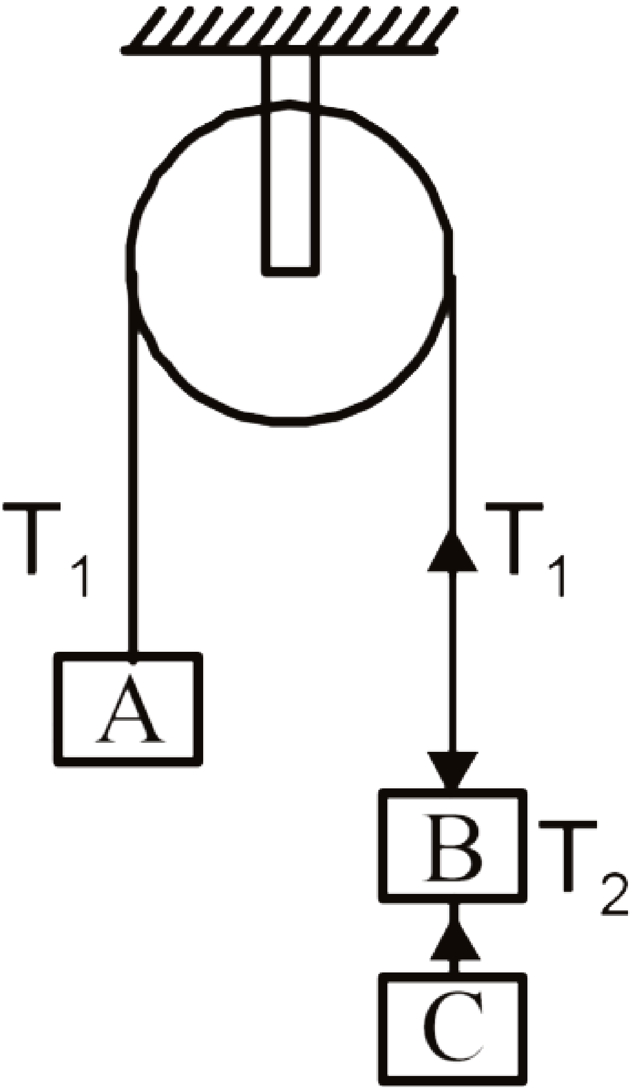
24. Three equal weights of mass m each are hanging on a string passing over a fixed pulley as shown in fig. The tensions in the string connecting weights A to B and B to C will respectively be -



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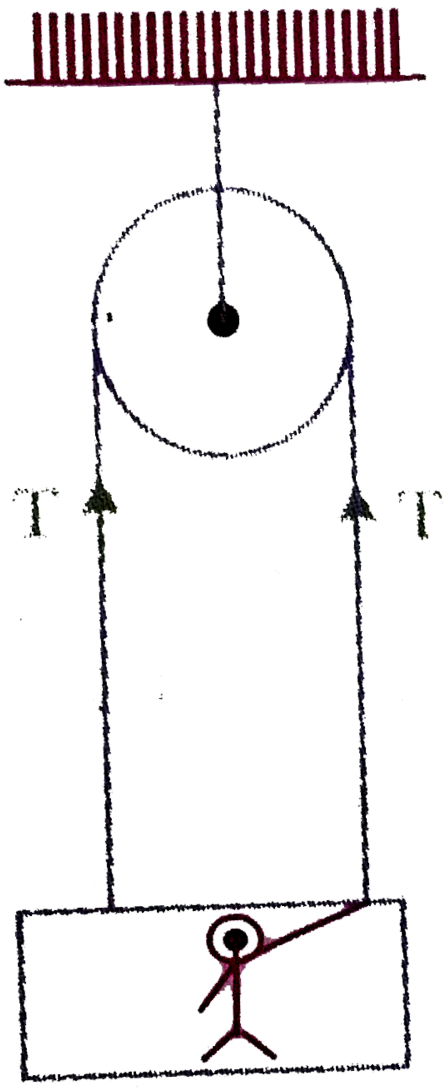
25. A man of mass $60kg$ is standing on a weighing machine kept in a box of mass $30kg$ as shown in the diagram If the man man ages to keep the box stationary, find the read ing of the weighing machine



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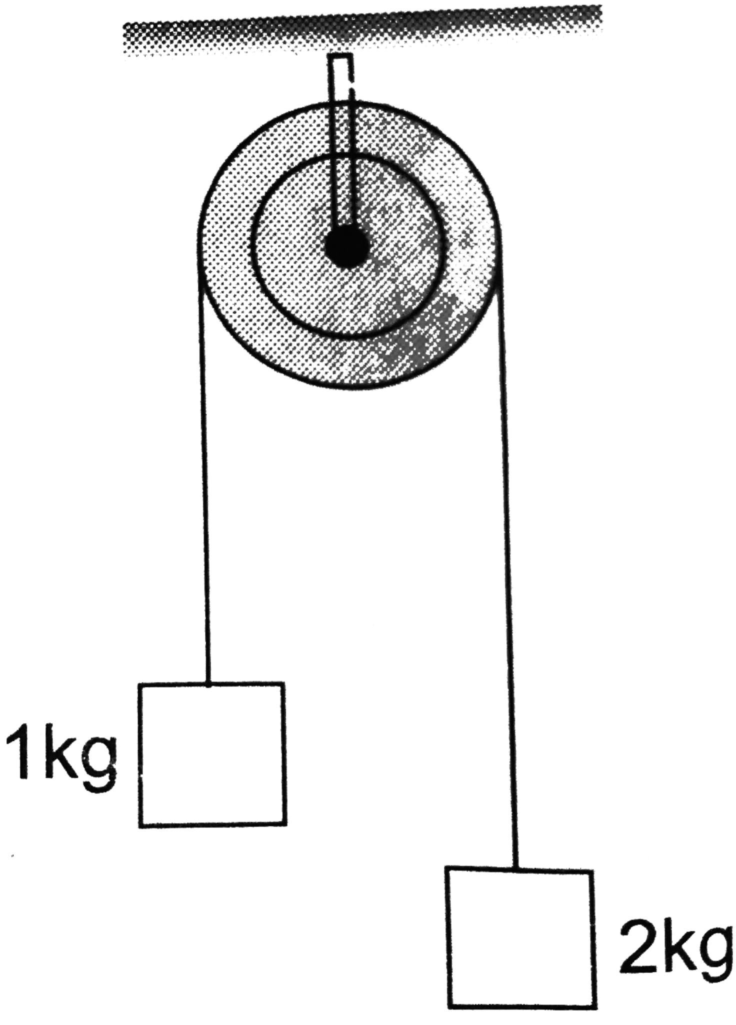
26. Two unequal masses are connected on two sides of a light and smooth pulley as shown in figure. The system is released from rest. The larger mass is stopped 1.0 second after the system is set into motion and then released immediately. The time elapsed before the string is tight again is: Take $g = 10m / s^2$


1kg
2kg

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27. In the figure, m_1 is at rest, find the relation among m_1, m_2 and m_3 ? .

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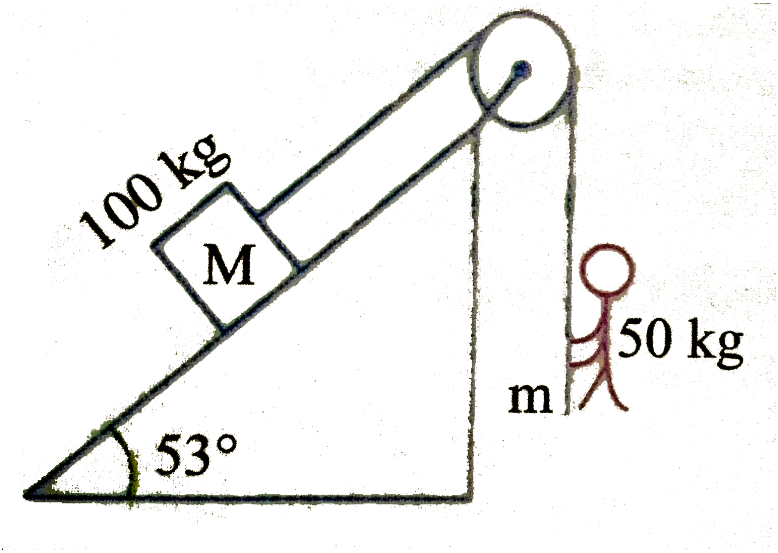
28. By what acceleration the boy must go up so that $100kg$ block remains stationary on the wedge. The wedge is fixed and is smooth

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



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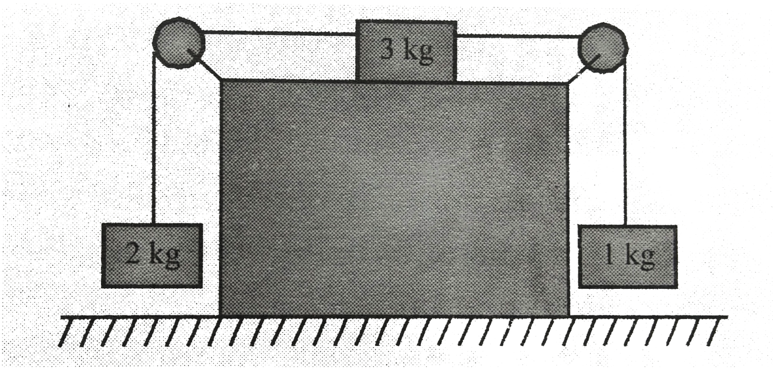
29. The system shown in fig, is released from rest. Calculate the tension in the string and the force exerted by the string on the pulleys, assuming pulleys and strings are massless.



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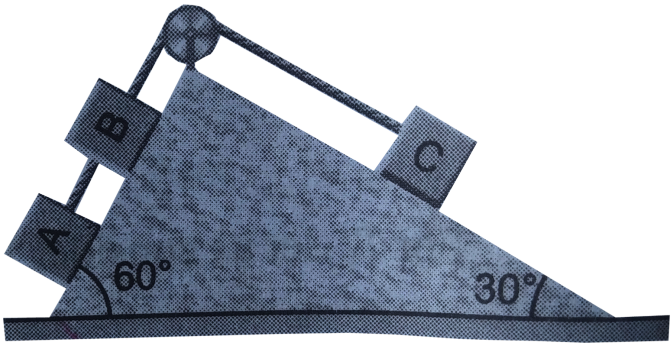
30. In the adjacent figure, masses of A, B and C are $1kg$, $3kg$ and $2kg$ respectively.Find

(a) the acceleration of the system and

(b) tension in the strings.

Neglect friction.$(g = 10m/s^2)$



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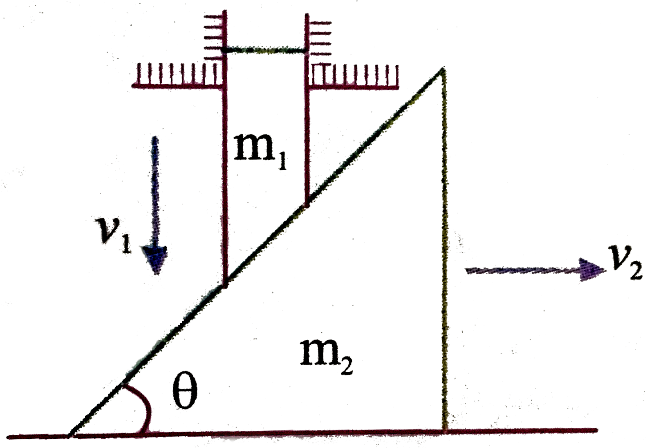
31. Find the relation between velocity of rod and that of wedge at any instant



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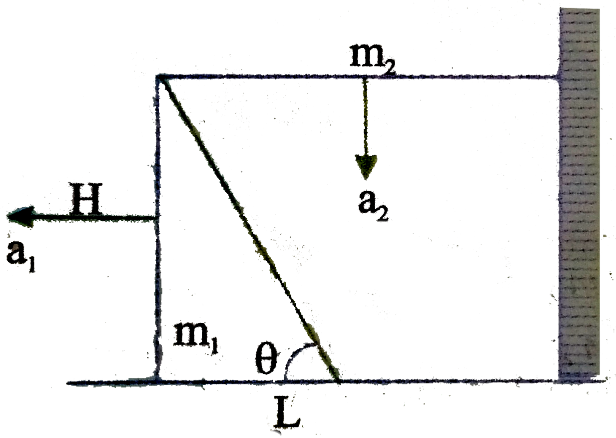
32. Find the relation between a_1 and a_2



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33. A rod of length 'l' is inclined at an angle 'theta' with the floor against a smooth vertical wall. If the end A moves instantaneously with velocity v_1 what is the velocity of end B at the instant when rod makes 'theta' angle with the horizontal .

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34. In the fig, find the acceleration of mass m_2

.

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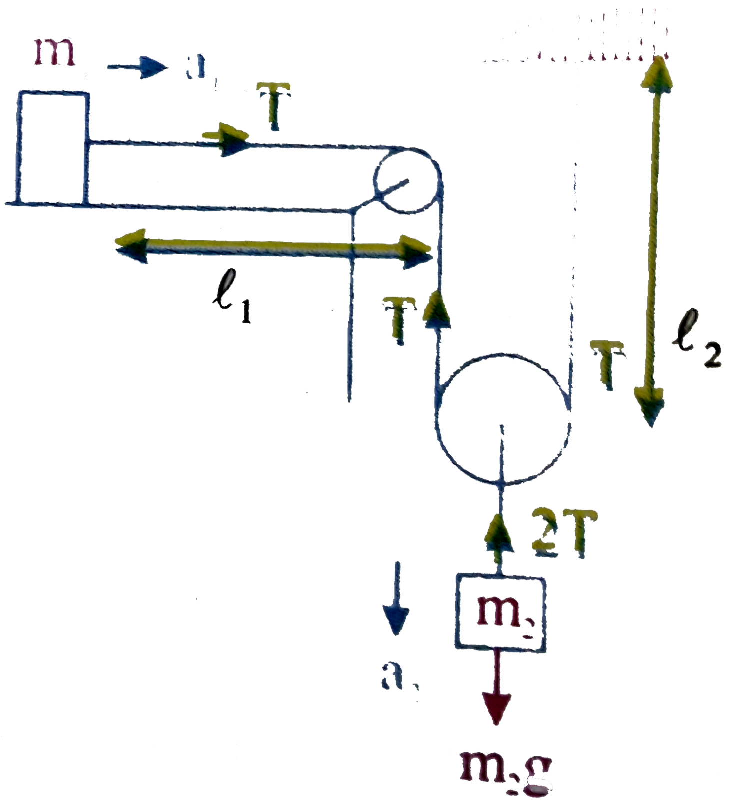
35. In the fig, find the acceleration of m_1 and m_2



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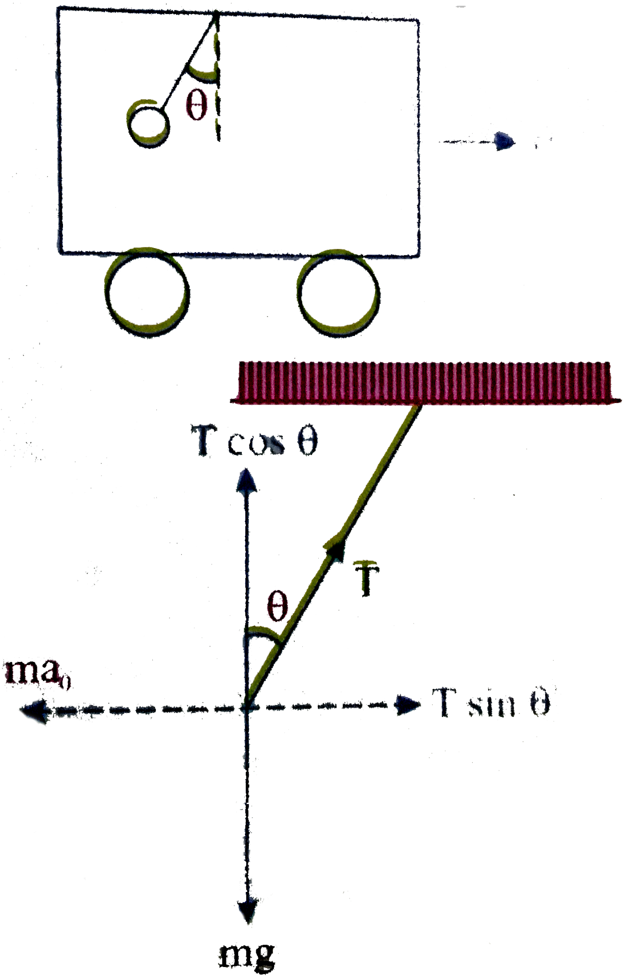
36. A pedulum is hanging from the ceiling of a car having an acceleration a_0 with respect to the road Find the angle made by the string with vertical at equilibrium Also find the tension in the string in this position



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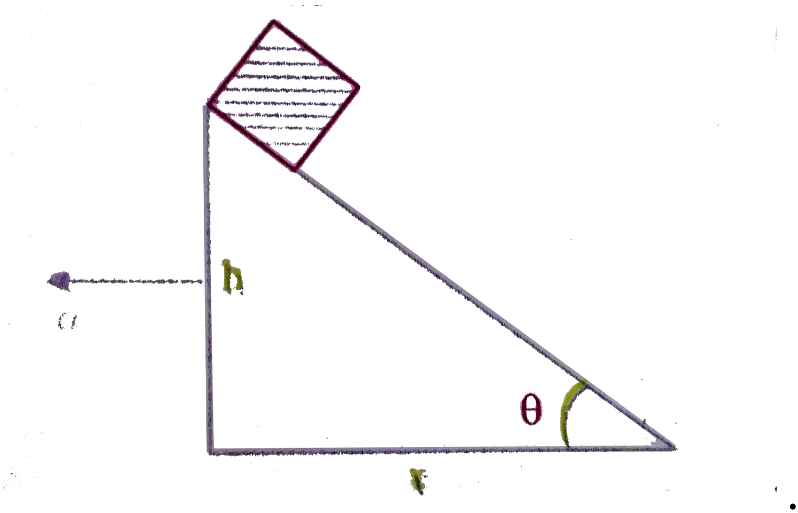
37. For what value of 'a' the block falls freely ?



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38. A block of mass m is placed on a smooth wedge of inclination. The whole system is accelerated horizontally so that block does not slip on the wedge Find the i) Acceleration of the wedge Force to be applied on the wedge Force exerted by the wedge on the block .

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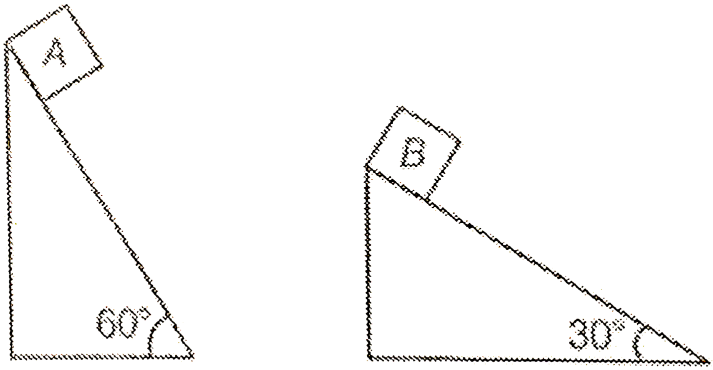
39. Two fixed frictionless inclined plane making angles 30° and 60° with the vertical are shown in the figure. Two blocks A and B are placed on the two planes What is the relative vertical acceleration of A with respect to B ?



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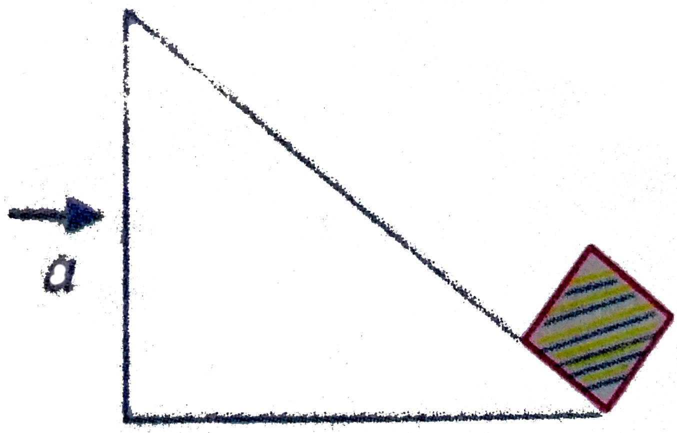
40. For what value of 'a' block slides up the plane with an acceleration 'g' relative to the inclined plane



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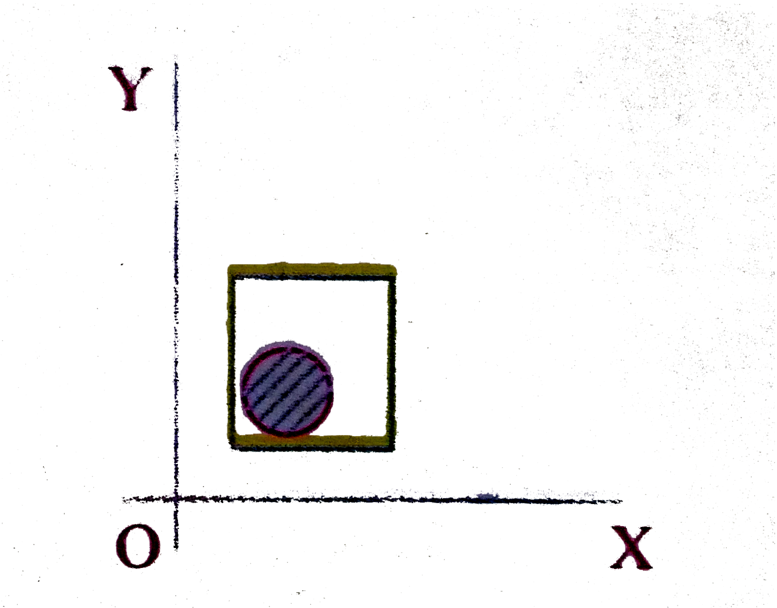
41. A solid sphere of mass of $2kg$ rests inside a cube as shown The cube is moving with velocity $\vec{v} = \left(5t\hat{i} + 2t\hat{j}\right)ms^{-1}$ where 't' is in sec and 'v' is in m/s What force does sphere exert on cube



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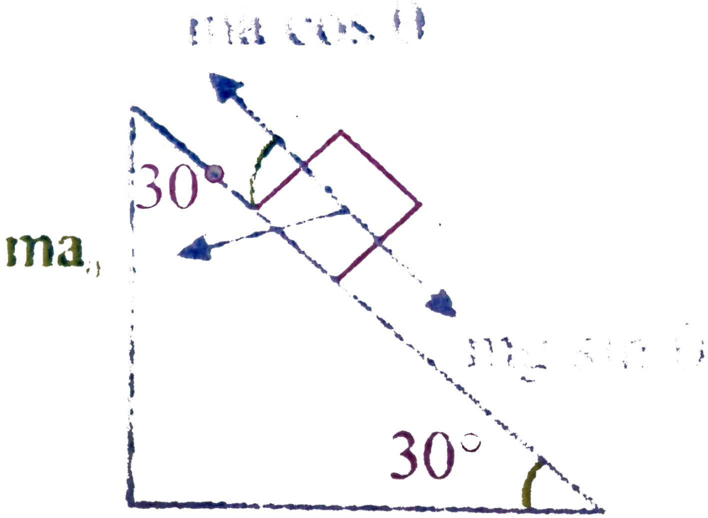
42. A block is placed on an inclined plane moving towards right with an acceleration $a_0 = g$ The length of the inclined plane is l_0.

All the surfaces are smooth Find the time taken by the block to reach from bottom to top.



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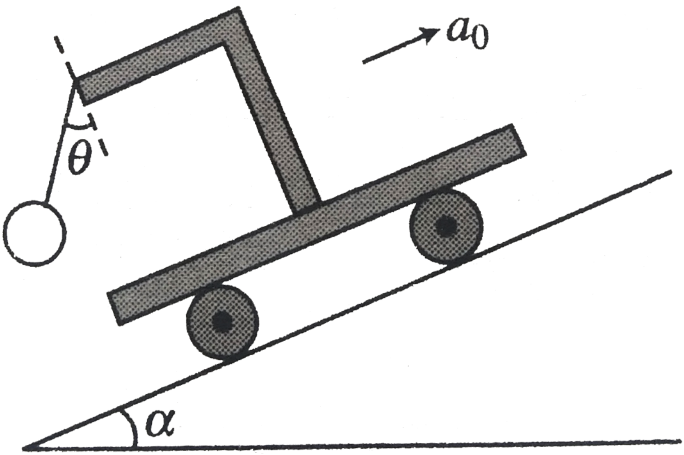
43. A pendulum of mass m hangs from a support fixed to a trolley. The direction of the string when the trolley rolls up a plane of inclination α with acceleration a_0 is



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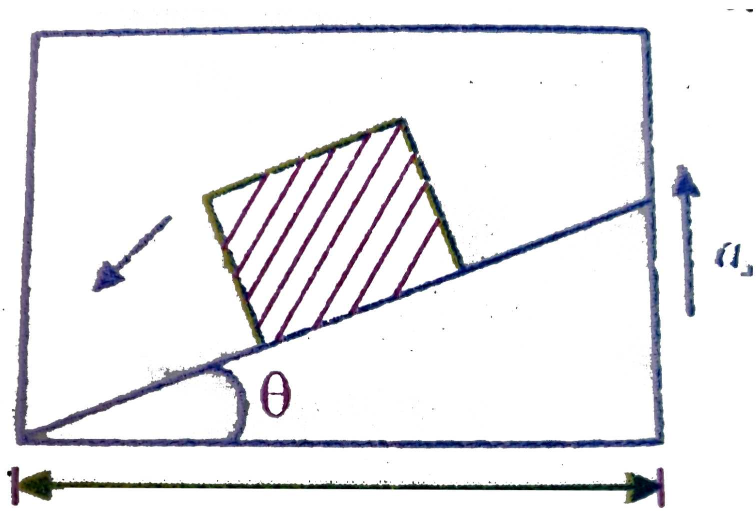
44. A block slides down from top of a smooth inclined plane of elevation • fixed in an elevator going up with an acceleration a_0 The base of incline hs length L Find the time taken by the block to reach the bottom



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45. A bomb moving with velocity $(40i + 50j - 25k)m/s$ explodes into two pieces of mass ratio 1:4. After explosion the smaller piece moves away with velocity $(200i + 70j + 15k)m/s$. The velocity of larger piece after explosion is .

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46. A particle of mass $4m$ explodes into three pieces of masses m,m and $2m$ The equal masses move along X-axis and Y-axis with velocities $4ms^{-1}$ and $6ms^{-1}$ respectively. The magnitude of the velocity of the heavier mass is

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47. A rifle of $20kg$ mass can fire 4 "bullets"//"s". The mass of each bullet is $35 \times 10^{-3}kg$ and its final velocity is $400ms^{-1}$., Then what force must be applied on the rifle so that it does not move backwards while firing the bullets ? .

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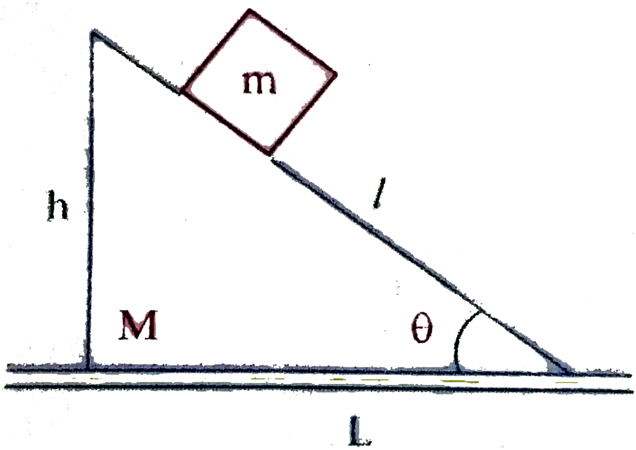
48. All surfaces are smooth Find the horizontal displacements of the block and the wedge when the block slides down from top to bottom



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49. A bomb of mass $1kg$ is thrown vertically upwards with a speed of $100m/s$. After 5 seconds, it explodes into two fragments. One fragment of mass $400gm$ is found to go down with a speed of $25m/s$. What will happen to the second fragment just after the explosion ? $(g = 10ms^{-1})$

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50. A particle of mass $2m$ is projected at an angle of 45° with horizontal with a velocity of $20\sqrt{2}m/s$. After $1s$ explosion takes place and the particle is broken into two equal pieces. As a result of explosion one part comes to rest. Find the maximum height attained by the other part. Take $g = 10m/s^2$.

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51. A man of mass $40kg$ is at rest between the walls as shown in the If ' $\bullet$ ' between the man and the walls is 0.8 find the normal reactions exerted by the walls on the man .

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52. A $2kg$ block is in contact with a vertical wall having coefficient of friction 0.5 between the surfaces. A horizontal force of $40N$ is applied on the block at right angles to the wall.

Another force of $15N$ is applied on the plane of the wall and at right angles to $40N$ force. Find the acclecration of the block .

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53. A block of mass $4kg$ is placed on a rough horizontal plane A time dependent horizontal force $F = kt$ acts on the block $(k = 2N / s)$. Find the frictional force between the block and the plane at $t = 2$ seconds and $t = 5$ seconds $(\mu = 0.2)$.

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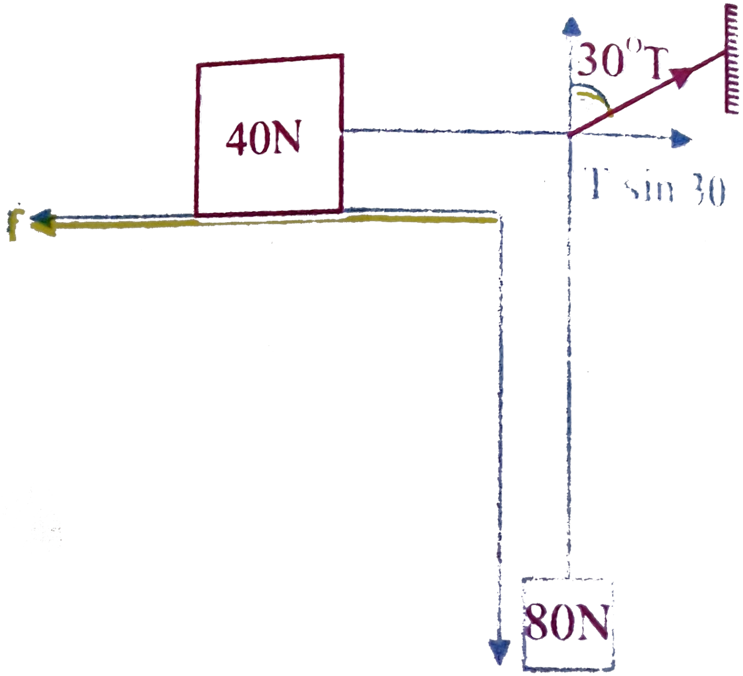
54. A block on table shown in is just on the edge of slipping Find the coefficient of static friction between the blocks and table



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55. When a car of mass $1000kg$ is moving with a veocity of $20ms^{-1}$ on a rough horizontal road its engine is switched off. Hwo for does the car move before it comes to rest if the coefficient of kintic friction between the road and tyres of the car is 0.75 ? .

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56. A horizontal conveyor belt moves with a constant velocity V. A small block is projected with a velocity of $6m/s$ on it in a direction opposite to the direction of motion of the belt The block comes to rest relative to the belt in a time $4s$. $\mu = 0.3$, $g = 10.\ m/s^2$ Find V.

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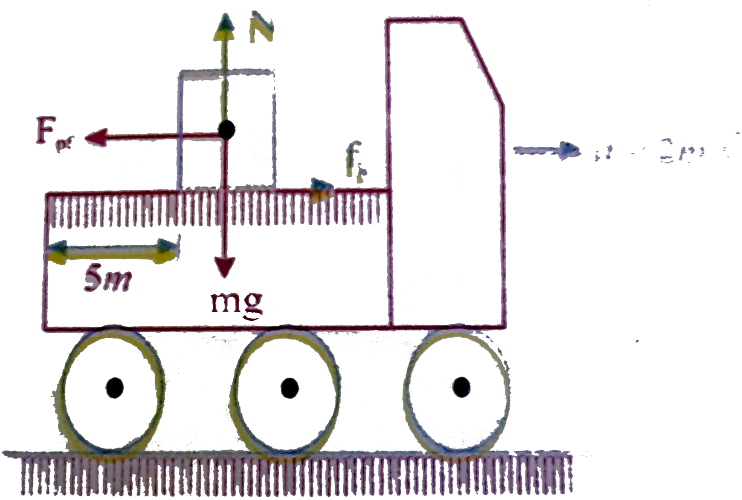
57. The rear side of a truck is open. A box of $40kg$ mass is placed $5m$ away from the open end as shown in figure. The coefficient of friction between the box and the surface is 0.15. On a straight road, the truck starts from rest and accel erating with $2m/s^2$. At what distance from the starting point does the box fall off the truck? Ignore the size of the box



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58. A block of mass $10kg$ is pushed by a force F on a horizontal rough plane is moving with acceleration $5ms^{-2}$ When force is doubled its acceleration becomes $18ms^{-2}$ Find the coefficient of friction between the block and rough horizontal plane $\left(g = 10ms^{-2}\right)$.

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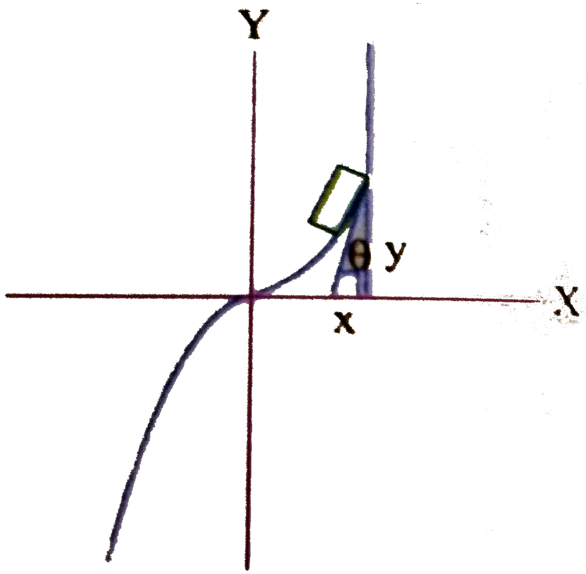
59. A block of mass $'m'$ is placed on a rough surface with a vertical cross section of $y = \dfrac{x^3}{6}$

. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is .



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60. A body is moving down a long inclined plane of angle of inclination $'\theta'$ for which the coefficient of friction varies with distance x as μ(x) = kx , where k is a constant . Here x is the distance moved by the body down the plane . The net force on the body will be zero at a distance x_0 is given by ....

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61. A body of mass 'm' slides down a smooth inclined plane having an inclination of 45° with the horizontal . It takes 2 s to reach the bottom . If the body is placed on a similar plane having coefficient of friction 0.5 , then what is the time taken for it to reach the bottom ?

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62. Two blocks of masses 4 kg and 2 kg are in contact with each other on an inclined plane of inclination 30° as shown in the figure . The coefficient of friction between 4 kg mass and the inclined plane is 0.3 , whereas between 2 kg mass and the plane is 0.2 . find the contact force between the blocks .

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63. A $30kg$ box has to move up an inclined plane of slope 30° the horizontal with a unform velocity of $5ms^{-1}$. If the frictional force retarding the motion is $150N$, the horizontal force required to move the box up is $\left(g = ms^{-2}\right)$.

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64. A body is sliding down an inclined plane having coefficient of friction 0.5. If the normal reaction is twice that of resultant downward force along the inclined plane, then find the angle between the inclined plane and the horizontal .

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65. In the given the wedge is acted upon by a constant horizontal force 'F'. The wedge is moving on a smooth horizontal surface A ball of mas 'm' is at rest relative to the wedge The ratio of forces exerted on 'm' by the wedge when 'F' is acting and 'F' is withdrawn assuming no friction between the edge and the ball is equal to .

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66. A block of mass m kg is pushed up against a wall by a force P That makes an angle 'theta' with the horizontal as shown in The coefficient of static friction between the block and the wall is μ The minimum value of P that allows the block to remain stationary is .

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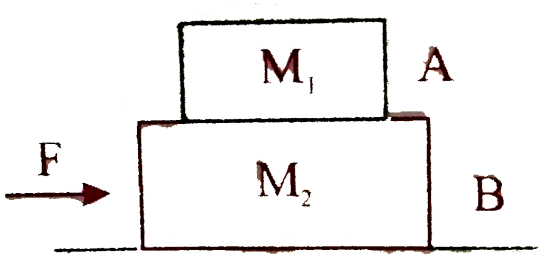
67. A block the of mass $4kg$ is placed on another block of mass $5kg$ and the block B rests on a smooth horizontal table for sliding the block A on B a horizontal force $12N$ is required to be applied force on it How much maximum horizontal force can be applied on 'B' s that both A and B move together? Also find out the accleration proudced by this force



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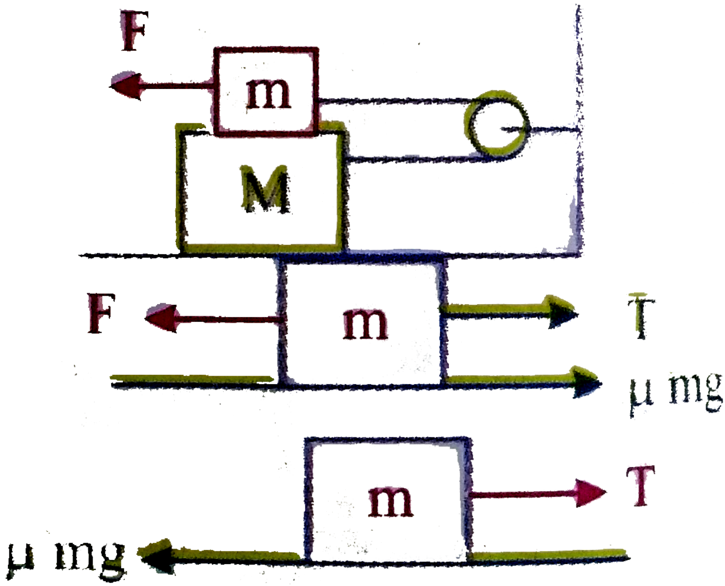
68. Two blocks of masses 'm' and and 'M' are arranged as shown in the The coefficient of friction between the two blocks is $'\mu'$, where as between the lower block and the horizontal surface is zero. Find the force 'F' to be applied on the upper block for the system to be under equilibrium ? .



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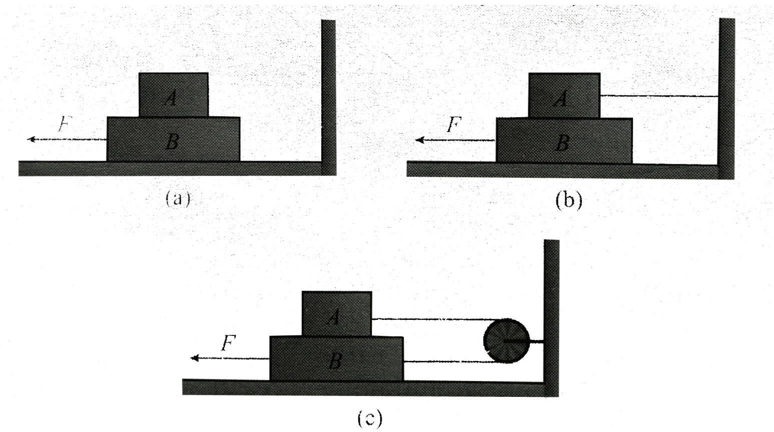
69. Block A weighs $4N$ and block weigh $8N$ The coefficient of kinetic friction is 0.25 for all surface find the force F to slide B at a constant speed when (a)A rest on B and moves with it (b) A is held at rest and (c) A and B are connected by a light cord passing over a smooth putting as shown in fig 7.31 (a - c) restively.



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70. Two cars of masses m_1 and m_2 are moving in circles of raddii r_1 and r_2 respectively. Their speeds are such that they make complete circle in the same time t The ratio of their centripetal acceleration is .

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71. A car is driven round a curved path of radius $18m$ without the danger of skidding The coefficeient of friction between the tyres of the car and the surface of the curved path is 0.2 What is the maximum speed in kmph of the car for safe driving ? $\left(g = 10 m s^{-2}\right)$.

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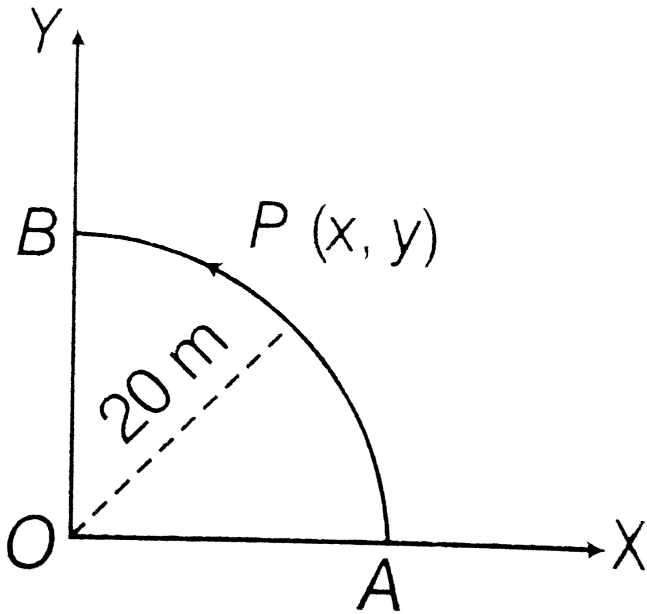
72. A point P moves in counter-clockwise direction on figure. The movement of P is such that it sweeps out a length $s = t^3 + 5$, where s is in metre and t is in second. The radius of the pathh is 20 m. the acceleration of P when t=2s is nearly



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73. A turn of radius $20m$ is banked for the vehicle of mass $200kg$ going at a speed of $10m/s$. Find the direction and magnitude of frictional force (a) $5m/s$

(b) $15m/s$

Assume that friction is sufficient to prevent slipping. $(g = 10m/s^2)$

Watch Video Solution

C.U.Q

1. The behaviour of a body under zero resultant force is given by .

A. first law of motion

B. second law of motion

C. third law of motion

D. law of gravitation

Answer: A

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2. Which law of Newton defines an 'inertial frame of reference' ? .

A. First law of motion

B. Second law of motion

C. Third law of motion

D. Law of gravitation

Answer: A

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3. The statement "acceleration is zero if and only if the net force is zero" is valid in .

A. non-inertial frames

B. inertial frames

C. both in inertial frames and non-inertial frames

D. neither inertial frames non-inertial frames

Answer: B

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4. You move forward when your car suddenly come to a halt and you are thrown backward when your car rapidly accelerates. Which law of Newton is involved in these ?

A. third law

B. second law

C. first law

D. law of gravitation

Answer: C

Watch Video Solution

Watch Video Solution

5. You are thrown outer side when your car suddenly takes a turn. Which law of Newtn is involved in this ? .

A. Third law

B. Second law

C. First law

D. Law of gravitation

Answer: C

Watch Video Solution

6. An object is thrown vertically upward with some velocity. If gravity is turned off at the instant the object reaches the maximum height what happens ? .

A. The object continues to move in a straight line

B. The object will be at rest

C. The object falls back with uniform velocity

D. The object falls back with unform acceleration

Answer: B

Watch Video Solution

7. Which of the following is the most significant law of motion given by Newton ? .

A. First law of motion

B. Second law of motion

C. Third law of motion

D. Zeroth law of motion

Answer: B

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8. The quantity of motion of a body is best represented by .

A. its mass

B. its speed

C. its velocity

D. its linear momentum

Answer: D

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9. A certain particle undergoes erratic motion. At very point in its motion the direaction of the particle' s momentum is always .

A. the same as the direaction of its velocity

B. the same as the direction of its acceleration

C. the same as the direction of its net force

D. the same as the direction of its kinetic energy .

Answer: A

Watch Video Solution

10. Inside a railway car a plumb bob is suspended from the roof and a helium filled balloon is tied by a string to the floor of the car. When the railway car accelerates to the right then.

A. both the plumb bob and balloon move the left

B. both the plumb bob and balloon move to the right

C. plumb bob moves to the left and the balloon moves to the right

D. plumb bob moves to the right and the balloon moves to the left

Answer: C

Watch Video Solution

11. A constant force (F) is applied on a stationary particle of mass 'm' The velocity attained by the particle in a certain displacement will be proportional to .

A. m

B. $1/m$

C. $\sqrt{m}$

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

Answer: D

Watch Video Solution

12. A constant force (F) is applied on a stationary particle of mass 'm' The velocity attained by the particle in a certain displacement will be proportional to .

A. m

B. $1/m$

C. $\sqrt{m}$

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

Answer: B

Watch Video Solution

Watch Video Solution

13. A force produces an acceleration of a_1 in a body and the same force produces an acceleration of a_2 in another body. It the to bodies are combined and the same force is applied on the combination the acceleration produced in it is .

A. $a_1 + a_2$

B. $\frac{a_1 + a_2}{a_1 a_2}$

C. $\frac{a_1 a_2}{a_1 + a_2}$

D. $\sqrt{a_1 a_2}$

Answer: C

Watch Video Solution

14. The keep a particle moving with constant velocity on a frictionless surface, an external force .

A. should act continuosly

B. should be a variable force

C. not necessary

D. should act opposite to the direction of motion

Answer: C

Watch Video Solution

15. If action force acting on a body is gravitational in nature, then reaction force .

A. will be a contact force

B. will be gravitational force

C. will be a gravitational or contact force

D. will be a force of any origin

Answer: B

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16. Action and reaction can never balance out because

A. they are equal but not opposite always

B. they are unequal in magnitude even though opposite in direction

C. though they are equal in magnitude and opposite in direaction they act on different bodies

D. they are unequal in magnitudes

Answer: C

Watch Video Solution

17. The propulsion of a rocket is based on the principle of condservation of .

A. linear momentum

B. energy

C. angular momentum

D. mass

Answer: A

Watch Video Solution

18. An automobile that is towing a trailer is accelerating on a level road. The force that the automobile exerts on the trailer is .

A. equal to the force the trailer exerts on the automobile

B. greater than the force the trailer exerts on the automobile

C. equal to the force the trailer exerts on the road

D. equal to the force the road exerts on the trailer

Answer: A

Watch Video Solution

19. A man is standing in the middle of a perfectly smooth 'island of ice' where there is no friction between the ground and his feet. Under these circumstances .

A. he can reach the desired corner by throwing and object in the same direction

B. he can reach the desired corner by throwing and object in the opposite direction

C. he has no chance of reaching any corner of the island

D. he can reach the desired corner by pursuing on the ground in that direction

Answer: B

Watch Video Solution

20. Which law of Newton reveals the underlying symmetry in the forces that occure in nature ? .

A. First law of motion

B. Second law

C. Third law

D. Law of gravitation

Answer: C

Watch Video Solution

21. You hold a rubber ball in your hand. The Newton's third law companion force to the force of gravity on the ball is the force exerted by the .

A. ball on the earth

B. ball on the hand

C. hand on the ball

D. earth on the ball

Answer: A

Watch Video Solution

22. A lift is going up with uniform velocity When brakes are applied it slows down. A person in that lift experiences

A. more weight

B. less weight

C. normal weight

D. zero weight

Answer: B

Watch Video Solution

23. While we catch a cricket ball, we catch it at the fornt and make the hands move with the ball backwards. Why is that ? .

A. To reduce the impulse

B. To increases the time of contact, there by increase the force

C. To increase the impulse

D. To increase the time of contact, there by decrease the force

Answer: D

Watch Video Solution

24. The change in momentum per unit time of body represents .

A. impulse

B. force

C. kinetic energy

D. resultant force

Answer: D

Watch Video Solution

25. A father and his seven years old son are facing each other on ice skates. Whith their hands they push off against one another. Regarding the froces that act on them as a result of this and the acceleration they experience which of the following is correct ? .

A. Father exerts more force on the son and experiences less acceleration

B. Son exerts less force on the father and experiences less acceleration

C. Father exerts as much force on the son as son exerts on the father, but the father experiences less acceleration

D. Father exerts as much force on the son as son exerts on the father, but the father experiences less acceleration

Answer: C

Watch Video Solution

26. A student initially at rest on a frictionless frozen pond throws a $2kg$ hammer in one direction After the throw, the hammer moves off in one direaction while the student moves off in the other direction. Which of the following correctly describes the above situation ? .

A. The hammer will have the momentum with greater magnitude

B. The hammer will have the momentum with greater magnitude

C. The hammer will have the greater kinetic energy

D. The student will have the greater kinetic energy .

Answer: C

Watch Video Solution

27. A ball falls towards the earth. Which of the following is correct ? .

A. If the system contains ball the momentum

B. If the system contains earth , the momentum is conserved

C. If the system contains ball and earth, the momentum is conserved

D. If the system contains ball, earth and sun, the momentum is conserved

Answer: C

Watch Video Solution

28. A block moving in air breaks into two parts and the parts separate ? .

A. the total momentum must be conserved

B. the total kinetic energy must be conserved

C. the total momentum must change

D. the potential energy must be conserved

Answer: A

Watch Video Solution

29. Regarding linear momentum of a body

(a) It is a measure of quantity of motion contained by the body

(b) Change in momentum is the measure of impulse

(c) Impulse and acceleration act in opposite direction to the change im momentum

(d) In the case of uniform circular motion the linear momentum is conserved .

A. a& b are true

B. b & c are true

C. c& d are true

D. a,b & c are true

Answer: A

Watch Video Solution

30. Compare the impulses exerted on a wall by the two objects, a golf ball and a lump of mud both having the same mass and the veloctiy .

A. the golfball imparts greater impulse

B. the lump of mud imparts the greater impulse

C. both impart equal impulse

D. nothing can be said

Answer: A

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31. Two objects X and Y are thrown unpwards simultaneously with the same speed. The mass of X is greater than that of Y The air exerts equal resistive force on two objects, then .

A. X reaches maximum height than Y

B. Y reaches maximum height than X

C. the two objects wall reach the same height

D. cannot say

Answer: A

Watch Video Solution

32. A man drops an apple in the lift. He finds that the apple remains stationary and does not fall The lift is .

A. going down with constant speed

B. going up with constant speed

C. going down with constant acceleration

D. going up with constant acceleration

Answer: C

Watch Video Solution

33. Internal forces can change

A. linear momentum as well as kinetic energy

B. linear momentum but not the Kinetic energy

C. the kinetic energy but not linear momentum

D. Neither the linear momentum nor the kinetic energy

Answer: C

Watch Video Solution

34. A man is standing on a sparing platform, Reading of spring balaance is $60 kg$ wt If man jumps outside the platform then the reading of the spring balance .

A. remains same

B. decreases

C. incerases

D. first increases and then decreasses to zero

Answer: D

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35. A stretching force of $10N$ is applied at one end of a spring balance and an equal force is applied at the other end at the same time The reading of the balance is .

A. $5N$

B. $10N$

C. $20N$

D. 0

Answer: B

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36. A ball is dropped from a spacecraft revolving around the earth at a height of $1200km$. What will happen to the ball ? .

A. It will continue to move with velocity V along the original orbit of spacecraft .

B. It will move with the same speed tangential to the space craft .

C. It will fall down the earth gradually

D. It will go far in space

Answer: A

Watch Video Solution

37. A body is under the action of three forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$. In which case the body cannot undergo angular acceleration ? .

A. $\overrightarrow{F}_1, \overrightarrow{F}_2$ and $\overrightarrow{F}_3$ are concurrent, point of concurrence beign centre of mass .

B. $\overrightarrow{F}_1 + \overrightarrow{F}_2 + \overrightarrow{F}_3 = 0$

C. $\overrightarrow{F}_1, \overrightarrow{F}_2$ is parallel to $\overrightarrow{F}_3$ but the three forces are not concurrent .

D. $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$ act at the same point but $\overrightarrow{F}_3$ acts at different point .

Answer: A

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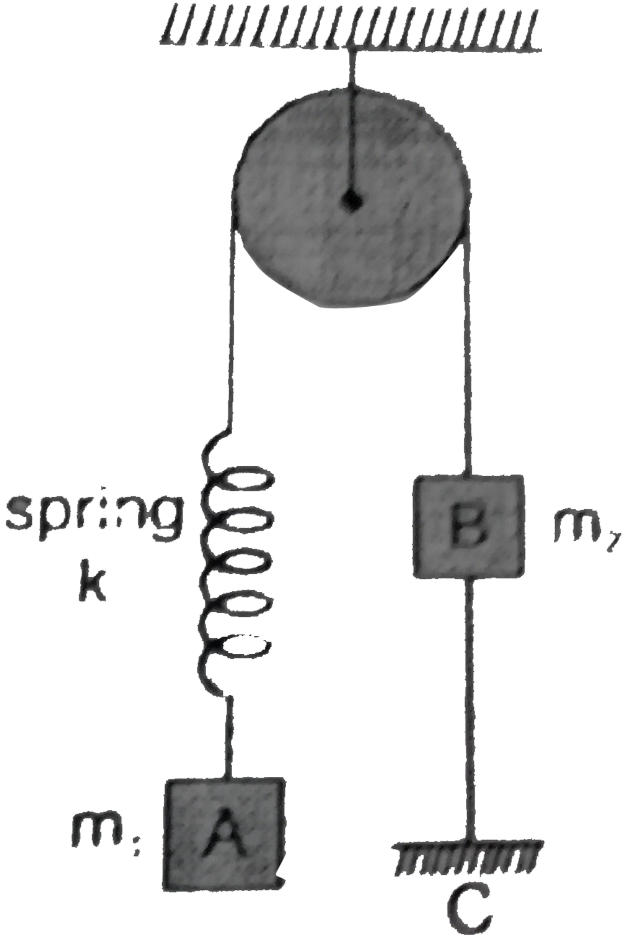

38.

In the system in the figure $m_1 > m_2$ system is held at rest by thread BC. Just after the thread BC is burnt:

A. acceleration of m_1 will be equal to zero

B. acceleration of m_2 will downwards

C. magnitude of acceleration of two blocks will be non-zero and unequal .

D. magnitude of acceleration of both the blocks will be $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)g$.

Answer: A

Watch Video Solution

39. A lift is asecending with a constnat speed "V". A passenger in the lift drops a coin. The acceleration of the coin towards the floor will be .

A. Zero

B. g

C. $< g$

D. $> g$

Answer: B

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40. A reference frame attached to the earth

A. is an inertial frame because Newton's laws of motion are applicable in it .

B. is an intertial frame by definiation

C. cannot be an intertial frame because earth is rotating about its axis .

D. can be an inertial frame because earth is revolving around the sun .

Answer: C

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41. A Stationary railway platform on earth is .

A. an inertial frame of reference for an observer earth .

B. a Non inertial frame of reference for an observer on moon

C. both are true

D. both are false

Answer: C

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42. A rotating platform for a stationary observer outside it is .

A. inertial frame of reference

B. non intertial frame of reference

C. both

D. some times intertial (or) some times non inertial

Answer: B

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43. The acceleration of a particle is found to be non zero when no force acts on the particle. This is possible if the measurement is made from

A. inertial frame

B. non inertial frame

C. both

D. some times intertial (or) some times non inertial

Answer: B

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44. Frictional force between two bodies

A. increases the motion between the bodies

B. destroys the relative motion between the bodies

C. sometimes helps and sometimes opposes the motion

D. incerases the relative velocity between the bodies

Answer: C

Watch Video Solution

45. Maximum value of static friction is .

A. limiting friction

B. rolling friction

C. static friction

D. normal reaction

Answer: A

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46. A good lubricant should be highly

A. viscous

B. non-volatile

C. both (1and2)

D. transparent

Answer: C

Watch Video Solution

47. Theoretically which of the following are best lubricants ? .

A. Solids

B. Liquids

C. Gases

D. Both 2 and 3

Answer: C

Watch Video Solution

48. A block 'B' rests on 'A' A rests on a horizontal surface 'C' which is frictionless. There is friction between A and B If 'B' pulled to the right .

A. B moves forward and A to the left

B. $'B'$ only moves to the left

C. B' does not move

D. $'A'$ and 'B' move together to the right .

Answer: D

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49. Sand is dusted to the railway tracks during rainy season to .

A. make it always wet

B. increase friction

C. to reduce consumption of fuel

D. make it always dry

Answer: B

Watch Video Solution

50. With increase of temperature the friction force acting between two surfaces .

A. increases

B. decreases

C. remians same

D. may increase or decrease

Answer: B

Watch Video Solution

51. If we imagine ideally smooth surfaces and it they are kept in contact, the frictional force acting between them is .

A. zero

B. a finite value but not zero

C. very large

D. we can't predict

Answer: C

Watch Video Solution

52. If man is walking direction of friction is .

A. opposite to the direction of motion

B. same as the direction of motion

C. perpendicular to that of direction of motion

D. 45° to the direction of motion

Answer: B

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53. Aeroplanes are streamlined to reduce .

A. fluid friction

B. sliding friction

C. kinetic friction

D. limiting friction

Answer: A

Watch Video Solution

54. The limiting friction between two surface does not depend

A. on the nature of two surface

B. on normal reaction

C. on the weight of the body

D. on volume of the body

Answer: D

Watch Video Solution

55. To avoid slipping while walking on ice, one should take smaller steps because of the

A. larger friction

B. smaller friction

C. larger normal force

D. smaller normal force

Answer: C

Watch Video Solution

56. In order to stop a car in shortest disatance on a horizontal road one should

A. apply the brakes very hard so that the wheels stop rotating .

B. apply the brakes hard enough to just prevent slipping

C. pump the brakes (press and release)

D. shut the engine off and not apply brakes

.

Answer: B

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57. A body rests a rough horizontal plane A force is applied to the body directed towards the plane at an angle θ with the vertical. The body can be moved along the plane .

A. only if θ is greater than the angle of friction

B. only if θ is lesser than the angle of friction

C. only if θ is equal to the angle of friction

D. for all values of θ

Answer: A

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58. A lift is moving down with an acceleration equal to the acceleration due to gravity. A body of mass M kept on the floor of the lift is pulled horizontally If the coefficient of friction is μ then the frictional resistance offered by the body is .

A. $\mu_k Mg$

B. Mg

C. Zero

D. $\mu_k Mg^2$

Answer: C

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59. A body is struck to the front part of the truck. The coefficient of frction between the body and is μ. The minimum acceleration with which the truck should travel so that the body does not fall down is .

A. μ / g

B. μg

C. g / μ

D. $\mu^2 g$

Answer: C

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

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

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

C. in the backward direction on both the front and rear wheels

D. in the forward direction on the front and rear wheels

Answer: A

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61. A body of mass M is applying horizontal force to slide a box of mass M_1 on a rough horizontal surface The coefficient of friction between the shoe of the boy and the floor is μ and that between the box and the floor is $'\mu_1'$ In which of the following cases is it certainly not possible to slide the box ? .

A. $\mu < \mu_1, M < M_1$

B. $\mu > \mu_1, M > M_1$

C. $\mu < \mu_1, M > M_1$

D. $\mu_1 > \mu_1, M < M_1$

Answer: A

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62. When a person walks on a rough surface .

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

B. reaction of the force applied by the man on the surface keeps him moving

C. the force applied by the man keep him moving

D. weight of the man keeps him moving .

Answer: A

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63. The maximum speed of a car on a curved path of radius 'r' and the coefficient of friction μ_k is .

A. $v = \sqrt{\frac{\mu_k}{gr}}$

B. $v = \sqrt{\mu_k gr}$

C. $v = \sqrt{\frac{gr}{\mu_k}}$

D. $v = \sqrt{\frac{1}{\mu_k gr}}$

Answer: B

Watch Video Solution

64. The angle which the rough inclined plane makes with the horizontal when the body placed on it just starts sliding down is called .

A. angle of Friction

B. angle of repose

C. critical angle

D. brewster's angle

Answer: B

Watch Video Solution

65. A body of mass M is placed on a rough inclined plane of inclination θ and coefficient of friction μ_k A force of ($mg\sin\theta + \mu_k mg\cos\theta$) is applied in the upward direction the acceleration of the body is .

A. $g\sin\theta$

B. $g(\sin\theta + \mu_k\cos\theta)$

C. $g(\sin\theta + \mu_k\cos\theta)$

D. Zero

Answer: D

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66. It is easier to pull a lawn roller than to push it because pulling .

A. involves sliding friction

B. involves dry friction

C. increases the effective weight

D. decreases normal reaction

Answer: D

Watch Video Solution

67. A block of mass m and surface area A just begins to slide down an inclined plane when the angle of inclination is $\pi/5$. Keeping the mass of the block same, if the surface area is doubled the inclination of the plane at which the block starts sliding will be .

A. $\pi/5$

B. $\pi / 10$

C. $\pi / 5$

D. $\pi / 5\sqrt{2}$

Answer: A

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68. A block X kept on an inclined surface just begins to slide if the inclination is θ_1 The block is replaced by another block Y and it is found that it just begins to slide if the inclination is $\theta_2, (\theta_2 > \theta_1)$ Then .

A. Mass of $X =$ mass of Y

B. Mass of $X <$ mass of Y

C. Mass of $X >$ mass of Y

D. All the three are possible .

Answer: D

Watch Video Solution

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

A. the Kinetic energy of the particle changes with time

B. the accceleration of the particle is constant

C. the velocity of the particle is constant

D. the speed of the particle is constant .

Answer: D

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70. The direction of angular acceleration of a body moving in a circle in the plane of the paper is .

A. along the tangent

B. along the radius inward

C. along the radius inward

D. perpendicular to the plane of the paper

Answer: D

Watch Video Solution

71. Suppose a disc is rotating counter clockwise in the plane of the paper then .

A. Its angular velocity vector will be perpendicular to the page pointing up out of the page .

B. Its angular velocity vector will be perpendicular to the page pointing inwards

C. Its angular velocity vector acts along the tangent to the disc

D. None of above

Answer: A

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72. A Particle of mass 'M' moves in a uniform circular path of radius 'r' with a constant speed 'v' then its centripetal acceleration is .

A. $\frac{v^2}{r}$

B. $\frac{v^2}{r^2}$

C. $v^2 r$

D. Zero

Answer: A

Watch Video Solution

73. A vehicle moves safe on rough curved and unbanked road Then

(a) The direction of static friction is radially out wards

(b) The direction of static friction is radially inwards

(c) The direction of kinetic friction is tangential to curved path

(d) Static friction does not exist .

A. a & b are correct

B. c & d are correct

C. b & c are correct

D. a & c are correct

Answer: C

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LEVEL -I (C.W)

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

A. mnu

B. $2mnu$

C. $4mnu$

D. $mnu/2$

Answer: B

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2. A ball reaches a racket at $60m/s$ along +X dirction and leaves the racket in the opposite direaction with the same speed. Assuming that the mass of the ball as $50gm$ and the contact time is 0.02 second the force exerted by the racket on the ball is .

A. $300N$ along $+X$ direction

B. $300N$ along $-X$ direction

C. $3, 00, 000N$ along $+X$ direction

D. $3, 00, 000N$ along $-X$ direction

Answer: B

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3. P' and 'Q' horizontally push in the same direaction a $1200kg$ crate. 'P' pushes with force of 500 newton 'Q' pushes with a force of 300 newton If a frictional force provides 200 newton of resistance what is the acceleration of the crate. ?

A. $1.3m/s^2$

B. $1.0m/s^2$

C. $0.75m/s^2$

D. $0.5m/s^2$

Answer: D

Watch Video Solution

4. A ball of mass $'m'$ moves normal to a wall with a velocity $'u'$ and rebound with the same speed. The change in momentum of the ball during the rebounding is

A. $m(u+v)$ towards the wall

B. $m(u-v)$ towards the wall

C. $m(u+v)$ away from the wall

D. $m(u-v)$ away from the wall

Answer: C

Watch Video Solution

5. If a force of $250N$ acts on a body, the momentum required is $125kgm^{-1}$. The period for which the force acts on the body is .

A. $0.1s$

B. $0.3s$

C. $0.5s$

D. $0.2s$

Answer: C

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6. A machine gun fires a bullet of mass 40 g with a velocity $1200ms^{-1}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fire per second at the most?

A. One

B. Three

C. Two

D. Four

Answer: B

Watch Video Solution

7. A truck of mass $500kg$ is moving with constant speed $10ms^{-1}$. If sand is dropped into the truck at the constant rate $10k\frac{g}{\min}$,the force required to mainatain the motion with constant velocity is .

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

B. $\frac{5}{4}N$

C. $\frac{7}{5}N$

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

Answer: D

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8. A 5000 kg rocket is set for verticle firing. The relative speed of burnt gas is $800ms^{-1}$. To give an initial upwards acceleration of $20ms^{-2}$, the amount of gas ejected per second to supply the needed thrust will be

A. $127.5kgs^{-1}$

B. $137.5kgs^{-1}$

C. $187.5kgs^{-1}$

D. $185.5 kgs^{-1}$

Answer: C

Watch Video Solution

9. A small sphere of mass $m = 2kg$ moving with a velocity $\bar{u} = 4\hat{i} - 7\hat{j}m/s$ colides with a smooth wall and returns with a velocity $\bar{v} = -\hat{i} + 3\hat{j}m/s$. The magnitude of the impulse received by the ball is .

A. $5 kgms^{-1}$

B. $10\sqrt{5}kgms^{-1}$

C. $20kgms^{-1}$

D. $15kgms^{-1}$

Answer: B

Watch Video Solution

10. A ball of mass $'m'$ is thrown at an angle is $'\theta'$ with the horizontal with an initial velcoity 'u'. The change in its momentum during its flight in a time interval of 't' is .

A. mgt

B. mgt $\cos \theta$

C. mgt $\sin\theta$

D. ½mgt

Answer: A

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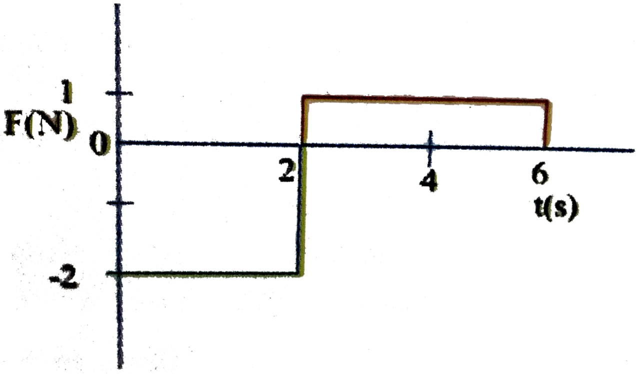
11. A force time graph for the motion of a body is as shown in Change in linear momentum between 0 and 6s is



A. zero

B. $8Ns$

C. $4Ns$

D. $2Ns$

Answer: A

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12. An object of mass $3kg$ is at rest. Now a force of $\overrightarrow{F} = 6t^2\hat{I} + 4t\hat{j}$ is applied on the object, the velocity of object at $t = 3s$ is.

A. $18\overrightarrow{i} + 3\overrightarrow{j}$

B. $18\overrightarrow{i} - 3\overrightarrow{j}$

C. $3\overrightarrow{i} - 18\overrightarrow{j}$

D. $3\overrightarrow{i} + 18\overrightarrow{j}$

Answer: A

Watch Video Solution

13. An impulse $\overrightarrow{I}$ changes the velocity of a particle from $\overrightarrow{v}_1$ to $\overrightarrow{v}_2$. Kinetic energy gained by the particle is :-

A. $I(v_1 + v_2)$

B. $I(v_1 + v_2)/2$

C. $I(v_1 - v_2)$

D. $I(v_1 - v_2)/2$

Answer: B

Watch Video Solution

14. A $60kg$ man is inside a lift which is moving up with an acceleration of $2.45_{ms^{-2}}$. The appar-ent percentage change in his weight is .

A. 20%

B. 25%

C. 50%

D. 75%

Answer: B

Watch Video Solution

15. The apparent weight of a man in a lift is W_1 when lift moves upwards with some acceleration and is W_2 when it is accerating down with same acceleration. Find the true weight of the man and acceleration of lift .

A. $\dfrac{W_1 + W_2}{2}$

B. $\dfrac{W_1 + W_2}{2}$

C. $2W_1$

D. $2W_2$

Answer: A

Watch Video Solution

16. A person of mass $60mg$ is in a lift The change in the apparent weight of the person when the lift moves up with acceleration of ms^{-2} and the down with an acceleration of $2ms^{-2}$ is (take $g = 10m/\sec^2$) .

A. $120N$

B. $240N$

C. $480N$

D. $720N$

Answer: B

View Text Solution

17. A rope of length $10m$ and linear density $0.5kg/m$ is lying length wise on a smooth horizontal floor It is pulled by a force of $25N$.

The tension in the rope at a point $6m$ away from the point of application is .

A. $20N$

B. $15N$

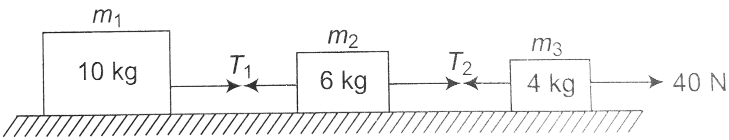
C. $10N$

D. $5N$

Answer: C

Watch Video Solution

18. There blocks of masses m_1 , m_2 and m_3 are connected by may less unstretchable strings on a smooth surface. Tension T_2 is.



A. $10N$

B. $20N$

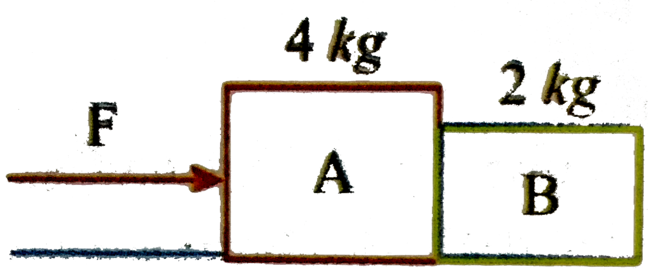
C. $32N$

D. $40N$

Answer: C

Watch Video Solution

19. A horizontal force F pushes a $4kg$ block (A) which pushes against a $2kg$ block (B) as shown The have an acceleration of $3m/s^2$ to the right There is no friction between the blocks and the surface on which they slide. What is the net force B exerts on A



A. $6N$ to the right

B. $12N$ to the right

C. $6N$ to the left

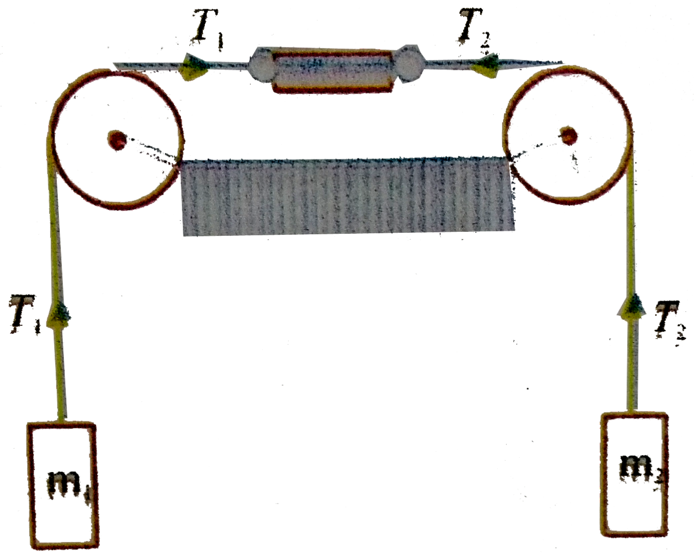
D. $12N$ to the left

Answer: C

Watch Video Solution

20. Two masses m_1 and m_2 are attached to a spring balance S as shown in figure. $m_1 > m_2$

then the reading of spring balance will be .



A. $(m_1 - m_2)$

B. $(m_1 + m_2)$

C. $\dfrac{2m_1m_2}{m_1 + m_2}$

D. $\dfrac{m_1m_2}{m_1 + m_2}$

Answer: C

Watch Video Solution

21. The masses $(M+m)$ and $(M-m)$ are attached to the ends of a light inextensible string and the string is made to pass over the surface of a smooth fixed pulley. When the masses are relased from rest the acceleraion of the system is .

A. gm / M

B. $2gM / m$

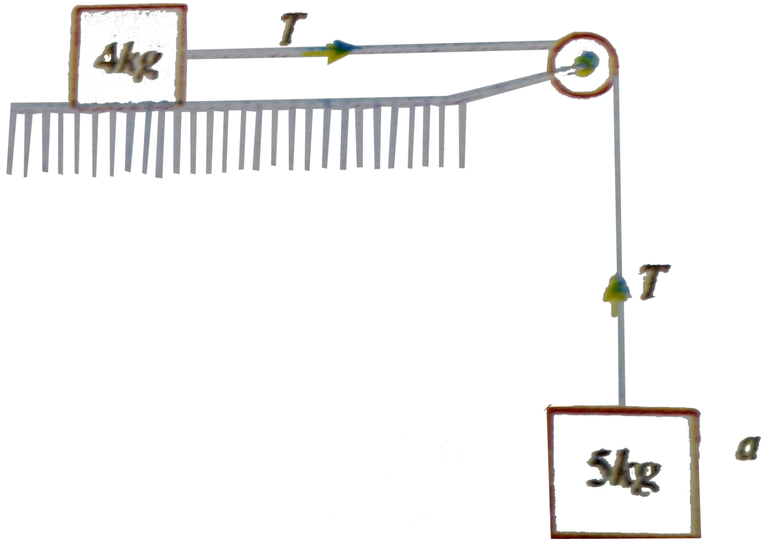
C. $gm / 2M$

D. $g(M^2 - m^2) / 2M$

Answer: A

Watch Video Solution

22. Two bodies of masses $5kg$ and $4kg$ are tied to a string as shown If the table and pulley are smooth, then acceleration of $5kg$ mass will be



A. $19.5m / s^2$

B. $0.55m / s^2$

C. $2.72m / s^2$

D. $5.45m / s^2$

Answer: D

Watch Video Solution

23. The object at rest suddenly explodes into three parts with the mass ratio $2:1:1$. The parts of other with equal speed 'v' the speed of the third part after explosion will be .

A. v

B. $\sqrt{2}v$

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

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

Answer: D

View Text Solution

24. A man and a cart move towards each other. The man weight $64kg$ and the cart weighs $32kg$. The velocity of the man is $5.4km/hr$ and that of the cart he jumps on to it The velocity of the cart carrying the man will be .

A. $3km/hr$

B. $30km/hr$

C. $1.8km/hr$

D. zero

Answer: A

Watch Video Solution

25. A bomb of mass $6kg$ initially at rest explodes in to three identical fragments On of the fragments moves with a velocity of $10\sqrt{3}\hat{i}m/s$ another frament moves with a velocity of $10\hat{j}m/s$ then the thired fragment moves with velocity of magnitude .

A. $30m/s$

B. $20m/s$

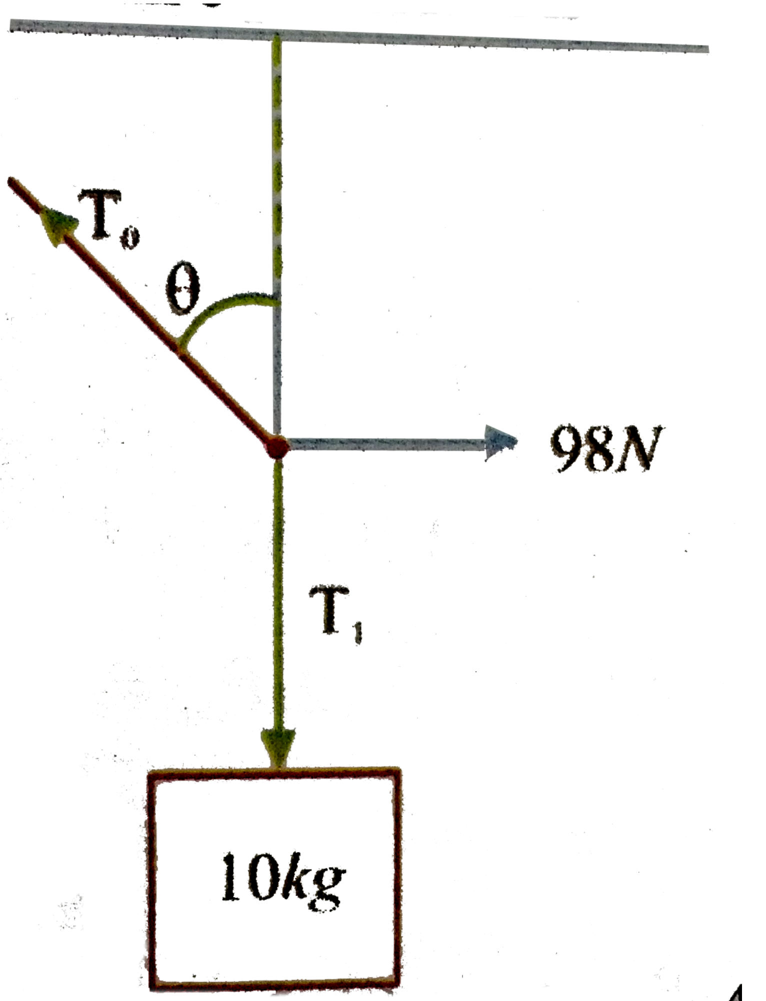
C. $15m/s$

D. $5m/s$

Answer: B

Watch Video Solution

26. A mass of $10kg$ is suspended by a rope of length $2.8m$ from a ceiling. A force of $98N$ is applied at the midpoint of the rope as shown in figure. The angle which the rope makes with the vertical in equilibrium is



A. 30°

B. 60°

C. 45°

D. 90°

Answer: C

Watch Video Solution

27. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is

A. Mg

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

C. $Mg(\sqrt{2}+1)$

D. $\sqrt{2}Mg$

Answer: A

Watch Video Solution

28. The coefficients of static and dynamic friction are 0.7 and 0.4 The minimum force required to create motion is applied on a body and if it is further continued the acceleration attained by the body in ms^{-2} is ($g = 10m/s^2$) .

A. 7

B. 4

C. 3

D. Zero

Answer: C

Watch Video Solution

29. The coefficients of static friction between contact surface of two bodies is 1. The contact surface of one body support the orther till the inclination is less than

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

Watch Video Solution

30. Brakes are applied to car moving with disengaged engine, bringing it to a halt after $2s$ Its velocity at the momnet when the breaks are applied if the coefficient of friction between the road and the tyres is 0.4 is .

A. $3.92ms^{-1}$

B. $7.84ms^{-1}$

C. $11.2ms^{-1}$

D. $19.6ms^{-1}$

Answer: B

Watch Video Solution

31. A book of weight $20N$ is pressed between two hands and each hand exerts a force of $40N$. If the block just starts to slide down Coefficient of friction is .

A. 0.25

B. 0.2

C. 0.5

D. 0.1

Answer: A

Watch Video Solution

32. A car running with a velocity $72kmph$ on a level road is stoped after travelling a distance of $30m$ after disengaging its engine $(g = 10m^{-2})$ The coefficient of friction between the road and the tyres is .

A. 0.33

B. 4.5

C. 0.67

D. 0.8

Answer: C

Watch Video Solution

33. In the above problem car got a stopping distance of $80m$ on cement road then μ_k is $\left(g = 10m/\sec^2\right)$.

A. 0.2

B. 0.25

C. 0.3

D. 0.35

Answer: B

View Text Solution

34. A 10 kg mass is resting on a horizontal surface and horizontal force of 80N is applied.

If $\mu = 0.2$, the ratio of acceleration without and with frication is $(g = 10ms)^2$

A. $3/4$

B. $4/3$

C. $1/2$

D. 2

Answer: B

Watch Video Solution

35. A block of mass $20kg$ is pushed with a horizontal force of $90N$. It the coefficient of static and kinetic friction are 0.4 and 0.3, the frictional force acting on the block is $\left(g=10ms^{-2}\right)$.

A. 90N`

B. $80N$

C. $60N$

D. $30N$

Answer: C

Watch Video Solution

36. A force of $150N$ produces an acceleration of $2ms^{-2}$ in a body and a force of $200N$ produces an acceleration of $3ms^{-2}$ The mass of the body and the coefficincent of kinetic friction are .

A. $50kg, 0.1$

B. $25kg, 0.1$

C. $50kg, 0.5$

D. $50kg, 0.2$

Answer: A

Watch Video Solution

37. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.5, the maximum percentage of the length of the chain that can hang over one edge of the table is

A. $20\ \%$

B. $25\ \%$

C. $35\ \%$

D. $15\ \%$

Answer: A

Watch Video Solution

38. The angle of inclination of an inclined plane is 60°. Coefficient of friction between $10kg$ body on it and its surface is

$0.2, g = 10ms^{-2}$. The acceleration of the body down the plane in ms^{-2} is .

A. 5.667

B. 6.66

C. 7.66

D. Zero

Answer: C

Watch Video Solution

39. The angle of inclination of an inclined plane is 60°. Coefficient of friction between $10kg$ body on it and its surface is 0.2, $g = 10ms^{-2}$. The acceleration of the body down the plane in ms^{-2} is .

In the above problem the frictional force on the body is .

A. '56.N6'

B. $66.6N$

C. $76.6N$

D. $86.6N$

Answer: C

Watch Video Solution

40. The angle of inclination of an inclined plane is 60°. Coefficient of friction between $10kg$ body on it and its surface is $0.2, g = 10ms^{-2}$. The acceleration of the body down the plane in ms^{-2} is .

In the above problem the minimum force on the body is .

A. Zero

B. $5N$

C. $7.5N$

D. $10N$

Answer: D

Watch Video Solution

41. The angle of inclination of an inclined plane is 60°. Coefficient of friction between $10kg$ body on it and its surface is 0.2, $g = 10ms^{-2}$. The acceleration of the body down the plane in ms^{-2} is

In the above problem the minimum, force required to pull the body up the inclined plane

.

A. $66.6N$

B. $86.6N$

C. $96.6N$

D. $76.6N$

Answer: C

Watch Video Solution

42. When a body slides down an inclined plane with coefficient of friction as μ_k, then its acceleration is given by .

A. $g(\mu_k \sin\theta + \cos\theta)$

B. $g(\mu_k \sin\theta - \cos\theta)$

C. $g(\mu_k \sin\theta + \mu_k \cos\theta)$

D. $g(\sin\theta - \mu_k \cos\theta)$

Answer: D

Watch Video Solution

43. A brick of mass 2kg begins to slide down on a plane inclined at an angle of 45° with the horizontal. The force of friction will be

A. $19.6 \sin 45^\circ$

B. $9.8\sin 45^\circ$

C. $19.6\cos 45^\circ$

D. $9.8\cos 45^\circ$

Answer: A

Watch Video Solution

44. The lengths of smooth & rough inclined planes of inclination 45° is same Times of sliding of a body on two surface $t_1 t_2$ and $\mu = 0.75$ then $t_1 : t_2 =$.

A. $2:1$

B. $2:3$

C. $1:2$

D. $3:2$

Answer: C

Watch Video Solution

45. A block of weight $200N$ is pulled along a rough horizontal surface at contant speed by a force of $100N$ acting at an angle 30° above the horizontal. The coefficient of kinetic friction between the block and the surface is .

A. 0.43

B. 0.58

C. 0.75

D. 0.83

Answer: C

Watch Video Solution

46. The centripetal force required by a 1000 kg car that takes a turn of radius $50m$ at a speed of 36kmph is .

A. $1000N$

B. $3500N$

C. $1600N$

D. $2000N$

Answer: D

Watch Video Solution

47. A stone of mass $0.5kg$ is attached to a string of length $2m$ and is whirled in a horizontal circle. If the string can withstand a tension of $9N$ the maximum velcoity with which the stone can be whirled is .

A. $6ms^{-1}$

B. $8ms^{-1}$

C. $4ms^{-1}$

D. $12ms^{-1}$

Answer: A

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LEVEL -II (C.W)

1. The momenta of a body in two perpendicular directions at any time 't' are given by $P_x = 2t^2 + 6$ and $P_y = \frac{3t^2}{2} + 3$. The force acting on the body at $t = 2$ sec is .

A. $5units$

B. $2units$

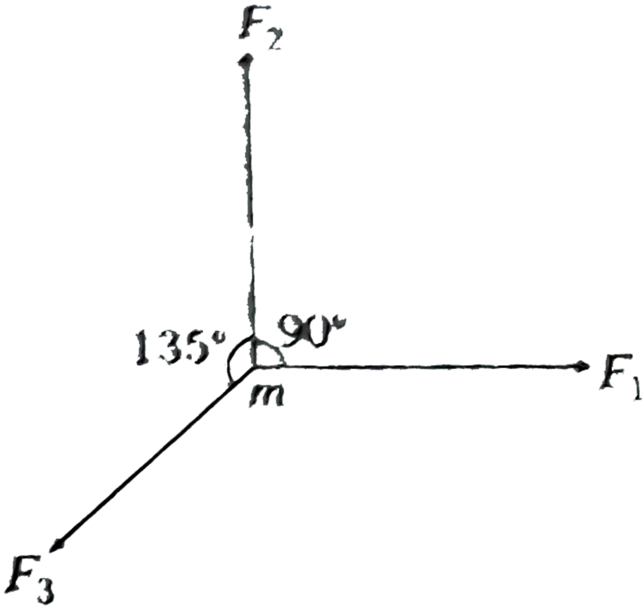
C. $10 units$

D. $15 units$

Answer: C

Watch Video Solution

2. When a force F acs on a body of mass m the acceleration product in the body is a . If htree equal forces $F_1 = F_2 = F_3 = F$ act on the same body as shown in figure the accleration produced is



A. $\left(\sqrt{2}-1\right)a$

B. $\left(\sqrt{2}+1\right)a$

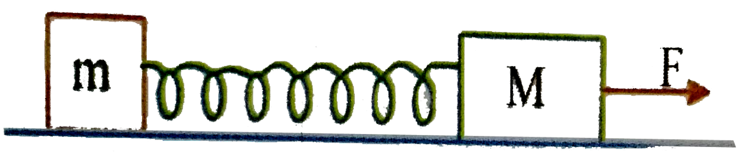
C. $\sqrt{2}a$

D. a

Answer: A

Watch Video Solution

3. Two blocks of masses m and M are placed on a horizontal frictionless table connected by light spring as shown in figure. The Mass M is pulled to the right with a force F It the acceleration of mass m is a then the acceleration of M will be .



A. $\dfrac{(F - ma)}{M}$

B. $\dfrac{(F + ma)}{M}$

C. $\dfrac{F}{M}$

D. $\dfrac{am}{M}$

Answer: A

Watch Video Solution

4. The displacement of a body moving along a straight line is givne by $S = bt^n$ where 'b' is a constant and 't' is time. For what value of 'n' the body moves under the action of constant force ? .

A. $3/2$

B. 1

C. 2

D. $1/2$

Answer: C

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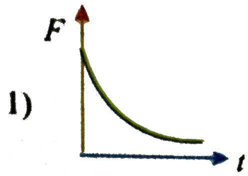
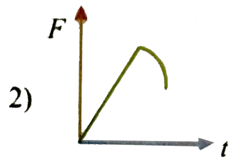
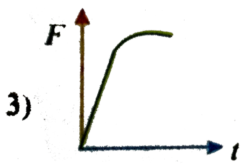
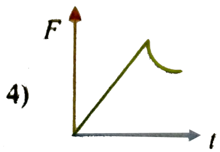
5. If $F = F_0\left(1 - e^{-1/\lambda}\right)$ the F-t graph is .`

A. 

B. 

C. 

D. 

Answer: C

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6. Three forces $20\sqrt{2}N, 20\sqrt{2}N$ and $40N$ are acting along X, Y and $Z -$ axes respectively on a $5\sqrt{2}kg$ mass at rest at the origin. The magnitude of its displacement after $5s$ is .

A. $50m$

B. $25m$

C. $60m$

D. $100m$

Answer: D

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7. A horizontal jet of water coming out of a pipe of area of cross-section $20cm^2$ hits a vertical wall with a velocity of $10ms^{-1}$ and rebounds with the same speed. The force exerted by water on the wall is .

A. $0.2N$

B. $10N$

C. $400N$

D. $200N$

Answer: C

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8. A rocket of mass $40kg$ has $160kg$ fuel. The exhaust velocity of the fuel is $2.0km/s$. The rate of consumption of fuel is $4kg/s$. Calculate the ultimate vertical speed gained by the rocket. $(g = 10m/s^2)$

A. $2.82 km s^{-1}$

B. $4.82 km s^{-1}$

C. $3.61 km s^{-1}$

D. $5.62 km s^{-1}$

Answer: A

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9. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u} = 30\hat{i} + 40\hat{j} m s^{-1}$. If a constant force $\vec{F} = -\left(\hat{i} + 5\hat{j}\right) N$ acts on the body, the time in which the y-component of the velocity becomes zero is

A. $5s$

B. $20s$

C. $40s$

D. $80s$

Answer: C

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10. A professional diver of mass $60kg$ performs a dive from a platform $10m$ above the water surface. Find the magnitude of the average impact force experienced by him if the impact time is $1s$ on collision with water surface. Assume that the velocity of the diver just after enering the water surface is $4ms^{-1}(g = 10ms^{-2})$.

A. $240N$

B. $600N$

C. $300N$

D. $60N$

Answer: B

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11. An open knife edge of mass 200g is dropped from height 5m on a cardboar. If the knife edge penetrates a distance 2 m into the cardboard. Find the average resistance offered by the cardboar to the knife edge (in N).

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

A. $7N$

B. $25N$

C. $35N$

D. None

Answer: A

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12. Six forces lying in a plane and forming angles of 60° relative to one another are applied to the centre of a homogeneous sphere with a mass $m = 6kg$. These forces are radially outward and consecutively $1N$, $2N$, $3N$, $4N$, $5N$ and $6N$ The acceleration of the sphere is .

A. 0

B. $1/2m/s^2$

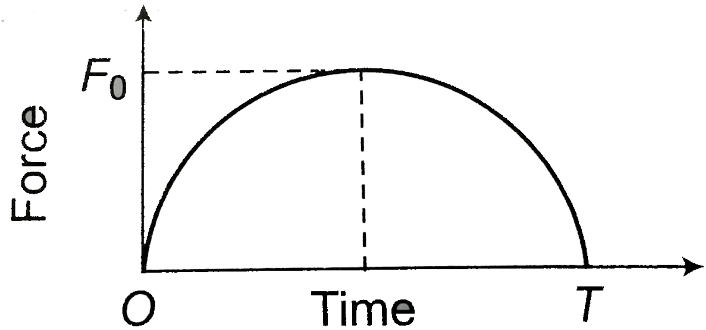
C. $1m/s^2$

D. $2m / s^2$

Answer: C

Watch Video Solution

13. A particle of mass m , initially at rest , is acted upon by a variable force F for a brief interval of time T. It begins to move with a velocity u after the force stops acting . F is shown in the graph as a function of time. The curve is a semicircle.



A. $u = \frac{\pi F_0^2}{2m}$

B. $u = \frac{\pi T^2}{8m}$

C. $u = \frac{\pi F_0 T}{4m}$

D. $u = \frac{\pi F_0 T}{2m}$

Answer: C

Watch Video Solution

14. A ball of mass $0.2kg$ strikes an obstacle and moves at 60° to its original direction If its speed also changes from $20m/s$ to $10m/s$, the magnitude of the impulse received by the ball is .

A. $2\sqrt{7}Ns$

B. $2\sqrt{3}Ns$

C. $2\sqrt{5}Ns$

D. $3\sqrt{2}Ns$

Answer: B

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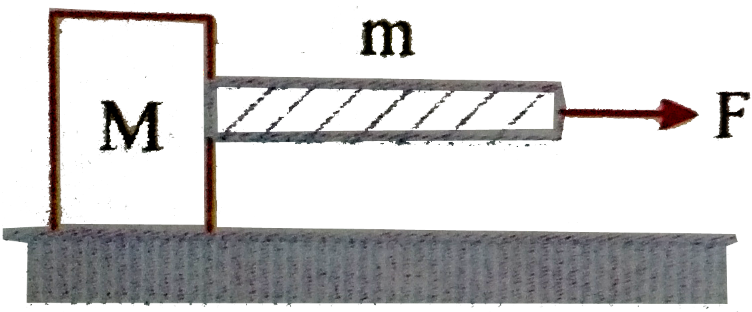
15. The block is placed on a frictionless surface in gravity free space. A heavy string of a mass m is conncected and force F is applied on the string then the tension at the middle of rope is



.

A. $\frac{\left(\frac{m}{2}+M\right).F}{m+M}$

B. $\frac{\left(\frac{M}{2}+m\right).F}{m+M}$

C. zero

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

Answer: A

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16. A ball is suspended by a thread from the ceiling of a tram car. The brakes are applied and the speed of the car changes uniformly from $36 kmh^{-1}$ to zero is $5 s$. The angle by which the ball deviates from the vertical is $(g = 10 ms^{-2})$.

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

B. $\sin^{-1}\left(\frac{1}{5}\right)$

C. $\tan^{-1}\left(\frac{1}{5}\right)$

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

Answer: C

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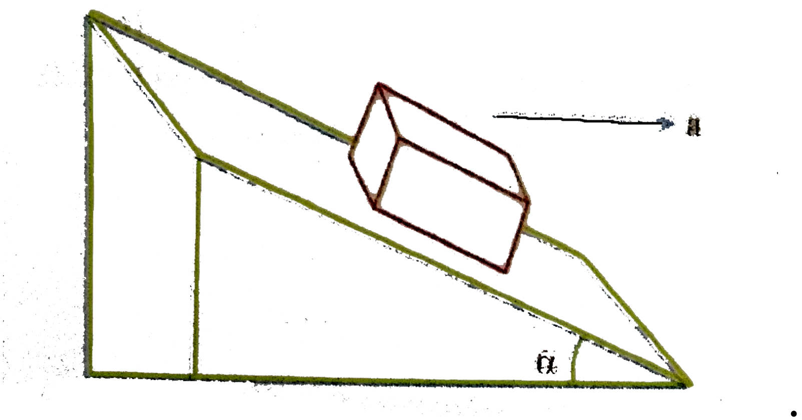
17. A block is kept on a frictionless inclined surface with angle of inclination α. The incline is given an acceeration 'a' to keep the block stationary Then 'a' is equal to



A. $\dfrac{g}{\tan\alpha}$

B. $g\cos ec\alpha$

C. g

D. $g\tan\alpha$

Answer: D

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18. A man sits on a chair supported by a rope passing over a frictionless fixed pulley. The man who weighs $1,000N$ exerts a force of $450N$ on the chair downwards while pulling the rope on the other side. If the chair weighs $250N$ then the acceleration of the chair is .

A. $0.45m/s^2$

B. 0

C. $2m/s^2$

D. $9/25m/s^2$

Answer: C

Watch Video Solution

19. A balloon of mass M is descending at a constant acceleration α. When a mass m is released from the balloon it starts rising with the same acceleration α Assuming that its volume does not change what is the value of m. ?

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

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

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

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

Answer: B

Watch Video Solution

20. A monkey of mass $40kg$ climbs on a massless rope of breaking strenght $600N$. The rope will break if the monkey (Take $g = 10m/s^2$) .

A. climbs up with a uniform speed of $6m/s$

B. climbs up with an acceleration of $6m/s^2$

C. climbs with an acceleration of $4m/s^2$

D. climbs down with a uniform speed of of

$5m/s^2$

Answer: B

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21. Two persons are holding a rope of negligible weight tightly at its ends so that it is horizontal. A $15kg$ weight is attached to rope at the midpoint which now no more remains horizontal The minimum tension required to completely straighten the rope is .

A. $150N$

B. $75N$

C. $50N$

D. Infinitely large

Answer: D

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22. A uniform rope of length L is pulled by a constant force F. What is the tension in the rope at a distance l from the end where it is applied?

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

B. $\frac{LF}{l}$

C. $\left(1-\frac{l}{L}\right)F$

D. $\left(1+\frac{l}{L}\right)F$

Answer: C

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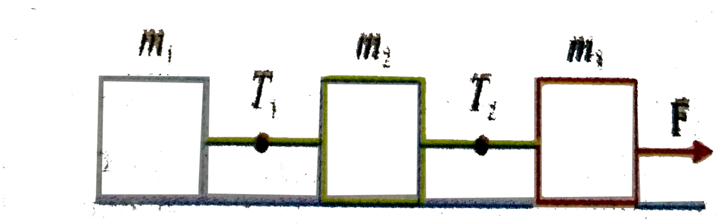
23. Consider three blocks of masses m_1, m_2, m_3 interconnected by strings which are pulled by a common force F on a frictionless horizontal tabel as in the figure. The tension T_1 and T_2 are also indicated



a) $T_2 > T_1$ if $m_2 > m_1$

b)$T_2 = T_1$ if $m_2 = m_1$, c) $T_2 > T_1$ always

d) acceleration of the system $\dfrac{F}{m_1 + m_2 + m_3}$

.

A. a, b

B. b, d

C. a, d

D. c, d

Answer: D

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24. A railway engine of mass 50 tons is pulling a wagon of mass 40 tons with a force of $4500N$. The resistance force acting is $1N$ per ton The tension in the coupling between the engine and the wagon is .

A. $1600N$

B. $2000N$

C. $200N$

D. $1500N$

Answer: B

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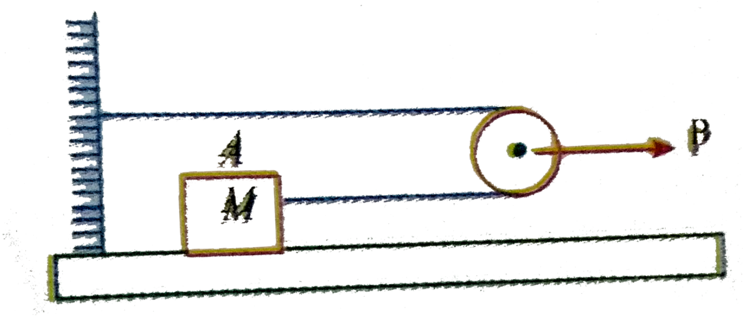
25. In the following figure, the pulley is massless and frictionless. There is no friction between the body and the floor. The acceleration produced in the body when it is displaced through a certain disatnace with force 'P' will be



.

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

B. $\frac{P}{2M}$

C. $\frac{P}{3M}$

D. $\frac{P}{4M}$

Answer: B

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26. Two identical blocks each of mass "M" are tied to the ends of a string and the string is laid over a smooth fixed pulley. Initially the masses are held at rest at the same level. What fraction of mass must be removed from one block and added to the other, so that is has an acceleration of $1/5^{th}$ of the acceleration due to gravity ? .

A. $1/10$

B. $1/5$

C. $2/5$

D. $1/20$

Answer: B

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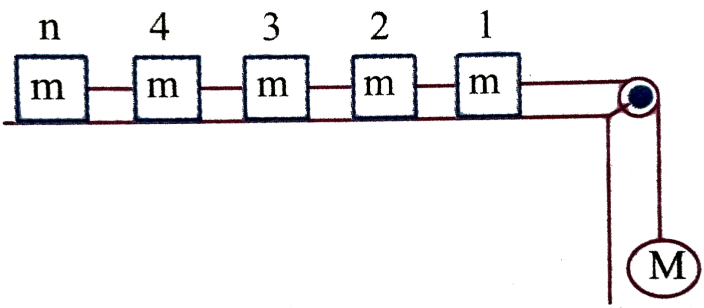
27. In the given arrangement, n number of equal masses are connected by stings of negligible masses. The tension in the string connected to n^{th} mass is



A. $\dfrac{mMg}{nm+M}$

B. $\dfrac{mMg}{nmM}$

C. mg

D. mng

Answer: A

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28. A block weighing $4N$ is supported by two ropes Once rope is horizontal and the other makes an angle of 30° with the ceilling The tension (in newton) in the rope attached to the ceilling is .

A. $80N$

B. $40N$

C. $34.6N$

D. $46.2N$

Answer: A

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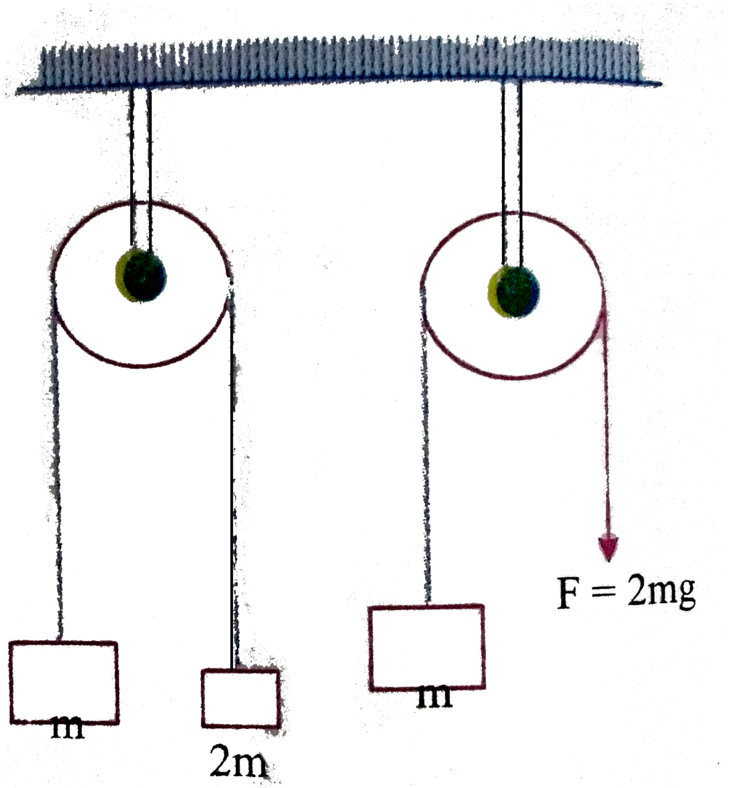
29. The pulley arrangements shown in figure are identical, the mass of the rope being negligible. In case I the mass m is lifted by attaching a mass $2m$ to the other end of rope with a constant downward force $F = 2mg$, where g is acceleration due to gravity The acceleration of mass m in case I is



A. zero

B. more than that is case II

C. less than that in case

D. equal to that in case II

Answer: C

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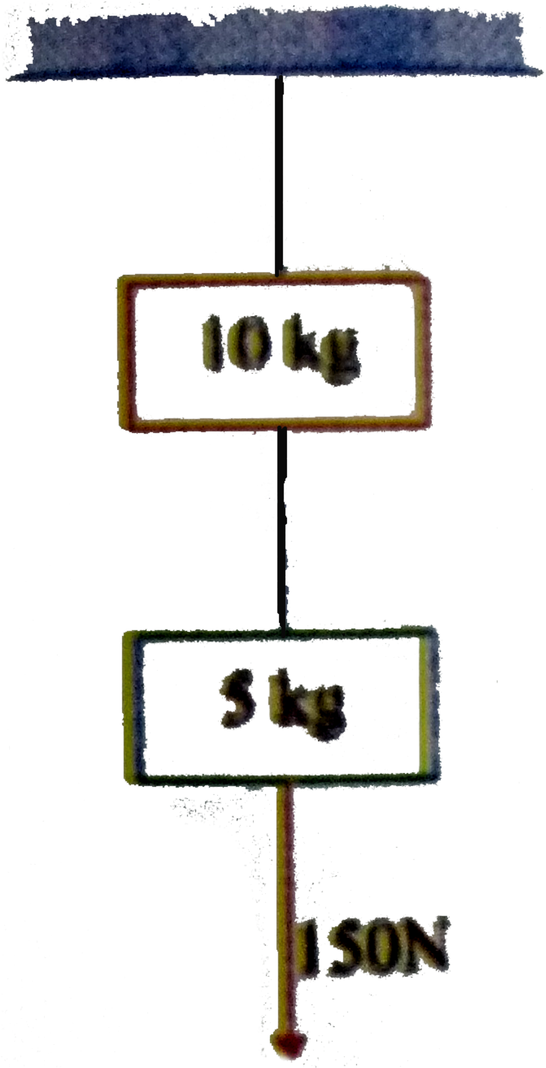
30. Two masses of $10kg$ and $5kg$ are suspended from a rigid support as shown in figure. The system is pulled down with a force of $150N$ attached to the lower mass. The string attached to the support breaks and the

system accelerates downwards



In case the force continues to act. what will be the tension acting between the two masses ? .

A. $300N$

B. $200N$

C. $100N$

D. zero

Answer: C

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31. Two bodies of masses $3kg$ and $2kg$ are connected by a along string and the string is made to pass over a smooth fixed pulley Initially the bodies are held at the saem level and released from rest. The velocity of the $3kg$ body after one second is $\left(g = 10m / s^2\right)$.

A. $2m / s$

B. $1m / s$

C. $0.4m / s$

D. $4m / s$

Answer: A

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32. A block of mass $3kg$ which is on a smooth inclined plane making angie of 30° to the horizontal is connected by cord passing over light frictionless pulley to second block of mass $2kg$ hanging vertically. What is the acceleration of each block and waht is the tension of the cord ? .

A. $0.98m/s^2, 17.6N$

B. $1.98m/s^2, 19.6N$

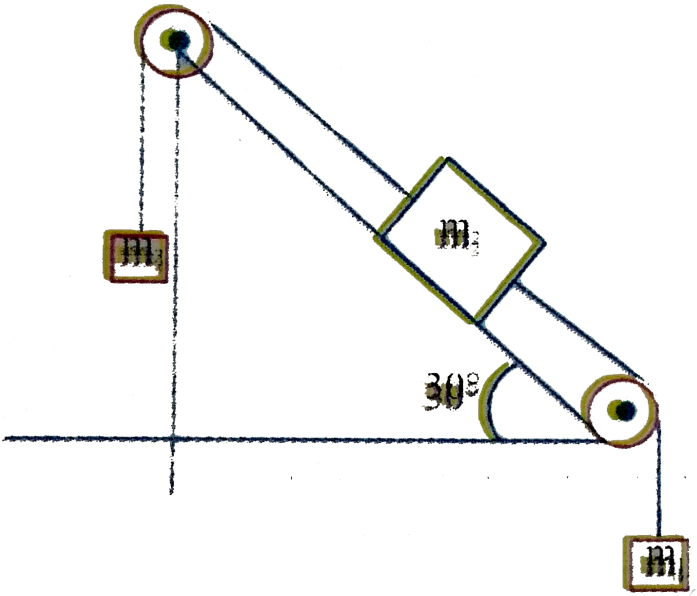
C. $0.49m/s^2, 9.8N$

D. $1.47m/s^2, 4.9N$

Answer: A

Watch Video Solution

33. If $m_1 = 10kg, m_2 = 4kg, m_3 = 2kg,$ the acceleration of system is



A. $5g/2$

B. $5g/3$

C. $5g/8$

D. $5g/14$

Answer: C

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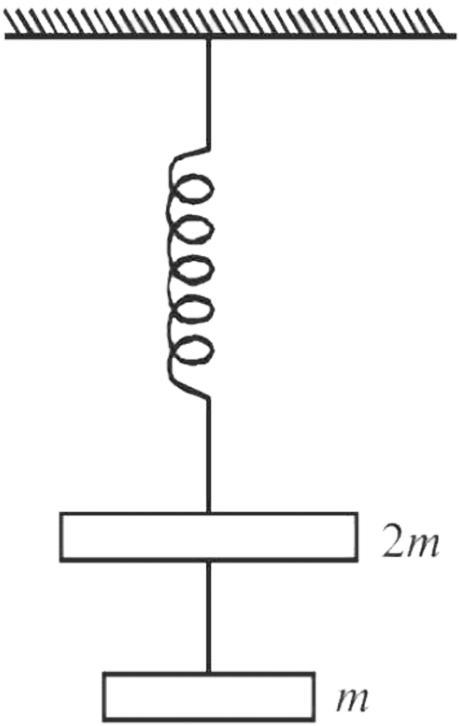
34. The string between blocks of mass m and 2m is massless and inextensible. The system is suspended by a massless spring as shown. If the string is cut find the magnitudes of accelerations of mass 2m and m (immediately

after cutting)



A. g, g

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

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

D. $\frac{g}{2}, \frac{g}{2}$

Answer: C

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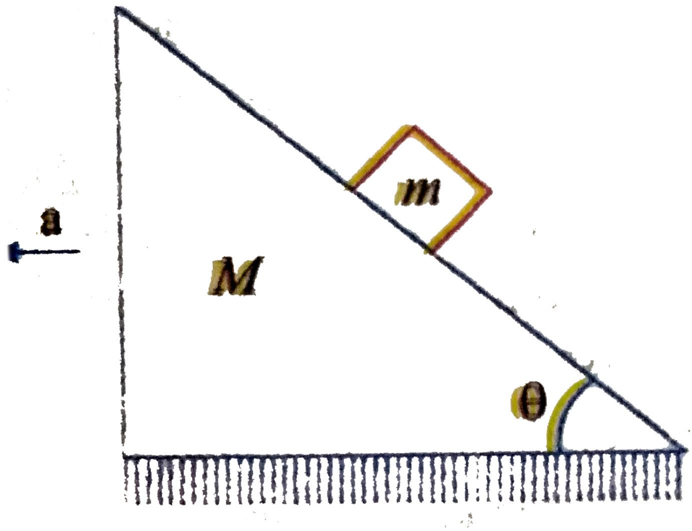
35. All surfaces are smooth The acceleration of mass m relative to the wedge is



A. $g \sin \theta$

B. $g \sin \theta + a \cos \theta$

C. $g \sin \theta - a \cos \theta$

D. $a \cos \theta$

Answer: B

Watch Video Solution

36. A bullet of mass $10gm$ moving with a horizontal velocity $100m/s$ passes through a wooden block of mass $100gm$. The block is resting on a smooth horizontal floor. After passing through the block the velocity of the bullet is $10m/s$ the velocity of the emerging bullet with respect to the block is .

A. $10m/s$

B. $9m/s$

C. $1m / s$.

D. $5m / s$

Answer: C

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37. A shell is fired from the ground at an angle θ with horizontal with a velocity 'v'. At its highest point it breaks into two equal fragments. if one fragment comes back through its initial line of motion with same speed then the speed of the second fragment will be .

A. $3v \cos \theta$

B. $3v \cos \theta / 2$

C. $2v \cos \theta$

D. $\sqrt{3}v \cos \theta / 2$

Answer: A

Watch Video Solution

38. Two trolleys of mass m and $3m$ are attached by a spring. The spring was compressed and then released , they move off in opposite direction and comes to rest after covering distances s_1 and s_2 respectively. Assuming the coefficient of friction to be uniform , the ratio of distances $s_1 : s_2$ is

A. $1 : 9$

B. $1 : 3$

C. $3 : 1$

D. $9:1$

Answer: D

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39. Two particles of masses m_1 and m_2 in projectile motion have velocities $\overrightarrow{v}_1$ and $\overrightarrow{v}_2$, respectively, at time $t=0$. They collide at time t_0. Their velocities become $\overrightarrow{v'}_1$ and $\overrightarrow{v'}_2$ at time $2t_0$ while still moving in air. The value of

$$\left|\left(m_1\overrightarrow{v'}_1+m_2\overrightarrow{v'}_2\right)-\left(m_1\overrightarrow{v}_1+m_2\overrightarrow{v}_2\right)\right|$$

A. zero

B. $(m_1 + m_2)\mathrm{gt}_0$

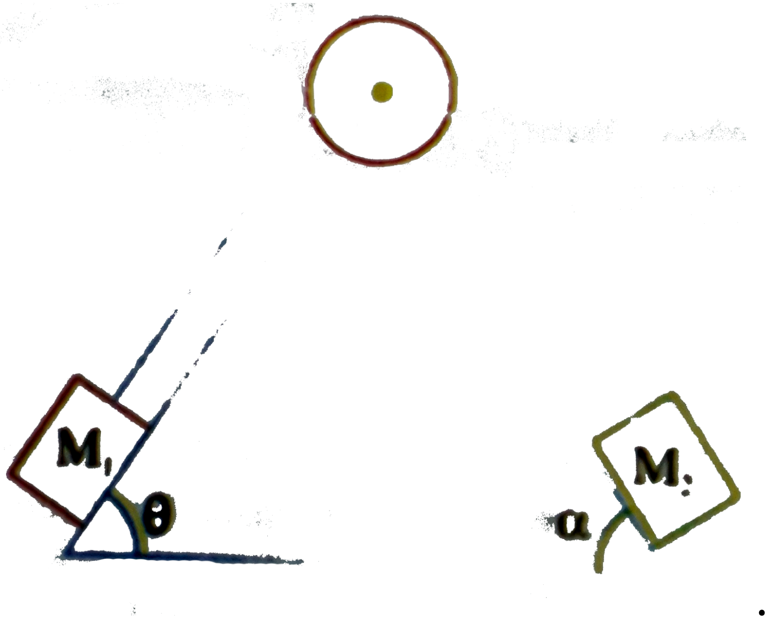
C. $2(m_1 + m_2)\mathrm{gt}_0$

D. $\frac{1}{2}(m_1 m_2)\mathrm{gt}_0$

Answer: C

Watch Video Solution

40. Two masses M_1 and M_2 connected by means of a string which is made to pass over light, smooth pulley are in equilibrium on a fixed smooth wedge as shown in figure. If $\theta = 60^\circ$ and $\alpha = 30^\circ$ then the ratio of M_1 to M_2 is



A. $1 : 2$

B. $2 : \sqrt{3}$

C. $1 : \sqrt{3}$

D. $\sqrt{3} : 1$

Answer: C

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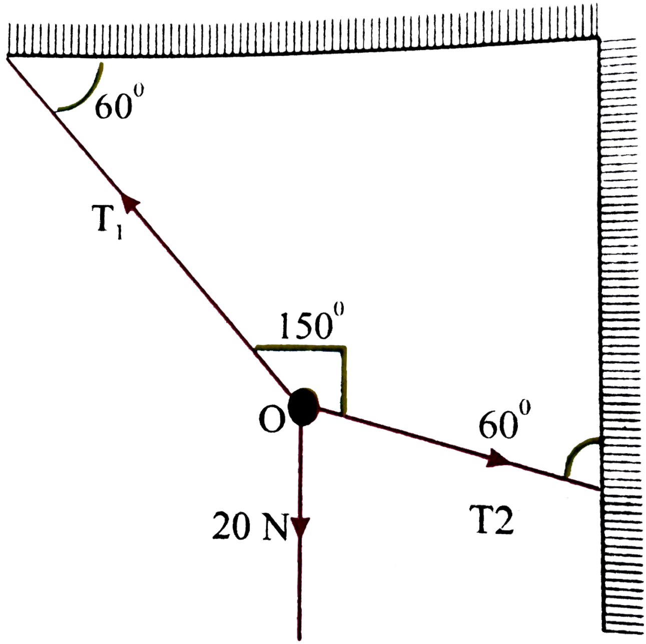
41. If O is at equilibrium then the values of the tension T_1 and T_2 are, ($20N$ is acting vertically downwards at O).



A. $20N$, $30N$

B. $20\sqrt{3}N$, $20N$

C. $20\sqrt{3}N$, $20\sqrt{3}N$

D. $10N$, $30N$

Answer: B

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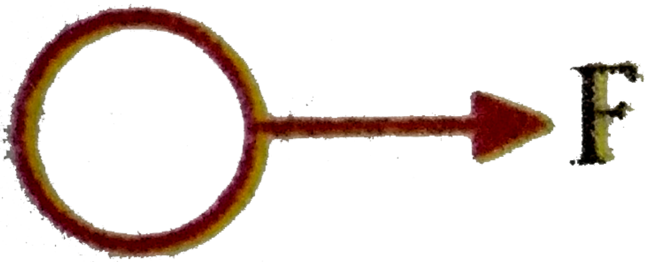
42. A $1N$ pendulum bob is held at an angle θ from the vertical by a $2N$ horizontal force F as shown in figure. The The tension in the string supporting the pendulum bob (in newton) is



A. $\cos\theta$

B. $\dfrac{2}{\cos\theta}$

C. $\sqrt{5}$

D. 1

Answer: C

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43. The coefficient of friction between a hemispherical bowl and an insect is $\sqrt{0.44}$ and the radius of the bowl is $0.6m$. The maximum height to which an insect can crawl in the bowl will be .

A. $0.4m$

B. $0.2m$

C. $0.3m$

D. $0.1m$

Answer: D

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44. A $500kg$ horse pulls a cart of mass $1500kg$ along a level road with an acceleration of $1m/s^2$. if coefficient of sliding friction is 0.2 then force exerted by the earth on horse is .

A. $3000N$

B. $4000N$

C. $5000N$

D. $6000N$

Answer: D

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45. An aeroplane requires for take off a speed of 108 kmph the run on the ground being $100m$ mass of the plane is $10^4 kg$ and the coefficinet of friction between the plane and the ground is 0.2. Assuming the plane accelerates uniformly the minimum force required is $\left(g = 10ms^{-2}\right)$.

A. $2 \times 10^4 N$

B. $2.43 \times 10^4 N$

C. $6.5 \times 10^4 N$

D. $8.86 \times 10^4 N$

Answer: C

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46. A duster weighs $0.5N$. It is pressed against a vertical board with a horizontal force $11N$ If the co-efficient of friction is 0.5 the mimmum force that must be applied on the duster parallel to the board to move it upwards is .

A. $0.4N$

B. $0.7N$

C. $6N$

D. $7N$

Answer: C

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47. A man of mass $65kg$ is standing stationary with respect to a conveyor belt which is accelerating with $1m/s^2$. if μ_s is 0.2 the net force on the man and the maximum acceleration of the belt so that the man is stationary relative to the belt are $(g = 10m/s^2)$.

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

B. $65N, 2m/s^2$

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

D. $65N, 1m/s^2$

Answer: A

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48. A man of mass $60kg$ sitting on ice pushes a block of mass $12kg$ on ice horizontally with a speed of $5ms^{-1}$ The coefficient of friction between the man and ice and between block and ice is $0.2Ifg = 10ms^2$ the distance beteen man and the block when they come to rest is .

A. $6m$

B. $6.5m$

C. $3m$

D. $7m$

Answer: B

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49. A vehicle of mass M is moving on a rough horizontal road with a momentum P If the coefficient of friction between the tyres and the road is μ is then the stopping distance is .

A. $\frac{P}{2\mu Mg}$

B. $\frac{P^2}{2\mu Mg}$

C. $\frac{P^2}{2\mu M^2 g}$

D. $\frac{P^2}{2\mu M^2 g}$

Answer: C

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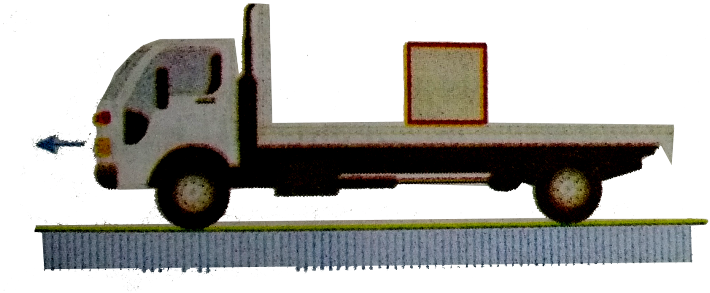
50. The rear side of a truck is open A box of $40kg$ mass is placed $5m$ away from the open end as shown in The coefficient of friction between the box and the surface is 0.15. On a straight road, the truck starts from rest and accel erating with $2m/s^2$. At what dis tance from the starting point does the box dis-tance from the starting point does the box fall from the truck? (Ignore the size of the box)



A. $20m$

B. $10m$

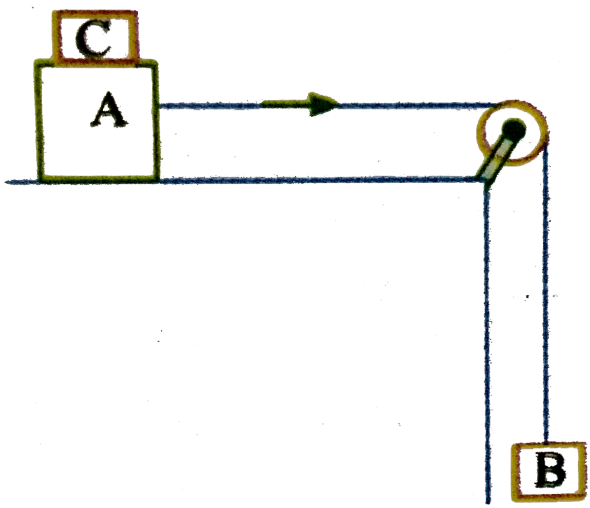
C. $\sqrt{20}m$

D. $5m$

Answer: A

Watch Video Solution

51. A block A of mass 3kg and another block B of mass $2kg$ are connected by a light inextensible string as shown in figure. If the coefficient of friction between the surface of the table and A is 0.5 What maximum mass C is to be placed on A so that the system is to be in equlibrium



A. $3kg$

B. $2kg$

C. $1kg$

D. $4kg$

Answer: C

Watch Video Solution

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

A. $\frac{v^2}{4\sin\theta}$

B. $\frac{v^2}{2\sin\theta}$

C. $\frac{v^2}{g\sin\theta}$

D. $\frac{4gv^2}{\sin\theta}$

Answer: A

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53. The minimum force required to start pushing a body up rough (frictional coefficient μ) inclined plane is F_1 while the minimum force needed to prevent it from sliding down is F_2. If the inclined plane makes an angle θ from the horizontal such that $\tan\theta = 2\mu$ then the ratio $\frac{F_1}{F_2}$ is

A. 4

B. 1

C. 2

D. 3

Answer: D

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54. 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. $\dfrac{\sqrt{l^2-l}}{g}$

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

Answer: A

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55. A body is released from the top of a smooth inclined plane of inclination θ. It reaches the bottom with velocity v. If the angle of inclina-tion is doubled for the same length of the plane, what will be the velocity of the body on reach ing the ground .

A. v

B. $2v$

C. $(2\cos\theta)^{\frac{1}{2}}v$

D. $(2\cos\theta)^{\frac{1}{2}}v$

Answer: C

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56. The force required to move a body up a rough inclined plane is double the force required to prevent the body from sliding down the plane. The coefficient of friction when the angle of inclination of the plane is 60° is .

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

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

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

D. $\frac{1}{3}$

Answer: B

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

A. $\mu_k = 1 - \frac{1}{n^2}$

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

C. $\mu_k = \dfrac{1}{1-n^2}$

D. $\mu_k = \sqrt{\dfrac{1}{1-n^2}}$

Answer: A

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58. 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. $\mu = 2\tan\theta$

B. $\mu = \dfrac{2}{\tan\theta}$

C. $\mu = \tan\theta$

D. $\mu = \dfrac{1}{\tan\theta}$

Answer: A

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59. A $30kg$ box has to move up an inclined plane of slope 30° the horizontal with a unform velocity of $5ms^{-1}$. If the frictional force retarding the motion is $150N$, the horizontal force required to move the box up is $\left(g = ms^{-2}\right)$.

A. $300 \times \dfrac{2}{\sqrt{3}}N$

B. $300 \times \dfrac{\sqrt{3}}{2}N$

C. $300N$

D. $150N$

Answer: A

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60. A block weighing $10kg$ is at rest on a horizontal table. The coefficient of static friction between the block and the table is 0.5. If a force acts downward at 60° with the horizontal, how large can it be without causing the block to move ? .$\left(g = 100ms^{-2}\right)$.

A. $346N$

B. $446N$

C. $746N$

D. $846N$

Answer: C

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

A. $\dfrac{W\cos\phi}{\cos(\theta-\phi)}$

B. $\dfrac{W\sin\phi}{\cos(\theta-\phi)}$

C. $\dfrac{W\tan\phi}{\sin(\theta-\phi)}$

D. $\dfrac{W\sin\phi}{\tan(\theta-\phi)}$

Answer: B

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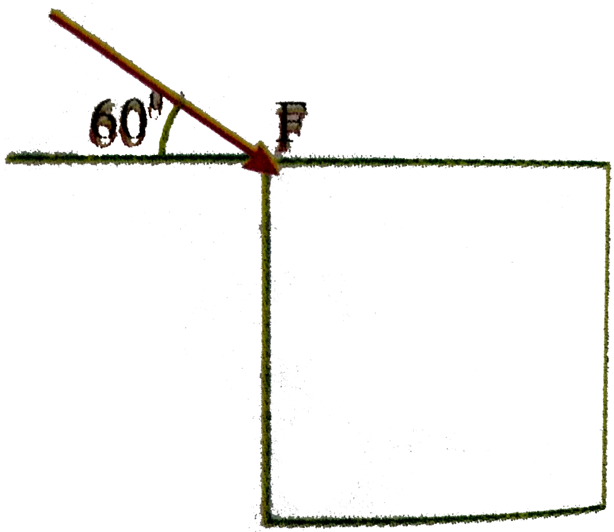
62. A block of mass $\sqrt{3}kg$ is kept on a frictional surface with $\mu = \frac{1}{2\sqrt{3}}$. The minimum force to be applied as shown the move the block is



A. $5N$

B. $20N$

C. $10N$

D. $20/3N$

Answer: B

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63. A car is moving in a circular horizonta track of radius 10m with a constant speed of 10 m/s. A pendulum bob is suspended from the roof of the cat by a light rigid rod of length 1.00m. The angle made by the rod with track is

A. 0°

B. 30°

C. 45°

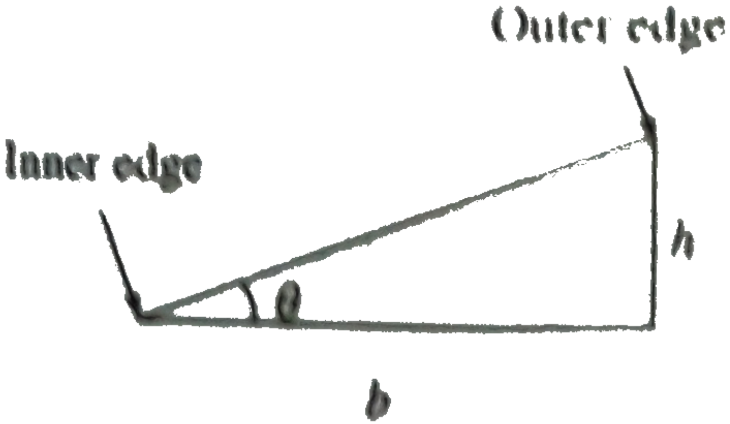
D. 60°

Answer: C

Watch Video Solution

64. A vehicle in moving with a velocity v on a carved total of width b and radius of curvature B For counteractiong the contritugal force on the vehicle , the difference in elevation required in between the outer and linner

edges of the rod is



A. $\frac{v^2b}{Rg}$

B. $\frac{rb}{Rg}$

C. $\frac{vb^2}{Rg}$

D. $\frac{vb}{R^2g}$

Answer: A

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65. The centripetal force required for a $1000kg$ car travelling at $36kmph$ to take a turn by 90° in travelling along an are of length $628m$ is .

A. $250N$

B. $500N$

C. $1000N$

D. $125N$

Answer: A

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66. A small coin is placed on a flat horizontal turn table. The turn table is observed to make three revolutions in $3.14 \sec$. What is the coefficient of static friction between the coin and turn table if the coin is observed to slide off the turn table when it is greater than $10cm$ from the centre of turn table .

A. 0.4

B. 0.36

C. 4

D. 0.004

Answer: B

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67. A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r.

Find a. the speed of the particle and b. the tension in the string. Sch a system is called a conical pendulum.

A. $\dfrac{rg}{\sqrt{L^2 - r^2}}$

B. $\dfrac{r\sqrt{g}}{\left(L^2 - r^2\right)^{\frac{1}{4}}}$

C. $\dfrac{r\sqrt{g}}{\left(L^2 - r^2\right)^{\frac{1}{2}}}$

D. $\dfrac{mgL}{\left(L^2 - r^2\right)^{\frac{1}{2}}}$

Answer: B

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68. Three point masses each of mass m are joined together using a string to form an equilateral triangle of side a. The system is placed on a smooth horizontal surface and rotated with a constant angular velcoity ω about a vertical axis passing through the centroid Then the tension in each string is .

A. $ma\omega^2$

B. $3ma\omega^2$

C. $\frac{ma\omega^2}{3}$

D. $\frac{ma\omega^2}{\sqrt{3}}$

Answer: C

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69. 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

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70. A car is travelling along a curved road of radius r. If the coefficient of friction between the tyres and the road is μ the car will skid if its speed exceeds .

A. $2\sqrt{\mu r g}$

B. $\sqrt{3\mu r g}$

C. $\sqrt{2\mu r g}$

D. $\sqrt{\mu r g}$

Answer: D

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71. A boy of mass $50kg$ is standing on a weihing machine placed on the floor of a lift. The machine reads his weight in newtons. The reading of the machine if the lift is moving upwards with uniform speed of $10ms^{-1}$.

A. $510N$

B. $480N$

C. $490N$

D. $500N$

Answer: C

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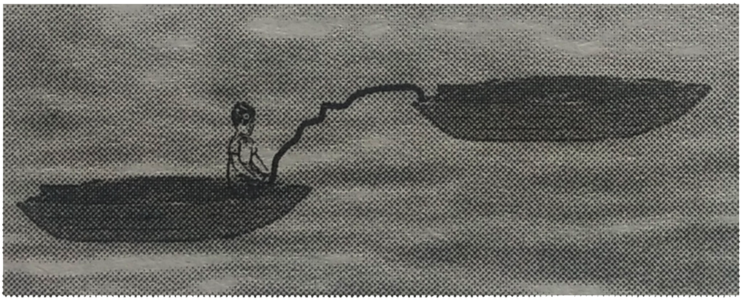
LEVEL -III

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



A. 13.8

B. 18.3

C. 3.18

D. 31.8

Answer: B

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2. In order to raise a mass of 100kg a man of mass 60kg fastens a rope to it and passes the rope over a smooth pulley. He climbs the rope with acceleration $5g/4$ relative to the rope. The tension in the rope is: Take $g = 10m/s^2$

A. $1432N$

B. $928N$

C. $1218N$

D. $642N$

Answer: C

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3. In the pulley-block arrangement shown in figure , find the relation between acceleration of blocks A and B

A. $a_B = -3a_A$

B. $a_B = -a_A$

C. $a_B = -2a_A$

D. $a_B = -4a_A$

Answer: A

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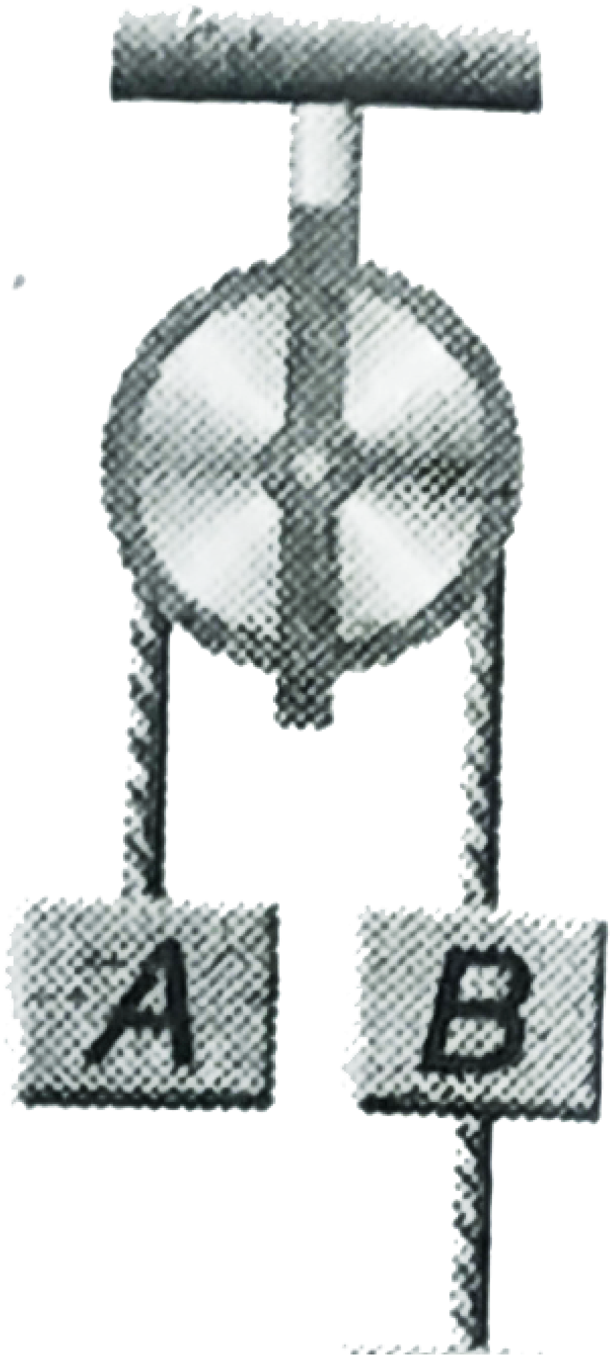
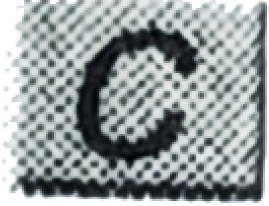
4. Three equal weight A, B and C of mass $2kg$ each are hanging on a string passing over a fixed frictionless pulley as shown in the figure. The tension in the string connecting weights

B and C is approximately





A. zero

B. $13N$

C. $3.3N$

D. 19.6

Answer: D

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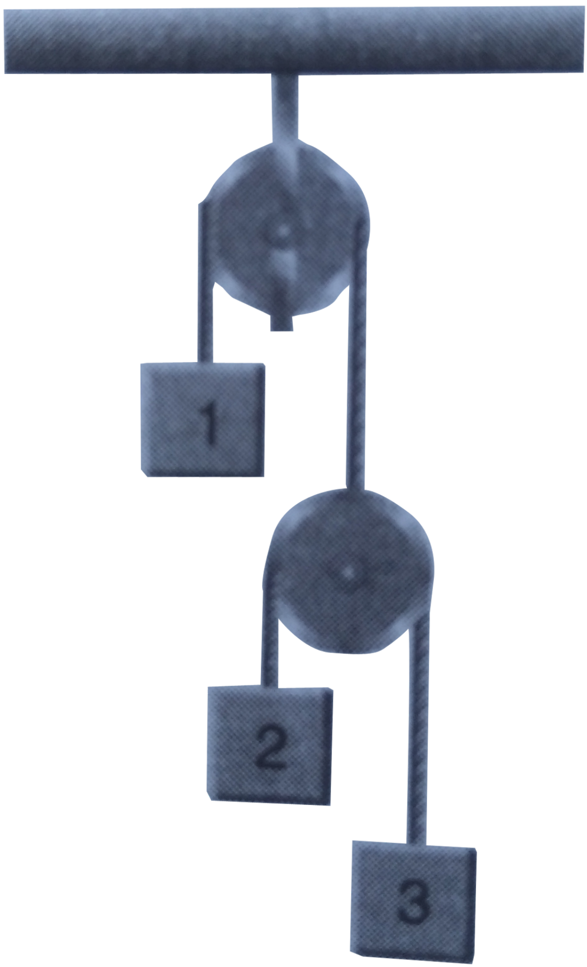
5. In the figure shown, $a_3 = 6m/s^2$ (downwards) and $a_2 = 4m/s^2$ (upwards) .Find acceleration of 1



A. $1m / \sec^2 upwards$

B. $2m / \sec^2 upwards$

C. $1m / sce^2 downwards$

D. $2 / \sec^2 downwards$

Answer: A

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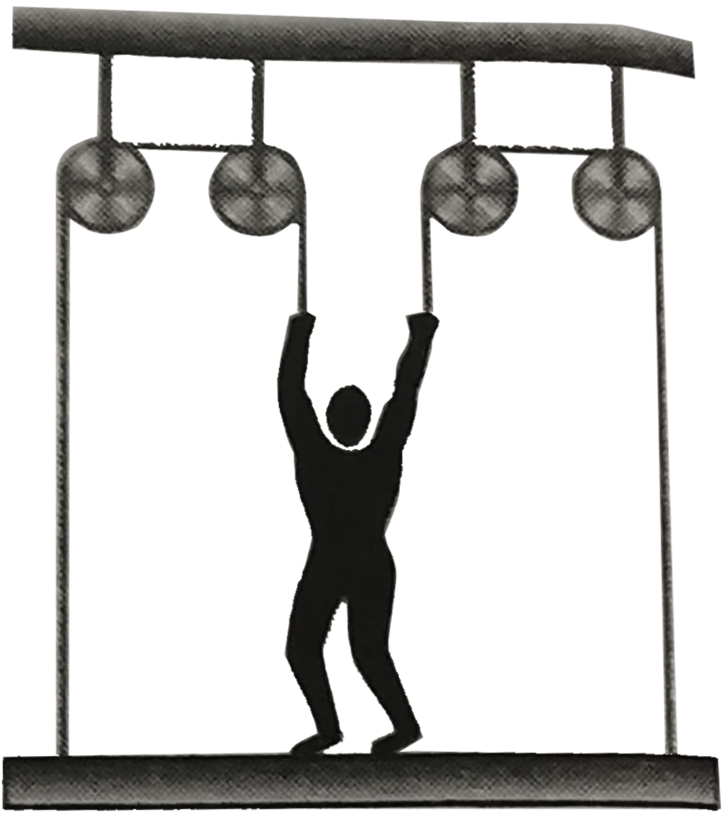
6. A man of mass m stands on a platform of equal mass m and pulls himself by two ropes passing over pulleys as shown in figure.If he pulls each rope with a force equal to half his weight ,his upwards acceleration would be



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

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

C. g

D. zero

Answer: D

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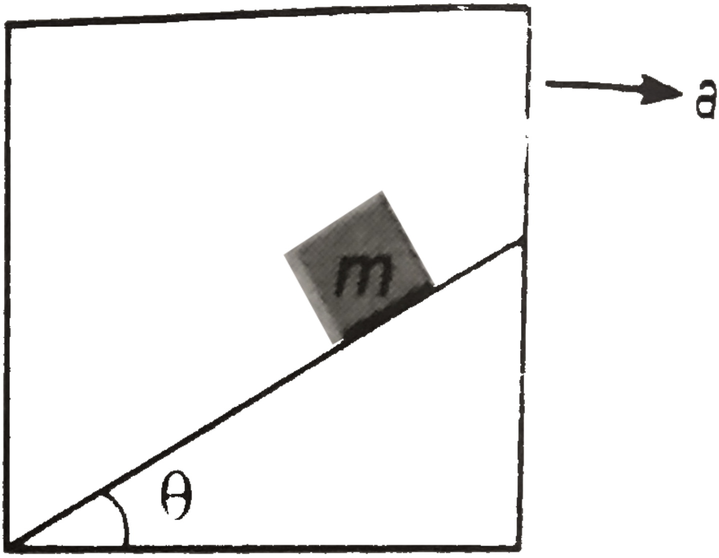
7. A block is sliding along an inclined plane as shown in figure . If the acceleration of chamber is a as shown in figure. The time required to cover a distance L along inclined is



A. $\sqrt{\dfrac{2L}{g\sin\theta - a\cos\theta}}$

B. $\sqrt{\dfrac{2L}{g\sin\theta + a\sin\theta}}$

C. $\sqrt{\dfrac{2L}{g\sin\theta + a\cos\theta}}$

D. $\sqrt{\dfrac{2L}{g\sin\theta}}$

Answer: C

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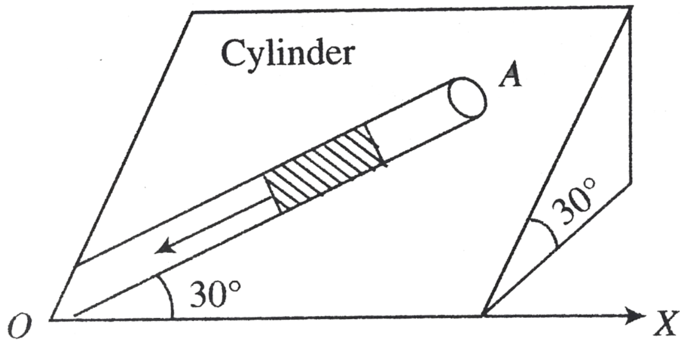
8. An inclined plane makes an angle 30° with the horizontal. A groove (OA) of length 5m cut in the plane makes an angle 30° with OX. A short smooth cylinder is free to slide down under the influence of gravity. The time taken by the cylinder to reach from A to O is

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



A. $4s$

B. $2s$

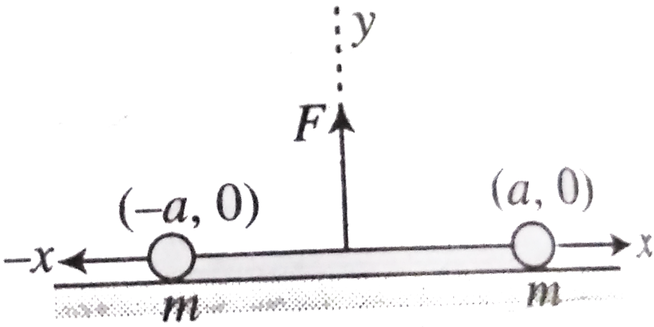
C. $3s$

D. $1s$

Answer: B

Watch Video Solution

9. 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. $\frac{2F}{F}\frac{\sqrt{(a^2-x^2)}}{x}$

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: C

Watch Video Solution

10. A piece of wire is bent in the shape of a parabola $y = Kx^2$ (y - axis vorical) with a bead of mass m on it . The beat can side on the wire without friction , it stays the wire is now accleated parallel to the bead , where the bead can stay at rest with repect 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

Watch Video Solution

11. A block of mass $m = 4kg$ is placed over a rough inclined plane as shown in fig . The coefficient of friction between the block and the plane $\mu = 0.5$ A force $F = 10N$ is applied on the block at an angle of 30°. Find the contact force between the block and the plane.

k

A. $10.65N$

B. $16.32N$

C. $27.15N$

D. $32.16N$

Answer: C

Watch Video Solution

12. A block of mass m slides down an inclined plane of inclination θ with uniform speed The coefficient of friction between the block and the plane is μ. The contact force between the block and the plane is .

A. $mg\sin\theta\sqrt{1+\mu^2}$

B. $\sqrt{(mg\sin\theta)^2+(\mu mg\cos\theta)^2}$

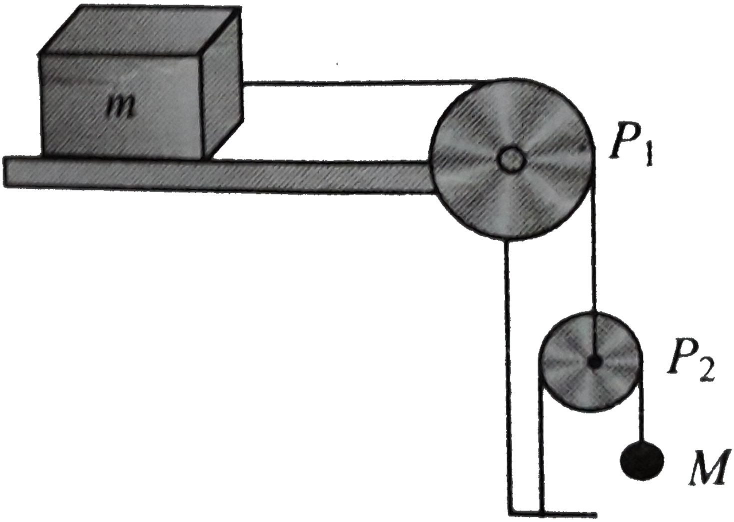
C. $mg\sin\theta$

D. mg

Answer: D

Watch Video Solution

13. In the pulley arrangement shown in Fig the pulley p_2 is movable .Assuming the coefficient of friction between m and surface to be μu the minimum value of M for which m is at rest is



A. $M = \frac{\mu m}{2}$

B. $m = \frac{\mu M}{2}$

C. $M = \frac{m}{2\mu}$

D. $m = \frac{M}{2\mu}$

Answer: A

Watch Video Solution

14. On an inclined plane of inclination angle 30°, a block is placed. It is observed that the force to drage the block along the plane upwards is smaller than the force required to lift it. The maximum value of coefficient of friction is .

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

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

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

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

Answer: C

Watch Video Solution

15. A body slides over an inclined plane of forming an angle of 45° with the horizontal. The distance x travelled by the body in time t is described by the equation $x = kt^2$ where $k = 1.732$. The coefficinet of friction between the body and the plane has a value .

A. $\mu = 0.5$

B. $\mu = 1$

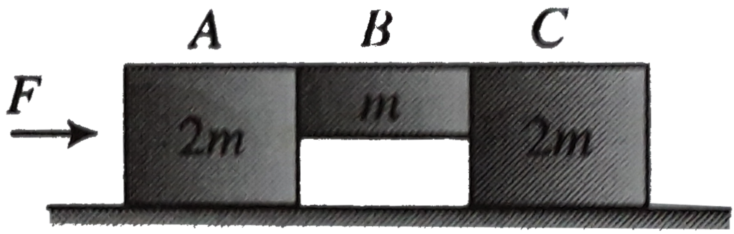
C. $\mu = 0.25$

D. $\mu = 0.75$

Answer: A

Watch Video Solution

16. A system is pushed by a force F as shown in figure All surfaces are smooth except between B and C is μ. Minimum value fo F to prevent block B from down ward slipping is



A. $\left(\frac{3}{2\mu}\right)mg$

B. $\left(\frac{5}{2\mu}\right)mg$

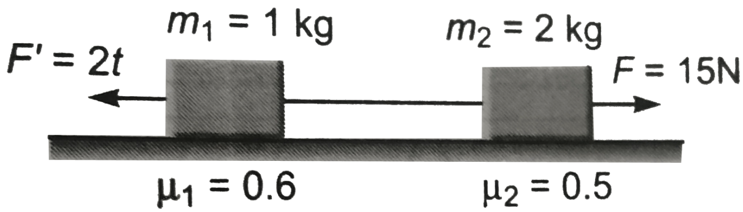
C. $\left(\frac{5}{2}\right)\mu mg$

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

Answer: B

Watch Video Solution

17. Two blocks A and B are separated by some distance and tied by a string as shown in the figure . The force of friction in both the blocks at $t = 2s$ is



A. $4N(\rightarrow), 5N(\leftarrow)$

B. $2N(\rightarrow), 5N(\leftarrow)$

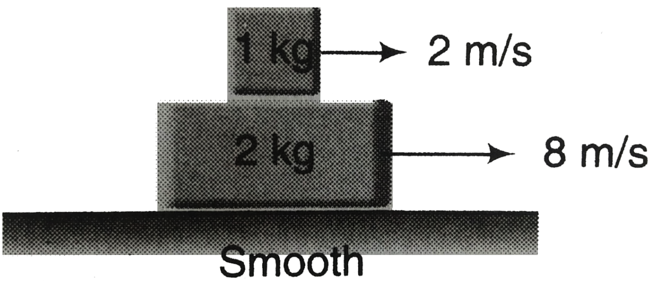
C. $0N(\rightarrow), 10N(\leftarrow)$

D. $1N(\leftarrow), 10N(\leftarrow)$

Answer: D

Watch Video Solution

18. Coefficient of friction between two block shown in figure is $\mu = 0.4$. The blocks are given velocities of $2m/s$ and $8m/s$ in the directions figure. Find



(a) The time when relative motion between them will stop

(b) the common velocities of blocks upto that instant. (c) Displacement of $1kg$ and $2kg$ block upto that instant $\left(g = 10m/s^2\right)$.

A. $1 \sec$

B. $2 \sec$

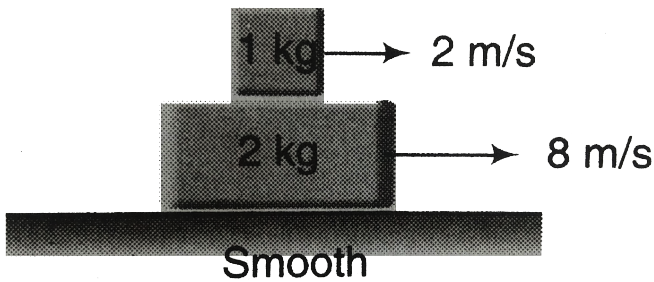
C. $3 \sec$

D. $4 \sec$

Answer: A

Watch Video Solution

19. Coefficient of friction between two block shown in figure is $\mu = 0.4$. The blocks are given velocities of $2m/s$ and $8m/s$ in the directions figure. Find



(a) The time when relative motion between them will stop

(b) the common velocities of blocks upto that instant. (c) Displacement of $1kg$ and $2kg$ block upto that instant $(g = 10m/s^2)$.

A. $4m/\sec$

B. $6m/\sec$

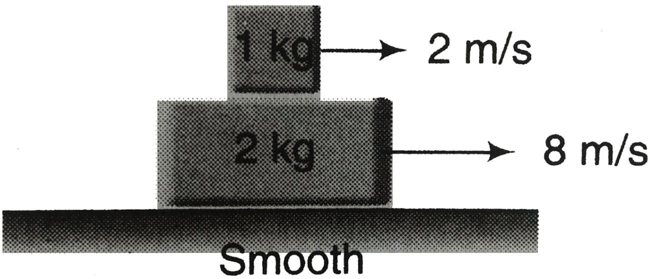
C. $8m/\sec$

D. $10m/\sec$

Answer: B

Watch Video Solution

20. Coefficient of friction between two block shown in figure is $\mu = 0.4$. The blocks are given velocities of $2m/s$ and $8m/s$ in the directions figure. Find



(a) The time when relative motion between them will stop

(b) the common velocities of blocks upto that instant. (c) Displacement of $1kg$ and $2kg$ block upto that instant $\left(g = 10m/s^2\right)$.

A. $4m$ towards right $7m$ towards right

B. $4m$ towards left $7m$ towards right

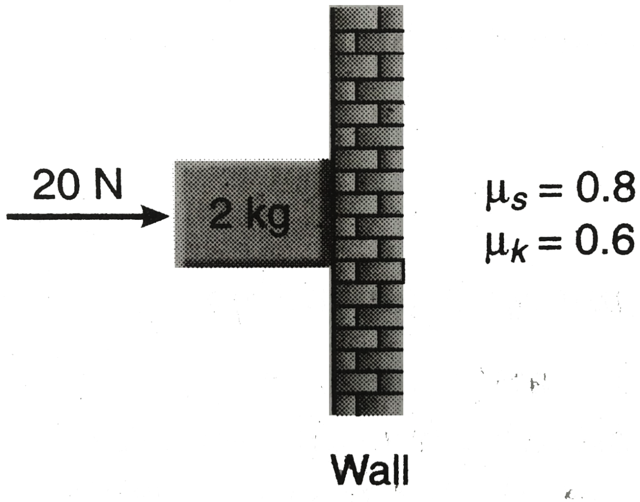
C. $4m$ towards left $7m$ towards right

D. $4m$ towards right $7m$ towards right

Answer: A

Watch Video Solution

21. A $2kg$ block is pressed against a rough wall by a force $F = 20N$ as shown in figure .Find acceleration of the block and force of friction acting on it .$(Take g = 10m/s^2)$



A. $4m/\sec^2$ downward, $12N$ upward

B. $2m/\sec^2$ downward, $6N$ upward

C. $12m/\sec^2$ downward, $4N$ upward

D. $8m/\sec^2$ downward, $12N$ upward

Answer: A

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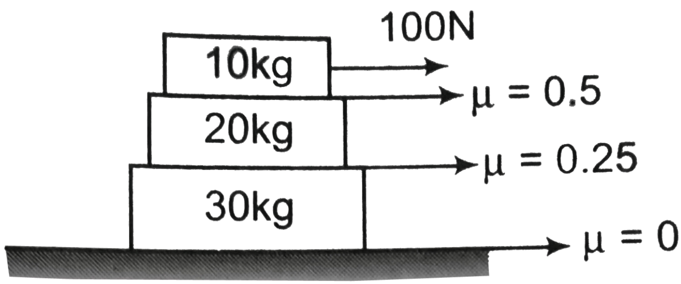
22. Three blocks are kept as shown in figure

Acceleration of $20kg$ block with respect to ground is



A. $5ms^{-2}$

B. $2ms^{-2}$

C. $1ms^{-2}$

D. 0

Answer: C

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23. A suitcase is gently dropped on a conveyor belt moving at $3ms^{-1}$ If the coefficient of friction between the belt and suitcase is 0.5 how far will the suitcase move on the belt before coming to rest ?

A. $2.7m$

B. $1.8m$

C. $0.9m$

D. $1.2m$

Answer: C

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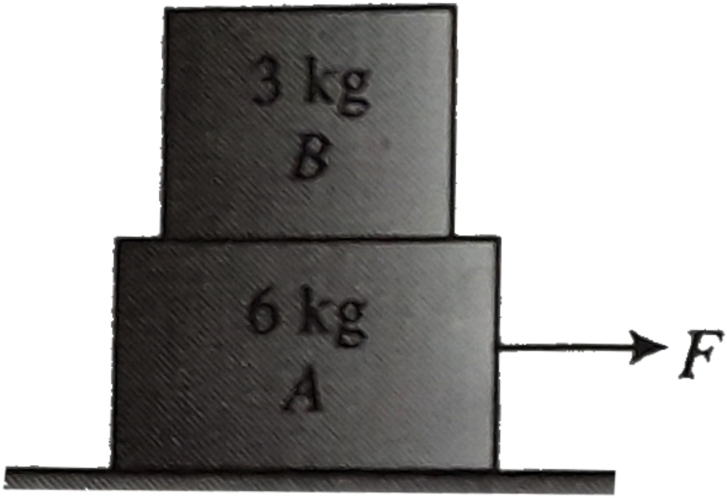
24. Two block A and B of masses $6kg$ and $3kg$ rest on a smooth horizontal surface as shown in figure If coefficient of friction between A and Bb is 0.4 the maximum horizontal force which can make them move without separation is



A. $72N$

B. $40N$

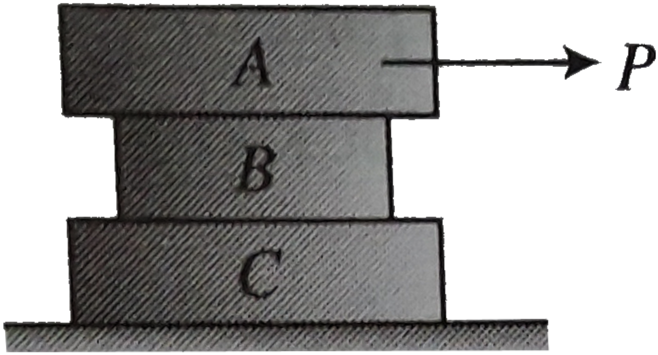
C. $36N$

D. $20N$

Answer: C

Watch Video Solution

25. Find the least horizontal force P to start motion of any part of the system of the three blocks resting upon one another as shown in figure The weights of blocks are $A = 300N, B = 100N$ and $C = 200N$ .Between A and B , the coefficient of friction is 0.3 between B and C is 0.2 and between C and the ground is 0.1



A. $60 N$

B. $90 N$

C. $80 N$

D. $70 N$

Answer: A

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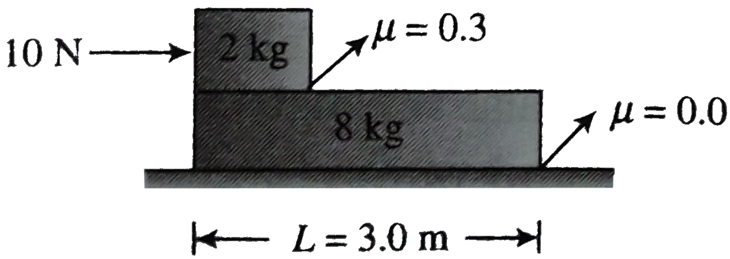
26. Determine the time in which the smaller block reaches other end of bigger block in figure



A. $4s$

B. $8s$

C. $2.19s$

D. $2.13s$

Answer: C

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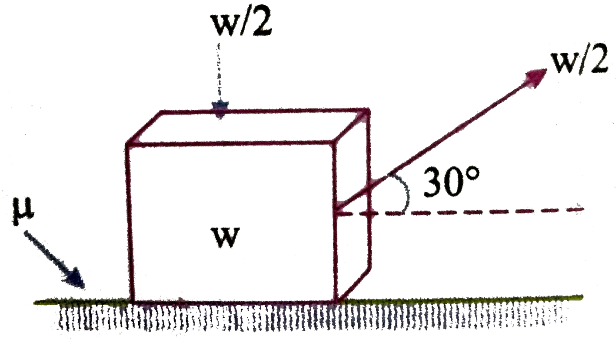
27. A block of weight W is kept on a rough horizontal surface (friction coefficient μ). Two forces $W/2$ each are applied as shown in the choose the correct statement



A. For $\mu > \dfrac{\sqrt{3}}{5}$ block will move .

B. For $\mu < \dfrac{\sqrt{3}}{5}$, work done by frictional force is zero in ground frame .

C. For $\mu > \dfrac{\sqrt{3}}{2}$ frictional force will do positive work (in ground frame) .

D. For $\mu \le \dfrac{\sqrt{3}}{2}$ block will move .

Answer: D

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28. A 2 kg block is placed over a 4 kg block and both are placed on a smooth horizontal surface. The coefficient of friction between the blocks is 0.20. Find the acceleration of the two blocks if a horizontal force of 12 N is applied to (a). the upper block, (b). the lower block. Take g=10 m/s^2.

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

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

C. $3ms^{-2}, 1ms^{-2}$

D. $4ms^{-2}, 1ms^{-2}$

Answer: A

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29. Blocks A and B shown in the figure are connected with a bar of negligible weight. A and B each has mass $170kg$, the coefficient of friction between A and the plane is 0.2 and that between B and the plane is $0.4 (g = 10ms_{-2})$

What is the total force of friction between the blocks and the plane?

A. $900N$

B. $700N$

C. $600N$

D. $300N$

Answer: A

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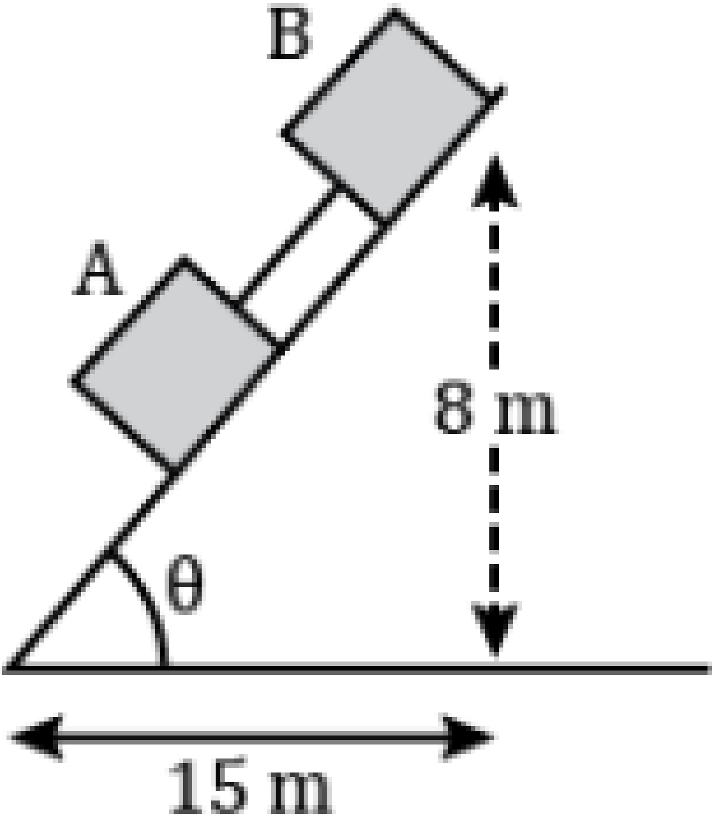
30. Block A and B shown in the figure are connected with a bar of negligible weight. A and B each has mass $170kg$, the coefficient of friction between A and the plane is 0.2 and that between B and the plane is $0.4(g = 10ms_{-2})$



What is the force acting on the connecting bar?

A. $150N$

B. $100N$

C. $75N$

D. $125N$

Answer: A

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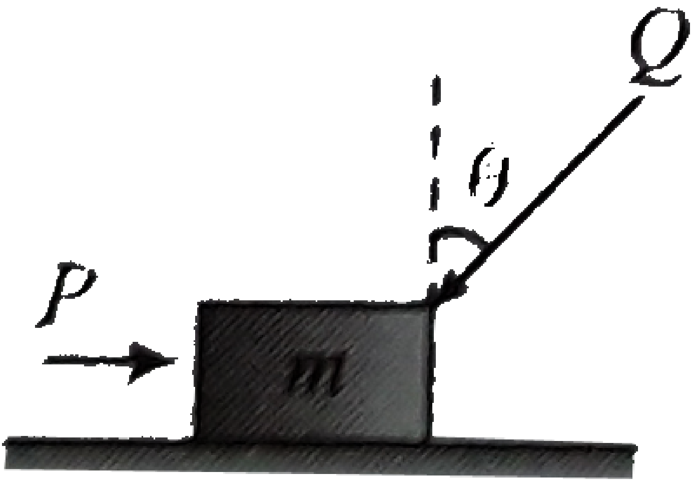
31. A block of mass m lying on a horizontal plane , is acted upon by a horizontal force p and another force Q inclined at an angle θ to the vertical .The block will remain in equilibrium if the coefficient of friction between it and the surface is (assume $p > Q$)



A. $\frac{(P+Q\sin\theta)}{(mg+Q\cos\theta)}$

B. $\frac{(P\cos\theta+Q)}{(mg-Q\sin\theta)}$

C. $\frac{(P+Q\cos\theta)}{(mg+Q\sin\theta)}$

D. $\frac{(P\sin\theta-Q)}{(mg-Q\cos\theta)}$

Answer: A

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NCERT BASED QUESTION

1. A ball is travelling with uniform translatory motion. This means that .

A. it is at rest.

B. the path can be a straight line or circular and the ball travels with uniform speed .

C. all parts of the ball have the same velocity (magnitude and direction) and the velocity is constant .

D. the centre of the ball moves with constant velocity and the ball spins about its centre uniformly .

Answer: C

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2. A metre scale is moving with uniform velocity. This implies .

A. the force acting on the scale is zero but, a torque about the centre of mass can act on the scale.

B. the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero.

C. the total force acting on it need not be zero but the torque on it is zero.

D. neiter the force not the torque need to be zero.

Answer: B

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3. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponet. The force that acts on the player is.

A. frictional force along westward.

B. muscle force along southward.

C. frictional force along south -west.

D. muscle force along south-west.

Answer: C

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4. A body of mass $2kg$ travels according to the law $x(t) = pt + qt^2 + rt^3$ where $p = 3ms^{-1}$, $q = 4ms^{-2}$ and $r = 5ms^{-3}$.

Find the force acting on the body at t=2 sec.

A. $136N$

B. $134N$

C. $158N$

D. $68N$

Answer: A

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5. A body with mass 5 kg is acted upon by a force $\overrightarrow{F} = \left(-3\hat{i} + 4\hat{j}\right)N$. If its initial velocity at t =0 is $\overrightarrow{v} = 6\hat{i} - 12\hat{j}ms^{-1}$, the time at which it will just have a velocity along the y-axis is :

A. never

B. $10s$

C. $2s$

D. $15s$

Answer: B

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6. The motion of a particle of mass m is given by $x=0$ for $t<0s$,$x(t)=A\sin 4\pi t$ for $0<t<\left(\frac{1}{4}\right)s(A>0)$,and $x=0$ for $t>\left(\frac{1}{4}\right)s.$

A. The force at $t=(1/8)s$ on the particle is $m16\pi^2A.$

B. The particle is acted upon by an impulse of magnitude $m4\pi^2 A$ at $t = 0s$ 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

Answer: A::B::D

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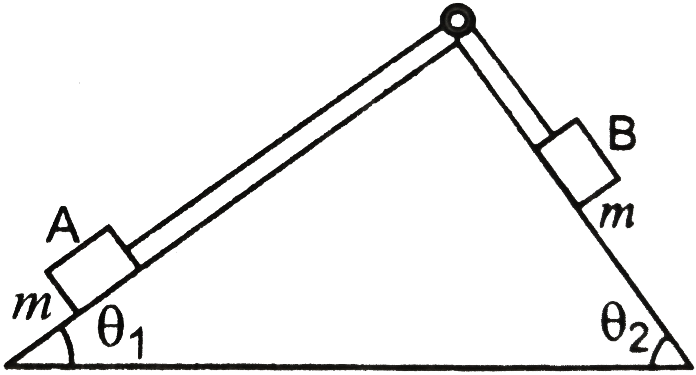
7. A body a of mass m slides on plane inclined at angle θ_0 to the horizontal and μ_1 is the coefficient of friction between A and the plane A is connected by a light string passing over a frictionless pulley to another body B also of mass m slidding on a frictionless plane inclined at angle θ_2 to the horizontal Which of the following statements are ture ?



A. A will never move up the plane.

B. A will just start moving up the plane when $\mu = \dfrac{\sin\theta_2 - \sin\theta_1}{\cos\theta_1}$

C. For A to move up the plane, θ_2 must always be greater than θ_1.

D. B will always slide down with constant speed.

Answer: B::C

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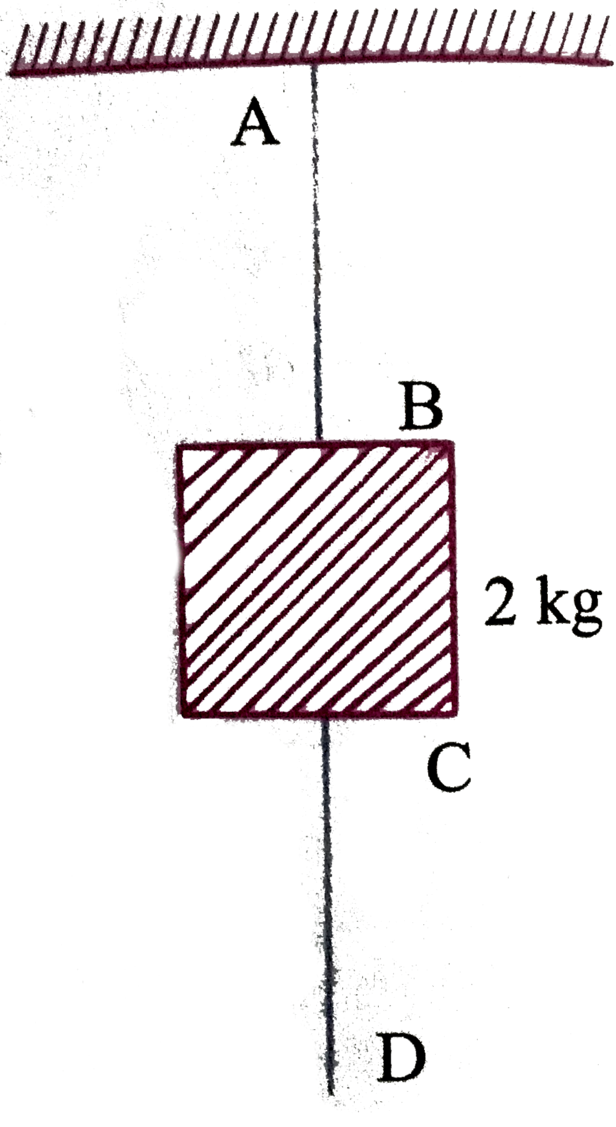
8. A mass of $2kg$ is suspended with thread AB (figure) Thread CD of the same type is attached to the other end of $2kg$ mass. Lower thread is pulled gradually, harder and harder in the downward gradually, harder and harder in the downward direction so as to apply force on AB. which of the threads will break and why?



A. AB will break earlier than CD

B. CD will break earlier than AB

C. Both will break togther

D. Neither AB nor CD will break

Answer: A

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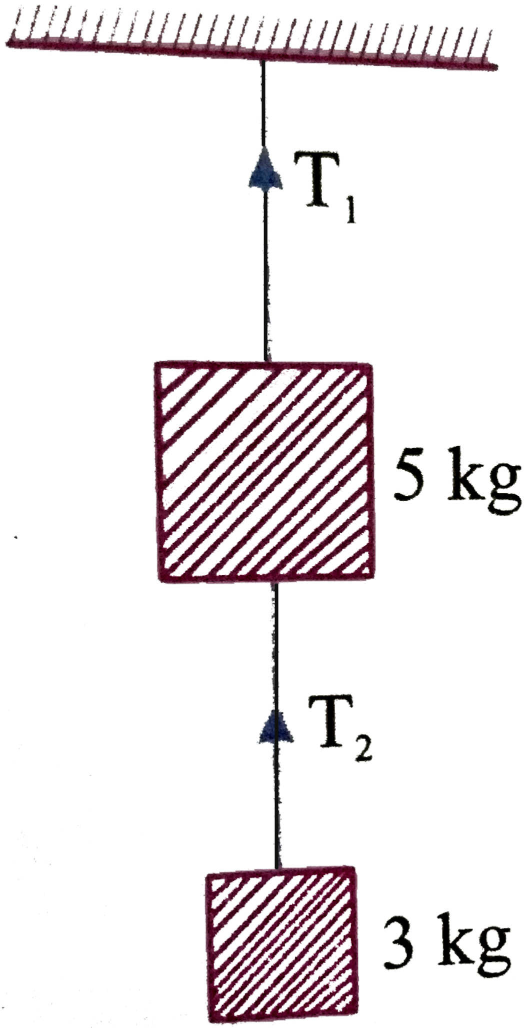
9. Two masses of $5kg$ and $3kg$ are suspended with help of massless inextensible strings as shown in figure. Calculate $T_1$and T_2 when whole system is going upwards with acceleration $= 2m/s^2 (use g = 9.8ms^{-2})$.



A. $T_1 = 50N, T_2 = 38N$

B. $T_1 = 35.4N, T_2 = 94.4N$

C. $T_1 = 94.4N, T_2 = 35.4N$

D. $T_1 = 0N, T_2 = 35.4N$

Answer: C

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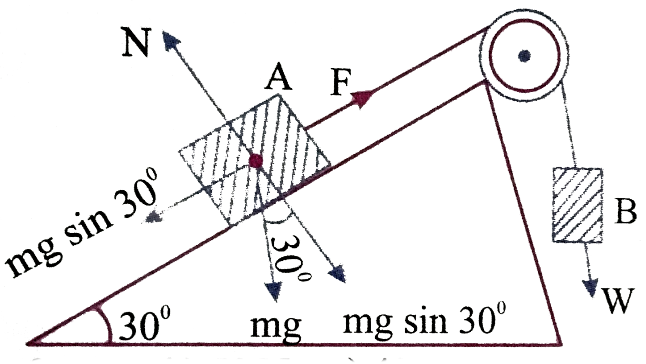
10. Block A of weight $100N$ rests on a frictionless inclined plane of slope angle 30° (Fig. 5.7). A flexible cord attached to A passes over a frictonless pulled and is connected to block B of weight W. Find the weight W for which the system in equilibrium.



A. $80N$

B. $50N$

C. $40N$

D. $100N$

Answer: B

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11. A cricket ball of mass $150g$ has an initial velocity $\left(3\hat{i}+4\hat{j}\right)ms^{-1}$ and a final velocity $v=-\left(3\hat{i}+4\hat{j}\right)ms^{-1}$ after beigh hit The change in momentum (final momentum initial momentum) is (in kg ms^{-1})

A. zero

B. $-\left(0.45\hat{i}+0.6\hat{j}\right)$

C. $-\left(0.9\hat{j}+1.2\hat{j}\right)$

D. $-5\left(\hat{i}+\hat{j}\right)\hat{i}$

Answer: C

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12. Conservation of momentum in a collision beween particles can be understood form

A. conservation of enegry.

B. Newton's first low only.

C. Newton's second law only.

D. both Newton's second and third law.

Answer: C

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13. A car of mass m starts from rest and acquires a velocity along east $v = v\hat{i} (v > 0)$ in two seconds Assuming the car moves with unifrom acceleration the force exerted on the car is .

A. $\frac{mv}{2}$ eastward and is exerted by the car engine.

B. $\frac{mv}{2}$ eastward and is due to the friction on the tyres exerted by the road.

C. more than $\frac{mv}{2}$ eastward exerted due to the engine and overcomes the frictions of the road.

D. $\frac{mv}{2}$ exerted by the engine.

Answer: B

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14. Two billiard balls A and B, each of mass 50 kg and moving in oppsite direction with speed of $5ms^{-1}$ each, collide and rebound with the same speed. If the collision lasts for $10^{-3}s$, which of the follwing statements are true?

A. The impluse imparated to each ball is $0.25kgms^{-1}$ and the force on each ball is $250N$.

B. The impluse imparated to each ball is $0.25 kgms^{-1}$ and the force exerted on each ball is $25 \times 10^{-5} N$.

C. The impluse imparated to each ball is $0.5 Ns$.

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

Answer: C::D

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15. A girl ridding a bicycle along a straight road with a speed of $5ms^{-1}$ throws a stone of mass 0.5 kg which has a speed of $15ms^{-1}$ with respect to the ground along her direction of motion. The mass of the girl and bicycle is $5kg$. Does the speed of the bicycle change after the stone is thrown ? What is the change in speed, if so ?

A. $0.5m/s$

B. $0.1m/s$

C. $0.3m / s$

D. $0.8m / s$

Answer: B

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16. A woman throws and object of mass $500g$ with a speed of $25ms^{-1}$. If the object hits a wall and rebounds with half the original speed, what is the change in momentum of the object?

A. $-18.75N - S$

B. $18.75N - S$

C. $-20.75N - S$

D. $20.75N - S$

Answer: A

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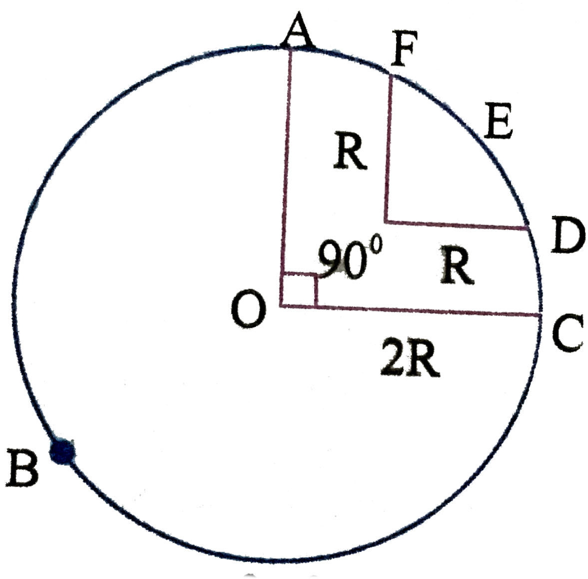
17. A racing car travels on a track (without banking) $ABCDEFA.ABC$ is a circular arc of radius $2R$. CD and FA are straight paths of length R and DEF is a circular arc of radius $R = 100m$. The co-efficient of friction on the road is ¼ $= 0.1$. the maximum speed of the car is $50ms - 1$. Find the minimum time for completing one round.



A. $50s$

B. $90.3s$

C. $83.6s$

D. $86.3s$

Answer: D

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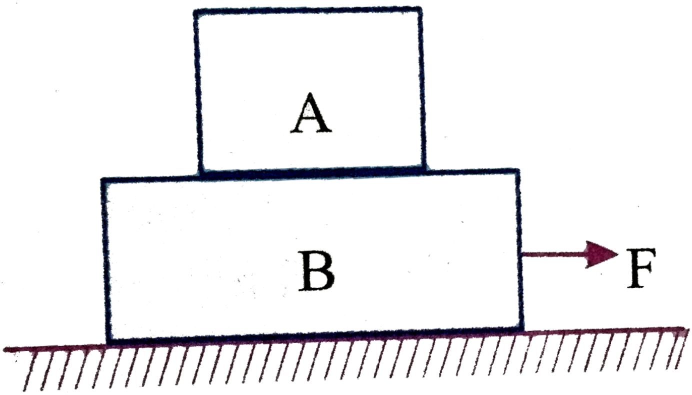
18. In the co-efficincet of friction between the floor and the body B is 0.1. The co-efficient of friction beteen the bodies B and A is 0.2 A fore F is applied as shown B The mass of A is $m/2$ and of B is m Which of the following statements are ture ?



A. The bodies will move together if

$F = 0.25mg$.

B. The body A will slip with respect to B if

$F = 0.5mg$.

C. The bodies will move together if

$F = 0.5mg$.

D. The bodies will be at rest if $F = 0.1mg$.

Answer: A::B::D

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19. A body of mass $10kg$ is acted upon by two per pendicular forces $6N$ and $8N$. The resultant ac-celeration of the body is .

A. $1ms^{-2}$ at angle of $\tan^{-1}\left(\frac{4}{3}\right)6N$ force

.

B. $0.2ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t

$6N$ force .

C. $1ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t

$8N$ force .

D. $0.2ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t

$8N$ force .

Answer: A

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20. A helicopter of mass 2000 kg rises with a vertical acceleration of $15 m s^{-2}$. The total mass of the crew and passengers is 500 kg. Give the magnitude and direction of the (g $= 10 m s^{-2}$)

(a) Force on the floor of the helicopter by the crew and passengers.

(b) action of the rotor of the helicopter on the surrounding air.

(c) force on the helicopter dur to the surrounding air.

A. $500N$

B. $1200N$

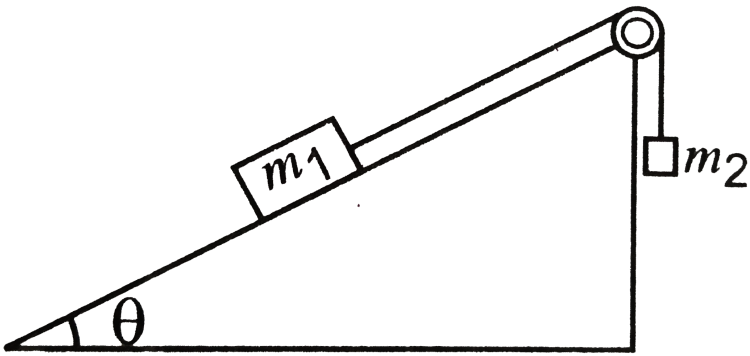
C. $12500N$

D. $10000N$

Answer: C

Watch Video Solution

21. Mass m_1 moves on a slope making an angle θ with the horizontal and is attached to mass m_2 by a string passing over a frictionless pulley as shown in The co-efficient of friction between m_1 and the slopping surface is μ Which of the following statements are true ?



A. If $m_2 > m_1 \sin\theta$, the body will move up the plane .

B. If $m_2 < m_1(\sin\theta + \mu\cos\theta)$ the body will move up the plane .

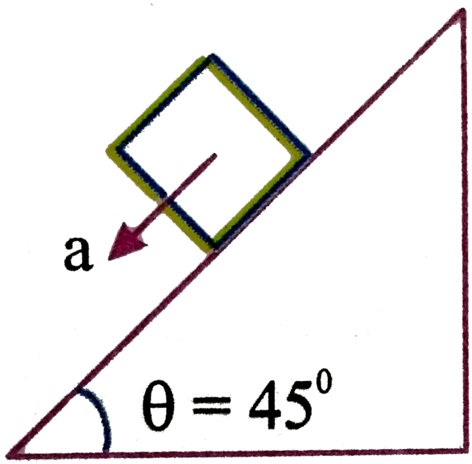
C. If $m_2 < m_1(\sin\theta - \mu\cos\theta)$, the body will move up the plane .

D. If $m_2 < m_1(\sin\theta - \mu\cos\theta)$ the body will move up the plane .

Answer: B::D

Watch Video Solution

22. When body slides down from rest along smooth inclined plane making angle of 45° with the horizontal, it takes time T When the same body slides down from rest along a rough inclined plane making the same angle and through the same distance it is seen to take time pT, where p is some number greater that 1. Calculate late the coefficient of friction beween the body and the rough plane.



.

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

B. $\left(1+\frac{1}{P^2}\right)$

C. $\frac{1}{P^2}$

D. $-\frac{1}{P^2}$

Answer: A

Watch Video Solution

23. A rectangular box lies on a rough inclined surface The co-efficient of friction beteen the surface and the box is μ. Le the mass of the box ne m What is the force acting on the box down the plane if the angle of inclination of the plane is increased to $\alpha > \theta$? .

A. $mg(S\text{in}\alpha + \mu\text{cos}\alpha)$

B. $mgCos\theta$

C. $mg(\text{sin}\alpha - \mu\text{cos}\alpha)$

D. $mg\text{sin}\theta + f$

Answer: C

Watch Video Solution

24. The minimum velocity (in ms^(-1))` with which a car driver must traverse a flat curve of radius 150m and coefficient of friction 0.6 to avoid skidding is

A. 60

B. 30

C. 15

D. 25

Answer: B

Watch Video Solution

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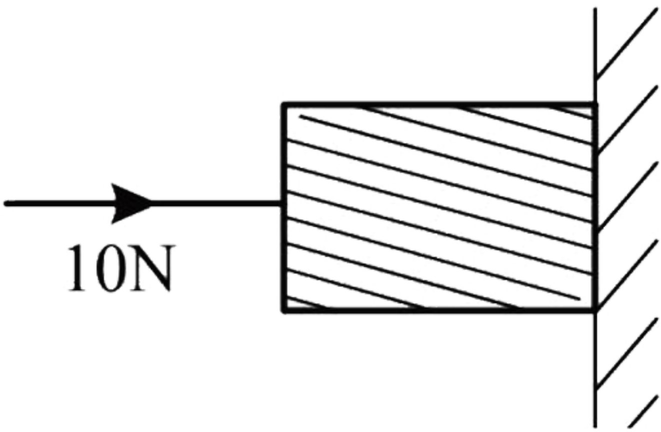
25. A horizontal force of 10N is necessary to just hold a block stationary against as well. The coefficient of friction between the block and the wall is 0.2. The weight of the block is



A. $2N$

B. $20N$

C. $50N$

D. $20N$

Answer: A

Watch Video Solution

26. A marble block of mass 2 kg lying on ice when given a velocity of $6m/s$ is stopped by friction in 10s. Then the coefficient of friction is

A. 0.01

B. 0.02

C. 0.03

D. 0.06

Answer: D

Watch Video Solution

27. A car is moving in a circular path of radius $500m$ with a speed of $30m/s$. If the speed is increased at the rate of $2m/s^2$, the resultant acceleration will be .

A. $2m/s^2$

B. $2.5m/s^2$

C. $2.7m/s^2$

D. $4m/s^2$

Answer: C

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28. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10N, the mass of the block (in kg) is

A. 2.0

B. 4.0

C. 1.6

D. 2.5

Answer: A

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

A. $\mu_s = \sqrt{1 - \frac{1}{n^2}}$

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

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

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

Answer: D

Watch Video Solution

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

A. $800m$

B. $1000m$

C. $100m$

D. $400m$

Answer: B

Watch Video Solution

31. The upper half of an inclined plane of inclination 45° is perfectly smooth while the lower half is rough. A block starting from rest at the top comes back to rest at the bottom.

The coefficient of friction for the lower half is

A. $\mu = \sin\theta$

B. $\mu = \cot\theta$

C. $\mu = 2\cos\theta$

D. $\mu = 2\tan\theta$

Answer: D

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32. A block of mass is placed on a surface with a vertical cross section given by $y = \frac{x^3}{6}$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is:

A. $\frac{1}{3}m$

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

C. $\frac{1}{6}m$

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

Answer: C

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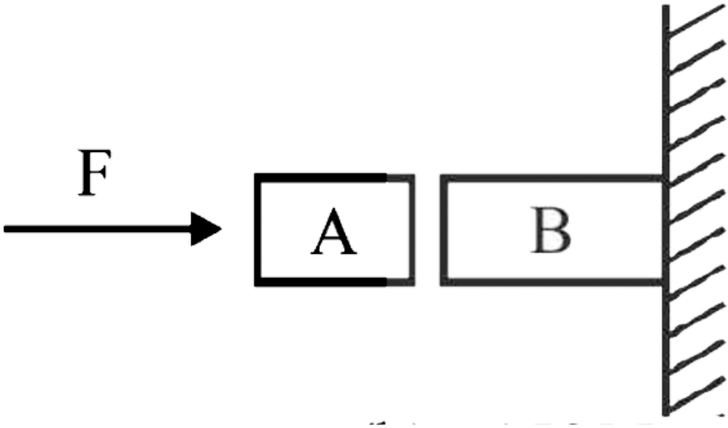
33. Given in figure are two blocks A and B of weight 20N and 100N, respectively. These are being pressed against a wall by a force F as shown. If the coefficient of friction between the blocks is 0.1 and between block B and the wall is 0.15, the frictional force applied by the wall on block B is:



A. $100N$

B. $80N$

C. $120N$

D. $150N$

Answer: C

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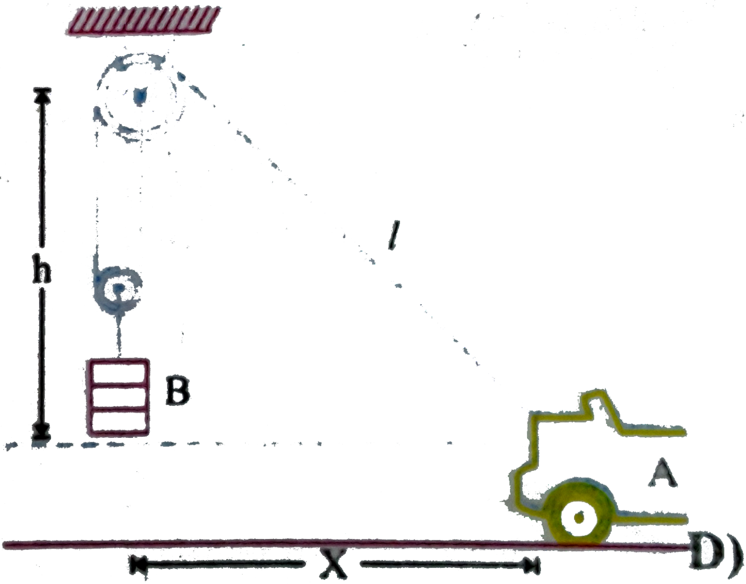
SINGLE ANSWER QUESTIONS

1. The car A is used to pull a load B with the pulley arrangement shown. If A has a forwed pulley arraangement shown. If A has a forward velcotiy v_A determine an experssion for the upward velcotiy v_B of the load in terms of V_A and θ, θ is angle between string and horizontal



A. $\frac{1}{2} V_A \cos \theta$

B. $V_A \sin \theta$

C. $V_A \cos \theta$

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

Answer: A

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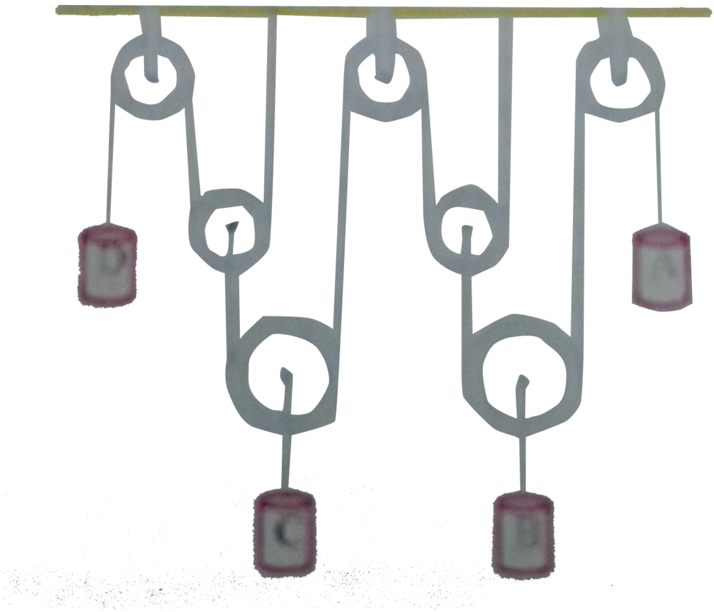
2. Identify the relationship which governs the velocities of the four cylinders. Assume all velocities as positive downward



A. $3v_A + 6v_B + 4v_C + v_D = 0$

B. $4v_A + 8v_B + 4v_C + v_D = 0$

C. $3v_A + 6v_B + 2v_C + v_D = 0$

D. $3v_A + 10v_B + 2v_C + v_D = 0$

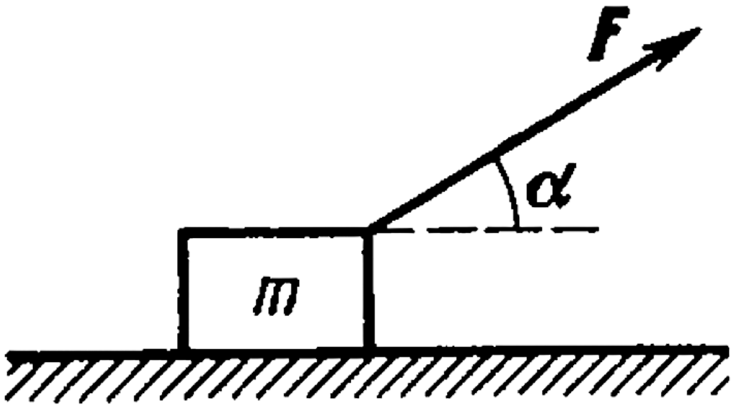
Answer: B

Watch Video Solution

3. 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. $\left(\dfrac{mg^2\cos\theta}{2c\sin^2\theta}\right)m/s,\ \left(\dfrac{mg^3 con\theta}{6c^2\sin^3\theta}\right)m$

B. $\left(\dfrac{mg^2\cos\theta}{2c\sin^2\theta}\right)m/s,\ \left(\dfrac{m^2g^3\cos\theta}{6c^2\sin^3\theta}\right)m$

C. $\left(\dfrac{mg\cos\theta}{2c\sin^2\theta}\right)m/s,\ \left(\dfrac{m^2g^3\sin\theta}{6c^2\cos^3\theta}\right)m$

D. $\left(\frac{mg^2 \cos\theta}{2c\sin^2\theta}\right)m/s, \left(\frac{m^2g^3\sin\theta}{6c^2\cos^3\theta}\right)m$

Answer: B

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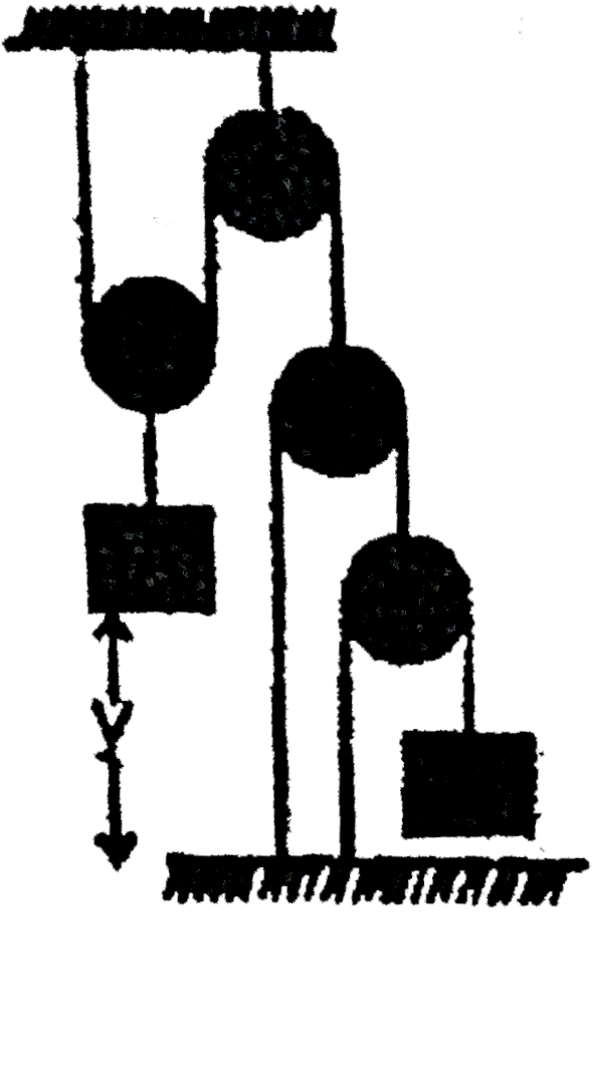
4. The vertical displacement of a block A in meter is given by $y = t^2/4$ where t is in second. The downward acceleration a_B of a block B (in m/s^2) is



A. $2ms^2$

B. $1ms^2$

C. $4ms^2$

D. $9ms^2$

Answer: C

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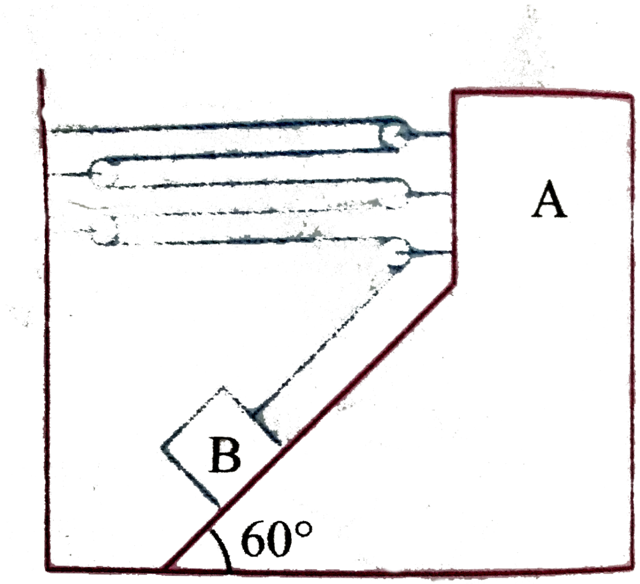
5. Find the acceleration of block B realtive to the ground if the block A moves to the left with an acceleration a_0



A. $\sqrt{31a_0}$

B. $\sqrt{25a_0}$

C. $\sqrt{30a_0}$

D. $30a_0$

Answer: A

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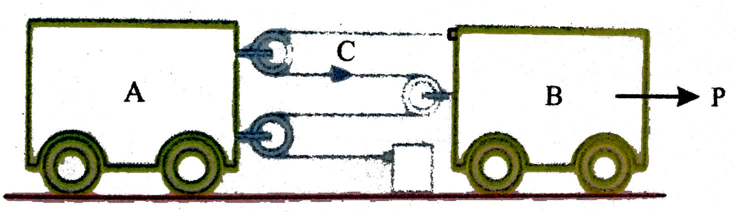
6. Under to action of force P the constant acceleration of block B is $3ms^{-2}$ to the right At the instant when the velcoity of B is $2ms^{-1}$ to the right determine the absolute velocity of point C of the cable



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A. 2

B. 1

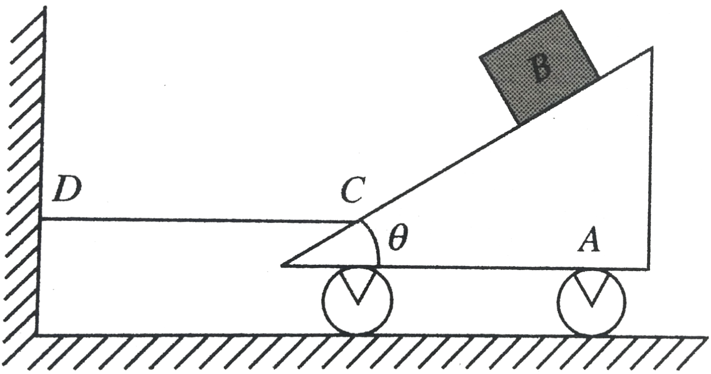
C. 3

D. 4

Answer: B

Watch Video Solution

7. Block B has mass m and is released from rest when it is on top of wedge A, which has a mass 3m. Determine the tension in cord CD needed to hold the wedge from moving while B is sliding down A. Neglect friction.



A. $\frac{mg}{2}\sin(2\theta)$

B. $\frac{mg}{2}\sin(3\theta)$

C. $\frac{mg}{2}\sin(3\theta)$

D. $\frac{mg}{2}\sin(2\theta)$

Answer: A

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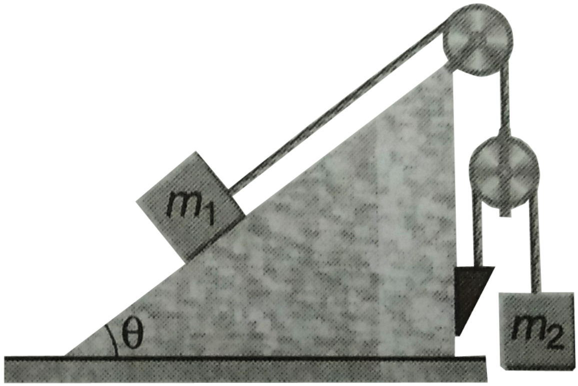
8. Find the acceleration of the body of mass m_2 in the arrangement shown in figure. If the massm_2 is η time great as the mass m_1 and the angle that the inclined plane forms with the horizontal is equal to θ. The masses of the pulley and threads, as well as the friction, are assumed to be negligible.



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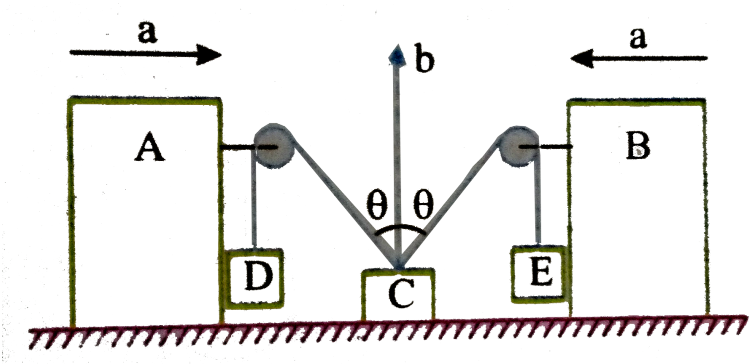
9. If A and B moves with acceleration a block c moves up with acceleration b calculate acceleration of D with respective A.



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A. $2a+b$

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

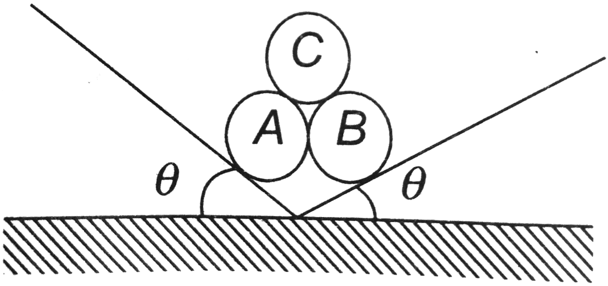
C. $b\cos\theta + a\sin\theta$

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

Answer: C

Watch Video Solution

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

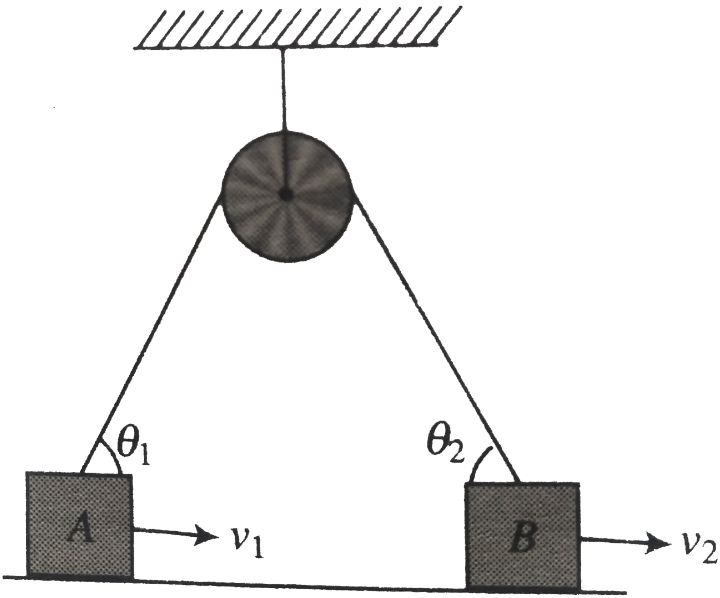
C. $\tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)$

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

Answer: C

Watch Video Solution

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



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

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

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

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

Answer: D

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12. In the arrangements shown, the pulleys, strings and springs are weightless and the systems can move freely without friction The extension of spring in 1 is x_1 and that in 2 is

x_2 Then

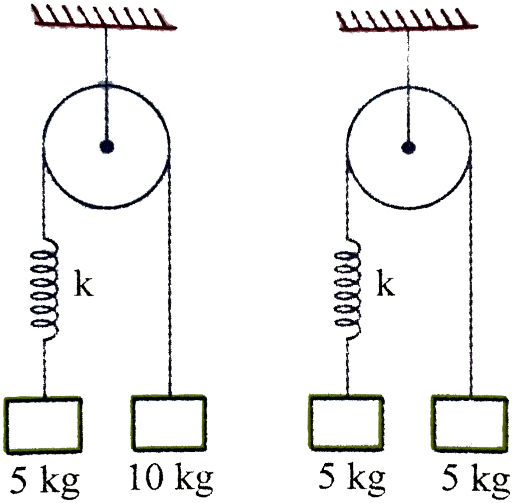

Fig 1

Fig 2

A. $x_1 = x_2$

B. $x_2 > x_1 > 0$

C. $x_1 > x_2 = 0$

D. $x_1 > x_2 > 0$

Answer: D

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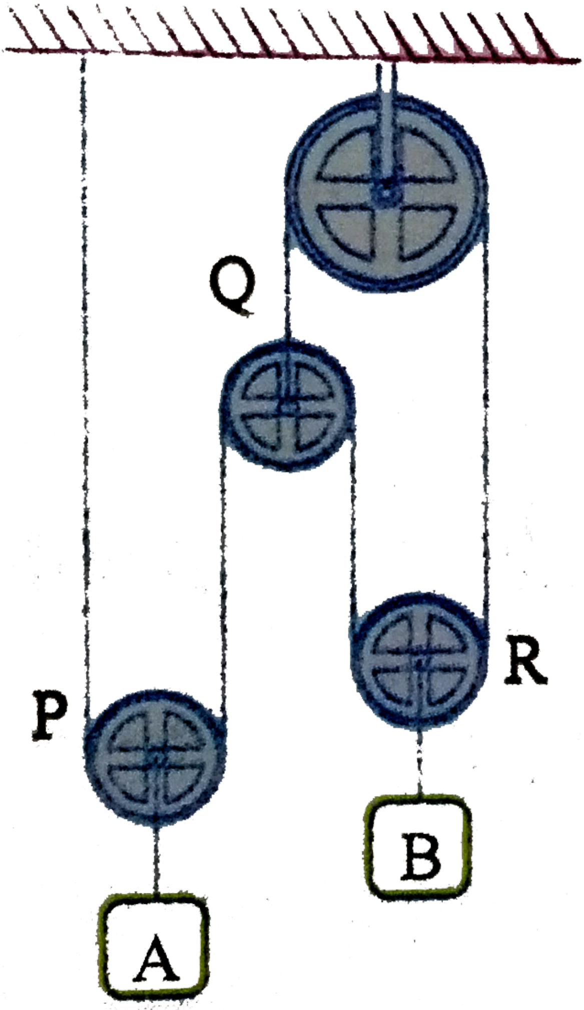
13. Figure shows a system of four pulleys with two masses $m_A = 3kg$ and $m_B = 4kg$. At an instant force acting on block A if block B is going up at an acceleration of $3m/s^2$ and pulley Q is going down at an acceleration of

$1m/s^2$ is



A. $7N$ acting upward

B. $7N$ acting downward

C. $10.5N$ acting upward

D. $10.5N$ acting downward

Answer: D

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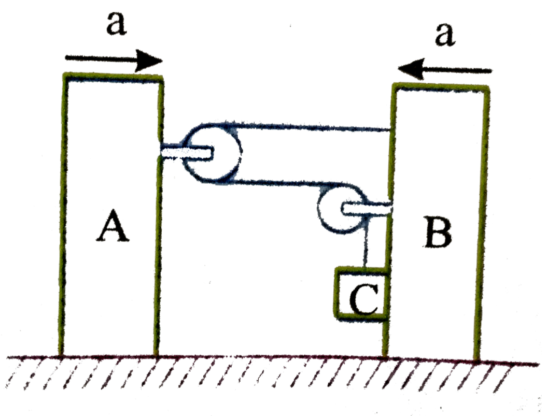
14. If A and B moves with acceleration a as shown in diagram calculate accelration of C

with respect to B



A. $2a$

B. $a\sqrt{2}$

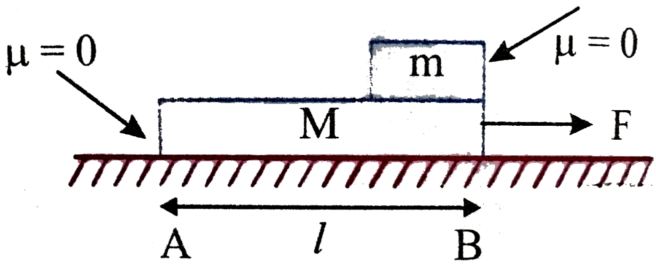
C. $3a$

D. $4a$

Answer: D

Watch Video Solution

15. In the small block m is kept on planck of mass M and a force F is applied on planck as shown in diagram then which of the following statements is/are correct



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A. the acceleration of w.r.t ground is $\frac{F}{m}$.

B. the acceleration of w.r.t ground is zero

C. the time taken by m to separate from M

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

D. the time taken by m to separate from M

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

Answer: B::D

Watch Video Solution

16. A particle of mass m starts moving at $t = 0$ due to force $F = F_0 \sin \omega t$ where F_0 and ω are constant Then correct statement is//are .

A. it will stop first time at $\frac{\pi}{\omega}$

B. It will travel distance $S = \frac{F_0}{m\omega^2}$ during this time .

C. During this distance maximum velocity of particle is $v_{\max} = \frac{F_0}{m\omega}$.

D. it will stop for first time at $2\pi / \omega$

Answer: C::D

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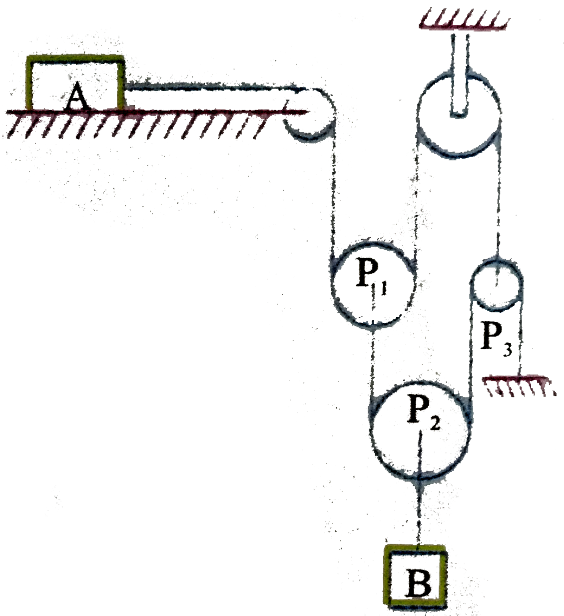
17. From the given, choose the correct option



A. acceleration of block A is zero

B. acceleration of B is g

C. acceleration of block A is non zero

D. tension in the string connecting A is zero

Answer: A::B::D

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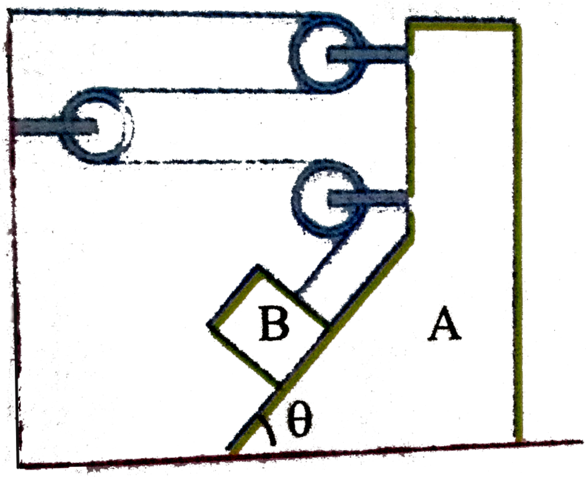
18. In the diagram shown, the acceleration of the block B as shown in relative to the block A and relative to ground is a_{BA} and a_{BG} respectively. If the block A is moving towards left with an acceleration a_0 then



A. $a_{BA} = 2a_0$

B. $a_{BG} = 3a_0$

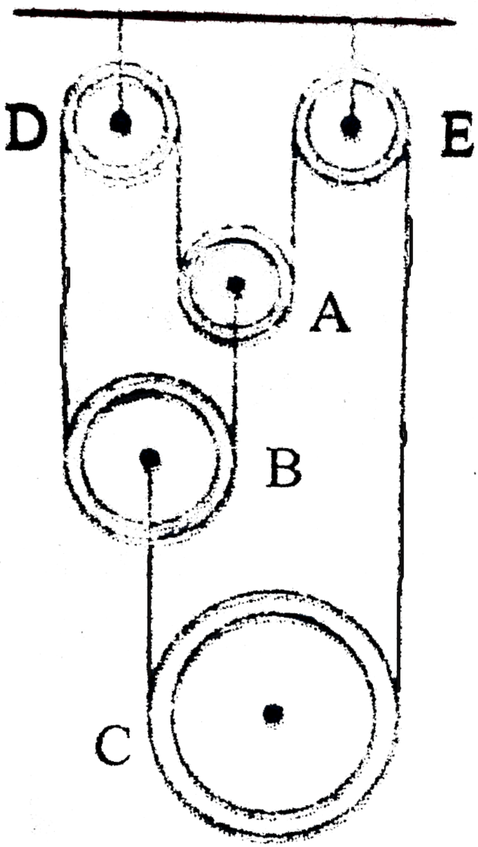
C. $a_{BA} = 3a_0$

D. $a_{BG} = a_0\sqrt{10 + 6\cos\theta}$

Answer: C::D

Watch Video Solution

19. 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



A. the tension throughout the string is the

same and equals $T = \frac{2mg}{3}$.

B. pulleys A and B have acceleration $\frac{g}{3}$ each in downward direaction and pulley C has acceleration $\frac{g}{3}$ in wpward direaction .

C. pulleys A, B and C all have accleration $\frac{g}{3}$ in downward direction .

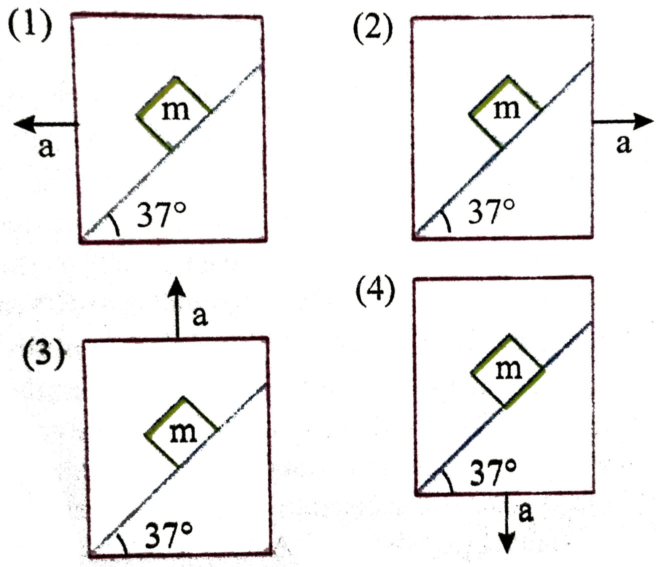
D. pulley A has acceleration $\frac{g}{3}$ in downward direction and pulleys B and C have acceleration $\frac{g}{3}$ each in upward direction .

Answer: A::B::D

Watch Video Solution

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

respectively then



A. $N_3 > N_1 > N_2 > N_4$

B. $N_4 > N_3 > N_1 > N_2$

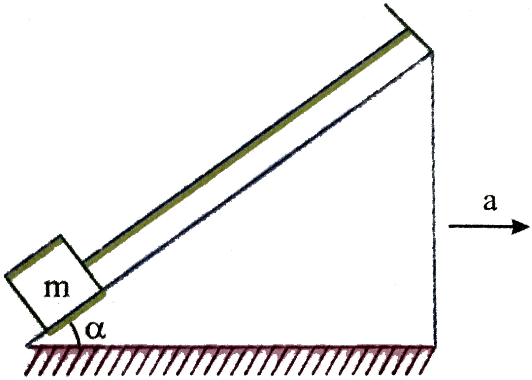
C. $b_2 > b_3 > b_4 > b_1$

D. $b_2 > b_3 > b_1 > b_4$

Answer: A::C

Watch Video Solution

21. A body of mass $m = 18kg$ is placed on an inclined plane the angle of inclination is $\alpha = 37^{\circ}$ and is attached to the top end of the slope with a thread which is parallel to the slope. Then the plane slope is moved with a horizontal acceleration of a. Friction is negligible.



The tension in thread in the above question is

.

A. $12N$

B. $10N$

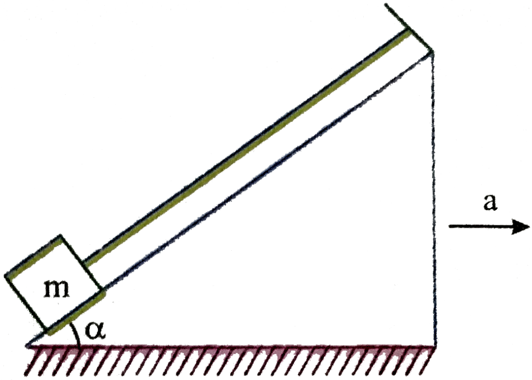
C. $8N$

D. $4N$

Answer: A

Watch Video Solution

22. A body of mass $m = 18kg$ is placed on an inclined plane the angle of inclination is $\alpha = 37^{\circ}$ and is attached to the top end of the slope with a thread which is parallel to the slope. Then the plane slope is moved with a horizontal acceleration of a. Friction is negligible.



At what acceleration will the body lose contact with plane .

A. $\frac{40}{3} m / s^2$

B. $7.5 m / s^2$

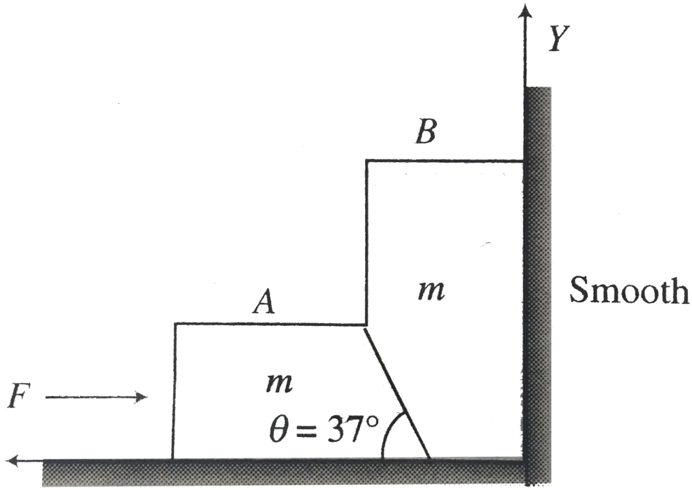
C. $10 m / s^2$

D. $5 m / s^2$

Answer: A

Watch Video Solution

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

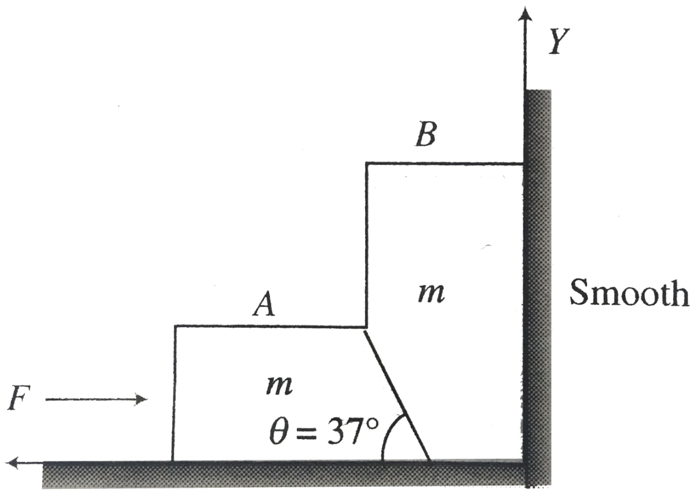
C. $\frac{3}{4}mg$

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

Answer: C

Watch Video Solution

24. 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

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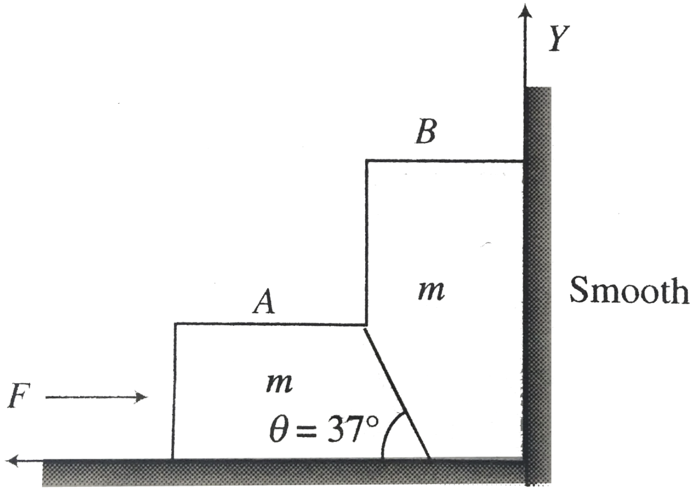
25. Two smooth block are placed at a smooth corner as shown in fig. Both the bloks are having mass m. We apply a force F on the block m. Block A presses block B in the normal direction, due to which pressing force on vertical wall will increase, and pressing force on the horizontal wall decreases, as 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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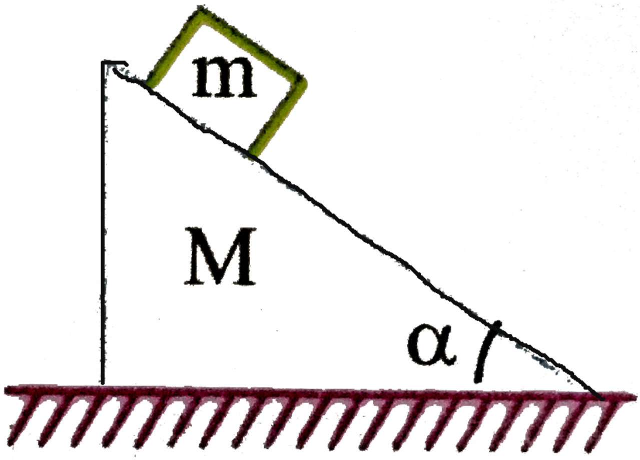
26. In the figure heavy mass m moves down the smooth surface of a wedge making an angle α with the horizontal. The wedge at rest

$t = 0$ 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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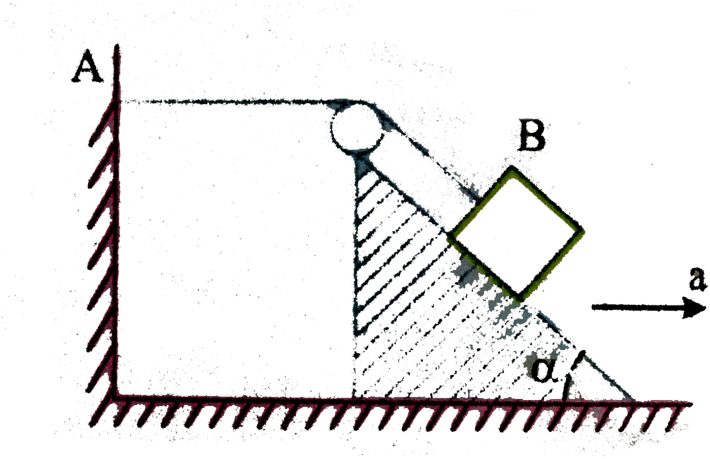
27. A weightless inextensible rope rests on a stationary wedge forming an angle α with a horizontal One end of the rope is fixed to the wall to point A.A small load is attached to the rope at point B The wedge starts moving to the right with a constant acceleration a The acceleration of the load is given by



A. a

B. $2a \sin(.^{\alpha} /_{2})$

C. $a \sin \alpha$

D. $\sin(.^{\alpha} /_{2})$

Answer: B

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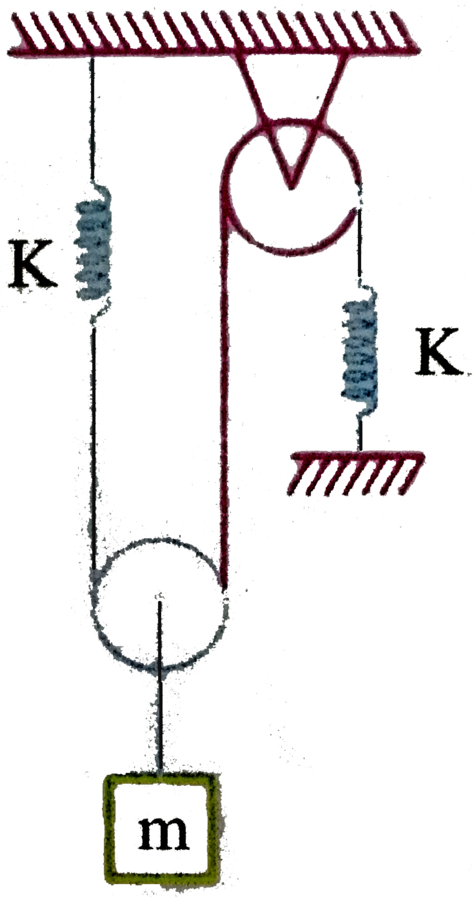
28. Block is attached to system of springs. Calculate equivalent spring constant.



A. K

B. $2K$

C. $3K$

D. $4K$

Answer: B

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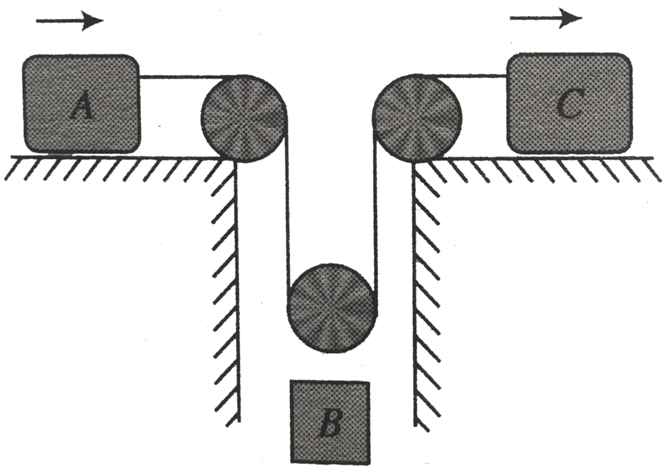
29. Block A and C starts from rest and move to the right with acceleration $a_A = 12tms^{-2}$ and $a_C = 3ms^{-2}$. Here t is in second. The time when block B again comes to rest is



A. $2s$

B. $1s$

C. $3/2s$

D. $1/2s$

Answer: D

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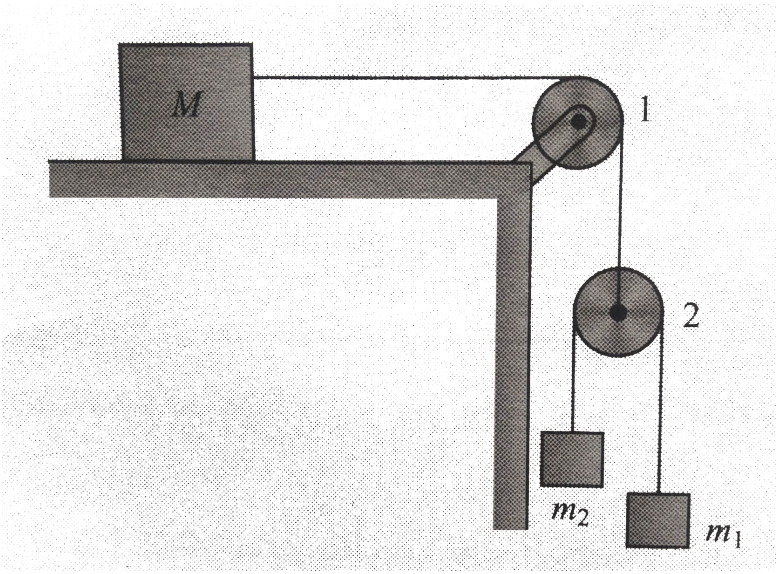
30. In the arrangement shown in fig. $m_1 = 1kg, m_2 = 2kg$. Pulleys are massless and strings are light. For what value of M, the mass m_1 moves with constant velocity.



A. $6kg$

B. $4kg$

C. $8kg$

D. $10kg$

Answer: C

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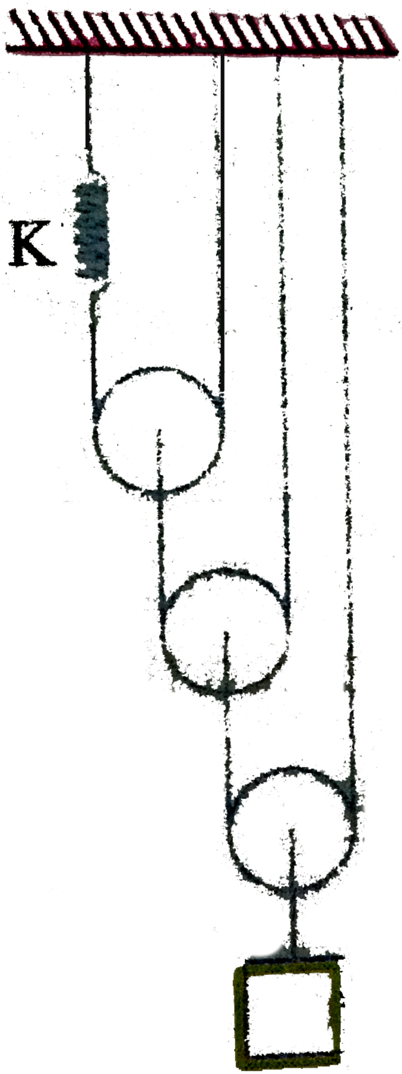
31. Find equivalent spring constant for the system



A. k

B. $2K$

C. $64K$

D. $8K$

Answer: C

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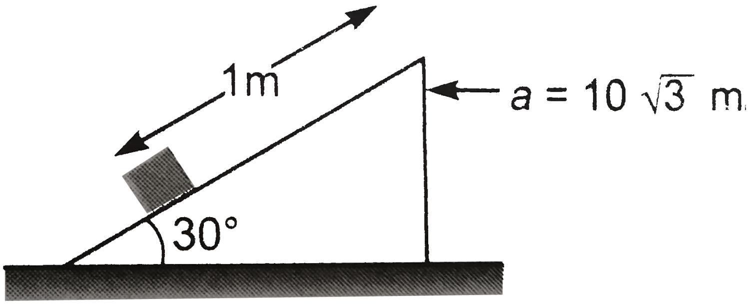
32. In the figure the wedge is pushed with an acceleration of $\sqrt{3}m/s^2$. It is seen that the block start climbing up on the smooth inclined face of wedge . What will be the time taken by the block to reach the top?



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

B. $\frac{1}{\sqrt{5}}s$

C. $\sqrt{5}s$

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

Answer: B

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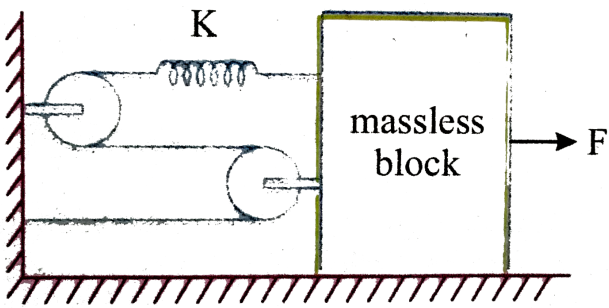
33. In the above diagram system is in equilibrium if applied force F is doubled how much mass less block will more towards right before new equilibrium is achieved



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

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

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

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

Answer: D

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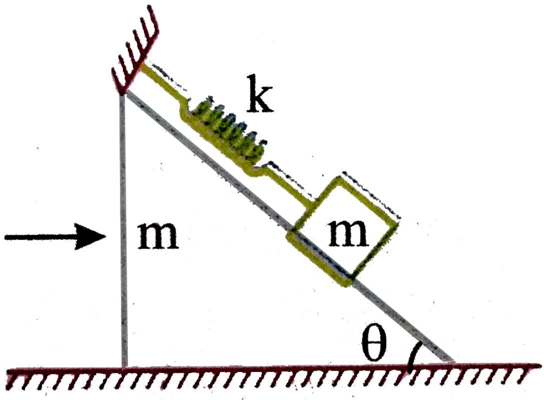
34. In the above diagram all surface friction less what horizontal force has to be applied on wedge such in equilibrium steady state sping is compressed by $\dfrac{mg\sin\theta}{K}$



A. $2mg\tan\theta$

B. $2mg\sin\theta$

C. $4mg\tan\theta$

D. $2mg\tan\theta$

Answer: C

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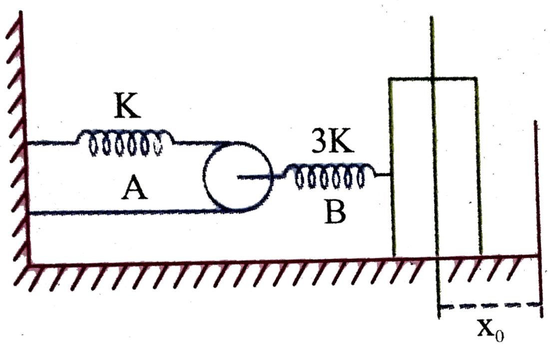
35. If the above diagram initially there is no elongation in spring if the block is displaced towards right by x_0. Calculate the elongation of spring A.



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

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

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

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

Answer: A

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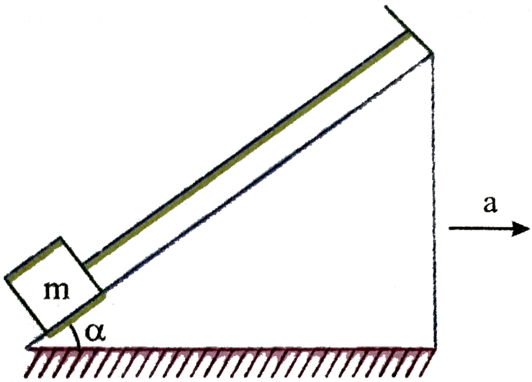
SINGLE ANSWER QUESTIONS Passage -1

1. A body of mass $m = 18kg$ is placed on an inclined plane the angle of inclination is $\alpha = 37^\circ$ and is attached to the top end of the slope with a thread which is parallel to the slope. Then the plane slope is moved with a horizontal acceleration of a. Friction is negligible.



THe acceleration if the body pushes the plane with a force of $\frac{3}{4}mg$ is .

A. $\frac{5}{43}m/s^2$

B. $0.5m/s^2$

C. $0.75m/s^2$

D. $\frac{5}{6}m/s^2$

Answer: D

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INTEGER TYPE QUESTIONS

1. Under to action of constant force $F = 10$ N, a body moves in a straight line so that the relation between the distance S moved by the body and the time t is described by the equation $S = A - Bt + Ct^2$ Find the mass of the body if $C = 1m/s^2$.

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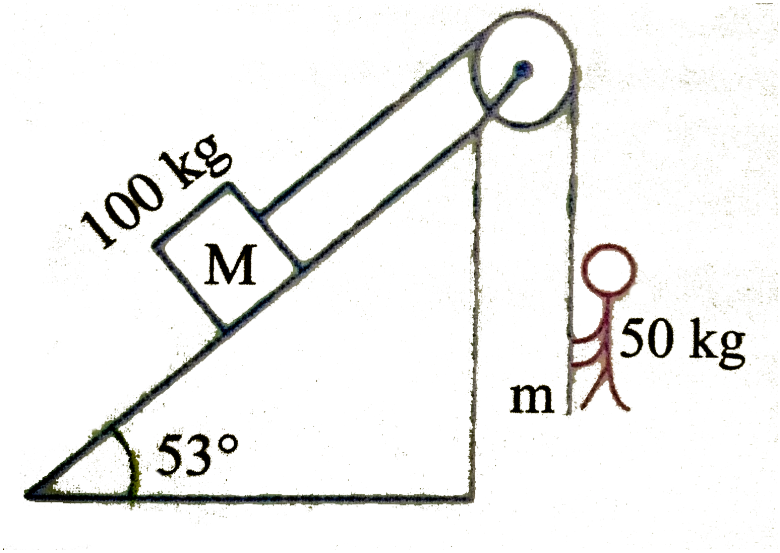
2. By what acceleration the boy must go up so that $100kg$ block remains stationary on the wedge. The wedge is fixed and is smooth

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



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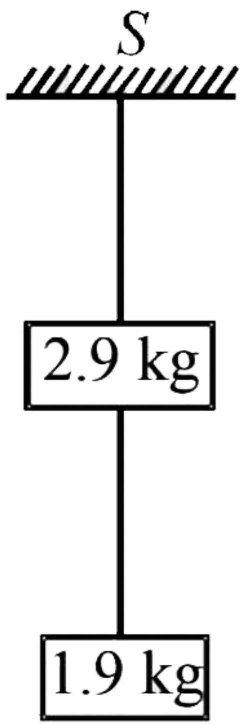
3. Two blocks of mass 2.9 kg and 1.9 kg are suspended from a rigid support S by two inextensible wires each of length 1 meter, see fig. The upper wire has negligible mass and the lower wire has a uniform mass of $0.2 kg/m$. The whole system of blocks wires and support have an upward acceleration of $0.2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



(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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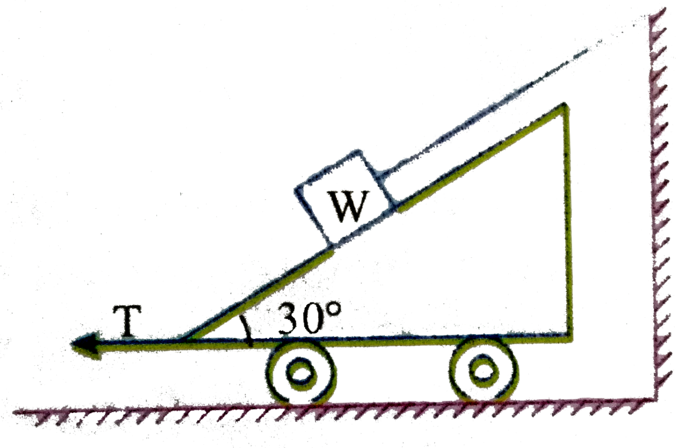
4. If the tension T needed to hold the cart equilibrium is $\frac{\sqrt{3}W}{x}$ there is no friction. Find value of x



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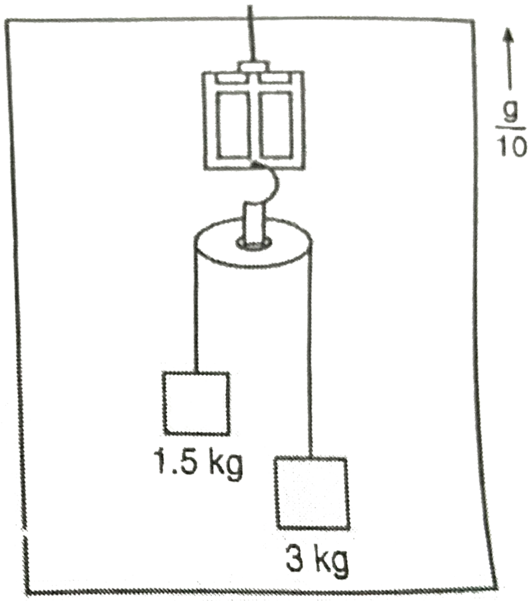
5. The elevator is going up with an acceleration of $g/10$ the pulley and the string are light and the pulley is smooth. If reading of spring balance shown is $1.1x$ Calculate x.

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



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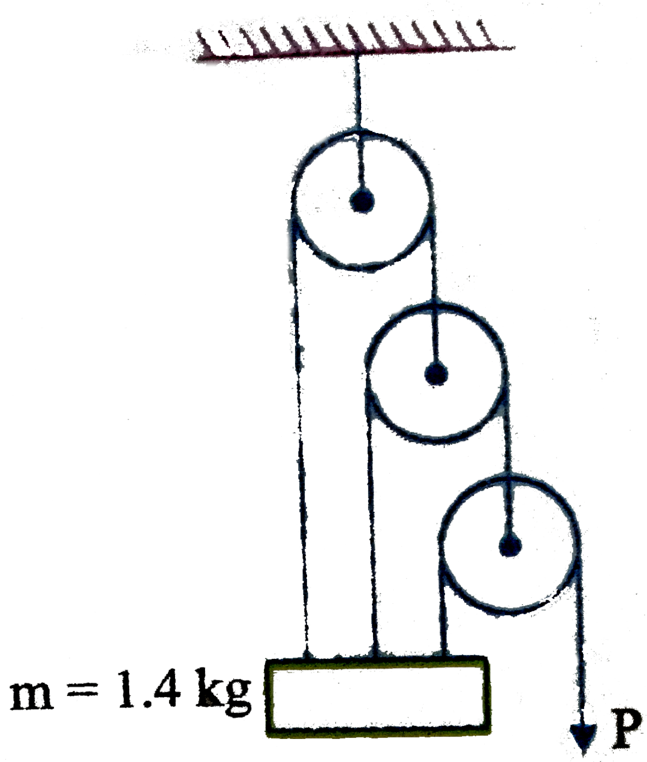
6. The pull P is just suffiient to keep the $14N$ block in equilibrium as shown Pulleys are ideal

Find the tension (in N) in the cable connected

with ceiling



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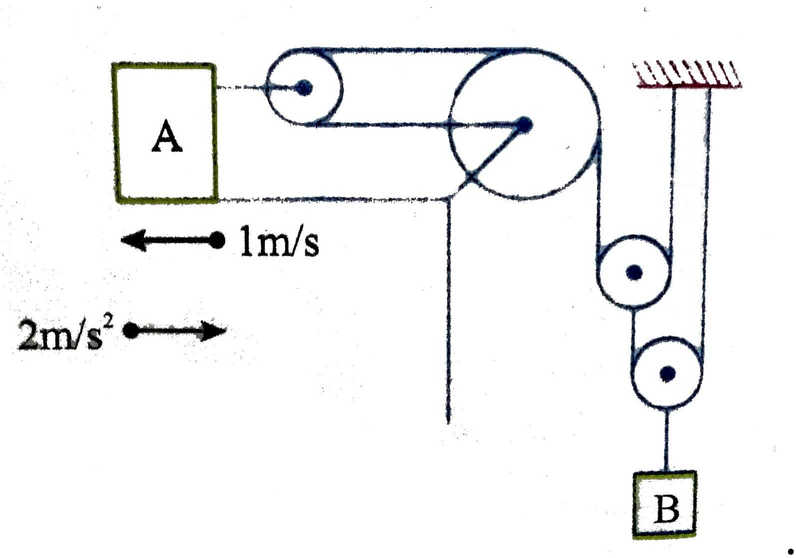
7. In the given find the and acceleration of B if instantaneous velocity and acceleration of A are as shown in the



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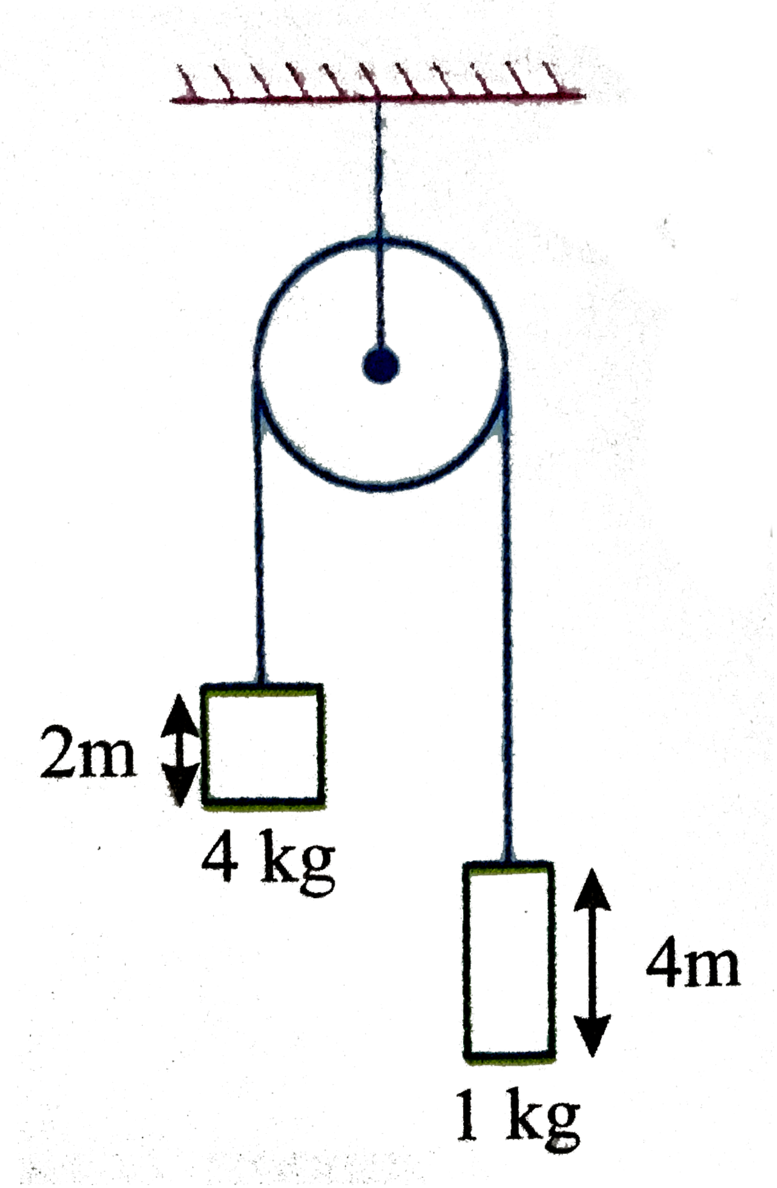
8. shown, both blocks are released room rest.

Length of $4kg$ 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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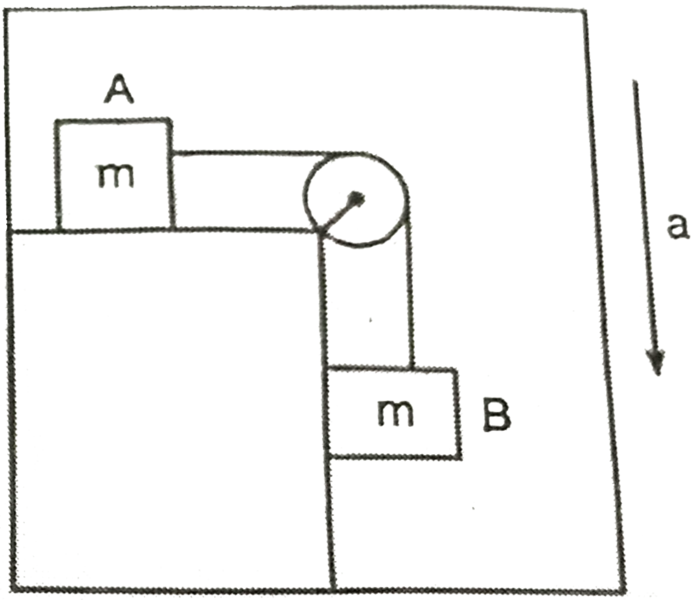
9. Two smooth blocks of same mass are connected by an inextensible and massless string which is passing over a smooth pulley are kept in a lift is going down with



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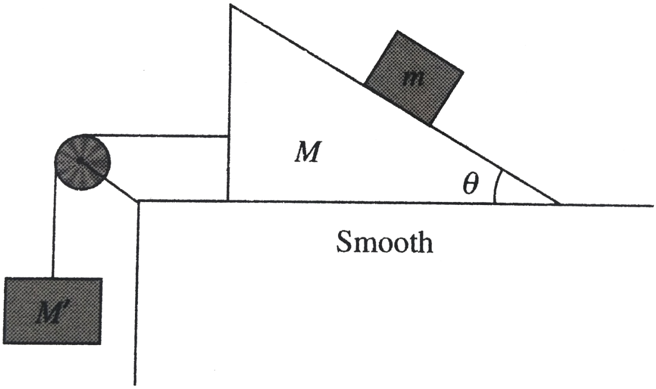
10. Figure shown a block of mass m placed on a smooth wedge of mass M. Calculate the minimum value of M' and tension in the string, so that the block of mass m will move vertically downwards with acceleration

$10ms^{-2}$



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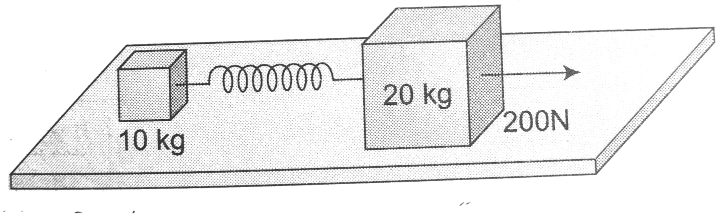
11. The masses of $10kig$ and $20kg$ respectively are connected by a massless spring as shown in figure. A force of $200N$ acts on the $20kg$ mass. At the instant shown, the $10kg$ mass has acceleration $12m / \sec^2$. What is the acceleration of $20kg$ mass?



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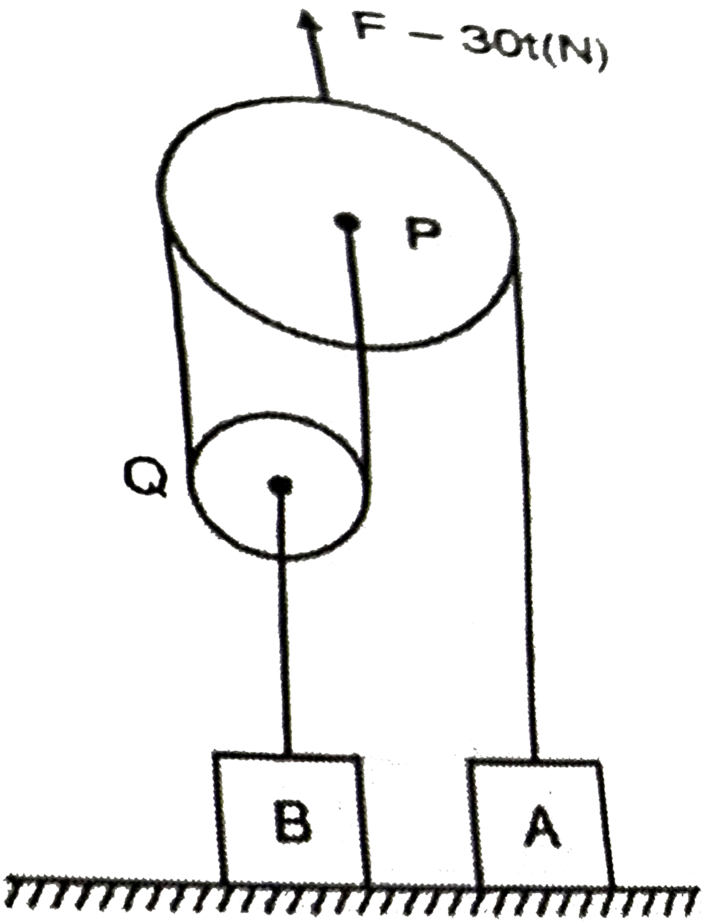
12. Two blocks A and B having masses $m_1 = 1kg m_2 = 4kg$ are arranged as shown in the figure The pulleys P and Q are light and frictionless. All the blocks are resting on a horizontal floor and the pulleys are held such

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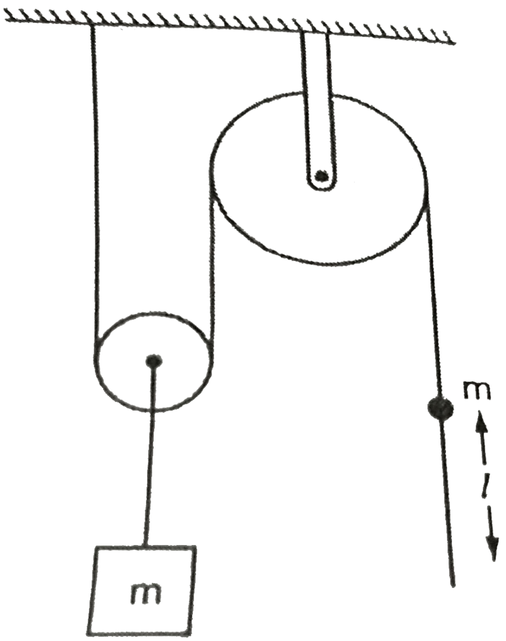
13. In the fig shown below, friction force between the bead and the light string is $\frac{mg}{4}$ if $t = \sqrt{\frac{nl}{7g}}$ where t is the time in which the bead loose contact with the string after the system is released from rest, find n



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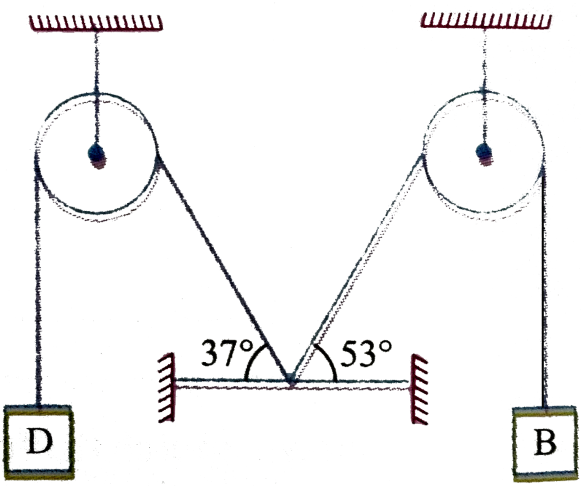
14. A bead C can move freely on a horizontal rod. The bead is connected by blocks B and D by a string as shown in the figure. If the velcoity of B is v The velcoity of block D is $4v/x$ find the value of x



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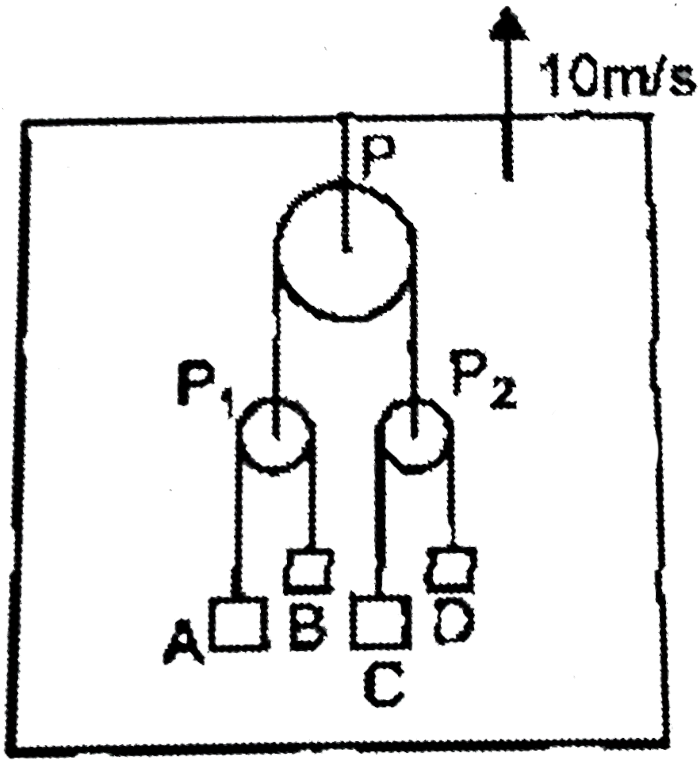
15. A lift goes up with 10 m/s. a pulley P is fixed to the ceiling of the lift. To this pulley other two pulley P_1 and P_2 are attached. P_1 moves up with velocity 30 m/s. A moves up with velocity 10 m/s. D is moving downwards with velocity 10 m/s at same instant of time. Find the velocity of B and that of C at that instant. Assume that all velocities are relative to the ground.



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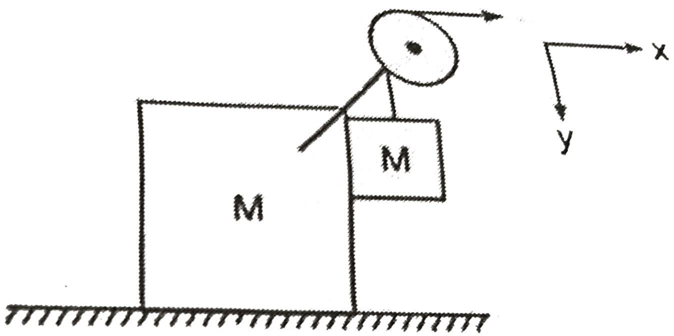
16. In the situation given, all surfaces are frictionless. Pulley is ideal and string is light if $F = mg/2$ the acceleration of the big block is g/x then x is:



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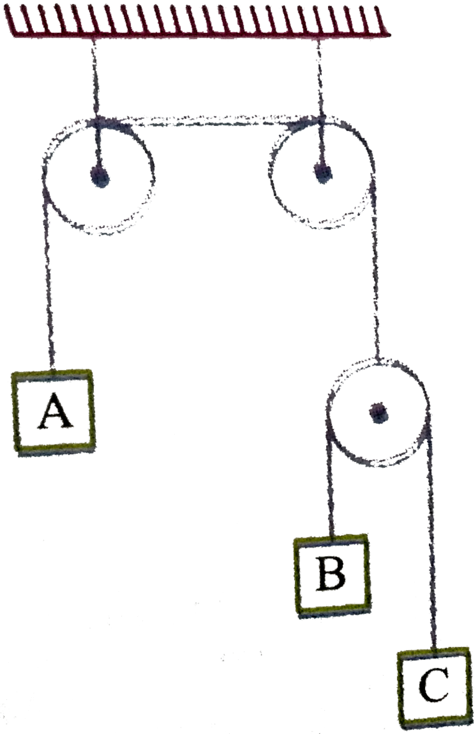
17. Three blocks shown in move vertically with constant velocities The relative velocity of w.r.t C is $100 m / s$ upward and the relative velocity of B w.r.t A is $50 m / s$ downward. All the string are ideal The velocity of C with respect to ground is $125/x$ calculate x



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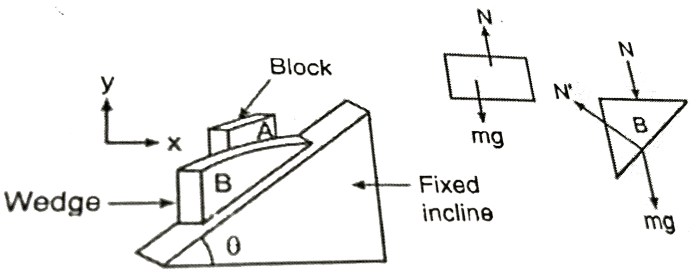
18. Block A of mass m is placed over a wedge of same mass m. Both the block and wedge are placed on a fixed inclined plane. Assuming all surfaces to be smooth, the displacement of the block A in ground frame in 1s is $\frac{g\sin^2\theta}{x+\sin^2\theta}$ then the value of x is:



(a) (b)

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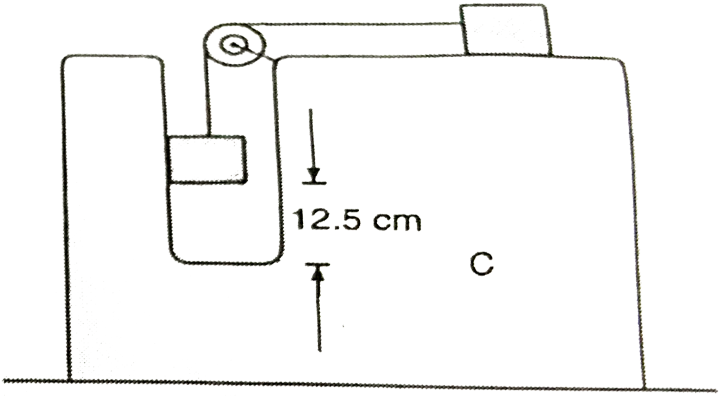
19. A small, light pulley is attached with a block C of mass 4 kg as shown in fig A block B of mass $1.5kg$ is placed on the top horizontal surface of C. Another block A of mass 2 kg is hanging from a string, attached with B and passing over the pulley. Taking $g = 10ms^{-2}$ and neglecting friction,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

calculate x.



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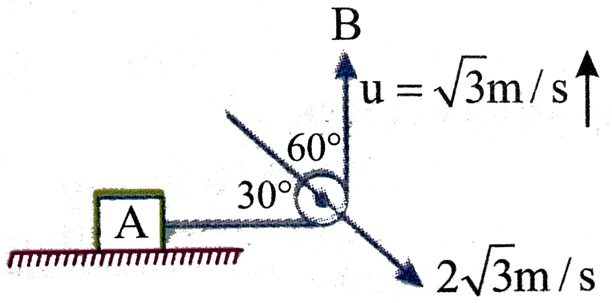
20. A system is shown in the End B of string is moving upwards with $\sqrt{3}m/s$ Pulley is moving with speed $2\sqrt{3}m/s$ in direction shown in the figure. The velocity of the block A is $x + 2\sqrt{3}(m / s)$ find x



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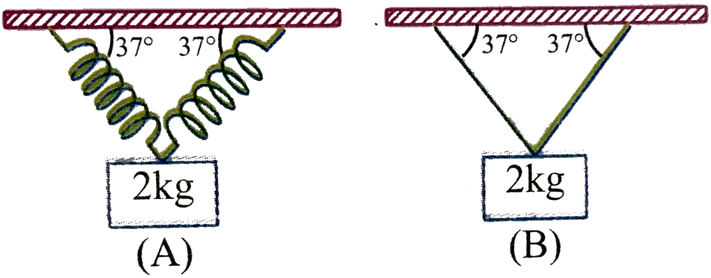
21. If at $t = 0$ right spring in (A) and right string in (B) breaks The ratio of magnitudes of instantaneous acceleration of blocks A & B is

$\frac{5x}{24}$ calculate x



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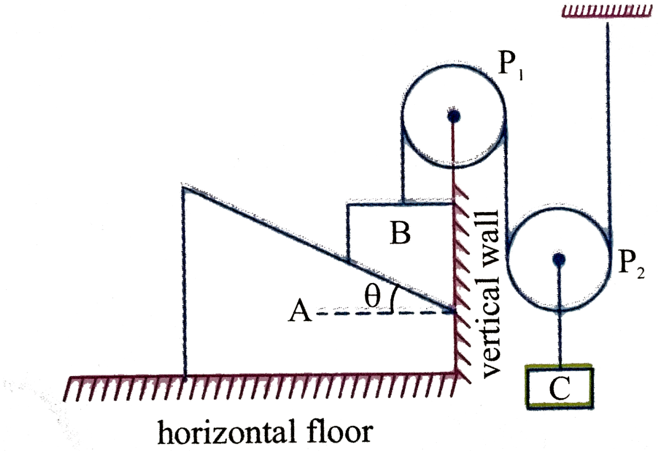
22. In the shown P_1 and P_2 are massless pulleys P_1 is fixed and P_2 can move Masses of A, B and C are $\frac{9m}{64}$ $2m$ amd m respectively All contacts are smooth and the string is massless $\theta = \tan^{-1}\left(\frac{3}{4}\right)$ (Take $g = 10m/s^2$)

The tension in string connecting pulley P_2 and block C is $\frac{13}{x}$ Calculate x (Take $m = 1kg$)



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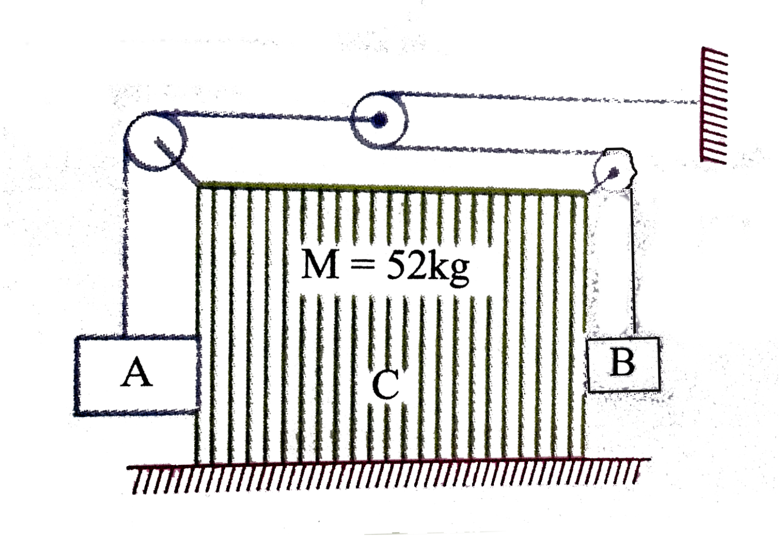
23. In the arrangement shown in the figure, pulleys are light, small and smooth. Mass of blocks A, B and C is $m_1 = 14kg$, $m_2 = 11kg$

and $M = 52kg$ respectively. The block A can slide freely along a vertical rail fixed to left vertical face of block C Assuming all the surface to be smooth magntitude of acceleration of block A is $\sqrt{\frac{10}{A}}$ Calculate x



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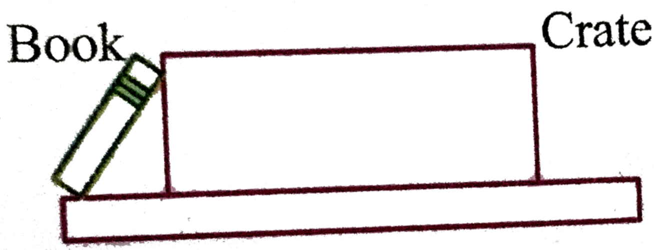
MULTIPLE ANSWER QUESTIONS

1. A book leans against a crate on a table. Neither is moving Which of the following statements concerning this situation is/are incorrect.



A. The force of the book on the crate is lessthan that of crate on the book .

B. Although there is no friction acting on the crate there must be friction acting on the book or else it will fall .

C. The net force acting on the book is zero

D. The direction of the frictional force acting on the book is in the same direction as the frictional acting on the crate .

Answer: A::B::D

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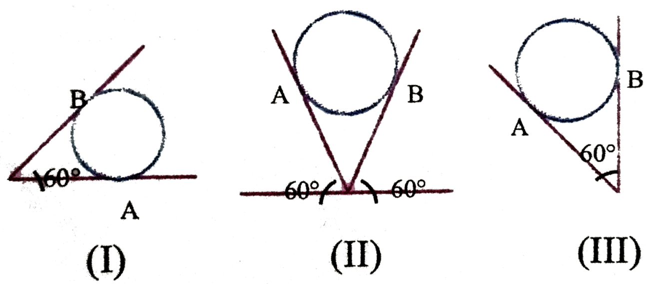
2. An iron sphere weighing $10N$ rests in a V shaped smooth trough whose sides form an angle of 60° as shown in the Then the reaction forces are



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A. $R_A = 10N$ and $R_B = 0$ in case (i)

B. $R_A = 10N$ and $R_3 = 10N$ in case (ii)

C. $R_A = \frac{20}{\sqrt{3}}N$ and $R_B = \frac{10}{\sqrt{3}}N$ in case (iii)

D. $R_A = 10N$ and $R_B = 10N$ in all the 3 cases

Answer: A::B::C

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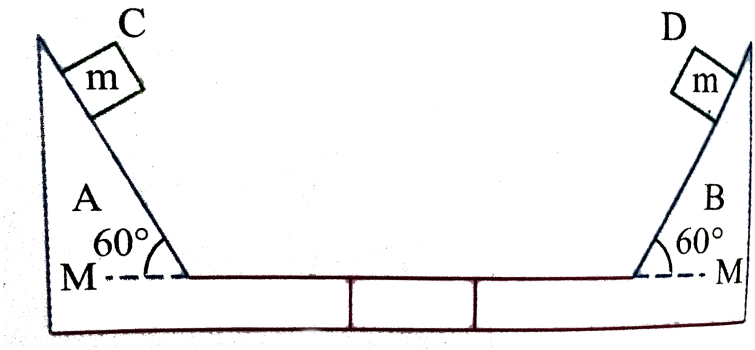
3. In the above situation all surface are frictionless system is released from rest. Then which of the following statements is/are correct



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A. acceleration of wedges are zero

B. wedges accelerate towards right

C. Normal force exerted by ground on A is more than normal force exerted by ground on B.

D. Tension in connecting string is nonzero

Answer: A::C::D

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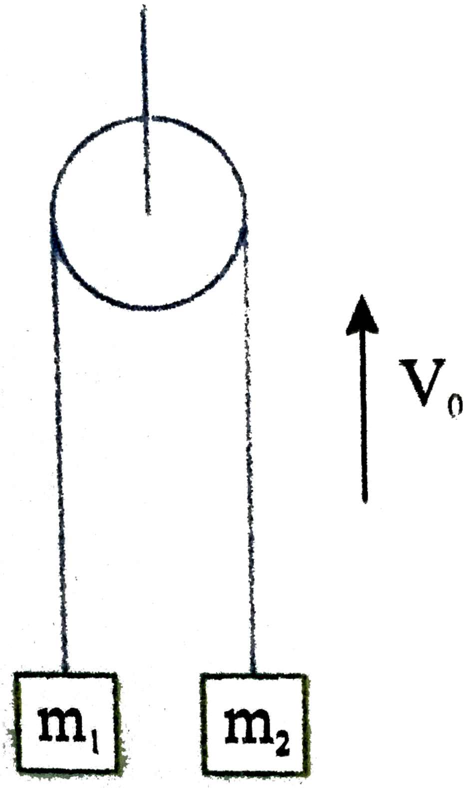
4. Two blocks of masses m_1 and $m_{-2}m > (m_2)$ are connected by massless threads that passes over a massless smooth pulley The pulley is suspended from the ceiling of an elevator Now the elevator moves up with uniform velocity V_0 Now select the correct options



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

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

C. Tension in the thread that connects m_1 and m_2 is equal to $\frac{2m_1 m_2 g}{m_1 + m_2}$.

D. Tension in the thread that connects m_1 and m_2 is equal to $\frac{2m_1 m_2 g}{m_1 + m_2}$.

Answer: B::C

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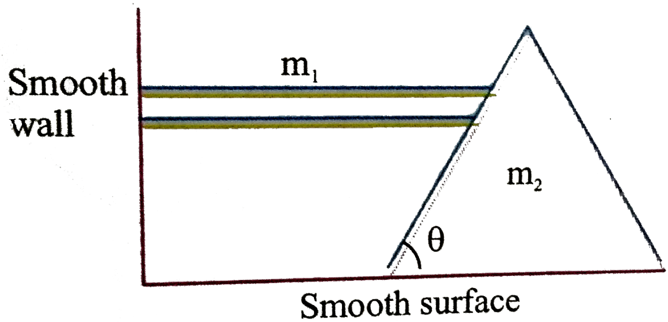
5. A horizontal bar of mass m_1 Prism of mass m_2 can move as shown. There is no friction at any contact point. During the motion the length of the rod is always horizontal Now, magnitude valuse of



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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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6. Which of the following regarding frame of reference is correct ? .

A. Newton' s third law is valid from both inertial and non inertial frame .

B. Newton' s third law is valid from both inertial and non inertial frame .

C. sun can be considered perfectly intertial frame

D. Acceleration of a body measured from different inerital frames are different .

Answer: A::B::D

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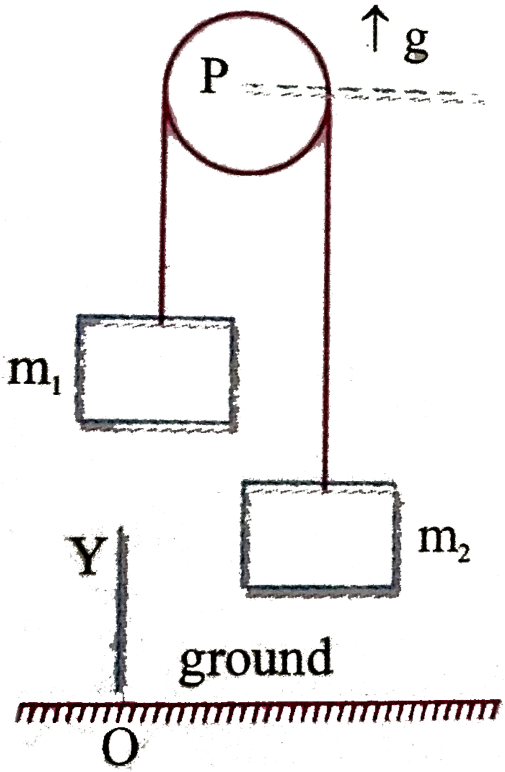
7. Two masses m_1 and m_2 are connected by light inextensible string passing over a smooth pulley P. If the pulley moves vertically upwards with an acceleration equal to g then



A. Tension on the string is $\dfrac{4m_1m_2g}{m_1+m_2}$

B. Tension on the string is $\dfrac{2m_1m_2g}{m_1+m_2}$

C. The acceleration of mass m_1 with respect to ground is $\frac{3m_2 - m_1}{m_1 + m_2} g$.

D. The acceleration of mass m_1 with respect to ground is $\frac{2(m_2 - m)}{m_1 + m_2} g$

Answer: A::C

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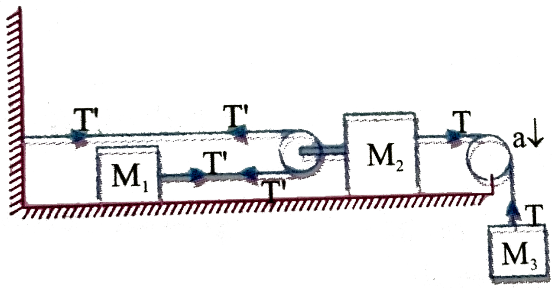
8. In the arrangement shown in the all contact surfaces are smooth strings and pulleys are massless

Given $M_1 = 1kg, M_2 = 2kg, M_3 = 4kg$ and

$g = 10ms^{-2}$



.

A. The acceleration of block of mass M_3 is

$4ms^{-2}$

B. The acceleration of block of mass M_1 is

$4ms^{-2}$

C. The tension (T) in the string connecting

blocks of masses M_3 and M_2 is $24N$.

D. The tension (T) in the string connecting blocks of masses M_1 and M_2 is $24N$.

Answer: A::C

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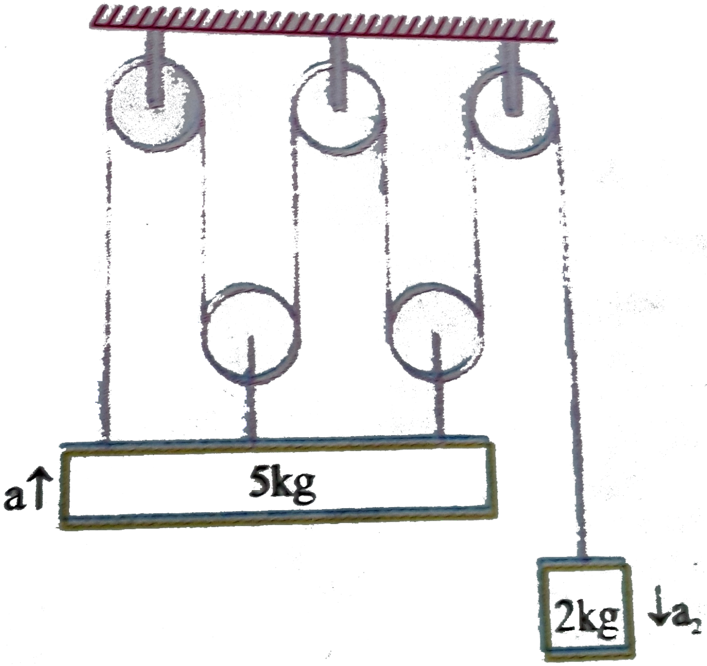
9. In the shown ,two blocks one of mass $5kg$ and the other of mass $2kg$ are connected by light and inextensible string Pulleys are light an d frictionless Choose the correct statement



A. The acceleration of $5kg$ mass is

$\frac{5g}{11} ms^{-2}$

B. The acceleration of $2kg$ mass is

$\frac{5g}{11} ms^{-2}$

C. Tension in the string is $\frac{12g}{11}N$.

D. Tension in the string is $\frac{10g}{11}N$.

Answer: B::C

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PASSAGE TYPE QUESTION

1. A shot putter with a mass of $80kg$ pushes the iron ball of mass of $6kg$ from a standing position accelerating it uniformly form rest at an angle of 45° with the horizontal during a time interval of 0.1 seconds. The ball leaves his hand when it $2m$ high above the level ground and hits the ground 2 seconds later $\left(g = 10m / s^{2}\right)$.

The accleration of the ball in shot putter's hand .

A. $11\sqrt{2}m / s^{2}$

B. $100\sqrt{2}m / s^{2}$

C. $90\sqrt{2}m / s^{2}$

D. $9\sqrt{2}m / s^{2}$

Answer: C

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2. A shot putter with a mass of $80kg$ pushes the iron ball of mass of $6kg$ from a standing position accelerating it uniformly form rest at an angle of 45° with the horizontal during a time interval of 0.1 seconds. The ball leaves his hand when it $2m$ high above the level ground and hits the ground 2 seconds later $(g = 10m/s^2)$.

The horizontal disatnce between the point of release and the point where the ball hits the ground .

A. $16m$

B. $18m$

C. $20m$

D. $22m$

Answer: B

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3. A shot putter with a mass of $80kg$ pushes the iron ball of mass of $6kg$ from a standing position accelerating it uniformly form rest at an angle of 45° with the horizontal during a time interval of 0.1 seconds. The ball leaves his hand when it $2m$ high above the level ground and hits the ground 2 seconds later $\left(g = 10m/s^2\right)$.

The minimum value of the static coefficient of friction if the shot putter does not slip during the shot is closest to .

A. 0.28

B. $18m$

C. $20m$

D. $22m$

Answer: B

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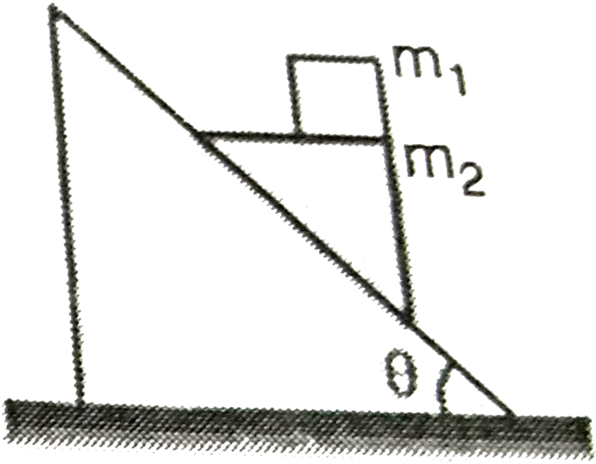
4. Two blocks m_1 and m_2 are allowed to move without friction. Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown. The angle of inclination of inclined plane is θ



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

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

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

Answer: A

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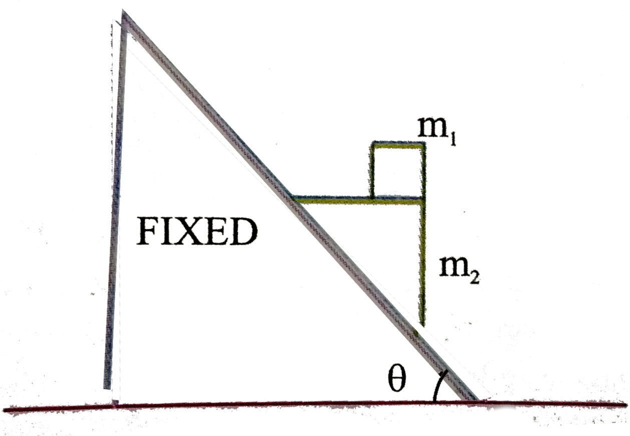
5. Two blocks m_1 and m_2 are allowed to move without friction Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown The angle of inclination of inclined plane is θ



The acceleration of m_2 with respect to ground is .

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

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

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

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

Answer: B

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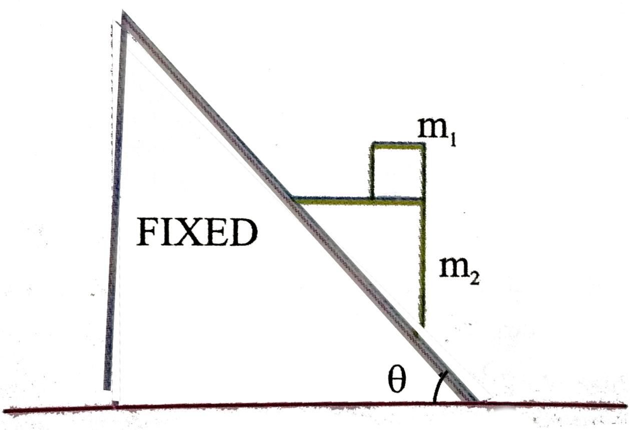
6. Two blocks m_1 and m_2 are allowed to move without friction Block m_1 is on block m_2 and m_2 slides on smooth fixed incline as shown The angle of inclination of inclined plane is θ



.

Normal reaction on m_1 is .

A. $m_1 g$

B. $(m_1 + m_2)g$

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

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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