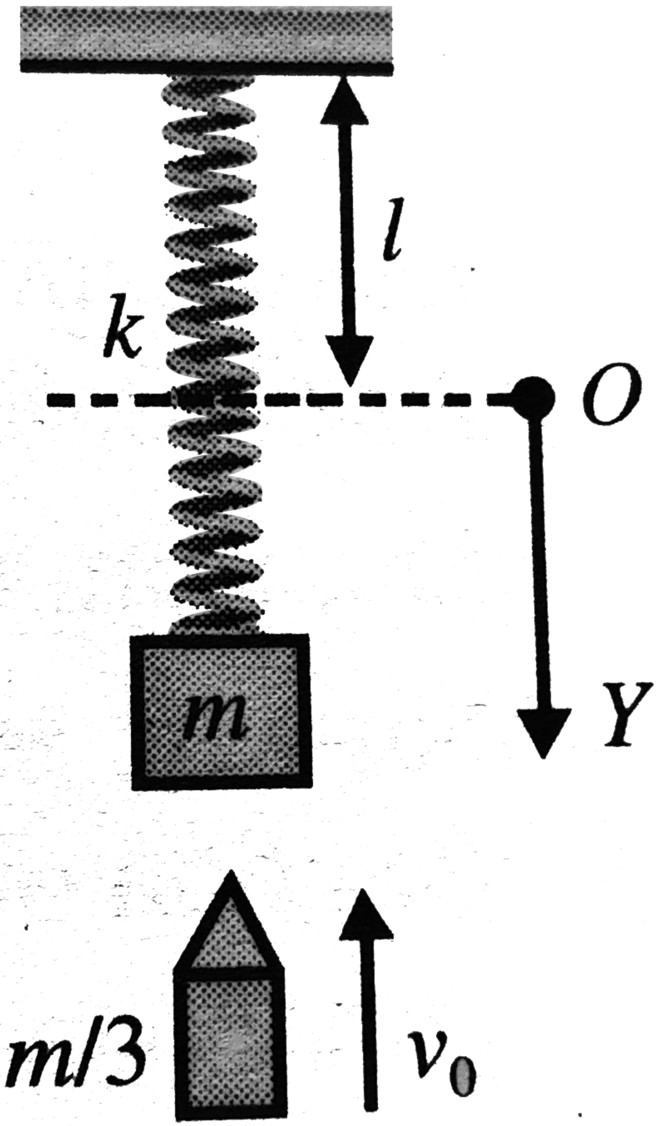
PHYSICS

BOOKS - AAKASH SERIES

LAWS OF MOTION

PROBLEM

1. A ball of mass is thrown vertically upwards by applying a force by hand. If the hand moves while applying the force and the ball goes up to height further, find the magnitude of the force. (Take $g = 10 \text{ms}^{-2}$)



2.

A block of mass m is suspended from one end of a light spring as shown. The origin O is considered at distance equal to natural length of the spring from the ceiling and vertical downwards direction as

positive y-axis. When the system is in equilibrium a bullet of mass $\frac{m}{3}$ moving in vertical up wards direction with velocity v_0 strikes the block and embeds into it. As a result, the block (with bullet embedded into it) moves up and start oscillating. Based on the given information, answer the following question:

Q. The time taken by the block bullet system to move from $y = \frac{mg}{k}$ (initial equilibrium position) to $y = 0$ (natural length of spring) is (A represents the amplitude of motion)

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3. Give the magnitude and direction of the net force acting on a drop of rain falling down with a constant speed

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4. Give the magnitude and direction of the net force acting on

a Cork of mass 10 g floating on water

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5. Give the magnitude and direction of the net force acting on

a kite skillfully held stationary in the sky

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6. Give the magnitude and direction of the net force acting on

a car moving with a constant velocity of 30km/h on a rough road

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7. Give the magnitude and direction of the net force acting on a high - speed electron in space far from all material objects, and free of electric and magnetic field .

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8. A force of 100 dyne acts on a mass of 5 grams for 10 sec . Find the velocity produced ?

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9. Gravel is dropped into a conveyer belt at a rate of 0.5kg/s. The extra force required in newton to keep the belt moving at 2m/s is:-

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10. A body of mass 5kg starts from the origin with an initial velocity of $\overline{U} = (30i + 40j)m/s$. A constant force of $F = (-\hat{i} - 5\hat{j})N$ acts on the body . Find the time in which they- component of the velocity becomes zero .

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11. A satellite is revolving round the earth in circular orbit

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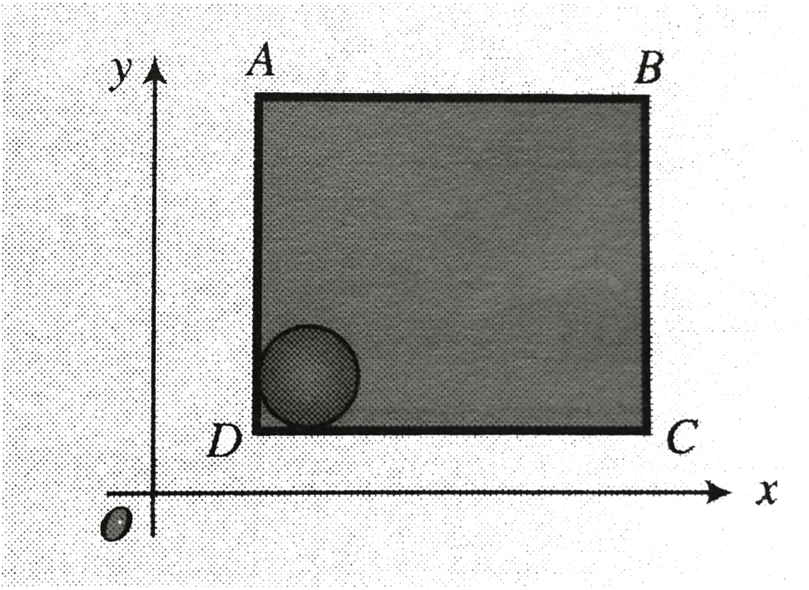
12. A solid sphere of mass 2 kg is resting inside a cube as shown in fig. The cube is moving with a velocity $\vec{v} = (5t\hat{i} + 2t\hat{j})ms^{-1}$. Here t is time in seconds. All surface are smooth. The sphere is at rest with respect to the cube. What is the total force exerted by the sphere on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



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13. Two blocks of mass 4kg and 6kg are connected by a string as shown in the figure. They are initially at rest on the floor. Calculate their acceleration when a force of (a) 50N (b) 100N is applied on the pulley.

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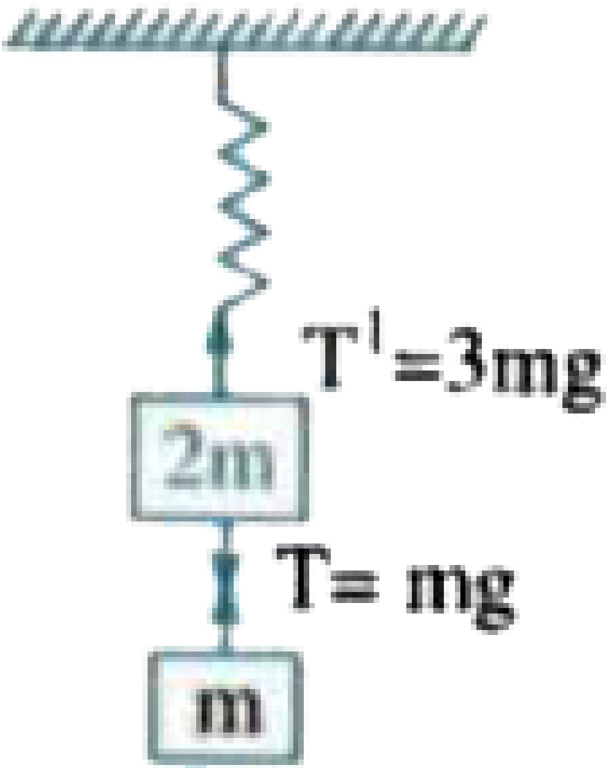
14. The system shown in the figure is in equilibrium at rest. The spring and string are massless Now the string is cut. Find the acceleration of the blocks just after the string is cut.



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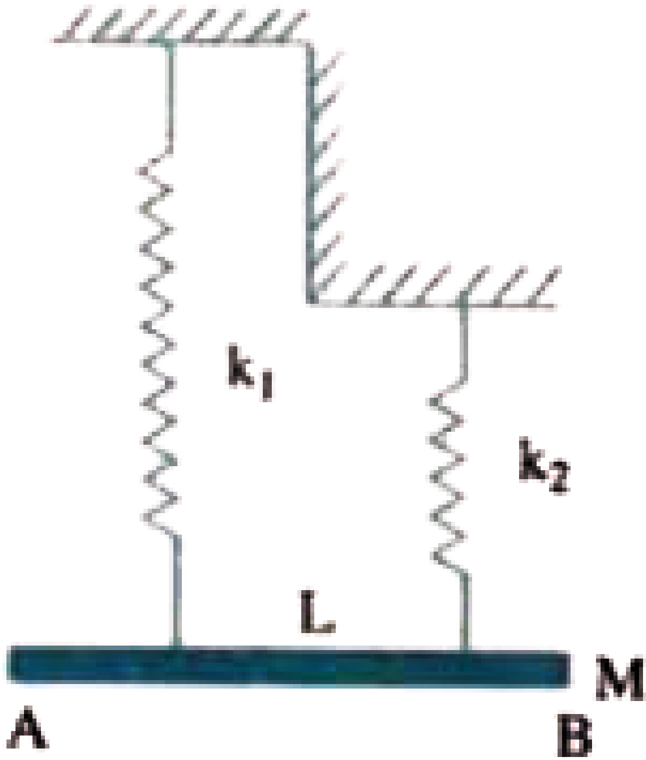
15. When a mass M hangs from a spring of length l, it stretches the spring by a distance x. Now the spring is cut in two parts of length l/3 and 2l/3, and the two springs thus formed are connected to a straight rod of mass M which is horizontal in the configuration shown in figure. Find the stretch in each of the spring.



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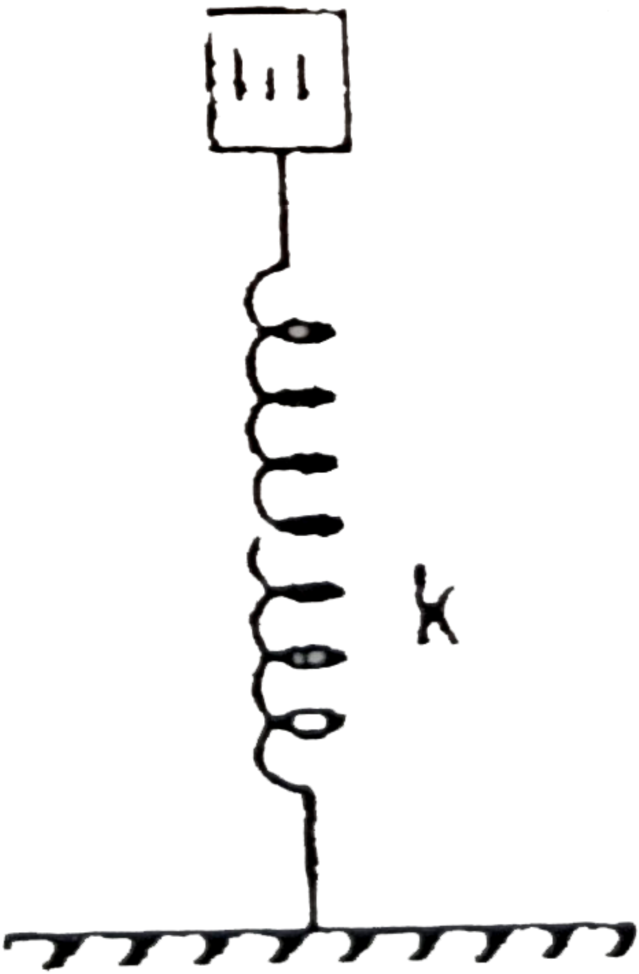
16. A block of mass m is attached to a spring of force constant k whose other end is fixed to a horizontal surface. Initially the spring is in its natural length and the block is released from rest. The average force acting on the surface by the spring till the instant when the block has zero acceleration for the first time is



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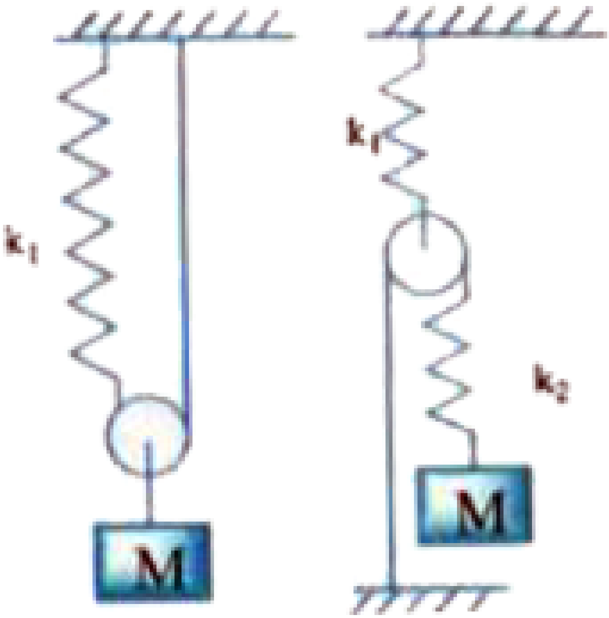
17. Find the stretch in the springs shown in figure. The respective data are given in the figure. The friction and masses in pulleys are negligible. Find the extension in spring?



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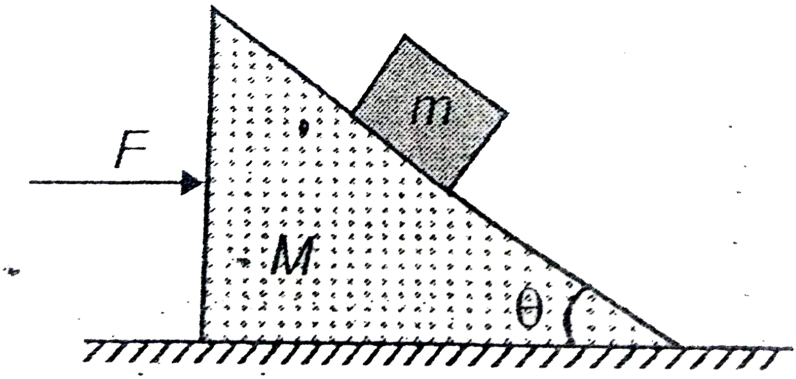
18. A block of mass m is placed on a wedge of mass M and a force F is acting on its as shown . If all surfaces are smooth , find the force F such that, there is no relative motion between m and M.



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

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20. In the figure given, the position-time graph of a particle of mass 0.1 kg is shown. The impulse at t=2 sec is

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21. A hunter has a machine gun that can fire 50g bullets with a velocity of 900ms^{-1}. A 40 kg tiger springs at him with a velocity of 10ms^{-1}. How many bullets must the hunter fire into the tiger in order to stop him in his track?

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22. A machine gun has a mass of 20kg. It fires 35 g bullets at the rate of 4 bullets per second, with a speed of 400ms^{-1}. What force must be applied to the gun to keep it in position?

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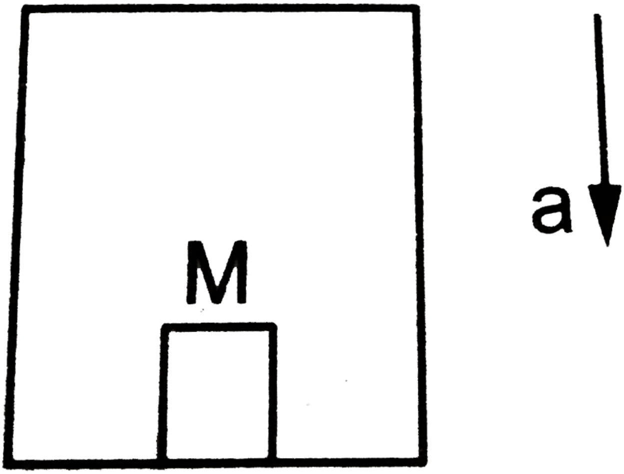
23. With what acceleration a should the box of figure descends so that the block of mass M exerts a force Mg/4 on the floor of the box?



24. A 75kg man stands in a lift. What force does the floor exert on him when the elevator starts moving upward with an acceleration of $2ms^{-2}$ Given: g = $10ms^{-2}$.

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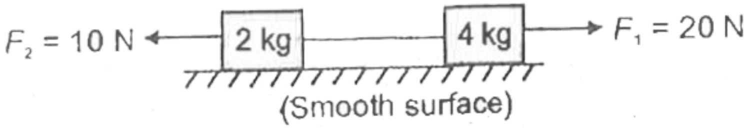
25. The tension in the string connected between blocks is



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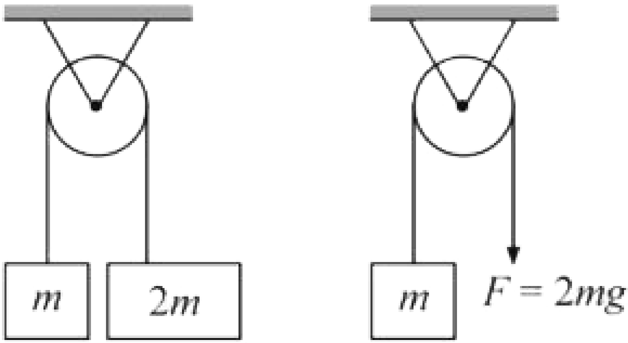
26. The pulley arrangements in the figure (A) and (B) are identical. The mass of the rope is negligible. In figure (A), the mass m is lifted up by attaching a mass 2m to the other end of the rope. In figure (B), m is lifted up by pulling the other end of the rope with a constant downward force F = 2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



(a) (b)

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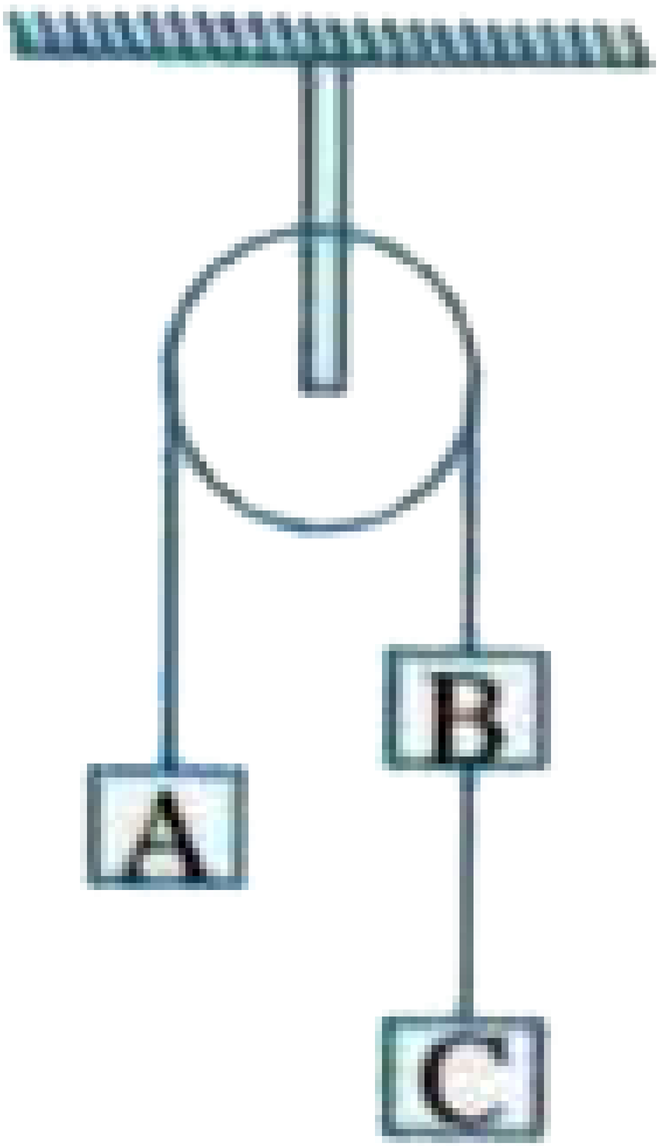
27. Figure shows three blocks of mass m each hanging on a string passing over a pulley. Calculate the tension in the string connecting

A to B and B to C?



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28. A rocket burns 50g of fuel per second ejecting it as a gas with a velocity of $5 \times 10 \text{cms}^{-1}$. What force is exerted by the gas on the rocket?

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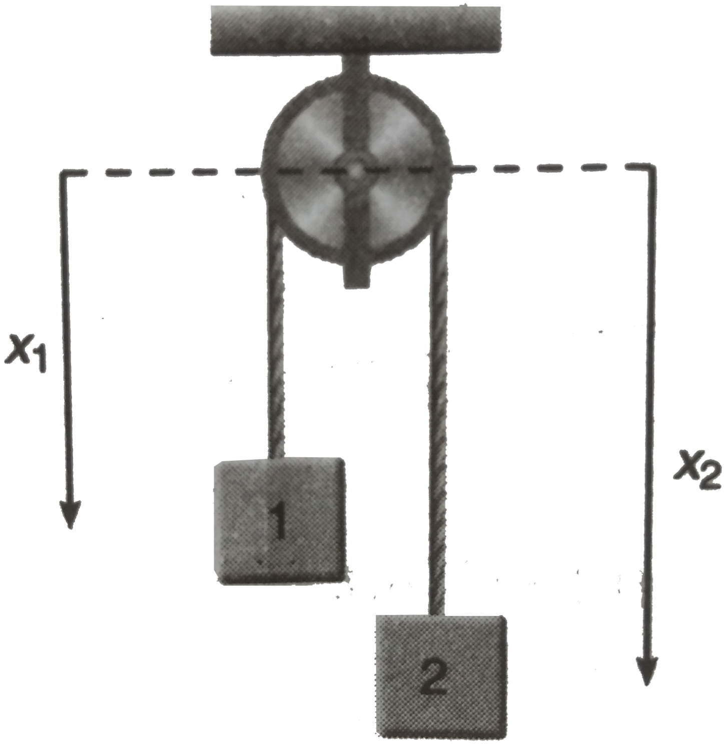
29. Using constraint method find the relation between accelerations of 1 and 2.


1
2



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30. The equation $\frac{A}{x-a_1}+\frac{A_2}{x-a_2}+\frac{A_3}{x-a_3}=0$, where$A_1, A_2, A_3 > 0$ and $a_1 < a_2 < a_3$ has two real roots lying in the invervals.

(A) (a_1, a_2) and (a_2, a_3) (B) $(-\infty, a_1)$ and (a_3, ∞) (C) (A_1, A_3) and (A_2, A_3) (D) none of these

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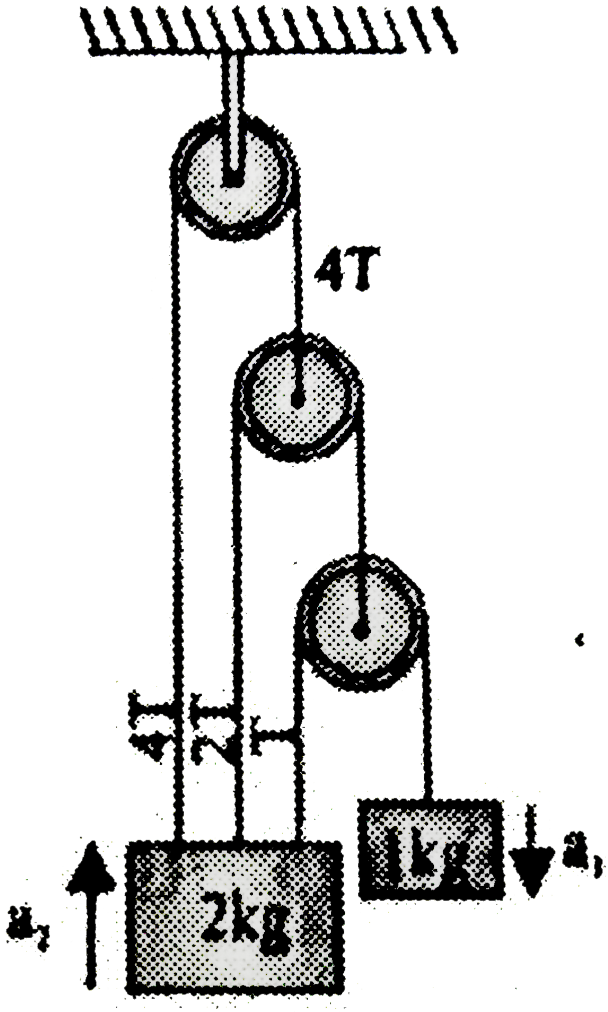
31. Using contraint equation. Find the relation between a_1 and a_2.



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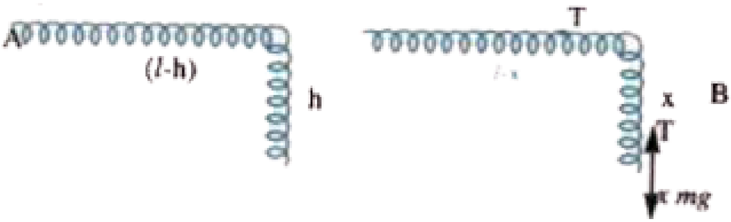
32. A chain AB of length l is located on a smooth horizontal table so that its fraction of length h hangs freely with end B on the table. At a certain moment, the end A of the chain is set free. With what velocity with this end of the chain slip off the table?



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33. A massless string passes over a frictionless pulley and carries mass m_1 hanging at one end and mass m_2 connected by another massless string to mass m_3 at other end as shown in figure. Calculate the tension in string joining masses m_2 and m_3.

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34. A block A of mass 8 kg is placed on a frictionless horizontal table. A thread tied to it passes over a frictionless pulley and carries a body B of mass 2 kg at the other end. Find the acceleration of the system. Also find the tension in the thread. If the thread is cut into two and tied to the ends of a spring of forceconstant 1600N/m, find the amount of stretching of the spring. Neglect the mass of thread and of spring $(g = 9.8 m / s^2)$

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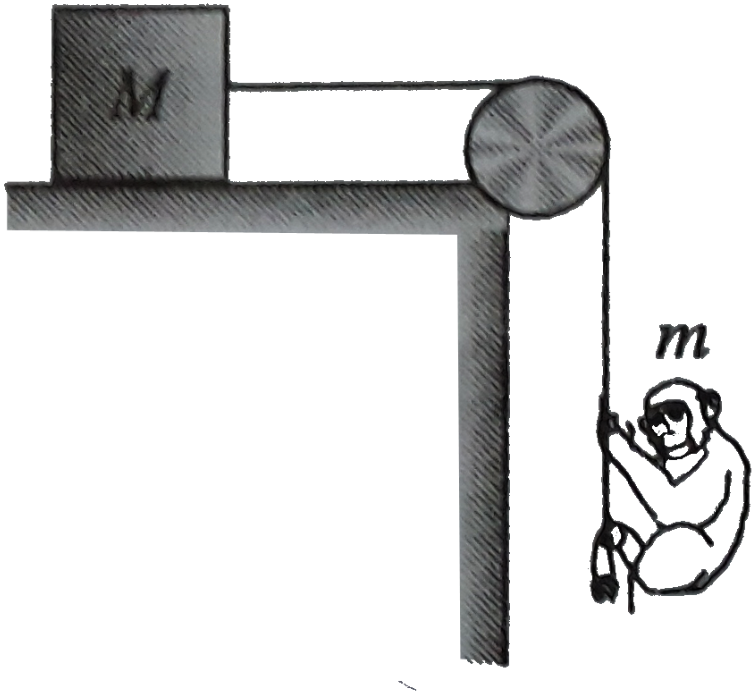
35. A monkey of mass m clings a rope to a slung over a fixed pulley .The opposite end of the rope is tried to a weight of mass M tying on a horizontal table is μ Find the acceleration of weight .The monkey move downward with respect to the rope with an acceleration b.



The acceleration of weight is

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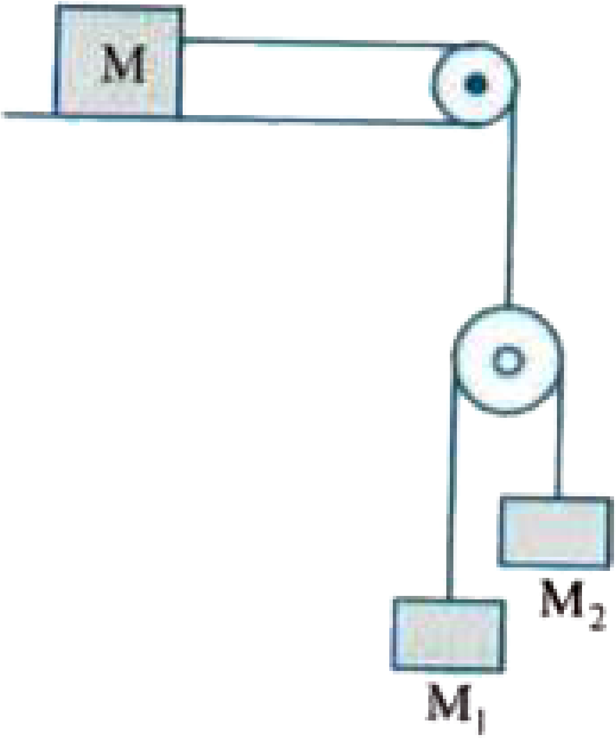
36. Referring to figure calculate the downward acceleration of mass m_1. Assume the surfaces are frictionless and pullyes are massless.



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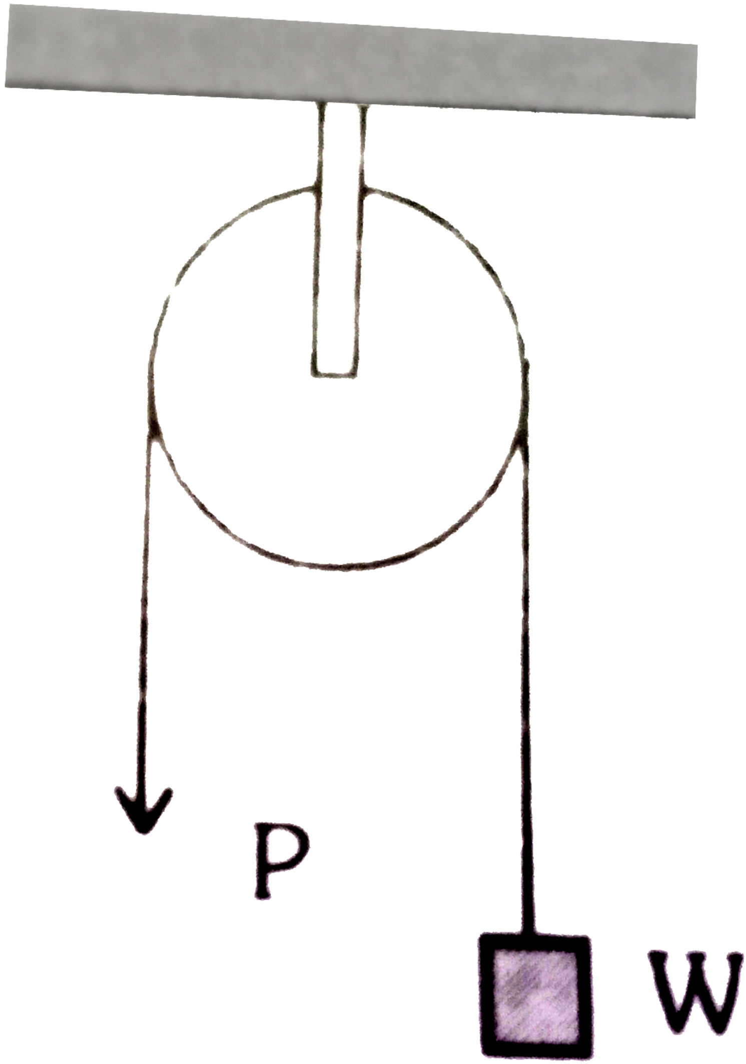
37. What is the mechanical advantage of single fixed pulley:-



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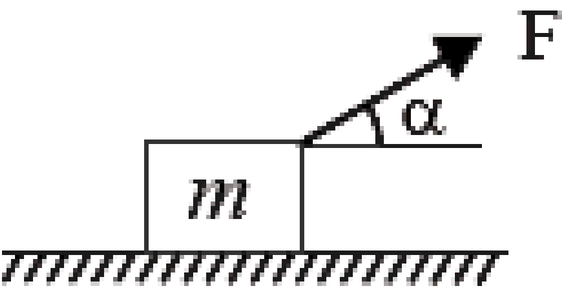
38. At t=0, a force F = kt is applied on a block of mass m making an angle α with the horizontal . Suppose surfaces to be smooth. Find the velocity of the body at the time of breaking off the plane.



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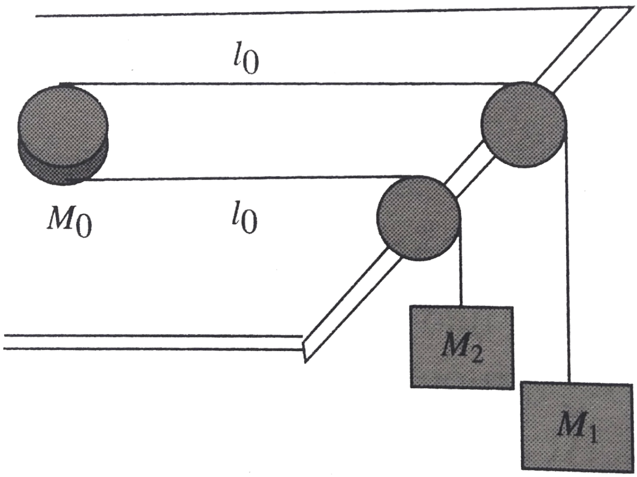
39. A smooth pulley A of mass M_0 is lying on a frictionless table. A massless rope passes round the pulley and has masses M_1 and M_2 tied to its ends, the two portions of the string being perpendicular to the edge of the table so that the masses hang vertically. Find the acceleration of the pulley.



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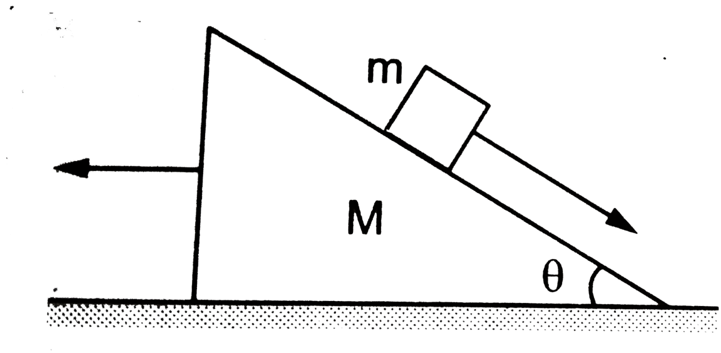
40. All the surfaces shown in figure are assumed to be frictionless. The block of mass m slides on the prism which in turn slides backward on the horizontal surface. Find the acceleration of the smaller block with respect to the prism.



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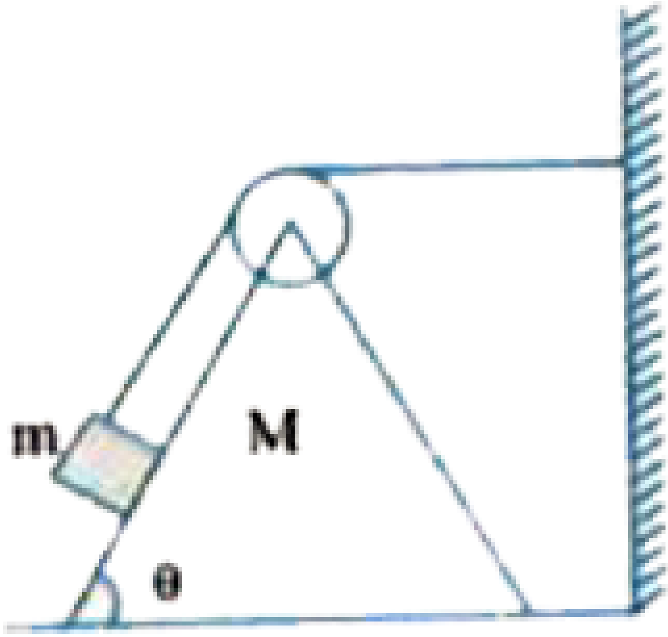
41. A block of mass m is arranged on the wedge as shown in figure . The wedge angle is θ. If the masses of pulley and thread and negligible and friction is absent , find the acceleration of the wedge



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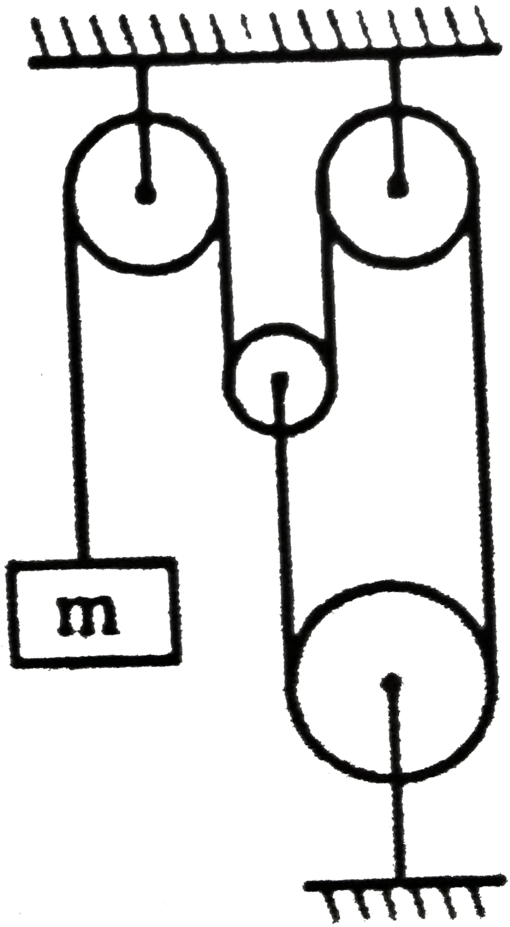
42. If the string & all the pulleys are ideal, acceleration of mass m is :-



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43. Two bodies with masses m_1 and $m_2(m_1 > m_2)$ are joined by a string passing over fixed pulley. Assume masses of the pulley and thread negligible. Then the acceleration of the centre of mass of the system $(m_1 + m_2)$ is

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44. A piece of uniform string hangs vertically so that its free end just touches horizontal surface of a table. The upper end of the string is now released. Show that at any instant during the falling of string, the total force on the surface is three times the weight of that part of string lying on the surface.

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45. A spherical ball of salt is dissolving in water in such a manner that the rate of decrease of volume at any instant is proportional to the surface. Prove that the radius is decreasing at a constant rate.

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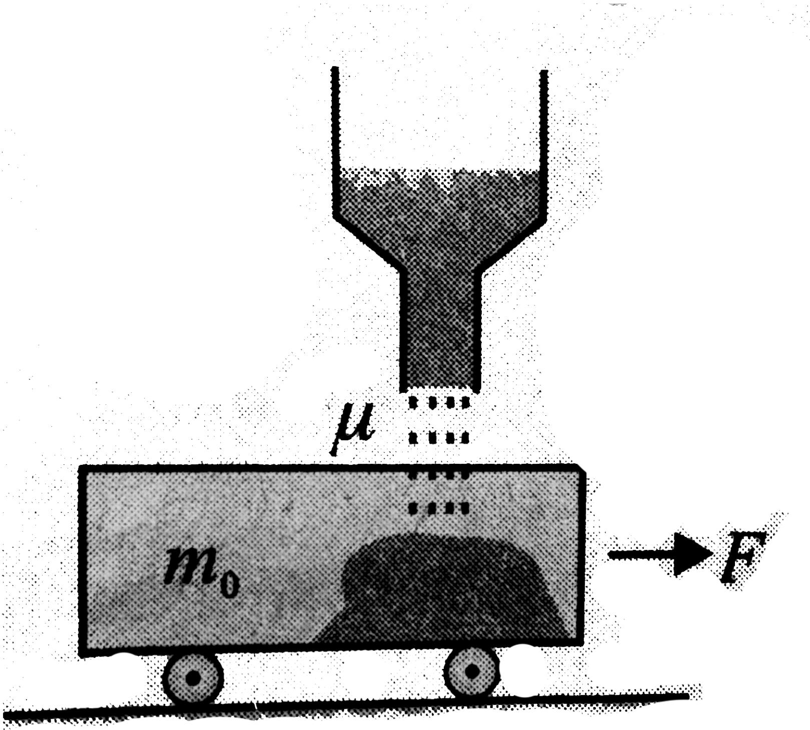
46. A flat car of mass m_0 starts moving to the right due to a constant horizontal force $F.S$ and spills on the flat car from a stationary hopper. The rate of loading is constant and equal to $\mu kg/s$. Find the time dependence of the velocity and the acceleration of the flat car in the process of loading. the friction is negligibly small.



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47. A liquid drop of mass m andradius r is falling from great height. Its velocity is proportional to

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48. Find the mass of the rocket as a function of time, if it moves with a constant acceleration a, in absence of external forces. The gas escapes with a constant velocity u relative to the rocket and its mass initially was m_0.

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49. A body of mass 1 kg is moving with velocity $30 ms^{-1}$ due north. It is acted on by a force of 10 N due east for 4 seconds. Find the velocity

of the body after the force ceases to act.

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50. A very fleible uniform chain of mass M and length L is suspended vertically such that its lower end just touches the surface of a table. When the upper end of the chain is released . it falls with each link coming to test the instant it strikes the table.

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51. Marbles each of mass'm' are dropped from height 'h' on pan of a balance at the rate 'R' per sec. The balance calibrated in units of mass reads zero initially. If marbles are dropped continuously, what will the balance read after 't' sec ?

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52. The variation of momentum with time of one of the body in a two body collision is shown. At what point the instantaneous force is maximum.

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53. A particle of mass 1 g moves on a straight line. The variation of its velocity with time is shown in fig. Find the force acting on the particle att = 1 s,4s and 7 s.

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54. Give the magnitude and direction of the net force acting on .

a drop of rain falling down with a constant speed.

(b) a cork of mass 10 g floating on water.

(c) a kite skillfully held stationary in the sky.

(d) high-speed electron in space far from all material objects. Give the direction electric and magnetic fields.

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55. A pebble of mass 0.05 kg is thrown vertically upwards. Give the direction and magnitude of the net force on the pebble .

(a) during its upward motion.

(b) during its downward motion.

(c) at the highest point where it is momentarily at rest. Do your answers change if the people was thrown at an angle of 45° with the horizontal direction ?

Ignore air resistance .

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56. Give the magnitude and direction of the net force acting on a stone of mass 0.1 kg.

Neglect air resistance throughout.

(a) just after it is dropped from the window of a stationary train.

(b) just after it is dropped from the window of a train running at a constant velocity of 36 km/h.

(c) just after it is dropped from the window of a train accelerating with 1ms^{-2}.

(d) lying on the floor of a train which is accelerating with 1ms^{-2}, the stone being at rest relative to the train.

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57. A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1ms^{-1}. What is the trajectory of the bob if the string is cut when the bob is (a) at one of its extreme positions, (b) at its mean position.

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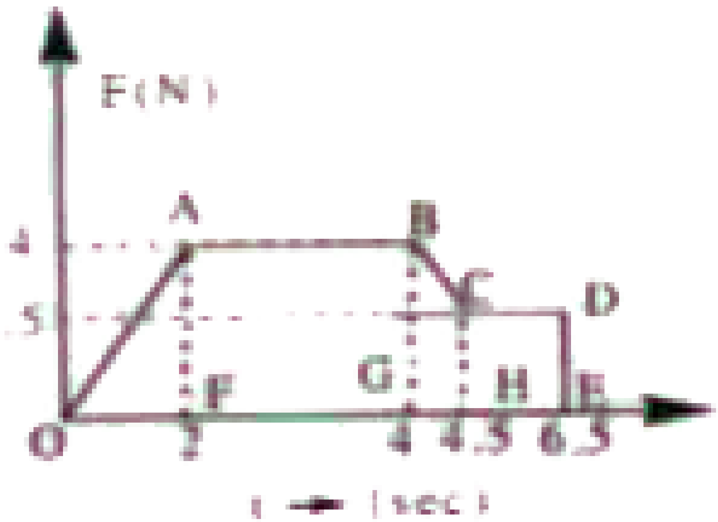
58. A body of mass 2kg has an initial speed 5 m/s. A force acts as it for some time in the direction of motion. The force-time graph is shown in figure. Find the final speed of the body.



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59. A particle of mass 120 g moving at speed of 750 cm/s is acted upon by a variable force opposite to its direction of motion. If the velocity of the particle becomes 250 cm/s along the direction of force, find the value of time 't' for which acted.

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60. A bullet is fired from a gun . The force on the bullet is given by

$F = 600 - (2 \times 10^5)t$

Here , F is in newton and t in second . The force on the bullet becomes zero as soon as it leaves the barrel . The impulse imparted to the bullet is

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61. particle of mass m, moving with velocity 'u' makes head on collision with identical stationary particle, which is elastic. Theforce of interaction increases to maximum and then becomes zero in time 'T' as shown in graph. What is the maximum value F_0 of interaction force ?

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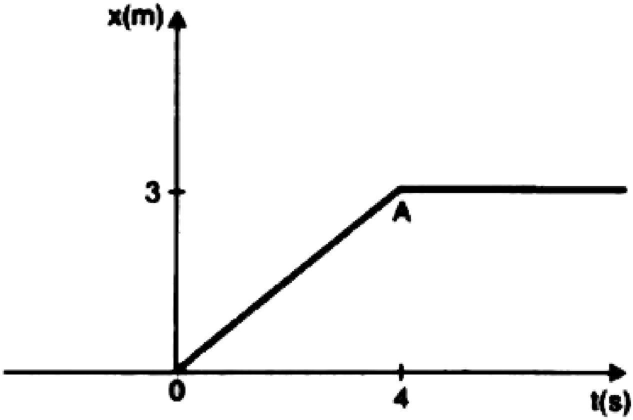
62. Figure 5.16 shows the position-time graph of a particle of mass 4 kg. What is the (a) force on the particle for t lt 0 , t lt 4s, 0 lt t lt 4s ? (b) impulse at t = 0 and t = 4 s ? (Consider one-dimensional motion

only) .



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63. A ball of $\sqrt{3} \times 10^{-2}$kg hits a hard surface at 45° to normal with speed $4\sqrt{2}$m/s and rebounds with $8/\sqrt{3}$m/s, at 60° angle. If ball remains in contact for 0.1 sec, what force does it exert ?

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64. A gardener is watering plants at the rate 0.1 litre/sec using a pipe of cross - section 1cm^2. What additional force he has to exert if he desires to increase the rate of watering two times ?

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65. The linear momentum of a particle varies with times as $p = a_0 + at + bt^2$. What s force and time relation ?

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66. Liquid of density ρ flows along a horizontal pipe of uniform area of cross section a with a velocity v through a right angled bend. What force should be applied to the bend to hold it in equilibrium?

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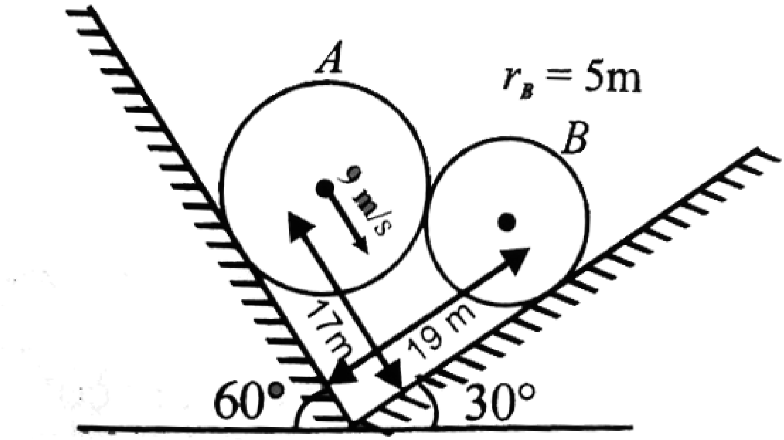
67. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

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68. Explain why a horse cannot pull a cart and run in empty space

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69. Two ice skaters A and B approach each other at right angles. A has mass 30 kg and velocity 1 mis and B has a mass of 20 kg and velocity

2 m/s. They meet and stick together. The final velocity of couple is :

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70. A man of mass m climbs a rope of length L suspended below a balloon of mass M. The balloon is stationary with respect to ground. If the man begins to climb up the rope at a speed v_{rel}. (relative to rope) in what direction and with what speed (relative to gound) with the balloon move ?

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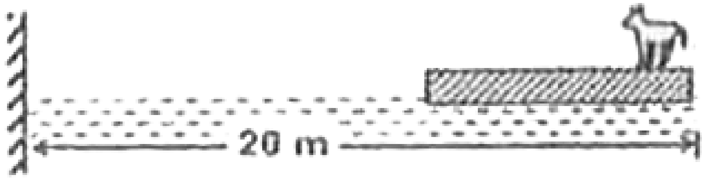
71. A dog of mass 10 kg is standing on a flat 10 m long boat so that it is 20 m meters from the shore. It walks 8 m on the boat towards the shore and then stops. The mass of the boat is 40 kg and friction between the boat and the water surface is negligible. How far is the dog from the shore now ?



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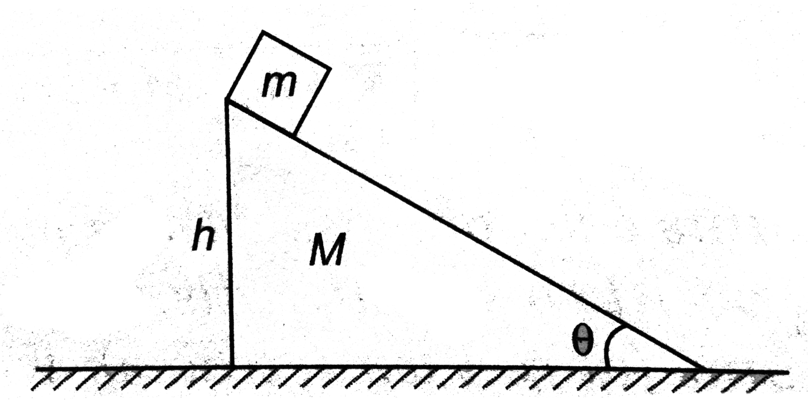
72. All surfaces shown in figure are smooth. Find velocity of wedge (of mass M) when the block (of mass m) reaches the bottom of the wedge.



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73. In a gravity free space, a man of mass M standing at a height h above the floor, throws a ball of mass m straight down with a speed u. When the ball reaches the floor, the distance of the man above the floor will be

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74. A bomb moving with velocity $40\hat{i} + 50\hat{j} + 25\hat{k}$ m/s explodes into pieces of mass ratio 1 : 4. If the small piece goes out with velocity $200\hat{i} + 70\hat{j} - 15\hat{k} m/s$, find the velocity of larger piece after explosion.

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75. A vessel at rest explodes breaking it into three pieces. Two pieces having equal mass fly off perpendicular to one another with the same speed of $30 m/s$. The third piece has three times the mass of each of the other two pieces. What is the direction (w.r.t. the pieces having equal masses) and magnitude of its velocity immediately after the explosion?

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76. A shell is fired from a cannon with a velocity V at an angle θ with the horizontal direction. A the highest point i its path, it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other priece immediately after the explocison is

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77. A bomb of 1 kg is thrown vertically up with speed 100 m/s. After 5 seconds, it explodes into two parts. One of mass 400 gm goes down with speed 25 m/s. What will happen to the other part just after explosion

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78. A particle of 2m is projected at an angle of 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 expansion one point comes to rests. The maximum height from the ground attained by the other part is $(g = 10m/s^2)$

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79. A boy of mass $60kg$ is standing over a platform of mass $40kg$ placed over a smooth horizontal surface. He throws a stone of mass $1kg$ with velocity $v = 10m/s$ at an angle of 45° with respect to the ground. Find the displacement of the platform (with boy) on the horizontal surface when the stone lands on the ground. Take $g = 10m/s^2$.

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80. An isolated particle of mass m is moving in horizontal plane xy along the x-axis, at a certain height above the ground. It suddenly explodes into two fragment of masses $m/4$ and $3m/4$. An instant later, the smaller fragment is at $y = +15$ cm. The larger fragment at this instant is at

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81. A bomb initially at rest at a height of 40 m above the ground suddenly explodes into two identical fragments. One of them starts moving vertically downwards with an initial speed of 10 m/s. If acceleration due to gravity is 10 m/s^2, the separation between the fragments, 2 seconds after the explosion is

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82. Fuel is consumed at the rate of 50 kg s^{-1} in a rocket. Find the thrust on the rocket if the velocity of the exhaust gases is 2 km s^{-1}. Also calculate the velocity of the rocket at the instant, when its mass is reduced to l/10th of its initial mass if its initial velocity is zero, (neglect gravity)

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83. The first & second stage of two stage rocket separately weigh 100 kg and 10 kg and contain 800kg and 90kg fuel respectively. If the exhaust velocity of gases is 2 km/sec then find velocity of rocket (nearly) ($\log_{10} 5 = 0.6990$) (neglect gravity)

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84. A mass of 3kg is suspended by a rope of length 2m from the ceiling. A force of 40N in the' horizontal 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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85. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of 4.9ms^2 (ii) lowered with an acceleration of 4.9ms^{-2}. The ratio of tension in the first and second case is

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86. A lift of mass 1000 kg moves up with an acceleration 1 ms^{-1} in upward direction. Find the tension developed in supporting string.

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87. The apparent weight of a person inside a lift is w_1 when lift moves up with a certain accelration and is w_2 when lift moves down with same acceleration. The weight of the person when lift moves up with constant speed is :

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88. A lift is going up. The total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as shown in the figure. Find the tension in the rope pulling the lift at t = 11 th second.

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89. A lift is going up. The total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as shown in the figure. In the above problem, find the height to which the lift takes the passenger.

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90. A 75 kg man stands in a lift . What force does the floor exert on him when the elevator starts moving upwards with an acceleration of $2ms^{-2}$ Given : $g = 10ms^{-2}$.

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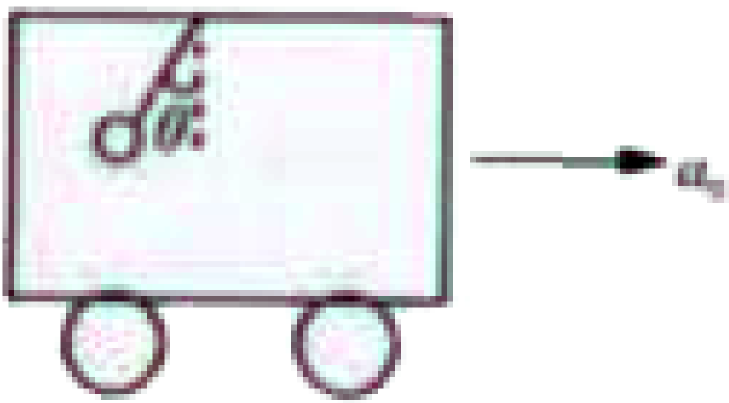
91. A pendulum is hanging from the ceiling of a car having an acceleration a_0 with respect to the road. Find the angle made by the string with vertical at equilibrium. Also find the tension in the sting in this position



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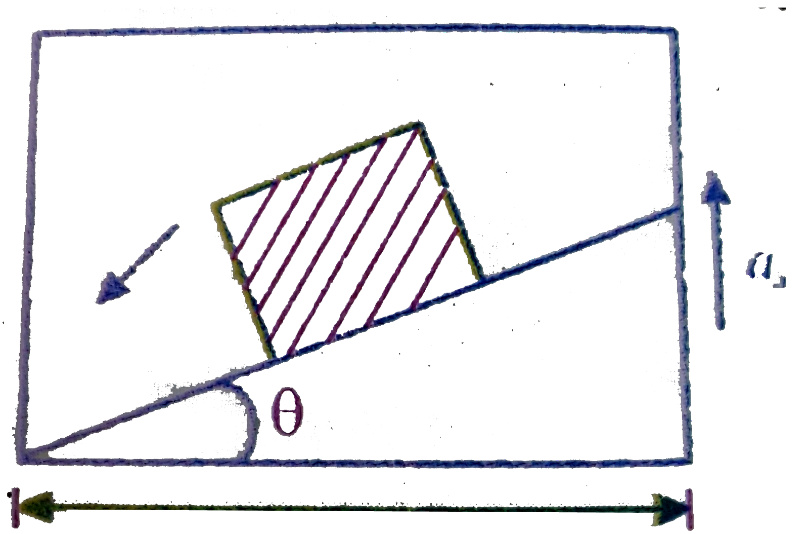
92. A block slides down from top of a smooth inclined plane of elevation • fixed in an elevator going up with an acceleration a_0 The base of incline hs length L Find the time taken by the block to reach the bottom



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93. A block of mass m is placed on a smooth wedge of inclination Q. The whole system is accelerated horizontally so that the block does not slip on the wedge. Find the

i) Acceleration of the wedge

ii) Force to be applied on the wedge

iii) Force exerted by the wedge on the block.

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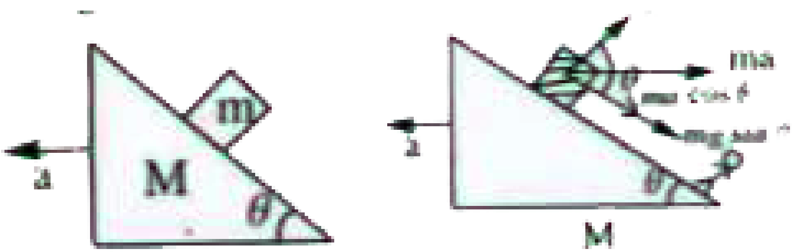
94. All surface are smooth. Find the acceleration of mass m relative to wedge when wedge is moving with acceleration 'a'



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

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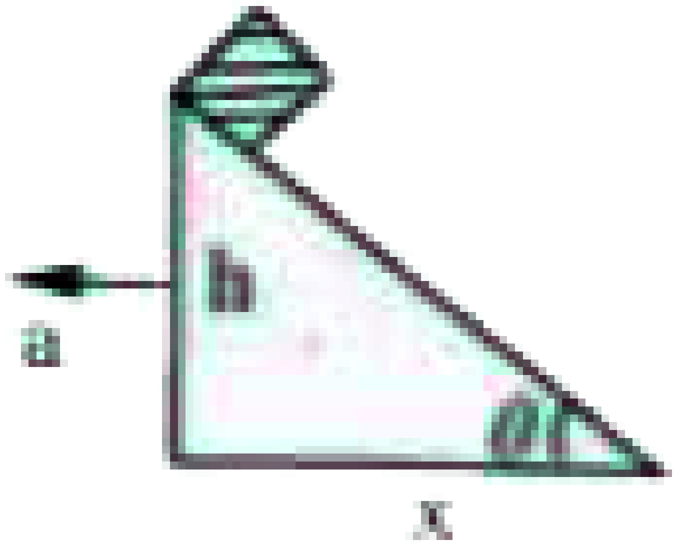
96. For what value of 'a'the block falls freely?



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

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98. A lorry carries a tank of water. If the lorry moves with a uniform acceleration 'a' in the horizontal direction, determine the angle made by the surface of water in the tank with the horizontal.

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99. A simple pendulum is suspended from the ceiling of trolley which is sliding down on a inclined plane of inclination θ Find the angle made by the string with normal to the trolley a) when trolley slides down with uniform velocity b) when the plane is smooth.

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100. Two blocks of masses 5 kg and 2 kg are kept in contact with each other on a frictionless horizontal surface. If a force of 14 N is applied on the larger block what is the acceleration of the system ? What is the contact force between the two blocks ?

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

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102. Two identical blocks A and B each of mass M are connected to each other through a light string. The system is placed on a smooth horizontal floor. When a constant force F is applied horizontally on the block A, find the tension in the string.

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103. Three blocks connected together by strings are pulled along a horizontal surface by applying force F. If $T_3 = 36N$, What is tension T_2?

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104. Two masses of 3 kg and 4 kg are connected at the two ends of a light inextensible string that passes over a frictionless pulley. Find the acceleration of the masses and the tension in the string, when the masses are released.

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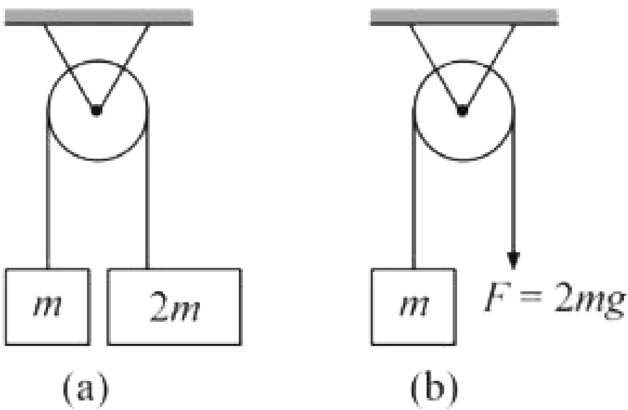
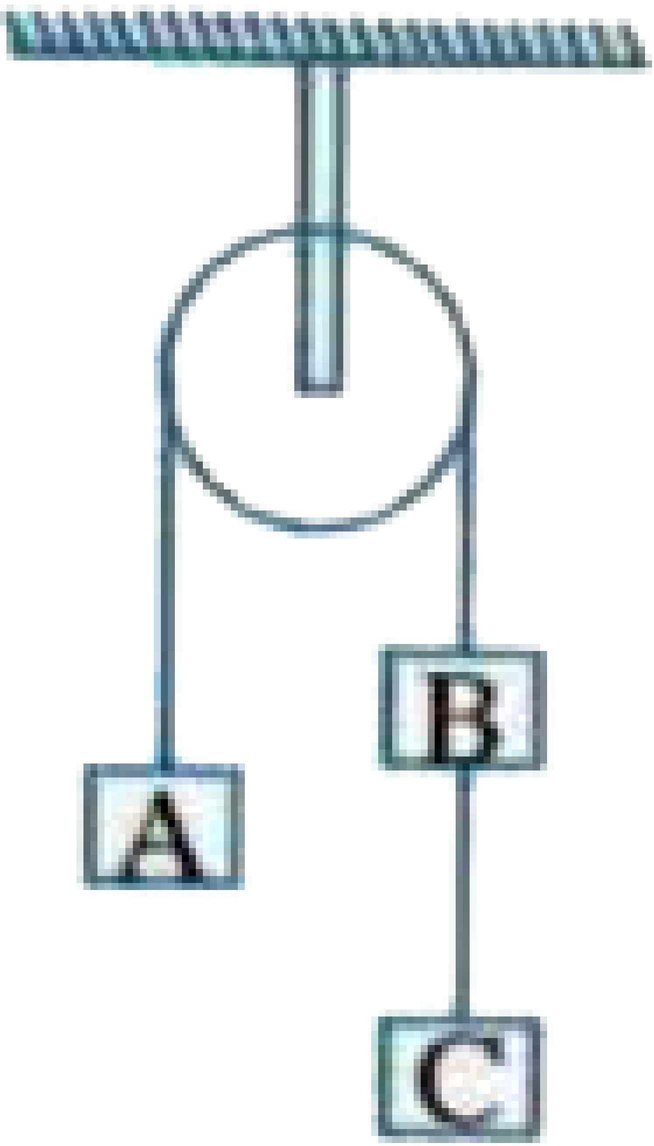
105. The pulley arrangements in the figure (A) and (B) are identical. The mass of the rope is negligible. In figure (A), the mass m is lifted up by attaching a mass 2m to the other end of the rope. In figure (B), m is lifted up by pulling the other end of the rope with a constant downward force F = 2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



Watch Video Solution

106. Figure shows three blocks of mass m each hanging on a string passing over a pulley. Calculate the tension in the string connecting

A to B and B to C?



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107. 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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108. In the above problem, what force should the man exert on the rope to get his correct weight on the machine?

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109. A monkey of mass 40 kg climbs on a rope (Fig 5.20) which can stand a maximum tension of 600 N. In which of the following cases will the rope break : the monkey

climbs up with an acceleraiton of $6ms^{-2}$

(b) climbs down with an acceleration of $4ms^{-2}$

(c) climbs up with a uniform speed of $5ms^{-2}$

(d) falls down the rope nearly freely under gravity ?

(Ignore the mass of the rope)

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110. A monkey of mass m moving up on a massless string so as to just lift a block of mass M. After some time the monkey stops moving w.r.t the string. Find the magnitude of the change in the monkey's acceleration.

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111. Two blocks of masses 2kg and 5kg are at rest on ground. The masses are connected by a string passing over a frictionless pulley which is under the influence of a constant upward force F = 50 N. Find the accelerations of 5kg and 2kg masses.

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112. A string of negligible mass passes over a pulley of mass m which is clamped. It supports a block of mass M at its lower free end. What is force exerted on pulley by the support ?

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113. Two weights w_1 and w_2 are suspended from the ends of a light string passing over a smooth fixed pulley. If the pulley is pulled up at an acceleration g , the tension in the string will be

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114. In the arrangement shown , by what acceleration the boy must go up so that 100 kg block remains stationary on the wedge. The wedge is fixed and friction is absent everywhere . (Take $g = 10 ms^{-2}$)

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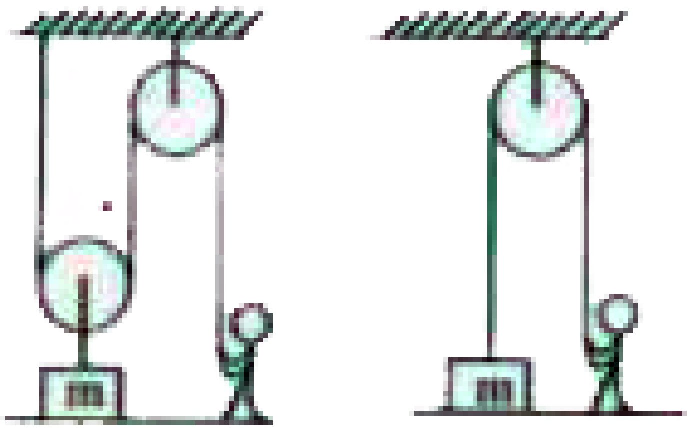
115. The block has to be raised to a height L in the same time t. In which case force required is more ?



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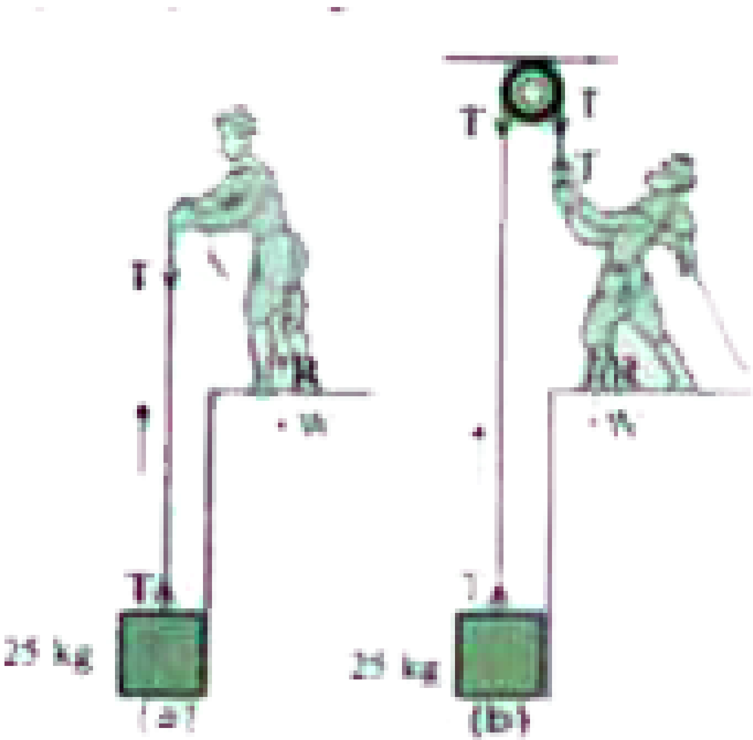
116. A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in figure. What is the action on the floor by the man in the two cases ? If the floor yields to a normal force of 700 N, which mode should the man adopt to lift the block without the floor yielding?



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117. A helicopter of mass 1000 kg rises with a vertical acceleration of $15 \mathrm{ms}^{-2}$. The crew and the passengers weigh 300 kg . Give the magnitude and direction of the

(a) force on the floor by the crew and passengers

(b) action of the rotor of the helicopter on the surroundings air :

(c) force on the helicopter due to the surroundings air :

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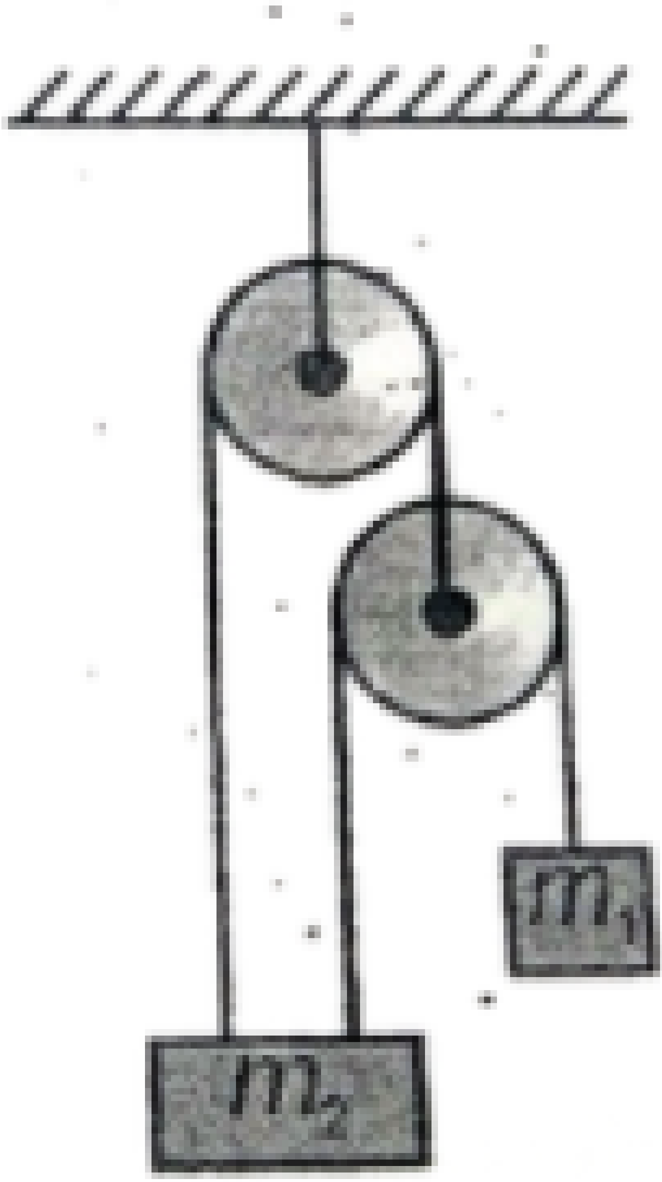
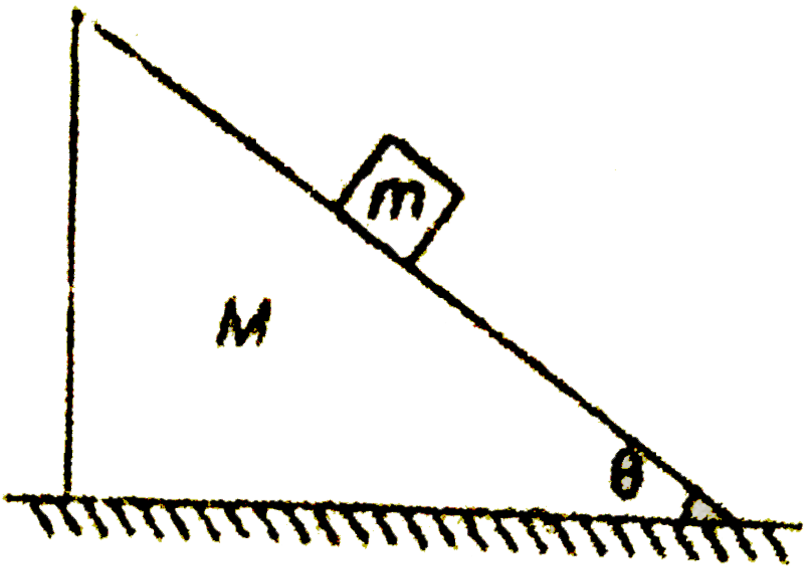
118. In the given diagram , find the relation between acceleration of blocks m_1 and m_2 . (m_2 remains horizontal).



m_1
m_2

119. A block of mass m slides down on a wedge of mass M as shown in figure .Let a_1 be the asseleration of the acceleration of and a_2 the the acceleration od block $1N_1$ is the normal reaction between block and wedge and N_2 the normal reaction between wedge and gound .frication is absent everwhere .Select the correct alternative(s)



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120. If the blocks are connected as shown in fig, the relation between their velocities is

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121. A rod of length 'l' is inclined at an angle 'θ' 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 'θ' angle with the horizontal.

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

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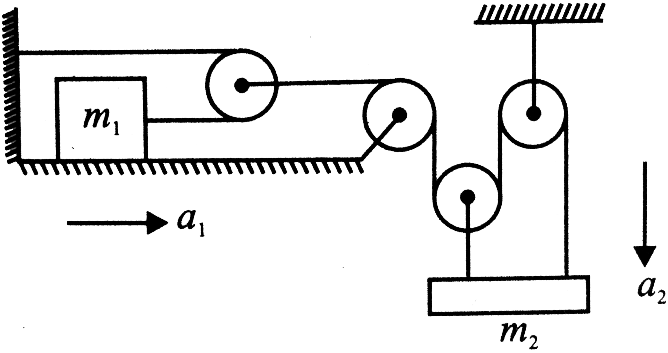
123. Two blocks are arranged as shown in figure. Find the ratio of a_1/a_2. (a_1 is acceleration of m_1 and a_2 that of m_2)



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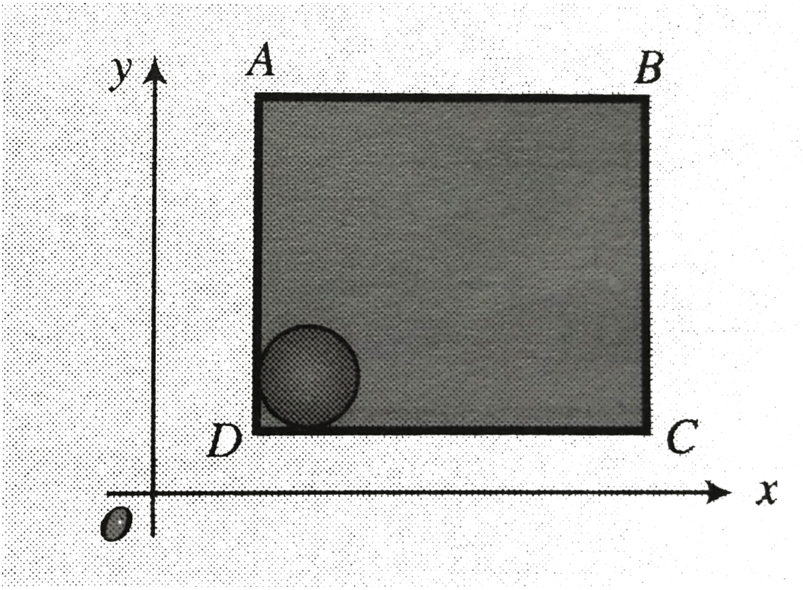
124. A solid sphere of mass 2 kg is resting inside a cube as shown in fig. The cube is moving with a velocity $\vec{v} = (5t\hat{i} + 2t\hat{j})ms^{-1}$. Here t is time in seconds. All surface are smooth. The sphere is at rest with respect to the cube. What is the total force exerted by the sphere on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



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125. A body of mass 60 kg is pushed up 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. What is the acceleration of the body ?

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126. A body of mass 10 kg lies on a rough horizontal surface. When a horizontal force of F newtons acts on it, it gets an acceleration of $5 \text{m} / \text{s}^2$. And when the horizontal force is doubled, it gets an acceleration of $18 \text{m} / \text{s}^2$. The coefficient of friction between the body and the horizontal surface is

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127. Two blocks A and B of masses 2kg and 3kg are connected by a light string as shown in the figure and placed on a horizontal surface. μ between all surfaces is 0.1 and g = 10ms^{-1}. The acceleration of the system is, when the force applied F = 45N

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128. A block of mass 4kg is placed on a rough horizontal force plane. A time dependent horizontal force $F = kt$ acts on the block. Here

$k = 2Ns^{-1}$. The frictional force between the block and plane at time $t = 2s$ is ($\mu = 0.2$) a) 4 N b) 8 N c) 12 N d) 10 N

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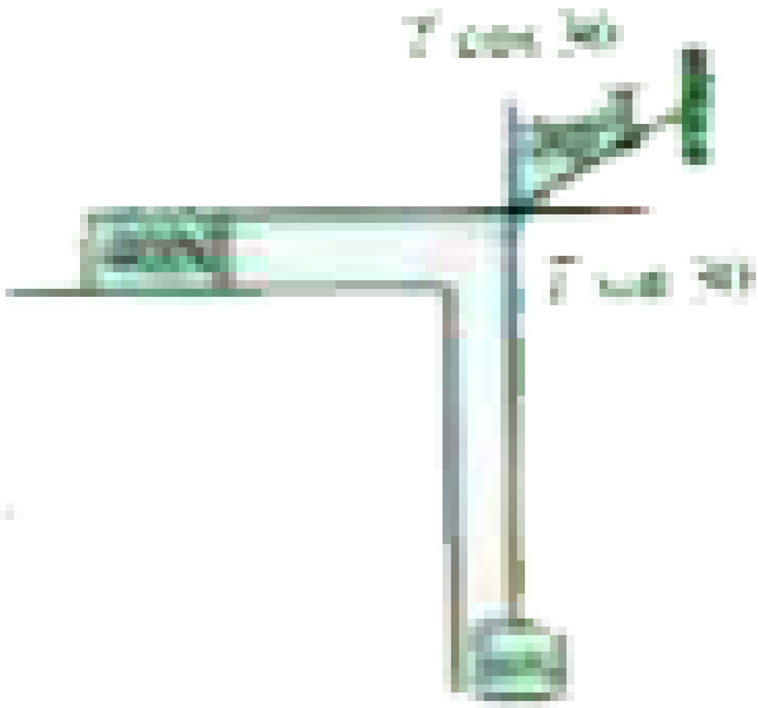
129. A block on table shown in figure is just on the wedge of slipping. Find the coefficient of static friction between the block and table top.



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130. Two blocks A and B attached to each other by a massless spring or kept on a rough horizontal surface ($\mu = 0.1$) and pulled by a force of200N as shown in figure. If at some instant, the 10 kg mass has an acceleration of 12ms^{-2} . what is the acceleration of 20 kg mass (in ms^2).

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131. A block of mass M slides along the sides of bowl as shown in the figure. The walls of the bowl are frictionless and the base has coefficient of friction 0.1, and length 0.5m. The block is released from the point A which is 0.2 m high as shown in figure. Then the block comes to rest

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132. A horizontal converyor belt moves with a constant velocity V. A small block is projected with a velocity of 6 mis 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. $\mu = 0.3g, g = 10 m/s^2$

Find V

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133. When a car of 3mass 1000 kg is moving with a velocity of $20 ms^{-1}$ 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 kinetic friction between the road and tyres of the car is 0.75 ?

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134. The rear side of a truck is open and a box of mass 40kg is placed 5m away from the open end. The coefficient of friction between the box and the surface below it is 0.15. The truck starts from rest with an acceleration of 2ms^{-2} on a straight road. At what distance from the starting points does not the box fall off the truck?

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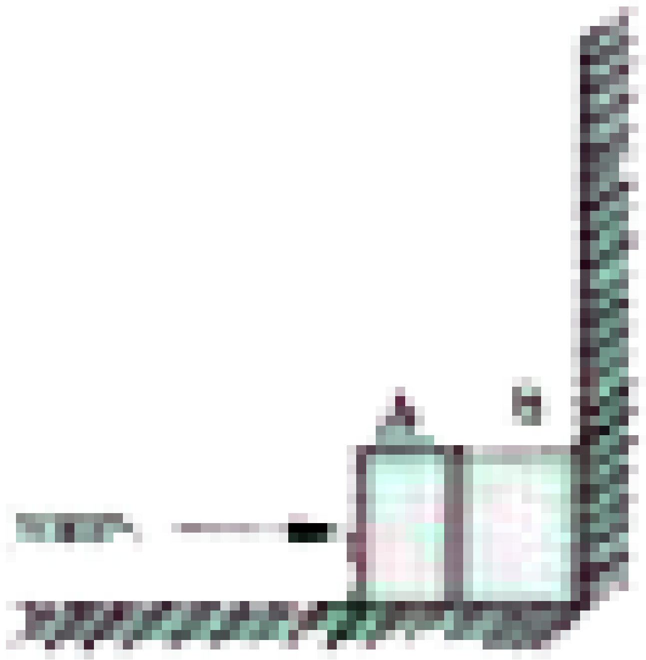
135. Two bodies A and B of masses 5 kg and 10 kg in contact with each other rest on a table against a rigid wall as shown in fig. The coefficient of friction between the bodies and the table is 0.15. A force 200 N is applied horizontally to A. What are

(a) the reaction of the partition

(b) the action-reaction forces between A and B ?

(c) What happens when the wall is removed? Does the answer to (b) change, when the bodies are in motion? Ignore the difference between μ_s and μ_k



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136. A car is driven round a curved path of radius 18 m without the danger of skidding. The coefficient 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 ? $[g = 10 ms^{-1}]$

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137. A disc revolves with a speed $33\frac{1}{3}$ rev/ min, and has a radius of 15 cm. Two coins A and B are placed at 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15, which of the coins will revolve with the record?

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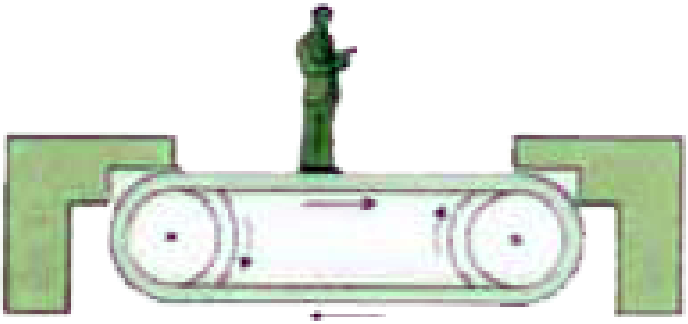
138. Figure shows a man standing stationary with respect to a horizontal conveyor belt that is accelerating with $l1ms^{-2}$. The net force on the man, if the coefficient of static friction between the man's shoes and the belt is 0.2, up to what acceleration of the belt can the man continue to be stationary relative to the belt

 (mass of the man-65kg)

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139. A 2kg block is placed over a 5kg block and both are placed on a smooth horizontal surface. The coefficient of friction between the blocks is 0.10. Find the acceleration of the two blocks if a horizontal force of 14N is applied to the upper block (g = 10ms^{-2}).

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140.

Block A is placed on block B, whose mass is greater than that of A. There is friction between the blocks, while the ground is smooth. A horizontal force P, increasing linearly with time, begins to act on A. The accelerations a_1 and a_2 of A and B respectively are plotted against time (t). The correct graph is

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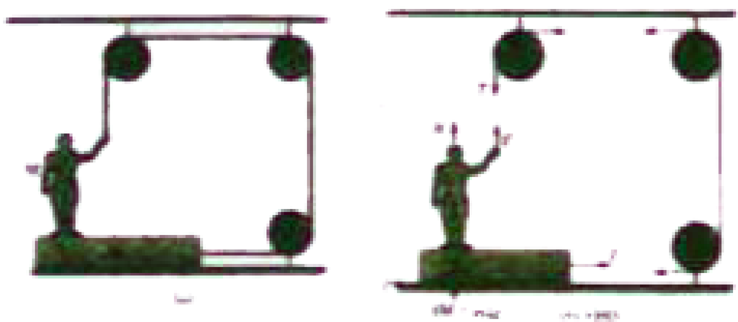
141. The coefficient of friction between the board and the floor shown in figure is μ. Find the maximum force that the man can exert on the rope so that the board does not slip on the floor.



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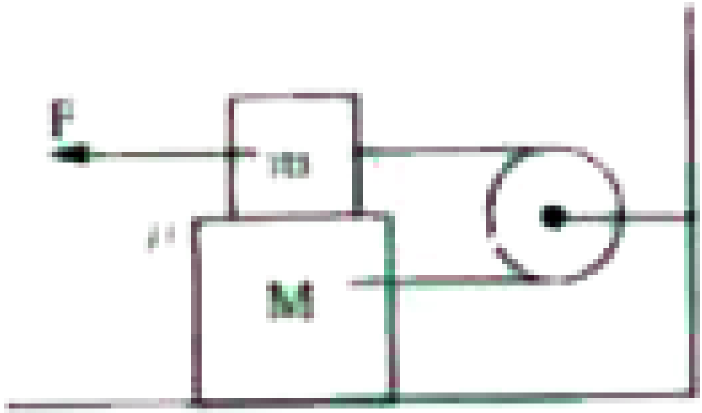
142. Two blocks of masses'm' and 'M' are arranged as shown in the figure. The coefficient of friction between the two blocks is ' μ ', where as between the lower block and the horizontal surface is zero. Find the force 'F' to be applied on the upper block, for the system to be under equilibrium ?



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143. A 70 kg man stands in contact against the inner wall of a hollow cylindrical drum of radius 3 m rotating about its vertical axis with 200 rev/min. The coefficient of friction between the wall and his clothing is 0.15 m What is the minimum rotational speed of the cylinder to enable the man to remain stuck to the wall (without falling) when the floor is suddenly removed ?

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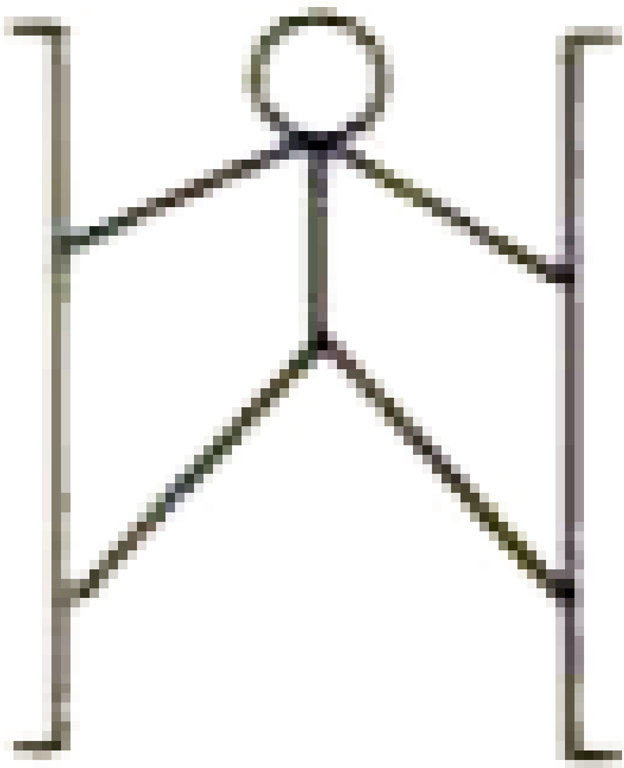
144. A man of mass 40 kg is at rest between the walls as shown in the figure. If between the man and the walls is 0.8, find the normal reaction exerted by the walls on the man. (g = $10 ms^{-2}$)



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

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146. A block of wood of mass 0.5 kg is placed on a plane making 30° with the horizontal. If the coefficient of friction between the surfaces of contact of the body and the plane is 0.2. What force is required to keep the body sliding down with uniform velocity.

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147. A body is sliding down an inclined plane have coefficient of friction 0.5. If the normal reaction is twice that of resultant downward force along the incline. Find the angle between the inclined plane and the horizontal.

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148. A block is placed on a rough inclined plane of inclination $\theta = 30^\circ$. If the force to drag it along the plane is to be smaller than to lift it. The coefficient of friction μ should be less than

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149. A 30 kg block is to be moved up an inclined plane at an anglue 30° to the horizontal with a velocity of 5ms^{-1}. If the frictional force retarding the motion is 150N find the horizontal force required to move the block up the plane. $(g = 10\text{ms}^{-2})$

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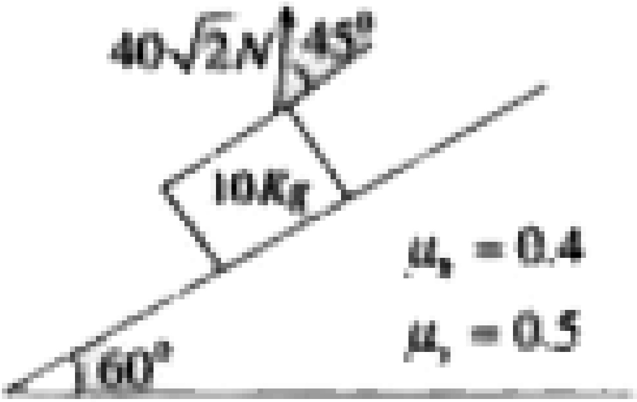
150. In the figure shown acceleration of the block is



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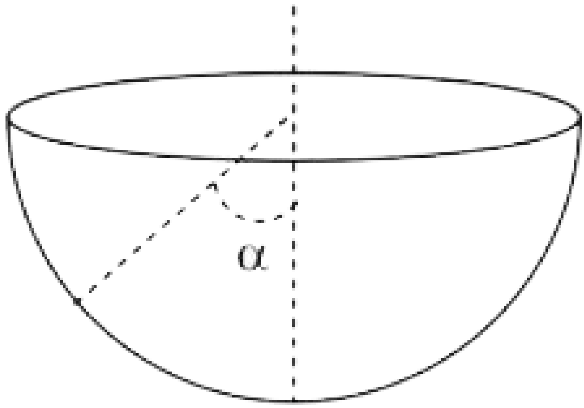
151. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of is given by:



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152. A rough inclined plane is inclined at 30° to the horizontal as shown in the figure. A uniform chain of length L is partly on the inclined plane and partly hanging from the top of the incline. If the coefficient offriction between chain and inclined plane is μ, the maximum length of the lianging part to prevent the chain from falling vertically is:

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153. A rough inclined plane is inclined at 30° to the horizontal as shown in the figure. A uniform chain of length L is partly on the inclined plane and partly hanging from the top of the incline. If the coefficient offriction between chain and inclined plane is μ, the maximum length of the lianging part to prevent the chain from falling vertically is:

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154. A block is placed on a ramp of parabolic shape given by the equation $y = x^2/20$. If $\mu_s = 0.5$, then the maximum height above the ground at which the block can be placed without slipping is

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155. One end of a massless spring of spring constant 100 N/m and natural length 0.5 m is fixed and the other end is connected to a particle of mass 0.5 kg lying on as frictionless horizontal table. The spring remains horizontal. If the mass is made to rotate at an angular velocity of 2 rad/s, find the elongation of the spring.

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156. A ball of200 g is at one end of a string of length 20 cm. It is revolved in a horizontal circle at an angular frequency of 6 rpm. Find (i) the angular velocity, (ii) the linear velocity, (Hi) the centripetal acceleration,

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157. In the Fig, shown below with what angular speed ' ω ' must 'm' with a radius 'r' rotate on a frictionless table so that' M' does not move ? (b) If m = 1.0 kg, M = 10.0 kg and r = 0.5 m, find ω

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158. A stone tied to the end of a string is whirled in a horizontal circle. The mass of the stone is 1.0 kg and the string is 0.50 m long. If the stone revolves at a constant speed for 10 times in 15.71 s, (a) what is the tension in the string? (b) What would happen to the tension in the string if the mass was doubled and all the other quantities remained the same? (c) What would happen to the tension in the string if the period was doubled and all the other quantities remain the same?

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159. A stone of mass 2.0 kg is tied to the end of a string of 2m length. It is whirled in a horizontal circle. If the breaking tension of the string is 400 N, calculate the maximum velocity of the stone.

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160. An aircraft executes a horizontal loop at a speed of 720 km/h with its wings banked at 15°. What is the radius of the loop?

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161. A train runs along an unbanked circular track of radius 30 m at a speed of 54 km/h . The mass of the train is 10 kg. What provides the centripetal force required for this purpose- The engine or the rails ? What is the angle of banking required to prevent wearing out of the rail ?

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162. A circular racetrack of radius 300 m is banked at an angle of 15° The coefficient of friction between the wheels of a race car and the road is 0.2. The optimum speed of the race car to avoid wear and tear on its tyres is

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LONG ANSWER TYPE QUESTIONS

1. State Newton's third law of motion.

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2. Two unequal masses are connected by a very light string over a clamped light smooth pulley. Find the acceleration of the system and the tension in the string.

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3. Explain the motion of an object suspended by a cable that passes over a pulley and horizontally connected at the other end to a second object that rests on a smooth horizontal table. Derive expressions for tension in the cable and acceleration of the objects.

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4. Consider two objects of different masses connected by a cable passing over a massless and frictionless Pulley. Derive expressions for the tension in the cable and acceleration of the objects.

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5. Discuss how apparent weight of a person in a lift changes when it is (a) moving up with acceleration (b) moving down with acceleration less than acceleration due to gravity (c) moving with uniform velocity

(d) when it is stationary.

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SHORT ANSWER TYPE QUESTION

1. State the Newton's laws of motion. What is the SI unit of force ?

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2. Give the magnitude and direction of the net force acting on .

a drop of rain falling down with a constant speed.

(b) a cork of mass 10 g floating on water.

(c) a kite skillfully held stationary in the sky.

(d) high-speed electron in space far from all material objects. Give the direction electric and magnetic fields.

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3. The horizontal force and the force inclined at an angle 60° with the vertical, whose resultant is in vertical direction of P kg, ar

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4. Explain why

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

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

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

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5. A stone of mass 0.1 kg is thrown vertically upwards. Give the magnitude and direction of the net force on the stone (a) during its

upward motion, (b) during its downward motion, (c) at the highest point, where it momentarily comes to rest.

Do you answers alter if the stone was thrown at an angle of say 30° with the horizontal direction?

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6. Two blocks of masses M_1 and M_2 are placed in contact with each other on a frictionless horizontal surface. If a force F is applied on the block of mass M_1, what is the contact force between the two blocks?

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7. How does the weight of a person standing in a lift change when the lift accelerates (a) upwards (b) downwards with an acceleration a ?

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VERY SHORT ANSWER TYPE QUESTIONS

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

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2. A heavy rope is suspended from a rigid support A wave pulse is set up at the lower end, then

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3. Why does a loaded truck start more slowly than an empty truck?

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4. Which is greater, the attraction of the earth on a 1 kg body or the attraction of the 1 kg body on the earth?

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5. While jumping out of a moving bus, what must be done for a safe jump?

Watch Video Solution

6. Why does mud fly off a rapidly turning wheel ?

Watch Video Solution

7. While during a carpet, we give a sudden jerk or beat it with a stick. Why?

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8. When a person is in a lift accelerated upwards or downwards, do force of gravity and normal reaction on the person form action and reaction pair?

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9. Give the magnitude and direction of the net force acting on a drop of rain falling down with a constant speed

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10. In a tug of war competition, two men pull the ends of the rope with forces equal in magnitude and opposite in direction. What is the tension in the rope ?

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11. A rope passess over a pulley which is sufficiently high. Two monkeys of equal mass climb the rope from opposite ends, one of them climbing quickly than the other relative to the rope. Assuming that the pulley and the rope are weightless and the rope is in extensible, which of monkeys will reach the top first?

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12. What is the net force on a piece of wood floating on water?

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13. An astronaut accidentally gets thrown out of his small spaceship accelerating in interstellar space at a constant rate. What is the acceleration of the astronaut, the instant after he is outside the spaceship?

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NUMERICAL EXERCISE (LEVEL-1)

1. Due to the application of a force on a body of mass 100 kg that is initially at rest, the body moves with an acceleration of 20ms^{-2} in the direction of the force. Find the magnitude of the force.

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2. A force is applied for a duration of 10sec on a body of mass 5kg that is at rest. As a result the body acquires a velocity of 2ms^{-1}. Find the magnitude of the force applied.

Watch Video Solution

3. A vehicle of mass 120kg is moving with a velocity of 90kmph What force should be applied on the vehicle to stop it in 5s.

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4. A ball of mass 0.2 kg moves with a velocity of 20ms^{-1} and stops in 0.1 s , then the force on the ball is

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5. A force acts for 0.1 s on a body of mass 2 kg initially at rest. The force is then withdrawn and the body moves with a velocity of 2 m/s. Find the magnitude of force.

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6. A ball of mass 50 g is dropped from a height of 20 m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 200 N, so that it attains a vertical height of 45 m. The time for which the ball remains in contact with the bat is [Take $g = 10 m/s^2$]

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7. An elevator weighing 6000 kg is pulled upwards by a cable with an acceleration of $5 ms^{-2}$. Taking g to be $10 ms^{-2}$, the tension in cable is

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8. A 2kg block lying on smooth table which is connected by a body of mass 1 kg by a string which passes through a pulley. Take 1 kg mass hanging vertically. Find the acceleration of block & tension in string.

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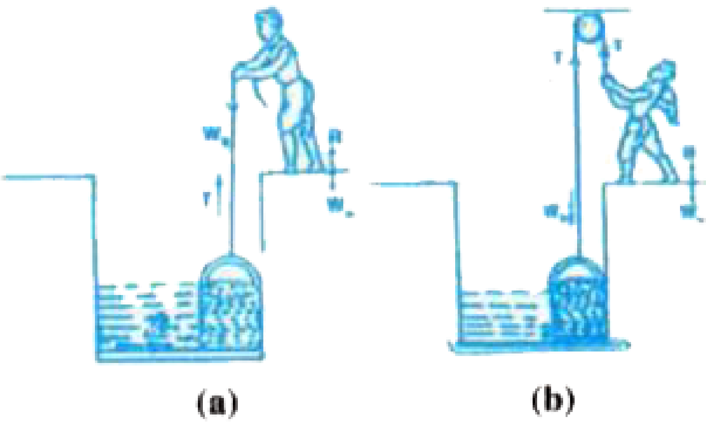
9. A man wants to draw a bucket full of water in two different ways. As shown in figure 'a' he draws the bucket directly and as shown in figure (b) he uses a pulley. The weight of the man is 50kg and the bucket with full water weighs 25kg. Find the action on the floor by the man in the two cases. (Take $g = 10 ms^{-2}$).



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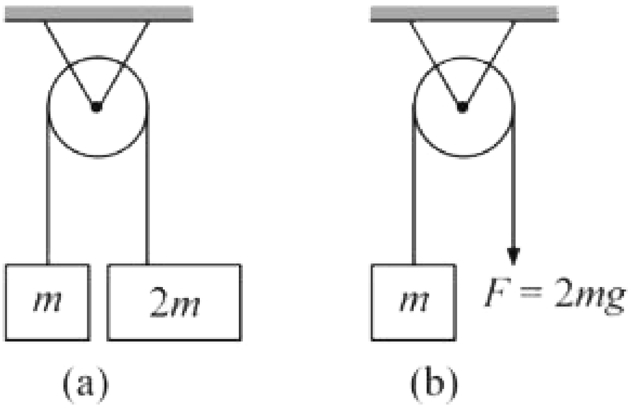
10. The pulley arrangements in the figure (A) and (B) are identical. The mass of the rope is negligible. In figure (A), the mass m is lifted up by attaching a mass 2m to the other end of the rope. In figure (B), m is lifted up by pulling the other end of the rope with a constant downward force F = 2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



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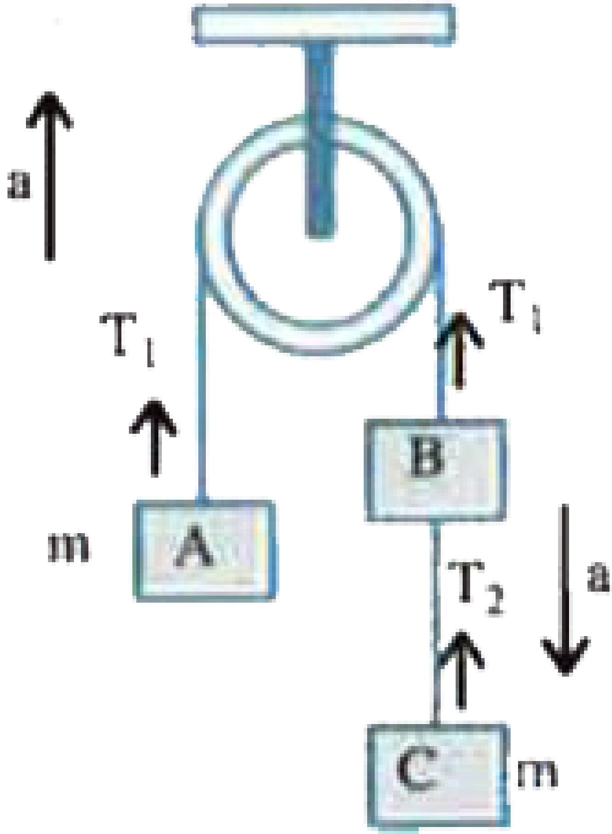
11. Three equal weights of mass m each are hanging on a string passing over a fixed pulley as shown in Fig. What are the tensions in the string connecting weights A to B and B to C?



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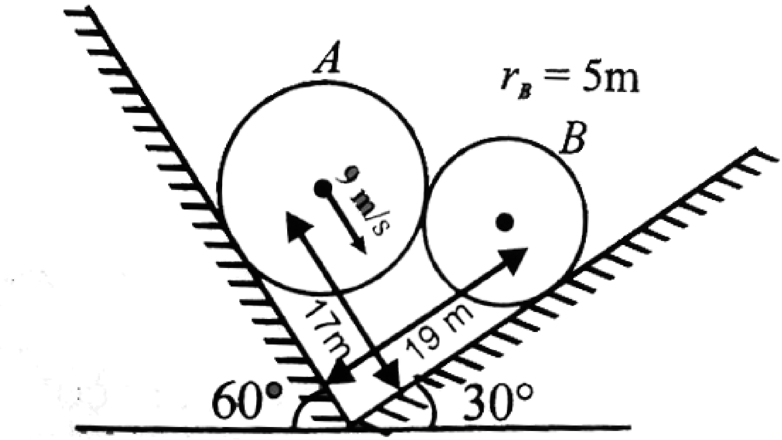
12. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{\text{m}}{\text{s}}$. Find the speed of sphere B.

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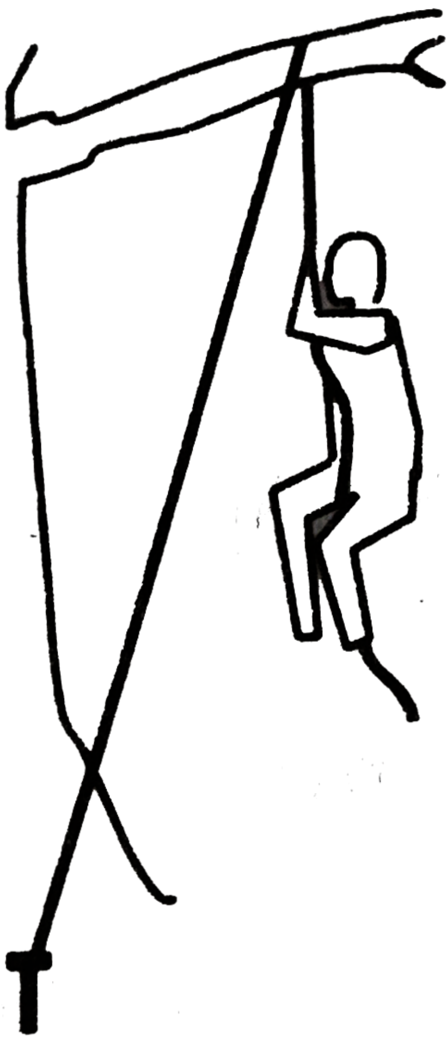
13. A light rope fixed at one end of a wooden clamp on the ground passes over a tree branch and hangs on the other side. It makes an angle of 30^0 with the ground. A man weighing (60 kg) wants to climb up the rope. The wooden clamp can come out of the ground if an upward force greater than 360 N is applied it. Find the maximum acceleration in the upward direction with which the man can climb

safely. Neglect friction at the tree branch. Take $g = 10 \frac{m}{s^2}$



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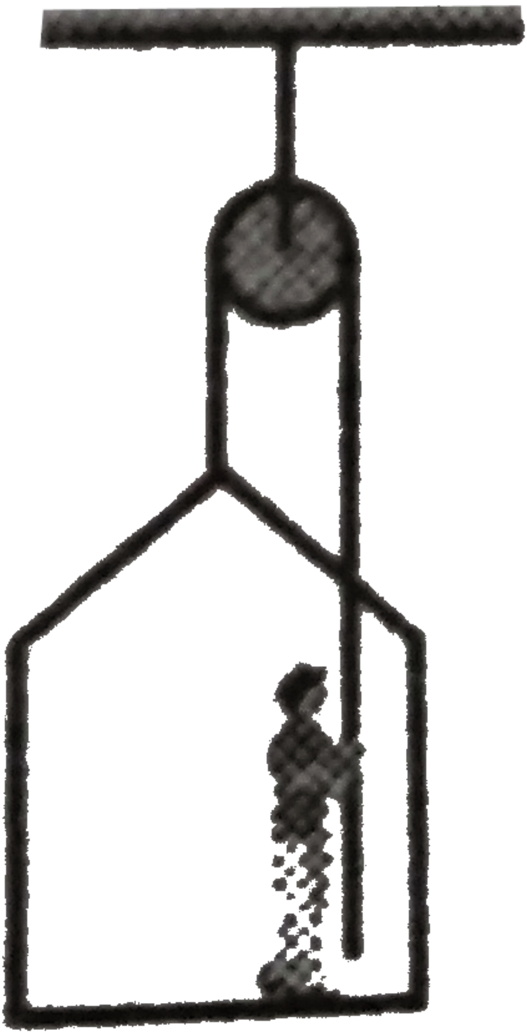
14. Figure represents a painter in a crate which hangs alongside a building. When the painter of mass 100kg pulls the rope, the force exerted by him on the floor of the crate is $450\mathrm{N}$. If the crate weighs

25 kg. find the acceleration (in ms^{-2}) of the painter.



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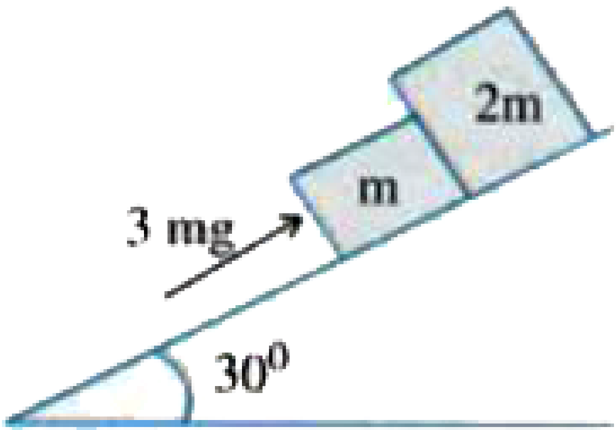
15. Two block of masses m and 2m are kept on a smooth inclined plane and the system is pushed using force 3mg as shown. Find the contact force between those two blocks



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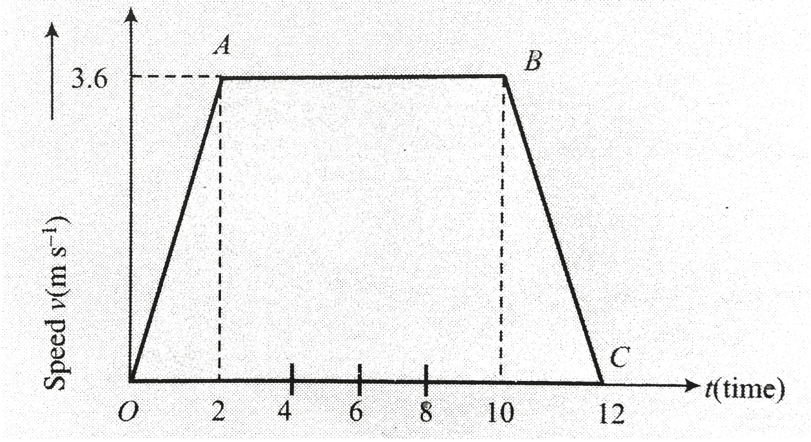
16. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph.



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

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

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

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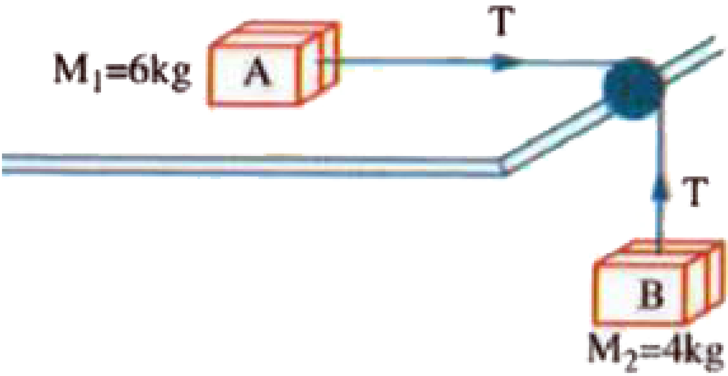
NUMERICAL EXERCISE (LEVEL-2)

1. A block A of mass 6kg is applied on a frictionless table. A thread tied to it passes over a frictionless pulley and carries a body B of mass 4kg at the other end. Find the acceleration of the system and tension in the thread (given $g = 10 ms^{-2}$)



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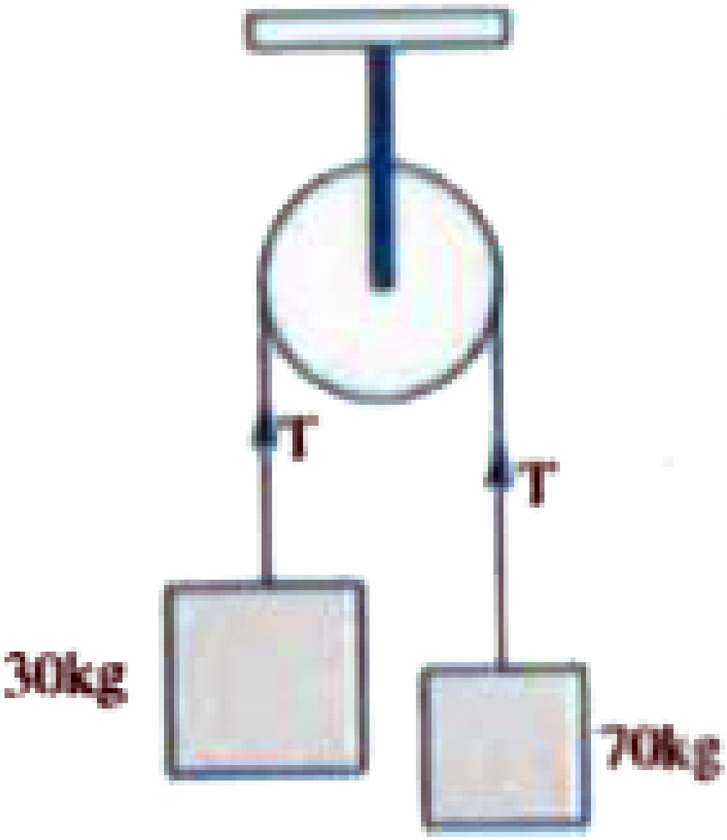
2. Figure shows a weight of 30kg suspended at one end of cord and a weight of 70kg applied at other end of the cord passing over a pulley. Neglecting weight of rope and pulley find the tension in the cord and acceleration of the system ($g = 10ms^{-2}$)



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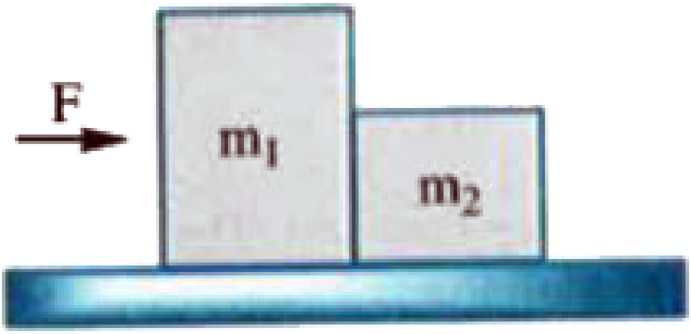
3. Two blocks are in contact on a frictionless table. A horizontal force is applied to one block as shown in fig. If $m_1 = 10kg$ and $m_2 = 5kg$ and $F = 15N$. Find the force of contact between the two bodies.



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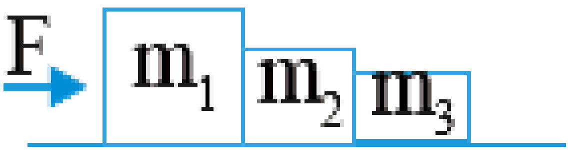
4. Three blocks of masses m_1, m_2 and m_3 kg are placed in contact with each other on a frictionless table. A force F is applied on the heaviest mass m_1 , the acceleration of m_3 will be :



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5. A man of 60kg mass is in a lift. Find the apparent weight of the man when the lift is moving up with uniform speed$(g = 10ms^{-2})$

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6. A vehicle of mass 500 kg is moving with a velocity of $15ms^{-1}$. It is brought to rest by a retarding force. Find the distance moved by the vehicle before coming to rest, if the sliding friction between the tyres and the road is 3000N.

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7. A lift of mass m is supported by a cable that can with stand a force of 3mg. Find the shortest distance in which the lift can be stopped when it is descending with a speed of g/4.

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8. A monkey A (mass = 5kg) is climbing up a rope tied to a rigid support. The monkey B (mass = 2kg) is holding on to the tail of monkey A. If the tail can tolerate a maximum tension of 30N, what force should monkey A apply on the rope in order to carry monkey B with it? $(g = 10 m/s^2)$.

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9. A metal plate of mass 200g is balanced in mid air by throwing 40 balls per second, each of mass 2g vertically upwards from below. The balls get rebounded with the same speed with which they strike the plate. Find the speed with which the balls strike the plate.

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10. A box is put on a scale which is adjusted to read zero, when the box is empty. A stream of pebbles is then poured into the base from a height h above its bottom at a rate of n pebbles/s. Each pebble has a mass m. If the pebbles collide with the box such that they immediately come to rest after collision, then the scale reading at time t after the pebbles begin to fill the box is [neglect piling up of pebbles]

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11. A block A can slide on a frictionless incline of angle θ and length l, kept inside an elevator going up with uniform velocity v. Find the time taken by the block to slide down the length of the incline if it is released from the top of the incline.

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12. A water pipe has an internal diameter of 10 cm. Water flows through it at the rate of 20 m/sec. The water jet strikes normally on a wall and falls dead. Find the force on the wall.

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13. A clean body of mass 100 g starts with a velocity of 2 m/s on a smooth horizontal plane, accumulating dust at the rate of 5 g/s. Find the velocity at the end of 20 seconds and the distance travelled during that period.

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QUESTIONS FOR DESCRIPTIVE ANSWER

1. A pendulum bob of mass 10^{-2}kg is raised to a height 5×10^{-2}m and then released. At the bottom of its swing, it picks up a mass 10^{-3}kg. To what height will the combined mass rise?

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2. A particle of mass m begins to side down a fixed smooth sphere from the top. What is its tangential acceleration when it breaks off the sphere ?

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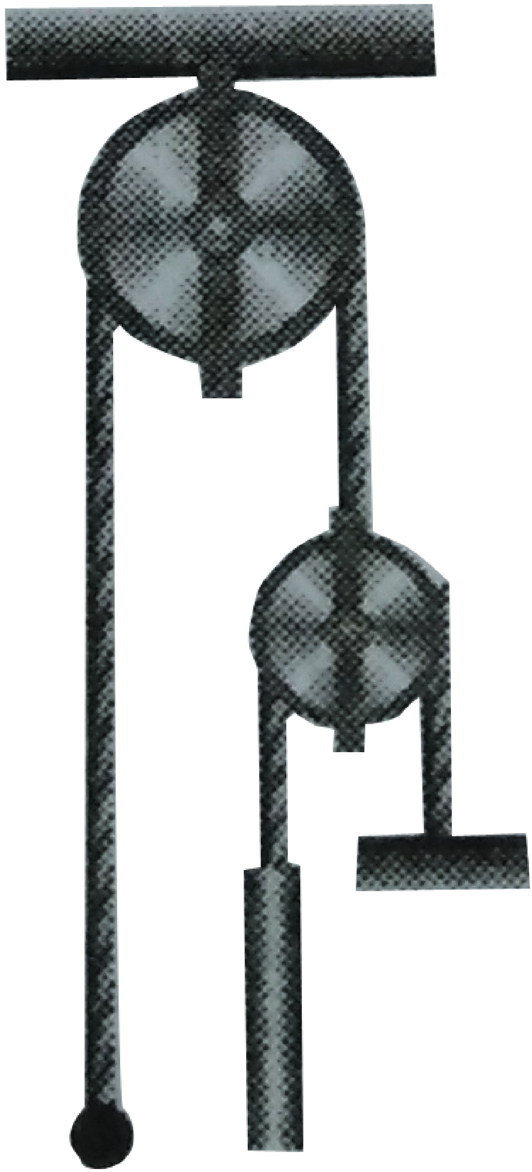
3. In the arrangement shown in figure the mass of the ball is η times as that of the rod. The length of the rod is L the masses of the pulleys and the threads as well as the friction, are negligible. The ball is set on the same level as the lower end of the rod and then released. How soon will the ball be opposite the upper end of the rod?



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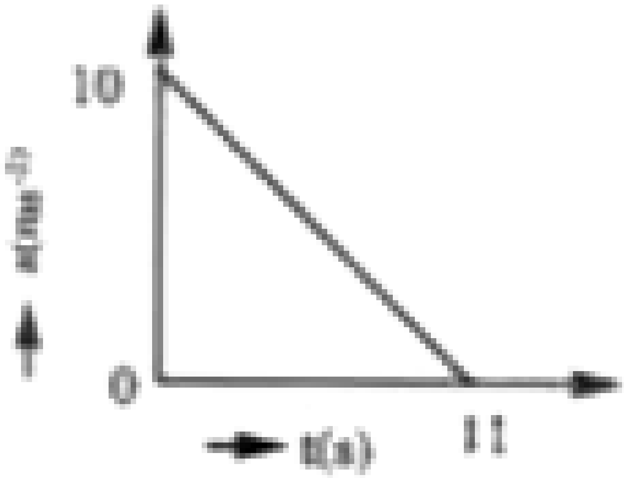
4. The a -t graph is shown in the figure. The maximum velocity attained by the body from rest will be



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

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PROBLEMS

1. A body of mass 1 kg is moving with velocity 30ms^{-1} due north. It is acted on by a force of 10 N due east for 4 seconds. Find the velocity of the body after the force ceases to act.

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2. A very fleible uniform chain of mass M and length L is suspended vertically such that its lower end just touches the surface of a table.

When the upper end of the chain is released . it falls with each link coming to test the instant it strikes the table.

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3. What is the effect of force on a rigid body ?

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4. Give the magnitude and direction of the net force acting on .

a drop of rain falling down with a constant speed.

(b) a cork of mass 10 g floating on water.

(c) a kite skillfully held stationary in the sky.

(d) high-speed electron in space far from all material objects. Give the direction electric and magnetic fields.

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5. Marbles each of mass'm' are dropped from height 'h' on pan of a balance at the rate 'R' per sec. The balance calibrated in units of mass reads zero initially. If marbles are dropped continuously, what will the balance read after 't' sec ?

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6. A particle of mass 1 g moves on a straight line. The variation of its velocity with time is shown in fig. Find the force acting on the particle att = 1 s,4s and 7 s.

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7. A pebble of mass 0.05 kg is thrown vertically upwards. Give the direction and magnitude of the net force on the pebble .

(a) during its upward motion.

(b) during its downward motion.

(c) at the highest point where it is momentarily at rest. Do your answers change if the people was thrown at an angle of 45° with the horizontal direction ?

Ignore air resistance .

Watch Video Solution

8. Give the magnitude and direction of the net force acting on a stone of mass 0.1 kg.

Neglect air resistance throughout.

(a) just after it is dropped from the window of a stationary train.

(b) just after it is dropped from the window of a train running at a constant velocity of 36 km/h.

(c) just after it is dropped from the window of a train accelerating with 1ms^{-2} .

(d) lying on the floor of a train which is accelerating with 1ms^{-2} , the stone being at rest relative to the train.

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9. A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1ms^{-1} . What is the trajectory of the bob if the string is cut when the bob is (a) at one of its extreme positions, (b) at its mean position.

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10. A solid sphere of radius 2.45m is rotating with an angular speed of $10\text{rad}/\text{s}$. When this rotating sphere is placed on a rough horizontal surface then after sometime it starts pure rolling. Find the linear speed of the sphere after it starts pure rolling.

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11. A particle of mass m is moving with speed u. It is stopped by a force F in distance x if the stopping force is 4 F then

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12. A bullet is fired from a gun . The force on the bullet is given by

$F = 600 - (2 \times 10^5)t$

Here , F is in newton and t in second . The force on the bullet becomes zero as soon as it leaves the barrel . The impulse imparted to the bullet is

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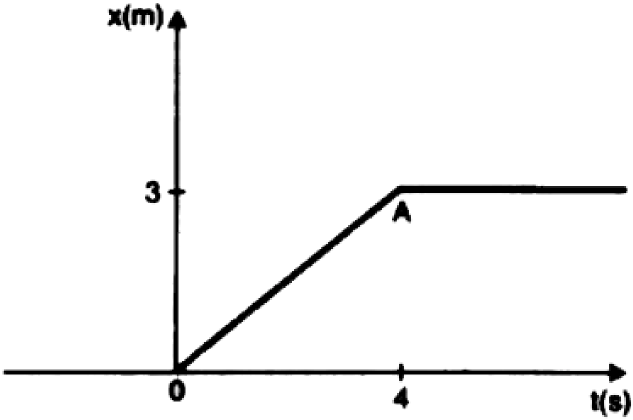
13. Figure 5.16 shows the position-time graph of a particle of mass 4 kg. What is the (a) force on the particle for t lt 0 , t lt 4s, 0 lt t lt 4s ? (b) impulse at t = 0 and t = 4 s ? (Consider one-dimensional motion only) .



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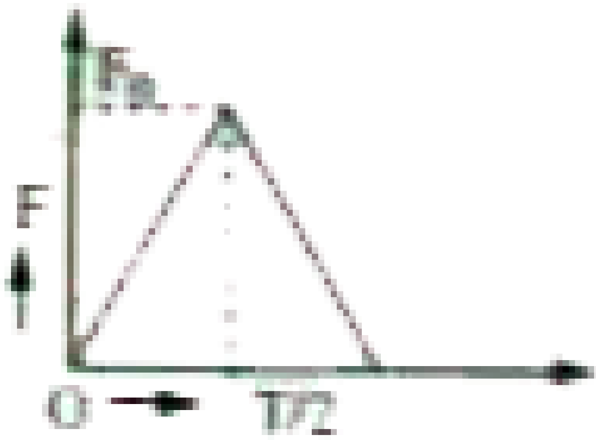
14. particle of mass m, moving with velocity 'u' makes head on collision with identical stationary particle, which is elastic. Theforce of interaction increases to maximum and then becomes zero in time 'T' as shown in graph. What is the maximum value F_0 of interaction force ?



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

What is the speed of the ball at the instant the force acting on it is maximum?

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16. Which of the following device is used to measure the rate of liquid through a pipe ?

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17. The linear momentum of a particle varies with time t as $p = a + bt + ct^2$. Then, whichh of the following is correct?

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18. Liquid of density ρ flows along a horizontal pipe of uniform area of cross section a with a velocity v through a right angled bend. What force should be applied to the bend to hold it in equilibrium?

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19. Force acting on a particle of mass m moving in straight line varies with the velocity of the particle as $F = K/V$ K is constant then speed of the particle in time t

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20. Explain why a horse cannot pull a cart and run in empty space

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21. Two ice skaters A and B approach each other at right angles. A has mass 30 kg and velocity 1 mis and B has a mass of 20 kg and velocity 2 m/s. They meet and stick together. The final velocity of couple is :

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22. A man of mass m climbs a rope of length L suspended below a balloon of mass M. The balloon is stationary with respect to ground. If the man begins to climb up the rope at a speed v_{rel}. (relative to rope) in what direction and with what speed (relative to gound) with the balloon move ?

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23. (i) Find the acceleration of the centre of mass of two particle approaching towards each other under their own grabitational field.

(ii) A boy of mass 30 kg is standing on a flat boat so that he is 20 meter from the shore. He walks 8 m on the boat towards the shore and then stops. The mass of the boat is 90 kg and friction between the boat and the water surface is negligible. How far is the boy from the shore now ?

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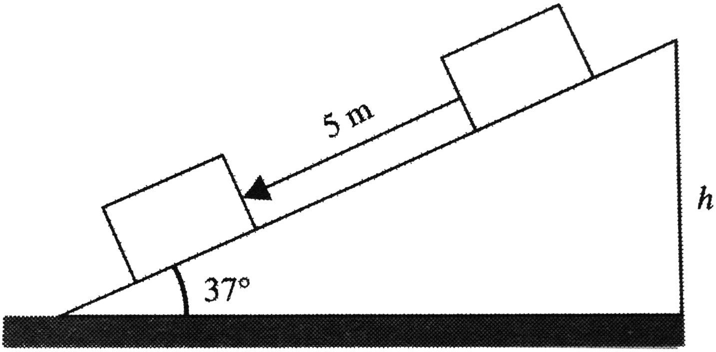
24. A block is placed on the top of a plane inclined at 37° with horizontal. The length of the plane is 5m. The block slides down the plane and reaches the bottom.



a. Find the speed of the block at the bottom if the inclined plane is smooth.

b. Find the speed of the block at the bottom if the coefficient of friction is 0.25.

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25. In a gravity free space, a man of mass M standing at a height h above the floor, throws a ball of mass m straight down with a speed

u. When the ball reaches the floor, the distance of the man above the floor will be

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26. A bomb of mass 12 kg explodes into two piece of masess 4 kg and 8kg . The velocity of mass 4 kg is 20 m/s . Find the velocity of mass 8 kg

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27. A vessel at rest explodes breaking it into three pieces. Two pieces having equal mass fly off perpendicular to one another with the same speed of $30 \mathrm{m/s}$. The third piece has three times the mass of each of the other two pieces. What is the direction (w.r.t. the pieces having equal masses) and magnitude of its velocity immediately after the explosion?

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28. An object is projected from ground with speed u at angle θ with horizotal the radius of curvature of its trajectory at maximum height from ground is

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29. A particle of 2m is projected at an angle of 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 expansion one point comes to rests. The maximum height from the ground attained by the other part is $(g = 10 m/s^2)$

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30. A person, standing on the roof of a 40 m high tower, throws a ball vertically upwards with speed 10 m/s. Two seconds later, he throws another ball again in vertical direction (use $g = 10\frac{m}{s^2}$). Both the balls hit the ground simultaneously.

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31. A boy of mass $60kg$ is standing over a platform of mass $40kg$ placed over a smooth horizontal surface. He throws a stone of mass $1kg$ with velocity $v = 10m/s$ at an angle of 45° with respect to the ground. Find the displacement of the platform (with boy) on the horizontal surface when the stone lands on the ground. Take $g = 10m/s^2$.

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32. An isolated particle of mass m is moving in horizontal plane xy along the x-axis, at a certain height above the ground. It suddenly explodes into two fragment of masses $m/4$ and $3m/4$. An instant later, the smaller fragment is at $y = +15$ cm. The larger fragment at this instant is at

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33. A bomb initially at rest at a height of 40 m above the ground suddenly explodes into two identical fragments. One of them starts moving vertically downwards with an initial speed of 10 m/s. If acceleration due to gravity is 10 m/s^2, the separation between the fragments, 2 seconds after the explosion is

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34. Fuel is consumed at the rate of 50 kg s^{-1} in a rocket. Find the thrust on the rocket if the velocity of the exhaust gases is 2 km s^{-1}. Also calculate the velocity of the rocket at the instant, when its mass is reduced to l/10th of its initial mass if its initial velocity is zero, (neglect gravity)

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35. The first & second stage of two stage rocket separately weigh 100 kg and 10 kg and contain 800kg and 90kg fuel respectively. If the exhaust velocity of gases is 2 km/sec then find velocity of rocket (nearly) ($\log_{10} 5 = 0.6990$) (neglect gravity)

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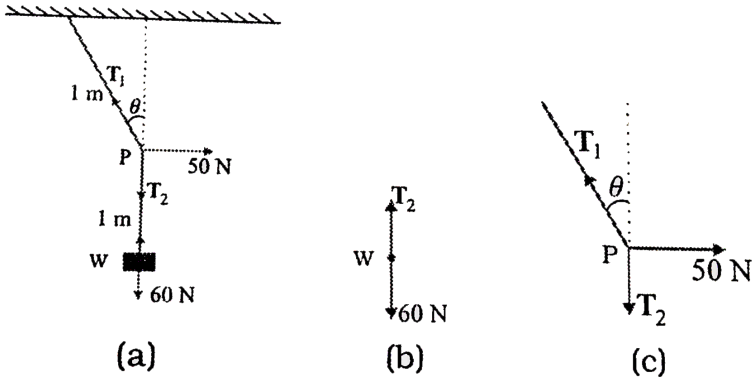
36. See Fig 5.8 .A mass of 6 kg is suspended by a rope of length 2m from the ceiling . A force of 50 N in the horizontal direction is applied at the mid-point P of the rope, as shown. What is the angle the rope makes with the vertical in equilibrium ? (Take g = 10 m s^{-2}). Neglect the mass of the rope.



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37. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of $4.9 ms^2$ (ii) lowered with an acceleration of $4.9 ms^{-2}$. The ratio of tension in the first and second case is

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38. The apparent weight of a person inside a lift is w_1 when lift moves up with a certain accelration and is w_2 when lift moves down with same acceleration. The weight of the person when lift moves up with constant speed is :

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39. A lift is going up. The total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as shown in the figure. Find the tension in the rope pulling the lift at t = 11 th second.

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40. A lift is going up. The total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as shown in the figure. In the above problem, find the height to which the lift takes the passenger.

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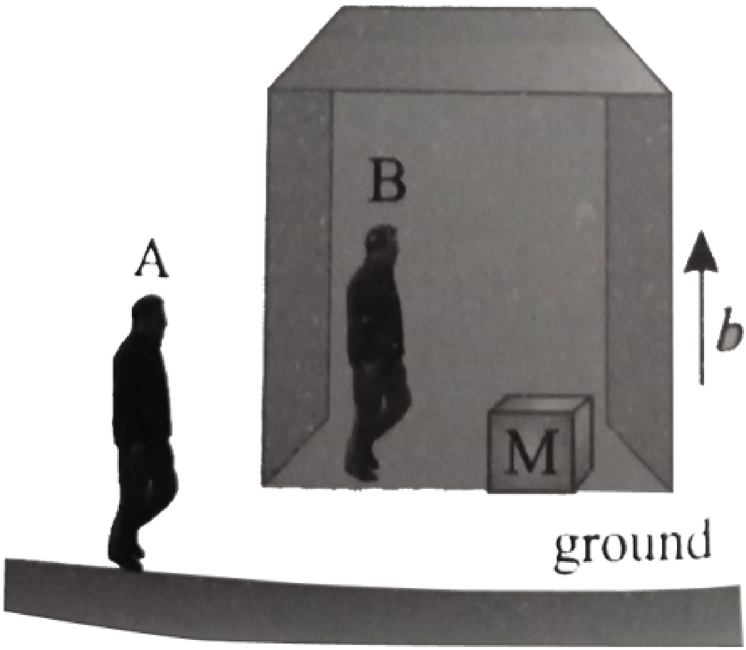

41.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. The observer A finds that the work done by gravity on the block is

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42. A 75 kg man stands in a lift . What force does the floor exert on him when the elevator starts moving upwards with an acceleration of $2ms^{-2}$ Given : $g = 10ms^{-2}$.

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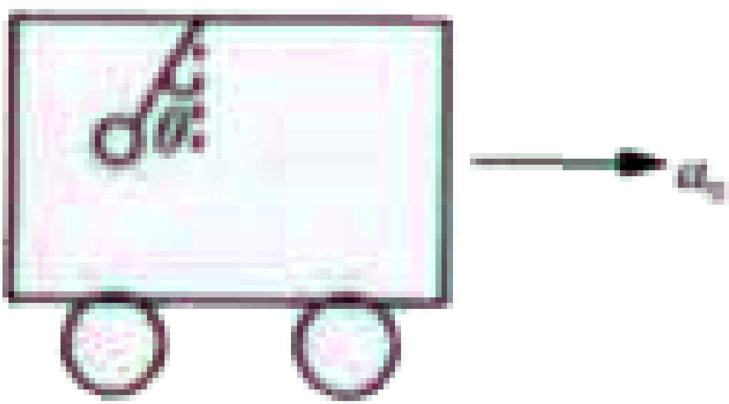
43. A pendulum is hanging from the ceiling of a car having an acceleration a_0 with respect to the road. Find the angle made by the string with vertical at equilibrium. Also find the tension in the sting in this position



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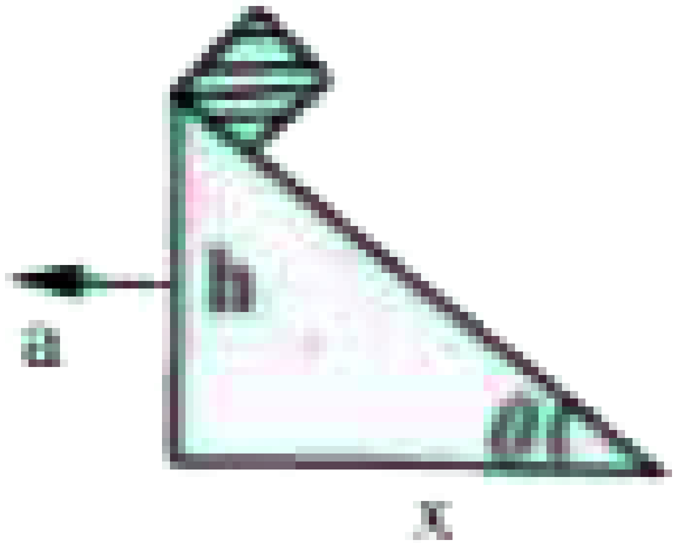
44. For what value of 'a'the block falls freely?



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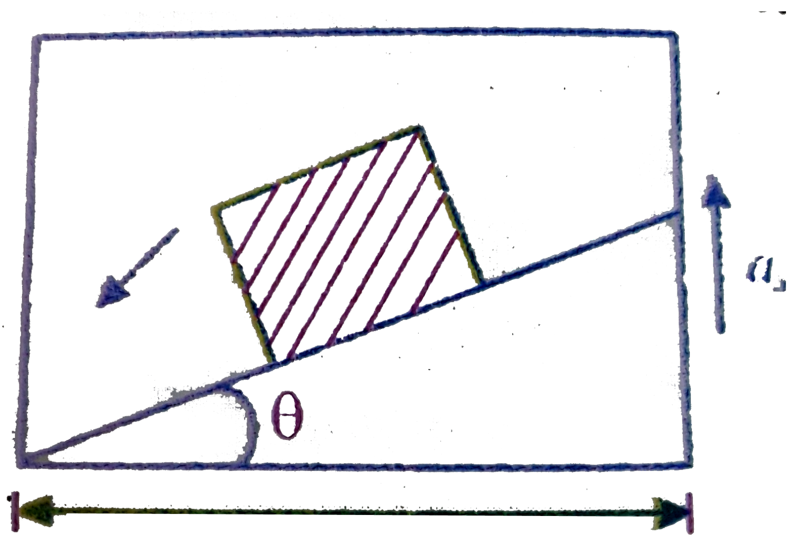
45. A block slides down from top of a smooth inclined plane of elevation • fixed in an elevator going up with an acceleration a_0 The base of incline hs length L Find the time taken by the block to reach the bottom



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

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47. A block of mass m is placed on a smooth wedge of inclination Q. The whole system is accelerated horizontally so that the block does not slip on the wedge. Find the

i) Acceleration of the wedge

ii) Force to be applied on the wedge

iii) Force exerted by the wedge on the block.

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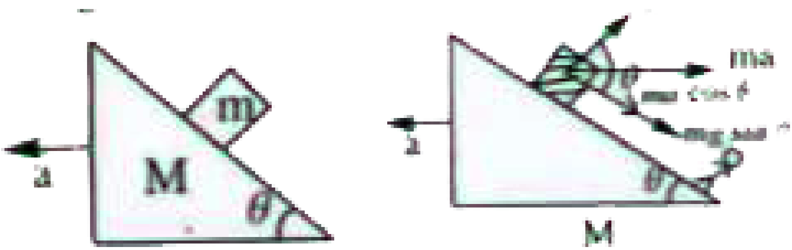
48. All surface are smooth. Find the acceleration of mass m relative to wedge when wedge is moving with acceleration 'a'



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

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50. A lorry carries a tank of water. If the lorry moves with a uniform acceleration 'a' in the horizontal direction, determine the angle made by the surface of water in the tank with the horizontal.

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51. A simple pendulum is suspended from the ceiling of trolley which is sliding down on a inclined plane of inclination θ Find the angle made by the string with normal to the trolley a) when trolley slides down with uniform velocity b) when the plane is smooth.

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52. Two blocks of masses 5 kg and 2 kg are kept in contact with each other on a frictionless horizontal surface. If a force of 14 N is applied on the larger block what is the acceleration of the system ? What is the contact force between the two blocks ?

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

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54. Three blocks connected together by strings are pulled along a horizontal surface by applying force F. If $T_3 = 36N$, What is tension T_2?

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55. Two identical blocks A and B each of mass M are connected to each other through a light string. The system is placed on a smooth horizontal floor. When a constant force F is applied horizontally on the block A, find the tension in the string.

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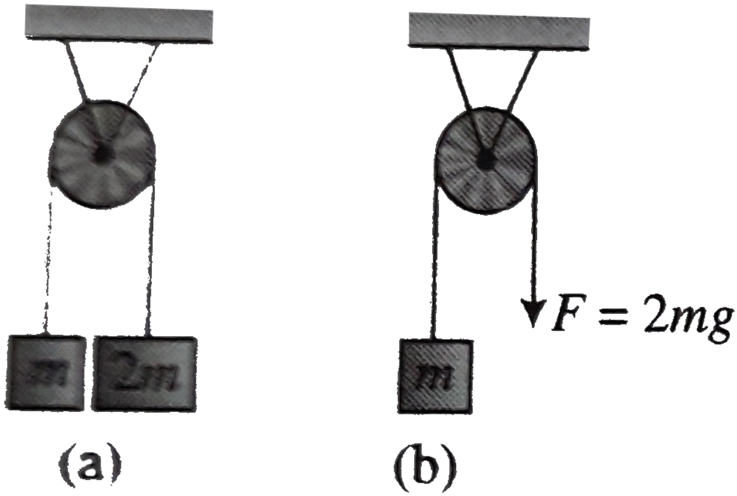
56. The pulley arrangement in Fig are identical .The mass of the rope is negligble in figure the mass m is lifted up by atteched a mass $2m$ to the other end of the rope . In (b), m is lifed up by pulley the other end of the rope with a constant force shown in the figure. Find the acceleration in in both cases



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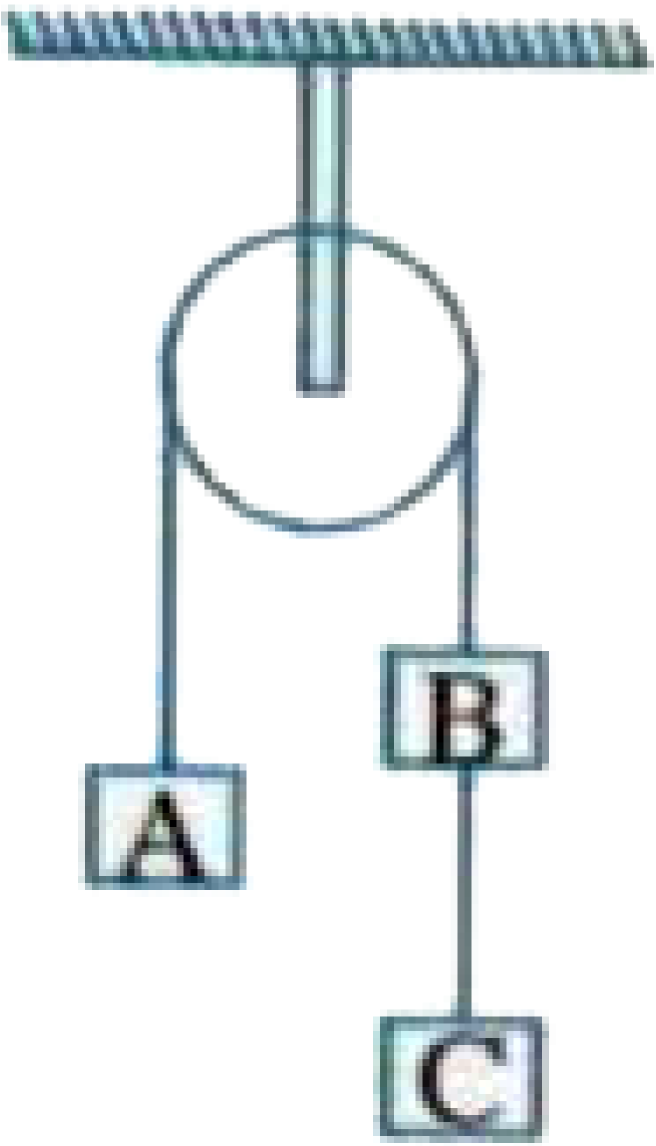
57. Figure shows three blocks of mass m each hanging on a string passing over a pulley. Calculate the tension in the string connecting

A to B and B to C?



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58. Two masses of 3 kg and 4 kg are connected at the two ends of a light inextensible string that passes over a frictionless pulley. Find the acceleration of the masses and the tension in the string, when the masses are released.

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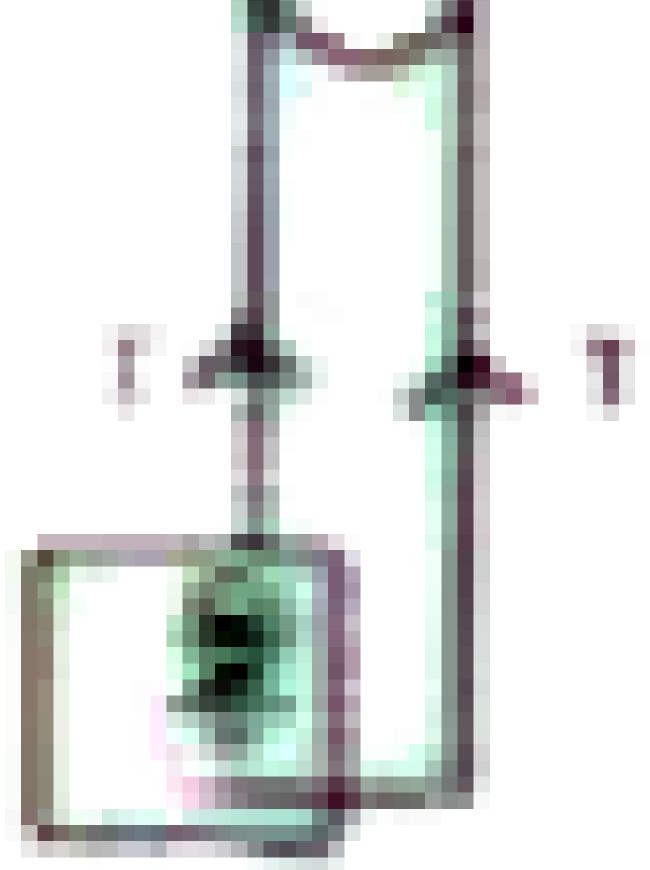
59. A man of mass 60 kg is standing on a weighing machine kept in a box of mass 30 kg as shown in the diagram, If the man manages to keep the box stationary find the reading of the weighing machine.



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60. In the above problem, what force should the man exert on the rope to get his correct weight on the machine?

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61. A monkey of mass m moving up on a massless string so as to just lift a block of mass M. After some time the monkey stops moving w.r.t the string. Find the magnitude of the change in the monkey's acceleration.

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62. A monkey of mass 40 kg climbs on a rope (Fig 5.20) which can stand a maximum tension of 600 N. In which of the following cases will the rope break : the monkey

climbs up with an acceleraiton of $6 ms^{-2}$

(b) climbs down with an acceleration of $4 ms^{-2}$

(c) climbs up with a uniform speed of $5 ms^{-2}$

(d) falls down the rope nearly freely under gravity ?

(Ignore the mass of the rope)

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63. Two weights w_1 and w_2 are suspended from the ends of a light string passing over a smooth fixed pulley. If the pulley is pulled up at an acceleration g , the tension in the string will be

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64. Two blocks of masses 2kg and 5kg are at rest on ground. The masses are connected by a string passing over a frictionless pulley which is under the influence of a constant upward force F = 50 N. Find the accelerations of 5kg and 2kg masses.

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65. A string of negligible mass passes over a pulley of mass m which is clamped. It supports a block of mass M at its lower free end. What is force exerted on pulley by the support ?

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66. In the arrangement shown , by what acceleration the boy must go up so that 100 kg block remains stationary on the wedge. The wedge is fixed and friction is absent everywhere . (Take $g = 10 ms^{-2}$)

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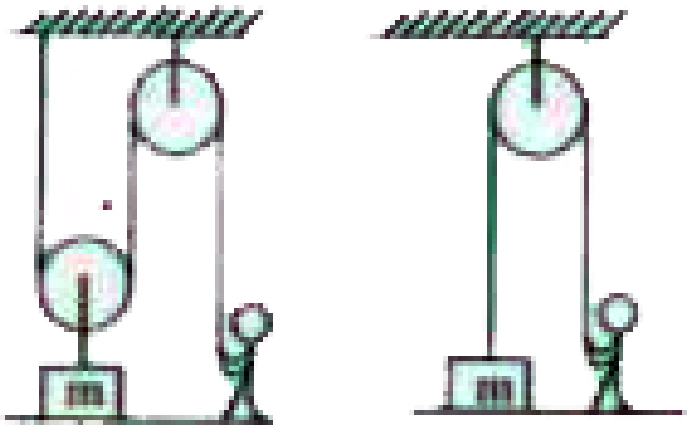
67. The block has to be raised to a height L in the same time t. In which case force required is more ?



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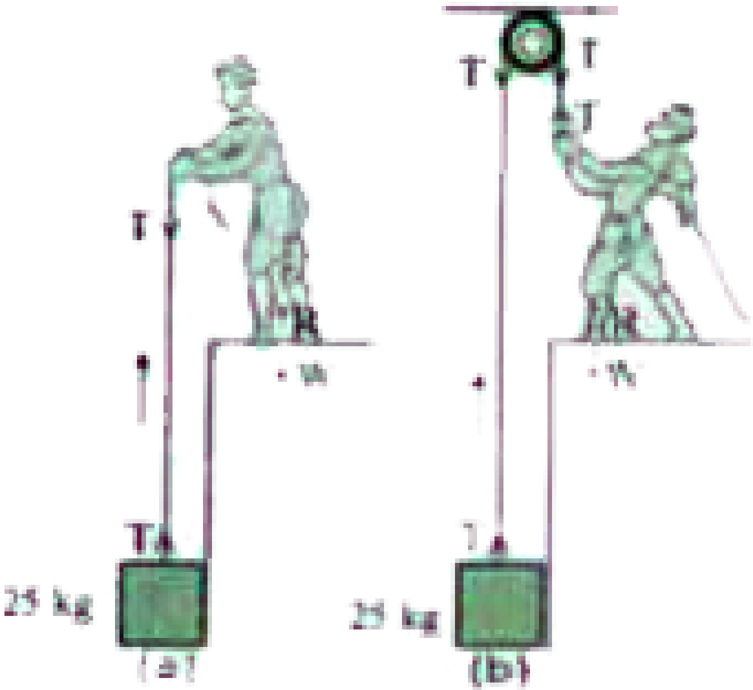
68. A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in figure. What is the action on the floor by the man in the two cases ? If the floor yields to a normal force of 700 N, which mode should the man adopt to lift the block without the floor yielding?



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69. A helicopter of mass 1000 kg rises with vertical acceleration of 15ms^{-1}. The crew and the passengers weigh 300 kg. Give the magnitude and direction of the

a) force on the floor by the crew and passengers

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

c) force on the helicopter due to the surrounding air

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70. A body of mass 60 kg is pushed up 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. What is the acceleration of the body ?

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71. A body of mass 10 kg lies on a rough horizontal surface. When a horizontal force of F newtons acts on it, it gets an acceleration of $5 \text{m}/\text{s}^2$. And when the horizontal force is doubled, it gets an acceleration of $18 \text{m}/\text{s}^2$. The coefficient of friction between the body and the horizontal surface is

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72. Two blocks A and B of masses 2kg and 3kg are connected by a light string as shown in the figure and placed on a horizontal surface. μ between all surfaces is 0.1 and g = 10ms^{-1}. The acceleration of the system is, when the force applied F = 45N

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73. A block of mass 4kg is placed on a rough horizontal force plane. A time dependent horizontal force $F = kt$ acts on the block. Here $k = 2\text{Ns}^{-1}$. The frictional force between the block and plane at time $t = 2\text{s}$ is $(\mu = 0.2)$ a) 4 N b) 8 N c) 12 N d) 10 N

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74. Two blocks A and B attached to each other by a massless spring or kept on a rough horizontal surface ($\mu = 0.1$) and pulled by a force of200N as shown in figure. If at some instant, the 10 kg mass has an acceleration of 12ms^{-2} . what is the acceleration of 20 kg mass (in ms^2).

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75. A block of mass M slides along the sides of bowl as shown in the figure. The walls of the bowl are frictionless and the base has coefficient of friction 0.1, and length 0.5m. The block is released from the point A which is 0.2 m high as shown in figure. Then the block comes to rest

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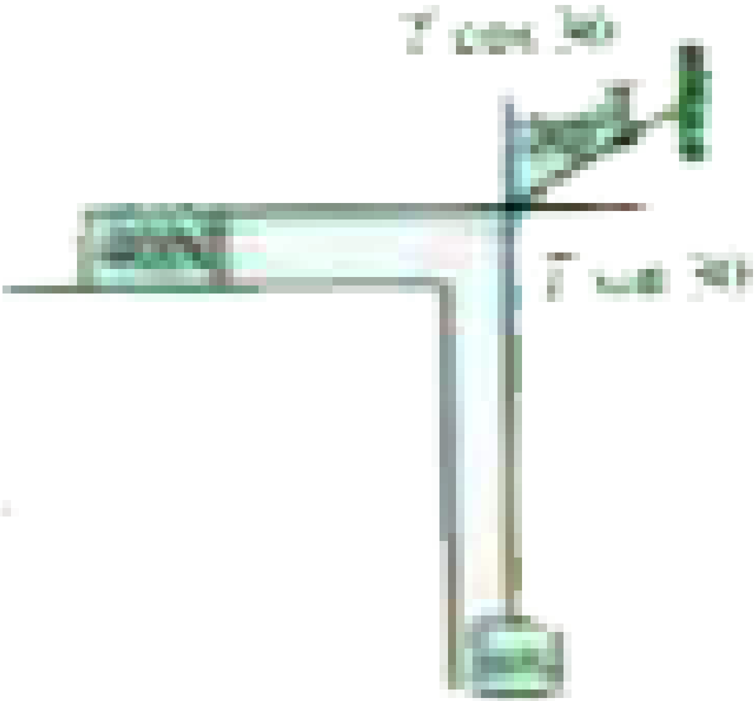
76. A block on table shown in figure is just on the wedge of slipping.

Find the coefficient of static friction between the block and table top.



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77. A horizontal converyor belt moves with a constant velocity V. A small block is projected with a velocity of 6 mis 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. $\mu = 0.3g, g = 10m/s^2$

Find V

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78. When a car of 3mass 1000 kg is moving with a velocity 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 kinetic friction between the road and tyres of the car is 0.75 ?

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79. The rear side of a truck is open and a box of mass 40kg is placed 5m away from the open end. The coefficient of friction between the

box and the surface below it is 0.15. The truck starts from rest with an acceleration of 2ms^{-2} on a straight road. At what distance from the starting points does not the box fall off the truck?

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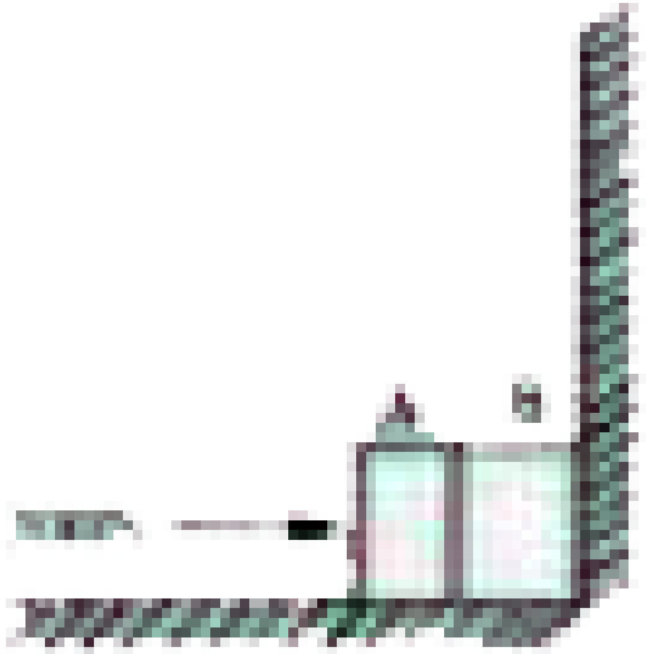
80. Two bodies A and B of masses 5 kg and 10 kg in contact with each other rest on a table against a rigid wall as shown in fig. The coefficient of friction between the bodies and the table is 0.15. A force 200 N is applied horizontally to A. What are

(a) the reaction of the partition

(b) the action-reaction forces between A and B ?

(c) What happens when the wall is removed? Does the answer to (b) change, when the bodies are in motion? Ignore the difference between μ_s and μ_k



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81. A car is driven round a curved path of radius 18 m without the danger of skidding. The coefficient 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 ? [$g = 10 \text{ms}^{-1}$]

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82. A disc revolves with a speed $33\frac{1}{3}$ rev/ min, and has a radius of 15 cm. Two coins A and B are placed at 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15, which of the coins will revolve with the record?

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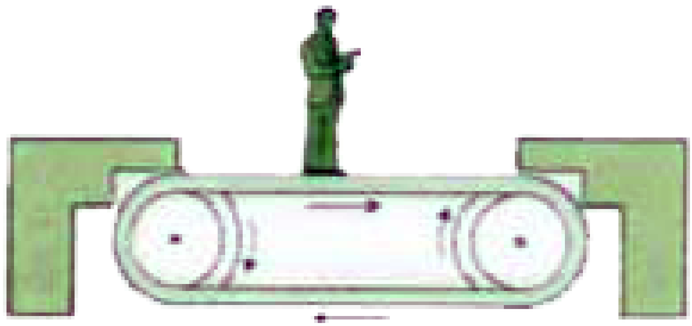
83. Figure shows a man standing stationary with respect to a horizontal conveyor belt that is accelerating with $l1ms^{-2}$. The net force on the man, if the coefficient of static friction between the man's shoes and the belt is 0.2, up to what acceleration of the belt can the man continue to be stationary relative to the belt



(mass of the man-65kg)

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84.

Block A is placed on block B, whose mass is greater than that of A. There is friction between the blocks, while the ground is smooth. A horizontal force P, increasing linearly with time, begins to act on A.

The accelerations a_1 and a_2 of A and B respectively are plotted against time (t). The correct graph is

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85. A 2kg block is placed over a 5kg block and both are placed on a smooth horizontal surface. The coefficient of friction between the blocks is 0.10. Find the acceleration of the two blocks if a horizontal force of 14N is applied to the upper block (g = $10ms^{-2}$).

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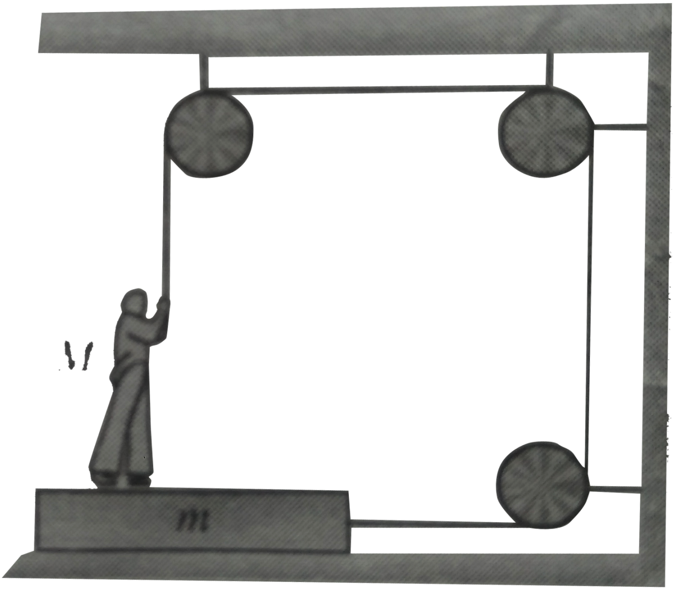
86. The friction coefficient between the board and the floor shown in figure is μ Find the maximum force that the man can exert on the rope so that the board does not slip on the floor



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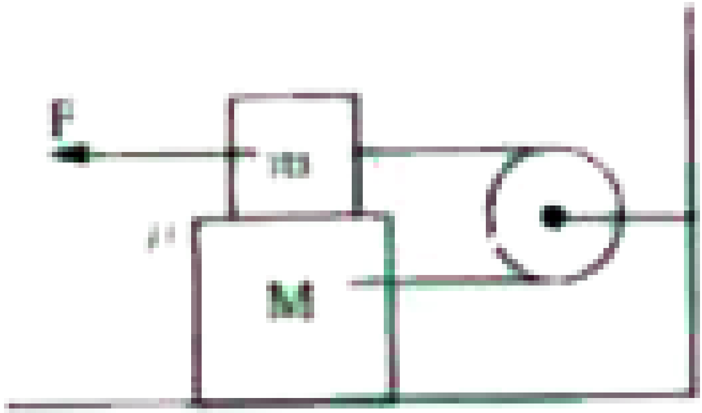
87. Two blocks of masses'm' and 'M' are arranged as shown in the figure. The coefficient of friction between the two blocks is ' μ ', where as between the lower block and the horizontal surface is zero. Find the force 'F' to be applied on the upper block, for the system to be under equilibrium ?



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88. A 70 kg man stands in contact against the wall of a cylindrical drum of radius 3 m rotating about its vertical axis with 200 rev/min. The coefficient of friction between the wall and his clothing is 0.15. What is the minimum rotational speed of the cylinder to enable the man to remain stuck to the wall (without falling) when the floor is suddenly removed ?

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89. A person (40 kg) is managing to be at rest between two verticle walls by pressing one wall A by his hands and feet and the other wall B by his back figure. Assume that the friction coefficient between his body and the walls is 0.8 and that limiting friction acts at all the contacts. (a). show that the person pushes the two walls with equal force. (b). find the normal force exerted by either wall on the person Take $g = 10\frac{m}{s^2}$.

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

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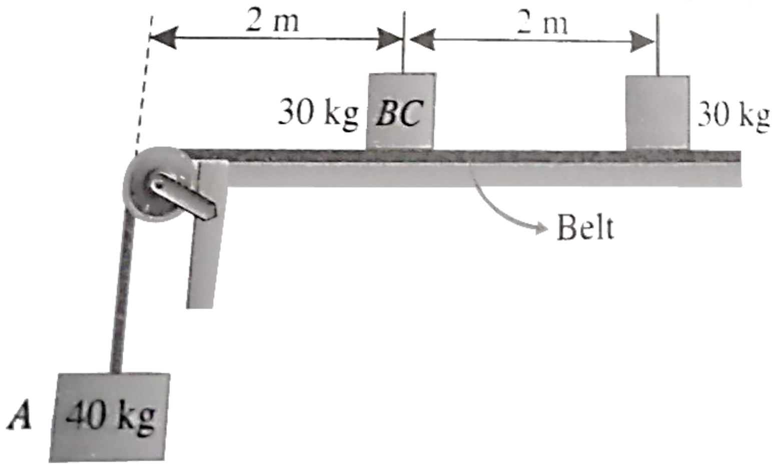

91.

Two 30 kg blocks rest on a massless belt which passes over a fixed pulley and is attached to a 40 kg block. If coefficient of friction between the belt and the table as well as between the belt and the blocks B and C is μ and the system is released from rest from the position shown, the speed with which the block B falls off the belt is

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

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93. A block is placed on a rough inclined plane of inclination $\theta = 30^{\circ}$. If the force to drag it along the plane is to be smaller than to lift it. The coefficient of friction μ should be less than

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94. A $10\sqrt{3}$ kg box has to move up an inclined slope of 60° to the horizontal at a uniform velocity of 5 ms^{-1} If the frictional force retarding the motion is 150N, the minimum force applied parallel to inclined plane to move up is (g=10 ms^{-2})

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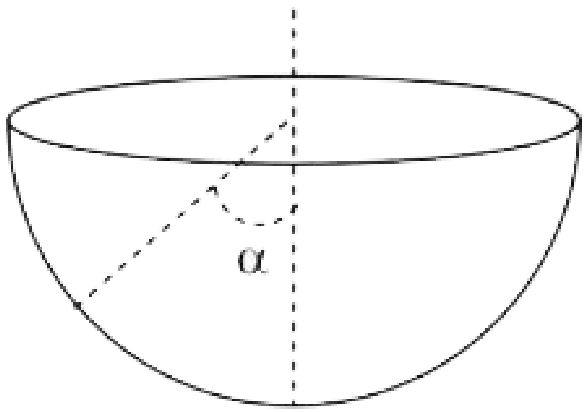
95. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of is given by:



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96. A rough inclined plane is inclined at 30° to the horizontal as shown in the figure. A uniform chain of length L is partly on the inclined plane and partly hanging from the top of the incline. If the coefficient offriction between chain and inclined plane is μ, the maximum length of the lianging part to prevent the chain from falling vertically is:

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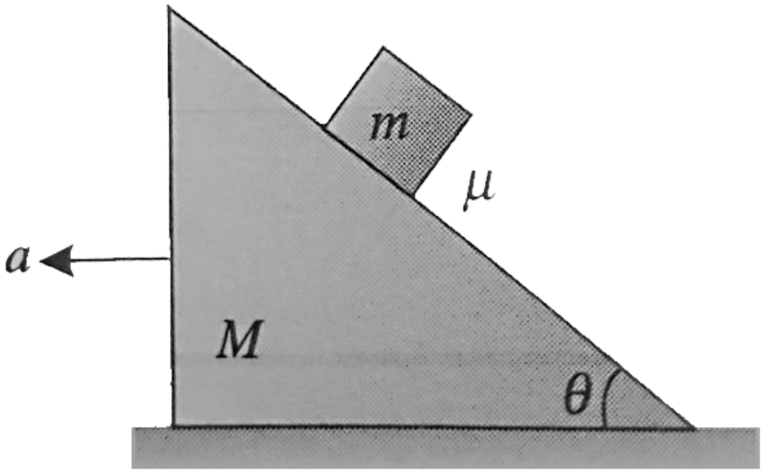

97.

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

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98. One end of a massless spring of spring constant 100 N/m and natural length 0.5 m is fixed and the other end is connected to a particle of mass 0.5 kg lying on as frictionless horizontal table. The spring remains horizontal. If the mass is made to rotate at an angular velocity of 2 rad/s, find the elongation of the spring.

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99. A ball of200 g is at one end of a string of length 20 cm. It is revolved in a horizontal circle at an angular frequency of 6 rpm. Find (i) the angular velocity, (ii) the linear velocity, (Hi) the centripetal acceleration,

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100. In the Fig, shown below with what angular speed ' ω ' must 'm' with a radius 'r' rotate on a frictionless table so that' M' does not move ? (b) If m = 1.0 kg, M = 10.0 kg and r = 0.5 m, find ω

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101. A stone of mass 2.0 kg is tied to the end of a string of 2m length. It is whirled in a horizontal circle. If the breaking tension of the string is 400 N, calculate the maximum velocity of the stone.

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102. A stone tied to the end of a string is whirled in a horizontal circle. The mass of the stone is 1.0 kg and the string is 0.50 m long. If the stone revolves at a constant speed for 10 times in 15.71 s, (a) what is the tension in the string? (b) What would happen to the tension in the string if the mass was doubled and all the other quantities remained the same? (c) What would happen to the tension in the string if the period was doubled and all the other quantities remain the same?

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103. A particle is projected from a horizontal floor with speed $10\frac{\text{m}}{\text{s}}$ at an angle 30° with the floor and striking the floor after sometime. State which is correct.

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104. The value of g at depth h is two third the value that on the earth's surface. The value of h in terms of radius of earth R is

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105. A circular racetrack of radius 300 m is banked at an angle of 15° The coefficient of friction between the wheels of a race car and the road is 0.2. The optimum speed of the race car to avoid wear and tear on its tyres is

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EXERCISE-1A (CHANGE IN MOMENTUM, IMPULSE & FORCES)

1. To keep a particle moving with constant velocity on a frictionless horizontal surface an external force

A. Should act continuously

B. Should be a variable force

C. Should not act

D. Should act opposite to the direction of motion

Answer: C

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2. Four particles of masses m,2m , 3m and 4m are kept in sequence at the corners of a square of side a. The magnitude of gravitational force acting on a particle of mass m placed at the centre of the square sill be:

A. Can change the velocity the system

B. Cannot change the velocity the system

C. Can change the acceleration of the system

D. Can change the direction of motion

Answer: B

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3. A train is moving with acceleration along a straight line with respect to ground. A person in the train finds that

A. Newton's 2nd law is false but newtons 3rd law is true

B. Newton's 3rd law is false but newtons 2nd law is true

C. All the three newtons laws are false but can apply 2nd law by considering a pseudo force

D. All the three Newton's laws are true

Answer: C

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4. The area under force time curve gives

A. work

B. power

C. displacement

D. impluse

Answer: D

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5. A force P acts on a particle so as to accelerate it from rest to certain velocity. If P is replaced then by Q which decelerates it to rest.

A. P must be equal to Q

B. P may be equal to Q

C. P must be unequal to Q

D. $P \leq Q$

Answer: D

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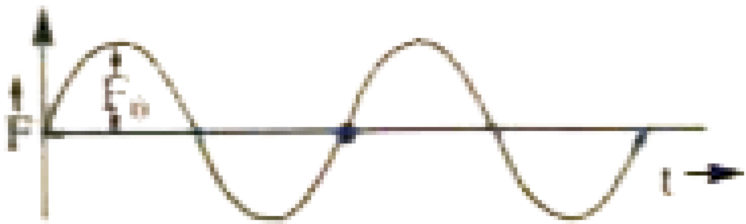
6. A force F varies with time in accordance with the following figure.

The mean force for one cycle:



A. F_0

B. $F_0/2$

C. $2F_0$

D. Zero

Answer: D

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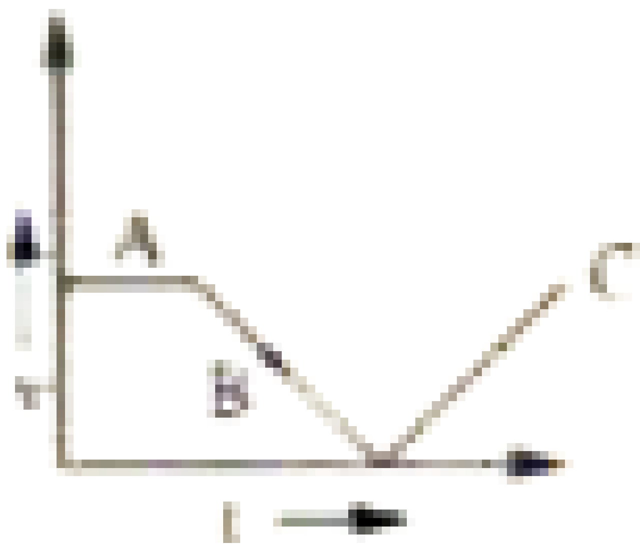
7. Graph of a body is shown. It explains that



A. at B force is zero

B. at B there is a force but towards motion

C. at B there is a force which opposes motion

D. at B the force may be in any direction

Answer: C

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8. 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

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9. A fat hose pipe is held horizontally by a fireman. It delivers water through a constricting nozzle at 1 litre/sec. If by increasing the pressure, the water is delivered at 2 litre/sec, the fireman now has to

A. push forward twice as hard

B. push forward four times as hard

C. push forward eight times as hard

D. push backward four times as hard

Answer: B

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10. Two trains A and B are running in the same directions on parallel tracks such that A is faster than B, packets of equal weight are exchanged between them. Then

A. A will be retarded and B will be accelerated

B. B will be retarded and A will be accelerated

C. There will no change in A but B will be retarded

D. There will no change in motion of A and B

Answer: A

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11. A man is standing at a spring platform. Reading of spring balance is 60kg. If man jumps outside platform. Then reading of spring balance:-

A. first increase and then decreases to zero

B. decreases

C. increases

D. remains same

Answer: A

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12. There are three Newton's laws of motion namely first, second and third laws. 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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13. An object is thrown vertically upward with a nonzero 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 freely

Answer: B

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14. Which law of Newton is called the law of equilibrium?

A. Newton's first law of motion

B. Newton's second law of motion

C. Newton's third law of motion

D. Newton's law of gravitation

Answer: A

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

A. may be a contact force

B. must be gravitational too

C. may be a gravitational or contact force

D. may be a force of any origin

Answer: B

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16. A father and his seven year 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 accelerations 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

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17. 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

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18. A car accelerates on a horizontal road due to the force exerted by

A. the driver of the car

B. the engine of the car

C. the earth

D. the road

Answer: D

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19. Measure of inertia in translatory motion is

A. mass

B. momentum

C. impulse

D. force

Answer: A

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20. Newton's 2nd law is a local law. It means

i) It is not applicable in non-local area

ii) $\vec{F}$ at certain instant determines $\vec{a}$ at the same point at that instant

iii) $\vec{a}$ at an instant doesnot depend on the history of motion

A. only (i) is true

B. only (i) and (ii) are true

C. only (ii) and (iii) are true

D. only (i) and (iii) are true

Answer: C

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21. In Which of the following cases the net force acting on the body is not zero ?

A. A drop of rain falling down with a constant speed

B. A cork of mass 10 g floating on the surface of water

C. A car moving with a constant speed of 20 km h^{-1} on a rough road

D. A pebble of mass 0.05 kg is thrown vertically upwards

Answer: D

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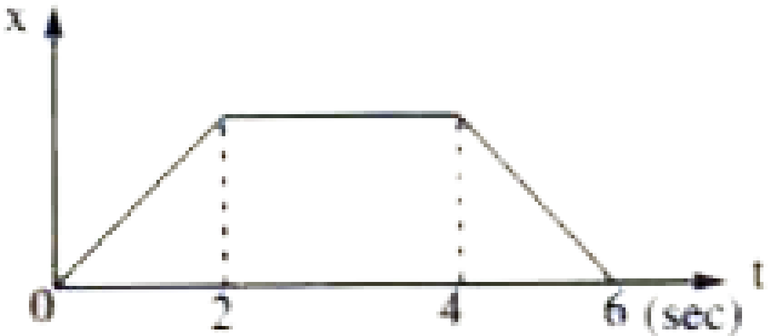
22. The position - time graph for a particle is shown in fig. Then in the time interval of (0, 6sec)



A. Particle receives two identical impulses

B. Particle receives two impulses in same direction, but of different magnitudes

C. Particle receives two impulses of same magnitude and opposite in directions.

D. Particle receives two impulses of different magnitudes and in opposite directions

Answer: A

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23. A boy holds a rubber ball in his hand. The reaction force of gravity on the ball is the force exerted by the

A. Ball on the hand

B. Hand on the ball

C. Earth on the ball

D. Ball on the earth

Answer: D

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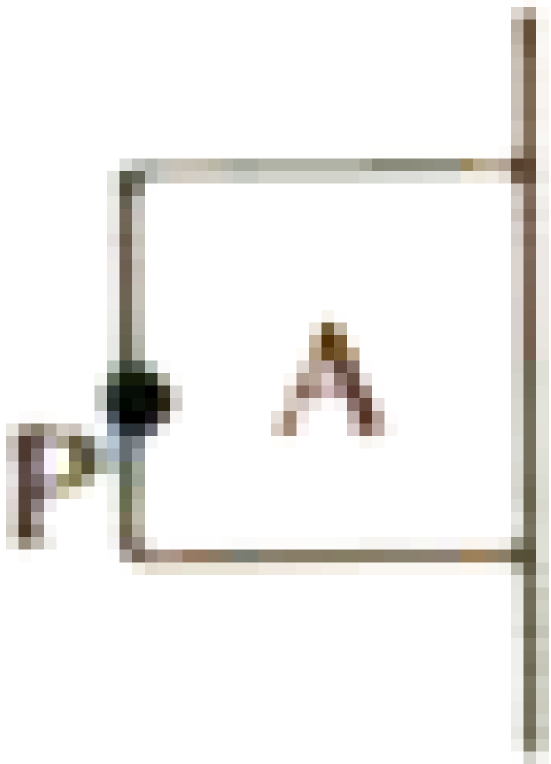
24. A block A is held at rest against a smooth wall by application of force at p. The direction of force at P. the direction of force to be applied at P.



A. 

B. 

C. 

D. 

Answer: C

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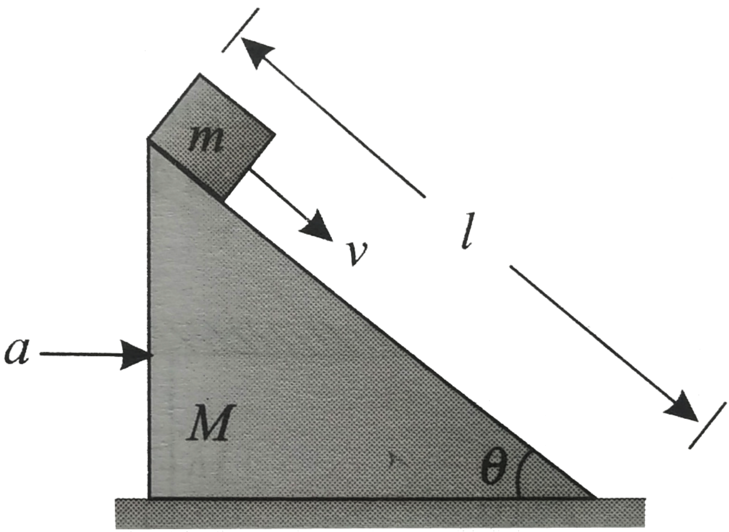

25.

A smooth wedge of mass M is pushed with an acceleration

$a =\ > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

`The horizontal force applied on the wedge is:

A. MV

B. 1.5MV

C. 2 MV

D. zero

Answer: C

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EXERCISE-1A (LAW OF CONERVATION OF LINEAR MOMENTUM)

1. Chemical reactions are invariably associated with the transfter of energy either in the form of heat or light. In the laboratory, heat changes in physical and chemical processes are measured with an instrument called calorimeter. Heat change in the process is calculated as

$q = ms\Delta T$ $\quad$ s = Specific heat

$= c\Delta T$ $\quad$ c = Heat capacity

Heat of reaction at constant volume is measured using bomb calorimeter.

$q_V = \Delta U =$ Internal energy change

Heat of reaction at constant pressure is measured using simple or water calorimeter.

$q_p = \Delta H$

$q_p = q_V + P\Delta V$

$\Delta H = \Delta U + \Delta nRT$

The heat capacity of a bomb calorimeter is $500 JK^{-1}$. When $0.1 g$ of methane was burnt in this calorimeter, the temperature rose by $2^\circ C$. The value of ΔU per mole will be

A. the linear momentum but not the kinetic energy

B. the kinetic energy but not the linear momentum

C. linear momentum as well as kinetic energy

D. neither the linear momentum nor the kinetic energy.

Answer: B

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2. A nucleus moving with velocity $\overline{v}$ emits an α-particle. Let the velocities of the α-particle and the remaining nucleus be $\overline{v}_1$ and $\overline{v}_2$ and their masses be m_1 and (m_2) then,

A. $\vec{v}$, $\vec{v}_1$ and $\vec{v}_2$ must be parallel to each other.

B. None of the two of $\vec{v}$, $\vec{v}_1$ and $\vec{v}_2$ should be parallel to each other

C. $\vec{v}_1 + \vec{v}_2$ must be parallel to $\vec{v}$

D. $m_1 \vec{v}_1 + m_2 \vec{v}_2$ must be parallel to $\vec{v}$

Answer: D

Watch Video Solution

3. An object is projected vertically up from the earth's surface with velocity $\sqrt{Rg}$ where R is the radius of the earth and 'g' is the acceleration due to earth on the surface of earth. The maximum height reached by the object is nR. Find value of n.

A. it is a violation of law of conservation of linear momentum

B. momentum of the body alone gets conserved

C. momentum of the body, earth and air molecules together remains constant

D. violates law of conservation of energy

Answer: C

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4. STATEMENT-1 : Two bodies of mass M and $2M$ released from rest and they move towards each other due to their mutual gravitational force of attraction and collide at mid point.

STATEMENT-2 : If the total mechanical energy of a body is zero than its linear momentum is necessarily non zero at any point other than reference point.

STATEMENT-3 : The linear momentum of the bob of a simple pendulum suspended by the roof of a car accelerating on a horizontal road increases due to tension in the string of the pendulum.

A. Newtons' first law of motion

B. Newton's second law of motion

C. Newton's third law of motion

D. Newton's law of gravitation

Answer: C

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5. 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: C

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6. A copper rod of mass m rests on two horizontal rails distance L apart and carries a current of I from one rail to the other. The coefficient of static friction between rod and rails is μ_s What are the (a) magnitude and (b) angle (relative to the vertical) of the smallest magnetic field that puts the rod on the verge of sliding?

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 the ground in that direction

Answer: B

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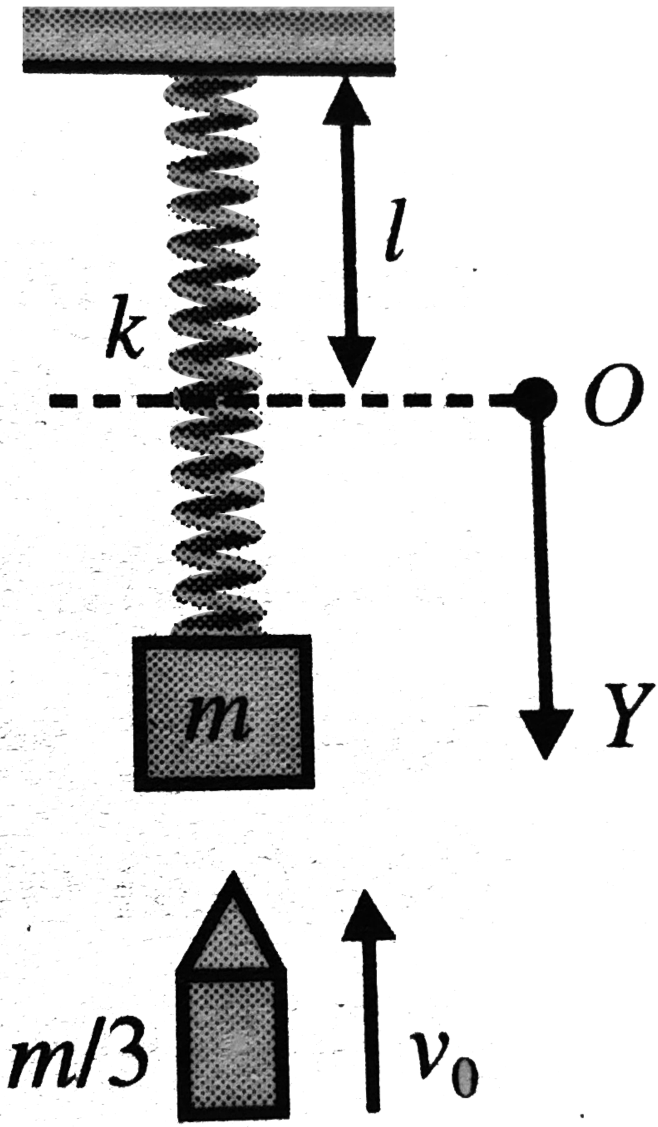
EXERCISE-1A (APPARENT WEIGHT, TENSION, NORMAL REACTION)



1.

A block of mass m is suspended from one end of a light spring as shown. The origin O is considered at distance equal to natural length of the spring from the ceiling and vertical downwards direction as

positive y-axis. When the system is in equilibrium a bullet of mass $\frac{m}{3}$ moving in vertical up wards direction with velocity v_0 strikes the block and embeds into it. As a result, the block (with bullet embedded into it) moves up and start oscillating. Based on the given information, answer the following question:

Q. The time taken by the block bullet system to move from $y = \frac{mg}{k}$ (initial equilibrium position) to $y = 0$ (natural length of spring) is (A represents the amplitude of motion)

A. W

B. 2W

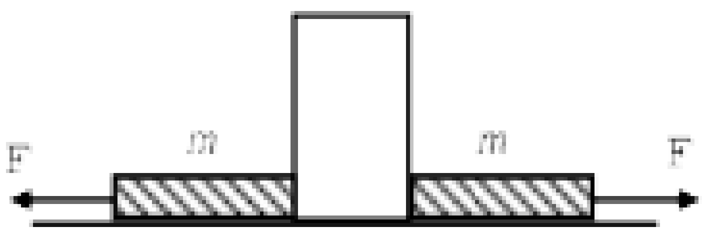
C. W/2

D. infinitely large

Answer: D

Watch Video Solution

2. Figure shows a heavy block kept on a frictionless surface and being pulled by two ropes of equal mass m. At t = 0, the force on the left rope is withdrawn but the force on the right end continues to act. Let F_1 and F_2 Figure shows a heavy block kept on a frictionless surface and being pulled by two ropes of equal mass m. At t = 0, the force on the left rope is withdrawn but the force on the right end continues to act. Let F1 and F2 be the magnitudes of the forces by the right rope and the left rope on the block respectively. Choose correct options.



A. $F_1 = F_2 = F$ for $t < 0$

B. $F_1 = F_2 = F + mg$ for $t < 0$

C. $F_1 = F . F_2 < F$ for $t < 0$

D. $F_1 < F , F_2 = F$ for $t < 0$

Answer: A

Watch Video Solution

3. A body of weight w_1 is suspended from the ceiling of a room through as chain of weight w_2. The ceiling pulls the chain by a force

A. w_1

B. w_2

C. $w_1 + w_2$

D. $\frac{w_1 + w_2}{2}$

Answer: C

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

A. zero

B. g

C. less than g

D. greater than g

Answer: B

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5. A block of mass m can slide on a smooth inclined plane of inclination θ kept on the floor of a lift . When the lift is descending with retardation a,

A. $a - g \sin \theta$

B. g-a

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

D. $(g + a)\sin \theta$

Answer: D

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6. An elevator is moving vertically upward with an acceleration of g . The force exerted on the floor by the passenger of mass m will be

A. Ma

B. Mg

C. M(g-a)

D. M(g+a)

Answer: D

Watch Video Solution

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

A. more weight

B. less weight

C. normal weight

D. zero weight

Answer: B

Watch Video Solution

8. If the tension in the cable supporting an elevator is equal to the weight of the elevator, the elevator may be

A. a, b are true

B. b, c are true

C. c, d are true

D. a, c are true

Answer: C

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EXERCISE-1A (PSEUDO FORCE)

1. A relerence frame atteched to the Earth

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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2. You are waiting for a train on a railway platform. Your three year old niece is standin on your iron trunk containing the luggage. Why does the trunk not recoil as she jumps off on the platform?

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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3. A rotating platform for a stationary observer outside, it is

A. inertial frame of reference

B. non inertial frame of reference

C. both

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

Answer: B

Watch Video Solution

4. Frames moving uniformly with respect to an inertial frame are

A. inertial frames

B. non inertial frames

C. both

D. accelerated

Answer: A

Watch Video Solution

5. If particle stays at rest as seen from a frame of reference

A. the frame may be inertial and a resultant force acts on it.

B. the frame may be non inertial and $F_{real} = -F_{pseudo}$

C. the frame may be non inertial but a resultant force acts on it

D. the frame must always be inertial

Answer: B

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6. The acceleration of a particle is found to be non zero while 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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7. A particle is observed from two frames S_1 and S_2. .the frame S_2 moves with respect toS_1 with an acceleration a. Let F_1 and F_2 be the pseudo forces on the particle when seen from S_1 and S_2 respectively. Which of the following are not possible.

A. $F_1 = 0, F_2 \neq 0$

B. $F_1 \neq 0, F_2 = 0$

C. $F_1 \neq 0, F_2 \neq 0$

D. $F_1 = 0, F_2 = 0$

Answer: D

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8. A particle is found to be at rest when seen from a frame S_1 and moving with a constant velocity when seen from another frame S_2

a) Both the frames are inertial

b) Both the frames are non inertial

c) S_1 is inertial and S_2 is non inertial

d) S_1 is non inertial and S_2 is inertial

A. a, b are true

B. c, d are true

C. b, c are true

D. a, d are true

Answer: A

Watch Video Solution

9. A ball hangs from a string inside a rail road car moving along a straight track. The string is observed to be inclined towards the rear of the car making a constant small angle with the vertical. It shows that the car is

A. moving with a uniform acceleration

B. moving with a uniform velocity

C. moving with a uniform retardation

D. moving with an acceleration which is increasing uniformly

Answer: A

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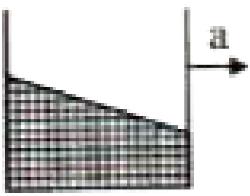
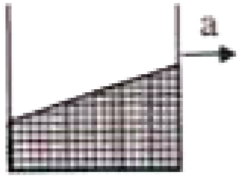
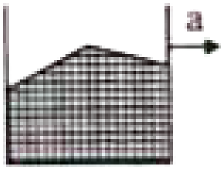
10. A vessel containing water is given a constant acceleration a towards the right,a straight horizontal path. Which of the following diagram represents the surface of the liquid.

A. 

B. 

C. 

D. 

Answer: A

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11. A satellite in force free space sweeps stationary interplanetary dust at a rate $\frac{dm}{dt} = \alpha v$ where m is mass , V is the velocity of the satellite and α is a constant . What is the decelration of the satellite .

A. $-av^2$

B. $-av^2/2M$

C. $-av^2/M$

D. $-2av^2/M$

Answer: C

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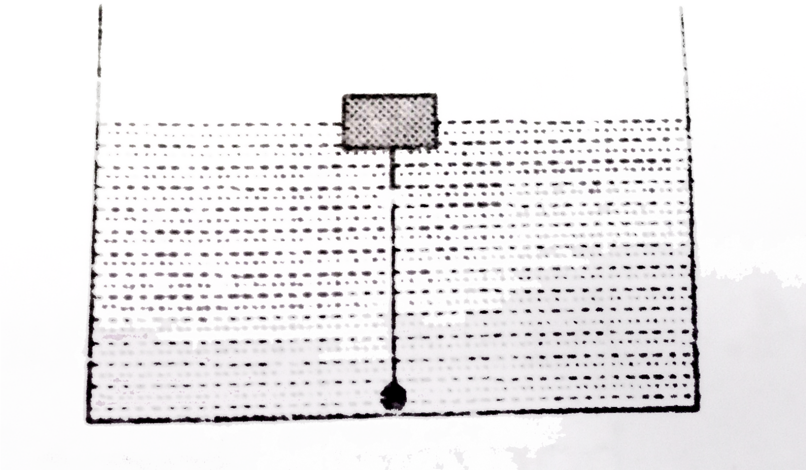
12. A cork and a metal bob are connected by a string as shown in the figure. If the beaker is given an acceleration towards left then the cork will be thrown towords:-



A. right

B. left

C. upwards

D. downwards

Answer: B

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

A. m

B. 1/m

C. $\sqrt{m}$

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

Answer: D

Watch Video Solution

14. 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. $\dfrac{1}{\sqrt{m}}$

Answer: B

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15. 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 sneezing

C. by rolling your body on the surface

D. by running on the plane

Answer: B

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16. To keep a particle moving with constant velocity on a frictionless horizontal surface an external force

A. should act continuously

B. should be a variable force

C. is not necessary

D. should act opposite to the direction of motion

Answer: C

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EXERCISE-1A (FRICTION)

1. A : Work done by the frictional force can't be positive.

R : Frictional force is a conservative force.

A. All statements are true

B. Only B and C are true

C. Only C is true

D. Only B is true

Answer: C

Watch Video Solution

2. A good lubricant should be highly

A. Viscous

B. Nonvolatile

C. Both

D. None

Answer: C

Watch Video Solution

3. An object is moving on a plane surface uniform velocity 10ms^{-1} in presence of a froce 10 N. The frictional force between the object and the surface is

A. twice that of B

B. half that of B

C. same that of B

D. depends on the power supplied

Answer: C

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4. Theoretically which of the following are best lubricants

A. solids

B. liquids

C. gases

D. all have same lubricating capacity

Answer: C

Watch Video Solution

5. A block of mass'm' is resting on the floor of a lift. The coefficient of friction between the block and the floor is μ. When the lift is falling freely, the limiting frictional force between block and surface is

A. μ mg

B. $\frac{\mu mg}{s}$

C. mg

D. zero

Answer: D

Watch Video Solution

6. When a moving body is suddenly stopped a long time after coming to rest

A. frictional force increases

B. roughness is found on the road

C. tyres of the vehicles burst

D. the frictional force reduces to zero as it is a self adjusting force

Answer: D

Watch Video Solution

7. 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' is pulled to the right, (If P is less than frictional force between A and B)

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

Watch Video Solution

8. Sand is dusted on the railway tracks during rainy season to

A. make it always wet

B. increase friction

C. to reduce consumption of fuel

D. none

Answer: B

Watch Video Solution

9. Which of the following are correct for rolling friction

A. The extent of deformation of the surfaces in content

B. It is lesser than kinetic and limiting friction

C. It is inversely proportional to the radius of the rolling body.

D. All the above

Answer: D

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10. If an external force and the frictional force acting on a body cancel each other and keep the body at rest, the frictional force is

A. Rolling friction

B. Sliding friction

C. Static friction

D. None

Answer: C

Watch Video Solution

11. Which of the following statements is not true ?

A. Coefficient of friction may be greater than unity.

B. Coefficient of rolling friction is less than that of kinetic friction.

C. The frictional force is independent of the speed of the body.

D. The frictional force is inversely proportional to the normal reaction.

Answer: D

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12. When normal reaction is halved the coefficient of friction is

A. halved

B. unchanged

C. doubled

D. none

Answer: B

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13. If μ_s, μ_k and μ_r are the coefficients of static, kinetic and rolling friction respectively then

A. $\mu_s > \mu_k < \mu_r$

B. $\mu_s < \mu_k > \mu_r$

C. $\mu_s > \mu_k > \mu_r$

D. $\mu_s = \mu_k = \mu_r$

Answer: C

Watch Video Solution

14. With increase of temperature, the frictional force acting between two surfaces

A. increases

B. decreases

C. remains same

D. none of the above

Answer: B

Watch Video Solution

15. If we imagine two ideally smooth surfaces & if they are kept in contact, the frictional force acting between them is,

A. zero

B. a small finite value but not zero

C. very high

D. we can't predict

Answer: C

Watch Video Solution

16. Two bodies of different masses are dropped simultaneously from the top of a tower. If air resistance is same on both of them,

A. lighter body reaches the ground earlier

B. heavier body reaches the ground earlier

C. both reach the ground at the same time

D. any of the above

Answer: A

Watch Video Solution

17. Maximum force of friction is called

A. Angle of repose

B. Angle of friction

C. Critical angle

D. None of the above

Answer: B

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18. A block of mass M is being pulley along horizontal surface .The coefficient of friction the block and the surface is μ If another block of mass $M/2$ is placed on the block and it is pulled is again pulled on the surface , the coefficient of friction the block and the surface will be

A. μ

B. $3\mu/2$

C. $\mu/2$

D. 2μ

Answer: A

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19. A cycle is fitted with small brakes and another is fitted with very big brakes. The one which is more effective is

A. Small brakes

B. Big brakes

C. Both are equally effective

D. None

Answer: C

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20. The coefficient of static friction may be

A. less than 1

B. greater than 1

C. equal to 1

D. all

Answer: D

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21. If μ, R and S represent coefficient of friction, normal reaction and distance moved, then the general expression for work against friction

A. μ RS

B. $\mu + R/S$

C. $\mu R/S$

D. $\mu S / R$

Answer: A

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22. Two masses m_1 and $m_2 (m_1 > m_2)$ are falling from the same height when same air resistance acts on them

A. m_1 has more acceleration

B. m_1 reaches the ground early

C. m_1 has more velocity on striking the ground

D. all the above

Answer: D

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23. Which of the following is correct

A. Using ball bearings, sliding friction changes to rolling friction

B. Lubricants decrease friction since inter molecular forces are weak in liquids.

C. Over polishing increases friction since surface adhesion increases

D. All of the above

Answer: D

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24. Explain why a high pressure tyre roll more easily than a low pressure tyre ?

A. Friction is less in high inflated tyre

B. Friction is more in high inflated tyre

C. Friction is zero in high pressure type

D. None

Answer: A

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25. The limiting friction between two bodies in contact is independent of

A. Nature of surfaces in contact

B. The area of surfaces in contact

C. Normal reaction between the surfaces

D. All the above

Answer: B

Watch Video Solution

26. If the normal force is doubled and limiting frictional force is maintained at the same value, the coefficient of friction

A. remains uncharged

B. becomes halved

C. gets doubled

D. gets quadrupled

Answer: B

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27. Lubrication reduces friction because

A. Lubricant molecules act as ball bearings

B. Laws of limiting friction are not applicable

C. The relative motion in between solid and liquid

D. Both 1 and 3

Answer: D

Watch Video Solution

28. 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' is pulled to the right, (If P is less than frictional force between A and B)

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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29. Frictional force between two bodies

A. Adds the motion between the bodies

B. Destroys the 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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30. If man is walking, direction of friction is

A. Opposite to 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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31. While walking on ice, one should take small steps to avoid sliping. This is because smaller steps ensure

A. larger friction

B. smaller friction

C. larger normal force

D. Both 1 & 3

Answer: D

Watch Video Solution

32. Car tyres are made of rubber and not of iron because

A. Rubber is cheaper than iron

B. Iron tyres produce noise

C. Rubber can give circular shape easily than iron

D. Friction between rubber & concrete is less than that between iron & concrete.

Answer: D

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33. Cars and aeroplanes are streamlined. Why?

A. fluid friction

B. sliding friction

C. kinetic friction

D. limiting friction

Answer: A

Watch Video Solution

34. A uniform rope of length l lies on a table . If the coefficient of friction is μ , then the maximum length l_1 of the part of this rope which can overhang from the edge of the table without sliding down is :

$\frac{1}{\mu}$

$\frac{l}{\mu + 1}$

$\frac{\mu l}{1 + \mu}$

$\frac{\mu l}{1 - \mu}$

A. L / μ

B. $L / \mu + 1$

C. $\dfrac{\mu}{\mu + 1}$

D. $\dfrac{\mu L}{\mu + 1}$

Answer: C

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35. The coordinates of a particle moving in a plane are given by x (t) = a cos (pt) and y (t) = b sin (pt), where a, b ($<$ a), and p are positive constants of appropriate dimensions. Then:

A. $a = g, a = g / \mu$

B. $a = 0, a = 0$

C. $a = g / \mu, a = \mu g$

D. none

Answer: B

Watch Video Solution

36. A body is moving in a circular orbit. It is just about to slide to the outer side and $\mu mg = \frac{mv^2}{l}$. In this expression, μ represents

A. Coefficient of static friction

B. Coefficient of kinetic friction

C. Coefficient of rolling friction

D. None

Answer: A

Watch Video Solution

37. A body is just supported at the face of a cart moving at an acceleration. The acceleration of the cart so that the body does not slide

A. Independent of mass of the body

B. Inversely proportional to coefficient of friction

C. 1&2

D. None

Answer: C

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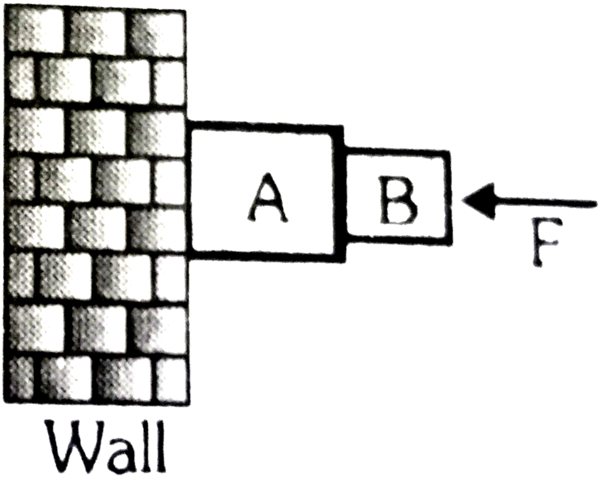
38. Adjoining figure shows two blocks A and B pushed against the wall with the force F. The wall is smooth but the surfaces in contact of A and B are rough. Which of the following is true for the system of bloods to be at rest against the wall:



A. F should be more than the weight of P & Q

B. F should be equal to the weight of P & Q

C. F should be less then the weight of P & Q

D. The system cannot be in equilibrium

Answer: D

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39. A block of mass 10 kg is in contact with a cart. If the coefficient of static friction is $\mu = 0.5$, then the minimum acceleration of cart, that will prevent falling of block , is

A. $a > \frac{mg}{\mu}$

B. $a > \frac{g}{\mu m}$

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

D. $\alpha < \frac{g}{\mu}$

Answer: C

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40. A wooden block sliding down from the top of a smooth inclined plane starting from rest takes t_1, seconds to reach the bottom of the plane and attains velocity V_1. Another block of twice the mass falling freely from the same height takes t_2 sec. to reach the bottom of the plane and attains V_2. If angle of inclination of the plane is 30°.

A. $v_1 = v_2$ & $t_1 = t_2$

B. $v_1 = v_2$ &$t_1 = 2t_2$

C. $v_1 > v_2$ & $t_1 > t_2$

D. $v_1 = v_2$ & $t_2 = 2t_1$

Answer: B

Watch Video Solution

41. 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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42. When the angle of inclination of on inclined plane is θ, an object slides down with uniform velocity. If the same object is pushed up with an initial velocity u on the same inclined plane, it goes up the plane and stops at a certain distance on the plane. There after the body.

A. Slides down the inclined plane and reaches the ground. With velocity "u"

B. Slides down the inclined plane and reaches the ground with velocity less than "u"

C. Slides down the inclined plane and reaches the ground with velocity greater than "u"

D. Stays at rest on the inclined plane and will not side down.

Answer: D

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43. In a situation the contact force by a rough horizontal surface on a body placed on it has constant magnitude. If the angle between this force and the vertical is decreased, the frictional force between the surface and the body will

A. increase

B. decrease

C. remain the same

D. may increase or decrease.

Answer: B

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44. A scooter starting from rest moves wilth as constant acceleration for a time $\triangle t_1$, then with a constant velocity for the next $\triangle t_2$ and finally with a constant deceleration for the next $\triangle t_3$ to come to rest with resect to the scooter wilthout touching any other part. The force exerted by the seat on the man is

A. 500N throughout the journey

B. less the 500 N throughout the journey

C. more than 500 N throughout the journey

D. $>$ 500 N for time Δt_1 , and Δt_3 and 500N for Δt_2

Answer: D

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45. A body of mass M is kept on a rough horizontal surface (friction coefficient `=μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the horizontal surface on the surface of the body is F, where

A. F= Mg

B. $F = \mu Mg$

C. $Mg \le F \le Mg\sqrt{1 + \mu^2}$

D. $Mg \ge F \ge Mg\sqrt{1 - \mu^2}$

Answer: C

Watch Video Solution

46. Two cars of unequal masses use similar tyres. If they are moving at the same initial speed, the minimum stopping distance

A. is smaller for the heavier car

B. is smaller for the lighter car

C. is same for both cars

D. depends on the volume of the car.

Answer: C

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47. 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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48. A boy of mass M is applying a horizontal force to slide a box of mass M on a rough horizontal surface. The floor is μ and the between the box and the floor is μ'. In which of the following cases it is certainly not possible to slide the box?

A. $\mu < \mu, M < M'$

B. $\mu < \mu', M < M'$

C. $\mu < \mu', M > M'$

D. $\mu > \mu', M > M'$

Answer: A

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49. A cylinder rolls up an inclined plane, reaches some height and then rolls down (without slipping thoughout these motions) .The directions of the firctional force acting on the cylinder are

A. up the incline while ascending and down the incline while descending

B. up the incline while ascending as well as descending

C. down the incline while ascending and up the incline while descending

D. down the incline while ascending as well as descending

Answer: B

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50. The contact force exerted by a body A on another body B is equal to the normal force between the bodies. We concude that

A. a and c are true

B. a, b and d are true

C. b and d are true

D. all are true

Answer: C

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51. A block is placed on a rough floor and a horizontal force F is applied on it. The force of friction f by the floor on the block is measured for different values of F and a graph is plotted between them.

A. a and c are true

B. a, b and d are true

C. c and d are true

D. all are true

Answer: C

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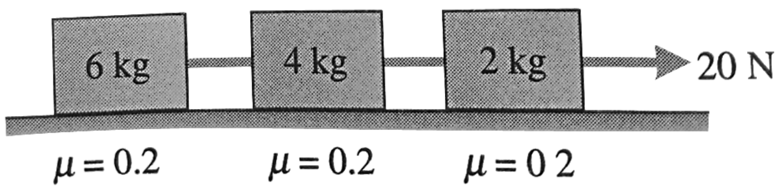
52. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. Both A and B are true

B. Both A and B are false

C. A is false and B is true

D. B is false and A is true

Answer: D

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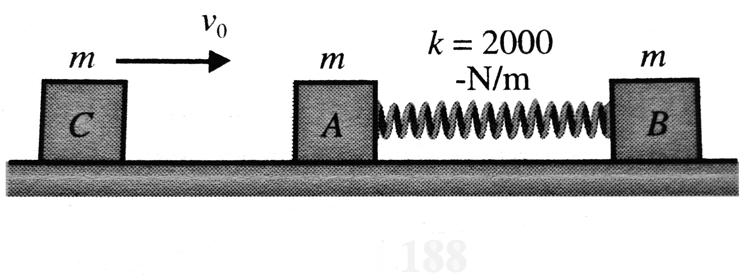

53.

Two identical blocks A and B, each of mass $m = 3kg$, are connected with the help of an ideal spring and placed on a smooth horizontal surface as shown in Fig. Another identical blocks C moving velocity $v_0 = 0.6\frac{m}{s}$ collides with A and sticks to it, as a result, the motion of system takes place in some way

Based on this information answer the following questions:

Q. After the collision of C and A, the combined body and block B would

Option1

oscillate about centre of mass of system and centre of mass is at rest.

Option2

oscillate about centre of mass of system and centre of mass is moving.

Option3

oscillate but about different location other than the centre of mass.

Option4

not oscillate.

A. Both A and B are true

B. Both A and B are false

C. A is false and B is true

D. B is false and A is true

Answer: C

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54. Identify the correct order in which the value of normal reaction increases, (object is placed on rough horizontal surface)

i) The object is pushed with the force F at an angle 'q' with horizontal

ii) The object is pulled with the force F at an angle 'q' with horizontal

iii) The object is pushed down with the force F normally

iv) The object pulled up with the force F normally

A. i, ii, iii, iv

B. iv, ii, i, iii

C. i, iii, ii, iv

D. ii, iv, iii, i

Answer: B

Watch Video Solution

55. Which of the following statements are correct?

A. A and B are true

B. A and B are false

C. A is false and B is true

D. B is false and A is true

Answer: D

Watch Video Solution

56. Identify the correct order in which the value of normal reaction increases, (object is placed on rough horizontal surface)

i) The object is pushed with the force F at an angle 'q' with horizontal

ii) The object is pulled with the force F at an angle 'q' with horizontal

iii) The object is pushed down with the force F normally

iv) The object pulled up with the force F normally

A. A,B,C,D

B. D,B,A,C

C. A,C,B,D

D. B,D,C,A

Answer: B

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57. Consider the following A and B, and identify the correct choice in the given answers.

A) For a body resting on a rough horizontal table, it is easier to pull at angle that push at the same angle to cause motion

B) A body sliding down a rough inclined plane of inclination equal to angle of friction has nonzero acceleration

A. A and B are true

B. A is true but B is false

C. A is false but B is true

D. A and B are false

Answer: B

Watch Video Solution

58. A block of mass m is placed at rest on a horizontal rough surface with angle of friction ϕ. The block is pulled with a force F at an angle θ with the horizontal. The minimum value of F required to move the block is

A. iv, iii, ii and i

B. i, ii, iii and iv

C. i, ii, iv and iii

D. iii,i, ii and iv

Answer: D

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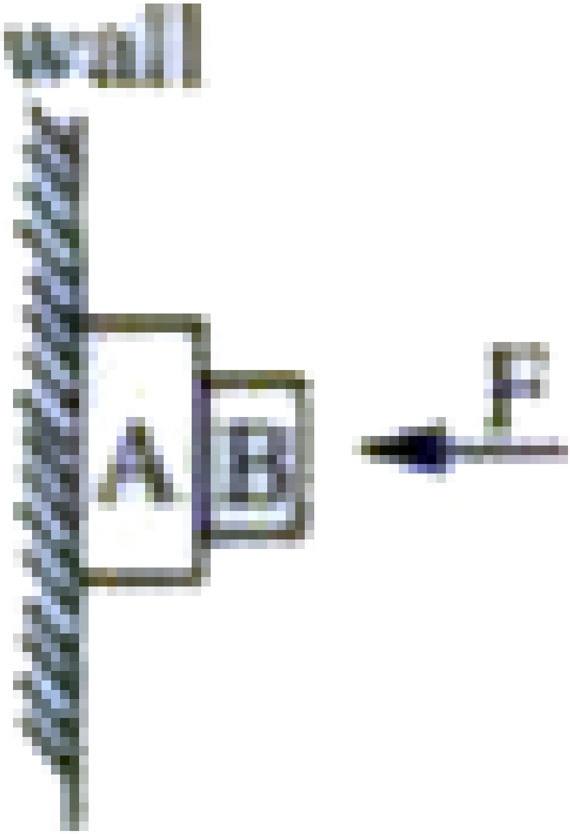
59. Two blocks A and B are pressed against a vertical wall by applying a horizontal force T" as shown in the figure. There is no friction between A and B. Then

a) Both the blocks A and B can be at rest for any magnitude of F

b) B can be at rest A moves down for smaller magnitude of F

c) Both A and B will move down for smaller magnitude

d) A can be at rest and B moves down for larger magnitude of F.



A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: B

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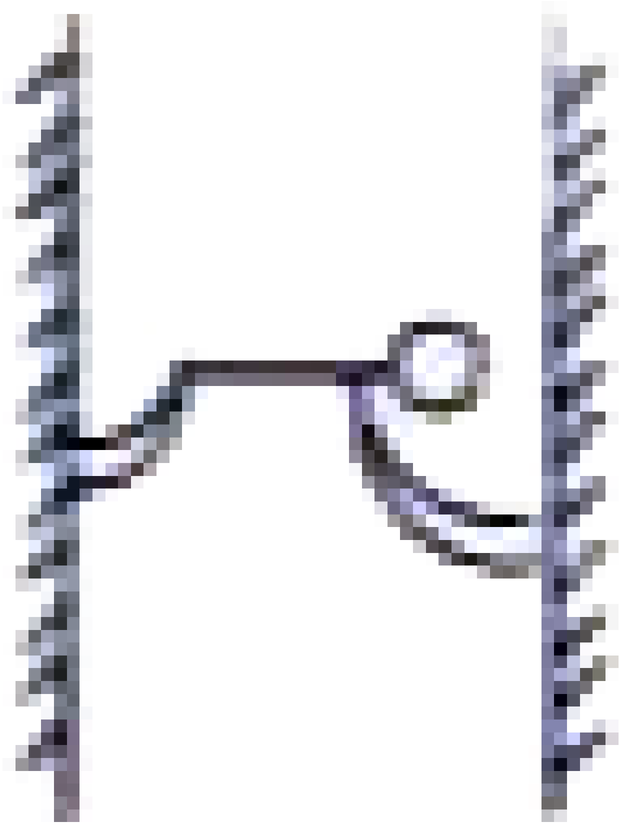
60. A man thinks to remain in equilibrium by pushing in his hands and feet against two vertical parallel walls as the shown in the figure :

a) He must exert equal forces on both walls

b) The forces of friction at both walls must be equal

c) The coefficients of friction between man and wall must be the same at both ends

d) Friction must be present on both walls.



A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: C

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61. A vehicle moves safe on a 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 and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: C

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62. A block of mass 'M' is pressed against a wall with a horizontal force F. Then

a) it will slide down if the wall is smooth

b) frictional force may balance the weight if the wall is rough

c) Normal reaction is equal to weight of the block

d) Normal reaction is zero if the wall is smooth

A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: A

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EXERCISE-1A (CIRCULAR MOTION (a_{cp}, a_t, f_{cp}, f_{cf}), MOTION ON HORIZONTAL CIRCULAR PATH WITH FRICTION, ANGLE OF BANKING)

1. 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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2. A particle of mass mis tied to a light string and rotated with a speed v along a circular path of radius r. If T=tension in the string and mg= gravitational force on the particle then the actual forces acting on the particle are:

A. mg, and T only

B. mg, T and an additional force of $\frac{mv^2}{r}$ directed inwards

C. mg.T and an additional force of $\frac{mv^2}{r}$ directed outwards

D. only a force $\frac{mv^2}{r}$ directed outwards

Answer: A

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3. A mass is revolving in a circle which lies in a plane of paper. The direction of angular acceleration can be:-

A. along the tangent

B. along the radius inward

C. along the radius outward

D. along the perpendicular to the plane of the paper

Answer: D

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

A. It's angular velocity vector will be perpendicular to the page pointing up out of the page

B. It's angular velocity vector will be perpendicular to the page pointing inwards

C. It's angular velocity vector acts along the tangent to the disc.

D. none of the above is correct

Answer: A

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5. Many great rivers flow towards the equator, what effect does the sediment they carry to sea have on the rotation of the earth?

A. The rotation of the earth slows down

B. The rotation of theearth speeds up

C. No effect un the rotation of the earth

D. None

Answer: A

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6. A vehicle is travelling along unbanked curved path. If the friction between the road and tyres suddenly disappears then the vehicle

A. Moves along tangential direction

B. Moves along radially outward direction

C. Moves along a direction between tangential and radially outward direction

D. Moves along the same curved path

Answer: A

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7. When a car takes a sudden turn it is likely to fall.

A. Away from the centre of curvature

B. Towards the centre of curvature

C. Towards forward direction

D. Towards backward direction

Answer: A

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8. Skidding occurs when the maximum frictional force of a flat road on a car is

A. less than centripetal force required

B. more than centripetal force required

C. equal to centripetal force required

D. independent of centripetal force

Answer: A

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9. A car moves along a horizontal circular road of radius r with velocity u -The coefficient of friction between the wheels and the road is μ. Which of the following statement is not true?

A. The car will slip if $v > \sqrt{\mu r g}$

B. The car will slip if $\mu < \frac{v^2}{rg}$

C. The car will slip if $\mu > \frac{v^2}{rg}$

D. the car will slip at lower speed, if it moves with some tangential acceleration, than if it moves at constant speed.

Answer: C

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10. For a car taking a turn on a horizontal surface, let N_1 and N_2 be the normal reactions of the road on the inner and outer wheels respectively

A. N_1 is always greater than N_2

B. N_2 is always greater than N_1

C. N_1 is always equal to N_2

D. Either (a) or (b) depending on the speed of the car and the radius of curvature of the road.

Answer: B

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11. A railway track is banked for a speed v, by making the height of the outer rail h higher than that of the inner rail. The distance between the rails is d. The radius of curvature of the track is r

A. $\frac{h}{d} = \frac{v^2}{rg}$

B. $\tan\left(\frac{\sin^{-1} h}{d}\right) = \frac{v^2}{rg}$

C. $\tan^{-1}\left(\frac{h}{d}\right) = \frac{v^2}{rg}$

D. $\frac{h}{r} = \frac{v^2}{dg}$

Answer: B

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12. A curved road is banked for speed v_0. When a car moves along the road with a constant speed v, the force the friction between the road and the tyres is F. Which of the following statements(s) is (are) correct ?

A. a car moving with speed v will not slip on the road

B. a car is more likely to slip on the road at speeds higher than v ,than at speeds lower thanu

C. a car is more likely to slip on the road at speeds lower than v, than at speeds higher than V

D. a car can remain stationary on the road without slipping

Answer: A

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13. A cyclist moves along a curved road with a velocity v. The road is banked for speed v. The angle of banking is θ.Which of the following statements in not true?

A. The cyclist will lean away from the vertical at an angle θ.

B. The normal reaction of the road will pass through the centre of gravity of the 'cycle plus cyclist' system

C. There will be no force of friction between the tyres and the road.

D. The cyclist is in equilibrium with respect to the ground.

Answer: D

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EXERCISE-1A (NEWTON.S LAWS OF MOTION)

1. A force of constant magnitude starts acting on a moving particle when it is at some point 'P'. Depending on the orientation of the force, the particle may

a) pass through point P at some time later

b) not return to point P

c) describe a circular path

d) describe a parabolic path

A. a is correct

B. a, b, c, d are correct

C. c only correct

D. d only correct

Answer: B

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2. A reference frame attached to the earth

a) is an inertial frame by definition

b) can not be an inertial frame because the earth is revolving around the sun

c) is an inertial frame because Newton's laws are applicable in this frame

d) cannot be an inertial frame because the earth is rotating about its axis

A. a, b, c are correct

B. b only correct

C. b and d are correct

D. all are correct

Answer: C

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3. a) In a frame of reference S_1(though the net force is zero, the net acceleration is not zero.

b) In a frame of reference S_2 though the net force is not zero, the net acceleration is zero.

c) In a frame of referenceS_3 the net acceleration is zero whenever the net force is zero.

A. S_1 and S_3 are inertial and S_2 is non-inertial

B. S_1 and S_2 are non-inertial and S_3 is inertial

C. S_1, S_2, S_3 are non-inertial

D. S_1, S_2, S_3 are inertial

Answer: B

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4. Statement A : Action and reaction act on two different bodies

Statement B : Action, reaction never cancel each other

A. A & B are correct

B. A & B are wrong

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: A

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5. A man of mass m is on the floor of a lift. The lift moving up with acceleration 'a', then :

a) the net unbalanced force on him is 'ma'

b) the normal reaction exerted by the floor on the man is m(g + a)

c) the apparent weight is greater than his true weight

A. a, b, c are correct

B. a, b, c are wrong

C. a & c are correct

D. b & c are correct

Answer: A

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6. A person of mass m is on the floor of a lift. The lift is moving down with an acceleration 'a'. Then :

a) the net force is acting in downward direction and is equal to mg

b) the force mg must be greater than reaction force

c) the man appears to be lighter than his true weight by a factor (a/g)

A. a, b, c are correct

B. b and c are correct

C. a and c are correct

D. only b is correct

Answer: B

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7. Statement A : If the lift is falling freely then the man on its floor experiences no reaction from the floor.

Statement B : If the lift moves down with an acceleration $a > g$, then the normal reaction becomes negative and the man feels floating up in the lift.

A. A and B are correct

B. A and B are false

C. A is true and B is false

D. A is false and B is true

Answer: A

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8. Statement A : If the force varies with time in a complicated way then the average force is measured by the total change in momentum of the body

Statement B : Change in momentum and impulsive force are numerically equal

A. A and B are correct

B. A and B are false

C. A is true and B is false

D. A is false and B is true

Answer: C

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9. Statement A : Shock absorbers reduce the magnitude of change in momentum.

Statement B : Shock absorbers increase the time of action of impulsive force

A. A and B are correct

B. A and B are false

C. A is true and B is false

D. A is false and B is true

Answer: D

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EXERCISE-1A (CIRCULAR MOTION)

1. A particle moves along a horizontal circle witrr constant speed. If 'a' is its acceleration and 'E' is its kinetic energy

A) a is constant

B) E is constant

C) a is variable

D) E is variable

A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: D

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2. Identify, the increasing order of angular velocities of following

a) Earth rotating about its own axis

b) Hour's hand of clock

c) Seconds hand of clock

d) Fly wheel of radius 2m making 300 r.p.m.

A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: A

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EXERCISE-1A (MATCHING)

1. Match the items mentioned in the lists I and II below

LIST -1

a) Static friction

b) Limiting friction

c) Kinetic friction

d) Rolling friction

LIST - II

e) constant for a given pair of surfaces

f) Independent of area of contact

g) Self adjusting

h) Has the least magnitude for a given normal reaction

A. a-e, b-f, c-g, d-h

B. a-h,b-f,c-e, d-g

C. a-g, b-e, c-f, d-h

D. a-g, b-h, c-f, d-e

Answer: C

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2. Matching the block type

LIST - I	LIST - II
a) Frictional force	e) Zero
b) Gravitational force	f) Electromagnetic force
c) When a body on a rough inclined plane is just ready to move, then the net force acting on the body	g) mg $\sin\theta$
d) The force acting on a body placed on smooth inclined plane	h) Conservative force

A. a-h, b-f, c-g, d-e

B. a-f, b-h, c-e, d-g

C. a-e, b-g, c-f, d-h

D. a-g, b-e, c-h, d-f

Answer: B

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3.

(i) A person is tuning his radio set to a particular station. What is the person trying to do to tune it? **[4]**

(ii) Name the phenomenon involved, in tuning the radio set.

(iii) Define the phenomenon named by you in part (ii).

A. a-g, b-h, c-f, d-e

B. a-f, b-e, c-h, d-g

C. a-g, b-f, c-h, d-e

D. a-e, b-g, c-h, d-f

Answer: C

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4. Matching the block type

LIST - I	LIST - II
a) Two rotating discs are brought in contact coaxially	e) Generated friction is equal to applied external force in magnitude
b) Contact force on a body placed in on rough surface	f) Loss of Rotational KE is transformed partly to heat
c) To continue a motion is easier than to initiate the motion	g) The resultant of normal reaction and friction
d) For a Static friction less than limiting friction	h) Kinetic friction is less than static friction

A. a-f, b-g, c-h ,d e

B. a-g, b-f, c-e, d-h

C. a-h, b-e, c-f, d-g

D. a-e, b-h, c-g, d-f

Answer: A

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5. Matching the block type

LIST - I	LIST - II
a) Centrifugal force	e) Along the axis of rotation
b) Centripetal force	f) Towards the centre of rotation
c) Tangential force	g) Away from the centre of rotation
d) Angular velocity	h) Changes the angular velocity
1) a-h, b-g, c-f, d-e	2) a-g, b-f, c-h, d-e

A. a-h, b-g, c-f, d-e

B. a-g, b-f, c-h, d-e

C. a-f, b-g, c h, d-e

D. a-e, b-h, c-e, d-f

Answer: B

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EXERCISE-1B (ASSERTION (A) & REASON (R) TYPE QUESTIONS)

1. (A) : According to Newton's third law sum of action and reaction is not equal to zero

(r) : The forces action and reaction acts on different bodies

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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2. (A) : A player lowers his hands while catching a cricket ball.

(r) : Increase in the time of action of force, decreases the impulsive force.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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3. (A) : Sportsman runs some distance before taking a long jump.

(R) : A man in state of motion enables him to have greater velocity to jump due to inertia of motion.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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4. (Assertion) :A body can have acceleration even if its velocity is zero at a given instant of time.

(Reason): A body is momentarily at rest when it reverses its direction of motion.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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5. Assertion: A rocket moves forward by pushing the surrounding air backwards.

Reason: It derives the necessary thrust to move forward according to Newton's third law of motion.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

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6. (A) : When bullet is fired from a gun, the gunner should exert force on gun in the direction of motion of bullet.

(R) : The gun recoils when bullet is fired.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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7. (A) : Force is required to move a body uniformly along a circle.

(R) : When the body is in uniform circular motion, acceleration is zero.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

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8. (A) : No force is required by the body to remain in a state of uniform motion.

(r) : In uniform linear motion, acceleration has a finite value.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

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9. (A) : A cyclist always bends inwards while negotiating a horizontal curve.

(r) : By bending, cyclist lowers his centre of gravity.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

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10. Assertion : A bullet is fired from a rifle. If the rifle recoils freely, the kinetic energy of rifle is more than that of the bullet.

Reason : In case of rifle bullet system, the law of conservation of momentum violates.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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11. (A) : A rocket works on the principle of conservation of linear momentum.

(r) : When there is no external force on a system of two bodies the rate of change in momenta of two bodies are equal and opposite

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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12. (A) : The apparent weight of a body in an elevator moving with some downward acceleration is always less than the actual weight of body.

(R) : Normal reaction force by the floor of elevator on the body is less than the weight of the body when elevator is moving down

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

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13. (A) : When a lift moves with uniform velocity the man in the lift will feel weightlessness.

(R) : In downward motion of a lift, apparent weight of a body in it decreases.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is false but (R) is true

D. Both (A) and (R) are false

Answer: D

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14. A : In case of free fall of a lift, the apparent weight of a man in it will be zero.

R : In free fall, acceleration of lift is equal to acceleration due to gravity.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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15. (A) : Newton's third law of motion is applicable only when bodies are in motion.

(R) : Newton's third law is not applicable to all types of forces. Like gravitational, electric or magnetic forces etc.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

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16. (A) : A reference frame attached to earth is a non inertial frame of reference.

(R) : The reference frame which has an acceleration is called a non inertial frame of reference.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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17. Statement 1 : A cloth covers a table. Some dishes are kept on it. The cloth can be palled out without dislodging the dishes from the table

Statement ii: For every action , there is an equal and opposite reaction.

Statement I: It is easier to pull a heavy is an equal and opposite reaction.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

18. (A) : A body subjected to three concurrent forces cannot be in equilibrium.

(R) : If large number of concurrent forces acting on the same point, then the point may be in equilibrium, even if the vectorial sum of all the force is not zero.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is false but (R) is True

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

EXERCISE-1B (ASSERTION (A) & REASON (R) TYPE QUESTIONS) (FRICTION)

1. (A) : The viscous force, air resistance etc., are examples of contact force

(R) : Contact force on an object arises due to contact with some other object

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

2. (A) : Contact forces like viscous force, air resistance are electromagnetic in nature

(R) : At the microscopic level, all bodies are made of charged constituents

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

3. (A) : A maximum possible speed of a car on banked curved road is greater than that on a flat curved road

(R) : On a banked curved road horizontal component of normal reaction by road along with friction provides necessary centripetal force

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

4. (A) : In the third laws of motion, action doesn't precede or cause reaction

(R) : Action-reaction are simultaneous mutual forces between a pair of bodies

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

5. (A) : For drawing water with a bucket from a well by a person usage of pulley reduces the force required rather than drawing directly

(R) : When water is drawn with a bucket directly from well normal reaction on man is more man than that when he draws it using a pulley

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

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

(R) : The mutual action- reaction forces between the horse and cart get cancelled

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

7. Assertion : On a rainy day, it is difficult to drive a car or bus at high speed.

Reason: The value of coefficient of friction is lowered due to wetting of the surface.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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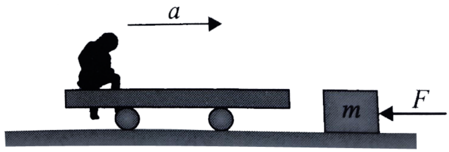
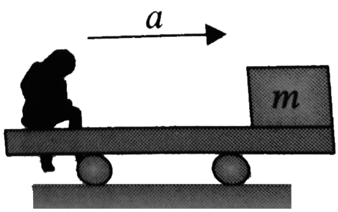
8.





Suppose you are sitting on an accelrating trolley car.

(i) Find the pseudo force action on the block of mass m placed on the trolley car.

If the block is placed (or moved) outside the trolley car, and an external force F acts in horizontal direction.

(ii) Find the pseudo force acting on the block as viewed by the observer.

(iii) Find the acceleration of the block as seen by the obersever

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

9. Assertion Angle of repose is equal to angle of limiting friction .

Reason When abody is just at the point of motion,the force of friction of this stae is called as limiting friction

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

10. "Friction is a self adjusting force" Why ?-

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

11. A : The value of kinetic friction is less than the limiting friction.

R : When motion of an object started, the inertia of rest has been overcome.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

12. Static-friction is a self- adjusting force. Comment.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

13. (A) : When you shake hands with your friend the force involved is electromagnetic in nature.

(R) : Frictional force is electromagnetic in nature

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

14. (A) : Brakes of very small contact area are not used although friction is independent of area of contact

(R) : Friction resists relative motion

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

15. When two surface are polished, the friction coefficient between them decreases. But the friction coefficient increases and becomes very large if the surfaces are made highly smooth. Explain.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

16. (A) : When a body moves on rough surface the mechanical energy is not constant

(R) : Friction is non conservative force

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

17. (A) : A person can walk on a rough surface

(R) : Reaction of the force applied by the man on the surface keeps him moving

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

18. (A) : A car can run on road because of force applied by road on the car.

(R) : Friction provides the necessary force for translatory motion for the car.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

19. (A) : On the rough horizontal surface if the external force is doubled then the acceleration also becomes more than doubled

(R) : For a small velocities sliding friction between a body and surface is constant

(a) Both (A) and (R) are true and (R) is the correct explanation of (A)

(b) Both (A) and (R) are true and (R) is not the correct explanation of (A)

(c) (A) is true but (R) is false

(d) Both (A) and (R) are false

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

20. (A) : It is easier to pull a lawn roller than to push on the same horizontal rough surface

(R) : Pulling body decreases normal reaction

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

21. (A) : The friction gives the necessary centripetal force at the unbanked curved path

(R) : When a body is moving an un banked curved path below the maximum safe velocity friction has self adjusting nature

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

22. (A) : An object placed on the rotating hori- zontal table may fly off at lower angular velocity when placed far away from the axis.

(R) : An object placed at the edge of the rotating table experiences more centrifugal force than at nearer position relative to the table

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

23. (A) : The time of ascent for a body projected to move up a rough inclined plane is less than the time of descent.

(R) : The retardation for upward motion is more than the acceleration for down motion on rough inclined plane.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

24. (A) : If a body moving in a circular path with constant speed, then no force acts on it.

(R) : The direction of the velocity vector of a body moving in a circular path is changing

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

25. (A) : The speed of particle remains constant in uniform circular motion

(R) : No force is acting on the particle in uniform circular motion.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

26. (A) : A coin placed on a rotating disc flies away if the angular velocity is gradually increased

(R) : Static friciton is self adjusting in nature.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of A

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

27. (A) : We take smaller steps to walk on wet floor

(R) : To take larger step, larger force is to be exerted on ground, which may exceed limiting friction between floor and foot

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

28. STATEMENT -1 : Friction always opposes motion .

STATEMENT - 2 : Lesser the friction on a surface it is easier to walk on it.

STATEMENT -3 : Soles of shoes gets flat due to friction .

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

29. Two bodies with masses M_1 and M_2 are initially at rest and a distance R apart. Then they move directly towards one another under the influence of their mutual gravitational attraction. What is the ratio of the distances travelled by M_1 to the distance travelled by M_2 ?

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

30. (A) : A particle is found to be at rest when seen from a frame S,and moving with a constant velocity when seen from another frame S_2. We can say both the frames are inertial

(R) : All frames moving uniformly with respect to an inertial frame are themselves inertial

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

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EXERCISE -2 (CHANGE IN MOMENTUM, FORCE, IMPULSE)

1. Due to the application of a force on a body of mass 100 kg that is initially at rest, the body moves with an acceleration of 20ms^{-2} in the direction of the force. Find the magnitude of the force.

A. 1000 N

B. 2000 N

C. 3000 N

D. 4000 N

Answer: B

Watch Video Solution

2. A force is applied for a duration of 10sec on a body of mass 5kg that is at rest. As a result the body acquires a velocity of 2ms^{-1}. Find the magnitude of the force applied.

A. 1 N

B. 2 N

C. 4 N

D. 5 N

Answer: A

Watch Video Solution

3. A vehicle of mass 120kg is moving with a velocity of 90kmph What force should be applied on the vehicle to stop it in 5s.

A. 240 N

B. 480 N

C. 600 N

D. 480 N

Answer: C

Watch Video Solution

4. A vehicle of mass 20kg is moving with a velocity of 4ms^{-1}. Find the magnitude of the force that is to be applied on the vehicle so that the vehicle have a velocity of 1ms^{-1} after travelling a distance of 20m.

A. 4 N

B. 6 N

C. 7.5 N

D. 9.5 N

Answer: C

Watch Video Solution

5. A force is applied on a body of mass 0.9kg that is at rest. The force is applied for a duration of 5s and as a result the body covers a distance of 250 m. Find the magnitude of the force.

A. 9 N

B. 18 N

C. 27 N

D. 46 N

Answer: B

Watch Video Solution

6. A ball of mass 600 gm strikes a wall with a velocity of 5ms^{-1} at an angle 30° with the wall and rebounds with the same speed at the same angle with the wall. The change in momentum of the ball is, (in kg ms^{-1})

A. 15

B. 10

C. 5

D. 3

Answer: D

Watch Video Solution

7. The driver of a three-wheeler moving with a speed of 36 km/h sees a child standing in the middle of the road and brings his vehicle to rest in 4.0 s just in time to save the child. What is the average retarding force on the vehicle ? The mass of the three-wheeler is 400 kg and the mass of the driver is 65 kg.

A. 1.2×10^3 N

B. 1.2×10^4 N

C. 1.2×10^5 N

D. 1.2×10^6 N

Answer: B

Watch Video Solution

8. When a force 1N acts on 1kg mass at rest for 1s, its final momentum is P. When 1N force acts on 1kg mass at rest through a distance 1m, its final momentum is P1. The ratio of P to P1 is

A. $1:1$

B. $1:\sqrt{2}$

C. $1:2$

D. $2:1$

Answer: B

Watch Video Solution

9. Gravitational force with which a body attracts the other is always equal to the force with which the other attracts the first. Assuming no other forces acting on the bodies, choose the correct statement.

A. 1 kg

B. 2 kg

C. 0.8 kg

D. 0.4 kg

Answer: D

Watch Video Solution

10. A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s . If the catching process is completed in 0.1s, the force of the blow exerted by the ball on the hand of the player is :

A. 150 N

B. 3 N

C. 30 N

D. 300 N

Answer: C

Watch Video Solution

11. A current I is flowing in a straight conductor of length L. The magnetic induction at a point distant $\frac{L}{4}$ from its centre will be

A. 8s

B. 16 s

C. 12 s

D. 24 s

Answer: B

Watch Video Solution

12. A balloon with its contents weighing 160 N is moving down with an acceleration of g/2 ms^{-2} . The mass to be removed from it so that the balloon moves up with an acceleration of-g/3 ms^{-2} is

A. 5 kg

B. 10 kg

C. 6 kg

D. 3 kg

Answer: B

Watch Video Solution

13. A block of mass 5 kg is at rest on a smooth horizontal surface. Water coming out of a pipe horizontally at the rate of 2 kgs^{-1} , hits the block with a velocity of $6ms^{-1}$.The initial acceleration of the block is,

A. zero

B. $1.2ms^{-1}$

C. $2.4ms^{-1}$

D. $0.6ms^{-1}$

Answer: C

Watch Video Solution

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

A. 0.2 N

B. 10 N

C. 400 N

D. 200 N

Answer: C

Watch Video Solution

15. A body of mass 2kg is moving along positive X - direction with a velocity of 5ms^{-1} Now a force of $10\sqrt{2}$ N N is applied at an angle 45° with X - axis. Its velocity after 3s is,

A. $20ms^{-1}$

B. $15ms^{-1}$

C. $25ms^{-1}$

D. $5ms^{-1}$

Answer: C

Watch Video Solution

16. A disc of mass 5 kg is kept floating horizontally in mid air by firing 10 bullets per second vertically up. If the mass of each bullet is 50 gm and bullets rebound with same speed, the speed of each bullet is, (g = $10ms^{-2}$)

A. $100ms^{-1}$

B. $200ms^{-1}$

C. $50ms^{-1}$

D. 10ms^{-1}

Answer: C

Watch Video Solution

17. A body of mass 5 kg moving on a horizontal surface with a velocity of 10ms^{-1} comes to rest in 2s. The force required to make this body move with a velocity of 10ms^{-1} on the same surface is

A. zero

B. 10 N

C. 25 N

D. 50 N

Answer: C

Watch Video Solution

18. 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) 3 b) 5 c) 6 d) 9

A. one

B. four

C. two

D. three

Answer: D

Watch Video Solution

19. Gravel is dropped on a conveyor belt at the rate of 2 kg/s. The extra force required to keep the belt moving at $3 ms^{-1}$ is

A. 1 N

B. 3 N

C. 4 N

D. 6 N

Answer: D

Watch Video Solution

20. A hammer of mass 1 kg strikes on Ihe head of a nail with a velocity of $2 ms^{-1}$. It drives the nail 0.01 m into a wooden block. Find the force applied by the hammer and the time of impact.

A. $200N, 10^{-2}$ sec

B. $100N, 10^{-3}$ sec

C. $300N, 10^{-2}$ sec

D. $400N, 10^{-3}$ sec

Answer: A

Watch Video Solution

21. A force of 5 N acts on a body for 2 milliseconds. Calculate the impulse. If the mass of the body is 5 g, calculate the change of velocity.

A. 2 m/s

B. 4 m/s

C. 6 m/s

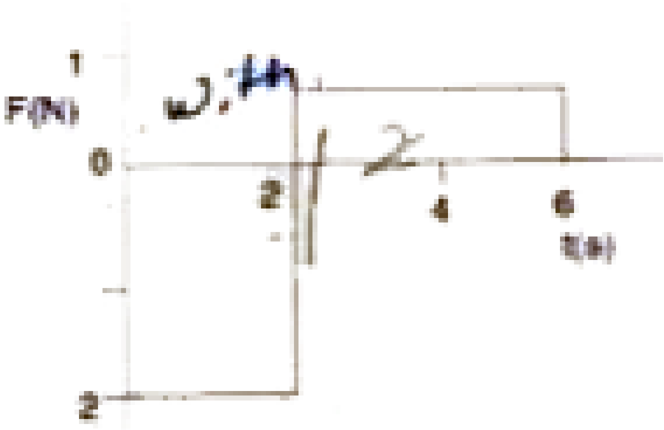
D. 10 m/s

Answer: A

Watch Video Solution

22. A force lime 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

Watch Video Solution

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

A. $I(v_1 + v_2)$

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

C. $I(v_1 - v_2)$

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

Answer: B

Watch Video Solution

24. The linear momentum of a particle as a fuction of time 't' is given by , p = a +bt , where a and b are positive constants . What is the force acting on the particle ?

A. a

B. b

C. ab

D. a+b

Answer: B

Watch Video Solution

25. A ball of mass 'm' is thrown vertically up-ward from the ground and reached a height 'h' before momentarily coming to rest , If 'g' is acceleration due to gravity . What is the impulse received by the ball due to gravity force during its flight ? (neglect air resistance)

A. $\sqrt{2m^2gh}$

B. $\sqrt{4m^2gh}$

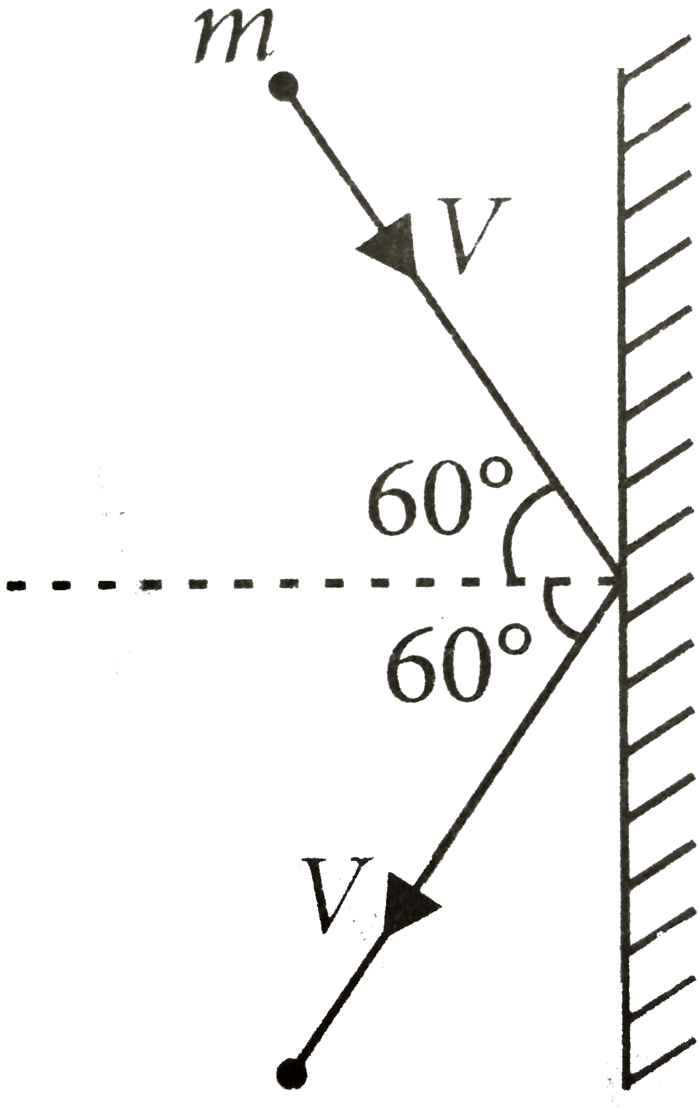
C. $\sqrt{8m^2gh}$

D. $4\sqrt{m^2gh}$

Answer: C

Watch Video Solution

26. A rigid ball of mass m strikes a rigid wall at 60° and angles reflected without loss of speed as shown in the figure. The value of impulse imparted by the wall on the ball will be.



A. MV

B. 2mV

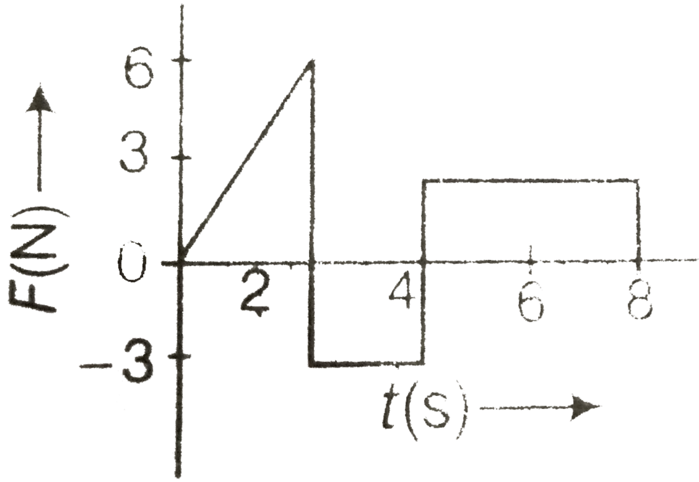
C. $\frac{mV}{2}$

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

Answer: A

Watch Video Solution

27. The force F acting on a particle of mass m is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from 0 to 8 s is



A. 24 Ns

B. 20 Ns

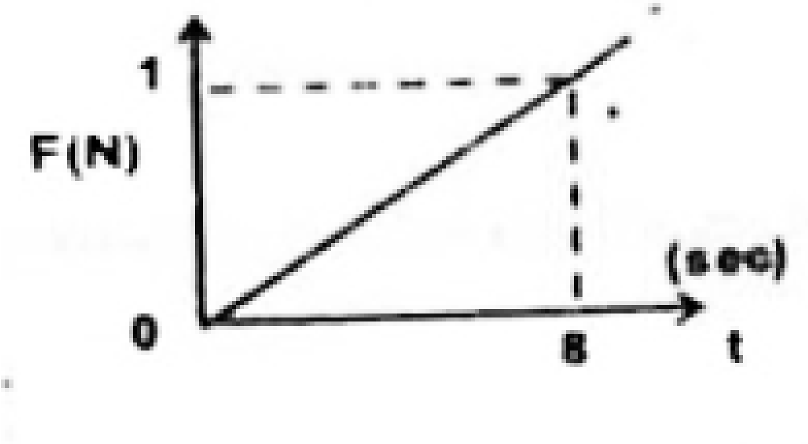
C. 12 Ns

D. 6 Ns

Answer: C

Watch Video Solution

28. A force-time graph for the motion of a body is shown in figure. Change in linear momentum between 0 and 8 s is:



A. zero

B. 4 N-s

C. 8 N-s

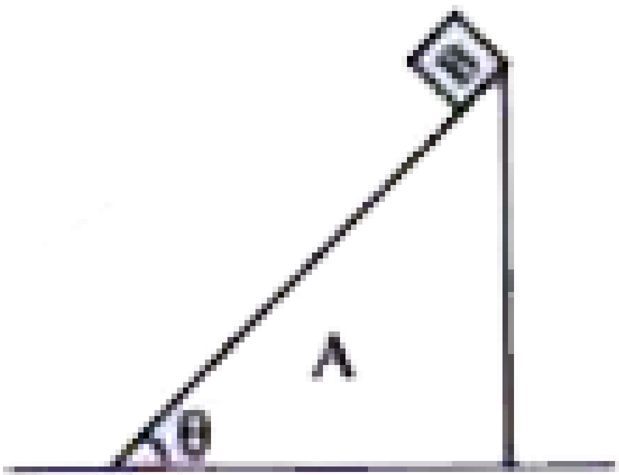
D. none of these

Answer: A

Watch Video Solution

EXERCISE -2 (CONSTRUCTION OF LINEAR MOMENTUM)

1. A wedge shaped block A' of mass M is at rest on a smooth horizontal surface. A small block 'B' of mass 'm' placed at the top edge of inclined plane of length 'l' as shown in the figure. By the time, the block 'B' reaches the bottom end, the wedge A moves a distance of:



A. $\frac{mL}{M \cos \theta}$

B. $\frac{mL \cos \theta}{m + M}$

C. $\frac{mL}{m + M}$

D. Zero

Answer: B

Watch Video Solution

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

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

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

C. $\frac{8}{5}$

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

Answer: A

Watch Video Solution

3. A stationary shell explodes into two fragments, having masses in the ratio of 1:2. The heavier fragment attains a Kinetic energy of 100J. The Kinetic energy released in the explosion is:

A. 200 J

B. 150 J

C. 300 J

D. 600 J

Answer: C

Watch Video Solution

4. A particle of mass 1 kg is thrown vertically upward with speed 100 m/s. After 5 sec it explodes into two parts. One part of mass 400 g comes back with speed 25 m/s, what is-the speed of the other part just after explosion? (g=$10\text{m}/\text{s}^2$)

A. 600 m/s upward

B. 100 m/s upward

C. 100 m/s down ward

D. 300 m/s upward

Answer: B

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5. A shell is fired from a cannon with a velocity V at an angle θ with the horizontal direction. A the highest point i its path, it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other priece immediately after the explocison is

A. $V \cos \theta$

B. $2 \cos \theta$

C. $3V \cos \theta$

D. $(3v/2)\cos \theta$

Answer: C

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6. A gun mounted on the top of a moving truck t is aimed in the backward direction at an angle of 30° to the vertical. If the muzzle velocity of the bullet is $4ms^{-1}$ the value of speed of the truck that will make the bullet come of out vertically is

A. $1ms^{-1}$

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

C. $0.5ms^{-1}$

D. $2ms^{-1}$

Answer: D

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7. A gun of mass M fires a bullet of mass m with a Kinetic energy E. The velocity of recoil of the gun is

A. $\frac{\sqrt{2ME}}{m}$

B. $\frac{\sqrt{2mE}}{M}$

C. $\frac{\sqrt{2mE}}{M+m}$

D. $\frac{\sqrt{2ME}}{M+m}$

Answer: B

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8. A gun of mass M fires a bullet of mass m with a velocity v relative to the gun. The average force required to bring the gun to rest in 0.5 sec. is

A. $\frac{2Mmv}{M+m}$

B. $\frac{Mmv}{2(M+m)}$

C. $\frac{3Mv}{2(M+m)}$

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

Answer: A

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9. A shell of mass 0.01 kg fired by a gun of mass 10 kg. If the muzzle speed of the shell is $50 ms^{-1}$, what is the recoil speed of the gun?

A. 0.01 m/s

B. 0.02 m/s

C. 0.03 m/s

D. 0.05 m/s

Answer: D

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EXERCISE -2 (ROCKET PROPULSION)

1. A rocket consumes 20 kg fuel per second. The exhaust gases escape at a speed of 1000ms^{-1} relative to the rocket. Calculate the upthrust received by the rocket. Also calculate the velocity acquired. When its mass is 1/100 of the initial mass.

A. $2 \times 10^4 \text{N}, 4.6 \text{Km/s}$

B. $2 \times 10^6 N, 5.3 Km/s$

C. $4 \times 10^2 N, 4.6 Km/s$

D. $4 \times 10^6 N, 5.3 Km/s$

Answer: A

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2. A rocket of initial mass 6000kg ejects mass at constant rate of 200 kg/sec. with constant relative speed of 800 m/sec. The acceleration of the rocket after 5 sec is (neglect gravity)

A. $50 m/s^2$

B. $16 m/s^2$

C. $60 m/s^2$

D. $32 m/s^2$

Answer: D

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3. A rocket of mass 20kg has 180kg fuel. The exhaust velocity of the fuel is $1.6\text{km}/\text{s}$. Calculate the minimum rate of consumption of fuel so that the rocket may rise from the ground. Also, calculate the ultimate vertical speed gained by the rocket when the rate of consumption of fuel is $(g = 9.8\text{m}/\text{s}^2)$

(i) $2\text{kg}/\text{s}$ (ii) $20\text{kg}/\text{s}$

A. 3.7 km/sec

B. 2 km/sec

C. 10 km/sec

D. 5 km/sec

Answer: A

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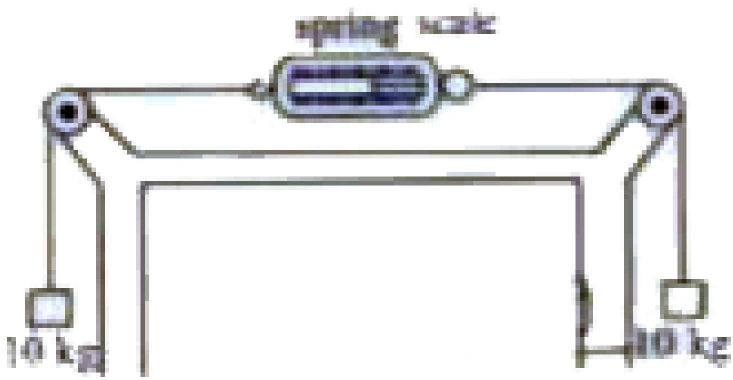
EXERCISE -2 (EQUILIBRIUM)

1. Two 10 kg bodies are attached to a spring balance as shown in figure. The reading of the balance will be:



A. 20 kg-wt

B. 10 kg-wt

C. Zero

D. 5 kg-wt

Answer: B

Watch Video Solution

2. A mass 'M' is suspended by a rope from a rigid support. It is pulled horizontally with a force F. If the rope makes an angle ' θ' with vertical in equilibrium, then the tention in the string is

A. $F \sin \theta$

B. $\frac{F}{\sin \theta}$

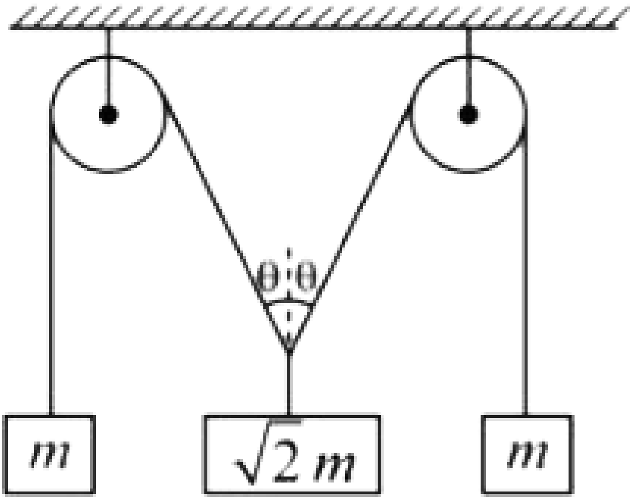
C. $F \cos \theta$

D. $\frac{F}{\cos \theta}$

Answer: B

Watch Video Solution

3. 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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EXERCISE -2 (CONTACT FORCE, TENSION, NORMAL REACTION APPARENT WEIGHT)

1. A uniform rope of length 5m is on a smooth horizontal surface. It is being pulled by a horizontal force of 20 N at one end. The ratio of tension at a distance of 2m from force end to tension at a distance of 2m from free end is,

A. $1:1$

B. $2:3$

C. $1:2$

D. $3:2$

Answer: D

Watch Video Solution

2. Two block of masses 3 kg and 1 kg are kept in contact with each other on a frictionless horizontal surface. If a force of 10 N is applied on the larger block what is the acceleration of the system? What is the contact force between the two blocks?

A. $2.5\text{m}/\text{s}^2, 2.5\text{N}$

B. $5\text{m}/\text{s}^2, 5\text{N}$

C. $5\text{m}/\text{s}^2, 2.5\text{N}$

D. $2.5\text{m}/\text{s}^2, 5\text{N}$

Answer: A

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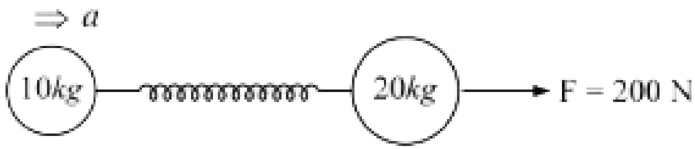
3. Two masses 10 kg and 20 kg are connected with a massless spring as shown in the figure. A force of 200 N is acting on the mass 20 kg. When the acceleration of 10 kg mass is 12 m/s^2, the acceleration of 20 kg mass is:



A. 4ms^{-2}

B. 12ms^{-2}

C. 20ms^{-2}

D. 8ms^{-2}

Answer: A

Watch Video Solution

4. A block of mass 10 kg lying on a smooth horizontal surface is being pulled by means of-a rope of mass 2 kg. If a force of 36N is applied at the end of the rope, the tension at the mid point of the rope is,

A. 33 N

B. 30 N

C. 24 N

D. 12 N

Answer: A

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5. Ten coins each of mass 10 gm are placed one above the other. The reaction force exerted by 7th coin from the bottom on the 8th coin is $(g = 10ms^{-2})$

(a) 0.3 N

(b) 0.2 N

(c) 0.4 N

(d) 0.7 N

A. 0.3 N

B. 0.2 N

C. 0.4 N

D. 0.7 N

Answer: A

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6. The apparent weight of man inside a lift moving up with certain acceleration is 900N. When the lift is coming down with the same acceleration apparent weight is found to be 300N. The mass of the man is ($g = 10 ms^{-2}$)

A. 45 kg

B. 60 kg

C. 75 kg

D. 80 kg

Answer: B

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7. A 60kg man is inside a lift which is moving up with an acceleration of 2.45ms^{-2}. The apparent percentage change in his weight is,

A. $20\ \%$

B. $25\ \%$

C. $50\ \%$

D. $75\ \%$

Answer: B

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8. When an empty lift is moving down with an acceleration of $\frac{g}{4}ms^{-2}$ the tension in the cable is 9000N. When the lift is moving up with an acceleration of $\frac{g}{3}ms^{-2}$ the tension in the cable is

A. 16,000 N

B. 18,000 N

C. 12,000 N

D. 15,000 N

Answer: A

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9. A fireman wants to slide down a rope. The breaking load for the rope is 3/4th of the weight of the man. With what minimum acceleration sholud the fireman slide down? Acceleration due to gravity is g.

A. zero

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

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

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

Answer: B

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10. How can you lower a 100 kg body from the roof of a house using a cord with a breaking strength of 80 kg weight without breaking the rope? (1 kg weight = gN)

A. $1.96\text{m}/\text{s}^2$ downwards

B. $9.8\text{m}/\text{s}^2$ downwards

C. $4.9\text{m}/\text{s}^2$ downwards

D. $19.6\text{m}/\text{s}^2$ downwards

Answer: A

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11. A man in a lift feels an apparent weight W when the lift is moving up with a uniform acceleration of 1/3rd of the acceleration due to gravity. If the same man were in the same lift now moving down with a uniform acceleration that is 1/2 of the acceleration due to gravity, then his apparent weight is

A. $\frac{3W}{8}$

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

C. $\frac{W}{8}$

D. $\frac{5W}{8}$

Answer: A

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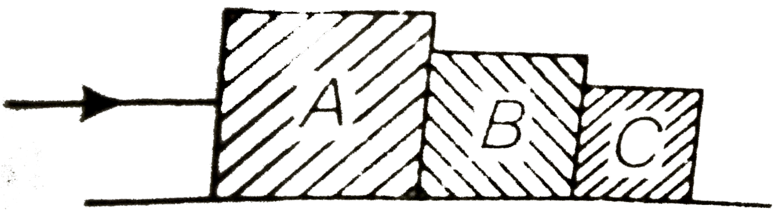
12. Three blocks A,B and C of masses 4 kg, 2kg and 1kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is



A. 2 N

B. 6 N

C. 8 N-s

D. 18 N

Answer: B

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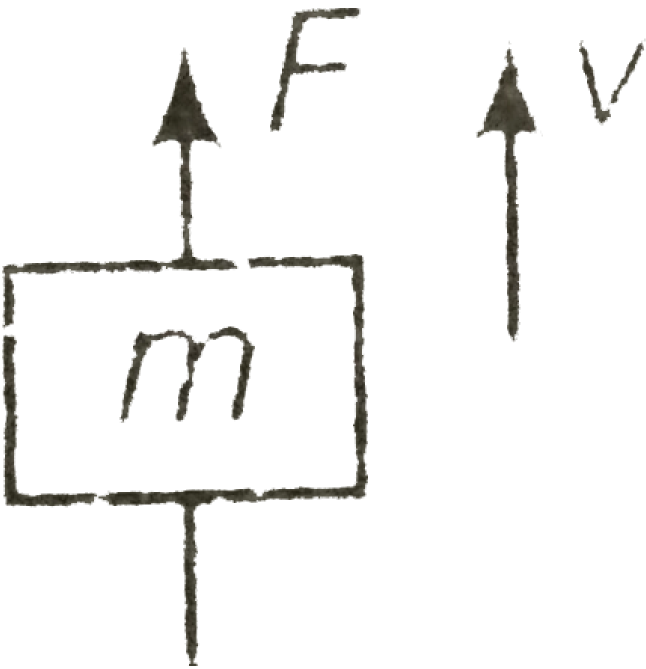
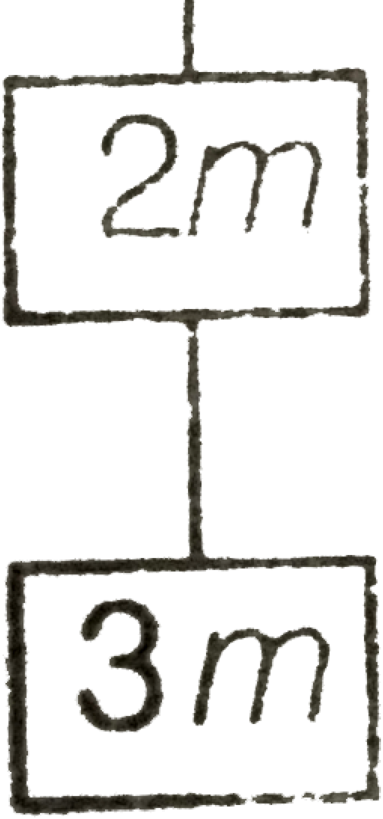
13. Three blocks with masses m,2m and 3m are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m ? (g is the acceleration due to gravity).





A. 3 mg

B. 6 mg

C. zero

D. 2 mg

Answer: C

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EXERCISE -2 (PULLEY)

1. A boy of mass 40 kg climbs up a rope with an acceleration of 2ms^{-2}. What is the tension in the rope ?

A. 472 N

B. 435 N

C. 232 N

D. 568 N

Answer: A

Watch Video Solution

2. Two bodies of masses 1 kg and 2 kg are connected by a very light string passed over a clamped light smooth pulley. If the system is released from rest, find the acceleration of the two masses and the tension in the string

A. $3.27 \text{m} / \text{s}^2, 13 \text{N}$

B. $4.5 \text{m} / \text{s}^2, 13 \text{N}$

C. $1.27 \text{m} / \text{s}^2, 13 \text{N}$

D. $0.327 \text{m} / \text{s}^2, 13 \text{N}$

Answer: A

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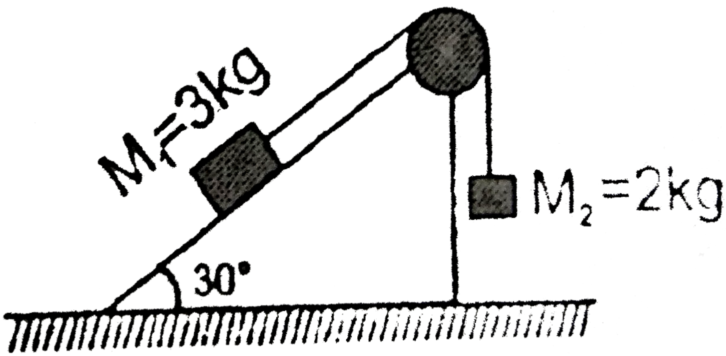
3. A block of mass $M_1 = 3 \text{kg}$ on a smooth fixed inclined plane of angle 30° is connected by a cord over a small frictionless pulley to a second block mass 2kg hanging vertically. The tension in the cord and the acceleration of each block are .... and .... respectively.



A. 0.98 m/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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4. Two blocks of masses 2 kg and 4 kg are connected by a light string passing over a light smooth pulley clamped to the edge of a horizontal table. The 2 kg block is on the smooth horizontal table and the other block is hanging vertically, (i) Find the acceleration of the stem if it is released from rest, (ii) Find the tension in the string.

A. $6.54 \mathrm{m/s^2}, 26 \mathrm{N}$

B. $2.6 \mathrm{m/s^2}, 6.54 \mathrm{N}$

C. $6.54 \mathrm{m/s^2}, 13 \mathrm{N}$

D. $13 \mathrm{m/s^2}, 26 \mathrm{N}$

Answer: C

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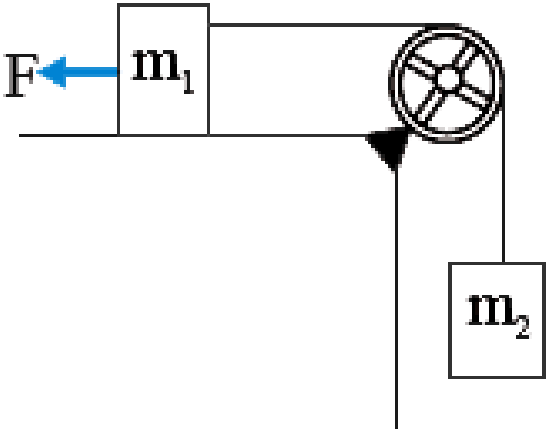
5. A constant force $F = m_2 g/2$ is applied on the block of mass m_1 as shown in fig. The string and the pulley are light and the surface of the table is smooth. The acceleration of m_1 is :



A. $\dfrac{m_2 g}{2m_1}$

B. $\dfrac{m_2 g}{2(m_1 + m_2)}$

C. $\dfrac{3m_2 g}{2(m_1 + m_2)}$

D. $\dfrac{3m_2 g}{(2m_1)}$

Answer: B

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6. A particle of small m is joined to a very heavy body by a light string passing over a light pulley. Both bodies are free to move. The total downward force on the pulley is

A. mg

B. 2mg

C. 4 mg

D. $> > mg$

Answer: C

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EXERCISE -2 (PSEUDO FORCE)

1. A small ball is suspended by a string from the ceiling of a car. As the car accelerates at a rate 'a' the string makes an angle '/theta' with the vertical in equilibrium. Then the tension in the string is :

A. $mg\cos\theta$

B. $ma\sin\theta$

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

D. $ma\sqrt{a^2 + g^2}$

Answer: C

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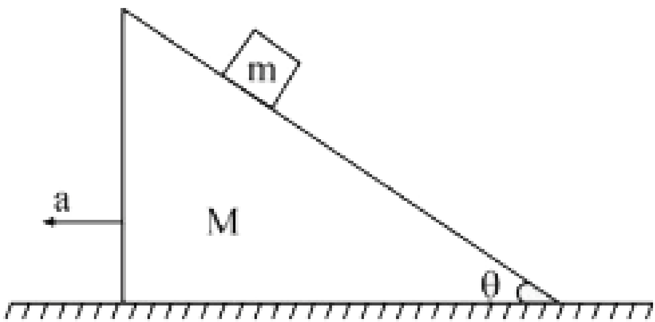
2. All the surfaces are smooth as shown in figure. The acceleration of mass m relative to wedge is :



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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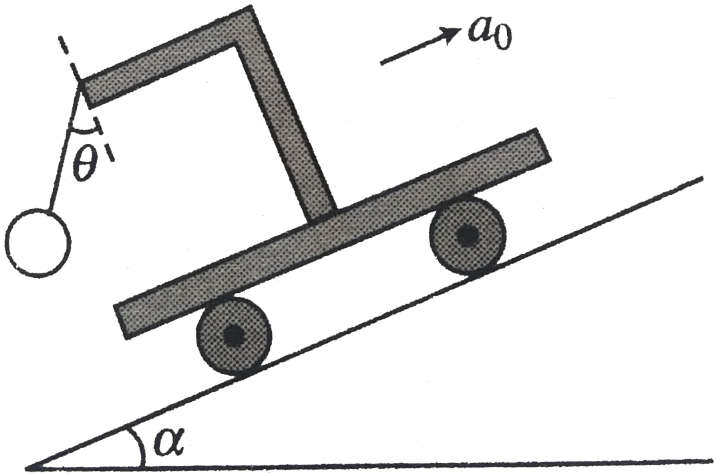
3. A pendulum of mass m hangs from a support fixed to a trolley. The direction of the string when the trolley rolls up a plane of inclination

α with acceleration a_0 is



A. zero

B. $\tan^{-1}\alpha$

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

D. $\frac{\tan^{-1}a}{g}$

Answer: C

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EXERCISE -2 (FRICTION : ROUGH HORIZONTAL SURFACE)

1. A wooden block of 100 kg is about to be pushed on a floor of coefficient of friction 0.4. What is the magnitude of the force of friction on the wooden block when it is just pushed ?

A. 392 N

B. 294N

C. 196N

D. 490N

Answer: A

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2. 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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3. 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 $g = 10 ms^{-2}$ The frictional force on the block is

A. 25 N

B. 15 N

C. 10 N

D. zero

Answer: D

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4. The coefficient of friction is 0.75. If sin37°= 0.6, the angle of friction is

A. 18°

B. 37°

C. 74°

D. 53°

Answer: B

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

A. 90 N

B. 80 N

C. 60 N

D. 30 N

Answer: C

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6. A body of mass 60 kg is pushed up 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. What is the acceleration of the body ?

A. $14.7 ms^{-2}$

B. $1.96 ms^{-2}$

C. $0.98 ms^{-2}$

D. $4.9 ms^{-2}$

Answer: C

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7. A block of mass 2 kg is on a horizontal surface. The coefficient of static & kinetic frictions are 0.6 & 0.2 The minimum horizontal force required to start the motion is applied and if it is continued, the velocity acquired by the body at the end of the 2nd second is (g= $10 ms^{2}$)

A. $8 ms^{-1}$

B. $4 ms^{-1}$

C. $2 \mathrm{ms}^{-1}$

D. zero

Answer: A

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8. A marble block of mass 2 kg lying on ice when given a velocity of 6 $\mathrm{m\,s}^{-1}$ is stopped by friction in 10 s. Then the coefficient of friction is

A. 0.02

B. 0.03

C. 0.06

D. 0.01

Answer: C

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

A. $\mu M g$

B. Mg

C. Zero

D. μ Mg/2

Answer: C

Watch Video Solution

10. Two bodies having the same mass 5kg each have different surface areas $20 m^2$ and $10 m^2$ in contact with a horizontal plane. If the coefficient of friction is 0.4, the forces of friction that come into play when they are in motion will be in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

Watch Video Solution

11. A boy of weight 25kg slides down a rope hanging from the branch of a tree. If the force of friction against him is 50N, the boy's acceleration is ($g=10ms^{-2}$)

A. $10ms^{-2}$

B. $12ms^{-2}$

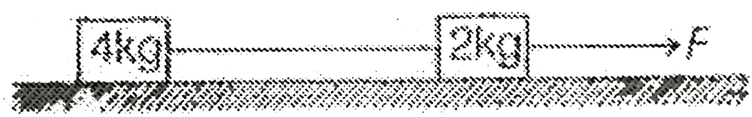
C. $8ms^{-2}$

D. $2ms^{-2}$

Answer: C

Watch Video Solution

12. Two blocks of mass 4kg and 2kg are connected by a heavy string and placed on rough horizontal plane. The 2 kg block is pulled with a constant force F. the coeffcent of friction between the blocks and the ground is 0.5. what is the value of F so that tension in the string is constant throughout the length? $(g = 10m/s^2)$



A. 40 N

B. 30 N

C. 50 N

D. 60 N

Answer: B

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13. A block of mass 4 kg is kept over a rough horizontal surface. The coefficient of friction between the block and the surface is 0.1 At, t=0, $(3\hat{i})\left(\frac{m}{s}\right)$ velocity is imported to the block simultaneously $(-2\hat{i})N$ force starts acting on it. Its displacement in first 5s is

A. $8\hat{i}$

B. $-8\hat{i}$

C. $3\hat{i}$

D. $-3\hat{i}$

Answer: C

Watch Video Solution

14. A body of mass 5kg is under the action of 50N on the horizontal surface. If coefficient of friction in between the surfaces is one, the distance it travels in 3 s is

A. 2 m/s

B. 1.5 m

C. 0.9 m

D. 6 m

Answer: C

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15. Two trolleys of masses m and 3 m are connected by a spring. The spring is compressed and released the trolleys move off in opposite directions and come to rest after travelling distances s1, and s2, respectively. Assuming coefficient of friction is same for both the ratio of sto s_1 to s_2 is

A. $1:9$

B. $1:3$

C. $3:1$

D. $9:1$

Answer: C

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16. A ball of mass is thrown vertically upwards by applying a force by hand. If the hand moves while applying the force and the ball goes up to height further, find the magnitude of the force. (Take $g = 10 ms^{-2}$)

A. 0.2

B. `0.4

C. 0.6

D. 0.8

Answer: D

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17. A horizontal force applied on a body on a rough horizontal surface produces an acceleration 'a'. If coefficient of friction between the body & surface which is m is reduced to m/3, the accele-ration increases by 2 units. The value of m is

A. 2/3kg

B. 3/2kg

C. 3/g

D. 1/g

Answer: C

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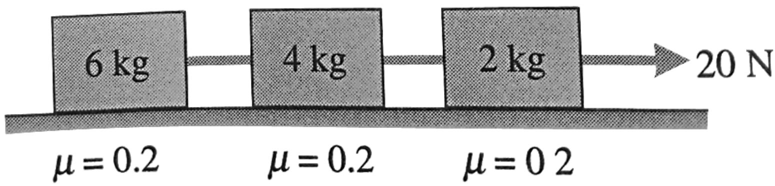
18. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. 360 m

B. 10 m

C. 350 m

D. 422.5 m

Answer: D

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19. When a car of mass 1200 kg is moving with a velocity of $15 \mathrm{ms}^{-1}$ on a rough horizontal road, its engine is switched off. How far does the car travel before it comes to rest if the coefficient of kinetic friction between the road and tyres of the car is 0.5? ($g = 10 \mathrm{ms}^{-2}$)

A. 21.6 m

B. 25 m

C. 23.5 m

D. 22.5 m

Answer: D

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20. A vehicle of mass m is moving on a rough horizontal road with momentum p. If the coefficient of friction between the tyres and the road be 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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EXERCISE -2 (PULLING AND PUSHING)

1. A body of weight 20N is on a horizontal surface, minimum force applied to pull it when applied force makes an angle 60° with horizontal (angle of friction a = 30°) is

A. 20 N

B. $20\sqrt{3}$N

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

D. 20 N

Answer: C

Watch Video Solution

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

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

B. $100\sqrt{3}$

C. $50\sqrt{3}$

D. 50N

Answer: D

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3. A homogeneous chain lies in limiting equilibrium on a horizontal table of coefficient of friction 0.5 with part of it hanging over the edge of the table. The fractional length of the chain hanging down the edge of the table is

A. $1/2$

B. $1/5$

C. $1/3$

D. $2/3$

Answer: C

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EXERCISE -2 (MOTION ON UNBANKED ROAD)

1. A car is travelling at 36 kmph on a road. If $\mu = 0.5$ between the tyres and the road, the minimum turning radius of the car is: ($g = 10 ms^{-2}$)

A. 20 m

B. 25 m

C. 30 m

D. 35 m

Answer: A

Watch Video Solution

2. A coin is kept at distance of 10 cm from the centre of a circular turn table. If $\mu = 0.8$ the frequency of rotation at which the coin just begins to slip is

A. 62.8 rpm

B. 84.54 rpm

C. 54.6 rpm

D. 32.4 rpm

Answer: B

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

A. 4

B. 3

C. 2

D. 1

Answer: D

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4. A car is driven round a curved path of radius 18 m without the danger of skidding. The coefficient 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 ? [g = $10 ms^{-1}$]

A. 21.6 kmph

B. 18.5 kmph

C. 25.4 kmph

D. 28.6 kmph

Answer: A

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5. A block of mass kg lies on a horizontal surface in a truckÂ· The coefficient of stalk friction between the block and the surface is 0.6. If the acceleration of the truck is $5 ms^{-2}$. The frictional force acting on the block is

A. 2 N

B. 5 N

C. 3 N

D. 6 N

Answer: B

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6. The rear side of a truck is open and a box of mass 40kg is placed 5m away from the open end. The coefficient of friction between the box and the surface below it is 0.15. The truck starts from rest with an acceleration of $2 \mathrm{ms}^{-2}$ on a straight road. At what distance from the starting points does not the box fall off the truck?

A. 20 m

B. 10 m

C. $\sqrt{20}$m

D. 5 m

Answer: A

Watch Video Solution

7. A box is placed on the floor of a truck moving with an acceleration of 7ms^{-2}. If the coefficient 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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EXERCISE -2 (FRICTION ON VERTICAL SURFACES)

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

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A. 20 N

B. 50 N

C. 100 N

D. 2 N

Answer: D

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2. A person holds a block weighing 2kg between his hands & keeps it from falling down by pres-sing it with his hands. If the force exerted by each hand horizontally is 50N, the coefficient of friction between the hand & the block is ($g=10ms^{-2}$)

A. 0.2

B. 0.4

C. 0.1

D. 0.5

Answer: A

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3. An eraser weighing 2N is pressed against the black board with a force of 5N. If 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. 2.8 N

C. 4N

D. 4.8 N

Answer: C

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4. Block of mass 10 kg is moving on inclined plane with constant velocity 10 m/s. The coedfficient of kinetic friction between incline plane and block is :-

A. 48N

B. 24 N

C. 40 N

D. zero

Answer: C

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5. A book of weight 20 N is pressed between two hands and each hand exerts a force of 40 N. If the book just starts to slide down. What is the value of the coefficient of friction?

A. 0.25

B. 0.2

C. 0.5

D. 0.1

Answer: A

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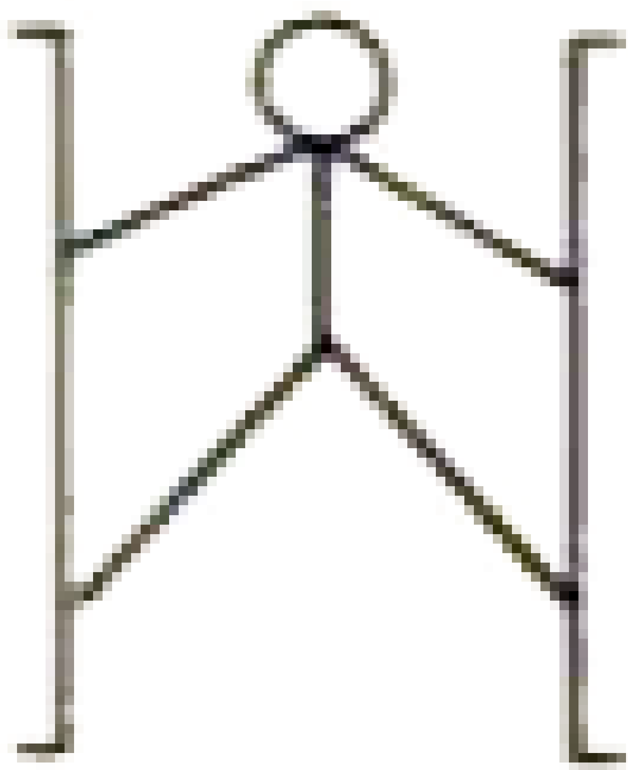
6. A man of mass 40 kg is at rest between the walls as shown in the figure. If between the man and the walls is 0.8, find the normal reaction exerted by the walls on the man. (g = 10ms^{-2})



A. 100 N

B. 250 N

C. 80 N

D. 50 N

Answer: B

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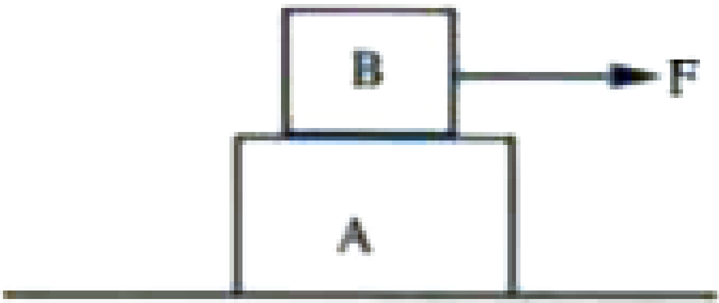
7. A block B of mass 5kg is placed on a slab A of mass 20kg which lies on a frictionless surface as shown in the figure. The coefficient of static friction between the block and the slab is 0.4 and that of kinetic friction is 0.2. If a force F = 25N acts on B, the acceleration of the slab will be:



A. $0.4 \mathrm{ms}^{-2}$

B. $0.5 \mathrm{ms}^{-2}$

C. $1 \mathrm{ms}^{-2}$

D. zero

Answer: C

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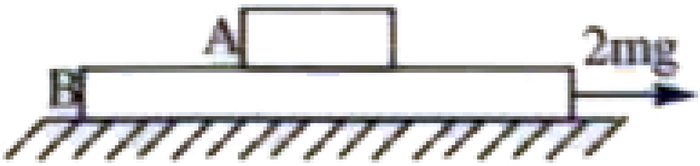
8. Block A of mass m rests on the plank B of mass 3m which is free to slide on a frictionless horizo-ntal surface. The coefficient of friction between the block and plank is 0.2. If a horizontal force of magnitude 2 mg is applied to the plank B, the acceleration of A relative to the plank and relative to the ground respectively, are:



A. $0, \frac{g}{2}$

B. $0, \frac{2g}{3}$

C. $\frac{3g}{5}, \frac{g}{5}$

D. $\frac{2g}{5}, \frac{g}{5}$

Answer: D

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EXERCISE -2 (INCLINED PLANE)

1. A wooden block is placed on an inclined plane. The block just begins to slide down when the angle of the inclination is increased to 45°. What is the coefficient of the friction?

A. 0.25

B. 0.75

C. 1

D. 0.5

Answer: C

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2. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. If $\mu_S = 0.6$, what is the frictional force on the block ?

A. 9.8 N

B. 19.6N

C. 14.7N

D. 4.9N

Answer: A

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3. A body takes $1\left(\frac{1}{3}\right)$ times as much time to slide down a rough inclined plane as it takes to slide down an identical bust 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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4. A block of mass 2kg is lying on a rough inclined plane. The force needed to move the block up the plane with uniform velocity by applying a force parallel to the plane is 100N. The force needed to move the block up with an accele-ration of 2ms^{-2} is

A. 100 N

B. 200 N

C. 96 N

D. 104 N

Answer: D

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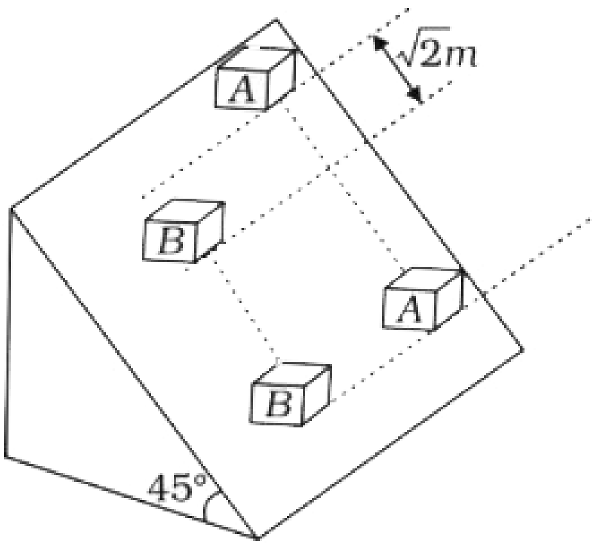
5. Two identical blocks A and B of equal masses are placed on rough inclined plane as shown in the figure. Initially the block A is $\sqrt{2}$m behind the block B. Coefficient of kinetic friction for the blocks A and B are 0.2 and 0.3 respectively $(g = 10\text{m}/\text{s}^2)$. By the time the two blocks come on the same line on the inclined plane if they are released simultaneously, the distance moved by B is βm Find the value of β



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

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

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

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

Answer: B

Watch Video Solution

6. A block is pushed up a rough inclined plane of 45°. If the time of descent is twice the time of ascent, the coefficient of friction is

A. 0.6

B. 0.4

C. 0.5

D. 0.25

Answer: A

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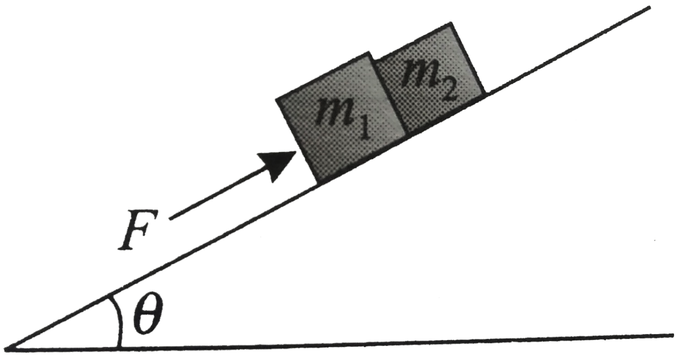
7.



Two blocks are placed at rest on a smooth fixed inclined place. A force F acts on block of mass m_1 and is parallel to the inclined plane as shown in figure. Both blocks move up the incline. Then

(i) Draw free body diagram blocks of mass m_1 and blocks mass m_2

(ii) Find acceleration of blocks of mass m_1 and blocks mass m_2

(iii) Find normal reaction between the blocks of mass m_1 and m_2

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

B. 1.414 s

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

D. 2s

Answer: B

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8. A block slides down a slope of angle θ with constant velocity. It is then projected up with a velocity of 10ms^{-1}, $g = 10\text{ms}^{-2}$ & θ = 30º. The maximum distance it can go up the plane before coming to stop is

A. 10 m

B. 5 m

C. 4 mg

D. 15 m

Answer: B

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9. A 30 kg block is to be moved up an inclined plane at an anglue 30° to the horizontal with a velocity of $5 \mathrm{ms}^{-1}$. If the frictional force retarding the motion is 150N find the horizontal force required to move the block up the plane. $(g = 10 \mathrm{ms}^{-2})$

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

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

C. 300 N

D. 150 N

Answer: A

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10. An engine of one metric ton is going up an inclined plane, 1 in 2 at the rate of 36 kmph. If the coefficient of friction is $1/\sqrt{3}$, the power of engine is

A. 9.8 W

B. 98 W

C. 980 W

D. 98 kW

Answer: D

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11. The minimum force required to move a body up 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 $\frac{1}{2\sqrt{3}}$, then the angle of the inclined plane is

A. 80.5 N

B. 91.4 N

C. 85.4 N

D. 78.4 N

Answer: C

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12. A body of mass 10kg is on a rough inclined plane having an inclination of 30° with the horizontal. If coefficient of friction between the surfaces of contact of the body and the plane is 0.5. Find the least force required to pull the body up the plane.

A. 80.5 N

B. 91.45 N

C. 85.4 N

D. 78.4 N

Answer: B

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13. A block of wood of mass 0.5 kg is placed on a plane making 30° with the horizontal. If the coefficient of friction between the surfaces of contact of the body and the plane is 0.2. What force is required to keep the body sliding down with uniform velocity.

A. 6.4 N

B. 1.6 N

C. 3.2 N

D. 4.8 N

Answer: B

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

A. 3.725 sec

B. 2.650 sec

C. 2.828 sec

D. 4.135 sec

Answer: C

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15. A body is sliding down an inclined plane have coefficient of friction 0.5. If the normal reaction is twice that of resultant downward force along the incline. Find the angle between the inclined plane and the horizontal.

A. 90°

B. 30°

C. 60°

D. 45°

Answer: D

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EXERCISE -2 (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. 1000N

B. 3500N

C. 1600N

D. 2000N

Answer: D

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2. A stone of mass 0.5 kg is attached to a string of length 2 m and is whirled in a horizontal circle. If the string can with stand 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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3. 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 light rigid rod. The angle made by the rod with the vertical is:

A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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4. An electric kettle has two coils. When one of these is switched on, thje water in the kettle boils in 6 minutes. When the other coil is switched on, the water boils in 3 minutes. If the two coils are connected in series, the time taken to boil the water in the kettle is

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

B. 2T

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

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

Answer: C

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5. On one end of a string of length l is connected to a particle of mass m and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed v the net force on the particle (directed towards the centre) is :

T is the tension in the string . [Choose the correct alternative].

A. T

B. $T - \frac{mv}{t}$

C. $T + \frac{mv}{1}$

D. 0

Answer: A

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6. The linear momentum of a particle varies with time t as $p = a + bt + ct^2$. Then, whichh of the following is correct?

A. Velocity of particle is inversely proportional to time

B. Displacement of the particle is independent of time

C. Force varies with time in a quadratic manner

D. Force is dependent linearly on time

Answer: D

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EXERCISE-3(CHANGE IN MOMENTUM, FORCE, IMPULSE)

1. A body of mass 1 kg is moving with velocity $30 ms^{-1}$ due north. It is acted on by a force of 10 N due east for 4 seconds. Find the velocity of the body after the force ceases to act.

A. $50 m/s, \tan^{-1}(\frac{3}{4})$

B. $100 m/s, \tan^{-1}(\frac{4}{3})$

C. $50\text{m/s}, \tan^{-1}\left(\frac{3}{5}\right)$

D. $100\text{m/s}, \tan^{-1}\left(\frac{4}{5}\right)$

Answer: A

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2. A force of 20 N acts on a body of mass 5kg at rest. What is the acceleration of the body? What is its velocity after 5 seconds if the same force acts? After 5 seconds if the force ceases to act how will the body move?

A. 4m/s^2, 20 m/s, uniform velocity

B. 2m/s^2, 15 m/s , uniform velocity

C. 2m/s^2, 10 m/s , uniform velocity

D. 4m/s^2, 20 m/s, uniform acceleration

Answer: A

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3. A ball of mass 400 gm is dropped from a height of 5m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 100N so that it attains a vertical height of 20m. Find the time for which the ball remains in contact with the bat

A. 0.12 s

B. 0.24 s

C. 0.36 s

D. 0.48 s

Answer: A

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4. A batsman deflects a ball by an angle of 60° without changing its initial speed of 20 ms^{-1}. what is the impulse imparted to the ball if its mass is 0.15 kg?

A. 9 Js

B. 6 Js

C. 3 Js

D. 1 Js

Answer: C

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5. A body of mass 5 kg is at rest. Three force $F_1 = 10\mathrm{N}$ due North $F_2 = 10\mathrm{N}$ along East and $F_3 = 10\sqrt{2}\mathrm{N}$ along N-W act on it simultaneously. The acceleration produced in the body is,

A. $4ms^{-2}$, along North

B. $2ms^{-2}$, along North

C. $4ms^{-2}$, along east

D. $2ms^{-2}$, along east

Answer: A

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6. The momentum of a body in two perpendicular direction 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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7. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5 t$, where F is in newton and t in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the impulse imparted to the bullet?

A. 9Ns

B. Zero

C. 0.9 Ns

D. 1.8Ns

Answer: C

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8. A 15Kg mass is accelerated from rest with a force of 100N. As it moves faster, friction and air resistance create an oppositely directed retarding force given by $F_B = A + BV$. where $A = 25N$ and $B = 0.5\frac{N}{m/s}$.

At what velocity m/s does the acceleration equal to one half of the initial acceleration ?

A. $5ms^{-1}$

B. $50ms^{-1}$

C. $75ms^{-1}$

D. $100ms^{-1}$

Answer: B

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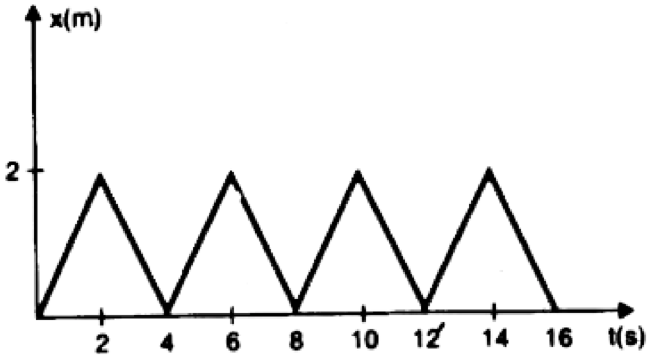
9. Figure 5.17 shows the position-time graph of a body of mass 0.04 kg . Suggest suitable physical context for this motion. What is the time between two consecutive impulses received by the body ? What is the magnitude of each impulse ?



A. 4 sec, 4×10^{-4} kg m/s

B. 2 sc, 8×10^{-4} kg m/

C. 6 sec, 4×10^{-4} kg m/s

D. 8 sec, 8×10^{-4} kg ms

Answer: B

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10. A box is put on a scale which is adjusted to read zero, when the box is empty. A stream of pebbles is then poured into the base from a height h above its bottom at a rate of n pebbles/s. Each pebble has a mass m. If the pebbles collide with the box such that they immediately come to rest after collision, then the scale reading at time t after the pebbles begin to fill the box is [neglect piling up of pebbles]

A. $mn\{\sqrt{(2gh)} + gt\}$

B. $\{\sqrt{(2gh) + gt}\}$

C. $\dfrac{\sqrt{(2gh) + gt}}{mn}$

D. $mn\{(2gh) + gt\}$

Answer: A

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11. Five persons A, B, C, D & E are pulling a cart of mass 100kg on a smooth surface and cart is moving with acceleration $3\mathrm{m/s}^2$ in east direction. When person A' stops pulling, it moves with acceleration $1\mathrm{m/s}^2$in the west direction. When person 'B' stops pulling, it moves with accele-ration $24\mathrm{m/s}^2$ in the north direction. The magnitude of acceleration of the cart when only A & B pull the cart keeping their directions same as the old direction is

A. $26\mathrm{m/s}^2$

B. $3\sqrt{71}\mathrm{m/s}^2$

C. $25\mathrm{m/s}^2$

D. $30\mathrm{m/s}^2$

Answer: C

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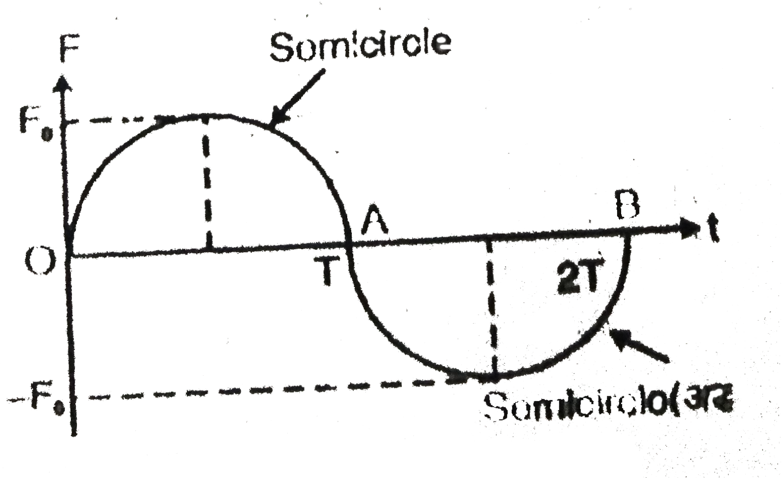
12. A unidirectional force F varying with time t as shown in the figure acts for a short duration 2T on a particle which is initially at rest. Then the velocity acquired by the body is:



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

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

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

D. zero

Answer: D

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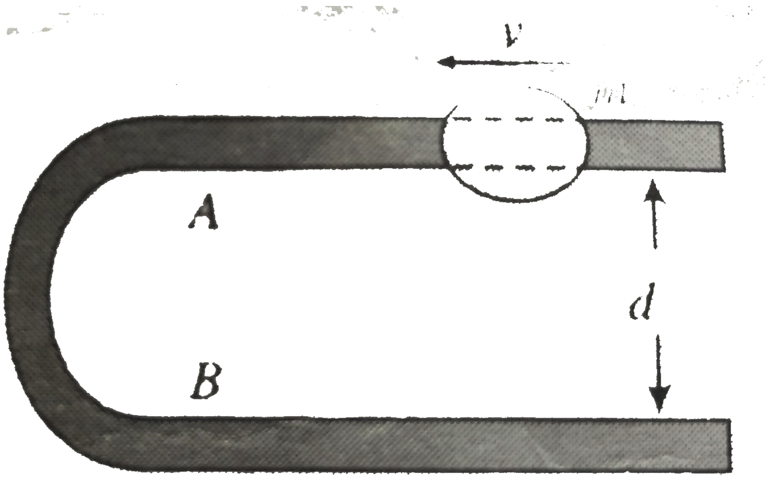
13. A U-shaped smooth wire has a semi-circular bending between A and B as shown in fig. A bead of mass m moving with uniform speed v through the wire enters the semiculcular bent at A and leaves at B. Find the average force exerted by the bead on the part AB of the wire.



A. 0

B. $\frac{mv^2}{\pi d}$

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

D. $\frac{mv^2}{\pi d}$

Answer: B

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EXERCISE-3 (LAW OF CONSERVATION OF LINEAR MOMENTUM)

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

$\left|(m_1\vec{v}_1' + m_2\vec{v}_2')\right| - \left|(m_1\vec{v}_1 + m_2\vec{v}_2)\right|$ 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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2. A bomb falling freely bursts after 10 sec. $(g = 10ms^2)$ into two fragments of masses in the ratio of 2:1. The velocity of heavier fragment immediately after the explosion is $200ms^{-1}$ vertically downwards. The velocity of the lighter fragment immediately after the explosion is

A. $50ms^{-1}$ upward

B. $75ms^{-1}$ downward

C. $100ms^{-1}$ upward

D. $400ms^{-1}$ upward

Answer: C

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3. A 500kg boat has an initial speed of 10ms^{-1} as it passes under a bridge. At that instant a 50 kg man jumps straight down into the boat from the bridge. The speed of the boat after the man and boat attain a common speed is

A. $\frac{100}{11}\text{ms}^{-1}$

B. $\frac{10}{11}\text{ms}^{-1}$

C. $\frac{50}{11}\text{ms}^{-1}$

D. $\frac{5}{11}\text{ms}^{-1}$

Answer: A

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4. A gun of mass M fires a bullet of mass m, with a Kinetic energy E. The total kinetic energy in the firing process is

A. $\left[\frac{m + M}{M}\right]E$

B. $\frac{[m + M]E}{m}$

C. $\left(\frac{M}{M + m}\right)E$

D. $\left(\frac{m}{M + m}\right)E$

Answer: A

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5. Two spacemen A and B are floating is gravity free space with zero velocity relative to each other. "A" has a mass of 120 kg and "B" has a mass of 90kg which includes a 5 kg radio box. "B" throws the box towards "A" with a velocity of 2m/x and A catches it. The change in velocity of each one is

A. $v_A = 11.8\text{cm}/\text{s}, v_B = 8\text{cm}/\text{s}$

B. $v_A = 8\text{cm}/\text{s}, v_B = 11.8\text{cm}/\text{s}$

C. $v_A = 10\text{cm}/\text{s}, v_B = 10\text{cm}/\text{s}$

D. $v_A = 9\text{cm}/\text{s}, v_B = 12\text{cm}/\text{s}$

Answer: B

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6. The first & second stage of two stage rocket separately weigh 100 kg and 10 kg and contain 800kg and 90kg fuel respectively. If the exhaust velocity of gases is 2 km/sec then find velocity of rocket (nearly) ($\log_{10} 5 = 0.6990$) (neglect gravity)

A. 7.8×10^3 m/s

B. 9.3×10^3 m/s

C. 2.4×10^3 m/s

D. 6.1×10^3 m/s

Answer: A

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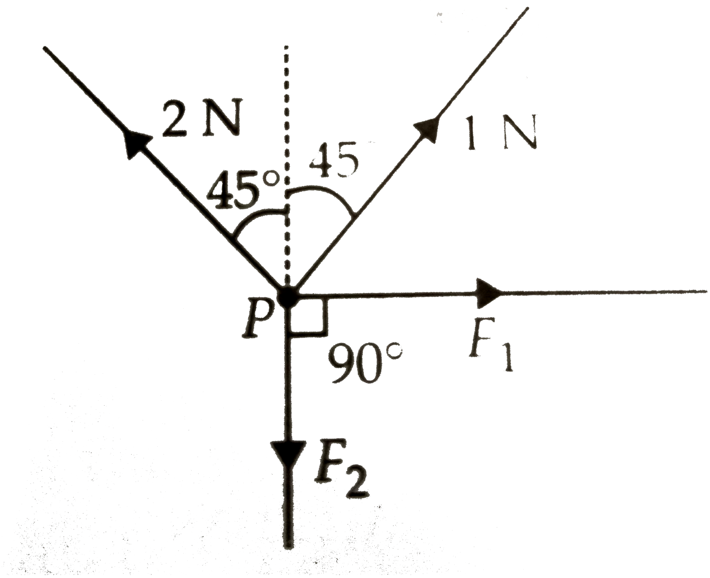
EXERCISE-3 (EQUILIBRIUM OF A PARTICLE)

1. There are four forces ,acting at a point P produced by strings as shown in figure. which is at rest. The forces F_1 and F_2 are



A. $\frac{1}{\sqrt{2}}, \frac{3}{\sqrt{2}}$

B. 1,3

C. $\sqrt{2}, 3\sqrt{2}$

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

Answer: A

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

A. 20 N, 30 N

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

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

D. 10 N, 30 N

Answer: B

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EXERCISE-3 (APPARENT WEIGHT, TENSION, AND NORMAL REACTION)

1. A person of mass 60 kg stands on a weighing machine in a lift which is moving

a) upwards with a uniform retardation of $2.8 \mathrm{ms}^{-2}$.

b) downwards with a uniform retardation of $2.2 \mathrm{ms}^{-2}$. Find the reading shown by the weighing machine in each case

A. 420 N, 720 N

B. 320 N , 520 N

C. 720 N , 420 N

D. 640 N , 720 N

Answer: A

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2. A uniform rope of mass m hangs freely from a ceiling. A bird of mass M climbs up the rope with an acceleration a. The force exerted by the rope on the ceiling is

A. Ma + mg

B. M(a+g)+mg

C. M(a+g)

D. Dependent on the position of bird on the rope

Answer: B

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3. In the arrangment shown in the figure, the ratio of tensions $T_1 : T_2 : T_3$ is:

A. $2:3:4$

B. $4:3:2$

C. $9:7:4$

D. $4:7:9$

Answer: D

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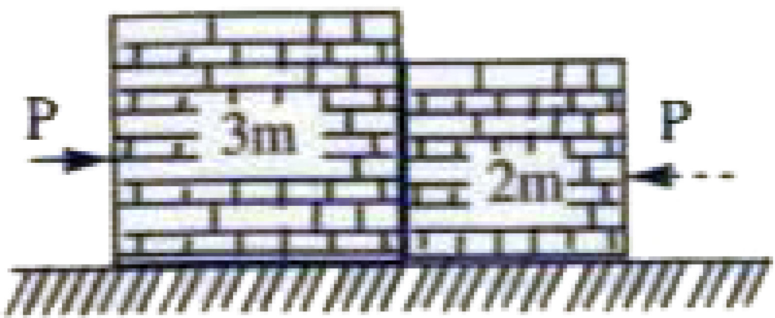
4. Two blocks of masses '3m' and '2m' are in contact on a smooth table. A force P is first applied horizontally on block of mass '3 m' and then on mass '2m'. The contact forces between the two blocks in the two cases are in the ratio:



A. $1:2$

B. $2:3$

C. $3:2$

D. $5:3$

Answer: B

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5. A monkey a mass 15 kg is climbing on a rope with one end fixed to the ceiling. If it wishes to go up with an acceleration of 1 m/s^2, how much force should it apply to the rope? If the rope is 5 m long and the monkey starts from rest, how much time will it take to reach the ceiling?

A. $120N, \sqrt{10}$ sec

B. $132N, \sqrt{10}$ sec

C. $153\text{N}, \sqrt{10}$sec

D. $165\text{N}, \sqrt{10}$ sec

Answer: D

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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 $2.5\text{m}/\text{s}^2$. 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. A homogeneous rod of length L is acted upon by two forces F_1 and F_2 applied to its ends and directed opposite to each other. With what force F will the rod be stretched at the cross section at a distance l from the end where F_1 is applied?

A. $\dfrac{(F_2 - F_1)l}{L}$

B. $\dfrac{(F_2 - F_1)l}{L} + F_1$

C. $\dfrac{(F_2 + F_1)l}{2L}$

D. $\dfrac{(F_2^2 - F_1^2)l}{L}$

Answer: B

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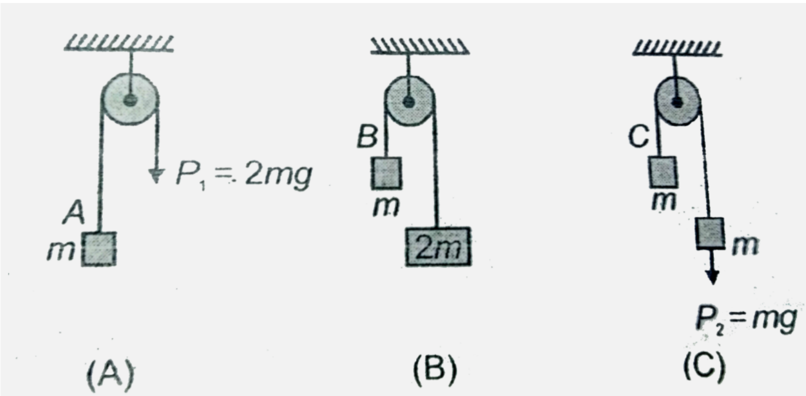
8. In the figure the blocks A, B and C of mass m each , having accelerations a_1, a_2 and a_3 respectively . P_1 and P_2 are external forces of magnitude 2 mg and mg respecttively .



A. $a_1 = a_2 = a_3$

B. $a_1 > a_3 > a_2$

C. $a_1 = a_2, a_2 > a_3$

D. $a_1 > a_2, a_2 = a_3$

Answer: B

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9. Two masses 5 kg and 3 kg are suspended from the ends of an unstretchable light string passing over a frictionless pulley. When the masses are released, the thrust on the pulley is (g = $10 ms^{-2}$)

A. 80 N

B. 37.5 N

C. 150 N

D. 75 N

Answer: D

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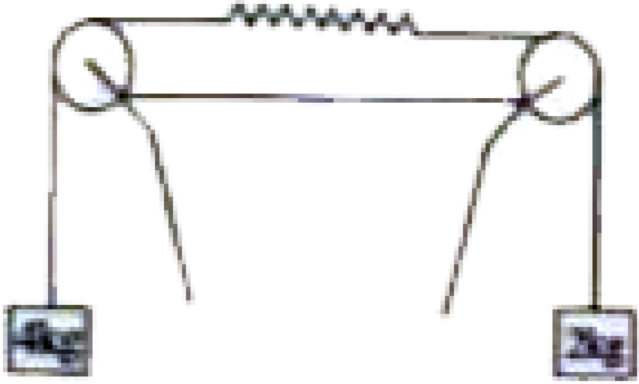
10. The reading in the spring balance is:



A. 2.6 kgwt

B. 2 kgwt

C. 6 kg wt

D. 4.3 kgwt

Answer: A

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11. Three mass points each of mass m are placed at the vertices of an equilateral triangle of side l. What is the gravitational field and potential at the centroid of the triangle due to the three masses?

A. Remains constant

B. Decreases

C. Increases by a factor 1.5

D. Increases by a factor 3

Answer: C

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12. In the arrangement shown in the figure, the acceleration of the pulley is, (Ignore friction)

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

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

C. zero

D. $\frac{F}{2M}$

Answer: A

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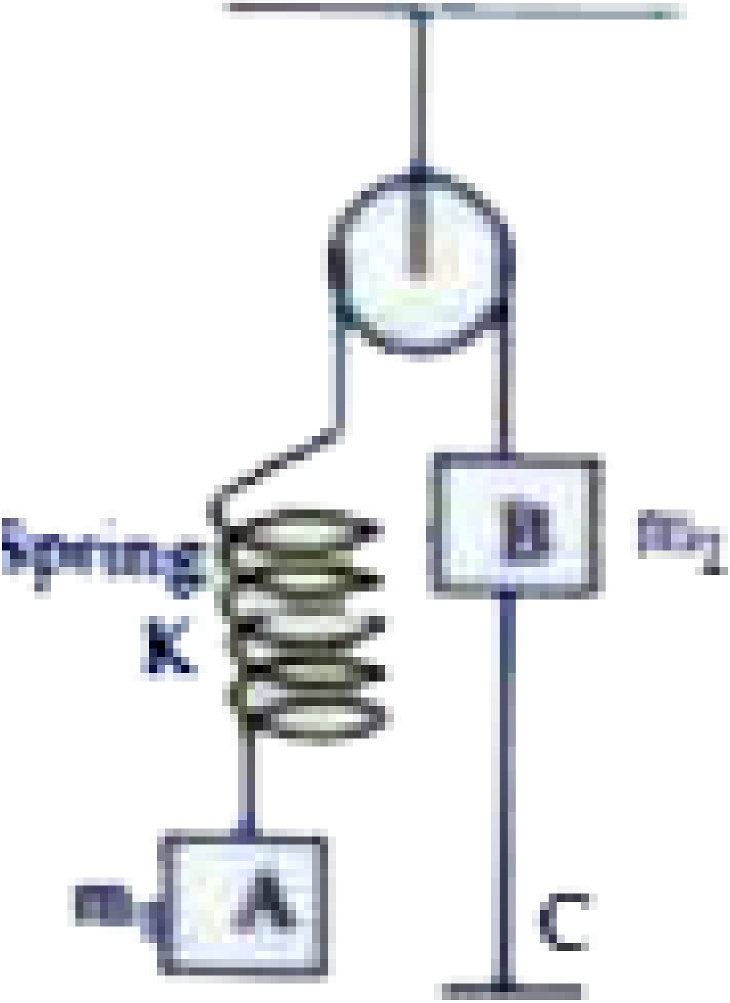
13. In the system shown in figure $m_1 > m_2$. System is held at rest by thread BC. Just after the thread BC is burnt.



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

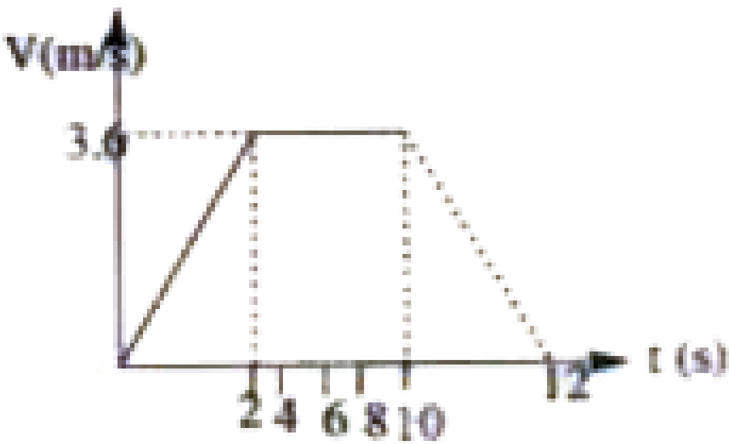
D. maginitude of acceleration of both the blocks will be

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

Answer: A

Watch Video Solution

14. A lift is going up, the total mass of the lift and the passengers is 1500kg. The variation in the speed of lift is shown in fig. Then the tension in the rope at t = 1 s will be:



A. 17400 N

B. 14700 N

C. 12000 N

D. 10000 N

Answer: A

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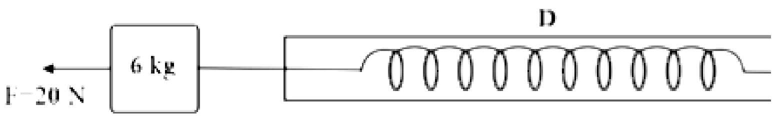
15. A dynamometer D, which is a device used to measure force, is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10 N are applied on the blocks as shown in the figure. The reading of the dynamometer is



A. 10 N

B. 20 Ns

C. 6 N

D. 14 N

Answer: D

Watch Video Solution

EXERCISE-3 (SPRING FORCE)

1. A block of 2 kg is suspended from the ceiling through a massless spring of spring constant k=100 N/m. What is the elongation of the spring? If another 1 kg is added to the block, what would be the further elongation?

A. 0.2m, 0.1m

B. 0.1m, 0.2m

C. 0.3m, 0.1m

D. 0.1m, 0.3m.

Answer: A

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EXERCISE-3 (PSEUDO FORCE)

1. A body is placed on a smooth inclined plane of inclination 1 in x. The horizontal acceleration to be given to the inclined plane so that the body on it remains at rest with respect to inclined plane is

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

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

C. $\dfrac{gx}{\sqrt{x^2 - 1}}$

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

Answer: D

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2. A pendulum is hanging from the ceiling of a cage. When the cage is moving up with certain acceleration and when it is moving down with the same acceleration, the tensions in the string are T_1 and T_2 respectively. When the cage moves horizontally with the same acceleration, the tension in the string is,

A. $\sqrt{2(T_1^2 + T_2^2)}$

B. $\sqrt{\frac{T_1^2 + T_2^2}{2}}$

C. $\sqrt{2(T_1^2 - T_2^2)}$

D. $\sqrt{T_1^2 + T_2^2}$

Answer: B

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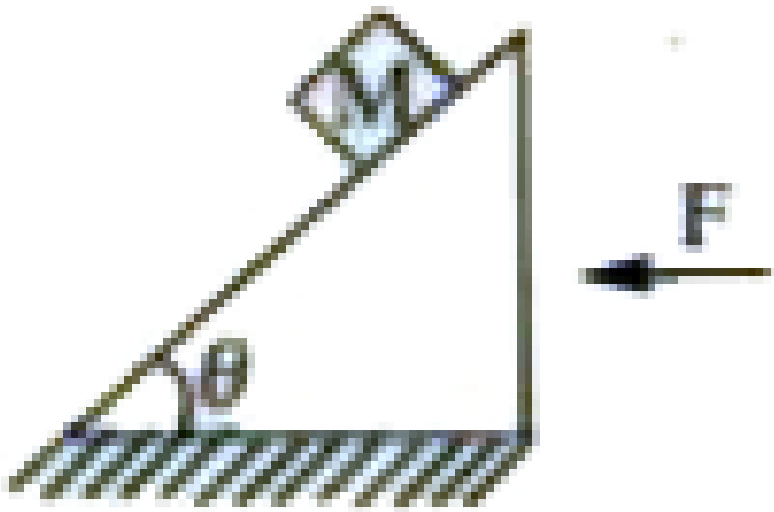
3. In given figure all surfaces are smooth. The ratio of forces exerted by the wedge on mass 'M' when force 'F' is not applied and when 'F' is applied such that 'M' is at rest with respect to wedge is:



A. 1

B. $1:2$

C. $\sec^2\theta$

D. $\cos^2\theta$

Answer: D

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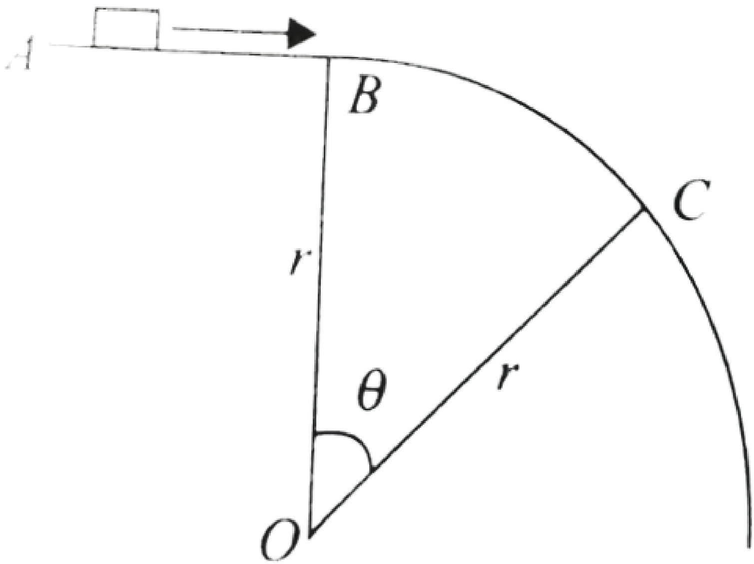
EXERCISE-3 (FRICTION : ROUGH HORIZONTAL SURFACE)



1.

A small block slides with velocity $v_0 = 0.5\sqrt{gr}$ on the horizontal frictiohnless surface as shown in the fig. the block leaves the surface at point C. The angle θ in the figure is:

A. less than μ

B. greater than μ

C. equal to μ

D. not dependent on μ

Answer: B

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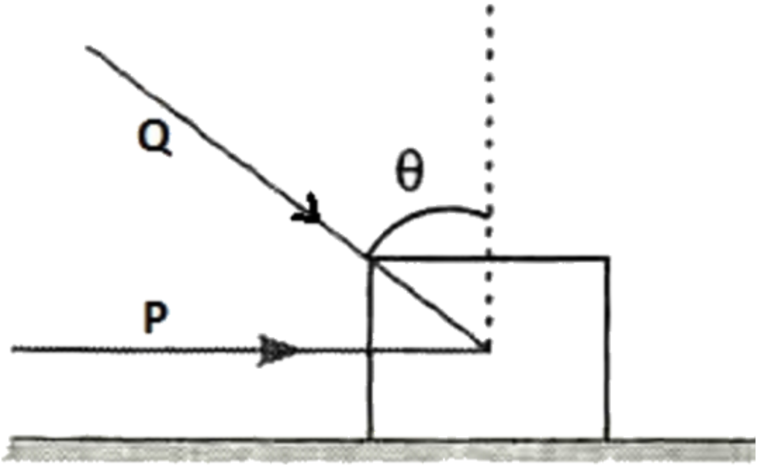
2. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is



A. $\left(\dfrac{P + Q\sin\theta}{mg + Q\cos\theta}\right)$

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

C. $\left(\dfrac{P + Q\cos\theta}{mg + Q\sin\theta}\right)$

D. $\left(\dfrac{P\sin\theta - Q}{mg - Q\cos\theta}\right)$

Answer: A

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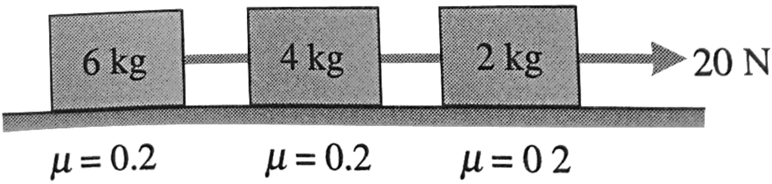
3.



Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. 6 N

B. 8N

C. 10 N

D. 12 N

Answer: B

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4. A suitcase is gently dropped on a conveyor belt moving at a velocity of 3ms^{-1}. If the coefficient of friction between the belt and the suitcase is 0.5, the displacement of the suitcase relative to conveyor belt before the slipping between the two is stopped, is $(g = 10\text{ms}^{-2})$

A. 2.7 m

B. 1.8 m

C. 0.9 m

D. 1.2 m

Answer: C

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5. A copper rod of mass m rests on two horizontal rails distance L apart and carries a current of I from one rail to the other. The coefficient of static friction between rod and rails is μ_s What are the (a) magnitude and (b) angle (relative to the vertical) of the smallest magnetic field that puts the rod on the verge of sliding?

A. $\dfrac{P^2}{2\mu_k M^2 g}$

B. $\dfrac{2\mu_k M^2 g}{P^2}$

C. $\dfrac{P^2}{2\mu_k g}$

D. $\dfrac{P^2 M^2}{2\mu_k g}$

Answer: A

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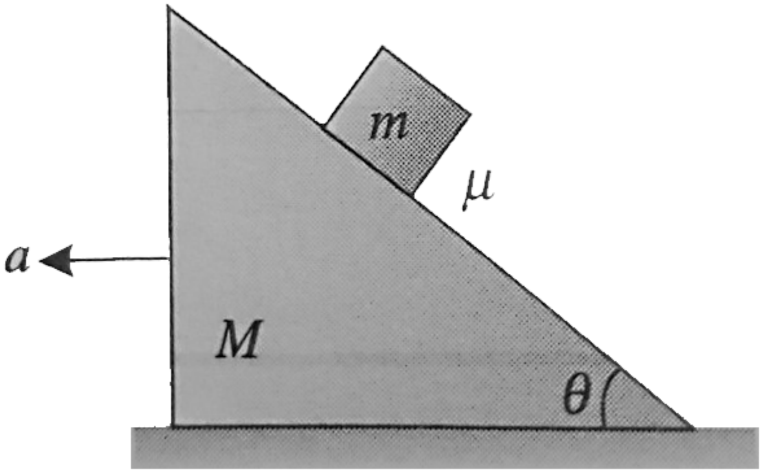

6.

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

A. μmg

B. zero

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

D. $2\mu mg$

Answer: B

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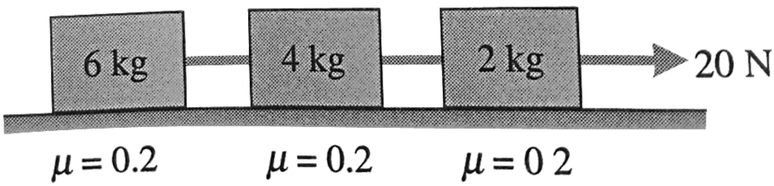
7. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. 3 kg

B. 2 kg

C. 1 kg

D. 4 kg

Answer: C

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8. A current I is flowing in a straight conductor of length L. The magnetic induction at a point distant $\frac{L}{4}$ from its centre will be

A. $\pi^2/6$

B. $\pi^2/18$

C. $\pi/6$

D. $\pi/2$

Answer: B

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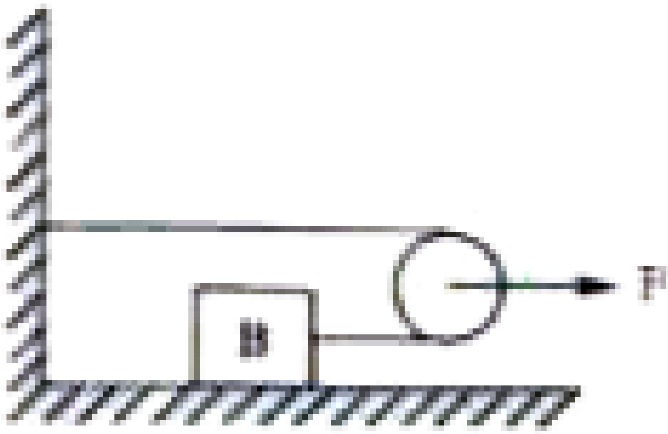
9. A block B is pulled by a force of 18 N applied to a light pulley as shown in the figure. If the coefficient of friction is 0.4 and the acceleration of the block is 0.5 ms^{-2}, the mass of the block is

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



A. 1 kg

B. 2 kg

C. 3 kg

D. 1.5 kg

Answer: B

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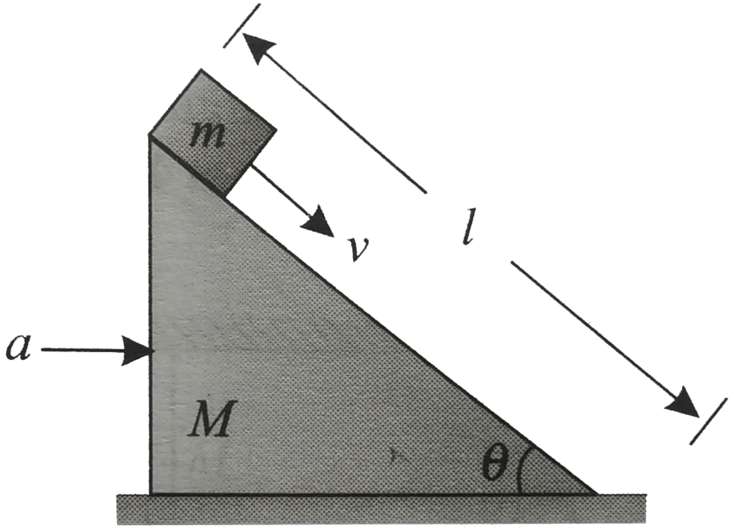

10.

A smooth wedge of mass M is pushed with an acceleration a = > anθ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

`The horizontal force applied on the wedge is:

A. 36 N

B. 5 N

C. 40 N

D. 60 N

Answer: C

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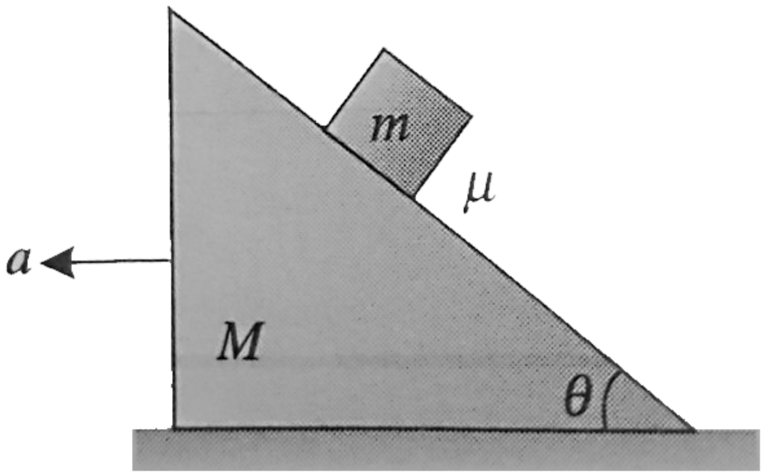
11. 

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

A. $M\left(\frac{v^2}{2s} + \mu g\right)$

B. $M\left(\frac{v^2}{2s} - \mu g\right)$

C. $M\left(\frac{2v^2}{s} + 2\mu g\right)$

D. $M\left(\frac{2v^2}{s} - 2\mu g\right)$

Answer: A

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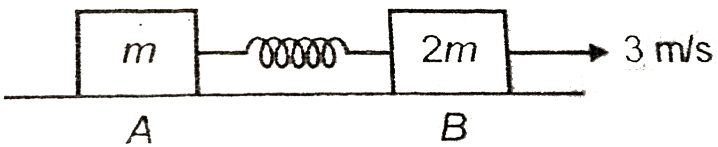
12. Two blocks A and B of masses m and $2m$ are placed on a smooth horizontal surface. Block B is given a speed of $3m/s$. Find

(i) The maximum speed of A

(ii) The minimum speed of B.



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

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

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

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

Answer: A

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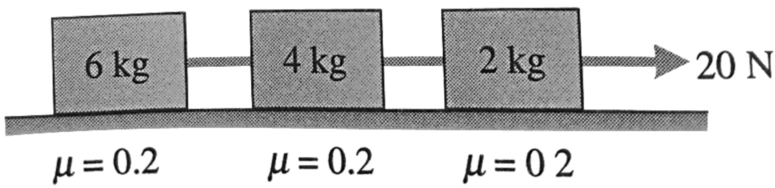
13. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. $\frac{13}{4}, 0.6$

B. $\frac{14}{3}, 3$

C. $\frac{13}{4}, 3$

D. $\frac{14}{3}, 0.6$

Answer: D

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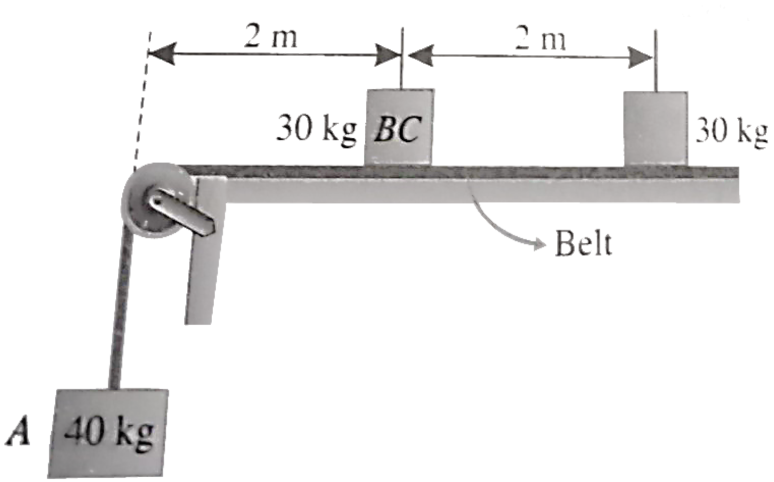

14.

Two 30 kg blocks rest on a massless belt which passes over a fixed pulley and is attached to a 40 kg block. If coefficient of friction between the belt and the table as well as between the belt and the blocks B and C is μ and the system is released from rest from the position shown, the speed with which the block B falls off the belt is

A. 0.19 m

B. 0.569 m

C. 0.758 m

D. 0.375 m

Answer: D

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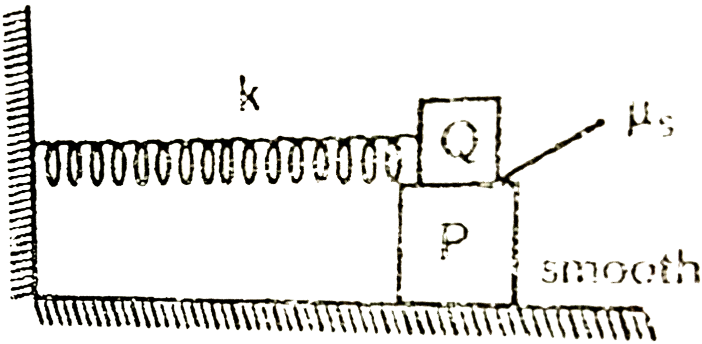
15. A block P of mass is placed on a fricationless horizontal surface. Another block Q of same mass is kept on P and connected to the wall with the help of a spring of spring constant k as shown in the figure. μ_s is the coefficient of frication between P and Q. The block move together performing SHM of the amplitude A. The maximum value of the frication force between P and Q is



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

B. KA

C. $\mu_k mg$

D. Zero

Answer: A

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16. A block of mass m is connected to another block of mass M by a string. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the string is unstretched. Then a constant force F starts acting on the block of mass M to pull it. Find the force on the block of mass m.

A. 25 N

B. 30 N

C. 48 N

D. 27 N

Answer: D

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EXERCISE-3 (VERTICAL SURFACE)

1. A grinding machine whose wheel has a radius of $\frac{1}{\pi}$ is rotating at 2.5 rev/sec. A tool to be shar-pened is held against the wheel with a force of 40N. If the coefficient of friction between the tool and 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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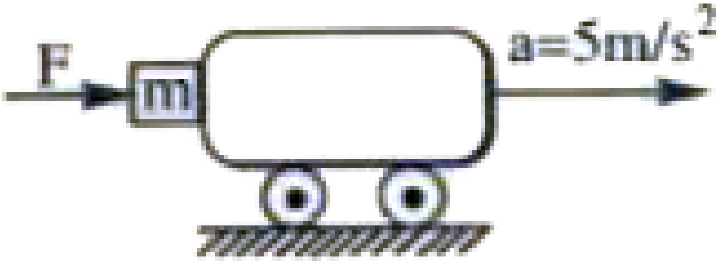
2. In this figure the force should be applied on mass m = 5kg so that it just won't slip is (Given that car is moving with constant acceleration a = 5 m/s and $\mu = 0.4$



A. 170 N

B. 180 N

C. 250 N

D. 150 N

Answer: D

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EXERCISE-3 (INCLINED PLANE)

1. A body is released from the top of an inclined plane of inclination (θ). fIt reaches the bottom with velocity (v), If keeping the length same the angle of inclination is doubled, what will be the velocity of the body on reaching the ground:-

A. v

B. 2v

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

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

Answer: C

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2. 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 incline, 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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3. Sand is piled up on a horizontal ground in the form of a regular cone of a fixed base radius R. The coefficient of static friction between sand layers is μ . The maximum volume of sand that can be pilled up, without the sand slipping on the surface is

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

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

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

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

Answer: D

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4. A box of mass 8kg placed on a rough inclined plane of inclination θ its downward motion can be prevented by applying an upward pull F and it can be made to slide upward appliying a force $2F$ .The coefficient of friction between the box and the inclined plane is

A. $\frac{1}{3}\tan\theta$

B. $3\tan\theta$

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

D. $2\tan\theta$

Answer: A

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5. A body is projected up along an inclined plane from the bottom with speed V_1. If it reaches the bottom of the plane with a velocity V_2, find (v_1/v_2) if θ is the angle of inclination with the horizontal and μ be the coefficient of.

A. $\dfrac{\sin\theta + \mu\cos\theta}{\sin\theta - \mu\cos\theta}$

B. $\sqrt{\dfrac{\operatorname{si}\in\theta + \mu\cos\theta}{\sin\theta - \mu\cos\theta}}$

C. $\dfrac{\cos\theta + \mu\sin\theta}{\cos\theta - \mu\sin\theta}$

D. $\sqrt{\dfrac{\cos\theta + \mu\sin\theta}{\cos\theta - \mu\sin\theta}}$

Answer: B

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6. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by

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

B. $\mu = \tan \theta$

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

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

Answer: A

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7. A body is moving up an inclined plane of angle θ with an initial kinetic energy E. The coefficient of friction between the plane and body is μ. The work done against friction before the body comes to rest is

A. $\frac{\mu \cos \theta}{E \cos \theta + \sin \theta}$

B. $2\mu E \cos \theta$

C. $\frac{\mu E \cos \theta}{\mu \cos \theta - \sin \theta}$

D. $\frac{\mu E \cos \theta}{\mu \cos \theta + \sin \theta}$

Answer: D

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EXERCISE-3 (CIRCULAR MOTION)

1. A hemispherical bowl of radius R si set rotating about its axis of symmetry which is kept vertical. A small block kept in the bowl rotates with the bowl without slipping on its surface. If the surfaces of the bowl is smooth, and the angle made by the radius through the block with the vertical is θ, find the angular speed at which the bowl is rotating.

A. $\sqrt{\dfrac{g}{R\cos\theta}}$

B. $\sqrt{\dfrac{g\cos\theta}{R}}$

C. $\sqrt{\dfrac{g\sin\theta}{R}}$

D. $\sqrt{\dfrac{R}{R\sin\theta}}$

Answer: A

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2. A particle describes a horizontal circle on the smooth surface of an inverted cone, the height of the plane of the circle above the vertex is 9.8 cm. Find the speed of the particle (g= $9.8\text{m}/\text{s}^2$) [See Fig.] (a) given in the answer section]

A. 0.49ms^{-1}

B. $0.98ms^{-1}$

C. $1.96ms^{-1}$

D. $3.92ms^{-1}$

Answer: B

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3. Length of a simple pendulum is 2m and mass of its bob is 0.2 kg. If the tension in the string exceeds 4N, it will break. If the bob is whirled in horizontal plane, the maximum angle the string can make with vertical during rotation is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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4. 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 velocity '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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5. There is a small hole in a table. A string of length lm passes through it. Two bodies of masses 70g and 100 g are attached at its ends. The lOOg mass hangs freely at a depth of 60 cm from the table. If this mass is to be in equilibrium, the other mass should rotate in a circle with a frequency equal to

A. $(4\pi/140)$ Hz

B. $\pi/140\mathrm{Hz}$

C. $\pi/\sqrt{140}$ Hz

D. $\dfrac{\sqrt{140}}{4\pi}\mathrm{Hz}$

Answer: D

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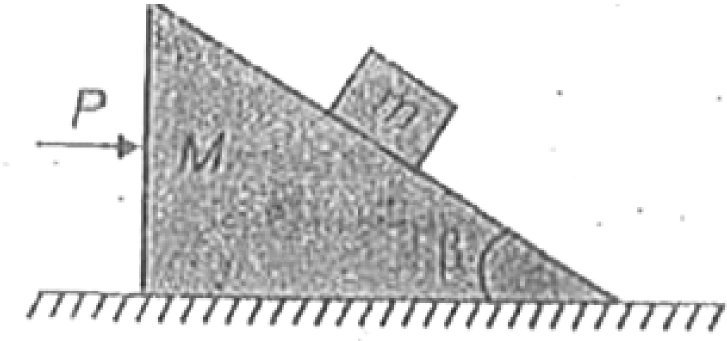
6. A block of mass m, is kept on a wedge of mass M, as shown in figure such that mass m remains stationary w.r.t. wedge. The magnitude of force P is



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

B. $g \tan \beta$

C. $mg \cos \beta$

D. $(M + m)g \operatorname{cosec}\beta$

Answer: B

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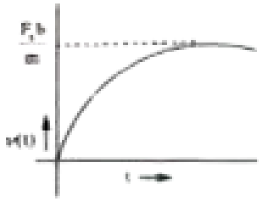
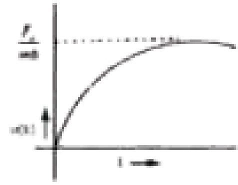
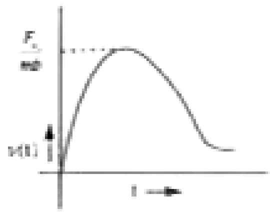
7. A particle of mass m is at rest at the origin at time t = 0. It is subjected to a force $F(t) = F_0 e^{-bt}$ in the $\times$ dicection. Its speed v(t) is depicted by which of the following curves?



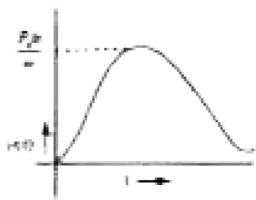
A.



B.



C.



D.

Answer: A

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

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

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

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

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

Answer: B

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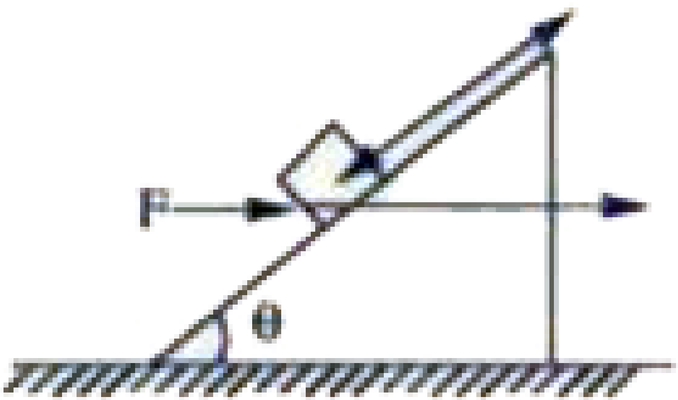
9. A horizontal force F is applied to a block of mass m on a smooth fixed inclined plane of inclination θ to the horizontal as shown in the figure. Resultant force on the block up the plane is:



A. $F \sin \theta + mg \cos \theta$

B. $F \sin \theta - mg \cos \theta$

C. $F \sin \theta + mg \cos \theta$

D. $F \cos \theta - mg \sin \theta$

Answer: D

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

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

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

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

Answer: C

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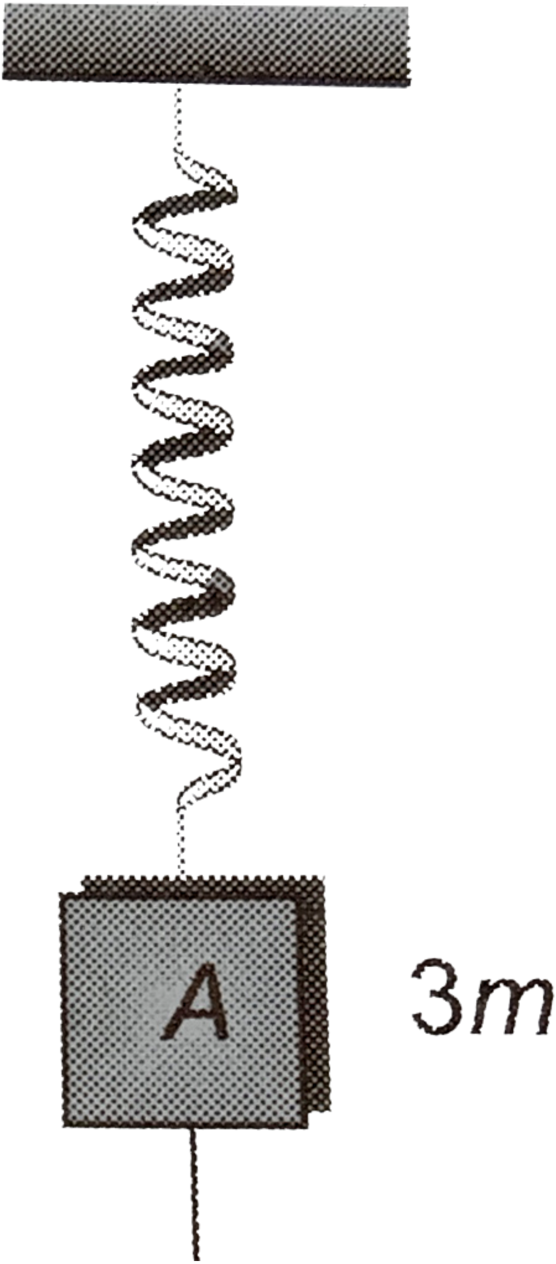
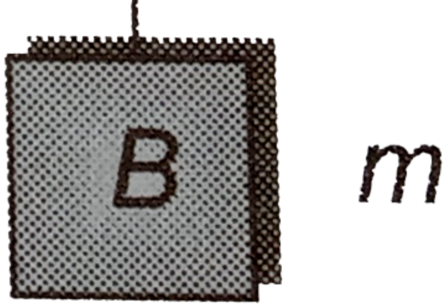
11. Two block A and B of masses $3m$ and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are resectively





A. $\frac{g}{3}, \frac{g}{3}$

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

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

D. g,g

Answer: C

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Application

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

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2. A block of mass m is placed behind in contact with vertical side of M as shown in the figure. The coefficient of static friction between m and M in μ. The least horizontal force with which m can be pushed so that the two blocks move together is (neglect friction between M and ground).

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3. A block is pushed up a rough inclined plane of 45°. If the time of descent is twice the time of ascent, the coefficient of friction is

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4. A body takes "n" 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 of the inclined plane is $''\theta''$. What is the coefficient of friction between the body and the rough plane ?

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5. In the given figure, the wedge is acted upon by a constant horizontal force 'F'. The wedge is moving on a smooth horizontal surface. A ball of mass '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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6. The value of escape speed from the surface of earth is

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EXERCISE - I

1. To keep a particle moving with constant velocity on a frictionless horizontal surface an external force

A. Should act continuously

B. Should be a variable force

C. Should not act

D. Should act opposite to the direction of motion

Answer: C

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2. The internal forces acting on an isolated system

A. Can change the velocity the system

B. Cannot change the velocity the system

C. Can change the acceleration of the system

D. Can change the direction of motion

Answer: B

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3. The rider tends to fall backward when a horse start suddenly. This is due to __________ of ____________.

A. inertia of rest

B. inertia of motion

C. inertia of direction

D. both 1 & 2

Answer: A

Watch Video Solution

4. The area under force time curve gives

A. work

B. power

C. displacement

D. impluse

Answer: D

Watch Video Solution

5. A train is moving with acceleration along a straight line with respect to ground. A person in the train finds that

A. Newton's 2nd law is false but newtons 3rd law is true

B. Newton's 3rd law is false but newtons 2nd law is true

C. All the three newtons laws are false but can apply 2nd law by considering a pseudo force

D. All the three Newton's laws are true

Answer: C

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6. A force P acts on a particle so as to accelerate it from rest to certain velocity. If P is replaced then by Q which decelerates it to rest.

A. P must be equal to Q

B. P may be equal to Q

C. P must be unequal to Q

D. $P \frac{>}{<} Q$

Answer: D

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7. A body of mass m has its position x at a time t, expressed by the equation :

$x = 3t^{3/2} + 2t - \frac{1}{2}$. The instantaneous force F on the body is proportional to

A. $t^{3/2}$

B. t

C. $t^{-1/2}$

D. t^{0}

Answer: C

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8. A jet of water with cross section of $6cm^2$ strikes a wall at an angle of 60° to the normal and rebounds elastically from the wall without losing energy. If the velocity of the water in the jet is $12m/s$, the force acting on the wall is

A. $2av^2\rho\cos\theta$

B. $av\rho\cos\theta$

C. $2av\rho\cos\theta$

D. $av\cos\theta$

Answer: A

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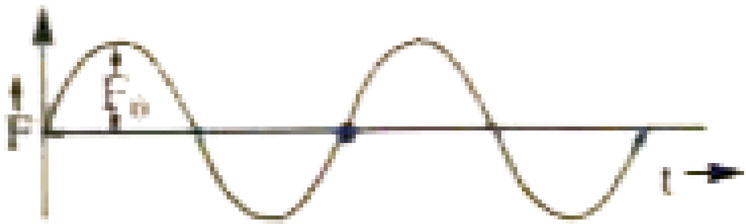
9. A force F varies with time in accordance with the following figure.

The mean force for one cycle:



A. F_0

B. $F_0/2$

C. $2F_0$

D. Zero

Answer: D

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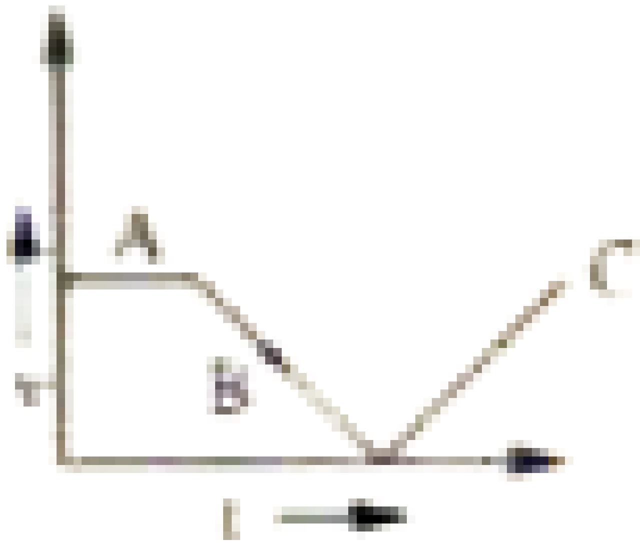
10. Graph of a body is shown. It explains that



A. at B force is zero

B. at B there is a force but towards motion

C. at B there is a force which opposes motion

D. at B the force may be in any direction

Answer: C

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11. A body is moving with an acceleration 'a' under the action of a force 'g'. The weight of the body is

A. g/a

B. $-g^2/a$

C. g^2/a

D. a^2/g

Answer: C

Watch Video Solution

12. 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

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13. A rubber ball falls from a height h and rebounds to a height h/2. A rubber ball of double the mass falling from the same height h rebounds to a height

A. h

B. h/2

C. 3h/4

D. 2h

Answer: B

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14. A fat hose pipe is held horizontally by a fireman. It delivers water through a constricting nozzle at 1 litre/sec. If by increasing the pressure, the water is delivered at 2 litre/sec, the fireman now has to

A. push forward twice as hard

B. push forward four times as hard

C. push forward eight times as hard

D. push backward four times as hard

Answer: B

Watch Video Solution

15. Two trains A and B are running in the same directions on parallel tracks such that A is faster than B, packets of equal weight are exchanged between them. Then

A. A will be retarded and B will be accelerated

B. B will be retarded and A will be accelerated

C. There will no change in A but B will be retarded

D. There will no change in B but A will be retarded

Answer: A

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16. When we jump out a boat standing in river water it moves

A. backward

B. forward

C. upward

D. opposite to the direction of jump

Answer: D

Watch Video Solution

17. A man is standing at a spring platform. Reading of spring balance is 60kg. If man jumps outside platform. Then reading of spring balance:-

A. first increase and then decreases to zero

B. decreases

C. increases

D. remains same

Answer: A

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18. A stone is projectef from level ground such that its horizontal and vertical components of initial velocity are $u_x = 10\frac{m}{s}$ and $u_y = 20\frac{m}{s}$ respectively. Then the angle between velocity vector of stone one second before and one second after it attains maximum height is:

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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19. At equilibrium state

A. Newton's first law of motion

B. Newton's second law of motion

C. Newton's third law of motion

D. Newton's law of gravitation

Answer: A

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20. An object is thrown vertically upward with a nonzero 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 freely

Answer: B

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21. If action force acting on a body is gravitational in nature, the reaction force

A. may be a contact force

B. must be gravitational too

C. may be gravitational or contact force

D. may be a force of any origin

Answer: B

Watch Video Solution

22. A father and his seven year 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 accelerations 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

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

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

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

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

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

Answer: A

Watch Video Solution

24. Internal forces can change

A. the linear momentum but not the kinetic energy

B. the kinetic energy but not the linear momentum

C. linear momentum as well as kinetic energy

D. neither the linear momentum nor the kinetic energy.

Answer: B

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25. A nucleus moving with velocity $\overline{v}$ emits an α-particle. Let the velocities of the α-particle and the remaining nucleus be $\overline{v}_1$ and $\overline{v}_2$ and their masses be m_1 and (m_2) then,

A. $\vec{v}$, $\vec{v}_1$ and $\vec{v}_2$ must be parallel to each other.

B. None of the two of $\vec{v}$, $\vec{v}_1$ and $\vec{v}_2$ should be parallel to each other.

C. $\vec{v}_1 + \vec{v}_2$ must be parallel to $\vec{v}$

D. $m_1\vec{v}_1 + m_2\vec{v}_2$ must be parallel to $\vec{v}$

Answer: D

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26. A shell is fired from a cannon with a velocity V at an angle θ with the horizontal direction. A the highest point i its path, it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other priece immediately after the explocison is

A. $3V \cos\theta$

B. $2V \cos\theta$

C. $\frac{3}{2}V \cos\theta$

D. $V \cos\theta$

Answer: A

Watch Video Solution

27. A block moving in air breaks in two parts and the parts separate

A. the total momentum must be conserved

B. the total kinetic energy must be conserved

C. the total momentum must change

D. the potential energy must be conserved

Answer: A

Watch Video Solution

28. A ball with initial momentum P collides with rigid wall elastically. If P^1 be it's momentum after collision then

A. $P^1 = P$

B. $P^1 = -P$

C. $P^{1} = 2P$

D. $P^{1} = -2P$

Answer: B

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29. A body is projected vertically upwards. Its momentum is gradually decreasing. In this

A. It is a violation of law of conservation of linear momentum

B. momentum of the body alone gets conserved

C. momentum of the body, earth and air molecules together remains constant

D. violates law of conservation of energy

Answer: C

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30. Assertion: A rocket moves forward by pushing the surrounding air backwards.

Reason: It derives the necessary thrust to move forward according to Newton's third law of motion.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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31. 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: C

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32. 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 comer of the island

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

Answer: B

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33. A block of weight W is suspended from the mid-point of a rope whose ends are at the same horizontal level. The force required to straighten the rope is

A. W

B. 2W

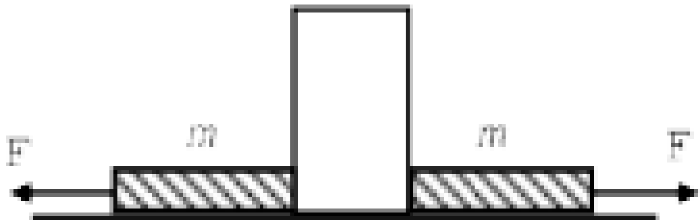
C. W/2

D. infinitely large

Answer: D

Watch Video Solution

34. Figure shows a heavy block kept on a frictionless surface and being pulled by two ropes of equal mass m. At t = 0, the force on the left rope is withdrawn but the force on the right end continues to act. Let F_1 and F_2 Figure shows a heavy block kept on a frictionless surface and being pulled by two ropes of equal mass m. At t = 0, the force on the left rope is withdrawn but the force on the right end continues to act. Let F1 and F2 be the magnitudes of the forces by the right rope and the left rope on the block respectively. Choose correct options.



A. $F_1 = F_2 = F$ for $t < 0$

B. $F_1 = F_2 = F + mg$ for $t < 0$

C. $F_1 = F, F_2 < F$ for $t < 0$

D. $F_1 < F, F_2 = F$ for $t < 0$

Answer: A

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35. A body of weight w_1 is suspended from the ceiling of a room through as chain of weight w_2. The ceiling pulls the chain by a force

A. w_1

B. w_2

C. $w_1 + w_2$

D. $\frac{w_1 + w_2}{2}$

Answer: C

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36. The apparent weight of a body

A. down with uniform speed

B. up with an acceleration

C. up with a retardation

D. up with an uniform speed

Answer: C

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37. The apparent weight of a freely falling body is

A. zero

B. increased

C. decreased

D. constant

Answer: A

Watch Video Solution

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

A. zero

B. g

C. less than g

D. greater than g

Answer: B

Watch Video Solution

39. A block of mass m can slide on a smooth inclined plane of inclination θ kept on the floor of a lift . When the lift is descending with retardation a,

A. $a - g \sin \theta$

B. $g - a$

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

D. $(g + a)\sin\theta$

Answer: D

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40. An elevator is moving vertically upward with an acceleration of g .

The force exerted on the floor by the passenger of mass m will be

A. Ma

B. Mg

C. M(g - a)

D. M(g + a)

Answer: D

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

A. more weight

B. less weight

C. normal weight

D. zero weight

Answer: B

Watch Video Solution

42. If the tension in the cable supporting an elevator is equal to the weight of the elevator, the elevator may be

A. a, b are true

B. b, c are true

C. c, d are true

D. a, c are true

Answer: C

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43. A relerence frame atteched to the Earth

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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44. 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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45. A rotating platform for a stationary observer outside, it is

A. inertial frame of reference

B. non inertial frame of reference

C. both

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

Answer: B

Watch Video Solution

46. Frames moving uniformly with respect to an inertial frame are

A. inertial frames

B. non inertial frames

C. both

D. accelerated

Answer: A

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47. If particle stays at rest as seen from a frame of reference

A. the frame may be inertial and a resultant force acts on it

B. the frame may be non inertial and $F_{real} = -F_{pseudo}$

C. the frame may be non inertial but a resultant force acts on it

D. the frame must always be inertial

Answer: B

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48. The acceleration of a particle is found to be non zero while 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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49. A particle is observed from two frames S_1 and S_2. .the frame S_2 moves with respect toS_1 with an acceleration a. Let F_1 and F_2 be the pseudo forces on the particle when seen from S_1 and S_2 respectively. Which of the following are not possible.

A. $F_1 = 0, F_2 \neq 0$

B. $F_1 \neq 0, F_2 = 0$

C. $F_1 \neq 0, F_2 \neq 0$

D. $F_1 = 0, F_2 = 0$

Answer: D

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50. A particle is found to be at rest when seen from a frame S_1 and moving with a constant velocity when seen from another frame S_2

(a) Both the frames are inertial

(b) Both the frames are non inertial

(c) S_1 is inertial and S_2 is non inertial

(d) S_1 is non inertial and S_2 is inertial

A. a, b are true

B. c, d are true

C. b, c are true

D. a, d are true

Answer: A

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51. A ball hangs from a string inside a rail road car moving along a straight track. The string is observed to be inclined towards the rear of the car making a constant small angle with the vertical. It shows that the car is

A. moving with a uniform acceleration

B. moving with a uniform retardation

C. moving with a uniform retardation

D. moving with an acceleration which is increasing uniformly

Answer: A

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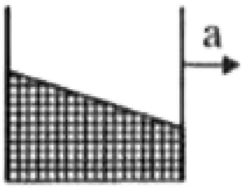
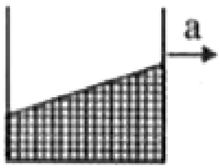
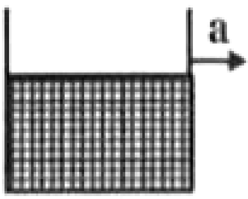
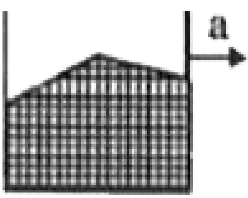
52. A vessel containing water is given a constant acceleration a towards the right,a straight horizontal path. Which of the following diagram represents the surface of the liquid.

A. 

B. 

C. 

D. 

Answer: A

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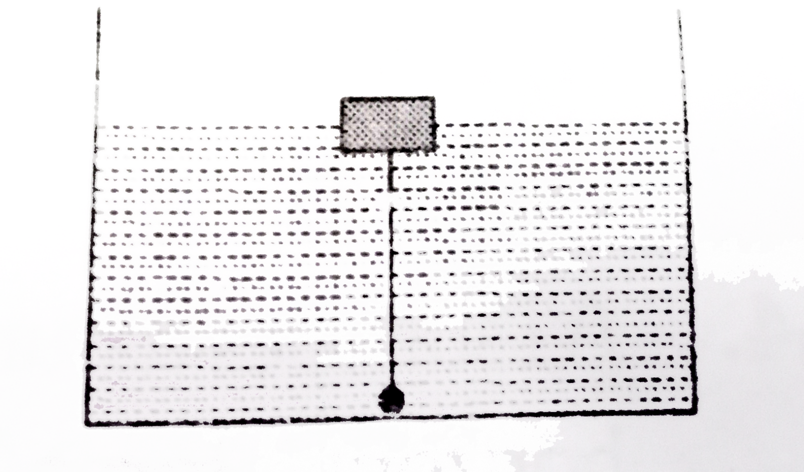
53. A cork and a metal bob are connected by a string as shown in the figure. If the beaker is given an acceleration towards left then the cork will be thrown towords:-



A. right

B. left

C. upwards

D. downwards

Answer: B

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54. A satellite in force free space sweeps stationary interplanetary dust at a rate $\frac{dm}{dt} = \alpha v$ where m is mass , V is the velocity of the satellite and α is a constant . What is the decelration of the satellite .

A. $-av^2$

B. $-av^2/2M$

C. $-av^2/M$

D. $-2av^2/M$

Answer: C

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

A. m

B. 1/m

C. $\sqrt{m}$

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

Answer: D

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56. 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

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57. 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 sneezing

C. by rolling your body on the surface

D. by running on the plane

Answer: B

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58. To keep a particle moving with constant velocity on a frictionless horizontal surface an external force

A. Should act continuously

B. Should be a variable force

C. is not necessary

D. Should act opposite to the direction of motion

Answer: C

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59. A force of constant magnitude starts acting on a moving particle when it is at some point 'P'. Depending on the orientation of the force, the particle may

a) pass through point P at some time later

b) not return to point P

c) describe a circular path

d) describe a parabolic path

A. a is correct

B. a, b, c, d are correct

C. c only correct

D. d only correct

Answer: B

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60. A bird of mass 0.1 kg rising vertically with an acceleration 0.2ms^{-2}. The muscular force exerted by it is $(\text{g} = 9.8\text{ms}^{-2})$

(a) 1 Newton

(b) 9.8 kg,wt

(c) 1/9.8 kg.wt

(d) 980 newtons.

A. a is correct

B. a and b are correct

C. a and c are correct

D. b and d are correct

Answer: C

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

A. b and c are correct

B. a and b are correct

C. b and d are correct

D. d only correct

Answer: A

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62. A satellite can be in a geostationary orbit around the earth at a distance r from the centre. If the angular velocity of earth about its axis doubles, a satellite can now be in a geostationary orbit around earth if its distance from the centre is :

A. a, b, c are correct

B. b only correct

C. b and d are correct

D. All are correct

Answer: C

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63. a) In a frame of reference S_1(though the net force is zero, the net acceleration is not zero.

b) In a frame of reference S_2 though the net force is not zero, the net acceleration is zero.

c) In a frame of referenceS_3 the net acceleration is zero whenever the net force is zero.

A. S_1 and S_3 are inertial and S_2 is non - inertial

B. S_1 and S_2 are non - inertial and S_3 is inertial

C. S_1, S_2, S_3 are non - inertial

D. S_1, S_2, S_3 are inertial

Answer: B

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64. Statement A : Action and reaction act on two different bodies

Statement B : Action, reaction never cancel each other

A. A & B are correct

B. A & B are wrong

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: A

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65. Statement A : When a person is on the floor of a lift which is at rest, the resultant force on him is equal to his weight

Statement B : When the lift is moving with uniform velocity, then the apparent weight of the man is zero

A. A & B are correct

B. A & B are wrong

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: B

Watch Video Solution

66. A man of mass m is on the floor of a lift. The lift moving up with acceleration 'a', then :

a) the net unbalanced force on him is 'ma'

b) the normal reaction exerted by the floor on the man is m(g + a)

c) the apparent weight is greater than his true weight

A. a, b, c are correct

B. a, b, c are wrong

C. a & c are correct

D. b & c are correct

Answer: A

Watch Video Solution

67. A man of mass m is on the floor of a lift. The lift moving up with acceleration 'a', then :

a) the net unbalanced force on him is 'ma'

b) the normal reaction exerted by the floor on the man is m(g + a)

c) the apparent weight is greater than his true weight

A. A & B are correct

B. A & B are wrong

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: A

Watch Video Solution

68. A person of mass m is on the floor of a lift. The lift is moving down with an acceleration 'a'. Then :

a) the net force is acting in downward direction and is equal to mg

b) the force mg must be greater than reaction force

c) the man appears to be lighter than his true weight by a factor (a/g)

A. a, b, c are correct

B. b and c are correct

C. a and c are correct

D. only b is correct

Answer: B

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69. Statement A : If the lift is falling freely then the man on its floor experiences no reaction from the floor.

Statement B : If the lift moves down with an acceleration $a > g$, then the normal reaction becomes negative and the man feels floating up in the lift.

A. A and B are correct

B. A and B are false

C. A is true and B is false

D. A is false and B is true

Answer: A

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70. Statement A : If the force varies with time in a complicated way then the average force is measured by the total change in momentum of the body

Statement B : Change in momentum and impulsive force are numerically equal

A. A & B are true

B. A & B are false

C. A is true and B is false

D. A is false & B is true

Answer: C

Watch Video Solution

71. Statement A : Shock absorbers reduce the magnitude of change in momentum.

Statement B : Shock absorbers increase the time of action of impulsive force

A. A & B are true

B. A & B are false

C. A is true and B is false

D. A is false & B is true

Answer: D

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72. Two blocks A and B of the same mass and surface finish are sliding on the same surface. Area of contact of A is twice that of the B. The frictional force between A and the surface is

A. twice that of B

B. half that of B

C. same that of B

D. depends on the power supplied

Answer: C

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73. A good lubricant should be highly

A. Viscous

B. Non - volatile

C. both

D. None

Answer: C

Watch Video Solution

74. Theoretically which of the following are best lubricants

A. solids

B. liquids

C. gases

D. All have same lubricating capacity

Answer: C

Watch Video Solution

75. A block of mass'm' is resting on the floor of a lift. The coefficient of friction between the block and the floor is μ. When the lift is falling freely, the limiting frictional force between block and surface is

A. μmg

B. $\frac{\mu mg}{s}$

C. mg

D. zero

Answer: D

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76. When a moving body is suddenly stopped a long time after coming to rest

A. Frictional force increases

B. roughness is found on the road

C. tyres of the vehicles burst

D. the frictional force reduces to zero as it is a self adjusting force

Answer: D

Watch Video Solution

77. 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' is pulled to the right, (If P is less than frictional force between A and B)

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

Watch Video Solution

78. Sand is dusted on the railway tracks during rainy season to

A. make it always wet

B. increase friction

C. To reduce consumption of fuel

D. None

Answer: B

Watch Video Solution

79. Which of the following are correct for rolling friction

A. The extent of deformation of the surfaces in content

B. It is lesser than kinetic and limiting friction

C. It is inversely proportional to the radius of the rolling body.

D. All the above

Answer: D

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80. If an external force and the frictional force acting on a body cancel each other and keep the body at rest, the frictional force is

A. Rolling friction

B. sliding friction

C. Static friction

D. None

Answer: C

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81. Which of the following statements is not true ?

A. Coefficient of friction may be greater than unity.

B. Coefficients of rolling friction is less than that of kinetic friction.

C. The frictional force is independent of the speed of the body.

D. The frictional force is inversely proportional to the normal reaction.

Answer: D

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82. When normal reaction is halved the coefficient of friction is

A. halved

B. unchanged

C. Doubled

D. None

Answer: B

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83. Match the items mentioned in the lists I and II below

LIST -1

a) Static friction

b) Limiting friction

c) Kinetic friction

d) Rolling friction

LIST - II

e) constant for a given pair of surfaces

f) Independent of area of contact

g) Self adjusting

h) Has the least magnitude for a given normal reaction

A. a-e, b-f, c-g, d-h

B. a-h, b-f, c-e, d-g

C. a-g, b-e, c-f, d-h

D. a-g, b-h, c-f, d-e

Answer: C

Watch Video Solution

84. With increase of temperature, the frictional force acting between two surfaces

A. increases

B. decreases

C. remains same

D. none of the above

Answer: B

Watch Video Solution

85. If we imagine two ideally smooth surfaces & if they are kept in contact, the frictional force acting between them is,

A. zero

B. a small finite value but not zero

C. very high

D. We can't predict

Answer: C

Watch Video Solution

86. The angle made by the resultant of normal reaction and limiting value of frictional force with normal to the surface is called

A. Angle of repose

B. Angle of friction

C. Critical angle

D. none of the above

Answer: B

Watch Video Solution

87. Two bodies of different masses are dropped simultaneously from same height. If air friction acting on them is directly proportional to the square of their mass, then,

A. lighter body reaches the ground earlier

B. heavier body reaches the earlier

C. both reach the ground at the same time

D. Any of the above

Answer: A

Watch Video Solution

88. A block of mass M is being pulley along horizontal surface .The coefficient of friction the block and the surface is μ If another block of mass $M/2$ is placed on the block and it is pulled is again pulled on the surface , the coefficient of friction the block and the surface will be

A. μ

B. $3\mu/2$

C. $\mu/2$

D. 2μ

Answer: A

Watch Video Solution

89. A cycle is fitted with small brakes and another is fitted with very big brakes. The one which is more effective is

A. Small brakes

B. Big brakes

C. both are equally effective

D. None

Answer: C

Watch Video Solution

90. (A) : When a bicycle is in motion, the force of friction exerted by the ground on the two wheels is always in forward direction.

(R) : The frictional force only when the bodies are in contact.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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91. In the figure, masses m_1, m_2 and M are 20kg, 5kg, and 50kg respectively. The coefficient of friction between M and ground is zero. The coefficient of friction between m_1 and M and that between m_2 and ground is 0.3. The pulleys and the strings are massless. The string is perfectly horizontal between P_1 and m_1 also between P_2 and m_2. The string is perfectly vertical between P_1 and P_2. An external horizontal force F is applied to the mass M. Let the magnitude of the force of friction between m_1 and M be f_1 and that between m_2 and ground be f_2. For a particular F it is found that $f_1 = 2f_2$. [Take $g = 10\frac{m}{s^2}$]

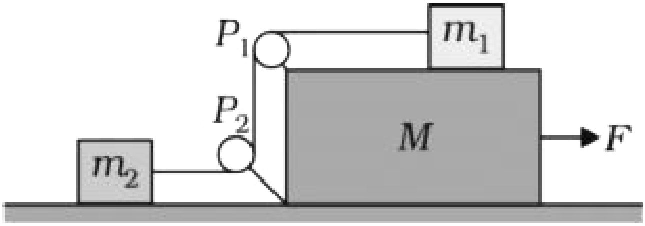
(i) Find f_1 in Newton

(ii) Find f_2 in Newton

(iii) Find F in Newton

(iv) Find tension in the string in Newton

(v) Find acceleration of the masses in m/s^2



A. μRS

B. $\mu + R/S$

C. $\mu R/S$

D. $\mu S/R$

Answer: A

Watch Video Solution

92. Two masses m_1 and $m_2(m_1 > m_2)$ are falling from the same height when same air resistance acts on them

A. m_1 has more acceleration

B. m_1 reaches the ground early

C. m_1 has more velocity on striking the ground

D. All the above

Answer: D

Watch Video Solution

93. Which of the following is correct

A. Using ball bearings, sliding friction changes to rolling friction.

B. Lubricants decrease friction since inter molecular forces are weak in liquids.

C. Over polishing increases friction since surface adhesion increases

D. All of the above

Answer: D

Watch Video Solution

94. Explain why a high pressure tyre roll more easily than a low pressure tyre ?

A. Friction is less in high inflated tyre

B. Friction is more in high inflated tyre

C. Friction is zero in high pressure tyre

D. None

Answer: A

Watch Video Solution

95. Matching block type

LIST - I

(a) Two rotating discs are brought in contact coaxially

(b) Contact force on a body placed in on rough surface

(c) To continue a motion is easier than to initiate the motion

(d) For a Static friction less than limiting friction

LIST - II

(e) Generated friction is equal to appliedexternal force in magnitude

(f) Loss of Rotational KE is transformed partly to heat

(g) The resultant of normal reaction and friction

(h) Kinetic friction is less than static friction

A. a-f, b-g, c-h, d-e

B. a-g, b-f, c-e, d-h

C. a-h, b-e, c-f, d-g

D. a-e, b-h, c-g, d-f

Answer: A

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96. The limiting friction between two bodies in contact is independent of

A. Nature of surfaces in contact

B. The area of surfaces in contact

C. Normal reaction between the surfaces

D. All the above

Answer: B

Watch Video Solution

97. (A) : When external force acting on a body moving on a rough horizontal surface is doubled, the acceleration of the body is doubled.

(R) : The acceleration of a body moving on a rough horizontal surface is proportional to the resultant force acting on it.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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98. Lubrication reduces friction because

A. Lubricant molecules act as ball bearings

B. Laws of limiting friction are not applicable

C. The relative motion in between solid and liquid

D. Both 1 and 3

Answer: D

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99. A cyclist pedals the cycle for some time and then stops peddling, then

A. frictional force on the back wheel is in the direction of motion and front wheel is opposite to the direction of motion

B. frictional force on the back wheel is opposite to the direction of motion and front wheel is in the direction of motion

C. frictional force on the both the wheels are opposite to the direction of motion.

D. frictional force on the both the wheels are in the direction of motion.

Answer: C

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100. The limiting friction between two surfaces depends

A. on the nature of two surfaces

B. proportional to normal reaction

C. independent of area of surface

D. All the above

Answer: D

Watch Video Solution

101. 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' is pulled to the right, (If P is less than frictional force between A and B)

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

Watch Video Solution

102. To keep a particle moving with constant velocity on a frictionless horizontal 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

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103. Frictional force between two bodies

A. Adds the motion between the bodies

B. Destroys the motion between the bodies

C. Sometimes helps and sometimes opposes the motion

D. Increases the relative velocity between the bodies

Answer: C

Watch Video Solution

104. If man is walking, direction of friction is

A. Opposite to 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

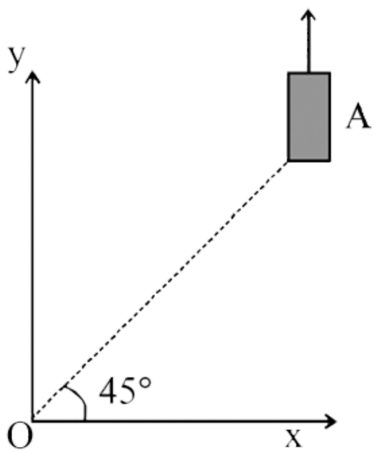
Answer: B

Watch Video Solution

105. On a frictionless horizontal surface , assumed to be the $x - y$ plane , a small trolley A is moving along a straight line parallel to the $y -$ axis (see figure) with a constant velocity of $(\sqrt{3} - 1) m/s$. At a particular instant , when the line OA makes an angle of $45(\circ)$ with the $x -$ axis , a ball is thrown along the surface from the origin O. Its velocity makes an angle ϕ with the $x -$ axis and it hits the trolley .

(a) The motion of the ball is observed from the frame of the trolley . Calculate the angle θ made by the velocity vector of the ball with the $x -$ axis in this frame .

(b) Find the speed of the ball with respect to the surface , if $\phi = (4\theta)/(3)$.



A. larger friction

B. smaller friction

C. larger normal force

D. Both 1 and 3

Answer: B

Watch Video Solution

106. Car tyres are made of rubber and not of iron because

A. Rubber is cheaper than iron

B. iron tyres produce noise

C. Rubber can give circular shape easily than iron

D. Friction between rubber & concrete is less than that between iron & concrete.

Answer: D

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107. Aeroplanes are streamlined to reduce

A. fluid friction

B. sliding friction

C. kinetic friction

D. limiting friction

Answer: A

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

A. involves sliding friction

B. Involves dry friction

C. Increases the effective weight

D. Decreases normal reaction

Answer: D

Watch Video Solution

109. A uniform rope of length l lies on a table . If the coefficient of friction is μ , then the maximum length l_1 of the part of this rope which can overhang from the edge of the table without sliding down is :

$\frac{1}{\mu}$

$\frac{l}{\mu+1}$

$\frac{\mu l}{1+\mu}$

$\frac{\mu l}{1-\mu}$

A. L/μ

B. $L/\mu + 1$

C. $\dfrac{\mu}{\mu + 1}$

D. $\dfrac{\mu L}{\mu + 1}$

Answer: C

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110. In case of pulling & pushing minimum forces required $\dfrac{w \sin \alpha}{\cos(\theta - \alpha)}$ & $\dfrac{w \sin \alpha}{\cos(\theta + \alpha)}$ then acceleration are

A. $a = g, a = g/\mu$

B. $a = 0, a = 0$

C. $a = g/\mu, a = \mu g$

D. none

Answer: B

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111. A body is moving in a circular orbit. It is just about to slide to the outer side and $\mu mg = \frac{mv^2}{l}$. In this expression, μ represents

A. Coefficient of static friction

B. Coefficient of kinetic friction

C. Coefficient of rolling friction

D. None

Answer: A

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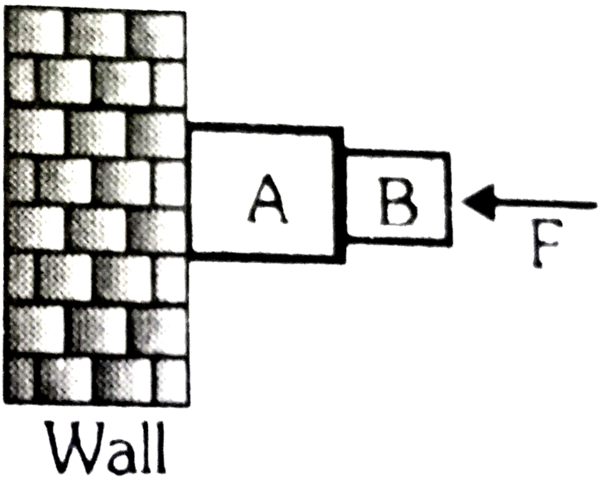
112. Adjoining figure shows two blocks A and B pushed against the wall with the force F. The wall is smooth but the surfaces in contact of A and B are rough. Which of the following is true for the system of bloods to be at rest against the wall:



A. F should be more than the weight of P & Q

B. F should be equal to the weight of P & Q

C. F should be less then the weight of P & Q

D. The system cannot be in equilibrium

Answer: D

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113. A body is just supported at the face of a cart moving at an acceleration. The acceleration of the cart so that the body does not slide

A. Independent of mass of the body

B. Inversely proportional to coefficient of friction

C. 1 & 2

D. None

Answer: C

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114. A wooden block sliding down from the top of a smooth inclined plane starting from rest takes t_1, seconds to reach the bottom of the plane and attains velocity V_1. Another block of twice the mass falling freely from the same height takes t_2 sec. to reach the bottom of the plane and attains V_2. If angle of inclination of the plane is 30°.

A. $v_1 = v_2 \& t_1 = t_2$

B. $v_1 = v_2 \& t_1 = 2t_2$

C. $v_1 > v_2 \& t_1 > t_2$

D. $v_1 = v_2 \& t_2 = 2t_1$

Answer: B

Watch Video Solution

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

A. angle of friction

B. Angle of repose

C. Critical angle

D. Brewster's angle

Answer: B

Watch Video Solution

116. When the angle of inclination of on inclined plane is θ, an object slides down with uniform velocity. If the same object is pushed up with an initial velocity u on the same inclined plane, it goes up the plane and stops at a certain distance on the plane. There after the body.

A. Slides down the inclined plane and reaches the ground . With velocity "u"

B. Slides down the inclined plane and reaches

C. Slides down the inclined plane an reaches the ground with velocity greater than "u"

D. Stays at rest on the inclined plane and will not slide down.

Answer: D

Watch Video Solution

117. In a situation the contact force by a rough horizontal surface on a body placed on it has constant magnitude. If the angle between this force and the vertical is decreased, the frictional force between the surface and the body will

A. increase

B. decrease

C. remain the same

D. may increases or decrease

Answer: B

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118. A scooter starting from rest moves wilth as constant acceleration for a time $\triangle t_1$, then with a constant velocity for the next $\triangle t_2$ and finally with a constant deceleration for the next $\triangle t_3$ to come to rest with resect to the scooter wilthout touching any other part. The force exerted by the seat on the man is

A. 500 N throughout the journey

B. less the 500 N throughout the journey .

C. more than 500 N throughout the journey

D. > 500 N for time Δt_1 and Δt_3 and 500 N for Δt_2

Answer: D

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119. A block of mass m is connected to another block of mass M by a string. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the string is unstretched. Then a constant force F starts acting on the block of mass M to pull it. Find the force on the block of mass m.

A. $F = Mg$

B. $F = \mu Mg$

C. $Mg \leq F \leq Mg\sqrt{1+\mu^2}$

D. $Mg \geq F \geq Mg\sqrt{1-\mu^2}$

Answer: C

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120. Two cars of unequal masses use similar tyres. If they are moving at the same initial speed, the minimum stopping distance

A. is smaller for the heavier car

B. is smaller for the lighter car

C. is same for both cars

D. depends on the volume of the car .

Answer: C

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121. In order to stop a car in shortest distance on a horizontal road one should

A. apply the breaks very hard so that the wheels stop rotatng

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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122. A boy of mass M is applying a horizontal force to slide a box of mass M on a rough horizontal surface. The floor is μ and the between the box and the floor is μ'. In which of the following cases it is certainly not possible to slide the box?

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

B. $\mu > \mu, M < M$

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

D. $\mu > \mu, M > M$

Answer: A

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123. A cylinder rolls up an inclined plane, reaches some height and then rolls down (without slipping thoughout these motions) .The directions of the firctional force acting on the cylinder are

A. up the incline while ascending as well as descending

B. up the incline ascending as well as descending

C. down the incline while ascending and up the incline while descending

D. down the incline while ascending as well as descinding

Answer: B

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124. The contact force exerted by a body A on another body B is equal to the normal force between the bodies. We concude that

A. a and c are true

B. a, b and d are true

C. b and d are true

D. all are true

Answer: C

Watch Video Solution

125. A block is placed on a rough floor and a horizontal force F is applied on it. The force of friction f by the floor on the block is measured for different values of F and a graph is plotted between them.

A. a and c are true

B. a , b and d are true

C. c and d are true

D. all are true

Answer: C

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126. Consider the following statements

A) The coefficient of friction between two surfaces will increase if the surfaces are made rough.

B) rolling friction is more than sliding friction

A. Both A and B are true

B. Both A and B are false

C. A is false and B is true

D. B is false and A is true

Answer: D

Watch Video Solution

127. The kinetic friction is always

A) Less than static friction

B) Greater than rolling friction

A. Both A and B are true

B. Both A and B are false

C. A is false and B is true

D. B is false and A istrue

Answer: C

Watch Video Solution

128. Consider the following statements

A) Angle of repose is equal to angle of friction

B) Angle of friction is independent of coefficient of friction

A. Both A and B are true

B. Both A and B are false

C. A is false and B is true

D. B is false and A is true

Answer: D

Watch Video Solution

129. Identify the correct order in which the value of normal reaction increases, (object is placed on rough horizontal surface)

i) The object is pushed with the force F at an angle 'q' with horizontal

ii) The object is pulled with the force F at an angle 'q' with horizontal

iii) The object is pushed down with the force F normally

iv) The object pulled up with the force F normally

A. I,ii,iii,iv

B. iv,ii,I,iii

C. I,iii,ii,iv

D. ii,iv,iii,i

Answer: B

Watch Video Solution

130. Identify the correct order in which the value of normal reaction increases, (object is placed on rough horizontal surface)

i) The object is pushed with the force F at an angle 'q' with horizontal

ii) The object is pulled with the force F at an angle 'q' with horizontal

iii) The object is pushed down with the force F normally

iv) The object pulled up with the force F normally

A. A,B,C,D

B. D,B,A,C

C. A,C,B,D

D. B,D,C,A

Answer: B

Watch Video Solution

131. Consider the following A and B, and identify the correct choice in the given answers.

A) For a body resting on a rough horizontal table, it is easier to pull at angle that push at the same angle to cause motion

B) A body sliding down a rough inclined plane of inclination equal to angle of friction has nonzero acceleration

A. both A and B are true

B. A is true but B is false

C. A is false but B is true

D. both A and B are false

Answer: B

Watch Video Solution

132. A body is kept on a rough horizontal surface of angle of friction ' α ' and moved by applying a force of magnitude 'F' making angle θ with horizontal. Arrange the following cases in the order of increasing magnitude for F.

i) F is pulling force and $\theta = \alpha$

ii) F is pulling force and $\theta = 0$

iii) F is pulling force and $\alpha = \theta = 0$

iv) F is pushing force and $\theta = \alpha$

A. iv,iii,iiand i

B. I,ii,iii and iv

C. I,ii,iv and iii

D. iii,I ,ii and iv

Answer: D

Watch Video Solution

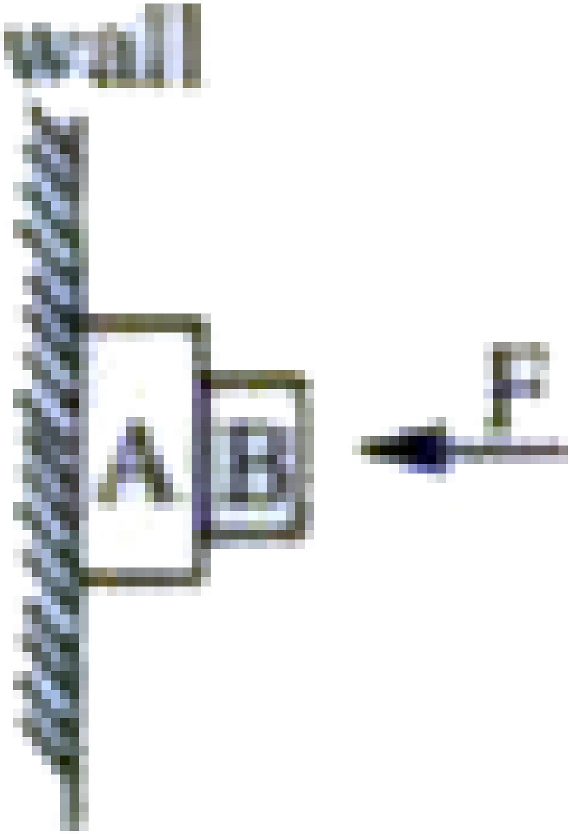
133. Two blocks A and B are pressed against a vertical wall by applying a horizontal force T" as shown in the figure. There is no friction between A and B. Then

a) Both the blocks A and B can be at rest for any magnitude of F

b) B can be at rest A moves down for smaller magnitude of F

c) Both A and B will move down for smaller magnitude

d) A can be at rest and B moves down for larger magnitude of F.



A. a and b are correct

B. c and d are correct

C. a and d are correct

D. b and c are correct

Answer: B

Watch Video Solution

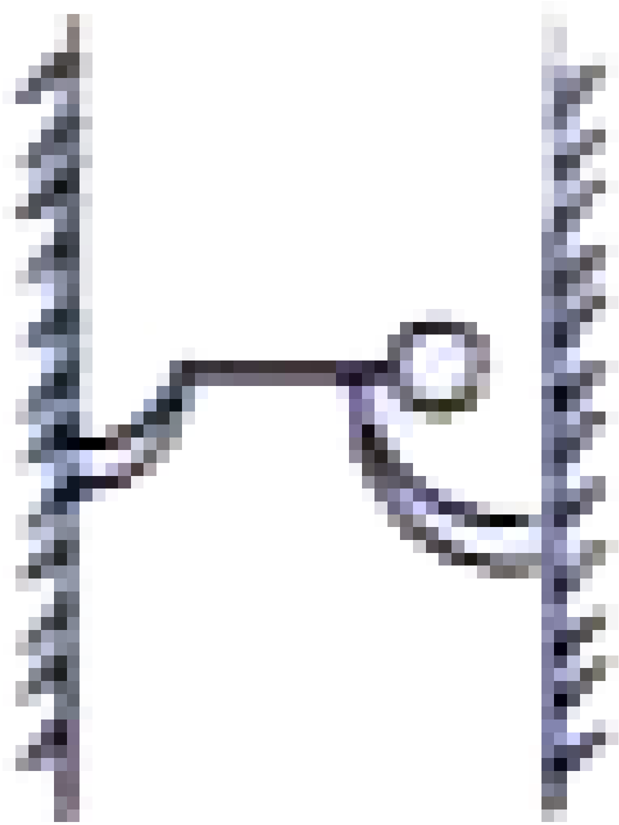
134. A man thinks to remain in equilibrium by pushing in his hands and feet against two vertical parallel walls as the shown in the figure :

a) He must exert equal forces on both walls

b) The forces of friction at both walls must be equal

c) The coefficients of friction between man and wall must be the same at both ends

d) Friction must be present on both walls.



A. a and b are correct

B. a and c are correct

C. a and d are correct

D. all correct

Answer: C

Watch Video Solution

135. A vehicle moves safe on a 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 and b are correct

B. c and d are correct

C. b and c are correct

D. a and c are correct

Answer: C

Watch Video Solution

136. A block of mass 'M' is pressed against a wall with a horizontal force F. Then

a) it will slide down if the wall is smooth

b) frictional force may balance the weight if the wall is rough

c) Normal reaction is equal to weight of the block

d) Normal reaction is zero if the wall is smooth

A. a & b are correct

B. a & d are correct

C. c & are correct

D. b & c are correct

Answer: A

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137. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. If $\mu_S = 0.6$, what is the frictional force on the block ?

A. a and b are correct

B. b , c and d are correct

C. a,b and c are correct

D. c and d are correct

Answer: A

Watch Video Solution

138. (A) : A car can run on road because of force applied by road on the car.

(R) : Friction provides the necessary force for translatory motion for the car.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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139. 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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140. 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. its velocity is constant

B. its kinetic energy is constant

C. its acceleration is constant

D. it moves in a straight line

Answer: B

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141. A mass is revolving in a circle which lies in a plane of paper. The direction of angular acceleration can be:-

A. along the tangent

B. along the radius inward

C. along the radius outward

D. along the perpendicular to the plane of the paper

Answer: D

Watch Video Solution

142. A particle of mass mis tied to a light string and rotated with a speed v along a circular path of radius r. If T=tension in the string and mg= gravitational force on the particle then the actual forces acting on the particle are:

A. mg, and T only

B. mg, T and an additional force of $\frac{mv^2}{r}$ directed inwards

C. mg. T and an additional force of $\frac{mv^2}{r}$ directed outwards

D. only a force $\frac{mv^2}{r}$ directed outwards

Answer: A

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

A. It's angular velocity vector will be perpendicular to the page pointing up out of the page

B. It's angular velocity vector will be perpendicular to the page pointing inwards

C. It's angular velocity vector acts along the tangent to the disc.

D. none of the above is correct.

Answer: A

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144. Many great rivers flow towards the equator, what effect does the sediment they carry to sea have on the rotation of the earth?

A. The rotation of the earth slows down

B. The rotation of theearth speeds up

C. No effect on the rotation of the earth

D. None

Answer: A

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145. (A) : An object placed on the rotating hori- zontal table may fly off at lower angular velocity when placed far away from the axis.

(R) : An object placed at the edge of the rotating table experiences more centrifugal force than at nearer position relative to the table

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

Watch Video Solution

146. A vehicle is travelling along unbanked curved path. If the friction between the road and tyres suddenly disappears then the vehicle

A. Moves along tangential direction

B. Moves along radially outward direction

C. Moves along a direction between tangential and radially outward direction

D. Moves along the same curved path.

Answer: A

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147. When a car takes a sudden turn it is likely to fall.

A. Away from the centre of curvature

B. Towards the centre of curvature

C. Towards forward direction

D. Towards backward direction

Answer: A

Watch Video Solution

148. Skidding occurs when the maximum frictional force of a flat road on a car is

A. less than centripetal force required

B. more than centripetal force required

C. equal to centripetal force required

D. independent of centripetal force

Answer: A

Watch Video Solution

149. A car moves along a horizontal circular road of radius r with velocity u -The coefficient of friction between the wheels and the road is μ. Which of the following statement is not true?

A. The car will slip if $v > \sqrt{\mu r g}$

B. The car will slip if $\mu < \frac{v^2}{rg}$

C. The car will slip if $\mu > \frac{v^2}{\mu g}$

D. the car will slip at lower speed, if it moves with some tangential acceleration, than if it moves at constant speed.

Answer: C

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150. For a car taking a turn on a horizontal surface, let N_1 and N_2 be the normal reactions of the road on the inner and outer wheels respectively

A. N_1 is always greater than N_2

B. N_2 is always greater than N_1

C. N_1 is always equal to N_2

D. Either (a) or (b) depending on the speed of the car and the radius of curvature of the road.

Answer: B

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151. A curved road is banked for speed v_0. When a car moves along the road with a constant speed v, the force the friction between the road and the tyres is F. Which of the following statements(s) is (are) correct ?

A. a car moving with speed υ will not slip on the road

B. a car is more likely to slip on the road at speed higher than υ, than at speeds lower than υ

C. a car is more likely to slip on the road at speeds lower than υ, than at speeds higher than υ

D. a car can remain stationary on the road without slipping

Answer: A

Watch Video Solution

152. (A) : A cyclist always bends inwards while negotiating a horizontal curve.

(r) : By bending, cyclist lowers his centre of gravity.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

Watch Video Solution

153. A railway track is banked for a speed v, by making the height of the outer rail h higher than that of the inner rail. The distance between the rails is d. The radius of curvature of the track is r

A. $\frac{h}{d} = \frac{v^2}{rg}$

B. $\tan\left(\sin^{-1}\frac{h}{d}\right) = \frac{v^2}{rg}$

C. $\tan^{-1}\left(\frac{h}{d}\right) = \frac{v^2}{rg}$

D. $\frac{h}{r} = \frac{v^2}{dg}$

Answer: B

Watch Video Solution

154. A cyclist moves along a curved road with a velocity v. The road is banked for speed v. The angle of banking is θ.Which of the following statements in not true?

A. The cyclist will lean away from the vertical at an angle θ.

B. The normal reaction of the road will pass through the centre of gravity of the 'cycle plus cyclist' system

C. There will be no force of friction between the tyres and the road.

D. The cyclist is in equilibrium with respect to the ground.

Answer: D

Watch Video Solution

155. A particle moves along a horizontal circle witrr constant speed. If 'a' is its acceleration and 'E' is its kinetic energy

A) a is constant

B) E is constant

C) a is variable

D) E is variable

A. A and B are correct

B. C and D are correct

C. A and D are correct

D. B and C are correct

Answer: D

Watch Video Solution

156. Identify, the increasing order of angular velocities of following

a) Earth rotating about its own axis

b) Hour's hand of clock

c) Seconds hand of clock

d) Fly wheel of radius 2m making 300 r.p.m.

A. a, b, c, d

B. b, c, d, a

C. c, d, a, b

D. d, a, b, c

Answer: A

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157. Match List-I with List-II

List-I	List-II
a) proton and electron	e) gains same velocity in an elctric field for same time
b) proton and positron	f) gains same KE in an electric field for same time.
c) Deuteron and α - particle	g) experience same force in electric field
d) electron and positron	h) gains same KE when accelerated by same potential difference.

A. a-h, b-g, c-f, d-e

B. a-g, b-f, c-h, d-e

C. a-f, b-g, c-h, d-e

D. a-c, b-h, c-e, d-f

Answer: B

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EXERCISE - II

1. Due to the application of a force on a body of mass 100 kg that is initially at rest, the body moves with an acceleration of 20ms^{-2} in the direction of the force. Find the magnitude of the force.

A. 1000 N

B. 2000 N

C. 3000 N

D. 4000 N

Answer: B

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2. A force is applied for a duration of 10sec on a body of mass 5kg that is at rest. As a result the body acquires a velocity of 2ms^{-1}. Find the magnitude of the force applied.

A. 1 N

B. 2 N

C. 4 N

D. 5 N

Answer: A

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3. A vehicle of mass 120kg is moving with a velocity of 90kmph What force should be applied on the vehicle to stop it in 5s.

A. 240 N

B. 480 N

C. 600 N

D. 480 N

Answer: C

Watch Video Solution

4. A vehicle of mass 20kg is moving with a velocity of 4ms^{-1}. Find the magnitude of the force that is to be applied on the vehicle so that the vehicle have a velocity of 1ms^{-1} after travelling a distance of 20m.

A. 4 N

B. 6 N

C. 7. 5 N

D. 9.5 N

Answer: C

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Watch Video Solution

5. A force is applied on a body of mass 0.9kg that is at rest. The force is applied for a duration of 5s and as a result the body covers a distance of 250 m. Find the magnitude of the force.

A. 9 N

B. 18 N

C. 27 N

D. 46 N

Answer: B

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6. A ball of mass 600 gm strikes a wall with a velocity of 5ms^{-1} at an angle 30° with the wall and rebounds with the same speed at the same angle with the wall. The change in momentum of the ball is, (in kg ms^{-1})

A. 15

B. 10

C. 5

D. 3

Answer: D

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7. When a force 1N acts on 1kg mass at rest for 1s, its final momentum is P. When 1N force acts on 1kg mass at rest through a distance 1m, its final momentum is P1. The ratio of P to P1 is

A. $1:1$

B. $1:\sqrt{2}$

C. $1:2$

D. $2:1$

Answer: B

Watch Video Solution

8. The driver of a three-wheeler moving with a speed of 36 km/h sees a child standing in the middle of the road and brings his vehicle to rest in 4.0 s just in time to save the child. What is the average retarding force on the vehicle ? The mass of the three-wheeler is 400 kg and the mass of the driver is 65 kg.

A. $1.2 \times 10^3 N$

B. 1.2×10^4 N

C. $1.2 \times 10^5 N$

D. $1.2 \times 10^6 N$

Answer: B

Watch Video Solution

9. A force of 25 N acts on a body at rest for 0.2s and a force of 70 N acts for the next 0.1s in opposite direction. If the final velocity of the body is 5ms^{-1}, the mass of the body is

A. 1 kg

B. 2 kg

C. 0.8 kg

D. 0.4 kg

Answer: D

Watch Video Solution

10. A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s . If the catching process is completed in 0.1s, the force of the blow exerted by the ball on the hand of the player is :

A. 150 N

B. 3 N

C. 30 N

D. 300 N

Answer: C

Watch Video Solution

11. A body of mass 3 kg is moving along a straight line with a velocity of $24 ms^{-1}$. 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. 16 s

C. 12 s

D. 24s

Answer: B

Watch Video Solution

12. A balloon with its contents weighing 160 N is moving down with an acceleration of g/2 ms^{-2} . The mass to be removed from it so that the balloon moves up with an acceleration of-g/3 ms^{-2} is

A. 5 kg

B. 10 kg

C. 6 kg

D. 3 kg

Answer: B

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13. A block of mass 5 kg is at rest on a smooth horizontal surface. Water coming out of a pipe horizontally at the rate of 2 kgs^{-1} , hits the block with a velocity of $6ms^{-1}$.The initial acceleration of the block is,

A. Zero

B. $1.2ms^{-2}$

C. $2.4ms^{-2}$

D. $0.6ms^{-2}$

Answer: C

Watch Video Solution

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

A. 0.2 N

B. 10 N

C. 400 N

D. 200 N

Answer: C

Watch Video Solution

15. A body of mass 2kg is moving along positive X - direction with a velocity of $5ms^{-1}$ Now a force of $10\sqrt{2}$ N N is applied at an angle 45° with X - axis. Its velocity after 3s is,

A. $20ms^{-1}$

B. $15ms^{-1}$

C. $25ms^{-1}$

D. $5ms^{-1}$

Answer: C

Watch Video Solution

16. A disc of mass 5 kg is kept floating horizontally in mid air by firing 10 bullets per second vertically up. If the mass of each bullet is 50 gm and bullets rebound with same speed, the speed of each bullet is, (g = $10ms^{-2}$)

A. $100ms^{-1}$

B. $200ms^{-1}$

C. $50ms^{-1}$

D. $10 \mathrm{~ms}^{-1}$

Answer: C

Watch Video Solution

17. A body of mass 5 kg moving on a horizontal surface with a velocity of $10 \mathrm{~ms}^{-1}$ comes to rest in 2s. The force required to make this body move with a velocity of $10 \mathrm{~ms}^{-1}$ on the same surface is

A. Zero

B. 10 N

C. 25 N

D. 50 N

Answer: C

Watch Video Solution

18. A machine gun fires a bullet of mass 40 g with a velocity $1200 \mathrm{ms}^{-1}$. 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) 3 b) 5 c) 6 d) 9

A. One

B. Four

C. Two

D. Three

Answer: D

Watch Video Solution

19. Gravel is dropped on a conveyor belt at the rate of 2 kg/s. The extra force required to keep the belt moving at $3 \mathrm{ms}^{-1}$ is

A. 1 N

B. 3 N

C. 4 N

D. 6 N

Answer: D

Watch Video Solution

20. A hammer of mass 1 kg strikes on Ihe head of a nail with a velocity of 2ms^{-1} . It drives the nail 0.01 m into a wooden block. Find the force applied by the hammer and the time of impact.

A. $200\text{N}, 10^{-2}$ sec

B. $100\text{N}, 10^{-3}$ sec

C. $300\text{N}, 10^{-2}$ sec .

D. $400\text{N}, 10^{-3}$ sec

Answer: A

Watch Video Solution

21. A force of 5 N acts on a body for 2 milliseconds. Calculate the impulse. If the mass of the body is 5 g, calculate the change of velocity.

A. 2 m/s

B. 4 m/s

C. 6 m/s

D. 10 m/s

Answer: A

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22. A ball reaches a racket at $60\text{m}/\text{s}$ along +X direction and leaves the racket in the opposite direction 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

Watch Video Solution

23. A force lime 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

Watch Video Solution

24. An impulse $\vec{I}$ changes the velocity of a particle from $\vec{v}_1$ to $\vec{v}_2$.

Kinetic energy gained by the particle is :-

A. $I(v_1 + v_2)$

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

C. $I(v_1 - v_2)$

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

Answer: B

Watch Video Solution

25. The linear momentum of a particle as a function of time t is given by p = a + bt, where a and b are positive constants. The force acting on the particle is

A. a

B. b

C. ab

D. a + b

Answer: B

Watch Video Solution

26. A ball of mass m is thrown vertically upward from the ground and reaches a height h before momentarily coming to rest. If g is acceleration due to gravity, the impulse received by the ball due to gravity force during its flight is

A. $\sqrt{2m^2gh}$

B. $\sqrt{4m^2gh}$

C. $\sqrt{8m^2gh}$

D. $4\sqrt{m^2gh}$

Answer: C

Watch Video Solution

27. A packet of weight w is dropped with the help of a parachute and on strinking the ground comes to rest with retardation equal to twice the acceleration due to gravity. The foce exerted on the ground is

A. W

B. 2 W

C. 3 W

D. 4 W

Answer: C

Watch Video Solution

28. A person of 60 Kg mass is in a lift which is coming down such that the man exerts a force of 150 N on the floor of the lift. Then the acceleration of the lift is (g=10 ms^{-2})

A. $40.0ms^{-2}$

B. $15.0ms^{-2}$

C. $22.5ms^{-2}$

D. $7.5ms^{-2}$

Answer: D

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

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

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

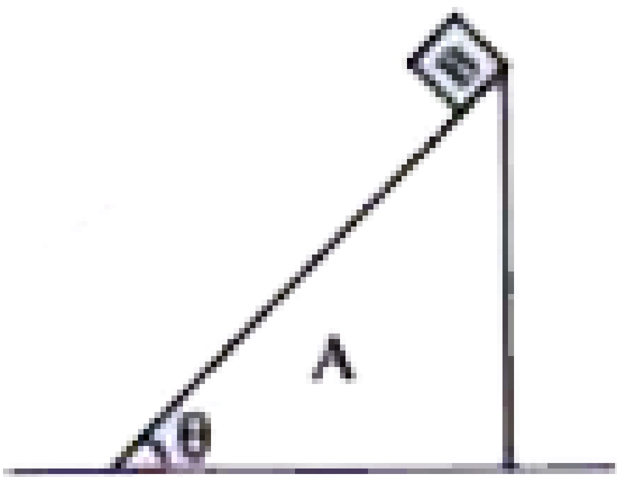
C. $\frac{8}{5}$

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

Answer: A

Watch Video Solution

30. A wedge shaped block A' of mass M is at rest on a smooth horizontal surface. A small block 'B' of mass 'm' placed at the top edge of inclined plane of length 'l' as shown in the figure. By the time, the block 'B' reaches the bottom end, the wedge A moves a distance of:



A. $\dfrac{mL}{M \cos \theta}$

B. $\dfrac{mL \cos \theta}{m + M}$

C. $\dfrac{mL}{m + M}$

D. Zero

Answer: B

Watch Video Solution

31. A stationary shell explodes into two fragments, having masses in the ratio of 1:2. The heavier fragment attains a Kinetic energy of 100J. The Kinetic energy released in the explosion is:

A. 200 J

B. 150 J

C. 300 J

D. 600 J

Answer: C

Watch Video Solution

32. A particle of mass 1 kg is thrown vertically upward with speed 100 m/s. After 5 sec it explodes into two parts. One part of mass 400 g comes back with speed 25 m/s, what is-the speed of the other part just after explosion? (g=$10\text{m}/\text{s}^2$)

A. 600 m/s upward

B. 100 m/s upward

C. 100 m/s down ward

D. 300 m/s upward

Answer: B

Watch Video Solution

33. A shell is fired from a cannon with a velocity V at an angle θ with the horizontal direction. A the highest point i its path, it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other priece immediately after the explocison is

A. $V \cos \theta$

B. $2 \cos \theta$

C. $3V \cos \theta$

D. $(3v/2)\cos \theta$

Answer: C

Watch Video Solution

34. A gun mounted on the top of a moving truck t is aimed in the backward direction at an angle of 30° to the vertical. If the muzzle velocity of the bullet is $4 ms^{-1}$ the value of speed of the truck that will make the bullet come of out vertically is

A. $1 ms^{-1}$

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

C. $0.5 ms^{-1}$

D. $2 ms^{-1}$

Answer: D

Watch Video Solution

35. A gun of mass M fires a bullet of mass m with a Kinetic energy E. The velocity of recoil of the gun is

A. $\frac{\sqrt{2ME}}{m}$

B. $\frac{\sqrt{2mE}}{M}$

C. $\frac{\sqrt{2mE}}{M+m}$

D. $\frac{\sqrt{2ME}}{(M+m)}$

Answer: B

Watch Video Solution

36. A gun of mass M fires a bullet of mass m with a velocity v relative to the gun. The average force required to bring the gun to rest in 0.5 sec. is

A. $\frac{2Mmv}{M+m}$

B. $\frac{Mmv}{2(M+m)}$

C. $\frac{3Mmv}{2(M+m)}$

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

Answer: A

Watch Video Solution

37. A shell of mass 0.01 kg fired by a gun of mass 10 kg. If the muzzle speed of the shell is 50ms^{-1}, what is the recoil speed of the gun?

A. 0.01 m/s

B. 0.02 m/s

C. 0.03 m/s

D. 0.05 m/s

Answer: D

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38. A rocket consumes 20 kg fuel per second. The exhaust gases escape at a speed of 1000ms^{-1} relative to the rocket. Calculate the upthrust received by the rocket. Also calculate the velocity acquired. When its mass is 1/100 of the initial mass.

A. 2×10^4N, 4.6 Km/s

B. 2×10^6N , 5.3 Km/s

C. 4×10^2 N , 4.6 Km/s

D. 4×10^6N , 5.3 Km/s

Answer: A

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39. A rocket of initial mass 6000kg ejects mass at constant rate of 200 kg/sec. with constant relative speed of 800 m/sec. The acceleration of the rocket after 5 sec is (neglect gravity)

A. $50\text{m}/\text{s}^2$

B. $16\text{m}/\text{s}^2$

C. $60\text{m}/\text{s}^2$

D. $32\text{m}/\text{s}^2$

Answer: D

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40. A rocket of mass 20kg has 180kg fuel. The exhaust velocity of the fuel is 1.6km/s. Calculate the minimum rate of consumption of fuel so that the rocket may rise from the ground. Also, calculate the ultimate vertical speed gained by the rocket when the rate of consumption of fuel is $(g = 9.8\text{m/s}^2)$

(i) 2kg/s (ii) 20kg/s

A. 3.7 km/sec

B. 2 km/sec

C. 10 km/sec

D. 5 km/sec

Answer: A

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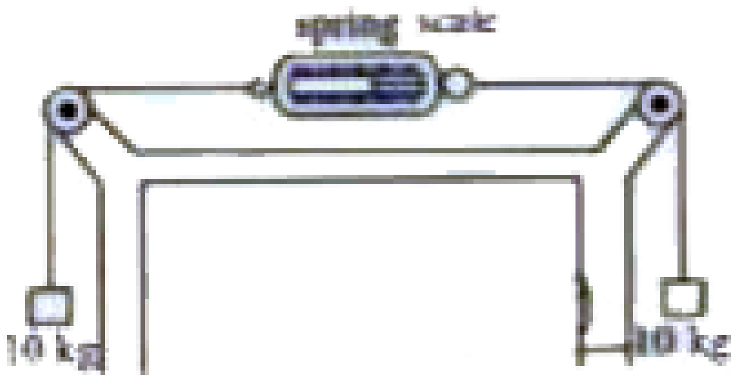
41. Two 10 kg bodies are attached to a spring balance as shown in figure. The reading of the balance will be:



A. 20 kg-wt

B. 10 kg-wt

C. Zero

D. 5 kg-wt

Answer: B

Watch Video Solution

42. A mass 'M' is suspended by a rope from a rigid support. It is pulled horizontally with a force F. If the rope makes an angle ' θ' with vertical in equilibrium, then the tention in the string is

A. $F \sin \theta$

B. $\frac{F}{\sin \theta}$

C. $F \cos \theta$

D. $\frac{F}{\cos \theta}$

Answer: B

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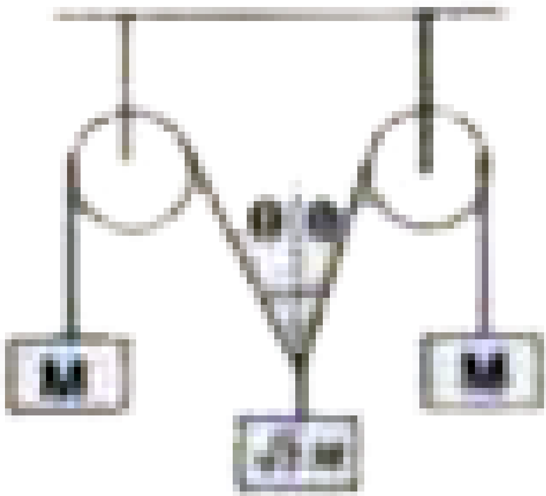
43. In the given arrangement, for the system to remain under equilibrium, the 'θ' should be:



A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

Watch Video Solution

44. A uniform rope of length 5m is on a smooth horizontal surface. It is being pulled by a horizontal force of 20 N at one end. The ratio of tension at a distance of 2m from force end to tension at a distance of 2m from free end is,

A. $1:1$

B. $2:3$

C. $1:2$

D. $3:2$

Answer: D

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45. Two block of masses 3 kg and 1 kg are kept in contact with each other on a frictionless horizontal surface. If a force of 10 N is applied on the larger block what is the acceleration of the system? What is the contact force between the two blocks?

A. $2.5 \mathrm{m/s}^2$, 2.5 N

B. $5 \mathrm{m/s}^2$, 5N

C. $5 \mathrm{m/s}^2$, 2.5 N

D. $2.5 \mathrm{m/s}^2$, 5N

Answer: A

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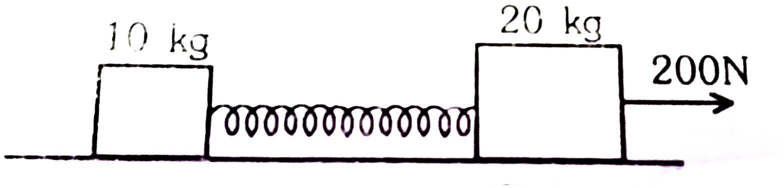
46. Two masses of 10 kg and 20 kg respectively are connected by a massless spring as shown in the figure. A force of 200N acts on the 20kg mass. At the instant shown the 10kg mass has acceleration

$12 m/s^2$. What is the acceleration of 20 kg mass:-



A. $4 ms^{-2}$

B. $12 ms^{-2}$

C. $20 ms^{-2}$

D. $8 ms^{-2}$

Answer: A

Watch Video Solution

47. A block of mass 10 kg lying on a smooth horizontal surface is being pulled by means of-a rope of mass 2 kg. If a force of 36N is applied at the end of the rope, the tension at the mid point of the rope is,

A. 33 N

B. 30 N

C. 24 N

D. 12 N

Answer: A

Watch Video Solution

48. Ten coins each of mass 10 gm are placed one above the other. The reaction force exerted by 7th coin from the bottom on the 8th coin is $(g = 10ms^{-2})$

(a) 0.3 N

(b) 0.2 N

(c) 0.4 N

(d) 0.7 N

A. 0.3 N

B. 0.2 N

C. 0.4 N

D. 0.7 N

Answer: A

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49. The apparent weight of man inside a lift moving up with certain acceleration is 900N. When the lift is coming down with the same acceleration apparent weight is found to be 300N. The mass of the man is ($g = 10ms^{-2}$)

A. 45 kg

B. 60 kg

C. 75 kg

D. 80 kg

Answer: B

Watch Video Solution

50. A 60kg man is inside a lift which is moving up with an acceleration of 2.45ms^{-2}. The apparent percentage change in his weight is,

A. 0.2

B. 0.25

C. 0.5

D. 0.75

Answer: B

Watch Video Solution

51. When an empty lift is moving down with an acceleration of $\frac{g}{4}ms^{-2}$ the tension in the cable is 9000N. When the lift is moving up with an acceleration of $\frac{g}{3}ms^{-2}$ the tension in the cable is

A. 16,000 N

B. 18,000 N

C. 12,000 N

D. 15,000 N

Answer: A

Watch Video Solution

52. A fireman wants to slide down a rope. The breaking load for the rope is 3/4th of the weight of the man. With what minimum acceleration sholud the fireman slide down? Acceleration due to gravity is g.

A. Zero

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

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

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

Answer: B

Watch Video Solution

53. How can you lower a 100 kg body from the roof of a house using a cord with a breaking strength of 80 kg weight without breaking the rope? (1 kg weight = gN)

A. 1.96 m/s^2 downwards

B. 9.8 m/s^2 downwards

C. 4.9 m/s^2 downwards

D. 19.6 m/s^2 downwards

Answer: A

Watch Video Solution

54. A man in a lift feels an apparent weight W when the lift is moving up with a uniform acceleration of 1/3rd of the acceleration due to gravity. If the same man were in the same lift now moving down with a uniform acceleration that is 1/2 of the acceleration due to gravity, then his apparent weight is

A. $\frac{3W}{8}$

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

C. $\frac{W}{8}$

D. $\frac{5W}{8}$

Answer: A

Watch Video Solution

55. A boy of mass 40 kg climbs up a rope with an acceleration of $2 ms^{-2}$. What is the tension in the rope ?

A. 472 N

B. 435 N

C. 232 N

D. 568 N

Answer: A

Watch Video Solution

56. Two bodies of masses 1 kg and 2 kg are connected by a very light string passed over a clamped light smooth pulley. If the system is released from rest, find the acceleration of the two masses and the tension in the string

A. 3.27 m/s^2 , 13 N

B. $4.5m/s^2$, 26 N

C. $1.27m/s^2$, 13N

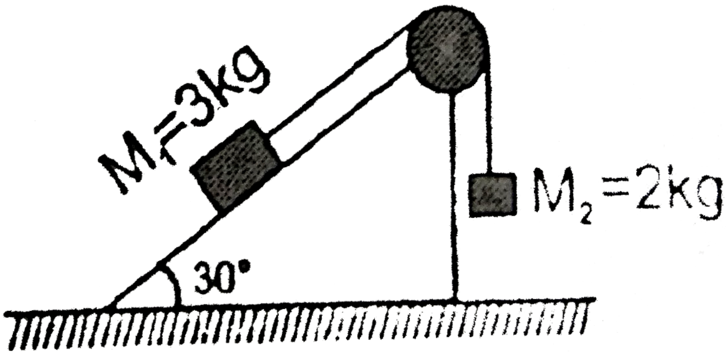
D. $0.327m/s^2$,13 N

Answer: A

Watch Video Solution

57. A block of mass $M_1 = 3kg$ on a smooth fixed inclined plane of angle 30° is connected by a cord over a small frictionless pulley to a second block mass $2kg$ hanging vertically. The tension in the cord and the acceleration of each block are .... and

.... respectively.



A. $0.98 \mathrm{m/s^2}$, 17.6 N

B. $1.98 \mathrm{m/s^2}$, 19.6 N

C. $0.49 \mathrm{m/s^2}$, 9.8 N

D. $1.47 \mathrm{m/s^2}$, $4.9 \mathrm{N}$

Answer: A

Watch Video Solution

58. Two blocks of masses 2 kg and 4 kg are connected by a light string passing over a light smooth pulley clamped to the edge of a horizontal table. The 2 kg block is on the smooth horizontal table and the other block is hanging vertically, (i) Find the acceleration of the stem if it is released from rest, (ii) Find the tension in the string.

A. $6.54 \text{m/s}^2, 26 \text{N}$

B. $2.6 \text{m/s}^2, 6.54 \text{N}$

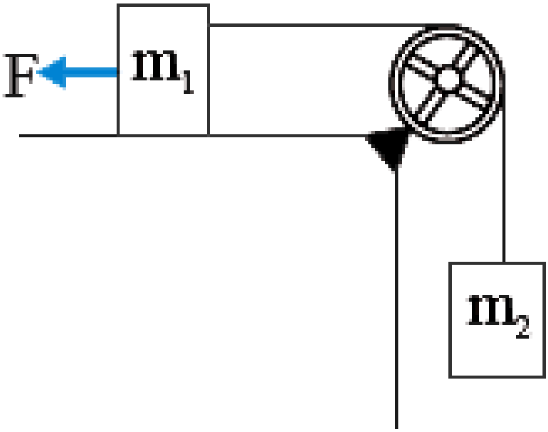
C. $6.54 \text{m/s}^2, 13 \text{N}$

D. $13 \text{m/s}^2, 26 \text{N}$

Answer: C

Watch Video Solution

59. A constant force $F = m_2 g/2$ is applied on the block of mass m_1 as shown in fig. The string and the pulley are light and the surface of the table is smooth. The acceleration of m_1 is :



A. $\dfrac{m_2 g}{2m_1}$

B. $\dfrac{m_2 g}{2(m_1 + m_2)}$

C. $\dfrac{3m_2 g}{2(m_1 + m_2)}$

D. $\dfrac{3m_2 g}{2m_1}$

Answer: B

Watch Video Solution

60. A particle of small m is joined to a very heavy body by a light string passing over a light pulley. Both bodies are free to move. The total downward force on the pulley is

A. mg

B. 2 mg

C. 4 mg

D. $> >$ mg

Answer: C

Watch Video Solution

61. A small ball is suspended by a string from the ceiling of a car. As the car accelerates at a rate 'a' the string makes an angle '/theta' with the vertical in equilibrium. Then the tension in the string is :

A. $mg \cos \theta$

B. $ma \sin \theta$

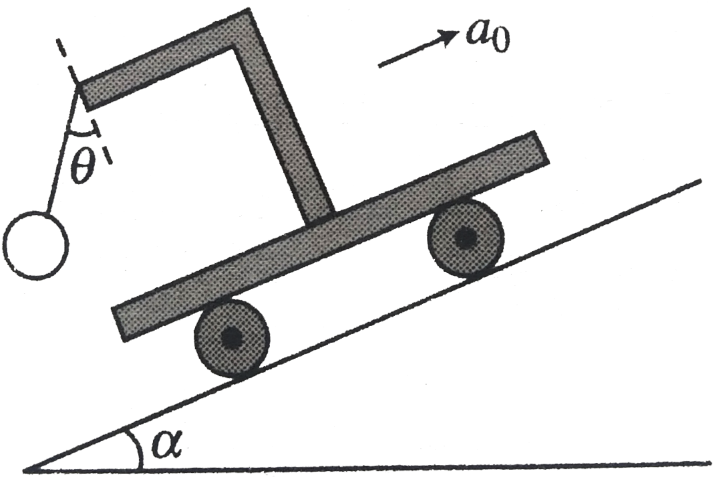
C. $m\sqrt{a^2 + g^2}$

D. $ma\sqrt{a^2 + g^2}$

Answer: C

Watch Video Solution

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



A. Zero

B. $\tan^{-1}\alpha$

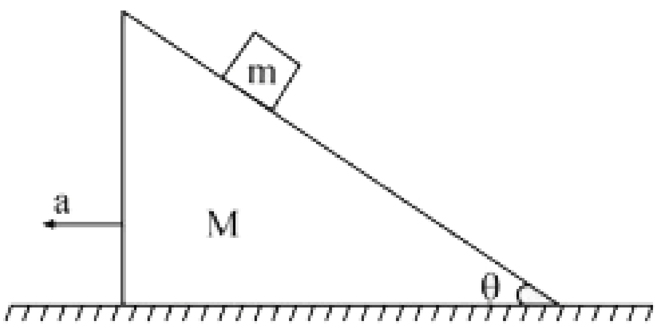
C. $\tan^{-1}\dfrac{a+g\sin\alpha}{g\cos\alpha}$

D. $\tan^{-1}\dfrac{a}{g}$

Answer: C

Watch Video Solution

63. All the surfaces are smooth as shown in figure. The acceleration of mass m relative to wedge is :



A. $g\sin\theta$

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

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

D. $a \cos \theta$

Answer: B

Watch Video Solution

64. A wooden block of 100 kg is about to be pushed on a floor of coefficient of friction 0.4. What is the magnitude of the force of friction on the wooden block when it is just pushed ?

A. 392 N

B. 294 N

C. 196 N

D. 490 N

Answer: A

Watch Video Solution

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

C. 0.5

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

Answer: A

Watch Video Solution

66. 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 $g=10ms^{-2}$ The frictional force on the block is

A. 25 N

B. 15 N

C. 10 N

D. zero

Answer: D

Watch Video Solution

67. The coefficient of friction is 0.75. If sin37°= 0.6, the angle of friction is

A. 18°

B. 37°

C. 74°

D. 53°

Answer: B

Watch Video Solution

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

A. 90 N

B. 80 N

C. 60 N

D. 30 N

Answer: C

Watch Video Solution

69. A body of mass 60 kg is pushed up 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. What is the acceleration of the body ?

A. $14.7 ms^{-2}$

B. $1.96 ms^{-2}$

C. $0.98 ms^{-2}$

D. $4.9 ms^{-2}$

Answer: C

Watch Video Solution

70. A block of mass 2 kg is on a horizontal surface. The coefficient of static & kinetic frictions are 0.6 & 0.2 The minimum horizontal force required to start the motion is applied and if it is continued, the velocity acquired by the body at the end of the 2nd second is (g= $10ms^2$)

A. $8ms^{-1}$

B. $4ms^{-1}$

C. $2ms^{-1}$

D. zero

Answer: A

Watch Video Solution

71. A marble block of mass 2 kg lying on ice when given a velocity of 6 $m s^{-1}$ is stopped by friction in 10 s. Then the coefficient of friction is

A. 0.02

B. 0.03

C. 0.06

D. 0.01

Answer: C

Watch Video Solution

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

A. m Mg

B. Mg

C. Zero

D. mMg/2

Answer: C

Watch Video Solution

73. Two bodies having the same mass 5kg each have different surface areas $20\mathrm{m}^2$ and $10\mathrm{m}^2$ in contact with a horizontal plane. If the coefficient of friction is 0.4, the forces of friction that come into play when they are in motion will be in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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Watch Video Solution

74. A boy of weight 25kg slides down a rope hanging from the branch of a tree. If the force of friction against him is 50N, the boy's acceleration is ($g=10ms^{-2}$)

A. $10ms^{-2}$

B. $12ms^{-2}$

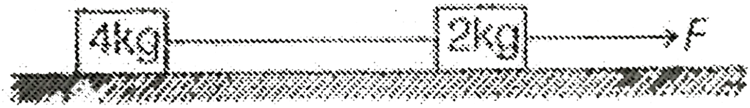
C. $8ms^{-2}$

D. $2ms^{-2}$

Answer: C

Watch Video Solution

75. Two blocks of mass 4kg and 2kg are connected by a heavy string and placed on rough horizontal plane. The 2 kg block is pulled with a constant force F. the coefficent of friction between the blocks and the ground is 0.5. what is the value of F so that tension in the string is constant throughout the length? ($g = 10 m/s^2$)



A. 40 N

B. 30 N

C. 50 N

D. 60 N

Answer: B

Watch Video Solution

76. A block of mass 4 kg is kept over a rough horizontal surface. The coefficient of friction between the block and the surface is 0.1 At, t=0,

$(3\hat{i})\left(\frac{m}{s}\right)$ velocity is imported to the block simultaneously $(-2\hat{i})N$ force starts acting on it. Its displacement in first 5s is

A. $8\hat{i}$

B. $-8\hat{i}$

C. $3\hat{i}$

D. $-3\hat{i}$

Answer: C

Watch Video Solution

77. A body of mass 5kg is under the action of 50N on the horizontal surface. If coefficient of friction in between the surfaces is one, the distance it travels in 3 s is

A. 2m

B. 1.5 m

C. 0.9 m

D. 6 m

Answer: C

Watch Video Solution

78. Two trolleys of masses m and 3 m are connected by a spring. The spring is compressed and released the trolleys move off in opposite directions and come to rest after travelling distances s1, and s2, respectively. Assuming coefficient of friction is same for both the ratio of sto s_1 to s_2 is

A. $1:9$

B. $1:3$

C. $3:1$

D. $9:1$

Answer: C

Watch Video Solution

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

A. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: D

Watch Video Solution

80. A horizontal force applied on a body on a rough horizontal surface produces an acceleration 'a'. If coefficient of friction between the body & surface which is m is reduced to m/3, the accele-ration increases by 2 units. The value of m is

A. 2/3 g

B. 3/2 g

C. 3/g

D. 1/g

Answer: C

Watch Video Solution

81. A person of mass 72 kg sitting on ice pushes a block of mass of 30kg on ice horizontally with a speed of $12 \mathrm{ms}^{1}$. The coefficient of friction between the man and ice and between block and ice in 0.02.

If $g = 10ms^2$, the distances between man and the block, when they come to rest is

A. 360 m

B. 10 m

C. 350 m

D. 422.5 m

Answer: D

Watch Video Solution

82. When a car of mass 1200 kg is moving with a velocity of $15ms^{-1}$ on a rough horizontal road, its engine is switched off. How far does the car travel before it comes to rest if the coefficient of kinetic friction between the road and tyres of the car is 0.5? ($g = 10ms^{-2}$)

A. 21.6 m

B. 25 m

C. 23.5 m

D. 22.5 m

Answer: D

Watch Video Solution

83. A vehicle of mass m is moving on a rough horizontal road with momentum p. If the coefficient of friction between the tyres and the road be μ, then the stopping distance is

A. $\frac{p}{2\mu mg}$

B. $\frac{p^2}{2\mu mg}$

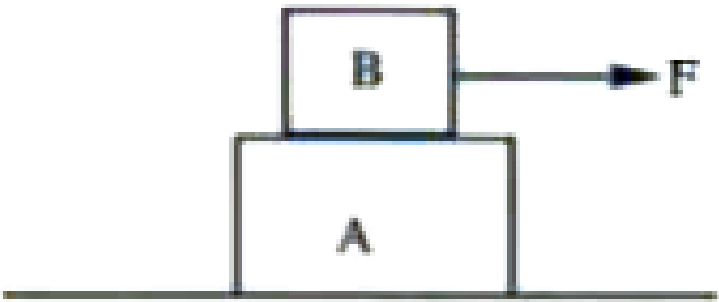
C. $\frac{p^2}{2\mu m^2 g}$

D. $\frac{p}{2\mu m^2 g}$

Answer: C

Watch Video Solution

84. A block B of mass 5kg is placed on a slab A of mass 20kg which lies on a frictionless surface as shown in the figure. The coefficient of static friction between the block and the slab is 0.4 and that of kinetic friction is 0.2. If a force F = 25N acts on B, the acceleration of the slab will be:



A. 0.4ms^{-2}

B. 0.5ms^{-2}

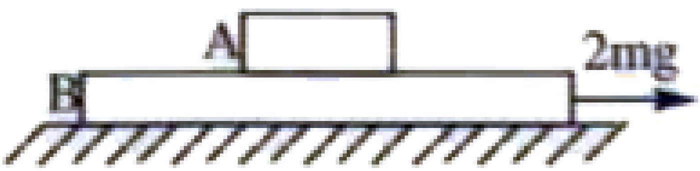
C. $1ms^{-2}$

D. Zero

Answer: C

Watch Video Solution

85. Block A of mass m rests on the plank B of mass 3m which is free to slide on a frictionless horizo-ntal surface. The coefficient of friction between the block and plank is 0.2. If a horizontal force of magnitude 2 mg is applied to the plank B, the acceleration of A relative to the plank and relative to the ground respectively, are:



A. $0, \frac{g}{2}$

B. $0, 2\frac{g}{3}$

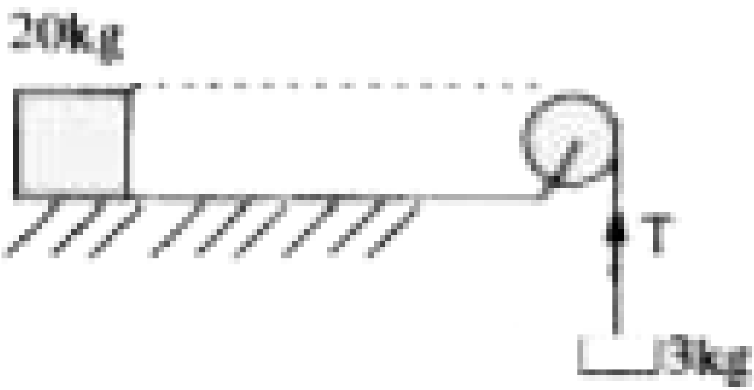
C. $3\frac{g}{5}, \frac{g}{5}$

D. $2\frac{g}{5}, \frac{g}{5}$

Answer: D

Watch Video Solution

86. A body of mass 20kg is moving on a rough horizontal plane. A block of mass 3kg is connected to the 20 kg mass by a string of negligible mass through a smooth pulley as shown in the figure. The tension in the string is 27 N. The coefficient of kinetic friction between the heavier mass and the surface is ($g = 10 m/s^2$)



A. 0.025

B. 0.035

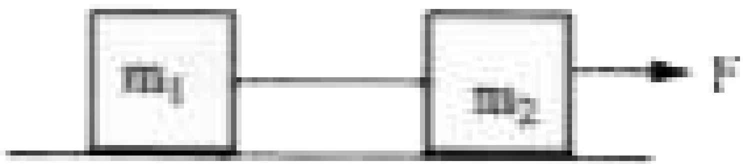
C. 0.35

D. 0.25

Answer: B

Watch Video Solution

87. Two masses m_1 and m_2 are placed on a smooth horizontal surface and are connected by a string of negligible mass. A horizontal force F is applied on the mass m_2 as shown in the figure. The tension in the string is



A. $\left(\frac{m_1}{m_1 + m_2}\right)F$

B. $\frac{m_2F}{m_1 + m_2}$

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

D. $\frac{m_2F}{m_1}$

Answer: A

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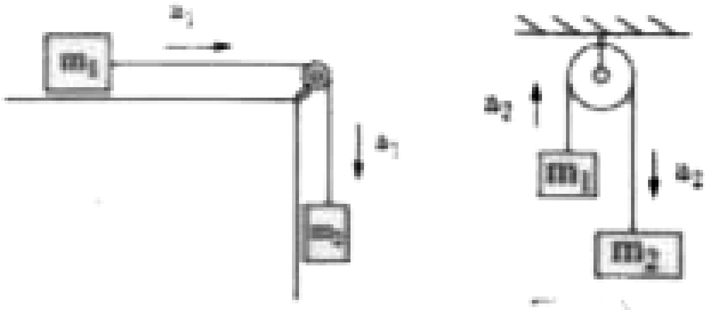


88.

The situations are shown in fig(a) & (b), in each case, m_1=3kg and $m_2 = 4$kg. If a_1, a_2 are the respective accelerations of the blocks in these situations, then the values of a_1 and a_2 are respectively [g=10 ms^{-2}]

A. $\frac{10}{7}ms^{-2}, \frac{25}{7}ms^{-2}$

B. $\frac{30}{7}ms^{-2}, \frac{5}{7}ms^{-2}$

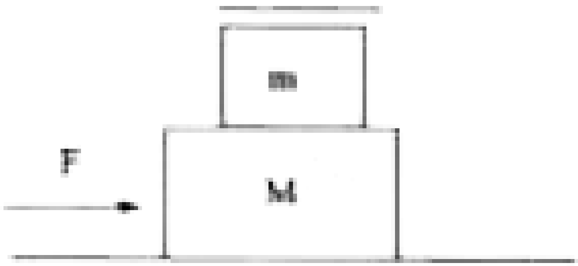
C. $\frac{40}{7}ms^{-2}, \frac{10}{7}ms^{-2}$

D. $\frac{20}{7}ms^{-2}, \frac{10}{7}ms^{-2}$

Answer: C

Watch Video Solution

89. Two blocks of masses 'M' and 'm' are placed on one another on a smooth horizontal surface as shown in the figure. The force 'F' is acting on the mass 'M' horizontally during time interval 't'. Assumings no relative sliding between the blocks, The work done by friction on the blocks is



A. $\dfrac{mF^2t^2}{2(M+m)^2}$

B. $\dfrac{F^2t^2}{(M+m)}$

C. $\dfrac{M+m}{m^2}$

D. $\dfrac{Ft}{2(M+m)}$

Answer: A

Watch Video Solution

90. A body of weight 20N is on a horizontal surface, minimum force applied to pull it when applied force makes an angle 60° with horizontal (angle of friction a = 30°) is

A. 20 N

B. $20\sqrt{3}$ N

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

D. 20 N

Answer: C

Watch Video Solution

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

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

B. $100\sqrt{3}$

C. $50\sqrt{3}$

D. 50 N

Answer: D

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92. A homogeneous chain lies in limiting equilibrium on a horizontal table of coefficient of friction 0.5 with part of it hanging over the edge of the table. The fractional length of the chain hanging down the edge of the table is

A. $1/2$

B. $1/5$

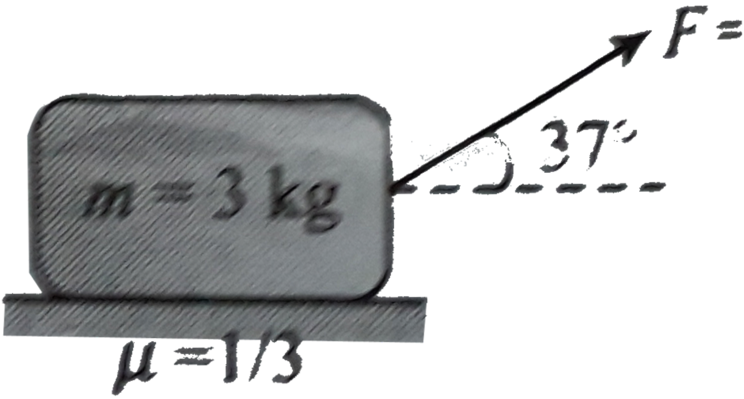
C. $1/3$

D. $2/3$

Answer: C

Watch Video Solution

93. A block of mass $m = 3kg$ is resting over a rough horizontal surface having coefficient of friction $\mu = 1/3$ The block is pulled to the right by appliying a force F inclined at angle 37° with the horizontal as shown in fig .The forceincreases with time according to law $F = 2r$ newton Calculate its velocity v at $t = 10s(g = 10ms^{-2})$



A. $25\sqrt{5}$ N

B. $\frac{25}{\sqrt{2}}$ N

C. $50\sqrt{2}$ N

D. $\frac{75}{\sqrt{2}}$N

Answer: B

Watch Video Solution

94. A car is travelling at 36 kmph on a road. If $\mu = 0.5$ between the tyres and the road, the minimum turning radius of the car is: ($g = 10 \text{ms}^{-2}$)

A. 20 m

B. 25 m

C. 30m

D. 35m

Answer: A

Watch Video Solution

95. A coin is kept at distance of 10 cm from the centre of a circular turn table. If $\mu = 0.8$ the frequency of rotation at which the coin just

begins to slip is

A. 62.8 rpm

B. 84.54 rpm

C. 54.6 rpm

D. 32.4 rpm

Answer: B

Watch Video Solution

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

A. 4

B. 3

C. 2

D. 1

Answer: D

Watch Video Solution

97. A car is driven round a curved path of radius 18 m without the danger of skidding. The coefficient 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 ? [g = $10ms^{-1}$]

A. 21.6 kmph

B. 18.5 kmph

C. 25.4 kmph

D. 28.6 kmph

Answer: A

Watch Video Solution

98. A block of mass kg lies on a horizontal surface in a truckÂ· The coefficient of stalk friction between the block and the surface is 0.6. If the acceleration of the truck is 5ms^{-2}. The frictional force acting on the block is

A. 2 N

B. 5 N

C. 3N

D. 6N

Answer: B

Watch Video Solution

99. A box is placed on the floor of a truck moving with an acceleration of 7ms^{-2}. If the coefficient 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

Watch Video Solution

100. The rear side of a truck is open and a box of mass 40kg is placed 5m away from the open end. The coefficient of friction between the box and the surface below it is 0.15. The truck starts from rest with an acceleration of 2ms^{-2} on a straight road. At what distance from the starting points does not the box fall off the truck?

A. 20m

B. 10m

C. $\sqrt{20}$m

D. 5m

Answer: A

Watch Video Solution

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

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A. 20 N

B. 50N

C. 100 N

D. 2 N

Answer: D

Watch Video Solution

102. A person holds a block weighing 2kg between his hands & keeps it from falling down by pres-sing it with his hands. If the force exerted by each hand horizontally is 50N, the coefficient of friction between the hand & the block is ($g=10ms^{-2}$)

A. 0.2

B. 0.4

C. 0.1

D. 0.5

Answer: A

Watch Video Solution

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

A. 2 N

B. 2.8 N

C. 4 N

D. 4.8 N

Answer: C

Watch Video Solution

104. 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 15 $m/s^2 (g = 10ms^{-2})$. The force of friction between lorry and block is

A. 48 N

B. 24 N

C. 40 N

D. Zero

Answer: C

Watch Video Solution

105. A book of weight 20 N is pressed between two hands and each hand exerts a force of 40 N. If the book just starts to slide down. What is the value of the coefficient of friction?

A. 0.25

B. 0.2

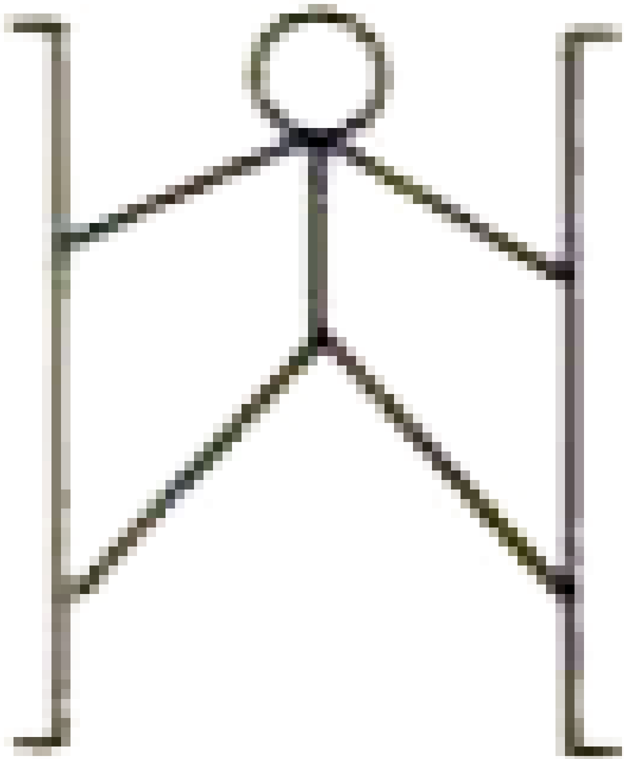
C. 0.5

D. 0.1

Answer: A

Watch Video Solution

106. A man of mass 40 kg is at rest between the walls as shown in the figure. If between the man and the walls is 0.8, find the normal reaction exerted by the walls on the man. ($g = 10ms^{-2}$)



A. 100 N

B. 250 N

C. 80 N

D. 50 N

Answer: B

Watch Video Solution

107. A wooden block is placed on an inclined plane. The block just begins to slide down when the angle of the inclination is increased to 45°. What is the coefficient of the friction?

A. 0.25

B. 0.75

C. 1

D. 0.5

Answer: C

Watch Video Solution

108. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. If $\mu_S = 0.6$, what is the frictional force on the block ?

A. 9.8 N

B. 19.6 N

C. 14.7 N

D. 4.9 N

Answer: A

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109. A body takes $1\left(\frac{1}{3}\right)$ times as much time to slide down a rough inclined plane as it takes to slide down an identical bust 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

Watch Video Solution

110. A block of mass 2kg is lying on a rough inclined plane. The force needed to move the block up the plane with uniform velocity by applying a force parallel to the plane is 100N. The force needed to move the block up with an accele-ration of 2ms^{-2} is

A. 100 N

B. 200 N

C. 96 N

D. 104 N

Answer: D

Watch Video Solution

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

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

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

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

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

Answer: B

Watch Video Solution

112. A block is pushed up a rough inclined plane of 45°. If the time of descent is twice the time of ascent, the coefficient of friction is

A. 0.6

B. 0.4

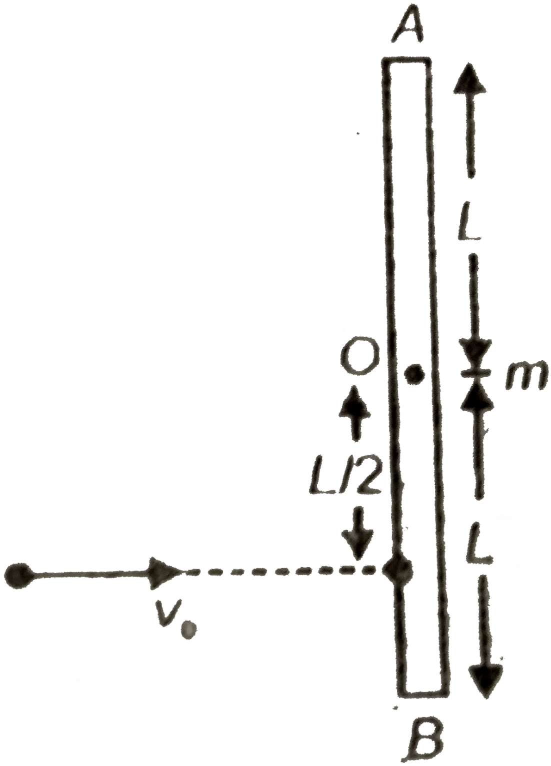
C. 0.5

D. 0.25

Answer: A

Watch Video Solution

113. A rod AB of length $2L$ and mass m is lying on a horizontal frictionless surface. A particle of same mass m travelling along the surface hits the rod at distance $\frac{L}{2}$ from COM with a velocity v_0 in a direction perpendicular to rod and sticks to it.



Distance of point P on rod from B which is at rest immediately afte

collision is

A. $2:1$

B. $2:3$

C. $1:2$

D. $3:2$

Answer: C

Watch Video Solution

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

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

B. 1.414s

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

D. 2s

Answer: B

Watch Video Solution

115. A particle is projected at an angle $\theta = 30^{\circ}$ with the horizontal, with a velocity of 10ms^{-1}. Then

A. 10 m

B. 5m

C. 4 m

D. 15 m

Answer: B

Watch Video Solution

116. A 30 kg block is to be moved up an inclined plane at an anglue 30° to the horizontal with a velocity of 5ms^{-1}. If the frictional force retarding the motion is 150N find the horizontal force required to move the block up the plane. $(g = 10\text{ms}^{-2})$

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

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

C. 300N

D. 150N

Answer: A

Watch Video Solution

117. An engine of one metric ton is going up an inclined plane, 1 in 2 at the rate of 36 kmph. If the coefficient of friction is $1/\sqrt{3}$, the power of engine is

A. 9.8 W

B. 98 W

C. 980 W

D. 98 W

Answer: D

Watch Video Solution

118. The minimum force required to move a body up 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 $\frac{1}{2\sqrt{3}}$, then the angle of the inclined plane is

A. 60°

B. 45°

C. 30°

D. 15°

Answer: C

Watch Video Solution

119. A body of mass 10kg is on a rough inclined plane having an inclination of 30° with the horizontal. If coefficient of friction between the surfaces of contact of the body and the plane is 0.5. Find the least force required to pull the body up the plane.

A. $80.5N$

B. 91.4 N

C. 85.4 N

D. 78.4 N

Answer: B

Watch Video Solution

120. A block of wood of mass 0.5 kg is placed on a plane making 30° with the horizontal. If the coefficient of friction between the surfaces of contact of the body and the plane is 0.2. What force is required to keep the body sliding down with uniform velocity.

A. 6.4 N

B. 1.6 N

C. 3.2 N

D. 4.8 N

Answer: B

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

A. 3.725 sec

B. 2.650 sec

C. 2.828 sec

D. 4.135 sec

Answer: C

Watch Video Solution

122. A body is sliding down an inclined plane have coefficient of friction 0.5. If the normal reaction is twice that of resultant downward force along the incline. Find the angle between the inclined plane and the horizontal.

A. 90°

B. 30°

C. 60°

D. 45°

Answer: D

Watch Video Solution

123. 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

Watch Video Solution

124. A wooden box lying at rest on an inclined surface of a wet wood is held at static equilibrium by a constant force F applied perpendicular to the incline. If the mass of the box is 1kg, the angle of inclination is 30° and the coefficient of static friction between the box and the inclined plane is 0.2, the minimum magnitude of F is (Use g= $10 \mathrm{m/s}^2$)

A. A. 0 N , as 30° is less than angle of repose

B. B. $\geq 1 \mathrm{N}$

C. C. $\geq 3.3 \mathrm{N}$

D. D. $\geq 16.3 \mathrm{N}$

Answer: D

Watch Video Solution

125. Consider a frictionless ramp on which a smooth object is made to slide down from an initial height 'h'. The distance 'd' necessary to stop the object on a flat track of coefficient of friction 'μ.'), kept at the ramp end is

A. h/μ

B. μh

C. $\mu^2 h$

D. $h^2 \mu$

Answer: A

Watch Video Solution

126. A body of mass 2 kg slides down with an acceleration of 3 m/s^2 on a rough inclined plane having a slope of 30° The external force required to take the same body up the plane with the same acceleration will be : $(g = 10 m/s^2)$

A. 14 N

B. 20 N

C. 6 N

D. 4 N

Answer: B

Watch Video Solution

127. 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. 3500 N

C. 1600 N

D. 2000 N

Answer: D

Watch Video Solution

128. A stone of mass 0.5 kg is attached to a string of length 2 m and is whirled in a horizontal circle. If the string can with stand a tension of 9N, the maximum velocity with which the stone can be whirled is:

A. $6 ms^{-1}$

B. $8 ms^{-1}$

C. $4 ms^{-1}$

D. $12 ms^{-1}$

Answer: B

Watch Video Solution

129. 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 light rigid rod. The angle made by the rod with the vertical is:

A. 0^0

B. 30^0

C. 45^0

D. 60^0

Answer: C

Watch Video Solution

130. Two point size bodies of same mass are knotted to a horizontal string one at the end, and the other at the mid point of it. The string is rotated in horizontal plane with the other end as centre. If T is tension in the string between centre of circles and first body then the tension in the string between the two bodies is

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

B. $2T$

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

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

Answer: C

Watch Video Solution

131. On one end of a string of length l is connected to a particle of mass m and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed v the net force on the particle (directed towards the centre) is :

T is the tension in the string . [Choose the correct alternative].

A. T

B. $T - \frac{mv}{1}$

C. $T + \frac{mv}{1}$

D. 0

Answer: A

Watch Video Solution

132. A solid sphere of radius 2.45m is rotating with an angular speed of 10rad/s. When this rotating sphere is placed on a rough horizontal surface then after sometime it starts pure rolling. Find the linear speed of the sphere after it starts pure rolling.

A. $5\sqrt{3}$

B. $2.5\sqrt{3}$

C. $\frac{5}{\sqrt{3}}$

D. $\frac{2.5}{\sqrt{3}}$

Answer: B

Watch Video Solution

133. A point object moves along an arc of a circle of radius 'R'. Its velocity depends upon the distance covered 'S' as V = $K\sqrt{S}$ where 'K' is a constant. If ' theta' is the angle between the total acceleration and tangential acceleration, then

A. $\tan\theta = \sqrt{\frac{S}{R}}$

B. $\tan\theta = \sqrt{\frac{S}{2R}}$

C. $\tan\theta = \frac{S}{2R}$

D. $\tan\theta = \frac{2S}{R}$

Answer: B

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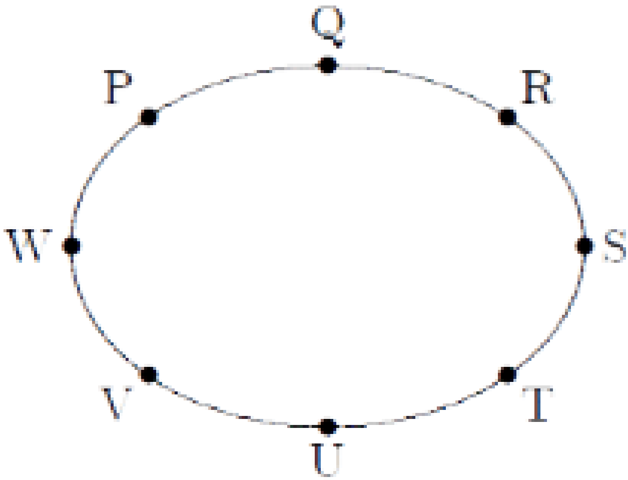
Watch Video Solution

134. A planet travels in an elliptical orbit about a star as shown. At what pair of points is the speed of the planet the same?



A. $r\sqrt{\frac{g}{\sqrt{L^2 - r^2}}}$

B. $g\sqrt{\frac{r}{\sqrt{L^2 - r^2}}}$

C. $r\sqrt{\frac{g}{L^2 - r^2}}$

D. $g\sqrt{\frac{r}{L^2 - r^2}}$

Answer: A

Watch Video Solution

135. The velocity $\vec{v}$ of a particle of mass 'm' acted upon by a constant force is given by $\vec{v}(t) = A[\cos(kt)\bar{i} - \sin(kt)\bar{j}]$. Then the angle between the force and the momentum of the particle is (Here A and k are constants)

A. 90°

B. 0°

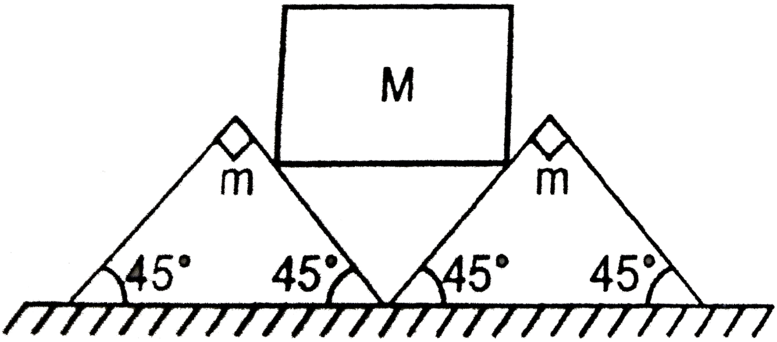
C. 180°

D. 45°

Answer: A

Watch Video Solution

136. Two wedges, each of mass m, are placed next to each other on a flat horizontal floor. A cube of mass M is balanced on the wedges as shown in figure. Assume no friction between the cube and the wedges, but a coeffіcent of static friction $\mu < 1$ between the wedges and the floor. What is the largest M that can be balanced as shown without motion of the wedges ?



A. 0.8

B. 0.6

C. 0.3

D. 1.2

Answer: A

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PRACTICE EXERCISE

1. A force of 50 N acts on a body of mass 10 kg at rest. Its velocity after 5 seconds if the same force acts, is

A. 15m/s

B. 20m/s

C. 25 m/s

D. 30 m/s

Answer: C

Watch Video Solution

2. A force of 10 N inclined to the horizontal at an angle of 60° acts on a body of mass 2 kg. If the body can move in horizontal direction only find its acceleration.

A. $2.5\text{m}/\text{sec}^2$

B. $5.5\text{m}/\text{sec}^2$

C. $4.5\text{m}/\text{sec}^2$

D. $3.5\text{m}/\text{sec}^2$

Answer: A

Watch Video Solution

3. A constant retarding force of 20 N acts on a body of mass 5 kg moving initially with a speed of 10 ms^{-1}. How long does the body take to stop?

A. 1.5 s

B. 2.5 s

C. 3.5 s

D. 4.5 s

Answer: B

Watch Video Solution

4. A bullet of mass 0.005 kg moving with a speed of 200 ms^{-1} enters a heavy wooden block and is stopped after a distance of 50 cm. What is the average force exerted by the block on the bullet?

A. -200 N

B. $+200\text{N}$

C. 400N

D. -400N

Answer: A

Watch Video Solution

5. A body of mass m falls from a height h_1 and rises to a height h_2. The magnitude of the change in momentum during the impact with the ground.

A. $mg(h_1 + h_2)$

B. $m(\sqrt{2gh_1} + \sqrt{2gh_2})$

C. $m(\sqrt{2gh_1} - \sqrt{2gh_2})$

D. Zero

Answer: B

Watch Video Solution

6. Two bodies of masses 4 kg and 16 kg at rest to acted upon by same force. The ratio of times required to attain the same speed is,

A. $1:1$

B. $4:1$

C. $1:4$

D. $1:2$

Answer: C

Watch Video Solution

7. In a football match a ball is kicked by a player with a force of 25N for 0.2 sec and then by another player with a force of 70 N for 0.1 sec in the same direction. If the foot ball gains a velocity of 24 m/s after the two kicks, the mass of the foot ball is nearly

A. 5 kg

B. 10 kg

C. 2.5 kg

D. 0.5 kg

Answer: D

Watch Video Solution

8. A body of mass 5 kg is at rest on a smooth horizontal surface. A horizontal force 'F' acts on it for 4s and then ceases to act. If the body travels 40 m in the next 5s, the value of F is,

A. 5 N

B. 20 N

C. 15 N

D. 10 N

Answer: D

Watch Video Solution

9. A balloon of total mass 1000 Kg float motionless over the earth's surface. If 100 kg of sand ballast are thrown over board, the balloon starts to rise with an acceleration of

A. $10 m/s^2$

B. $9.8 m/s^2$

C. $1.09 m/s^2$

D. $4.9 m/s^2$

Answer: C

Watch Video Solution

10. The horizontal speed of a jet of water is 100 cm/sec and 50cm^3 of water hits the plate each second. Assume that the water moves parallel to the plate after striking it. The force exerted on the stationary plate if it is held perpendicular to the jet of water is :

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

B. 5×10^2 N

C. 5×10^{-1} N

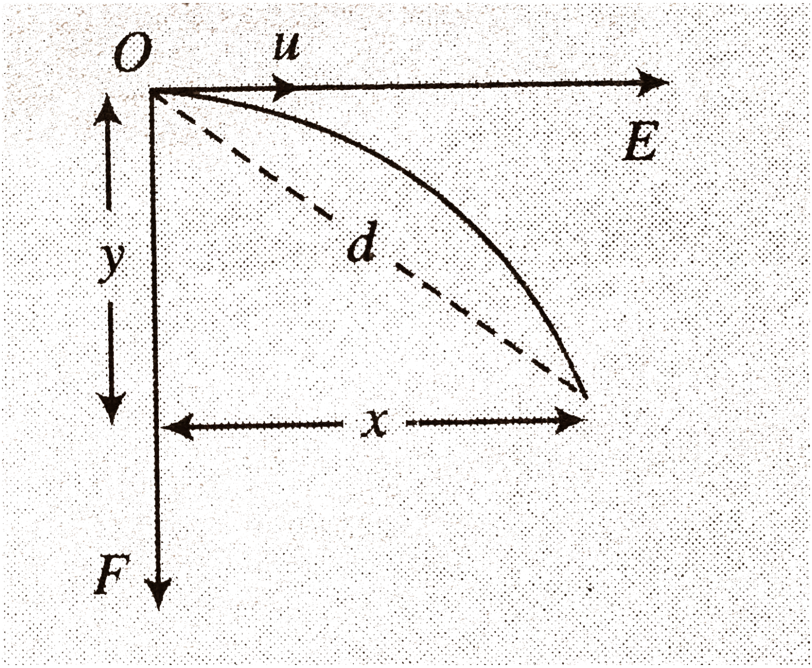
D. 5N

Answer: A

Watch Video Solution

11. A body of mass 2kg has an initial velocity of 3ms^{-1} along OE and it is subjected to a force of 4N in OF direction perpendicular to OE.

Find the distance of the body from O after 4s.



A. 12 m

B. 20 m

C. 28 m

D. 48 m

Answer: B

Watch Video Solution

12. A disc of mass 0.5kg is kept floating horizontally in mid air by firing bullets of mass 5 g each, vertically at it at the rate of 10 per second. If the bullets drop dead. The speed of the bullet striking the disc is (g=10 ms^{-2})

A. $100ms^{-1}$

B. $10ms^{-1}$

C. $10cm/s$

D. $1cm/s$

Answer: C

Watch Video Solution

13. A constant horizontal force of 20N acts on a body on a smooth horizontal plane. The body starts from rest and is observed to move 20 m in two seconds. The mass of the body is

A. 4 kg

B. 2 kg

C. 1 kg

D. 0.5 kg

Answer: B

Watch Video Solution

14. A gun of mass 10 kg fires 4 bullets per second. The mass of each bullet is 20 g and the velocity of the bullet, when it leaves the gun, is 300 ms^{-1}, The force required to hold the gun while firing is

A. 6 N

B. 8 N

C. 24 N

D. 240 N

Answer: C

Watch Video Solution

15. A ballon has 2 g of air . A small hole is pierced into it . The air comes out with relative velocity 4 m/s . If the balloon shrinks completely in 2.5 s , the average force acting on the balloon is

A. 2 dyne

B. 50 dyne

C. 8 dyne

D. 8 N

Answer: C

Watch Video Solution

16. A 1.5 kg hammer moving with a velocity of 10 m/s strikes a nail for 0.005 s. The average force exerted on the nail is

A. 5000 N

B. 3000 N

C. 1500 N

D. 750 N

Answer: C

Watch Video Solution

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

A. Zero

B. 1/2 m/s^2

C. $1 m/s^2$

D. $2 m/s^2$

Answer: C

Watch Video Solution

18. 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

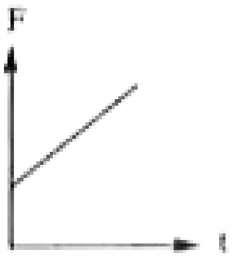
C. 72 N s

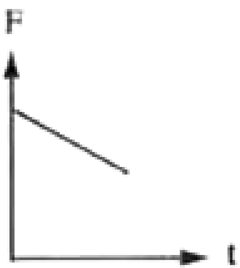
D. 32 N s

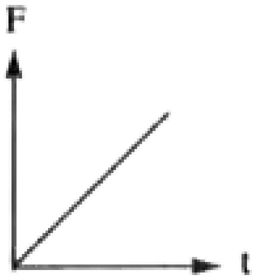
Answer: B

Watch Video Solution

19. The linear momentum of a particle varies with time as $p = a_0 + at + bt^2$. Which of the following graph represents force and time relation ?

A. 

B. 



C.

D.

Answer: A

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20. A constant force actson a body of mass m, at rest and produces a velocity 'v' over a displacement 's_1'. The same force acts on another body of mass m_2 at rest and produces the same velocity. 'v' over a displacement 's_2'. The ratio of the displacements is

A. $m_1 : m_2$

B. $m_2 : m_1$

C. $\sqrt{m_1} : \sqrt{m_2}$

D. $\sqrt{m_2} : \sqrt{m_1}$

Answer: A

Watch Video Solution

21. A man of mass 62 kg is standing on a stationary boat of mass 238 kg. The man is carrying a sphere of mass 0.5 kg in his hands. If the man throws the sphere horizontally with a velocity of 12 ms^{-1}, find the velocity with which the boat will move (in magnitude)

A. $0.02ms^{-1}$

B. $0.5ms^{-1}$

C. $0.04ms^{-1}$

D. $0.06ms^{-1}$

Answer: A

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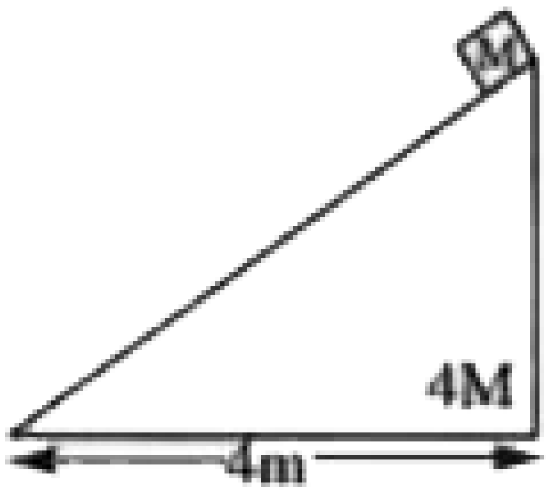
22. A block of mass 'M' is placed on the top of a wedge of mass '4M'. All the surfaces are frictionless. The system is released from rest. The distance moved by the wedge at the instant, the block reaches the bottom will be



A. 0.2 m

B. 0.4 m

C. 0.8 m

D. Zero

Answer: C

Watch Video Solution

23. A spaceship is returning to Earth with its engine turned off. Consider only the gravitational field of Earth and let M be the mass of Earth, m be the mass of the spaceship, and R be the radius of Earth. In moving from position 1 to position 2 the kinetic energy of the spaceship increases by:

A. 64

B. 128

C. 144

D. 288

Answer: D

Watch Video Solution

24. A cannon ball is fired with a velocity 200m / sec at an angle of 60° with the horizontal. At the highest point of its flight it explodes into 3 equal fragments, one going vertically upwards with a velocity 100 m / sec , the second one falling vertically downwards with a velocity 100 m / sec . The third fragment will be moving with a velocity

A. 600ms^{-1} in the horizontal direction

B. 300 ms^{-1} in the horizontal direction

C. 300ms^{-1} in the direction making 60° with the horizontal

D. 200ms^{-1} in the direction making 60° with the horizontal

Answer: B

Watch Video Solution

25. Kepler's second law regarding constancy of aerial velocity of a planet is a consequence

A. 1.6 m/s

B. 0.8 m/s

C. 3.2 m/s

D. 2.0 m/s

Answer: A

Watch Video Solution

26. A nucleus of mass 218 amu is in free state decays to emit an α-particle. Kinetic energy of α-particle emitted is 6.7Mev. The recoil energy in (MeV) emitted by the daughter nucleus is

A. 1.0

B. 0.5

C. 0.25

D. 0.125

Answer: D

Watch Video Solution

27. A shell of mass 0.02 kg is fird by a gun of mass 10 kg. If the muzzle speed of the shell is 600 ms^{-1}, what is the recoil speed of the gun?

A. 0.12 m/s

B. 0.16 m/s

C. 0.3 m/s

D. 0.4 m/s

Answer: A

Watch Video Solution

28. Assuming the earth to be a sphere of uniform density the acceleration due to gravity:

A. 58.8 Kg/s , 176.4 Kg/s

B. 132.8 Kg/s , 82.5 Kg/s

C. 72.5 Kg/s , 138.2 Kg/s

D. 93.2 Kg/s , 185.6 Kg/s

Answer: A

Watch Video Solution

29. A 500kg rocket has to be fired vertically. Exhaust velocity of the gases is 1.96 km/s. Minimum mass of the fuel to be released in kg per second is

A. 250

B. 25

C. 2.5

D. 50

Answer: C

Watch Video Solution

30. A rocket of mass 6000kg is set for vertical firing. If the exhaust speed is 1000m/sec. The rate of mass of gas ejected to supply a thrust needed to give the rocket an initial upward acceleration of 20.2 m/s^2 is

A. 150 kg/sec

B. 160 kg/sec

C. 28 kg/sec

D. 180 kg/sec

Answer: D

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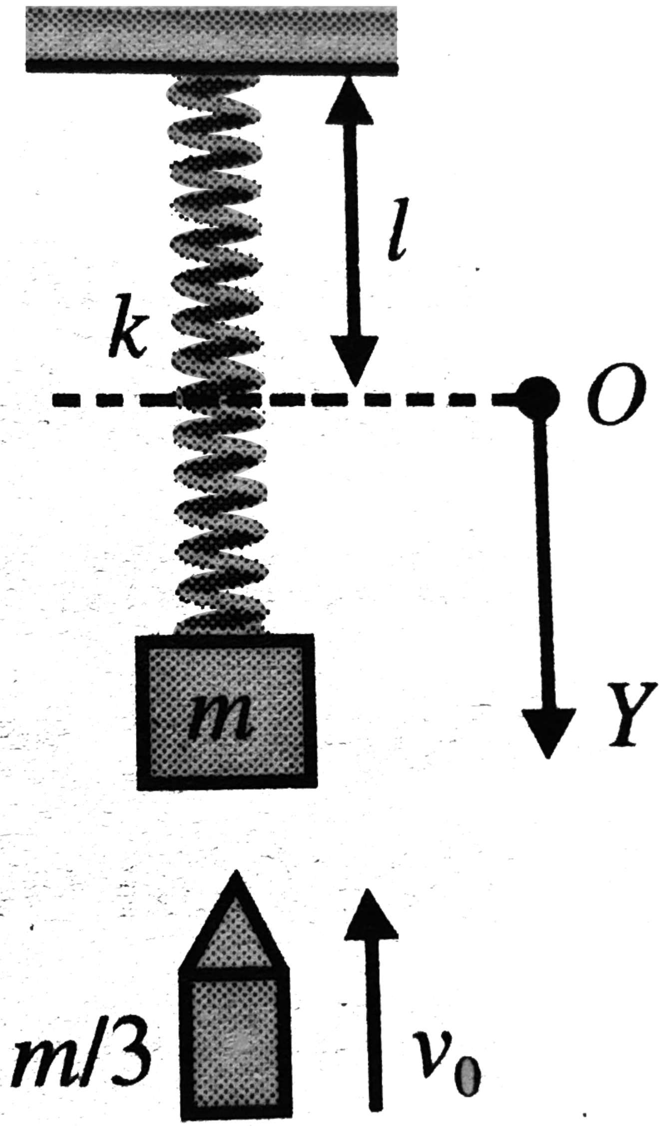

31.

A block of mass m is suspended from one end of a light spring as shown. The origin O is considered at distance equal to natural length of the spring from the ceiling and vertical downwards direction as

positive y-axis. When the system is in equilibrium a bullet of mass $\frac{m}{3}$ moving in vertical up wards direction with velocity v_0 strikes the block and embeds into it. As a result, the block (with bullet embedded into it) moves up and start oscillating. Based on the given information, answer the following question:

Q. The time taken by the block bullet system to move from $y = \frac{mg}{k}$ (initial equilibrium position) to $y = 0$ (natural length of spring) is (A represents the amplitude of motion)

A. Both the scales will read 10 kg

B. Both the scales will read 20 kg

C. The sum of readings of two balances will be 20 kg

D. None of the above

Answer: B

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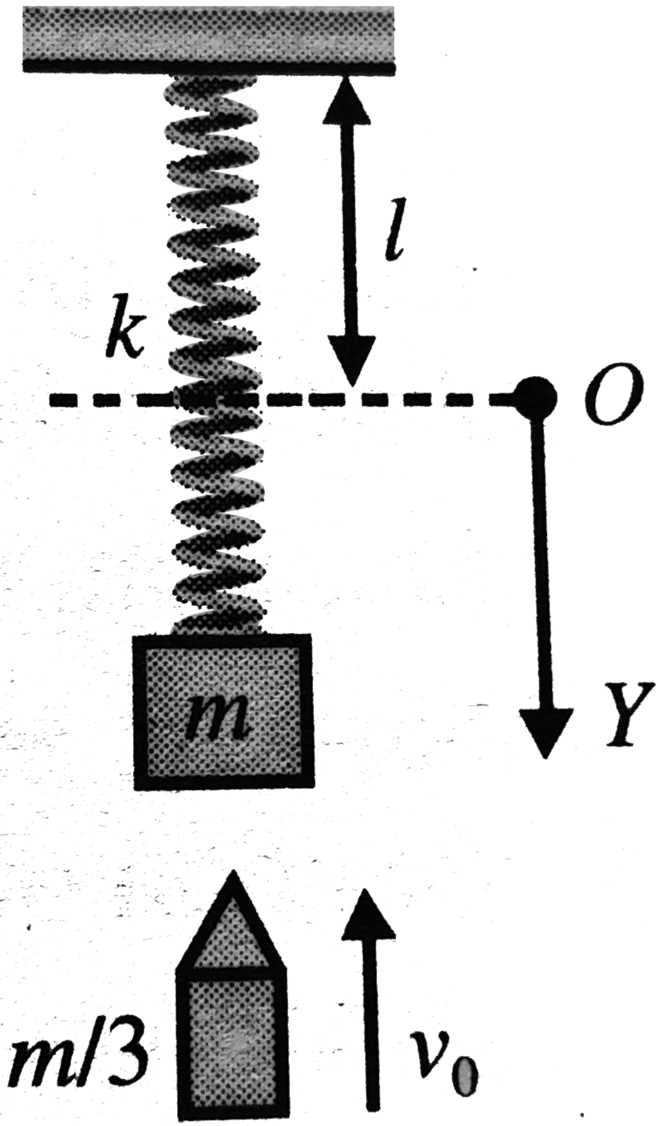


32.

A block of mass m is suspended from one end of a light spring as shown. The origin O is considered at distance equal to natural length of the spring from the ceiling and vertical downwards direction as

positive y-axis. When the system is in equilibrium a bullet of mass $\frac{m}{3}$ moving in vertical up wards direction with velocity v_0 strikes the block and embeds into it. As a result, the block (with bullet embedded into it) moves up and start oscillating. Based on the given information, answer the following question:

Q. The time taken by the block bullet system to move from $y = \frac{mg}{k}$ (initial equilibrium position) to $y = 0$ (natural length of spring) is (A represents the amplitude of motion)

A. Mg

B. Mg/2

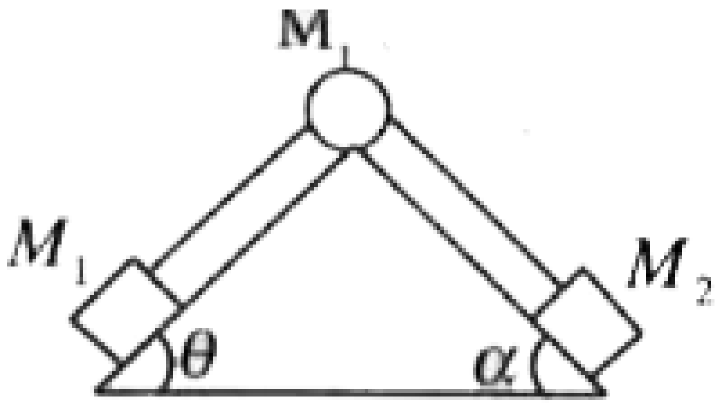
C. Mg/$\sqrt{2}$

D. $\sqrt{2}$ Mg

Answer: A

Watch Video Solution

33. 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 $\alpha = 30^\circ$ 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

Watch Video Solution

34. A uniform rope of length L, resting on a frictionless horizontal table is pulled at one end by a force F. What is the tension in the rope at a distance x form the end where the force is applied?

A. F(L -x)

B. Fx/L

C. (L-x) / F

D. F(1- x/L)

Answer: D

Watch Video Solution

35. Two blocks of masses 5 kg and 2 kg are kept in contact with each other on a frictionless horizontal surface. If a force of 14 N is applied on the larger block what is the acceleration of the system ? What is the contact force between the two blocks ?

A. $2\text{m}/\text{s}^2, 4\text{N}$

B. $1\text{m}/\text{s}^2, 2\text{N}$

C. $1\text{m}/\text{s}^2, 4\text{N}$

D. $2\text{m}/\text{s}^2, 2\text{N}$

Answer: A

Watch Video Solution

36. A block of mass m is connected to another block of mass M by a string. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the string is unstretched. Then a constant force F starts acting on the block of mass M to pull it. Find the force on the block of mass m.

A. $\dfrac{mF}{M}$

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

C. $\dfrac{mF}{(m+M)}$

D. $\dfrac{MF}{(m+M)}$

Answer: C

Watch Video Solution

37. A chain of length 'L' and mass 'M' is hanging by fixing its upper end to a rigid support. The tension in the chain at a distance 'x' from the rigid support is

A. Zero

B. Mg

C. $\dfrac{Mg(L-x)}{L}$

D. $\dfrac{Mg(L-x)}{x}$

Answer: C

Watch Video Solution

38. Ten coins are arranged one above the other. The mass of each coin is 10 g. Reaction force of the sixth coin from the bottom of the seventh coin is

A. 0.392 N

B. 0.49 N

C. 0.98 N

D. 0.784 N

Answer: A

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39. A 60 kg man stands on an elevator floor The elevator is going up with constant acceleration of 1.96 m/s^2. Percentage change in the apparent weight of the person is

A. 10

B. 15

C. 20

D. 25

Answer: C

Watch Video Solution

40. An elevator weighing 6000 kg is pulled upwards by a cable with an acceleration of $5ms^{-2}$. Taking g to be $10ms^{-2}$, the tension in cable is

A. 120 KN

B. 60 KN

C. 30 KN

D. 90 KN

Answer: A

Watch Video Solution

41. A 10 kg stone is suspended with a rope of breaking strength 30kg-wt.The minimum time in which the stone can be raised through a height 10m starting from rest is

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

A. 0.5 s

B. 1.0 s

C. $\sqrt{2/3}s$

D. 2s

Answer: B

Watch Video Solution

42. A body of mass 50 kg and specific gravity force is to be lifted using a rope of breaking strength of 60 kg wt. The acceleration with which it can be pulled up in least interval of time

A. Zero

B. g/2

C. g/4

D. g/5

Answer: D

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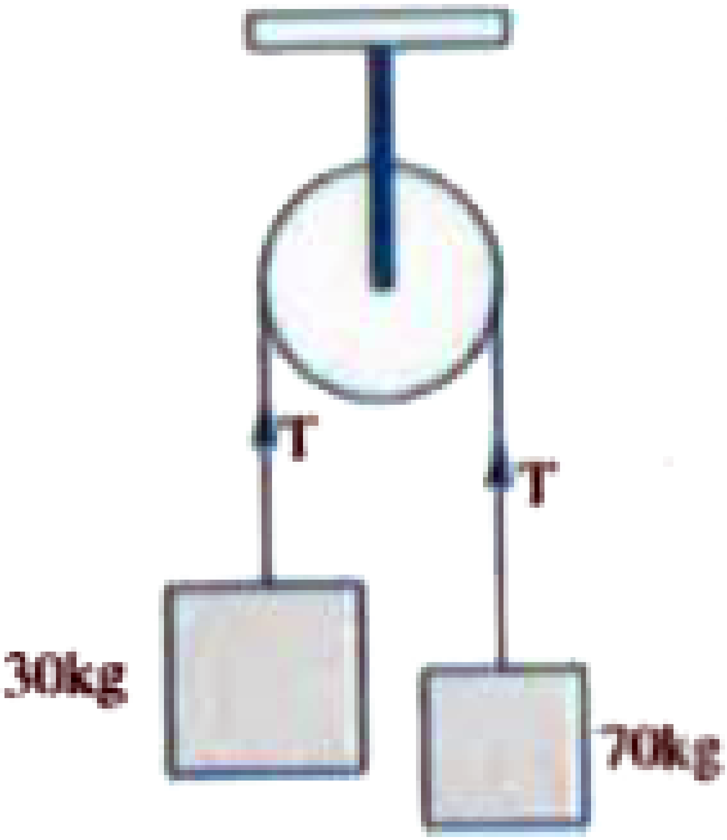
43. Figure shows a weight of 30kg suspended at one end of cord and a weight of 70kg applied at other end of the cord passing over a pulley. Neglecting weight of rope and pulley find the tension in the cord and acceleration of the system ($g = 10ms^{-2}$)



A. $2m/s^2$, 120N

B. $4m/s^2$, 420N

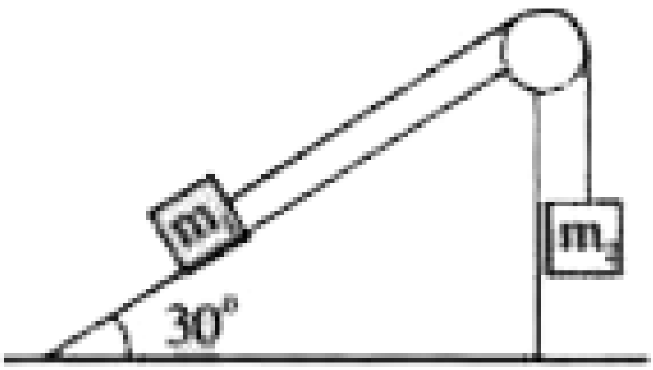
C. $6\text{m}/\text{s}^2$, 180N

D. $4\text{m}/\text{s}^2$, 240N

Answer: B

Watch Video Solution

44. A block of mass m_1 = 4kg lying on a plane inclined at an angle of 30°, is connected to another freely suspended block of mass m_2 = 6kg with the help of a string passing over a smooth pulley as shown in the figure. The acceleration of each block is (g = 10 m/s^2)



A. $8\text{m}/\text{s}^2$

B. $5 m / s^2$

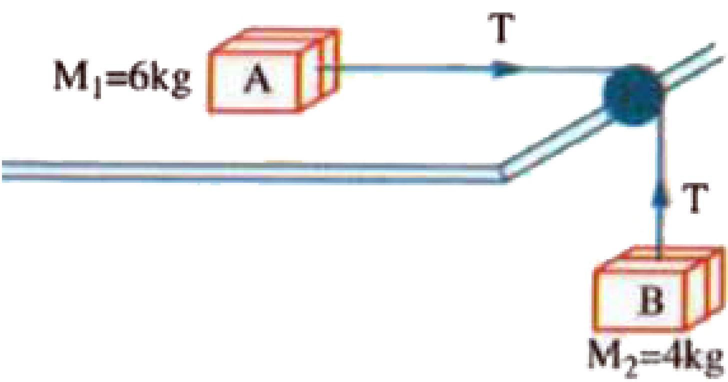
C. $4 m / s^2$

D. $1 m / s^2$

Answer: C

Watch Video Solution

45. A block A of mass 6kg is applied on a frictionless table. A thread tied to it passes over a frictionless pulley and carries a body B of mass 4kg at the other end. Find the acceleration of the system and tension in the thread (given $g = 10 ms^{-2}$)



A. $2\text{m}/\text{s}^2$, 12N

B. $4\text{m}/\text{s}^2$, 24N

C. $6\text{m}/\text{s}^2$, 48N

D. $8\text{m}/\text{s}^2$, 60N

Answer: B

Watch Video Solution

46. A small sphere is suspended by a stirng from the celling of a car. If the car begins to move with a constant accelration a, the inclination of the string to the vertical is:-

A. $\tan^{-1} g/a$

B. $\tan^{-1} a/g$

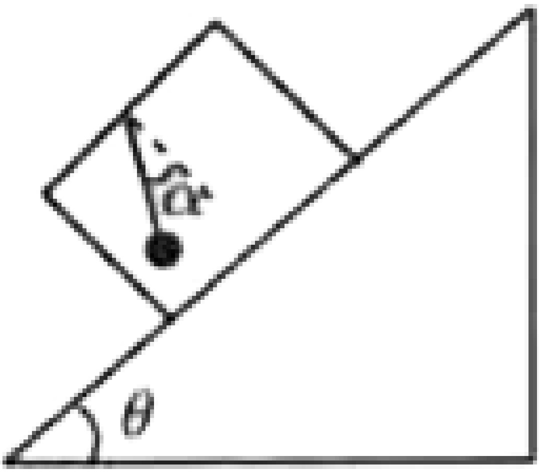
C. $\sin^{-1} g/a$

D. $\sin^{-1} a/g$

Answer: B

Watch Video Solution

47. A pendulum is hanging from the ceiling of a trolley which moves down a smooth inclined plane. Then



A. $\theta = \alpha$

B. $\alpha = 0^{\circ}$

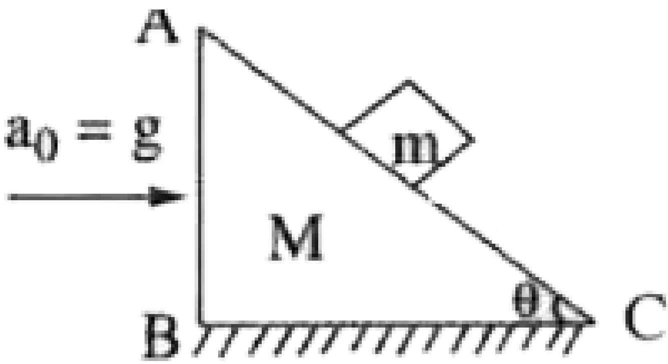
C. $\theta = 2\alpha$

D. $\alpha = 2\theta$

Answer: B

Watch Video Solution

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



A. $g \sin \theta$

B. $g \cos \theta$

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

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

Answer: D

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49. A force of 147N is required to just slide a sledgeweighing 500N over a surface of ice. Calculate the coefficient the coefficient of friction between the surface of contact of the sledge and the ice.

A. A) 0.472

B. B) 0.294

C. C) 0.354

D. D) 0.262

Answer: B

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50. 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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51. A block of mass 20kg is placed on a rough horizontal plane and a horizontal force of 12N is applied. If coefficient of friction is 0.1 the frictional force acting on it is,

A. 20 N

B. 12 N

C. 8 N

D. 28 N

Answer: B

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52. 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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53. 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 $g=10ms^{-2}$ The frictional force on the block is

A. 25 N

B. 5 N

C. 10 N

D. Zero

Answer: B

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54. The co-efficient of static & kinetic friction are 0.6 & 0.3 The minimum horizontal force required to start the motion is applied and if it is continued, the distance travelled by the body in 4 sec is ($g = 10\ ms^{-2}$)

A. 6 m

B. 24 m

C. 2.4 m

D. 5 m

Answer: B

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55. A 4 kg mass is resting on a horizontal surface. For this surface $\mu_s = 0.6$ & $\mu_k = 0.2$. Force required to move the body with $5ms^{-2}$ acceleration is ($g = 10ms^{-2}$)

A. 20 N

B. 24 N

C. 28 N

D. 32 N

Answer: C

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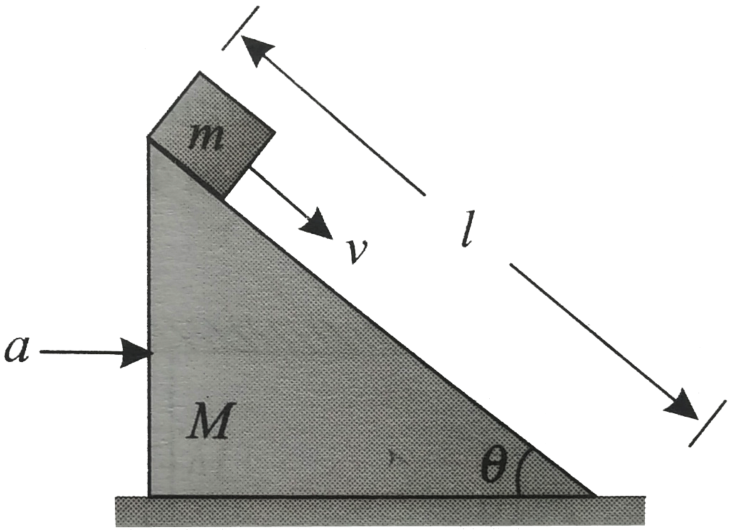

56.

A smooth wedge of mass M is pushed with an acceleration $a = > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

`The horizontal force applied on the wedge is:

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

B. 0

C. Mg

D. $2\mu Mg$

Answer: D

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57. Two bodies having the same mass 2kg each have different surface areas $50m^2$ and $100m^2$ in contact with a horizontal plane. If the coefficient of friction is 0.2, the forces of friction that come into play when they are in motion will be in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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58. 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. $\frac{w}{2}$

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

D. w

Answer: C

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59. Determine the maximum acceleration of the train I which a box lying on its floor will remain stationary given that the co-efficient of static friction between the box and the train's floor is 0.15 .

A. 2.5ms^{-2}

B. 1.5ms^{-2}

C. 2ms^{-2}

D. 1ms^{-1}

Answer: B

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60. A body of mass 10kg is under the action of 138N on the horizontal surface. If coefficient of friction in between the surfaces is one, the distance it travels in 10s in metre is

A. 100

B. 200

C. 300

D. 500

Answer: B

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61. Two blocks of masses m and 3m on a horizontal surface are in contact with the ends of a horizontal massless spring. The coefficient of friction between m and surface and between 3m and surface is μ and $\mu/3$ respectively. The two blocks are moved towards each other to compress the spring and then released. The two blocks move off in opposite directions covering distances S_1 and S_2 before comming to rest. $S_1 : S_2$ is

A. $1:9$

B. $1:3$

C. $3:1$

D. $9:1$

Answer: C

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62. A horizontal force of 150N produces an acceleration of 2m/s2 in a body placed on a 6 horizontal surface. A horizontal force of 200N produces an acceleration of $3\text{m}/\text{s}^2$. The mass of the body and coefficient of kinetic friction are (g = 10 ms^{-2})

A. 50 kg , 0.1

B. 25 kg , 0.1

C. 50 kg , 0.5

D. 50 kg , 0.2

Answer: A

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63. A block of mass 10kg pushed by a horizontal force F on a horizontal rough plane moves with an aceleration 5ms^{-2}. When force is doubled, its acceleration becomes 18ms^{-2}. The coefficient of friction is (g=10ms^{-2})

A. 0.8

B. 0.2

C. 0.4

D. 0.6

Answer: A

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

A. 6 m

B. 6.5 m

C. 3 m

D. 7 m

Answer: B

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65. Starting from rest a wooden block moves with a velocity of $25 \mathrm{ms}^{-1}$ along a rough ground and comes to rest. Calculate the distance travelled by the wooden block on the rough surface of coefficient of friction 0.25.

A. 50 m

B. 75 m

C. 100 m

D. 125 m

Answer: D

Watch Video Solution

66. A vehicle of mass m is moving on a rough horizontal road with kinetic energy 'E'. If the co-efficient of friction between the tyres and the road be μ. Then the stopping distance is,

A. $\frac{E}{2\mu mg}$

B. $\frac{E^2}{2\mu mg}$

C. $\frac{E}{2\mu m^2 g}$

D. $\frac{E}{\mu mg}$

Answer: D

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67. A block of mass 2kg lying on ice when given a velocity of 6ms^{-1} is stopped by friction in 5s. The coefficient of friction between the block and ice is (g=10 ms^{-2})

A. 0.5

B. 0.2

C. 0.12

D. 0.4

Answer: C

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

A. 0.43

B. 0.58

C. 0.75

D. 0.85

Answer: B

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69. A weight W rests an on rough horizontal plane. If the angle of friction be θ, then calculate least horizontal force that will move the body along the plane.

A. $W \cos \theta$

B. $W \tan \theta$

C. $W \cot \theta$

D. $W \sin \theta$

Answer: D

Watch Video Solution

70. A heavy uniform chain lies on horizontal table top. If the co-efficient 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. 75 %

D. 50 %

Answer: B

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71. A body moves along a circular path of radius 1m & $\mu = 0.4$. The maximum angular velocity in rad/sec of the body so that it does not slide is (g = 10ms^{-2})

A. 2

B. 30

C. 15

D. 4

Answer: A

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72. The value of escape speed from the surface of earth is

A. 34.02

B. 34.48

C. 18.42

D. 20.15

Answer: B

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73. A block of mass 1kg lies on a horizontal surface in a truck. The coefficeint of friction between the block and surface is 0.5. If the acceleration of the truck is $6ms^{-2}$ the acceleration of the block relative to ground is

A. $6m/s^2$

B. $1.1m/s^2$

C. $4.9m/s^2$

D. $0m/s^2$

Answer: C

Watch Video Solution

74. A wooden box is placed on the back part of a lorry moving with an acceleration of 6ms^{-2}, if $\mu = 0.5$, the acceleration of the box relative to lorry is

A. 1.1ms^{-2}

B. 2ms^{-2}

C. $1.\ 5\text{ms}^{-2}$

D. 0

Answer: A

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75. A block is placed at distance of 2m from the rear on the floor of a truck (g=10ms^{-2}). 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

Watch Video Solution

76. A body of mass 5kg rests on a rough horizontal surface of coefficient of friction 0.2. The body is pulled through a distance of 10m by a horizontal force of 25N. The kinetic energy acquired by the body is (g= 10ms^{-2})

A. 250 J

B. 200 J

C. 150 J

D. 100 J

Answer: C

Watch Video Solution

77. A block of mass 1 kg is pressed against a wall by applying a horizontal force of 10N on the block. If the coefficient of friction between the block and the wall is 0.5, magnitude of the frictional force acting on the block is

A. 9.8 N

B. 0.98 N

C. 1.96 N

D. 5 N

Answer: D

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78. A man holds a 2 kg book between his palms. so that each hand exerts the same horizontal force on the book. The coefficient of static friction between the palms and the book is 0.4 and g = $10 ms^{-2}$. If the book is prevented from falling, the least force exerted by each hand on the book is

A. 50 N

B. 25 N

C. 75 N

D. 100 N

Answer: B

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79. A duster weighs 0.5N. It is pressed against a 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. 6 N

D. 7 N

Answer: C

Watch Video Solution

80. A body is in contact with the vertical front part of the truck. The coefficient of friction between the body and the 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

Watch Video Solution

81. A body of mass M is pressed between two hands. Each hand exerts a horizontal force F. The net horizontal force acting on the body is

A. F

B. 2 F

C. F/2

D. Zero

Answer: D

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82. On a smooth table two blocks of masses 2.5kg and 1.5kg are placed one over the other as shown in figure. If the coefficient of static friction between two blocks is 0.2, the maximum horizontal force to be applied on the lower block so that the two blocks move together is (g = ms^{-2})

A. 8 N

B. 5 N

C. 3 N

D. 16 N

Answer: A

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83. If the angle of inclination of the inclined plane is $\sin^{-1}\left(\frac{1}{2}\right)$ when the body just starts sliding find the angle of repose and coefficient of static friction between the body and the inclined plane.

A. $60^\circ, \frac{2}{\sqrt{3}}$

B. $45^\circ \frac{1}{\sqrt{3}}$

C. $30^\circ \frac{1}{\sqrt{3}}$

D. $30^\circ \frac{1}{2}$

Answer: C

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84. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is: (Take =10 ms^{-2})

A. 0.2 kg

B. 0.4 kg

C. 0.8 kg

D. 2 kg

Answer: D

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85. A given object takes n times more time to slide down a 45° rough inclined planeas it takes to slide down a perfectly smooth 45° incline. The coefficient of kinetic friction between the object and the incline is :

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

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

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

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

Answer: B

Watch Video Solution

86. A block sliding down a rough 45^{o} inclined plane has half the velocity it would have had, the inclined plane been smooth. The coefficient of sliding friction between block and the inclined plane is

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

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

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

D. $\frac{8}{9}$

Answer: D

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87. A block is pushed up a rough inclined plane of 45°. If the time of descent is twice the time of ascent, the coefficient of friction is

A. 0.6

B. 0.4

C. 0.8

D. 0.25

Answer: C

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88. An object takes 1 second to slide down a rough 45° inclined plane. The time taken to slide down a smooth 30° inclined plane having the same slope length is $(\mu = 0.5)$

A. $\sqrt{2}$s

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

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

D. $2^{-1/4}$s

Answer: D

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89. A body slides down a smooth plane starting from rest in 4sec. Time taken to slide first 1/4 of the distance is

A. 2 s

B. 1 s

C. 3 s

D. (1/8) s

Answer: A

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90. A block is lying on an inclined plane which makes an angle of 60° with the horizontal. If coefficient of friction between the block and the plane is 0.25 and g = 10 ms^{-2}, the acceleration of block when it is moves along the plane will be

A. $2.5 ms^{-2}$

B. $5 ms^{-2}$

C. $7.25 ms^{-2}$

D. $8.66 ms^{-2}$

Answer: C

Watch Video Solution

91. A $10\sqrt{3}$ kg box has to move up an inclined slope of 60° to the horizontal at a uniform velocity of 5 ms^{-1} If the frictional force retarding the motion is 150N, the minimum force applied parallel to inclined plane to move up is (g=10 ms^{-2})

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

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

C. $300 N$

D. $150N$

Answer: C

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92. The minimum force required to move a body up 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 $\frac{1}{2\sqrt{3}}$, then the angle of the inclined plane is

A. 60°

B. 45°

C. 30°

D. 15°

Answer: A

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93. A body of mass 10kg is on a rough inclined plane having an inclination of 30° with the horizontal. If co-efficient of friciton between the surface of contact of the body and the plane is 0.25. Find the least force required to pull the body up.

A. 70.2 N

B. 80.6 N

C. 60.5 N

D. 90.4 N

Answer: A

94. A block of wood mass 5kg is placed on a plane making an angle 30° with the horizontal. If the co-efficient of friction between the surface of contact of the body and plane is 0.5. What force is required to keep the body sliding down with uniform velocity

A. 1.6 N

B. 4.8 N

C. 6.4 N

D. 0.33 N

Answer: D

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

A. $4\sqrt{2}$ sec

B. 4 sec

C. $3\sqrt{2}$ sec

D. 2 sec

Answer: A

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96. A body is sliding down an inclined plane have coefficient of friction 0.5. If the normal reaction is twice that of resultant downward force along the incline. Find the angle between the inclined plane and the horizontal.

A. 45°

B. 53°

C. 37°

D. 60°

Answer: C

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97. 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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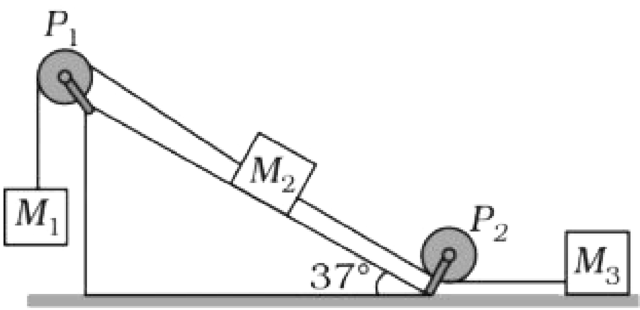
98. Masses M_1, M_2 and M_3 are connected by strings of negligible mass which pass over massless and frictionless pulleys P_1 and P_2 as shown in the figure. The masses move such that the portion of the string betweenP_1 and P_2 is parallel to the inclined plane and the portion of the string between P_2 and M_3 is horizontal. The masses M_2 and M_3 are 4.0 kg each and the coefficient of kinetic friction between both the masses and the surfaces is 0.25. The inclined plane makes an angle of 37° with the horizontal. If the mass M_1 moves downwards with a uniform velocity, find

(i) the mass of M_1 in kg

(ii) the tension in the horizontal portion of the string in Newton



A. 28.66

B. 47.73

C. 38.92

D. 54.12

Answer: B

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99. A car of mass 1000 kg is moving with a speed of 40ms^{-1} on a circular path of radius 400m. If its speed is increasing at the rate of 3ms^{-2} the total force acting on the car is

A. 3000N

B. 4000 N

C. 5000 N

D. 7000 N

Answer: C

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100. A cyclist rides round a curved path of radius 10m at a speed 18 kmph. If the cycle and the rider together have a mass of 100 kg, the firctional force the ground exerts on the wheel is (g = 10 ms^2)

A. 250 N

B. 400 N

C. 500 N

D. 600 N

Answer: A

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101. A coin placed on a rotating turntable just slips if it is placed at a distance of 4 cm from the centre. If the angular velocity of the turntable is doubled, it will just slip at a distance of

A. 1 cm

B. 2 cm

C. 4 cm

D. 8 cm

Answer: A

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102. If the centripetal force acting on a body revolving along a circular path of radius 25 m is 200 N, its KE is

A. A) 2.5 KJ

B. B) 4 KJ

C. C) 4.8 KJ

D. D) 6 J

Answer: A

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103. A bob is suspended from an ideal string of length 'l'. Now it is pulled to a side through 60° to vertical and whirled along a horizontal circle. Then its period of revolution is

A. A) $\pi\sqrt{\frac{l}{g}}$

B. B) $\pi\sqrt{\frac{l}{2g}}$

C. C) $\pi\sqrt{\frac{2l}{g}}$

D. D) $2\pi\sqrt{\frac{l}{g}}$

Answer: C

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104. An aircraft executes a horizontal loop at a speed of 720 km/h with its wings banked at 15°. What is the radius of the loop?

A. 15.23 km

B. 1.52 km

C. 30.46 km

D. 20 km

Answer: A

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105. A cyclist is moving on a smooth horizontal curved path of radius of curvature 10m.with a speed 10 ms^{-1}. Then his angle of leaning is

A. A) 15°

B. B) 30°

C. C) 45°

D. D) 60°

Answer: C

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106. A car is negotiating a curved road of radius R. The road is banked at angle θ. The coefficeint of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is

A. $\sqrt{gR\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

B. $\sqrt{\frac{g\mu_s + \tan\theta}{R - 1\mu_s \tan\theta}}$

C. $\sqrt{\frac{g\mu_s + \tan\theta}{R^2 1 - \mu_s \tan\theta}}$

D. $\sqrt{gR^2\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

Answer: A

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