PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

LAW OF MOTION

Illustration

1. 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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2. A particle of mass 4 m explodes into three pieces of masses, m, m and 2 m. 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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3. A rifle of 20 kg mass can fire 4 bullets/s. The mass of each bullet is $35 \times 10^{-3} kg$ and its final velocity is $400 ms^{-1}$. Then, what force must be applied on the rifle so that it does not move backwards while firing the bullets

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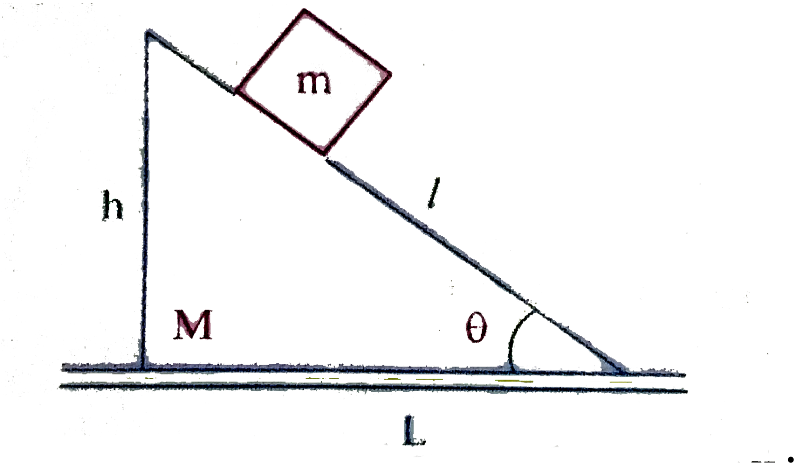
4. All surfaces are smooth Find the horizontal displacements of the block and the wedge when the block slides down from top to bottom



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5. Action and reaction forces acts on

A. Same body

B. Different bodies

C. Depends on the magnitude of force

D. Data insufficient

Answer: B

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

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7. 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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8. 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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9. A very flexible chain of length L and mass M is vertically suspended with its lower end just touching the table. If it is released so that each link strickes the table and comes to rest. What force the chain will exert on the table at

the moment 'y' part of length falls on the table ? .

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10. 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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11. Action and reaction forces are

A. Unequal in magnitude and in same direction

B. Equal in magnitude and in same direction

C. Unequal in magnitude and in opposite direction

D. Equal in magnitude and opposite in direction

Answer: D

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12. 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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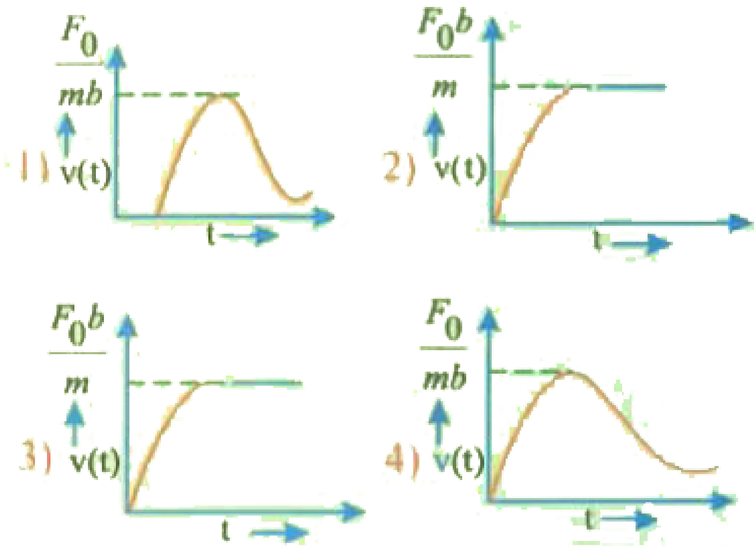
13. A particle of mass m is at rest at the origin at time $t = 0$. It is subjected to a force $F(t) = F_0 e^{-bt}$ in the X - direction. Its speed V(t) is depicted by which of the following curves.



14. A liquid of density ρ flows along a horizontal pipe of uniform cross - section A with a velocity v through a right angled bend as shown in Fig. What force has to be exerted at the bend to hold the pipe in equilibrium ?

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15. A flat plate moves normally with a speed v_1 towards a horizontal jet of water of uniform area of cross section. The jet discharges 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 at right angles to the original motion. The magnitude of the force acting on the plate due to the jet is

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16. A gardener is watering plants at the rate 0.1 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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17. A ball falling with velocity $\overrightarrow{v_i} = \left(-0.65\hat{i} - 0.35\hat{j}\right)ms^{-1}$ is subjected toa net impulse $\overrightarrow{I} = \left(0.6\hat{i} + 0.18\hat{j}\right)Ns$. If the ball has a mass of 0.275 kg, calculate its velocity immediately following the impulse.

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18. A spherical mirror, whose reflecting surface is curved inwards, that is,faces towards the centre of the sphere, is called a

A. Concave mirror

B. Convex mirror

C. Biconcave mirror

D. Biconvex mirror

Answer: A

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19. Image formed by a plane mirror is always____and____

A. Real and inverted

B. Real and erect

C. Virtual and erect

D. Virtual and inverted

Answer: C

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20. A ball hits a floor normally with velocity u and return with same speed. If the ball is in contact with the floor for 0.1 sec, find the average impulsive force acting on the ball. Take the mass of the ball m = 200 gm and $u = 2m / s$.

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21. 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 to $t_f = 0.3s$

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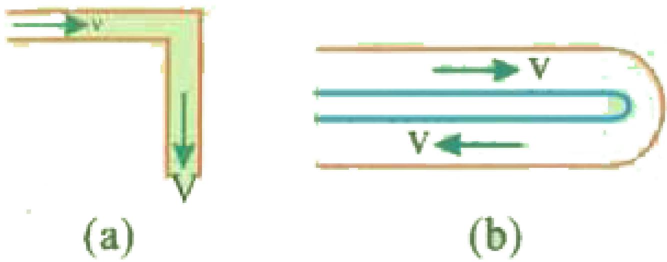
22. A liquid of density ρ is flowing inside a pipe of cross - sectional area A. The pipe is bent in the shape of a right angle as shown. What force should be exerted on the pipe at the corner to keep it fixed in the two cases shown?



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23. A mass of 3kg is suspended by a rope of length 2m from the ceiling. A force of 40 N in the horizonal direction is applied at midpoint P of the rope 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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24. 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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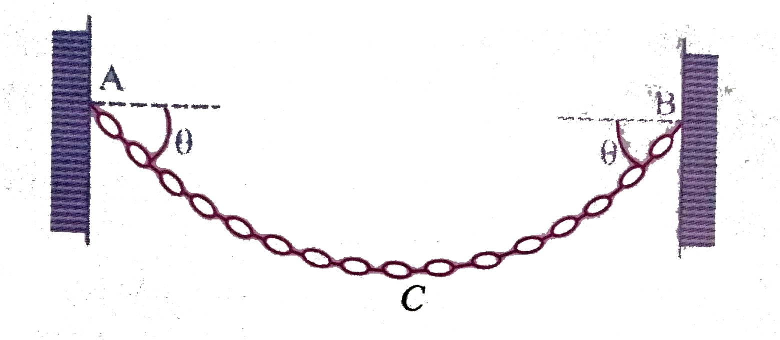
25. A chain of mass 'm' is attached at two points A and B of two fixed walls as shown in the Find the tension in the chain near the walls at point A and at the mid point C



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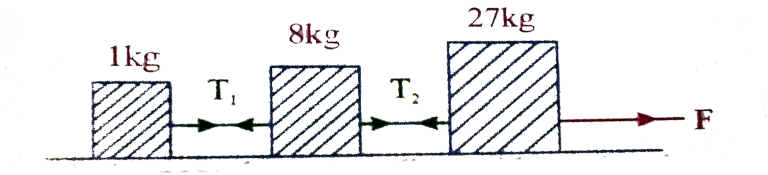
26. Three blocks connected together by strings are pulled along a horizontal surface by applying a force F. $If F = 36N$ What is the tension T_2 ?.



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27. The maximum tension a rope can withstand is 60 kg - wt. The ratio of maximum acceleration with which two boys of masses 20kg and 30kg can climb up the rope at the same time is

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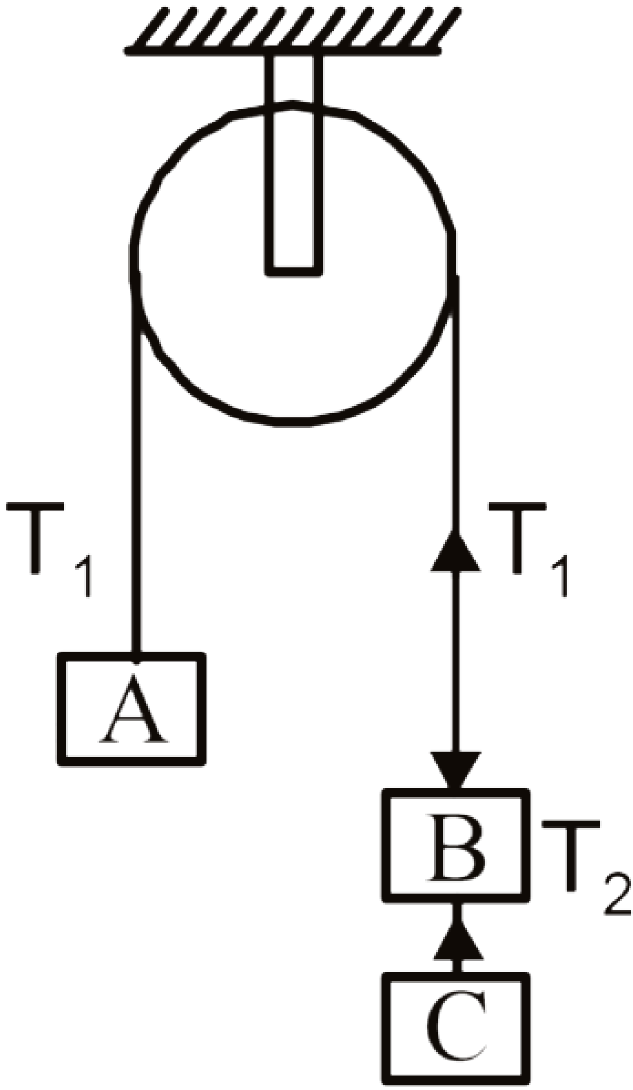
28. Three equal weights of mass m each are hanging on a string passing over a fixed pulley as shown in fig. The tensions in the string connecting weights A to B and B to C will respectively be -



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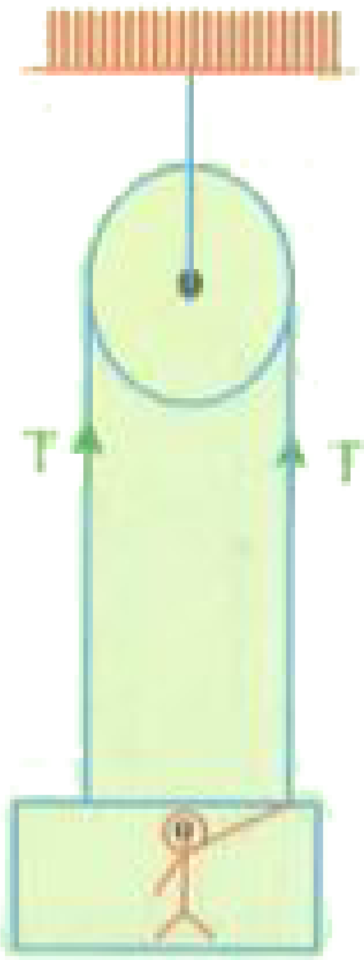
29. A man of mass 60 kg is standing on a weighing machine kept in a box of mass 30 kg as shown in the diagram. If the man manages to keep the box stationary, find the reading of the weighing machine.



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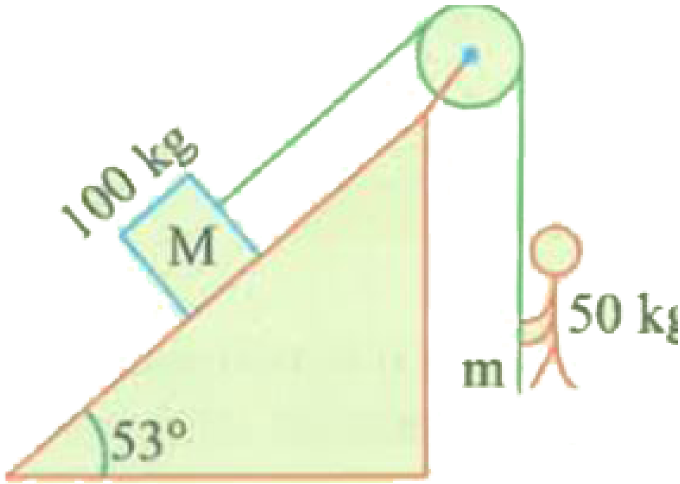
30. By what acceleration the boy must go up so that 100 kg block remains stationary on the wedge. The wedge is fixed and is smooth. $(g = 10 m / s^2)$



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31. The system as shown in fig is released from rest. Calculate the tension in the strings and force exerted by the strings on the pulley. Assuming pulleys and strings are massless

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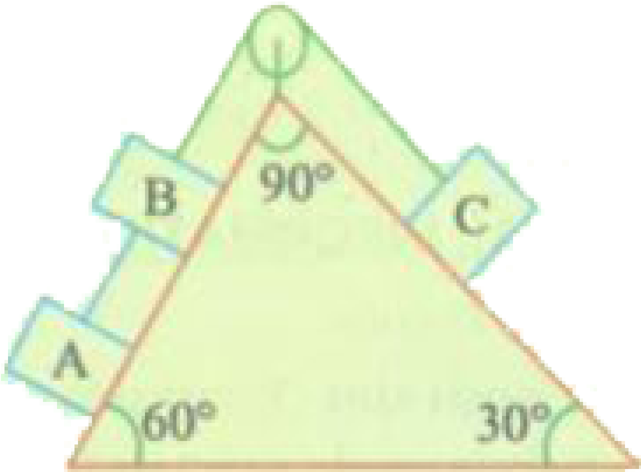
32. In the adjacent fig, masses of A, B and C are 1 kg, 3kg and 2kg respectively. Find a) the acceleration of the system b) tension in the string $(g = 10m/s^2)$



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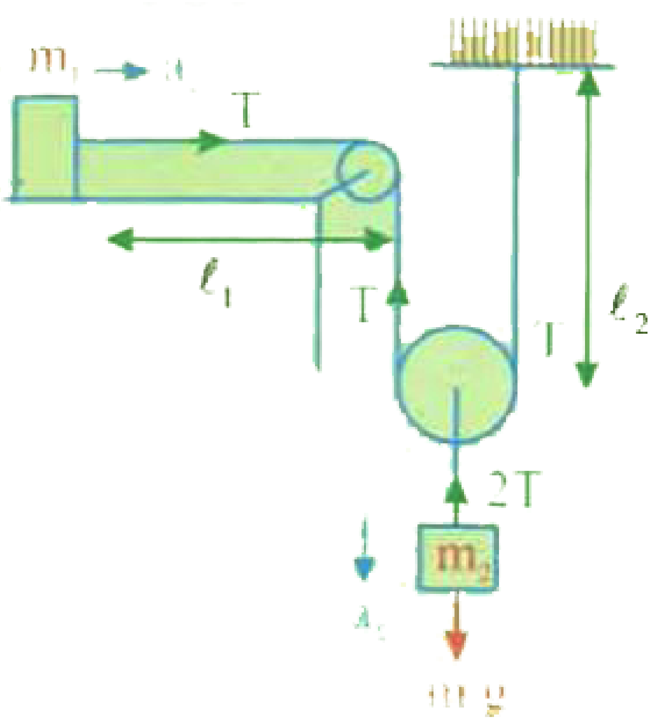
35. In the fig, find the acceleration of m_1 and m_2



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36. A block of weight 100 N is suspended (as shown) with the help of there strings. Find the tensions in the three strings).

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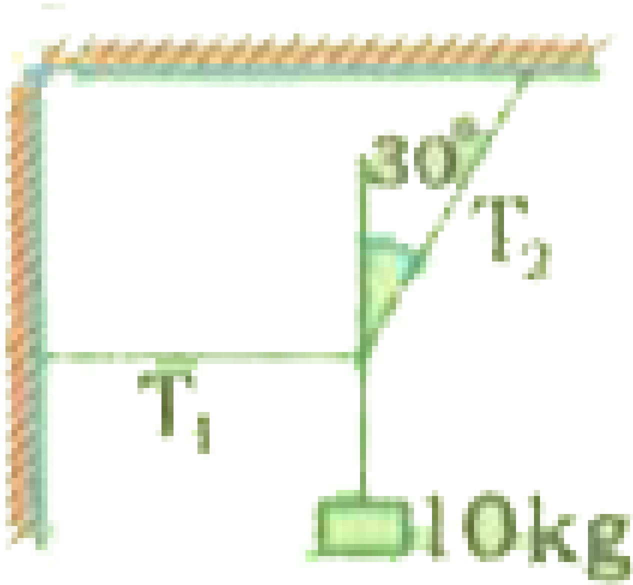
37. A block of mass 10 kg is suspended with two strings as shown in the fig. Find the tensions T_1 and T_2 in the two string.



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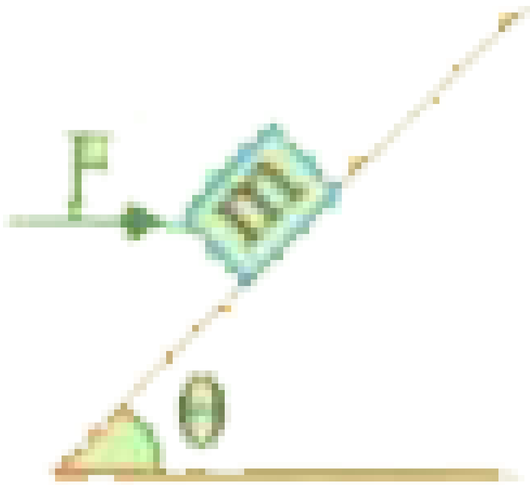
38. Find the magnitude of the horizontal force F required to keep the block of mass m stationary on the smooth inclined plane as

shown in the figure.



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39. A painter of mass 60 kg stands on a 15 kg platform. A rope attached to the platform and passing over an overhead pulley allows the painter to raise himself and the platform. (i) To get started, he pulls the rope down with force of 400 N. Find the acceleration of the platform as well as that of the painter.

(ii) What force he must exert on the rope so as to attain an upward speed of $1m/s$ in 1s ?

(iii) What force should he apply now to maintain the constant speed of $1m/s$?

40. Two blocks are connected by a smooth inextensible massless string passing over a fixed and smooth pulley. Their masses are m_1 and m_2 as shown in figure. Find

(a) Acceleration of each block

(b) Tension in the string

(c) Net forec on the pulley

41. Two masses m_1 and m_2 are connected by a light string passing over a fixed pulley as shown. The system is suspended in a vertical plane. Find the tension in the string connecting m_1 and m_2 and acceleration of masses if $m_1 = 3kg$ and $m_2 = 5kg$. Also find the tension in the rope connecting the centre of pulley to the ceiling.

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42. A body hangs from a spring balance supported from the ceiling of an elevator.

(a) If the elevator has an upward acceleration of $2.45 m / s^2$ and the balance reads 50 N, what is the true weight of the body?

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

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

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43. 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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44. 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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45. A pendulum 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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46. For what value of 'a' the block falls freely?

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47. A block of mass m is placed on a smooth wedge of incination θ. The whole system s acelerated horizontally so tht the block does not slip on the wedge. The force exerted by the wedge on the block has a magnitude

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48. Two fixed frictionless inclined planes making an angle 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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49. For what value of 'a' block slides up the plane with an acceleration 'g' relative to the inclined plane.

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50. A solid sphere of mass 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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51. 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 surface are smooth. Find the time taken by the block to reach from bottom to top.

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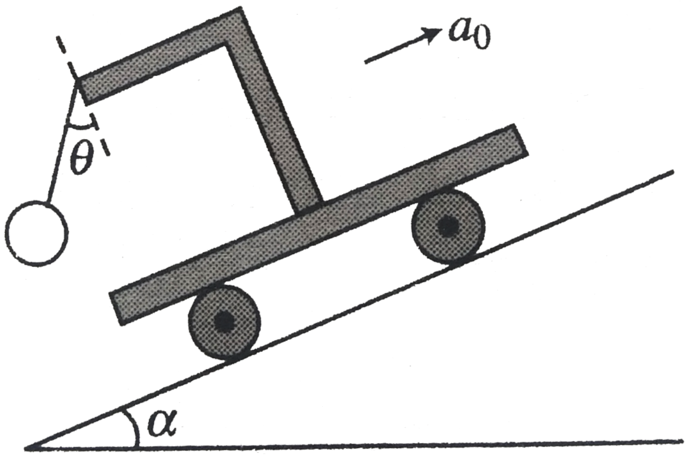
52. A pendulum of mass m hangs from a support fixed to a trolley. The direction of the string when the trolley rolls up a plane of inclination α with acceleration a_0 is



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

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54. An observer is standing inside a lift moving upwards with an acceleration a. A mass m is lying on the floor of the lift. Find the normal reaction between the block and the floor.

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55. A triangular block of mass M rests on a horizontal table. A block of mass m rests on the inclined side. What horizontal acceleration a must M have relative to table to keep m stationary relative to triangular block, assuming frictionless contacts?

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56. 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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57. 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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58. 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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59. A block on table shown in figure is just on the edge of slipping. Find the coefficient of static friction between the block and table

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60. When a car of mass $1000kg$ is moving with a veocity of $20ms^{-1}$ on a rough horizontal road its engine is switched off. How far 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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61. 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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62. The rear side of a truck is open. A box of 40 kg mass is placed 5m away from the open end as shown in figure. The coefficient of friciton between the box and the surface is 0.15. On a straight road, the truck starts from rest and accelerating with $2m/s^2$. At what distance from the starting point does the box fall off the trucks? (Ignore the size of the box).

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

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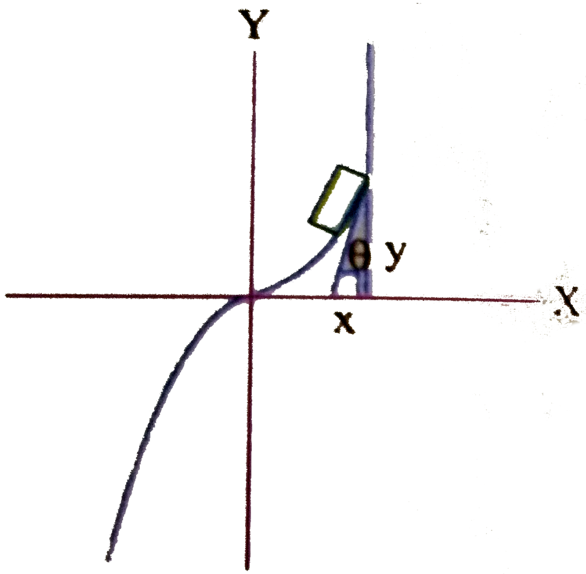
64. A block of mass $'m'$ is placed on a rough surface with a vertical cross section of $y = \frac{x^3}{6}$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is .



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65. 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

$\mu(x) = kx$, 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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66. 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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67. A blocks of masses 4kg and 2kg are in contact with each other on an inclined plane of inclination 30° as shown in the figure. The coefficient of friction between the figure. The coefficient of friction between 4kg mass and the inclined plane is 0.3, where as between 2 kg mass and hte plane is 0.2. Find the contact force between the blocks.

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68. 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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69. 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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70. 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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71. A block 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 on it. How much maximum horizontal force can be applied on 'B' so that both A and B move together? Also find out the acceleration produced by this force.

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72. Two blocks of masses 'm' and 'M' are arranged as shown in the figure. 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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73. 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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74. 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 ? $\left(g = 10ms^{-2}\right)$.

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75. A point P moves in a counter clock wise direction on a circular path as shown in fig. The movement of 'P' is such that it sweeps out a length $S = t^3 + 5$, where 'S' is in metres and 't' is in seconds. The radius of the path is 20m. The acceleration of 'P' when $t = 2s$ is nearly.

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

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77. A block of weight $100N$ lying on a horizontal surface just beging to when a horizontal to move when a horinzontal force of $25N$ acts on it Determine the coeffcent of static friction

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78. A 5kg block slides down a plane inclined at 30° to the horizontal. Find

(a) The acceleration of the block if the plane is frictionless

(b) The acceleration if the coefficient of kinetic friciton is 0.2

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79. A block of mass $2kg$ is given velocity $10m/s$ on a rough horizontal surface of friction coefficent$\mu = 0.2$. Find the magnitude and the direction of friction force acting on it. After how much time and at what distance it will stop ?

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80. A block of mass m is placed on another block of mass M lying on a smooth horizontal surface. The coefficient of static friction between m and M is μ_s.

What is the maximum vlue of the force F that can be applied to M so that the two blocks remains at rest relative to each other?

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81. A block of mass m is placed on another block of mass M lying on a smooth horizontal surface. The coefficient of static friction between m and M is μ_s. What is the maximum force that can be applied to m so that the blocks remains at rest relative to each other?

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82. A block of mass $M = 10kg$ is initially at rest on an inclined plane and is being pulled upward with a force F parallel to the incline as shown in figure. The coefficient of friction between the block and the incline is $\mu = 0.3$. Find the magnitude and direction of the friciton force acting on the block if

(i) F = 40 N

(ii) F = 80 N

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83. A small block of mass 2kg is placed at rest on a large block of mass 3 kg. The coefficient of friction between the two blocks is $\mu = 0.3$. The horizontal surface is smooth. A horizontal force F is applied on the lower block. Find the acceleration of each block when

(i) F = 10 N

(ii) F = 20 N

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84. A particle moves in a circular path of radius $0.5m$ at a speed that uniformly increases. Find the angular acceleration of particle if its speed changes from $2.0m/s$ to $4.0m/s$ in $4.0s$

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85. The speed of a particle moving in a circle of radius $r = 2m$ varies witht time t as $v = t^2$, where t is in second and v in m/s. Find the radial, tangential and net acceleration at $t = 2s$.

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86. A disc rotates at 30 rev/min around a vertical axis. A body lies on the disc at the distance of 20 cm from the axis of rotation. What should be the minimum value of the coefficient of friction between the body and the disc, so that the body will not slide off the disc?

What is the minimum distance from center without rotates at 60 rev/min.

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EVALUATE YOURSELF - 1

1. The linear momentum p of a body moving in one dimension varies with time according to the equation $p = a + bt^2$ where a and b are positive constants. The net force acting on the body is

A. t^2

B. A constant

C. $1/t$

D. t

Answer: D

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

A. $\overrightarrow{F_1}, \overrightarrow{F_2}$ and $\overrightarrow{F_3}$ are concurrent

B. $\overrightarrow{F_1} + \overrightarrow{F_2} + \overrightarrow{F_3} = \overrightarrow{0}$

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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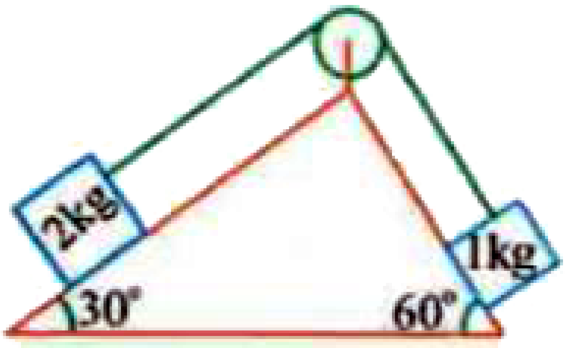
3. Which of the following reagarding the diagram shown in NOT TRUE (consider all surface to be smooth)



A. 2 kg block moves down

B. If the blocks are interchanged tension in the string remains unchanged

C. Force acting on pulley by the system of mass is $\sqrt{2}$ times the tension in the string

D. None of these

Answer: D

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4. Which of the following relations is NOT applicable to the rocket ?

A. $\overrightarrow{F} = \overrightarrow{d} p / dt$

B. $\overrightarrow{F} = M\overrightarrow{a}$

C. $\overrightarrow{P} = M\overrightarrow{v}$

D. $\overrightarrow{P} = \int \overrightarrow{F} dt$

Answer: B

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5. An electric fan is placed on a stationary boat and air is blown with it on the sail of the boat which of the following statements is correct?

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6. In which of the following cases the net force is NOT zero?

A. A kite skillfully held stationary in the sky

B. A ball freely falling from a height

C. An aeroplane rising upward at an angle of 45° with the horizontal with a constant speed

D. A cork floating on the surface of water

Answer: B

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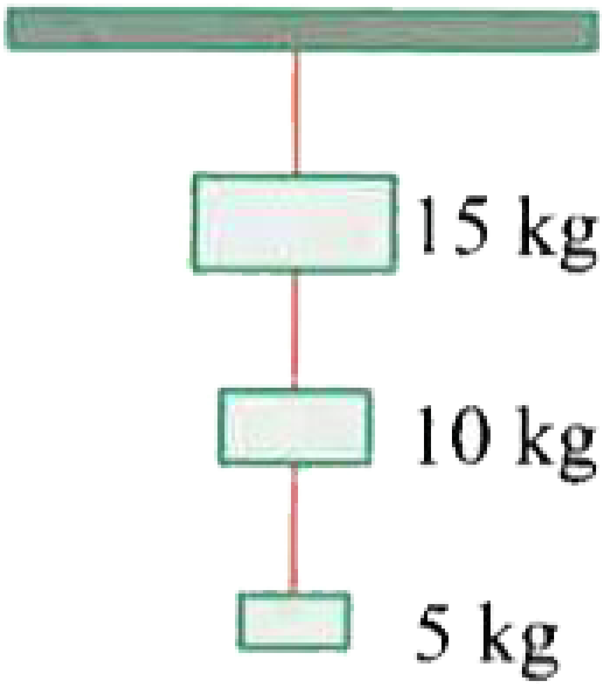
7. Three masses of 15 kg, 10 kg and 5kg are suspended vertically as shown in the Fig. If the string attached to the support breaks and the system falls freely, what will be the tension in the string between 10 kg and 5kg masses? Take $g = 10ms^{-2}$. It assumed that the string remains tight during te motion.



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8. A book is lying on the table. What is the angle between the action of the book on the

table and the weight of the book?

A. 0°

B. 45°

C. 90°

D. 180°

Answer: A

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9. A body is moving on a rough horizontal surface with uniform velocity. Which of the following statement is in accordance with the Newtons first law of motion?

A. No forces are acting on the body

B. The net force on the body is zero

C. The kinetic energy of the body is continuously decreasing

D. The kinetic energy of the body is continuously increasing

Answer: B

Watch Video Solution

10. Which one of the following is a non-conservative force ?

A. Gravitational force

B. Electrostatic force

C. Kinetic friction

D. Spring force

Answer: C

Watch Video Solution

11. Inertia of a body has direct dependence on

A. Velocity

B. Mass

C. Area

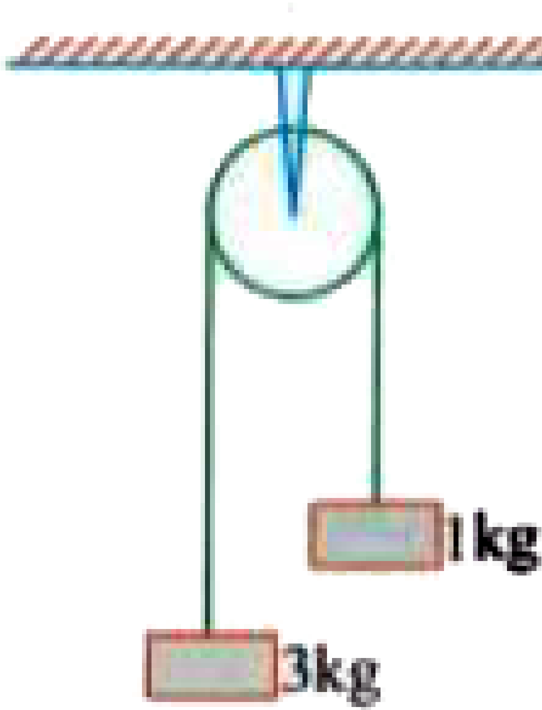
D. Volume

Answer: B

Watch Video Solution

EVALUATE YOURSELF - 2

1. Two masses are connected by a weightless cord passing over a fictionless pulley (see fig). The tension in the cord connecting the masses will be $\left(g = 10 m / s^{-2}\right)$



A. 20 N

B. 15 N

C. 37.5 N

D. 40 N

Answer: B

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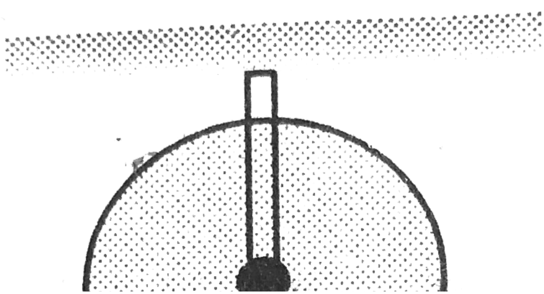
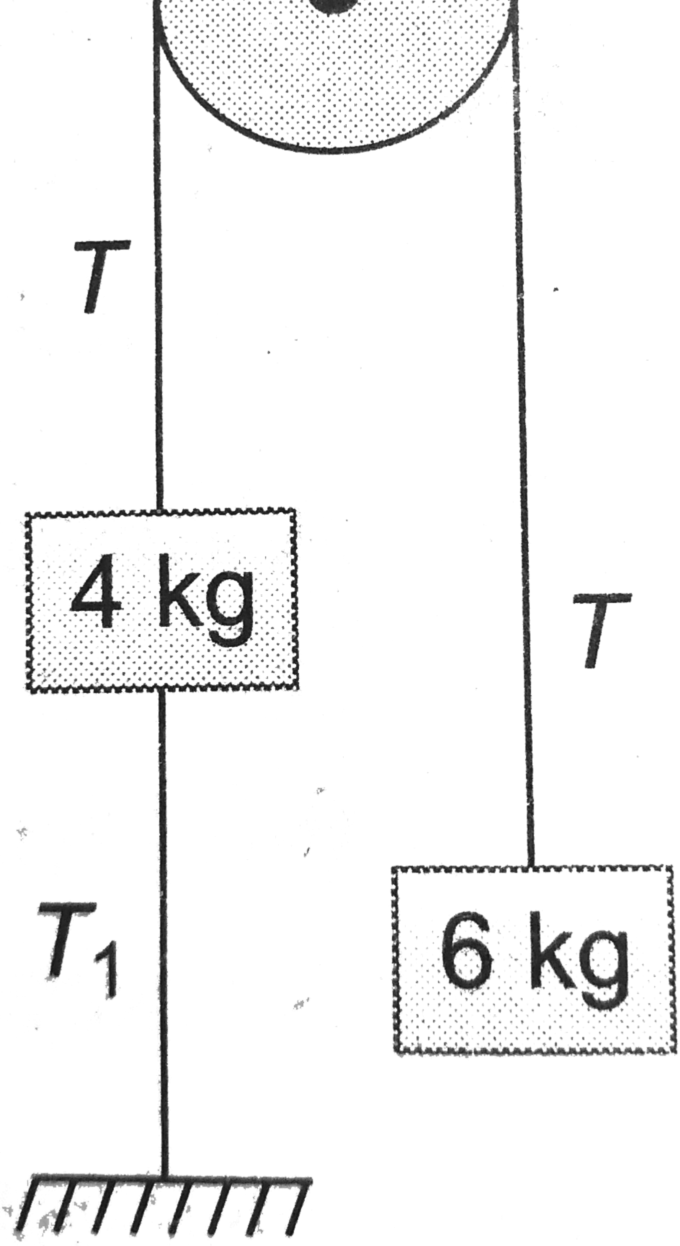
2. Two bodies of mass 4kg and 6kg are attached to the ends of a string passing over a pulley. The 4kg mass is attached to the table top by another string. The tension in this string T_1 is equal to: Take




T
4 kg
T
T1
6 kg

A. 19.6 N

B. 25 N

C. 10.6

D. 10 N

Answer: A

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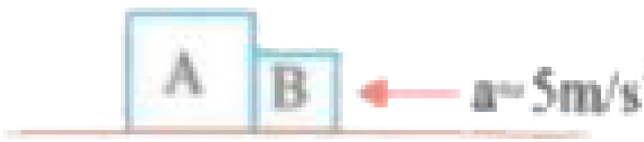
3. The blocks A & B are of masses5 kg and3 kg respectively. The inclined plane is smooth. Assume $g = 10m / s^2$. The contact force between the blocks A & B in the cases (a) and

(b) are $\left[\text{take g} = 10m / s^2\right]$

(b) 

A. 20 N, 15 N

B. 0, 15N

C. 10 N, 20 N

D. 0, 0

Answer: B

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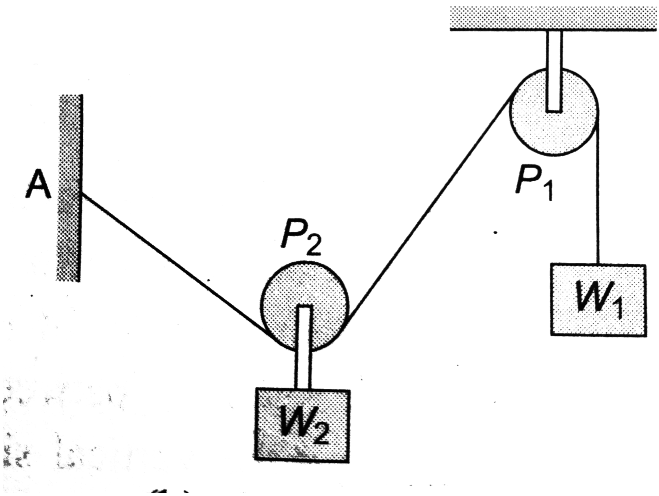
4. In the following figure the pulley P_1 is fixed and the pulley P_2 is movable. If $W_1 = W_2 = 100\ N$, what is the angle AP_2P_1

? The pulleys are frictionless.



A. 30°

B. 60°

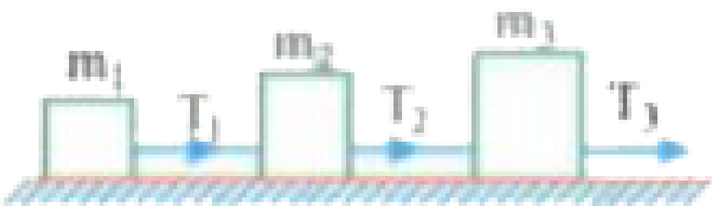
C. 90°

D. 120°

Answer: D

Watch Video Solution

5. Three blocks are connected as shown in the figure



If $m_1 = 5kg, m_2 = 10kg$ and $m_3 = 15kg$, find the tension T_1 given that $T_3 = 60N$

A. Zero

B. 45 N

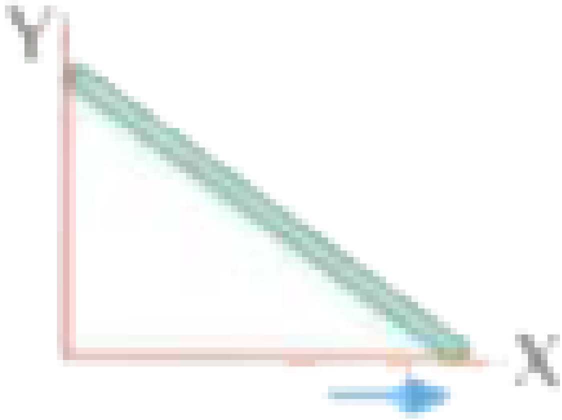
C. 30 N

D. 10 N

Answer: D

Watch Video Solution

6. The rod shown in fig starts slipping. Find the speed of lower end if the speed of upper end is $\sqrt{2}m/s$ when it makes an angle 45° with the x axis



A. $1m / s$

B. $\sqrt{2}m / s$

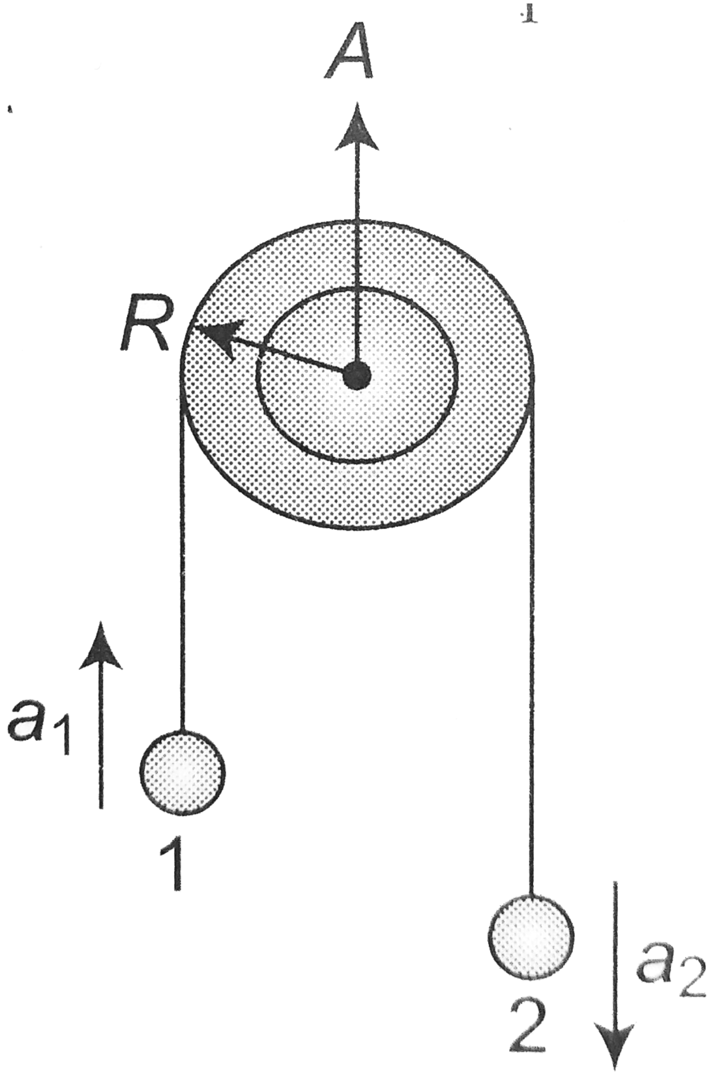
C. $-\sqrt{2}m / s$

D. $-1m / s$

Answer: B

Watch Video Solution

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



A. $A = a_1 - a_2$

B. $A = a_1 + a_2$

C. $A = (a_1 - a_2)/2$

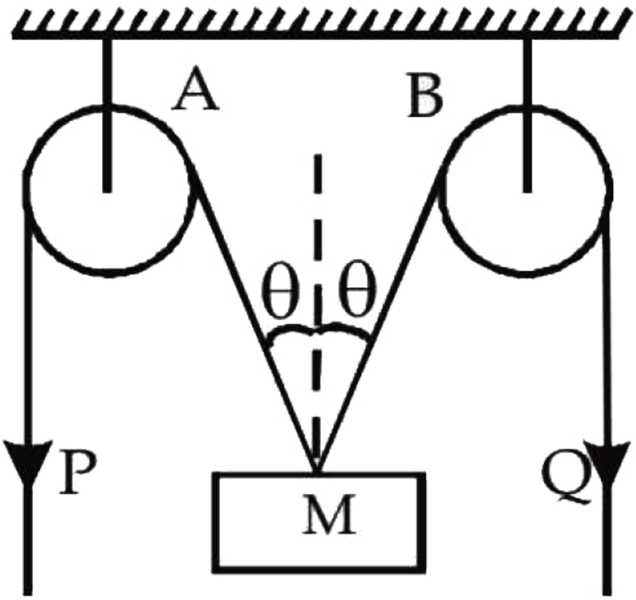
D. $A = (a_1 + a_2)/2$

Answer: C

Watch Video Solution

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

Mass M moves upwards with a speed



A. $2U \cos \theta$

B. $U \cos \theta$

C. $2U / \cos \theta$

D. $U / \cos \theta$

Answer: D

Watch Video Solution

9. A mass is hanging on a spring balance which is kept in a lift. The lift ascends. The spring balance will show in its reading

A. Increase

B. decreases

C. No change

D. Change depending upon velocity

Answer: A

Watch Video Solution

10. A block of mass 4 kg is suspended through two light spring balances A and B is series. Then A and B will read respectively.

A. 4 kg and zero kg

B. Zero kg and 4 kg

C. 4 kg and 4 kg

D. 2 kg and 2 kg

Answer: C

Watch Video Solution

11. A scooter of mass 120 kg is moving with a uniform velocity of 108 km/h. The force required to stop of the scooter in 10s is

A. 180 N

B. 208 N

C. 360 N

D. 720 N

Answer: C

Watch Video Solution

EVALUATE YOURSELF - 3

1. A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally, so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be

A. $mg \sin \theta$

B. $F \sin \theta$

C. $mg / \cos \theta$

D. $mg \cos \theta$

Answer: C

Watch Video Solution

2. When a horse pulls a cart, the force that helps the horse to move forward is the force exerted by

A. Force exerted by the horse on the cart

B. Force exerted by the ground on the cart

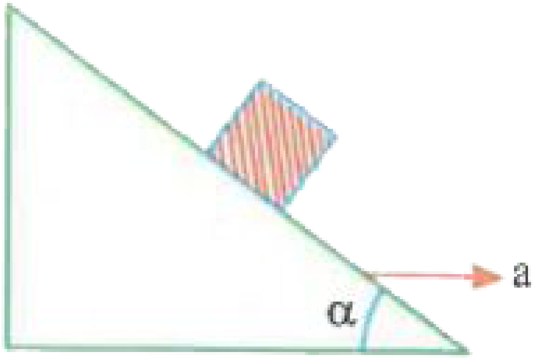
C. force exerted by the ground on the horse

D. Force exerted by the horse on the ground

Answer: A

Watch Video Solution

3. A block is kept on a frictionless inclined surface with angle of inclination α'.



The incline is given an acceleration 'a' to keep the block stationary. Then a is equal to

A. $g \tan \alpha$

B. g

C. $g \quad \operatorname{cosec} \quad \alpha$

D. $g / \tan \alpha$

Answer: A

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4. You are on a frictionless horizontal plane. How can you get off if no horizontal force is exerted by pushing against the surface

A. By jumping

B. By spitting or smeezing

C. B rolling your body on the surface

D. By running on the plane

Answer: B

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5. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/hr . The centripetal force is

A. 250 N

B. 750 N

C. 1000 N

D. 1200 N

Answer: C

Watch Video Solution

6. A pendulum is suspended from the roof of a rall road car. When the car is moving on a circular track the pandulum inclines:

A. Forward

B. Backward

C. Towards the centre of the path

D. Away from the centre of path

Answer: D

Watch Video Solution

EVALUATE YOURSELF - 4

1. Friction

A. Always opposes the motion of a moving body

B. May cause the motion of the body

C. Is a conservative force

D. None of the above

Answer: B

View Text Solution

2. A block of mass 2 kg is placed on the floor . The coefficient of static friction is 0.4 . If a force of 2.8 N is applied on the block parallel to floor , the force of friction between the block and floor is : (Taking g = $10m/s^2$)

A. 2.8 N

B. 8 Ns

C. 2 N

D. Zero

Answer: A

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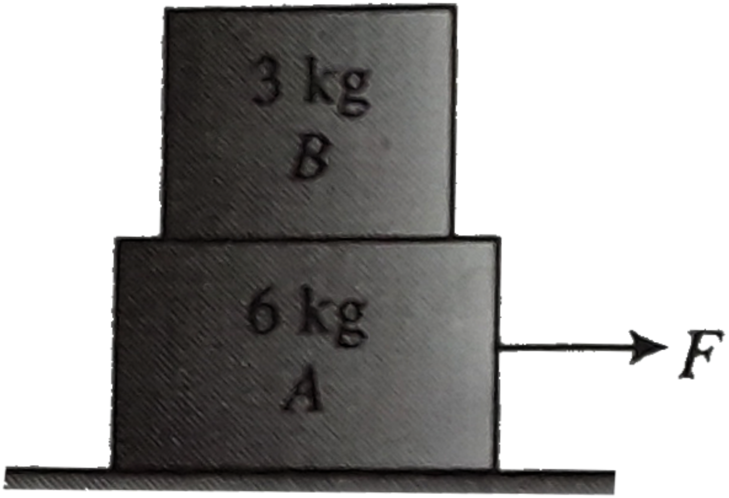
3. Two block A and B of masses $6kg$ and $3kg$ rest on a smooth horizontal surface as shown in figure If coefficient of friction between A and Bb is 0.4 the maximum horizontal force which can make them move without separation is



A. 72 N

B. 40 N

C. 36 N

D. 20 N

Answer: C

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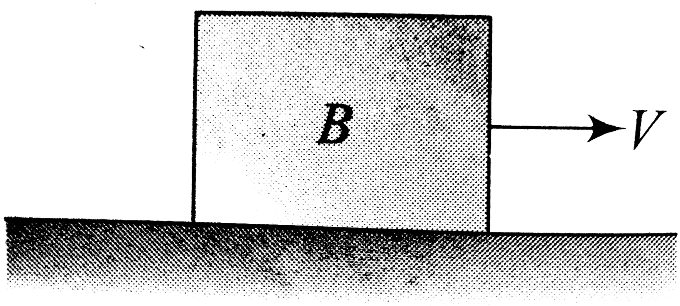
4. A block B is pushed momentarily along a horizontal surface with an initial velocity v . If mu is the coefficient of sliding friction between B and the surface, block B will come to rest after a time:



A. $\frac{v}{g\mu}$

B. $\frac{g\mu}{v}$

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

D. $\frac{v}{g}$

Answer: A

Watch Video Solution

5. A block of mass m is placed on a rough floor of a lift . The coefficient of friction between the block and the floor is μ. When the lift falls freely, the block is pulled horizontally on the floor. What is the force of friction -

A. μmg

B. $\mu mg / 2$

C. $2\mu mg$

D. Zero

Answer: D

Watch Video Solution

6. Friction

A. Always opposes the motion of a moving body

B. May cause the motion of the body

C. Is a conservative force

D. None of the above

Answer: B

Watch Video Solution

7. A block has been placed on an inclined plane . The slope angle of θ of the plane is such that the block slides down the plane at a constant speed . The coefficient of kinetic friction is equal to :

A. $\sin\theta$

B. $\cos\theta$

C. g

D. $\tan\theta$

Answer: D

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8. The frictional force between two surfaces is independent of

A. Nature of surface

B. Size of the body

C. Area of contact

D. Mass of the body

Answer: C

Watch Video Solution

9. A body of mass m slides down a rough plane of inclination α . If μ is the coefficient of friction, then acceleration of the body will be

A. $g \sin \alpha$

B. $\mu \cos \alpha$

C. $g(\sin \alpha - \mu \cos \alpha)$

D. $g(\cos \alpha - \mu \sin \alpha)$

Answer: C

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EVALUATE YOURSELF - 5

1. A uniform chain of mass M and length L is rotated in a horizontal circle about its one end at an angular frequency ω. The tension at its axis is

A. $M\omega^2 L$

B. $\frac{M\omega^2 L}{8}$

C. $\frac{M\omega^2 L}{4}$

D. $\dfrac{M\omega^2 L}{2}$

Answer: D

View Text Solution

2. A body is undergoing circular motion. Some vector expression that describe the motion are given below

(a) $\vec{V} = \vec{\omega} \times \vec{R}$

(b) $a_{\vec{T}} = \vec{\alpha} \times \vec{R}$

(c) $a_{\vec{C}} = \vec{\alpha} \times \vec{R}$

Of the above statements following are/is correct

A. a, b and c

B. a and b

C. b and c

D. c and a

Answer: B

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3. A particle is undergoing a non - uniform circular motion about the point O (origin). Read the following statements carrefully (here the symbols have their usual meanings)

a) $\overrightarrow{a_T}$ and $\overrightarrow{v}$ are always in the same line

b) $\overrightarrow{a_T}$, $\overrightarrow{v}$ and $\overrightarrow{a_C}$ are always in the same line

c) $\overrightarrow{\alpha}$ and $\overrightarrow{\omega}$ are always in the same line

d) $\overrightarrow{p}$, $\overrightarrow{v}$ and $\overrightarrow{a}_T$ are always in the same line

e) $\overrightarrow{L}$ and $\overrightarrow{\omega}$ are always in the same line

f) The net liner acceleration and angular acceleration are always perpendicular to each other

g) $\overrightarrow{r}$ (radius vector) $\overrightarrow{a_C}$ are along the same line Out of the above statements, the following are correct

A. a, c, d, e and g

B. a, c, d, e, f and g

C. d, e, f and g

D. e, f and g

Answer: B

View Text Solution

4. SI unit of force is

A. Newton

B. Pascal

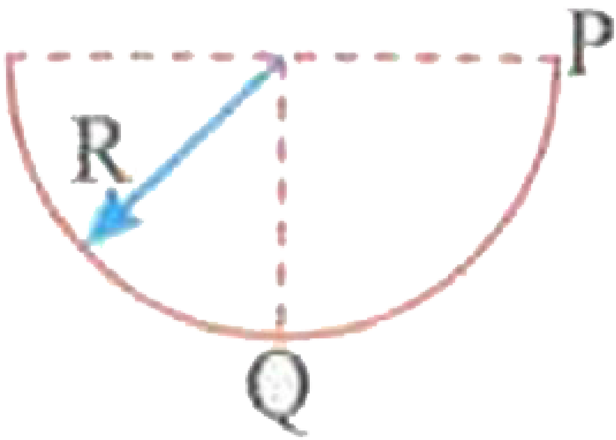
C. Meter

D. Kgm/s

Answer: A

View Text Solution

5. The small particle is released from P. As it reaches Q its KE becomes K. The force exerted by it on hemisphere at Q is



A. $\dfrac{K}{R}$

B. $\dfrac{2K}{R}$

C. $\dfrac{3K}{R}$

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

Answer: C

View Text Solution

6. A particle revolves around a circular path. The centripetal acceleration of the particle is inversely proportional to

A. radius of path

B. Mass of particle

C. speed of particle

D. both (2) and (3)

Answer: A

View Text Solution

7. A body of mass 5kg is moving in a circle of radius 1 m with an angular velocity of 2 rad-s^{-1}. The centripetal force acting on the body is

A. 10 N

B. 20 N

C. 30 N

D. 40 N

Answer: B

View Text Solution

8. Stone of mass 1 kg tied to the end of a string of length 1m , is whirled in horizontal circle with a uniform angular velocity $2rads^{-1}$

. The tension of the string is (in newton)

A. 0.5 N

B. 1N

C. 2N

D. 4N

Answer: D

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 nor non-inertial frames

Answer: B

View Text Solution

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

A. third law

B. second law

C. first law

D. law of gravitation

Answer: C

View Text 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 uniform acceleration

Answer: B

View Text 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

View Text Solution

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

A. its mass

B. its velocity

C. its speed

D. its linear momentum

Answer: D

View Text Solution

9. A certain particle undergoes erratic motion. At every point in its motion, the direction of the particle's momentum is always

A. the same as the direction 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

View Text 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 to 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

View Text 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. $\dfrac{1}{\sqrt{m}}$

Answer: D

View Text Solution

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

A. m

B. 1/m

C. $\sqrt{m}$

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

Answer: B

View Text Solution

View Text 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. If the two bodies are combined and the same force is applied on the combination, the acceleration produced in it is

A. $a_1 + a_2$

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

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

D. $\sqrt{a_1 a_2}$

Answer: C

View Text Solution

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

A. should act continuously

B. should be a variable force

C. not necessary

D. should act opposite to the direction of motion

Answer: C

View Text Solution

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

A. may be a contact force

B. may be gravitational force

C. may be a gravitational or contact force

D. may be a force of any origin

Answer: B

View Text Solution

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 direction they act on different bodies

D. they are unequal in magnitudes

Answer: C

View Text Solution

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

A. linear momentum

B. energy

C. angular momentum

D. mass

Answer: A

View Text 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

View Text 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 any object in the same direction

B. he can reach the desired corner by throwing any 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 ground in that direction

Answer: B

View Text Solution

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

A. First law

B. Second law

C. Third law

D. Law of gravitation

Answer: C

View Text 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

View Text 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

View Text Solution

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

A. To reduce the impulse

B. To increase 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

View Text Solution

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

A. impulse

B. force

C. kinetic energy

D. resultant force

Answer: D

View Text Solution

25. A father and his seven years old son are facing each other on ice skates. With their hands, they push off against one another. Regarding the forces 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 more acceleration

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

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

Answer: C

View Text Solution

26. A student initially at rest on a frictionless frozen pond throws a 2 kg hammer in one direction. After the throw, the hammer moves off in one direction 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 student 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

View Text Solution

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

A. If the system contains ball, the momentum is conserved

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

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

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

Answer: D

View Text 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

View Text 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 in 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

View Text 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 velocity.

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

View Text Solution

31. Two objects X and Y are thrown upwards 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 will reach the same height

D. cannot say

Answer: A

View Text 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

View Text Solution

33. Internal force 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

View Text Solution

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

A. remains same

B. decreases

C. increases

D. first increases and then decreases to zero

Answer: D

View Text Solution

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. 5 N

B. 10 N

C. 20 N

D. 0

Answer: B

View Text Solution

36. A ball is dropped from a spacecraft revolving around the earth at a height of 1200 km. 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 to the earth gradually

D. It will go far in space

Answer: A

View Text Solution

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

A. $\overrightarrow{F_1}, \overrightarrow{F_2}$ and $\overrightarrow{F_3}$ are concurrent

B. $\overrightarrow{F_1} + \overrightarrow{F_2} + \overrightarrow{F_3} = 0$

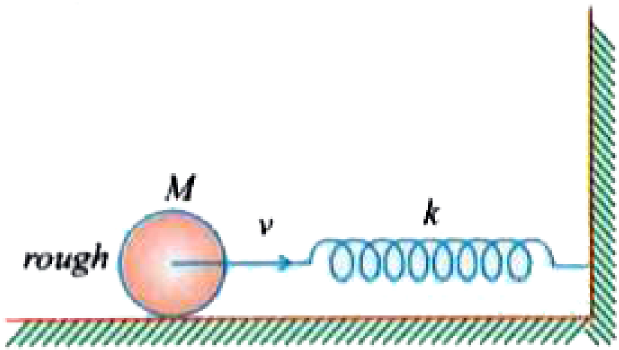
C. $\overrightarrow{F_1}, \overrightarrow{F_2}$ is parallel to $\overrightarrow{F_3}$ but the three forces are not concurrent

D. $\overrightarrow{F_1}$ and $\overrightarrow{F_2}$ act at the same point but $\overrightarrow{F_3}$ acts at different point.

Answer: A

View Text Solution

38. In the system shown in 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 be 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

View Text Solution

39. A lift is ascending with a constant 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 with respective to an observer in space

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

B. is an inertial frame by definition

C. cannot be an inertial 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 on 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 inertial frame of reference

C. both 4) some times inertial (or) some times non inertial

D. static friction

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 inertial (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. increases the relative velocity between the bodies

Answer: C

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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 (1 and 2)

D. transparent

Answer: C

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

A. Solids

B. Liquids

C. Gases

D. Both 2 and 3

Answer: C

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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

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

A. increases decrease

B. remains same

C. may increase or decrease

D.

Answer: B

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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

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52. If man is walking direction of friction is .

A. opposite to the direction of motion

B. same as that of 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

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54. The limiting friction between two surface does not depend

A. on the nature of two surfaces

B. on normal reaction

C. on the weight of the body

D. on volume of the body

Answer: D

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55. While walking on ice one should take small steps to avoid slipping. This is because smaller steps ensure

A. larger friction

B. smaller friction

C. larger normal force

D. smaller normal force

Answer: C

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56. In order to stop a car in shortest distance 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 on 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, 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 friction between the body and truck 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 in motion, the force of friction exerted by the ground on the two wheels is such that it acts

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

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

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

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

Answer: A

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61. A boy of mass M is applying a horizontal force to slide a box of mass M_1 on 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 'μ_1' In which of the following cases is it certainly not possible to slide the box ?

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

B. $\mu > \mu_3, M > M_1$

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

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

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. $v = \sqrt{\frac{1}{\mu_k g r}}$

Answer: B

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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

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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

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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

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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. $2\pi / 5$

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

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69. A particle is acted upon by a force of constant magnitude which is always perpendicular 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 acceleration 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 outward

D. perpendicular to the plane of the paper

Answer: D

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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 the 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

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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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EXERCISE - I (C.W)(NEWTON.S LAWS OF MOTION)

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. 300 N along $+$ X direction

B. 300 N along $-$ X direction

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

D. 3,00,000 N 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

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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

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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. 0.3 s

C. 0.5 s

D. 0.2 s

Answer: C

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6. A machine gun fires a bullet of mass 40 g with a velocity $1200 ms^{-1}$. 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

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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 500kg rocket is set for verticle firing. The exhaust speed is 800ms^{-2}. To give an initial upward acceleration of 20ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be (g=10 ms^{-2})

A. $127.5kgs^{-1}$

B. $137.5kgs^{-1}$

C. $187.5kgs^{-1}$

D. $185.5 kg s^{-1}$

Answer: C

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EXERCISE - I (C.W)(IMPULSE)

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

C. $20 kgms^{-1}$

D. $115 kgms^{-1}$

Answer: B

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

A. mgt

B. $m > \cos\theta$

C. $m > \sin\theta$

D. $1/2m > .$

Answer: A

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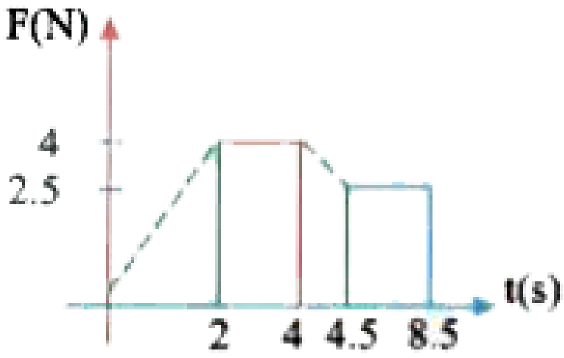
3. A body of mass 2kg has an initial speed $5ms^{-1}$. A force acts on it for 8.5 seconds in the direction of motion. The force time graph is shown in figure. The final speed of the body is



A. $8.5ms^{-1}$

B. $11ms^{-1}$

C. $16.8125ms^{-1}$

D. $4.31ms^{-1}$

Answer: C

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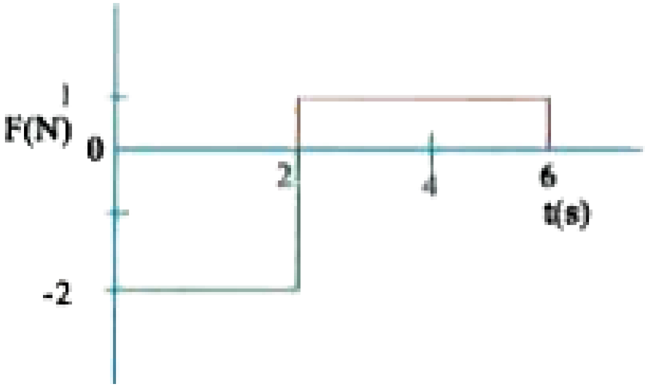
4. A force time graph for the motion of a body is as shown in figure. Change in linear momentum between 0 and 6s is



A. zero

B. 8 Ns

C. 4 Ns

D. 2 Ns

Answer: A

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5. An object of mass 3 kg is at rest. Now a force $F = 6t^2\hat{j} + 2t\hat{j}$ N is applied on the object. Find the velocity of the object at t=3 sec.

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

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6. An impulse "I" given to a body changes its velocity from $''v_1 \to v_2''$. The increase in the kinetic energy of the body is given by

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

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EXERCISE - I (C.W)(OBJECTS SUSTENDED BY STRINGS & APPARENT WEIGHT)

1. 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: A

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2. 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. $\frac{W_1 - W_2}{2}$

C. $2W_1$

D. $2W_2$

Answer: B

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3. A person of mass 60 kg is in a lift. The change in the apparent weight of the person, when the lift moves up with an acceleration of

$2ms^{-2}$ and then down with an acceleration of $2ms^{-2}$ is $(\text{take g} = 10m/\sec^2)$

A. 120 N

B. 240 N

C. 480 N

D. 720 N

Answer: C

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4. 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 25 N. The tension in the rope at a point 6m away from the point of application is

A. 20 N

B. 15 N

C. 10 N

D. 5 N

Answer: C

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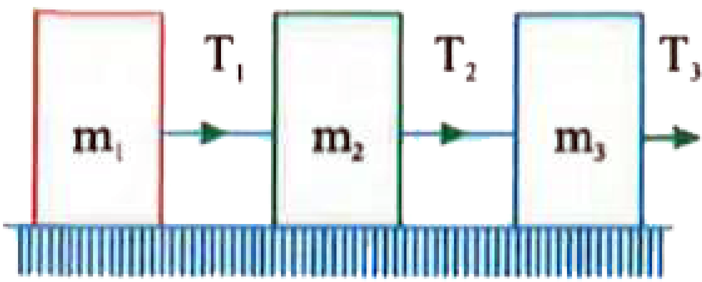
5. Three blocks of masses m_1, m_2 and m_3 are connected by a massless string as shown in figure on a frictionless table. They are pulled with a force $T_3 = 40N$. If $m_1 = 10kg, m_2 = 6kg$ and $m_3 = 4kg$, then tension T_2 will be



A. 10 N

B. 20 N

C. 32 N

D. 40N

Answer: C

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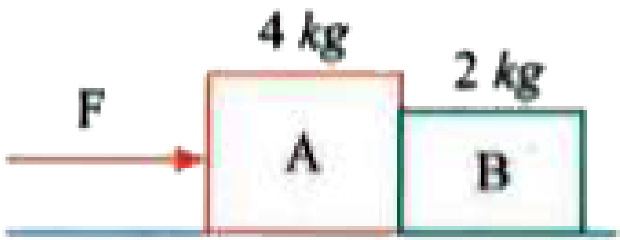
6. A horizontal force F pushes a 4 kg block (A) which pushes against a 2 kg block (B) as shown. The blocks have an acceleration of

$3m/s^2$ to the right. There is no friction between the blocks and the surfaces on which they slide. What is the net force B exerts on A ?



A. 6N to the right

B. 12 N to the right

C. 6 N to the left

D. 12 N to the left

Answer: C

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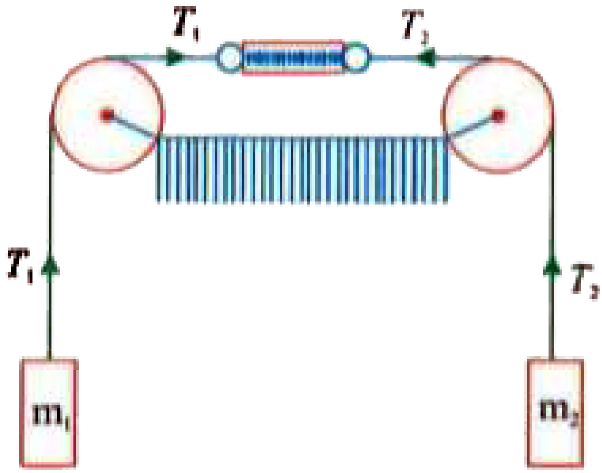
7. Two masses m_1 and m_2 are attached to a spring balance S as shown in Figure. If $m_1 > m_2$ then the reading of spring balance will be



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

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8. Two 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 released from rest, the acceleration of the system is

A. gm/M

B. $2gM/m$

C. $gm/2M$

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

Answer: A

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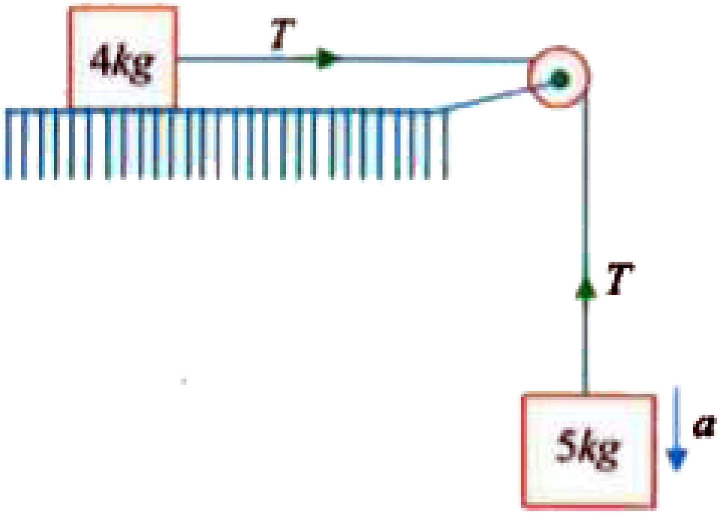
9. Two bodies of masses 5kg and 4kg are tied to a string as shown. If the table and pulley are smooth, then acceleration of 5kg mass will be



A. $19.5m/s^2$

B. $0.55m/s^2$

C. $2.72m/s^2$

D. $5.45m/s^2$

Answer: D

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EXERCISE - I (C.W)(LAW OF CONSERVATION OF MOMENTUM)

1. The object at rest suddenly explodes into three parts with the mass ratio $2:1:1$.The parts of equal masses move at right angles to each 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

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2. A man and a cart move towards each other. The man weighs 64 kg and the cart weighs 32kg. The velocity of the man is 5.4 km/hr and that of the cart is 1.8 km/hr. When the man approaches the cart, he jumps on to it. The velocity of the cart carrying the man will be

A. 3 km/hr

B. 30 km/hr

C. 1.8 km/hr

D. zero

Answer: A

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

A. 30 m/s

B. 20 m/s

C. 15 m/s

D. 5 m/s

Answer: B

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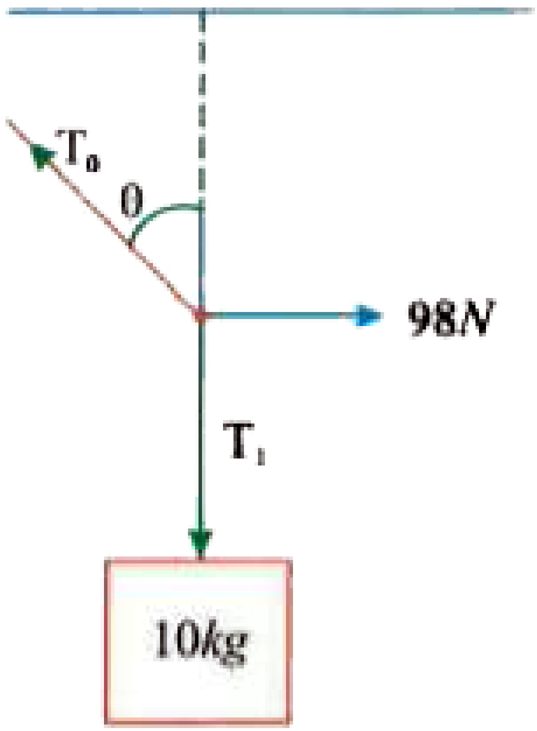
EXERCISE - I (C.W)(EQUILIBRIUM OF A PARTICLE)

1. A mass of 10 kg is suspended by a rope of length 2.8m from a ceiling. A force of 98 N 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

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2. 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 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

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EXERCISE - I (C.W)(LAWS OF FRICTION)

1. 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

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2. The coefficient of static friction between contact surfaces of two bodies is 1. The contact surfaces of one body support the other till the inclination is less than

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

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EXERCISE - I (C.W)(MOTION ON A HORIZONTAL ROUGH SURFACE)

1. Brakes are applied to a car moving with disengaged engine, bringing it to a halt after 2s. Its velocity at the moment 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

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

A. 0.25

B. 0.2

C. 0.5

D. 0.1

Answer: A

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3. A car running with a velocity 72 kmph on a level road, is stopped after travelling a distance of 30m after disengaging its engine

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

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4. In the above problem car got a stopping distance of 80m on cement road then μ_k is $(g = 10ms^{-2})$

A. 0.2

B. 0.25

C. 0.3

D. 0.35

Answer: B

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5. A 10kg 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 friction is $\left(g = 10ms^{-2}\right)$.

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

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

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

D. $\frac{4}{2}$

Answer: B

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

A. 90N

B. 80N

C. 60N

D. 30N

Answer: C

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7. 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 coefficient of kinetic friction are

A. 50kg, 0.1

B. 25kg , 0.1

C. 50kg , 0.5

D. 50kg , 0.2

Answer: A

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8. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, 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

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EXERCISE - I (C.W)(MOTION OF A BODY ON THE INCLINED PLANE)

1. 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

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2. In the above problem the resultant force on the body is

A. 56.6 N

B. 66.6 N

C. 76.6 N

D. 86.6 N

Answer: C

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

A. Zero

B. 5 N

C. 7.5N

D. 10N

Answer: D

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

A. 66.6 N

B. 86.6 N

C. 96.6 N

D. 76.6 N

Answer: C

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

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

Answer: D

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

A. $19.6\sin 45^\circ$

B. $19.6\cos 45^\circ$

C. $9.8\sin 45^\circ$

D. $9.8\cos 45^\circ$

Answer: A

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7. The lengths of smooth & rough inclined planes of inclination 45° is same. Times of sliding of a body on two surfaces is 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

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EXERCISE - I (C.W)(PULLING/PUSHING A BODY)

1. A block of weight 200N is pulled along a rough horizontal surface at constant 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: B

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EXERCISE - I (C.W)(UNIFORM CIRCULAR MOTION)

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

A. 1000 N

B. 3500N

C. 1600 N

D. 2000N

Answer: D

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2. A stone of mass 0.5 kg 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 velocity 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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EXERCISE - I (H.W)(NEWTON.S LAWS OF MOTION)

1. A horizontal force "F" produces an acceleration of $6m/s^{-2}$ on a block resting on a smooth horizontal surface. The same force produces an acceleration of $3m/s^{-2}$ on a second block resting on a smooth horizontal surface. If the two blocks are tied together and the same force acts, the acceleration produced will be

A. $9m/s^{-2}$

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

C. $4m/s^{-2}$

D. $\frac{1}{2} m / s^{-2}$

Answer: B

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2. A 0.2 kg object at rest is subjected to a force $\left(0.3\hat{i} - 0.4\hat{j}\right) N$. What is its velocity vector after 6 sec

A. $\left(9\hat{i} - 12\hat{j}\right)$

B. $\left(8\hat{i} - 16\hat{j}\right)$

C. $\left(12\hat{i} - 9\hat{j}\right)$

D. $\left(16\hat{i} - 8\hat{j}\right)$

Answer: A

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3. A body of mass 2 kg is moving with a velocity of $\overrightarrow{u} = 3\hat{i} + 4\hat{j}m/s$. A steady force $\overrightarrow{F} = \hat{i} - 2\hat{j}$ N begins to act on it. After four seconds, the body will be moving along.

A. X-axis with a velocity of $2m/s$

B. Y-axis with a velocity of $5m/s$

C. X-axis with a velocity of $5m/s$

D. Y-axis with a velocity of $2m/s$

Answer: C

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4. Three forces $\overline{F_1}, \overline{F_2}$ and $\overline{F_3}$ are simultaneously acting on a particle of mass 'm' and keep it in equilibrium. If $\overline{F_1}$ force is reversed in direction only, the acceleration of the particle will be.

A. $\overline{F_1}/m$

B. $2\overline{F_1}/m$

C. $-\overline{F_1}/m$

D. $-2\overline{F_1}/m$

Answer: D

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

A. $2.5m/s^2$

B. $5m/s^2$

C. $10m/s^2$

D. $20m/s^2$

Answer: A

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

A. zero

B. 2 N

C. 4 N

D. 8 N

Answer: C

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7. Ten coins are placed on top of each other on a horizontal table. If the mass of each coin is 10g and acceleration due to gravity is $10ms^{-2}$, what is the magnitude and direction of the force on the 7^{th} coin (counting from the bottom) due to all the coins above it ?

A. 0.3 N downwards

B. 0.3 N upwards

C. 0.7 N downwards

D. 0.7 N upwards

Answer: A

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

A. 2mu towards the wall

B. 2mu away from the wall

C. zero

D. mu away from the wall

Answer: B

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9. Bullets of 0.03 kg mass each hit a plate at the rate of 200 bullets per second with a velocity of $30m/s$. The average force acting on the plate in newton is

A. 120

B. 180

C. 300

D. 480

Answer: B

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10. A vehicle of mass 10kg is moving with a velocity of $5ms^{-1}$ .To stop it in $1/10$ sec the required force in opposite direction is

A. 5000N

B. 500N

C. 50N

D. 1000N

Answer: A

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EXERCISE - I (H.W)(IMPULSE)

1. An impulse is supplied to a moving object with the force at an angle 120° with the velocity vector. The angle between the impulse vector and the change in momentum vector is

A. 120°

B. 0°

C. 60°

D. 240°

Answer: B

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2. A 20 kg body is pushed with a force of 7N for 1.5 sec then with a force of 5N for 1.7 sec and finally with a force of 10N for 3 sec, the total impulse applied to the body and change in velocity will be

A. $49Ns, 12.5ms^{-1}$

B. $49Ns, 2.45ms^{-1}$

C. $98Ns, 4.9ms^{-1}$

D. $4.9Ns, 2.45ms^{-1}$

Answer: B

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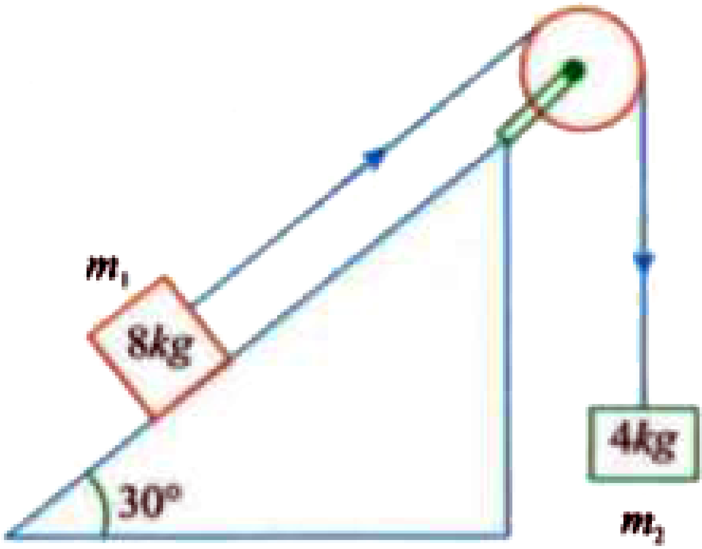
3. A body of mass 5 kg is acted upon by a net force F which varies with time t as shown in graph, then the net momentum in SI units gained by the body at the end of 10 seconds is



A. 0

B. 100

C. 140

D. 200

Answer: C

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4. A body is acted on by a force given by $F = (10 + 2t)N$. The impulse received by the body during the first four seconds is

A. 40 N s

B. 56 N s

C. 72 N s

D. 32 N s

Answer: B

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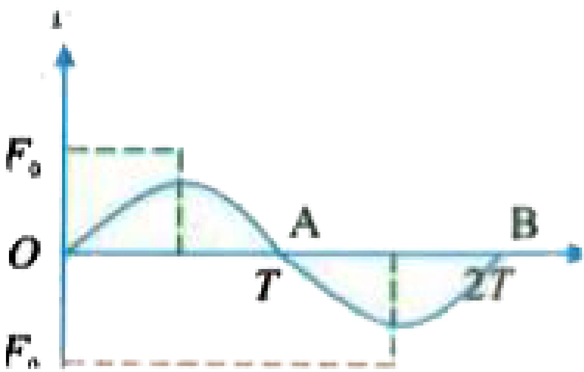
5. A unidirectional force F varying with time t as shown in the Fig. acts on a body initially at rest for a short duration 2T. Then the velocity acquired by the body is



A. $\dfrac{\pi F_0 T}{4m}$

B. $\dfrac{\pi F_0 T}{2m}$

C. $\dfrac{F_0 T}{4m}$

D. zero

Answer: D

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6. If the average velocity of a body moving with uniform acceleration under the action of a force is "v" and the impulse it receives during a displacement of "s" is "I", the constant force acting on the body is given by

A. $\frac{I \times v}{2s}$

B. $\frac{2I \times v}{s}$

C. $\frac{I \times v}{s}$

D. $\frac{I \times s}{v}$

Answer: C

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EXERCISE - I (H.W)(OBJECTS SUSTENDED BY STRINGS & APPARENT WEIGHT)

1. A 6.0kg object is suspended by a vertical string from the ceiling of an elevator which is accelerating upward at a rate of $2.2ms^{-2}$.the tension in the string is

A. 11N

B. 72N

C. 48N

D. 59N

Answer: B

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2. A young man of mass 60 kg stands on the floor of a lift which is accelerating downwards at $1m/s^2$ then the reaction of the floor of the lift on the man is (Take $g = 9.8m/s^2$).

A. 528 N

B. 540 N

C. 546N

D. none

Answer: A

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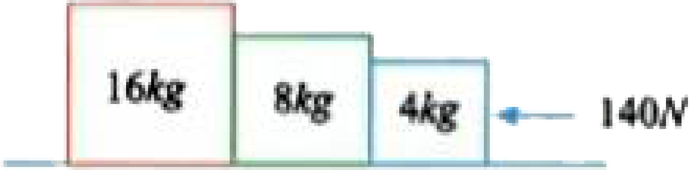
3. Three masses of 16 kg, 8 kg and 4kg are placed in contact as shown in Figure. If a force of 140 N is applied on 4kg mass, then the force on 16kg will be



A. 140N

B. 120N

C. 100 N

D. 80 N

Answer: D

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4. A body of mass M is being pulled by a string of mass m with a force P applied at one end. The force exerted by the string on the body is

A. $\dfrac{Pm}{(M+m)}$

B. $\dfrac{PM}{(M+m)}$

C. $Pm(M+m)$

D. $\dfrac{P}{(M-m)}$

Answer: B

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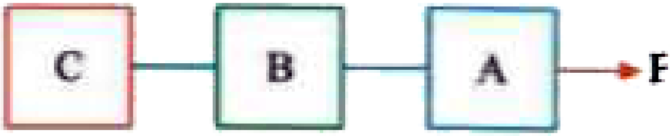
5. Three equal masses A, B and Care pulled with a constant force F. They are connected to each other with strings. The ratio of the tension between AB and BC is



A. $1 : 2$

B. $2 : 1$

C. $3 : 1$

D. $1 : 1$

Answer: B

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6. A coin is dropped in a lift. It takes time t_1 to reach the floor when lift is stationary. It takes time t_2 when lift is moving up with constant acceleration. Then

A. $t_1 > t_2$

B. $t_2 > t_1$

C. $t_1 = t_2$

D. $t_1 \geq t_2$

Answer: A

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7. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$, then the ratio of masses is

A. $8:1$

B. $4:3$

C. $5:3$

D. $9:7$

Answer: D

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8. A pendulum bob is hanging from the roof of an elevator with the help of a light string. When the elevator moves up with uniform acceleration 'a' the tension in the string is T_1 .When the elevator moves down with the same acceleration, the tension in the string is T_1 .If the elevator were stationary, the tension in the string would be

A. $\frac{T_1 + T_2}{2}$

B. $\sqrt{T_1 + T_2}$

C. $\dfrac{T_1 T_2}{T_1 + T_2}$

D. $\dfrac{2T_1 T_3}{T_1 + T_2}$

Answer: A

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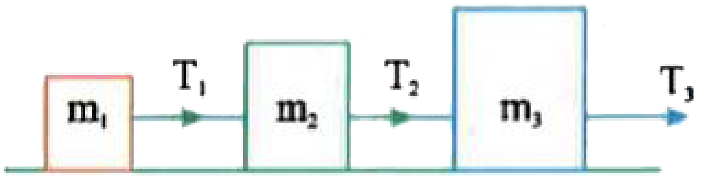
9. Three bodies are lying on a frictionless horizontal table and these are connected as shown in the figure. They are pulled towards right with a force $T_3 = 60N$ If

m_1, m_2 and m_3, are equal to 10 kg, 20kg and 30kg respectively, then the values of T_1 and T_2 will be



A. $10N, 10N$

B. $30N, 10N$

C. $10N, 30N$

D. $10N, 10N$

Answer: C

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EXERCISE - I (H.W)(LAW OF CONSERVATION OF MOMENTUM)

1. A bullet of mass 20gm is fired from a riffle of mass 8 kg with a velocity of $100m/s$. The velocity of recoil of the rifle is

A. $0.25m/s$

B. $25m/s$

C. $2.5m/s$

D. $250m/s$

Answer: A

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2. A space craft of mass 2000 kg moving with a velocity of $600m/s$ suddenly explodes into two pieces. One piece of mass 500 kg is left stationary. The velocity of the other part must be (in m/s)

A. 600

B. 800

C. 1500

D. 1000

Answer: B

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3. A person weighing 60 kg in a small boat of mass 140 kg which is at rest, throws a 5 kg stone in the horizontal direction with a velocity of $14 m s^{-1}$. The velocity of the boat immediately after the throw is (in m / s)

A. 1.2

B. 0.5

C. 0.35

D. 0.65

Answer: C

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EXERCISE - I (H.W)(LAWS OF FRICTION)

1. A body of mass 60kg is pushed with just enough force to start it moving on a rough surface with $\mu_s = 0.5$ and $\mu_k = 0.4$ and the force continues to act afterwards. The acceleration of the body is (in $m/\sec^2$)

A. 0.98

B. 3.92

C. 4.9

D. Zero

Answer: A

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2. If the coefficient of friction is $\sqrt{3}$, the angle of friction is

A. 30°

B. 60°

C. 45°

D. 37°

Answer: B

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EXERCISE - I (H.W)(MOTION ON A HORIZONTAL ROUGH SURFACE)

1. The coefficient of friction between a car wheels and a roadway is 0.5 The least distance in which the car can accelerate from rest to a speed of 72 kmph is $\left(g = 10ms^{-2}\right)$

A. 10m

B. 20m

C. 30m

D. 40m

Answer: D

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2. An eraser weighing 2N is pressed against the black board with a force of 5N. The coefficient of friction is 0.4. How much force parallel to the black board is required to slide the eraser upwards

A. 2N

B. 2.8N

C. 4N

D. 4.8N

Answer: C

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3. A marble block of mass 2 kg lying on ice when given a velocity of $6ms^{-1}$ is stopped by friction in 10 s. Then the coefficient of friction is $\left(g = 10ms^{-2}\right)$

A. 0.02

B. 0.03

C. 0.06

D. 0.01

Answer: C

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4. A block of weight 100N is pushed by a force F on a horizontal rough plane moving with an acceleration $1m/s^2$, when force is doubled its acceleration becomes $10m/s^{-2}$. The coefficient of friction is $(g = 10m/s^{-2})$

A. 0.4

B. 0.6

C. 0.5

D. 0.8

Answer: D

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5. A block of mass 5kg is lying on a rough horizontal surface. The coefficient of static and kinetic friction are 0.3 and 0.1 and $10m/s^{-2}$. If a horizontal force of 50N is applied on the block, the frictional force is

A. 25N

B. 5N

C. 10N

D. Zero

Answer: B

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6. 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. $33.3\ \%$

C. $76\ \%$

D. $50\ \%$

Answer: B

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EXERCISE - I (H.W)(MOTION OF A BODY ON THE INCLINED PLANE)

1. A body is sliding down an inclined plane forming an angle 30° with the horizontal. If the coefficient of friction is 0.3 then acceleration of the body is

A. $1.25ms^{-2}$

B. $2.35ms^{-2}$

C. $3.4ms^{-2}$

D. $4.9ms^{-2}$

Answer: B

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2. In the above problem its velocity after 3 seconds in ms^{-1} is

A. 7.05

B. 14.7

C. 29.4

D. zero

Answer: A

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3. In the above problem its displacement after 3 seconds is

A. 78.4m

B. 44.15m

C. 10.57m

D. Zero

Answer: C

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4. A block sliding down on a rough 45° inclined plane has half the velocity it would have been, the inclined plane is smooth. The coefficient of sliding friction between the block and the inclined plane is

A. $\frac{1}{4}$

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

C. $\dfrac{1}{2\sqrt{2}}$

D. $\dfrac{1}{\sqrt{2}}$

Answer: B

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5. A cube of weight 10N rests on a rough inclined plane of slope 3 in 5. The coefficient of friction is 0.6. The minimum force necessary to start the cube moving up the plane is

A. 5.4N

B. 10.8N

C. 2.7N

D. 18N

Answer: B

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EXERCISE - I (H.W)(CIRCULAR MOTION)

1. A body moves along a circular path of radius 5 m.The coefficient of friction between the surface of the path and the body is 0.5. The angular velocity in rad/s with which the body should move so that it does not leave the path is $\left(g = 10ms^{-2}\right)$

A. 4

B. 3

C. 2

D. 1

Answer: D

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2. A vanis moving with a speed of 72 Kmph on a level road, where the coefficient of friction between tyres and road is 0.5. The minimum radius of curvature, the road must have, for safe driving of van is

A. 80 m

B. 40 m

C. 20 m

D. 4 m

Answer: A

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3. What is the smallest radius of a circle at which a bicyclist can travel if his speed is $7m/s$ and the coefficient of static friction the between tyres and road is 0.25

A. 10 m

B. 20 m

C. 5 m

D. 15 m

Answer: B

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EXERCISE - II (C.W)(NEWTON.S LAWS OF MOTION)

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. 5 units

B. 2 units

C. 10 units

D. 15 units

Answer: C

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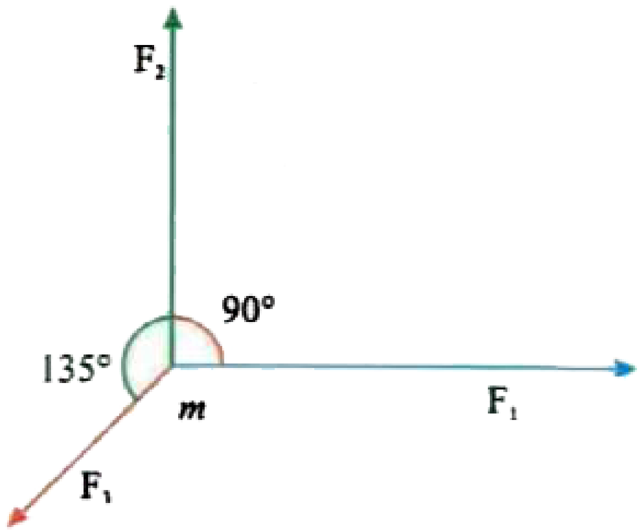
2. When a force F acts on a body of mass m, the acceleration produced in the body is a. If three equal forces $F_1 = F_2 = F_3 = F$ act on the same body as shown in figure the acceleration produced is



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

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

C. $\sqrt{2}$

D. a

Answer: A

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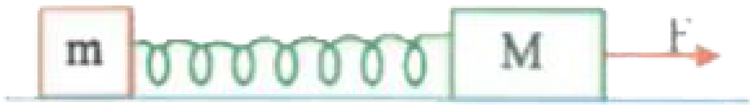
3. Two blocks of masses m and M are placed on a horizontal frictionless table connected by light spring as shown in the figure. Mass M is pulled to the right with a force F. If the acceleration of mass m is a, then the acceleration of mass M will be



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

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

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

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

Answer: A

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4. The displacement of a body moving along a straight line is given 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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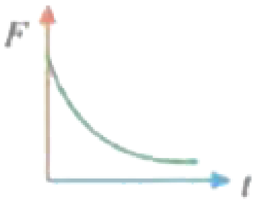
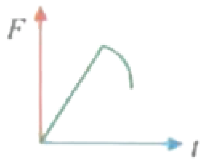
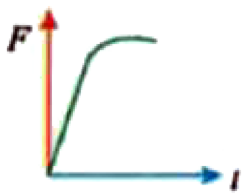
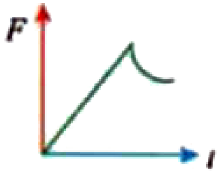
5. If $F = F_0\left(1 - e^{-t/\lambda}\right)$ the F-t graph is

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. 0.2 N

B. 10N

C. 400 N

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. $2.82kms^{-1}$

B. $4.82kms^{-1}$

C. $3.61kms^{-1}$

D. $5.62kms^{-1}$

Answer: A

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9. A body of mass 5kg starts from the origin with an initial velocity $\overrightarrow{u} = 30\hat{i} + 40\hat{j} ms^{-1}$. If a constant force $\overrightarrow{F} = -\left(\hat{i} + 5\hat{j}\right)N$ 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 60 kg performs a dive from a platform 10 m 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 entering 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 200 g is dropped from height 5m on a cardboard. If the knife edge penetrates distance 2m into the card board, the average resistance offered by the cardboard to the knife edge is $(g = 10m/s^2)$

A. 7 N

B. 25N

C. 35 N

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. $1/2\frac{m}{s^2}$

C. $1\frac{m}{s^2}$

D. $2\frac{m}{s^2}$

Answer: C

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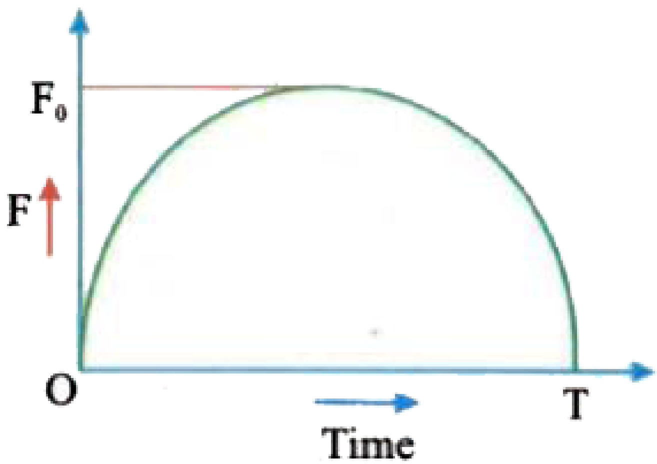
EXERCISE - II (C.W)(IMPULSE)

1. 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. Then



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

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

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

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

Answer: C

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2. 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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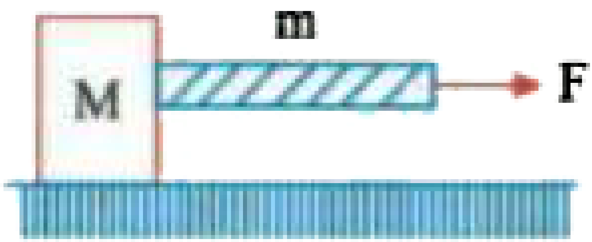
EXERCISE - II (C.W)(OBJECTS SUSPENDED BY STRINGS AND APPARENT WEIGHT)

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



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

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

C. zero

D. $\dfrac{M.\,F}{m+M}$

Answer: A

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2. 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 $36kmh^{-1}$ to zero in 5 s. The angle by which the ball deviates from the vertical is

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

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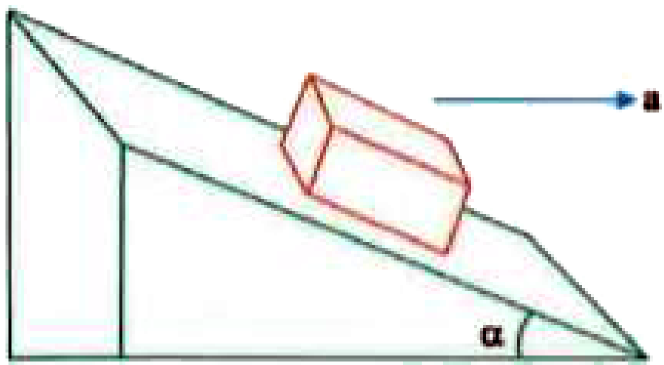
3. A block is kept on a frictionless inclined surface with angle of inclination α. The incline is given an acceleration 'a' to keep the block stationary. Then 'a' is equal to



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

B. $g\operatorname{cosec} \alpha$

C. g

D. $g \tan \alpha$

Answer: D

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4. A man sits on a chair supported by a rope passing over a frictionless fixed pulley. The man who weighs 1,000 N exerts a force of 450 N 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

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

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

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

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

Answer: B

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6. A monkey of mass 40 kg climbs on a massless rope of breaking strength 600 N. 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 down with an acceleration of $4m/s^2$

D. climbs down with a uniform speed of $5m/s$

Answer: B

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7. Two persons are holding a rope of negligible weight tightly at its ends so that it is horizontal. A 15 kg 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. 150 N

B. 75 N

C. 50 N

D. Infinitely large

Answer: D

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8. A straight rope of length 'L' is kept on a frictionless horizontal surface and a force 'F' is applied to one end of the rope in the direction of its length and away from that end. The tension in the rope at a distance 'l' from that end is

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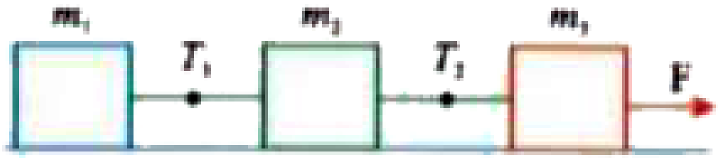
9. Consider three blocks of masses m_1, m_2, m_3 interconnected by strings which are pulled by a common force F on a frictionless horizontal table as in the figure. The tension T_1 and T_2 are also indicated



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)

$$\text{acceleration of the system} = \frac{F}{m_1 + m_2 + m_3}$$

A. a, b

B. b, d

C. a, d

D. c, d

Answer: D

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10. 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. 1600 N

B. 2000 N

C. 200 N

D. 1500N

Answer: B

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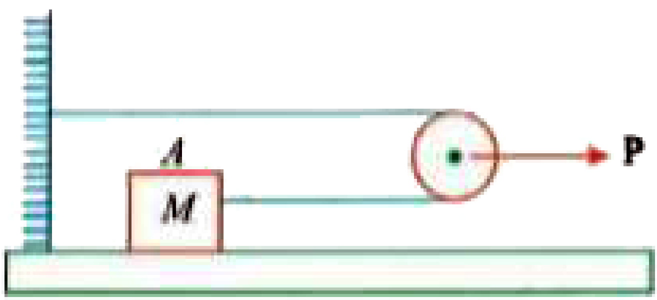
11. In the following figure, the pulley is massless and frictionless. There is no friction between the body and the floor. The acceleration produced in the body when it is displaced through a certain distance with force 'P' will be



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

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

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

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

Answer: B

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12. 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 it has an acceleration of $1/5^{\text{th}}$ of the acceleration due to gravity

A. $1/10$

B. $\frac{2.1}{5}$

C. $\frac{3.2}{5}$

D. $\frac{4.1}{20}$

Answer: B

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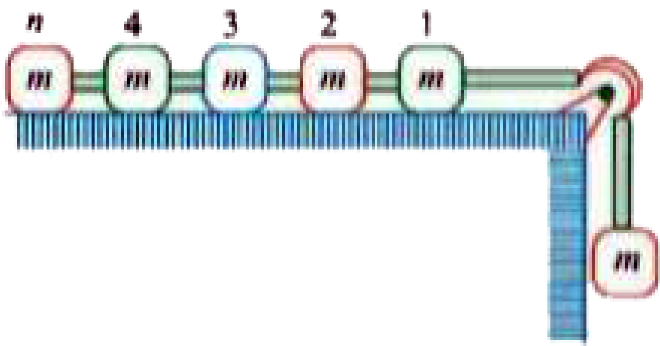
13. In the given arrangement, n number of equal masses are connected by strings of negligible masses. The tension in the string connected to n^{th} mass is :



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

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

C. mg

D. mng

Answer: A

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14. A 40 N block is supported by two ropes. One rope is horizontal and the other makes an angle of 30° with the ceiling. The tension in the rope attached to the ceiling is approximately :

A. 80 N

B. 40 N

C. 34.6 N

D. 46.2 N

Answer: A

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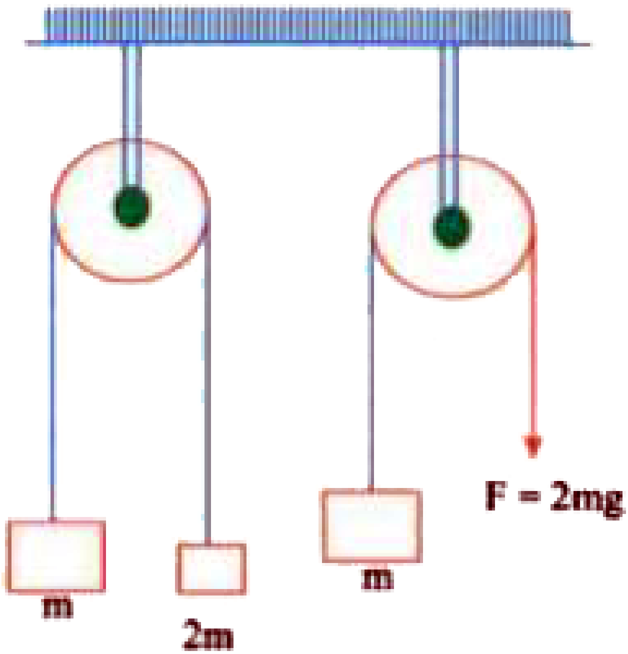
15. The pulley arrangements shown in figure are identical, the mass of the rope being negligible. In case I, the mass m is lifted by attaching a mass 2m to the other end of rope with a constant downward force F = 2mg, where g is acceleration due to gravity. The acceleration of mass m in case I is



A. zero

B. more than that in case

C. less than that in case II

D. equal to that in case II

Answer: C

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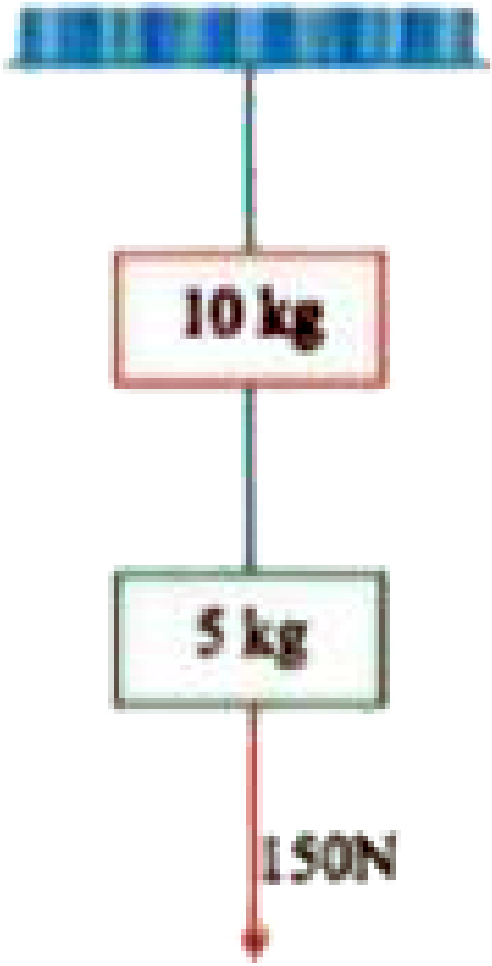
16. Two masses of 10 kg and 5 kg are suspended from a rigid support as shown in figure. The system is pulled down with a force of 150 N attached to the lower mass. The string attached to the support breaks and the system accelerates downwards.



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

A. 300 N

B. 200 N

C. 100 N

D. zero

Answer: C

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17. Two bodies of masses 3kg and 2kg are connected by a long string and the string is made to pass over a smooth fixed pulley.

Initially the bodies are held at the same level and released from rest. The velocity of the 3kg body after one second is $\left(g = 10\frac{m}{s^2}\right)$

A. $2m / s$

B. $1m / s$

C. $0.4m / s$

D. $4m / s$

Answer: A

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18. A block of mass 3kg which is on a smooth inclined plane making an 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 what 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

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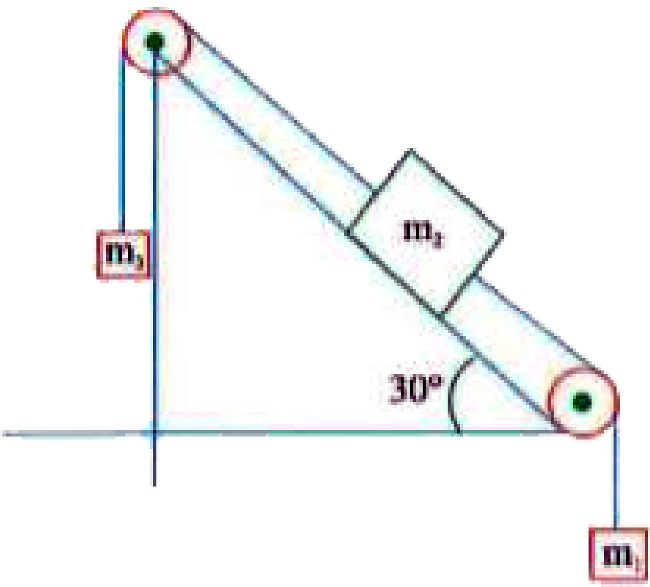
19. If $m_1 = 10kg, m_2 = 4kg, m_3 = 2kg,$ the acceleration of system is



A. $5g/2$

B. $5g/3$

C. $5g/8$

D. $5g/14$

Answer: C

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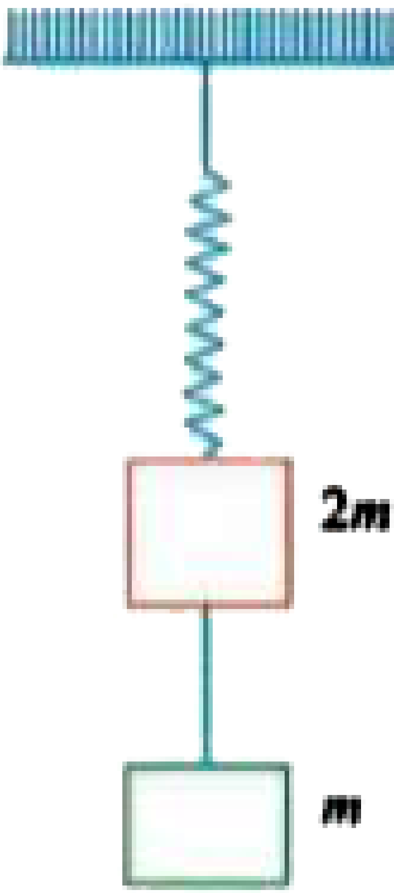
20. The string between blocks of masses 'm' and '2m' is massless and inextensible.The system is suspended by a massless spring as shown. If the string is cut, the magnitudes of accelerations of masses 2m and m (immediately after cutting)



A. g, g

B. $\left(g, \frac{g}{2}\right)$

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

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

Answer: C

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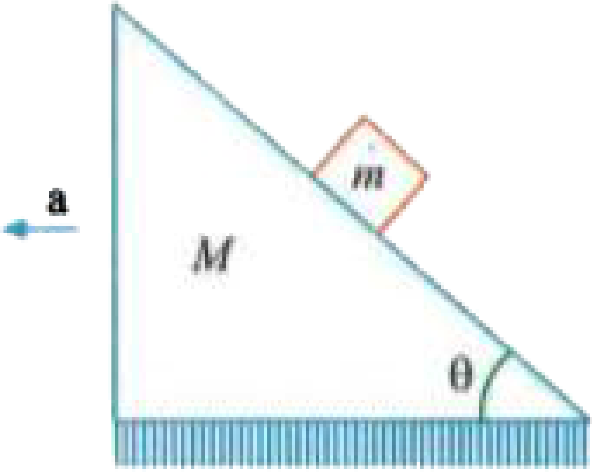
21. All surfaces are smooth. The acceleration of mass m relative to the wedge is



A. $g\sin\theta$

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

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

D. $a\cos\theta$

Answer: B

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EXERCISE - II (C.W)(LAW OF CONSERVATION OF MOMENTUM)

1. A bullet of mass 10 gm moving with a horizontal velocity $100m/s$ passes through a wooden block of mass 100 gm. 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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2. A shell is fired from the ground at an angle 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

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3. Two trolleys of masses m and 3m are connected by a spring. They are compressed and released, they move off in opposite direction and come to rest after covering distances s_1 and s_2 respectively. If the frictional force between trolley and surface is same in both the cases then 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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4. Two particles of masses m_1 and m_2 in projectile motion have velocities $\vec{v}_1$ and $\vec{v}_2$ respectively at time t= 0. They collide at time t_0. Their velocities become $\vec{v}_1$ and $\vec{v}_1$ at time

$2t_0$ while still moving in air. The value of $\left|\left(m_1 \vec{v}_1^{\,1} + m_2 \vec{v}_2^{\,1}\right) - \left(m_1 \vec{v}_1 + m_2 \vec{v}_2\right)\right|$ is

A. zero

B. $(m_1 + m_2)gt_0$

C. $2(m_1 + m_2)gt_0$

D. $\frac{1}{2}(m_1 + m_2)gt_0$

Answer: C

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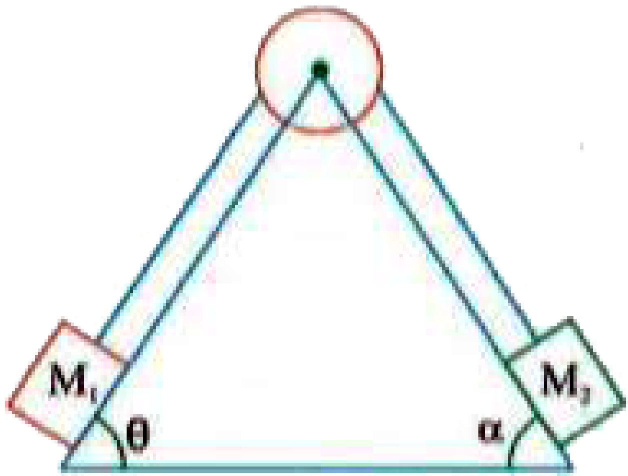
EXERCISE - II (C.W)(EQUILIBRIUM OF A PARTICLE)

1. 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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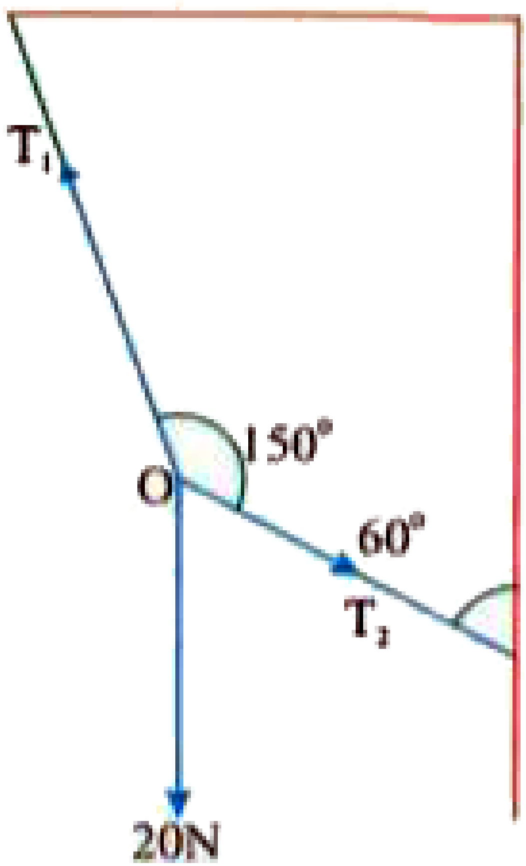
2. If 'O' is at equilibrium then the values of the tension T_1 and T_2 respectively.



A. 20N, 30 N

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

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

D. 10N, 30 N

Answer: B

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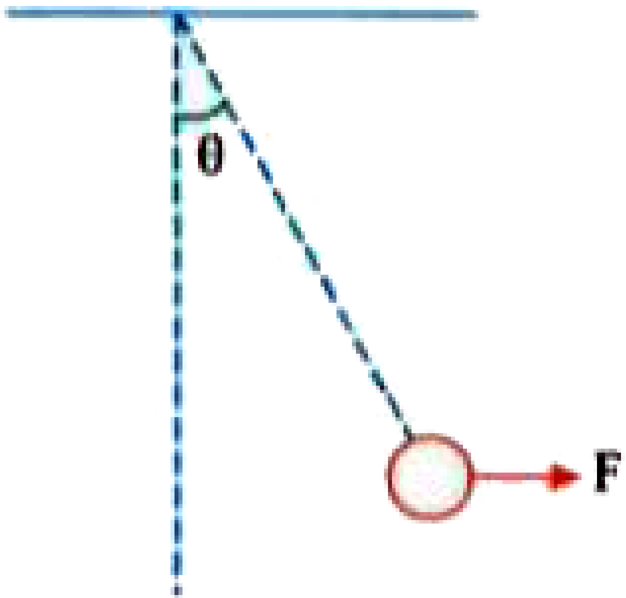
3. A 1N pendulum bob is held at an angle θ from the vertical by a 2 N horizontal force F as shown in the figure. The tension in the string supporting the pendulum bob (in newton) is



A. $\cos\theta$

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

C. $\sqrt{5}$

D. 1

Answer: C

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EXERCISE - II (C.W)(MOTION ON A HORIZONTAL ROUGH SURFACE)

1. 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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2. A 500 kg horse pulls a cart of mass 1500 kg 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. 5000 N

D. 6000N

Answer: D

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3. 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 coefficient of friction between the plane and the ground is 0.2. Assuming the plane accelerates uniformly the minimum force required is $(g = 10ms^{-2})$

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

A. 0.4 N

B. 0.7 N

C. 6N

D. 7N

Answer: C

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5. 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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6. A man of mass 60kg sitting on ice pushes a block of mass of 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 0.2. If $g = 10ms^{-2}$, the distance between 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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7. 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, 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. $\frac{P}{2\mu M^2 g}$

Answer: C

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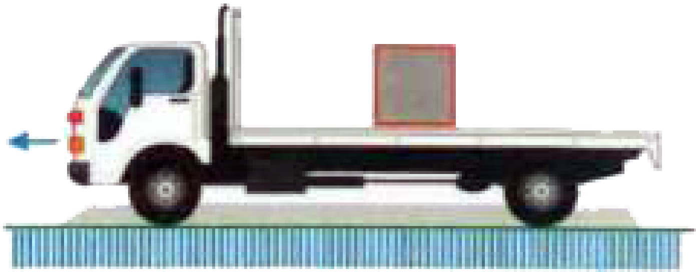
8. The rear side of a truck is open and a box of 40 kg mass is placed 5 m away from the open end as shown in figure. The coefficient of friction between the box the surface below it is 0.15. On a straight road, the truck starts from rest and accelerates with $2ms^{-2}$). At what distance from the starting point does the box fall from the truck ? (Ignore the size of the box.)



A. 20 m

B. 10m

C. $\sqrt{20}m$

D. 5m

Answer: A

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9. A grinding machine whose wheel has a radius of $\frac{1}{\pi}$ is rotating at $2.5 rev / \sec$. A tool to be sharpened is held against the wheel with a force of 40N. If the coefficient of friction between the tool and the wheel is 0.2, power required is

A. 40 W

B. 4 W

C. 8 W

D. 10 W

Answer: A

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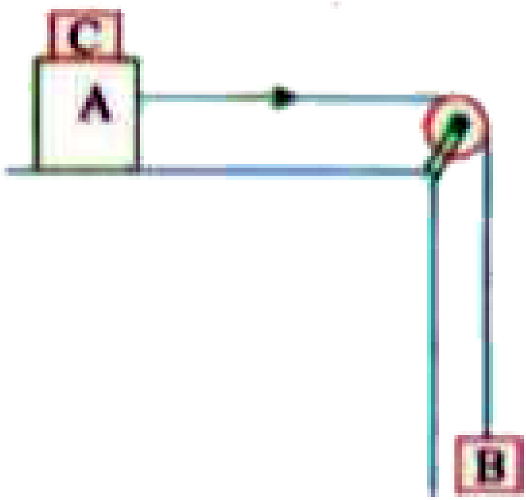
10. A block A of mass 3kg and another block B of mass 2 kg are connected by a light inextensible string as shown in figure. If the coefficient of friction between the surface of the table and A is 0.5. What maximum mass C is to be placed on A so that the system is to be in equilibrium ?



A. 3kg

B. 2kg

C. 1kg

D. 4kg

Answer: C

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EXERCISE - II (C.W)(MOTION OF BODY ON THE INCLINED PLANE)

1. A block slides down a rough inclined plane of slope angle θ with a constant velocity. It is then projected up the same plane with an initial velocity v. The distance travelled by the block up the plane before coming to rest is

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

B. $\dfrac{v^2}{2g\sin\theta}$

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

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

Answer: A

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2. The minimum force required to start pushing a body up a 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 with 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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3. The horizontal acceleration that should be given to a smooth inclined plane of angle $\sin^{-1}\left(\frac{1}{l}\right)$ to keep an object stationary on the plane, relative to the inclined plane is

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

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

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

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

Answer: A

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4. 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 inclination is doubled for the same length of the plane, what will be the velocity of the body on reaching the ground

A. v

B. 2v

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

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

Answer: C

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5. 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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6. A smooth block is released from rest on a 45° inclined plane and it slides a distance 'd'. The time taken to slide is n times that on a smooth inclined plane. The coefficient of friction

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

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

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

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

Answer: A

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7. The upper half of an inclined plane of inclination $'\theta'$ is perfectly smooth while the lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom. The coefficient of friction between the block and the lower half of the plane is given by

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

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

C. $\mu = \tan\theta$

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

Answer: A

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8. A 30 kg box has to move up an inclined plane of slope 30° to the horizontal with a uniform velocity of $5ms^{-1}$.If the frictional force retarding the motion is 150N, the horizontal force required to move the box up is $\left(g = 10ms^{-2}\right)$

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

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

C. $300 N$

D. $150 N$

Answer: A

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EXERCISE - II (C.W)(PULLING/PUSHING A BODY)

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

A. 346 N

B. 446 N

C. 746 N

D. 846 N

Answer: C

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2. A pulling force making an angle θ with the horizontal is applied on a block of weight W placed on a horizontal table. If the angle of friction is ϕ, the magnitude of the 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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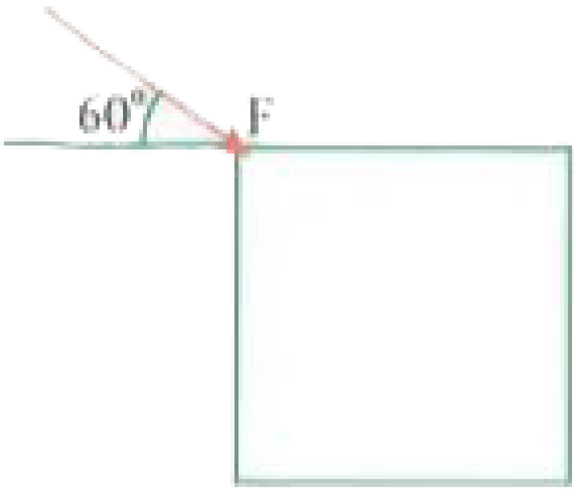
3. A block of mass $\sqrt{3}kg$ is kept on a frictional surface with $\mu = \dfrac{1}{2\sqrt{3}}$. The minimum force to be applied as shown to move the block is



A. 5N

B. 20 N

C. 10 N

D. $20 / 3N$

Answer: B

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EXERCISE - II (C.W)(CIRCULAR MOTION)

1. A car is moving in a circular horizontal track of radius 10 m with a constant speed of $10ms^{-1}$. A plumb bob is suspended from the roof of the car by a string of length 1m. The angle made by the string with vertical is $(g = 10ms^{-2})$

A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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2. A vehicle is moving with a velocity v on a curved road of width b and radius of curvature R. For counteracting the centrifugal force on the vehicle the difference in elevation required in between the outer and inner edges of the road is

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

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

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

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

Answer: A

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

A. 250 N

B. 500 N

C. 1000 N

D. 125 N

Answer: A

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

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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6. 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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EXERCISE - II (H.W)(NEWTON.S LAWS OF MOTION)

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

A. 20N

B. 22N

C. 4N

D. 16N

Answer: B

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2. A body of mass 3 kg is moving along a straight line with a velocity of $24ms^{-1}$. When it is at a point 'P' a force of 9 N acts on the body in a direction opposite to its motion. The time after which it will be at 'P' again is,

A. 8s

B. 16s

C. 12s

D. 24s

Answer: B

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3. A ball of mass 10 gm dropped from a height of 5m hits the floor and rebounds to a height of 1.25m. If the ball is in contact with the ground for 0.1s, the force exerted by the ground on the ball is $(g = 10m / s^2)$

A. 0.5 N

B. 1.5N

C. 0.15 N

D. 2.5 N

Answer: B

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4. A stream of water flowing horizontally with a speed of $15ms^{-1}$ pushes out of a tube of cross sectional area $10^{-2}m^2$ and hits a vertical wall near by what is the force exerted on the wall by the impact of water assuming.that it does not rebound? (Density of water $= 1000kgm^3$)

A. 1250N

B. 2250 N

C. 4500N

D. 2550 N

Answer: B

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5. What is the magnitude of the total force on a driver by the racing car he operates as it accelerates horizontally along a straight line from rest to $60m/s$ in $8.0s$ (mass of the driver $= 80kg$)

A. 0.06KN

B. 0.78KN

C. 1.4KN

D. 1.0KN

Answer: C

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6. A base ball of mass $150gm$ travelling at speed of $20m/s$ is caught by a fielder and brought to rest in $0.04s$.The force applied to the ball and the distance over which this force acts are respectively

A. 75 N, 0.8 m

B. 37.5 N,0.4 m

C. 75 N,0.4 m

D. 37.5 N, 0.8m

Answer: C

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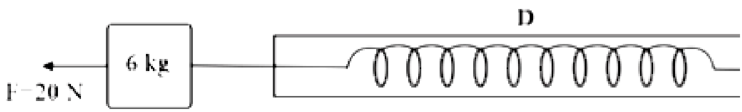
7. A dynamometer D, which is a device used to measure force, is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10 N are applied on the blocks as shown in the figure. The reading of the dynamometer is



A. 10N

B. 20N

C. 6N

D. 14N

Answer: D

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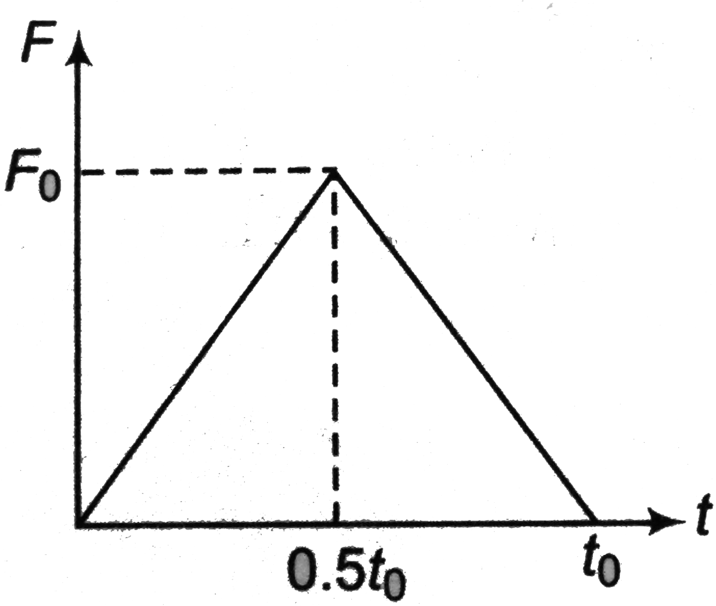
8. A particle of mass m moving with velocity u makes an elastic one-dimentional collision with a stationary particle of mass m. They come in contact for a very small time t_0. Their force of interaction increases from zero to F_0 linearly in time $0.5t_0$, and decreases linearly to zero in further time $0.5t_0$ as shown in figure.

The magnitude of F_0 is



A. $\dfrac{mu}{T}$

B. $\dfrac{2mu}{T}$

C. $\dfrac{mu}{2T}$

D. $\dfrac{3mu}{2T}$

Answer: B

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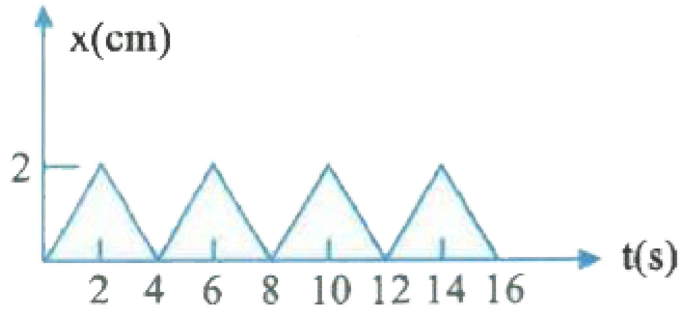
9. The position-time graph of a body of mass 0.04kg is shown in the figure. The time between two consecutive impulses received by the body and the magnitude of each impulse is



A. $4\sec, 4 \times 10^{-4} kgm/s$

B. $2\sec, 8 \times 10^{-4} kgm/s$

C. $6\sec, 4 \times 10^{-4} kgm/s$

D. $8\sec, 8 \times 10^{-4} kgm/s$

Answer: B

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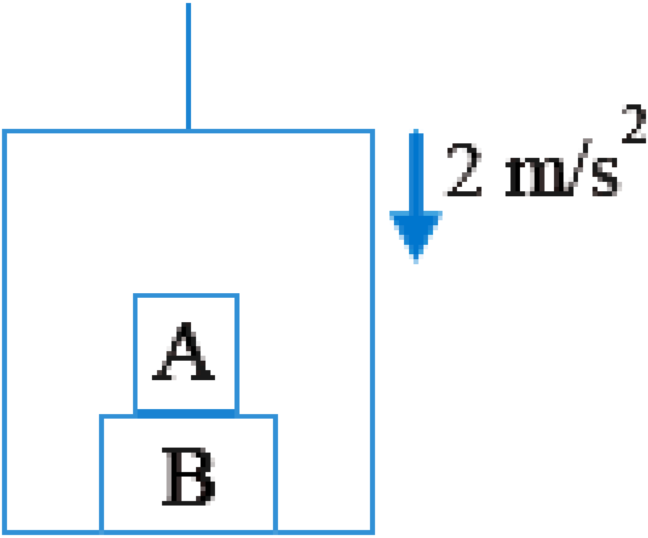
EXERCISE - II (H.W)(OBJECTS SUSPENDED BY STRINGS AND APPARENT WEIGHT)

1. The elevator shown in fig. is descending with an acceleration of 2 m/s^2. The mass of block A is 0.5 kg. The force exerted by the block A on the block B is



A. 2N

B. 4N

C. 6N

D. 8N

Answer: B

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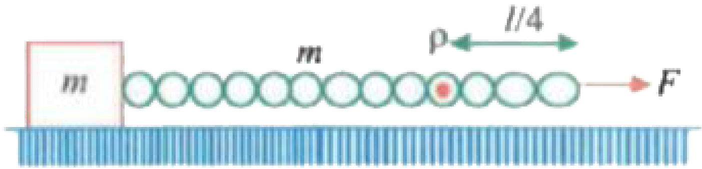
2. A block of mass m is pulled by a uniform chain of mass m tied to it by applying a force F at the other end of the chain. The tension at a point P which is at a distance of quarter of the length of the chain from the free end, will be



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

B. $\frac{7F}{8}$

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

D. $\frac{4F}{5}$

Answer: B

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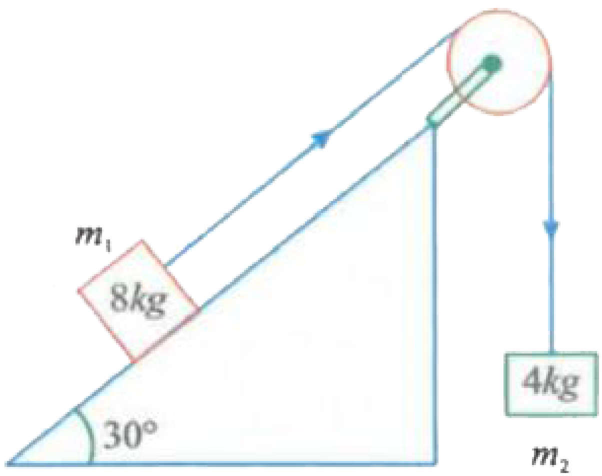
3. Two masses of 8 kg and 4 kg are connected by a string as shown in figure over a frictionless pulley. The acceleration of the system is



A. $4m/s^2$

B. $2m/s^2$

C. zero

D. $9.8m / s^2$

Answer: C

View Text Solution

4. Consider the system shown in figure. The pulley and the string are light and all the surface are frictionless. The tension in the string is $\left(\text{Take g} = 10m / s^2\right)$

A. 0N

B. 1N

C. 2N

D. 5N

Answer: D

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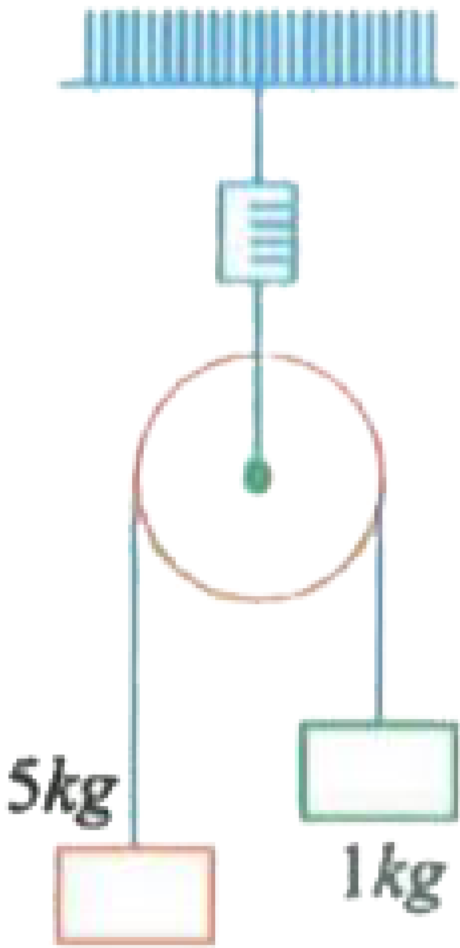
5. In the figure, a smooth pulley of negligible weight is suspended by a spring balance. Weights of 1 kg and 5kg are attached to the opposite ends of a string passing over the pulley and move with an acceleration due of gravity. During their motion, the spring balance reads a weight of



A. 6 kg

B. less than 6 kg

C. more than 6 kg

D. may be more or less than 6kg

Answer: B

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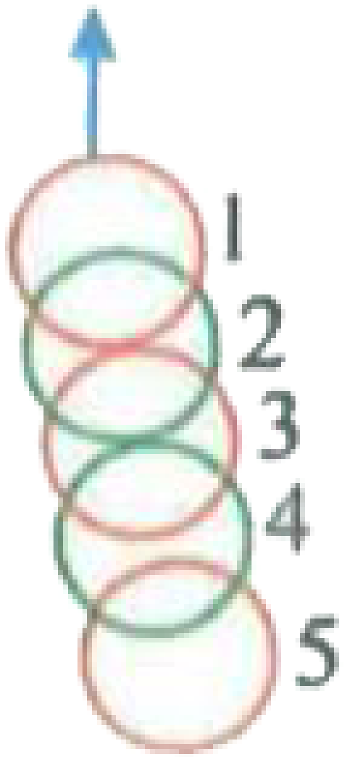
6. A chain consisting of 5 links each of mass 0.1 kg is lifted vertically up with a constant acceleration of $2.5m/s^2$. The force of interaction between 1st and 2nd links as shown



A. 6.15 N

B. 4.92 N

C. 9.84N

D. 2.46N

Answer: B

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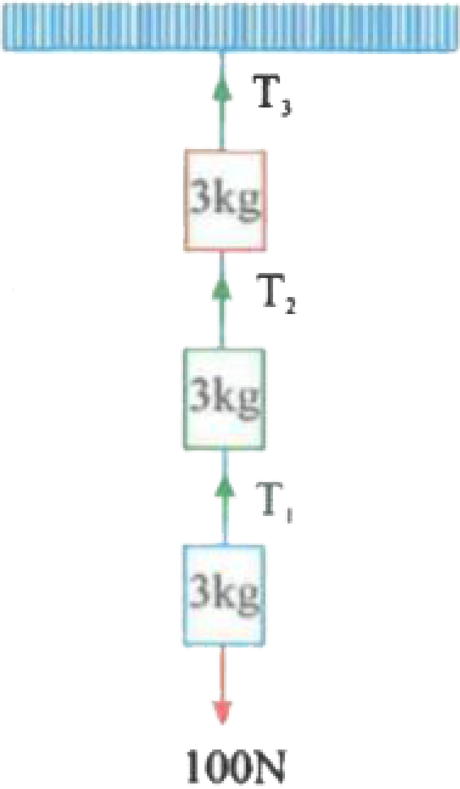
7. Three blocks of equal masses (each 3kg) are suspended by weightless strings as shown. If applied force is 100N, then T_1 is equal to

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



A. 130N

B. 190N

C. 100N

D. 160N

Answer: A

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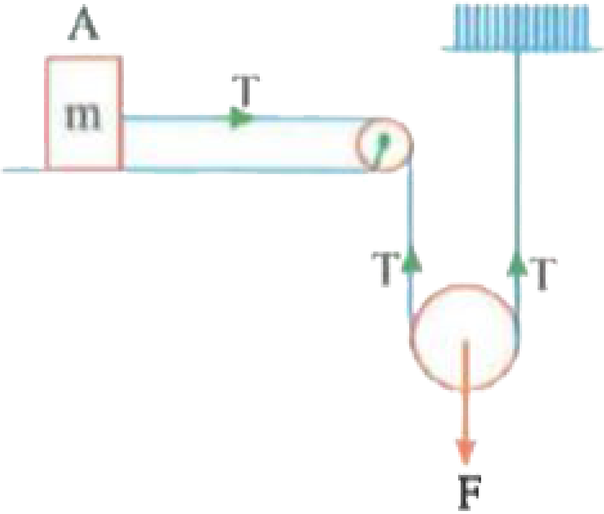
8. Pulleys and strings are massless. The horizontal surface is smooth. What is the acceleration of the block



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

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

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

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

Answer: A

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9. When a train starting from rest is uniformly accelerating, a plumb bob hanging from the roof of a compartment is found to be inclined at an angle of 45° with the vertical. The time taken by the train to travel a distance of $1/2km$ will be nearly

A. 7s

B. 10s

C. 15s

D. 25s

Answer: B

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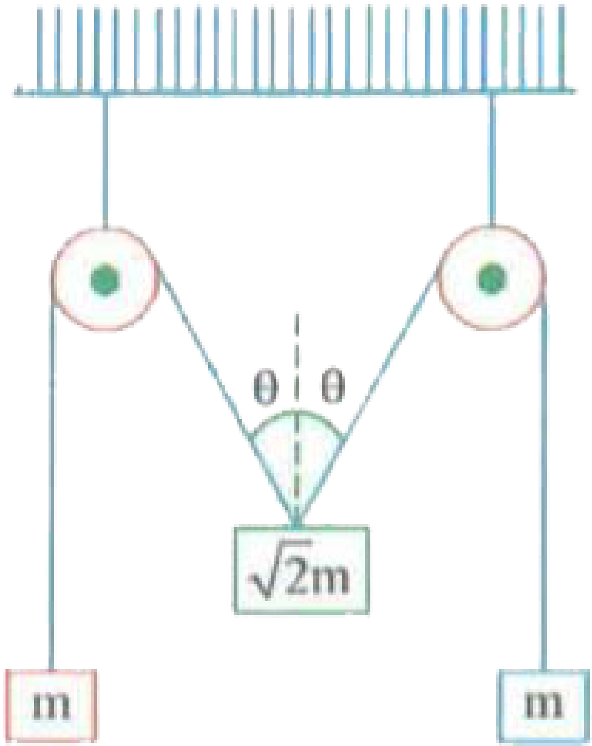
10. The pulley and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ

should be



A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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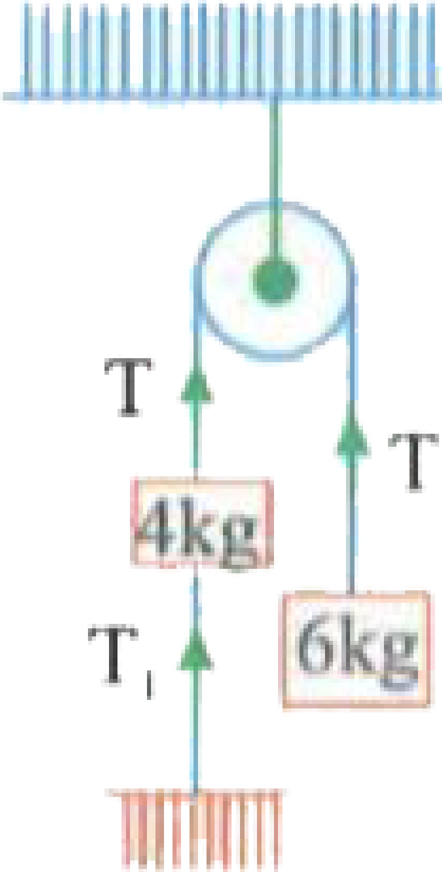
11. Two bodies of masses 4kg and 6kg are attached to the ends of a string which passes over a pulley, the 4kg mass is attached to the table top by another string.The tension in this string T_1 is equal to



A. 10N

B. 10.6N

C. 25N

D. 20N

Answer: D

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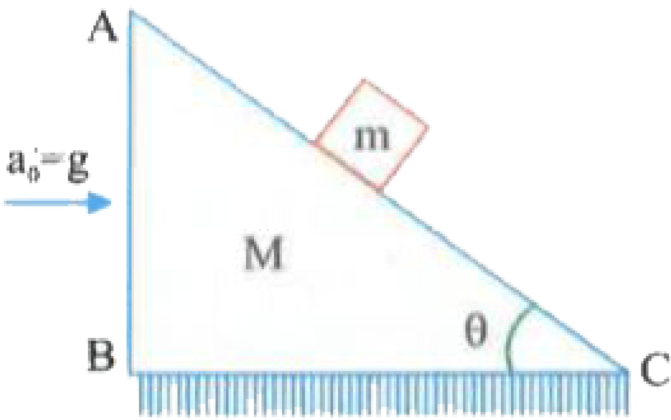
12. Acceleration of block m is $(\theta < 45^\circ)$



A. $g \sin \theta$

B. $g \cos \theta$

C. $g(\sin \theta - \cos \theta)$

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

Answer: C

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13. A stationary shell breaks into three fragments. The momentum of two of the fragments is P each and move at 60° to each other. The momentum of the third fragment is

A. P

B. 2P

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

D. $\sqrt{3}P$

Answer: D

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14. An object initially at rest explodes, disintegrating into 3 parts of equal mass. Parts 1 and 2 have the same initial speed 'v', the velocity vectors being perpendicular to each other. Part 3 will have an initial speed of

A. $\sqrt{2}v$

B. $v/2$

C. $v/\sqrt{2}$

D. $\sqrt{2v}$

Answer: A

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15. A man of 50 kg is standing at one end on a boat of length 25m and mass 200 kg. If he starts running and when he reaches the other end, has a velocity $2ms^{-1}$ with respect to the boat. The final velocity of the boat is

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

B. $\frac{2}{5}ms^{-1}$

C. $\frac{8}{5}ms^{-1}$

D. $\frac{8}{3}ms^{-1}$

Answer: B

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16. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off at right angles to each other, one with a velocity $2\hat{j}m/s$ and the other with a velocity $3\hat{j}m/s$. If the explosion takes place in 10^{-5}

sec, the average force acting on the third piece in Newtons is:

A. $\left(2\hat{i} + 3\hat{j}\right)10^{-5}$

B. $-\left(2\hat{i} + 3\hat{j}\right)10^{+5}$

C. $\left(3\hat{j} - 2\hat{i}\right)10^{-5}$

D. $\left(2\hat{j} - 2\hat{i}\right)10^{-5}$

Answer: B

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EXERCISE - II (H.W)(MOTION ON A HORIZONTAL ROUGH SURFACE)

1. A particle is placed at rest inside a hollow hemisphere of radius R. The coefficient of friction between the particle and the hemisphere is $\mu = \frac{1}{\sqrt{3}}$. The maximum height up to which the particle can remain stationary is

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

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

C. $\frac{\sqrt{3}}{2}R$

D. $\frac{3R}{8}$

Answer: B

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2. A horizontal force is applied on a body on a rough horizontal surface produces an acceleration 'a'. If coefficient of friction between the body and surface which is μ is reduced to $\mu/3$, the acceleration increases by 2 units. The value of $'\mu'$ is

A. 2/3g

B. 3/2g

C. 3/g

D. 1/g

Answer: C

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3. A block of mass $4kg$ is placed in contact with the front vertical surface of a lorry.The coefficient of friction between the vertical surface and block is 0.8.The lorry is moving with an acceleration of $15m/s^2$.The force of friction between lorry and block is $(g = 10ms^{-2})$

A. 48N

B. 24N

C. 40N

D. Zero

Answer: C

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4. A person of mass $72kg$ sitting on ice pushes a block of mass of $30kg$ on ice horizontally with a speed of $12ms^{-1}$.The coefficient of friction between the man and ice and between block and ice is 0.02.If $g = 10ms^{-1}$,the distance between man and the block,when they come to rest is

A. 360m

B. 10m

C. 350m

D. 422.5m

Answer: D

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5. Consider a $14 - tyre$ truck, whose only rear 8 wheels are power driven (means only these 8 wheels can produce an acceleration).These $8 wheels$ are supporting approximately half of the load.If coefficient of friction between road and each type is 0.6,then what could be the maximum attainable acceleration by the truck is

A. $6 ms^{-2}$

B. $24 ms^{-2}$

C. $3 ms^{-2}$

D. $10ms^{-2}$

Answer: C

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6. A block is sliding on a rough horizontal surface. If the contact force on the block is $\sqrt{2}$ times the frictional force, the coefficient of friction is

A. 0.25

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

C. $\sqrt{2}$

D. 1

Answer: D

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7. A block is in limiting equilibrium on a rough horizontal surface. If the net contact force is $\sqrt{3}$ times the normal force, the coefficient of static friction is

A. $\sqrt{2}$

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

C. 0.5

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

Answer: A

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8. A block of mass $2kg$ is placed on the surface of trolley of mass $20kg$ which is on a smooth surface.The coefficient of friction between the block and the surface of the trolley is 0.25.If a horizontal force of $2N$ acts on the block, the acceleration of the system in ms^{-2} is $(g = 10ms^{-2})$

A. 1.8

B. 1

C. 0.9

D. 0.09

Answer: D

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9. A man slides down on a telegraphic pole with an acceleration equal to one-fourth of acceleration due to gravity.The frictional force between man and pole is equal to (in terms of man's weight W)

A. $\frac{W}{4}$

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

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

D. W

Answer: B

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10. A box is placed on the floor of a truck moving with an acceleration of $7ms^2$.If the coeffecient of kinetic friction between the box and surface of the truck is 0.5,find the acceleration of the box relative to the truck

A. $1.7ms^{-2}$

B. $2.1ms^{-2}$

C. $3.5ms^{-2}$

D. $4.5ms^{-2}$

Answer: B

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11. A block is placed at a distance of $2m$ from the rear on the floor of a truck $\left(g = 10ms^{-2}\right)$.When the truck moves with an acceleration of $8ms^{-2}$ the block takes $2\sec$ to fall off from the rear of the truck.The coefficient of sliding friction between truck and the block is

A. 0.5

B. 0.1

C. 0.8

D. 0.7

Answer: D

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12. Sand is piled up on a horizontal ground in the form of a regular cone of a fixed base of radius R.The coefficient of static friction between sand layers is μ.The maximum volume of sand that can be piled up, without the sand slipping on the surface is

A. $\dfrac{\mu R^3}{3\pi}$

B. $\dfrac{\mu R^3}{3}$

C. $\dfrac{\pi R^3}{3\mu}$

D. $\dfrac{\mu\pi R^3}{3}$

Answer: D

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EXERCISE - II (H.W)(MOTION OF A BODY ON THE INCLINED PLANE)

1. A body is allowed to slide from the top along a smooth inclined plane of length $5m$ at an angle of inclination 30°.If $g = 10ms^{-2}$, time taken by the body to reach the bottom of the plane is

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

B. 1.414s

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

D. 2s

Answer: B

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2. A body slides down a smooth inclined plane of height h and angle of inclination 30° reaching the bottom with a velocity v.Without changing the height, if the angle of inclination is doubled, the velocity with which it reaches the bottom of the plane is

A. Velocity

B. v/2

C. 2v

D. $\sqrt{2}v$

Answer: A

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3. A body is projected up along an inclined plane from the bottom with speed is $2v$.If it reaches the bottom of the plane with a velocity v,if θ is the angle of inclination with the horizontal and μ be the coefficient of friction. find μ

A. $\frac{5}{3}\tan\theta$

B. $\frac{3}{5}\tan\theta$

C. $\frac{1}{5}\tan\theta$

D. $\frac{2}{5}\tan\theta$

Answer: B

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4. The minimum force required to move a body up on an inclined plane is three times the minimum force required to prevent it from sliding down the plane.If the coefficient of friction between the body and the inclined plane is $\frac{1}{2\sqrt{3}}$ the angle of the inclined plane is

A. 60°

B. 45°

C. 30°

D. 15°

Answer: C

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5. Starting from rest, the time taken by a body sliding down on a rough inclined plane at 45° with the horizontal is twice the time taken to travel on a smooth plane of same inclination and same distance. Then, the coefficient of kinetic friction is

A. 0.25

B. 0.33

C. 0.5

D. 0.75

Answer: D

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6. A body is sliding down a rough inclined plane The coefficient of friction between the body and the plane is 0.5.The ratio of the net force required for the body to slide down and the normal reaction on the body is $1:2$ Then the angle of the inclined plane is

A. 15°

B. 30°

C. 45°

D. 60°

Answer: C

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7. A body takes $1\frac{1}{3}$ times as much time to slide down a rough inclined plane as it takes to slide down an identical but smooth inclined plane,If the angle of inclination is 45° find the coefficient of friction.

A. $\frac{1}{16}$

B. $\frac{3}{16}$

C. $\frac{5}{16}$

D. $\frac{7}{16}$

Answer: D

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8. A body is sliding down an inclined plane having coefficient of friction $1/3$. If the normal reaction is three times that of the resultant downward force along the inclined plane, the angle between the inclined plane and the horizontal is

A. $\tan^{-1}\left[\frac{1}{2}\right]$

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

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

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

Answer: C

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9. A box of mass 4 kg is placed on a rough inclined plane of inclination 60°. Its downward motion can be prevented by applying an upward pull is F and it can be made to slide upwards by applying a force 3F. The coefficient of friction between the box and inclined plane is

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

B. $\dfrac{\sqrt{3}}{2}$

C. $\dfrac{1}{\sqrt{2}}$

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

Answer: B

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EXERCISE - II (H.W)(PULLING/PUSHING A BODY)

1. A block of weight $100N$ is lying on a rough horizontal surface.If coefficient of friction $\frac{1}{\sqrt{3}}$ .The least possible force that can move the block is

A. $\frac{100}{\sqrt{3}}N$

B. $100\sqrt{3}N$

C. $50\sqrt{3}N$

D. 50N

Answer: D

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2. A weight W rests on a rough horizontal plane,If the angle of friction is θ,the least force that can move the body along the plane will be

A. $W \cos \theta$

B. $W \tan \theta$

C. $W \cot \theta$

D. $W \sin \theta$

Answer: D

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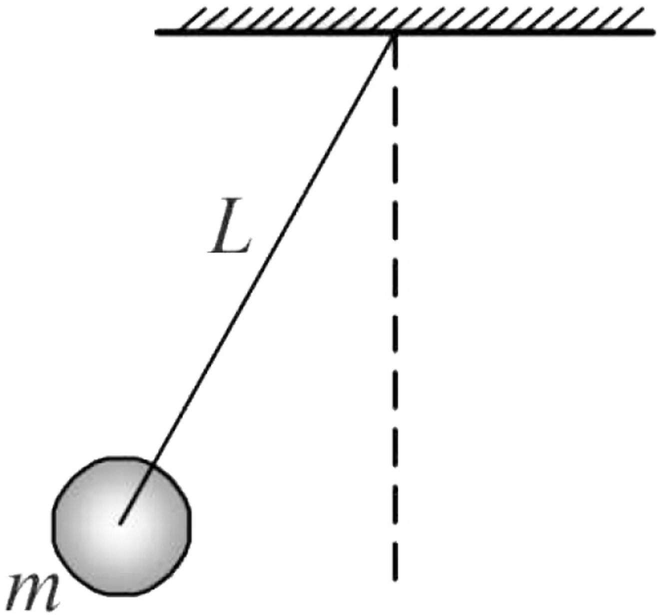
EXERCISE - II (H.W)(CIRCULAR MOTION)

1. A ball of mass (m) 0.5g is attached to the end of a string having length (L) 0.5m. The ball is rotated on a horizontal circular path about vertical axis. The maximum tension that the string can bear is 324N. The maximum possible value of anguar velocity of ball(in radian/s) is



A. 9

B. 18

C. 27

D. 36

Answer: D

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2. A disc rotates at $60 rev/\min$ around a vertical axis.A body lies on the disc at the distance of $20cm$ from the axis of rotation.What should be the minimum value of coefficient of friction between the body and the disc,so that the body will not slide off the disc

A. $8\pi^2$

B. $0.8\pi^2$

C. $0.8\pi^2$

D. $0.008\pi^2$

Answer: C

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3. A car is moving on a circular level road of curvature $300m$. If the coefficient of friction is 0.3 and acceleration due to gravity is $10m/s^2$, the maximum speed of the car be

A. $30km/h$

B. $81km/h$

C. $108km/h$

D. $162km/h$

Answer: C

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EXERCISE - III

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

A. 0°

B. 60°

C. 90°

D. 120°

Answer: D

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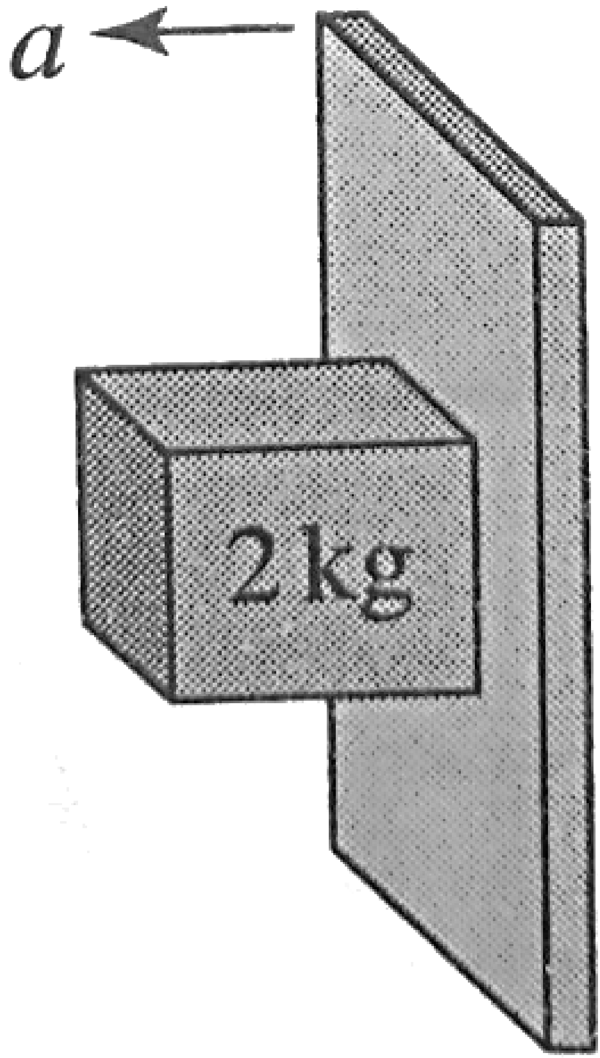

2.

A rough vertical board has an acceleration a so that a 2 kg block pressing against it dows not fall. The coefficient of friction between the block and the board should be

A. $> g/a$

B. $< g/a$

C. $= g/a$

D. $> a/g$

Answer: A

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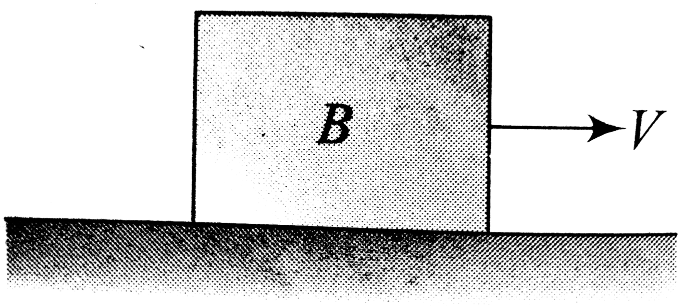
3. A block B is pushed momentarily along a horizontal surface with an initial velocity v . If mu is the coefficient of sliding friction between B and the surface, block B will come to rest after a time:



A. V / g

B. $V / (g\mu)$

C. $g\frac{\mu}{V}$

D. g/V

Answer: B

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

A. $10\sqrt{k}gwt$

B. $20\sqrt{3}kgwt$

C. $20kgwt$

D. $10kgwt$

Answer: C

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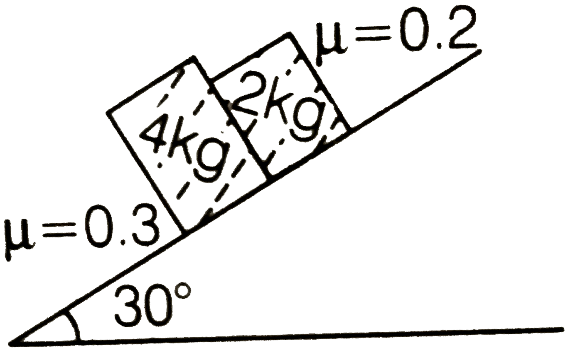
5. Two blocks 4 kg and 2 kg are sliding down an incline plane as shown in figure. The acceleration of 2 kg block is.



A. $1, 66m/s^2$

B. $2.66m/s^2$

C. $3.66m/s^2$

D. $4.66m/s^2$

Answer: B

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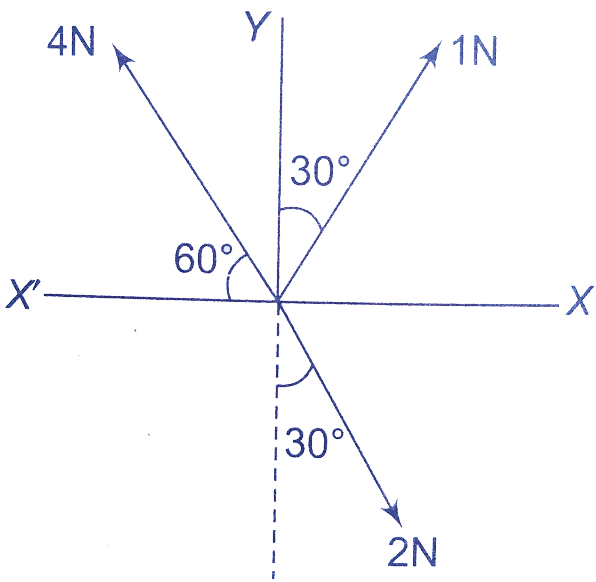
6. Three forces are acting on a particle as shown in the figure. To have the resultant force only along the Y-direction, the magnitude of the minimum additional force needed is



A. $\sqrt{3}N$

B. $0.5N$

C. $1.5N$

D. $\frac{\sqrt{3}}{4}N$

Answer: B

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

A. Zero

B. Mv newton

C. 2 Mv newton

D. `Mv//2 newton

Answer: B

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8. A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of $1ms^{-2}$. The mass of this body must be.

A. $2\sqrt{10}kg$

B. $10kg$

C. 20 kg

D. $10\sqrt{2}kg$

Answer: D

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

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

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

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

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

Answer: B

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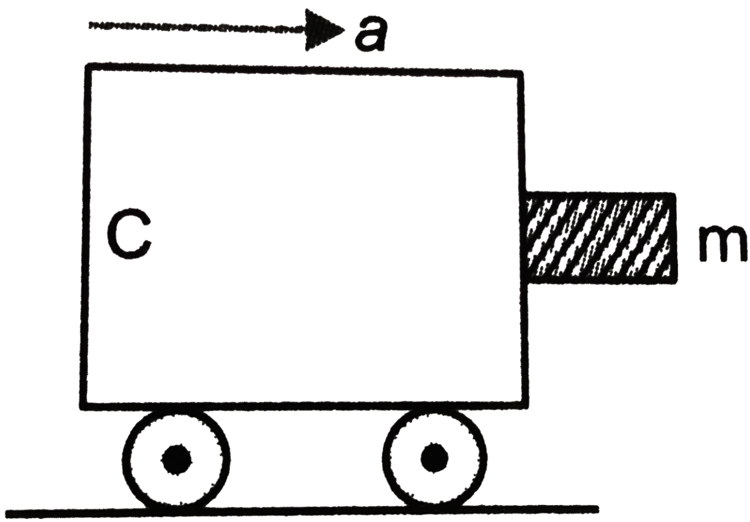
10. A block of mass m is in contact with the cart C as shown in The coefficient of static friction between the block and the cart is μ The acceleration a of the cart that will prevent the block from falling satisfies



A. $\alpha \geq \frac{g}{\mu}$

B. $\alpha \leq \dfrac{g}{\mu}$

C. $\alpha > \dfrac{mg}{\mu}$

D. $\alpha \geq \dfrac{g}{\mu m}$

Answer: A

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11. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration $1.0ms^{-2}$. If $g = 10ms^{-2}$,

the tension in the supporting cable is :

A. 8600 N

B. 9680 N

C. 11000 N

D. 1200 N

Answer: C

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12. A conveyor belt is moving at a constant speed of $2m / s$. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it taking $g = 10ms^{-2}$ is:

A. 0.4 m

B. 1.2 m

C. 0.6 m

D. Zero

Answer: A

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13. A car of mass $1000kg$ negotiates a banked curve of radius $90m$ on a fictionless road. If the banking angle is 45° the speed of the car is:

A. $30ms^{-1}$

B. $5ms^{-1}$

C. $10ms^{-1}$

D. $20ms^{-1}$

Answer: A

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14. Three blocks with masses m , $2m$ and $3m$ are connected by strings, as shown in the figure. After an upward force F is applied on block m , the masses move upward at costant speed v . What is the net force on the block of mass $2m$? (g is the acceleration due to gravity).

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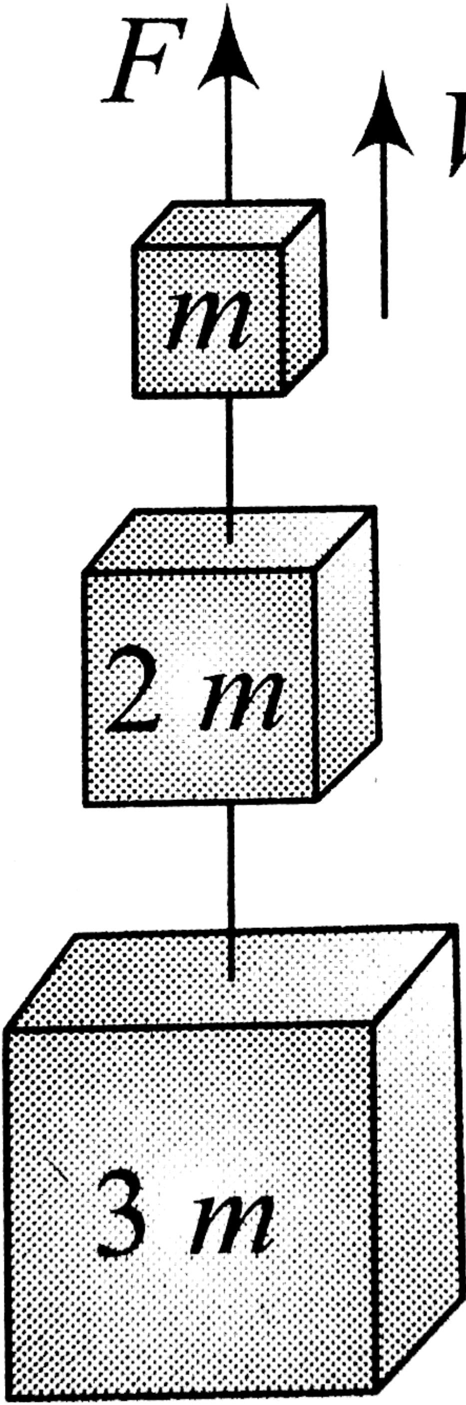

A. 2mg

B. 3mg

C. 6mg

D. zero

Answer: D

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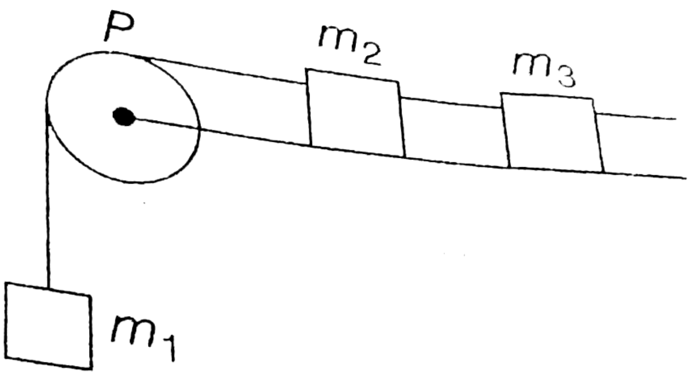
15. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction=μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is (assume, $m_1 = m_2 = m_3 = m$)



A. $\frac{g(1-2\mu)}{2}$

B. $\frac{g(1-g\mu)}{9}$

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

D. $\frac{g(1-2\mu)}{3}$

Answer: D

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

A. $\dfrac{ma}{g-a}$

B. $\dfrac{2ma}{g+a}$

C. $\dfrac{2ma}{g-a}$

D. $\dfrac{ma}{g+a}$

Answer: B

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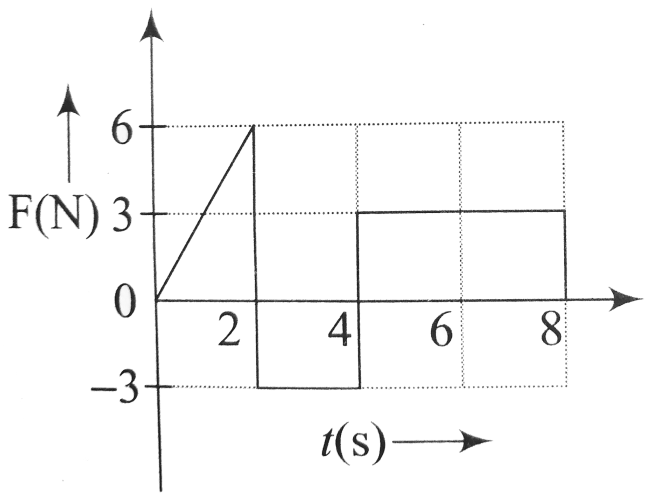
17. The force F acting on a partical of mass m is indicated by the force-time graph shown below. The change in momentum of the particle over time interval from zero to 8 s is.



A. 6 Ns

B. 24 Ns

C. 20 Ns

D. 12 Ns

Answer: D

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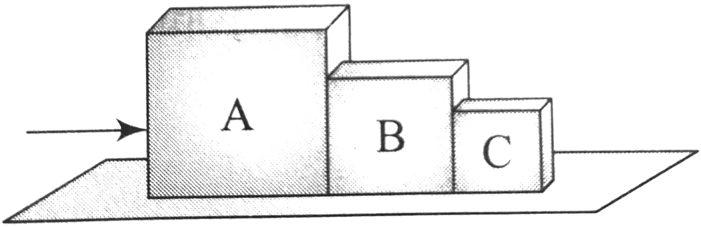
18. Three blocks A , B and C of masses $4kg$, $2kg$ and $1kg$ respectively are in contact on a frictionless surface, as shown. If a force of $14 N is applied on the$ 4kg $block, then the contact f$ or $ce between$ A and

B` is.



A. 8 N

B. 18 N

C. 2 N

D. 6 N

Answer: D

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19. A block A of mass m_1 rests on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of knetic friction between the block and table is μ_k . When the block A is sliding on the table, the tension in the string is.

A. $\dfrac{m_1 m_2 (1 + \mu_k) g}{(m_1 + m_2)}$

B. $\dfrac{m_1 m_2 (1 - \mu_k) g}{(m_1 + m_2)}$

C. $\dfrac{(m_2 - \mu_k m_1)g}{(m_1 + m_2)}$

D. $\dfrac{(m_2 - \mu_k m_1)g}{(m_1 + m_2)}$

Answer: A

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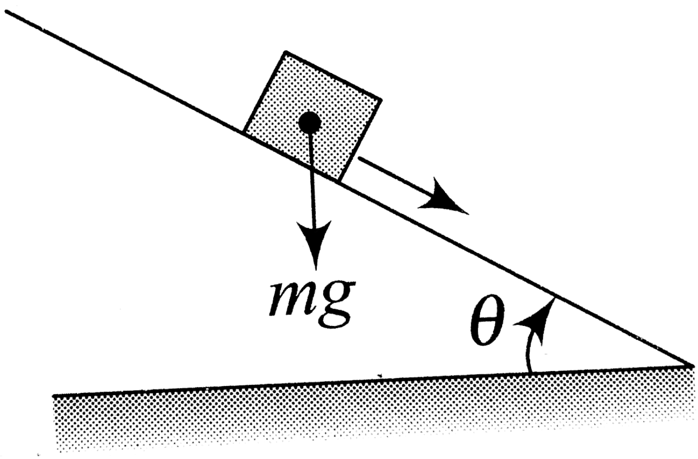
20. A plank with a box on it at one end is gradually raised about the other end. As the angle of inclination with the horizntal reaches 30° , the box starts to slip and slide $4.0m$ down the plank in $4.0s$. The coefficients of static and knitic friction between the box and the plank will be, respectively.



A. 0.4 and 0.3

B. 0.6 and 0.6

C. 0.6 and 0.5

D. 0.5 and 0.6

Answer: C

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EXERCISE - IV

1. When a body is stationary:

A. There is no force acting on it

B. The agent applying force on it is not in contact with it

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

D. The body is in vacuum

Answer: C

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2. The inertia of a moving object depends on:

A. Velocity

B. Mass

C. Area

D. Volume

Answer: B

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3. A thief stole a box full of valuable articles of weight W and while carrying it on his back, he jumped down a wall of height ‘ h ’ from the ground. Before he reached the ground he experienced a load of

A. 2 W

B. W

C. $W/2$

D. 0

Answer: D

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4. There are three Newton's laws of motion namely I, II and III : we can derive:-

A. Second and third laws from the first law

B. Third and first laws from the second law

C. First and second laws from the third law

D. All the laws are independent of each other

Answer: B

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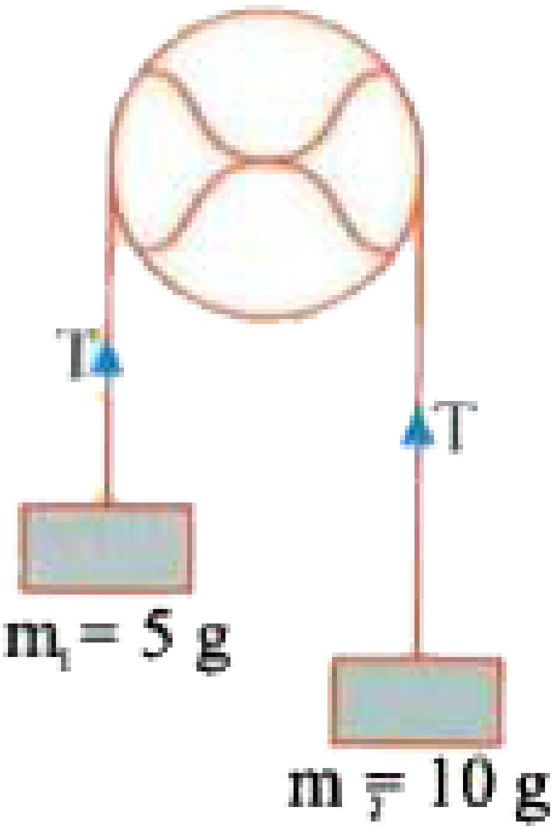
5. Two blocks m_1 = 5 g and m_2= 10 g are hung vertically over a light frictionless pulley as shown in figure. What is the acceleration of the masses when left free ?



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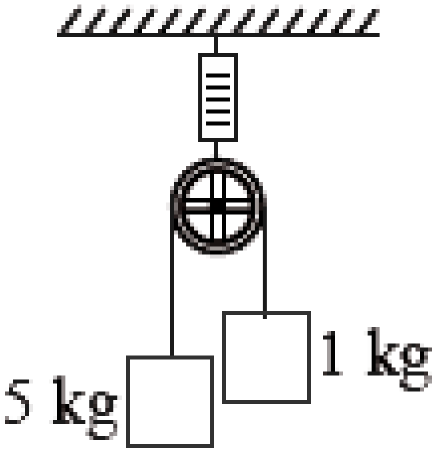
6. In the figure a smooth pulley of negligible weight is suspended by a spring balance. Weights of 1kg and 5 kg are attached to the opposite ends of a string passing over the pulley and move with acceleration because of gravity. During the motion, the spring balance reads a weight of :



.

A. 6 kg

B. Less than 6 kg

C. More than 6 kg

D. Many be more or less than 6 kg

Answer: B

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7. Two masses 2 kg and 3 kg are attached to the end of the string passed over a pulley fixed at the top. The tension and acceleration are

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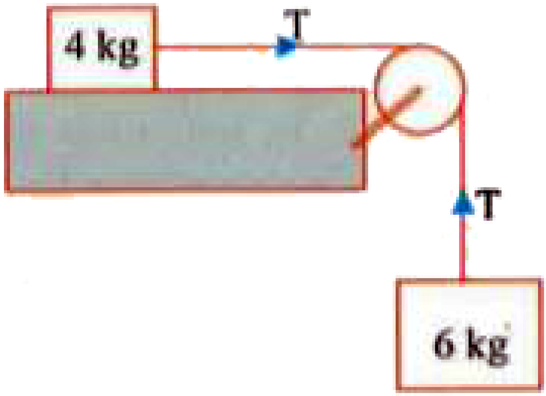
8. Two bodies of mass 6 kg and 4 kg are tied to a string as shown in the following figure. If the table is smooth and pulley frictionless, then acceleration of mass 6 kg will be ($g = 10ms^{-2}$)



A. $60ms^{-2}$

B. $40ms^{-2}$

C. $6ms^{-2}$

D. $4ms^{-2}$

Answer: C

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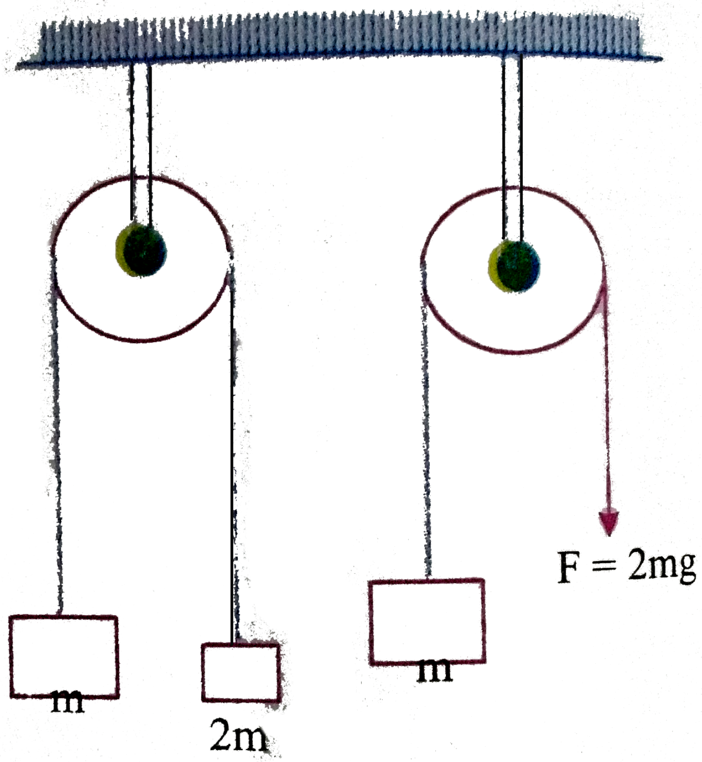
9. The pulley arrangements shown in figure are identical, the mass of the rope being negligible. In case I the mass m is lifted by attaching a mass $2m$ to the other end of rope with a constant downward force $F = 2mg$, where g is acceleration due to gravity The acceleration of mass m in case I is



A. Zero

B. More than that in case (b)

C. Less than that in case (b)

D. Equal to that is case (b)

Answer: C

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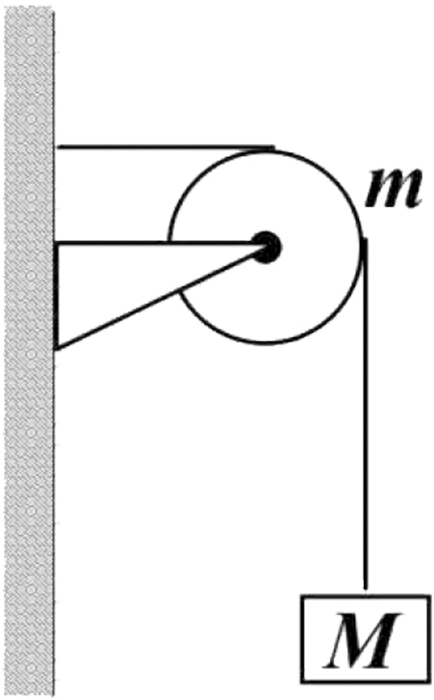
10. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by



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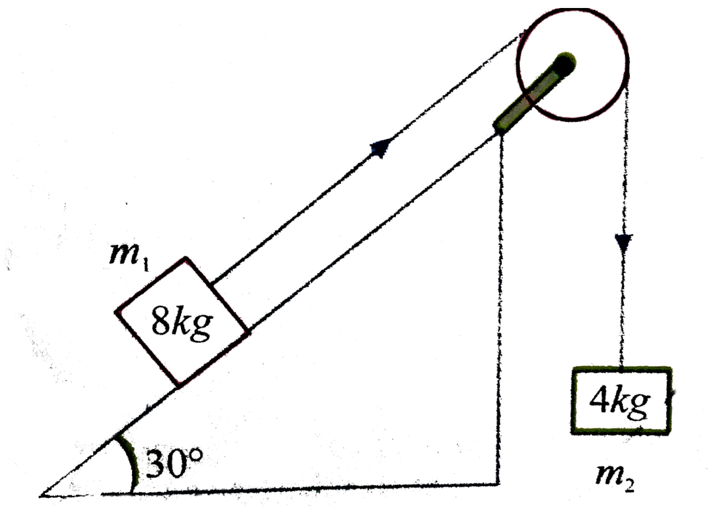
11. Two masses of $8kg$ and $4kg$ are connected by a string as shown in figure over a frictionless pulley.The acceleration of the system is



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

A. $m/5$

B. $2m/5$

C. $3m/5$

D. $4m/5$

Answer: B

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13. A monkey is decending from the branch of a tree with constant acceleration. If the breaking strength is 75% of the weight of the monkey, the minimum acceleration with which monkey can slide down without breaking the branch is

A. $3g/4$

B. $g/4$

C. g

D. $g/2$

Answer: B

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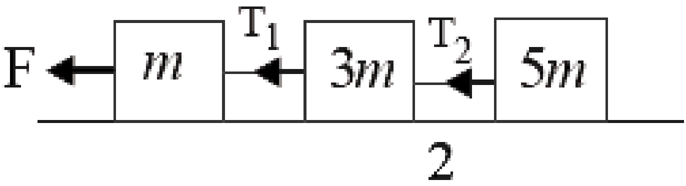
14. Fig. shows a system of three masses being pulled with a force F. the masses are connected to each other by strings. The horizontal surface is frictionless . The tension T_1 in the first string is 16 N. The acceleration of the system is :



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

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

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

D. $\frac{4}{m}$

Answer: B

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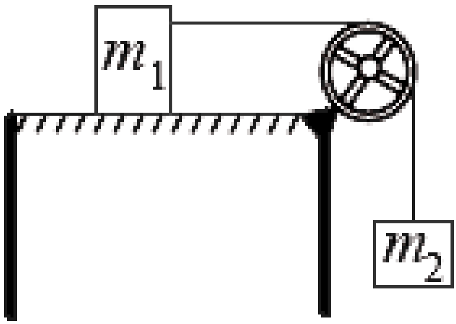
15. Fig. shows a block of mass m_1 resting on a smooth surface. It is connected to a mass m_2 by a string passing over a massless and frictionaless pulleys $m_2 > m_1$. The acceleration of the hanging mass m_2 is :



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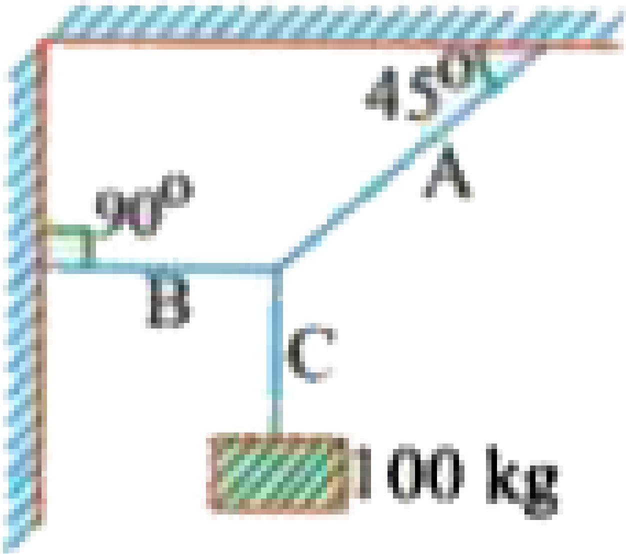
16. A 100 kg block is suspended with the help of three strings A, B and C. The tension in the string A is



A. 50 g N

B. 100 g N

C. 20 g N

D. $100\sqrt{2}gN$

Answer: D

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17. A frictionless inclined plane of length l having inclination θ is placed inside a lift which is accelerating downward with on acceleration a $(< g)$. If a block is allowed to move down the inclined plane, from rest, then the time taken by the block to slide from top of the inclined plane to the bottom of the inclined plane is

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18. Friction

A. Does not affect the efficiency of a machine

B. Increases the efficiency of a machine

C. Decreases the efficiency of a machine

D. Northing can be said about the effect of friction on efficiency of a machine

Answer: C

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19. A box is placed on an inclined plane and has to be pushed down.The angle of inclination is

A. Equal to angle of friction

B. More than angle of friction

C. Equal to angle of repose

D. Greater than angle of repose

Answer: D

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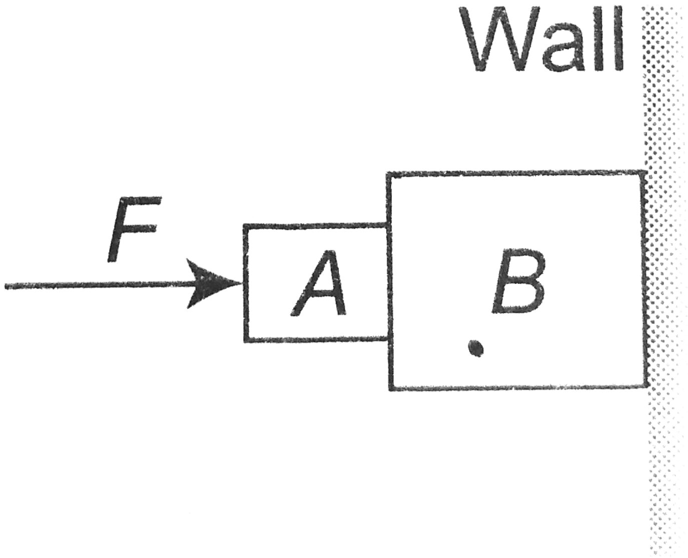
20. Figure shows two block A and B pushed against the wall with the force F . The wall is smooth but the surfaces in contact of A and B are rough. Which of the following is true for the system of blocks to be at rest againts wall?



A. F should be more than the weight of A and B

B. F should be equal to the weight of A and B

C. F should be less than the weight of A and B

D. System cannot be in equilibrium

Answer: D

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21. If μ_k is the coefficient of kinetic friction and μ_s the coefficient of static friction then generally

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22. A block of mass m is placed on a rough floor of a lift . The coefficient of friction between the block and the floor is μ. When the lift falls freely, the block is pulled horizontally on the floor. What is the force of friction -

A. $\mu m g$

B. $\mu m g / 2$

C. $2 \mu m g$

D. Zero

Answer: D

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23. When a horse pulls a wagon, the force that causes the horse to move forward is the force

A. He exerts on the wagon

B. The wagon exerts on him

C. The ground exerts on him

D. He exerts on the ground

Answer: C

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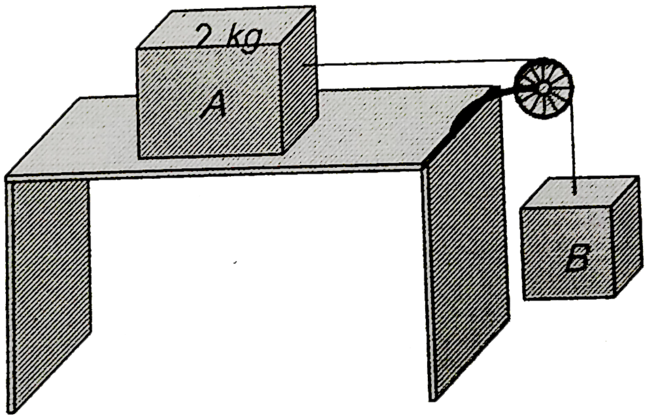
24. The coefficient of static friction, μ_s between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless. $(g = 10m / s^2)$



A. 4.0 kg

B. 0.2 kg

C. 0.4 kg

D. 2.0 kg

Answer: C

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25. A body of mass m slides down a rough plane of inclination α . If μ is the coefficient of friction, then acceleration of the body will be

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26. A particle is moving along a circular path. The angular velocity, linear velocity, angular acceleration, and centripetal acceleration of the particle at any instant respectively are

$\overrightarrow{w}$, $\overrightarrow{v}$, $\overrightarrow{\alpha}$, $\overrightarrow{a}_c$. Which of the following relation is not correct ?

A. $\overrightarrow{\omega} \perp \overrightarrow{v}$

B. $\overrightarrow{\omega} \perp \overrightarrow{\alpha}$

C. $\overrightarrow{\omega} \perp \overrightarrow{\alpha}_c$

D. $\overrightarrow{v} \perp \overrightarrow{\alpha}_c$

Answer: B

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27. The angular acceleration of a particle moving along a circular path with uniform speed is

A. uniform but no zero

B. Zero

C. variable

D. such as cannot be predicted from the given information

Answer: B

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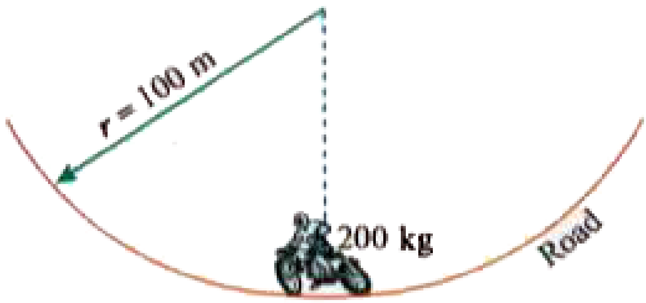
28. A bike of mass 200 kg (with rider) is running on the road with constant speed $5m/s$, the reaction exerted on the bike by the road at the lowest point will be $(g = 10m/s^2)$



A. 200 N

B. 2050 N

C. 1950 N

D. None of these

Answer: B

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29. At t = 0 and u = 0, an object begins to be uniformly accelerated by a force of 40 N. The momentum of the body at t= 4 s is

A. $40kgms^{-1}$ $80kgms^{-1}$

B. $120 kgms^{-1}$

C. $160 kgms^{-1}$

D.

Answer: D

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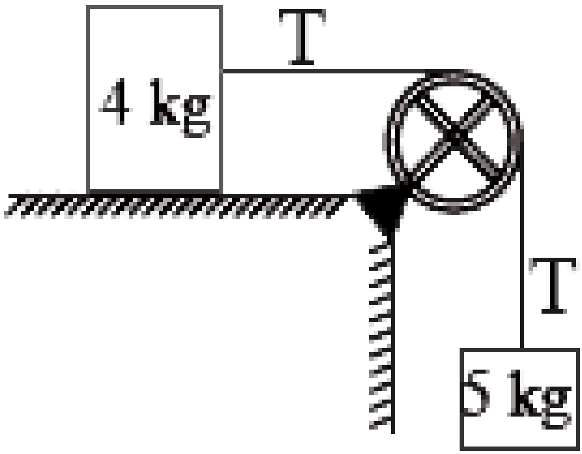
30. Two bodies of 5 kg and 4 kg are tied to a string as shown in the figure. If the surface and pulley both are smooth, acceleration of 5 kg body will be equal to :



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31. An unloaded car moving with velocity u on a road can be stopped in a distance S. If passengers add 40% to its weight and braking force remains the same, the stopping distance at velocity u is now

A. 1.4 S

B. S

C. $(1.4)^2 S$

D. $1/1.4S$

Answer: A

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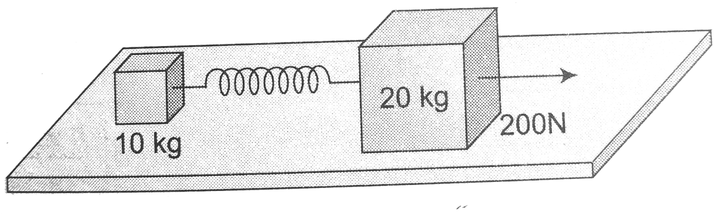
32. The masses of $10kig$ and $20kg$ respectively are connected by a massless spring as shown in figure. A force of $200N$ acts on the $20kg$ mass. At the instant shown, the $10kg$ mass has acceleration $12m/\sec^2$. What is the acceleration of $20kg$ mass?



A. Zero

B. $10m/s^2$

C. $4m/s^2$

D. $12m/s^2$

Answer: C

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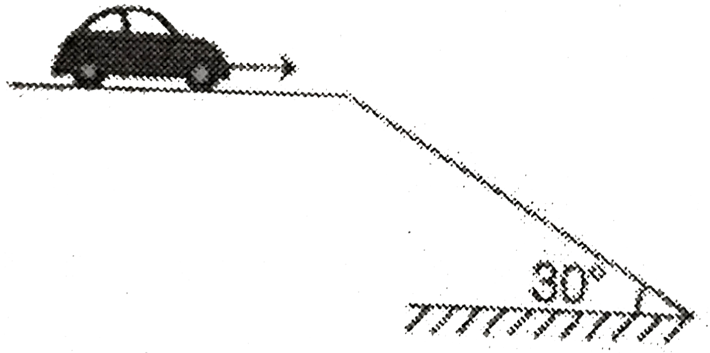
33. A car going at a speed of 6m/s when it encounters a 15m slope of angle 30°. The friction coefficient between the road an tyre is 0.5. the driver applies the brakes. The minimum speed of car with with which it can reach the bottom is $\left(g = 10m / s^2\right)$



A. $4m / s$

B. $3m / s$

C. $7.5m / s$

D. $8.45m / s$

Answer: C

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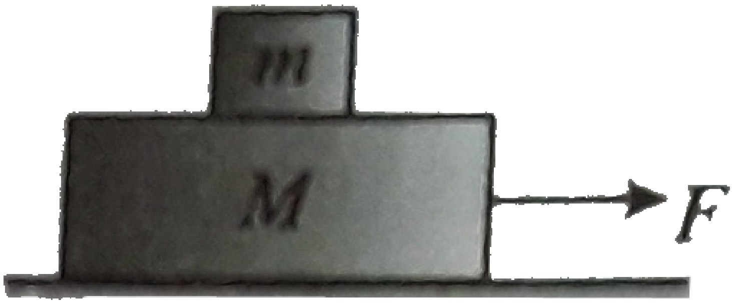
34. A block of mass$m$ is placed on another block of mass M which itself is lying on a horizontal surface .The coefficient of friction between two blocks is $\mu_1$and that between the block of mass M and horizontal surfece is μ_2 What maximum horizontal force can be applied to the lower block move without separation?



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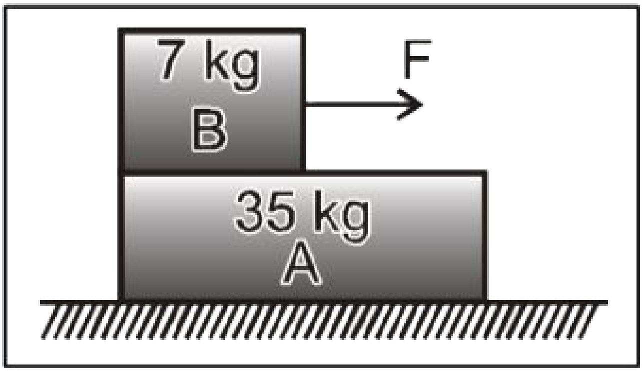
35. Block A of mass 5 kg is resting on a frictionless floor. Another block B of mass 7kg is resting on it as shown in the figure. The coefficient of friction between the blocks is 0.5 while kinetic friction is 0.4. If a force of 100 N is applied to block B, the acceleration of the block A will be $\left(g = 10ms^{-2}\right)$:



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