PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

NEWTONS LAWS OF MOTION AND FRICTION

Practice Exercise

1. Two bodies have same mass and speed, then

A. their momentum are same

B. the ratio of momentums is not determined

C. the ratio of their magnitudes of momentum is one

D. Both a and b are correct

Answer: D

2. In the superhit film 'Raja Hindustani' Amir khan greets his beloved by shaking hand, What kind of force do they exert?

A. Nuclear

B. Gravitational

C. Weak

D. Electromagnetic

Answer: D

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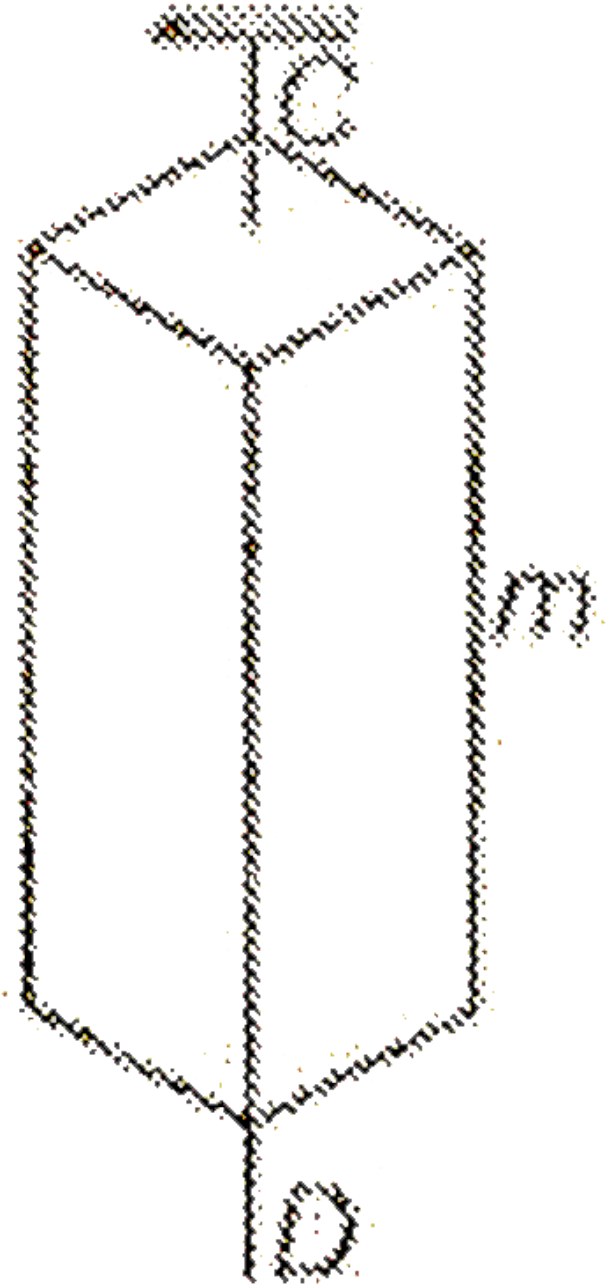
3. A heavy block of mass m is supported by a cord C attached to the ceiling, and another cord D is attached to the bottom of the block. If a sudden jerk

is given to D, then



A. cord C breaks

B. cord D breaks

C. cord C and D both Break

D. None of the cords breaks

Answer: B

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4. At time t second, a particle of mass 3 kg has position vector r metre, where $r = 3t\hat{i} - 4\cos t\hat{j}$. Find the impulse of the force during the time interval $0 \leq t \leq \frac{\pi}{2}$

A. $12\hat{j}N - s$

B. $9\hat{j}N - s$

C. $4\hat{j}N - s$

D. $14\hat{j}N - s$

Answer: A

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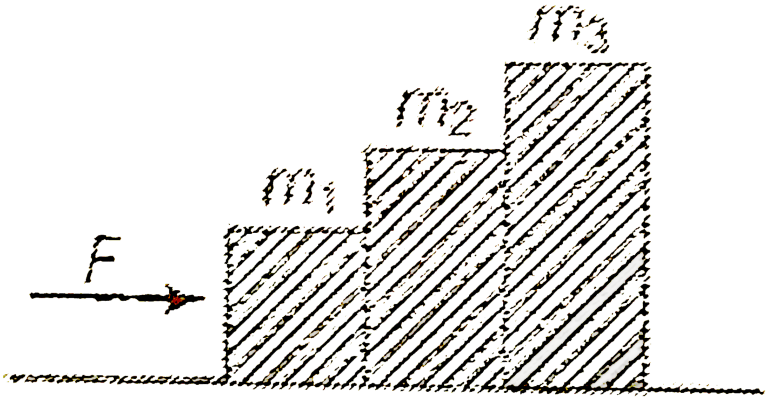
5. Three blocks of masses $m_1 = 1kg, m_2 = 2kg$ and $m_3 = 3kg$ are placed in contact on a horizontal frictionaless plane as shown in figure. A force of 12 N

is applied on m_1. Acceleration of the system is



A. $12m/s^2$

B. $2m/s^2$

C. $6m/s^2$

D. $4m/s^2$

Answer: B

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6. 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. it moves in a circular path

D. Both b and c are correct

Answer: D

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7. A particle of mass m moves on the $x - a\xi s$ as follows : it starts from rest at $t = 0$, from the point $x = 0$, and comes to rest at $t = l$ at the point $x = 1$. No other information is available about its motion at intermediate times $(0 < t < l)$. If α denotes the instantaneous accelartion of the particle , then :

A. α cannot remain positive for all t in the interval $0 \leq t \leq 1$

B. $|\alpha|$ cannot exceed 2 at any point in its path

C. $|\alpha|$ be $\geq$ 4 at point or some points in its path

D. Both a and c are correct

Answer: D

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8. A 0.1 kg body moves at a constant speed of 10 m/s. It is pushed by applying a constant force for 2 s. Due to this force, it starts moving exactly in the opposite direction with a speed of $4m/s$. Then

A. the deceleration of the body is $7m/s^2$

B. the magnitude of change in momentum is 1.4 kg-m/s

C. impulse of the force is 1.4 N-s

D. All of the above

Answer: D

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9. Water jet issues water from a nozzle of $2cm^2$ cross-section with velocity 30 cm/s and strikes a plane surface placed at right angles to the jet. The force exerted on the plane is

A. 200 dyne

B. 400 dyne

C. 1800 dyne

D. None of the above

Answer: C

10. The action and reaction forces referred to Newton's third law of motion

A. must act upon the same bodies

B. must act upon different bodies

C. need not to be equal in magnitude but must have the same line of action

D. must be equal in magnitude but need not have the same line of action

Answer: B

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11. A man is pulling a rope attached to a block on a smooth horizontal table. The tension in the rope will be the same at all points

A. if and only if the rope is not accelerated

B. if and only if the rope is massless

C. if either the rope is not accelerated or is massless

D. always

Answer: C

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12. A particle of mass m moves on the x-axis under the influence of a force of attraction towards the origin O given by $F = -\frac{k}{x^2}\hat{i}$. If the particle starts from rest at x = a. The speed of it will attain to reach at distance x from the origin O will be

A. $\sqrt{\frac{2k}{m}}\left[\frac{x-a}{ax}\right]^{1/2}$

B. $\sqrt{\frac{2k}{m}}\left[\frac{a+x}{ax}\right]^{1/2}$

C. $\sqrt{\frac{k}{m}}\left[\frac{ax}{x-a}\right]$

D. $\sqrt{\frac{m}{2k}}\left[\frac{a-x}{ax}\right]^{1/2}$

Answer: A

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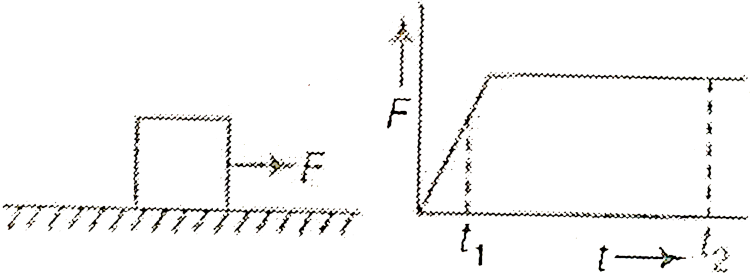
13. A particle is on a smooth horizontal plane. A force F is applied whose F-t graph is given. Then,



A. at t_1, acceleration is constant

B. initially body must be in rest

C. at t_2, acceleration is constant

D. both c and d are correct

Answer: D

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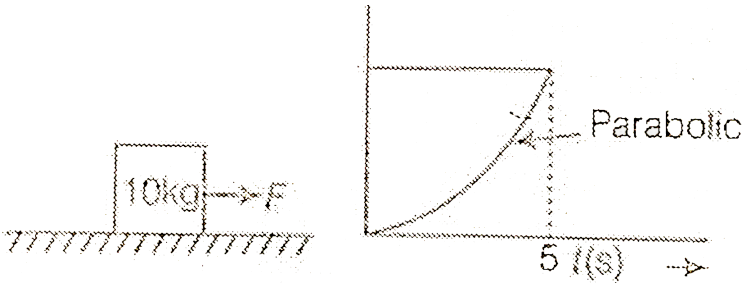
14. A force F is applied to the initially, stationary cart. The variation of force with time is shown in the figure. The speed of cart at t = 5 s is



A. 10 m/s

B. 8.33 m/s

C. 2 m/s

D. zero

Answer: B

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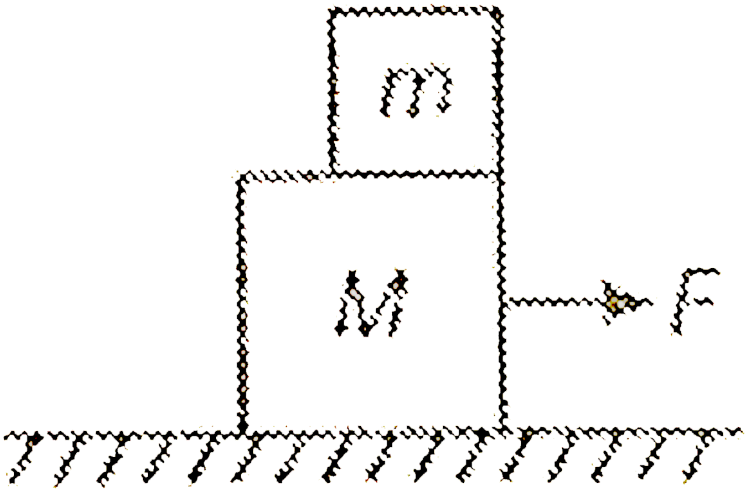
15. The mass m is placed on a body of mass M. There is no friction. The force F is applied on M on it moves with acceleration a. Then, the force on the top body is



A. F

B. ma

C. F - ma

D. None of these

Answer: D

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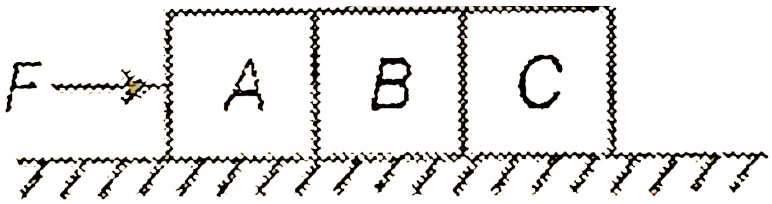
16. Three identical blocks each of mass M are along a frictionless table and a force F is acting as shown. Which of the following statements is false ?



A. The net vertical force on block A is zero

B. The net force on block A is $\frac{F}{3}$

C. The acceleration of block C is $\frac{F}{3M}$

D. The force of interaction between A and B is $\frac{2F}{3}$

Answer: B::C::D

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17. A 40 N block is supported by two ropes. One rope is horizontal and other makes an angle of 30° with

the ceiling. The tension in the rope attached to the ceiling is approximately

A. 80 N

B. 40 N

C. 34.6 N

D. 46.2 N

Answer: A

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18. A weight w is suspended from the midpoint of a rope, whose ends are at the same level. In order to

make the rope perfectly horizontal, the force applied to each of its ends must be

A. less than w

B. equal to w

C. equal to 2w

D. infinitely large

Answer: D

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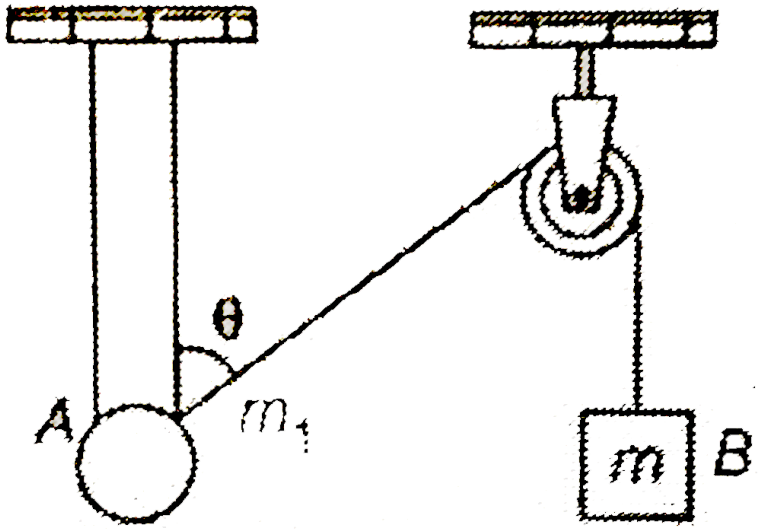
19. A ring of mass 5 kg sliding on a frictionless vertical rod connected by a clock B of mass 10 kg by

the help of a massless string.

Then, at the equilibrium of the system, the value of θ is



A. 30°

B. 60°

C. 90°

D. 0°

Answer: B

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20. A body of mass 10 kg is to be raised by a massless string from rest to rest, through a height 9.8 m. The greatest tension which the string can safely bear is 20 kg-wt. The least time of ascent is

A. 1 s

B. 3 s

C. 4 s

D. None of the above

Answer: A

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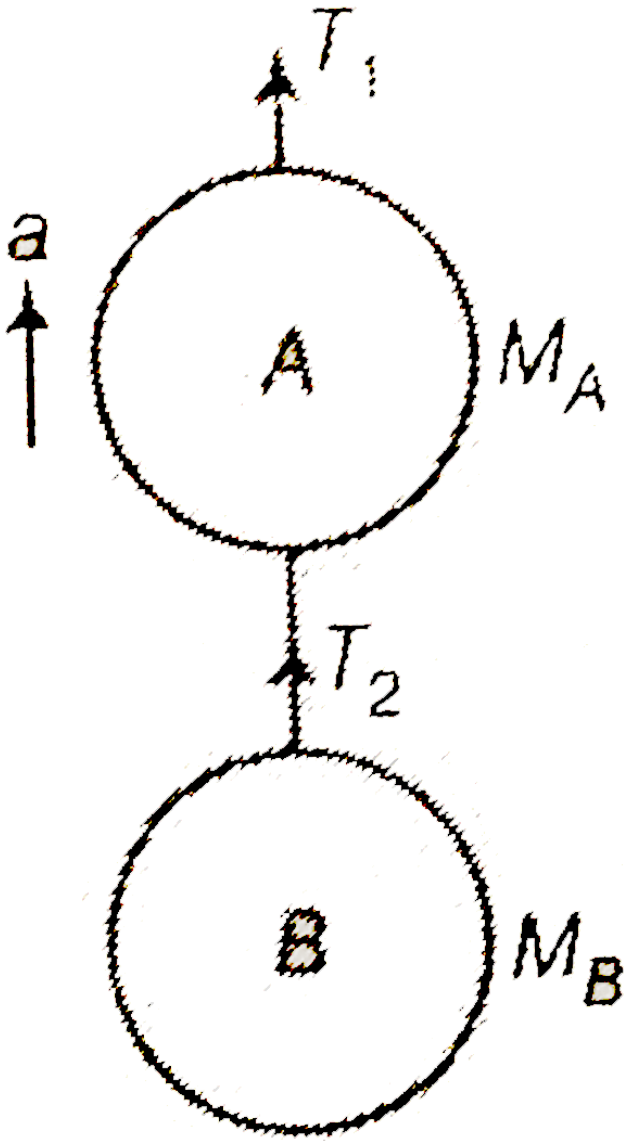
21. Which of the following expression correctly represents T_1 and T_2 if the system is given an

upward acceleration by a pulling up mass A?



A.

$$T_1 = M_A(a - g) + M_B(a - g), T_2 = M_B(a - g)$$

B.

$$T_1 = M_A(g - a) + M_B(g - a), T_2 = M_B(g - a)$$

C.

$$T_1 = M_A(g + a) + M_B(g + a), T_2 = M_B(g + a)$$

D. $T_1 = M_A(g + a), T_2 = M_B(g + a)$

Answer: C

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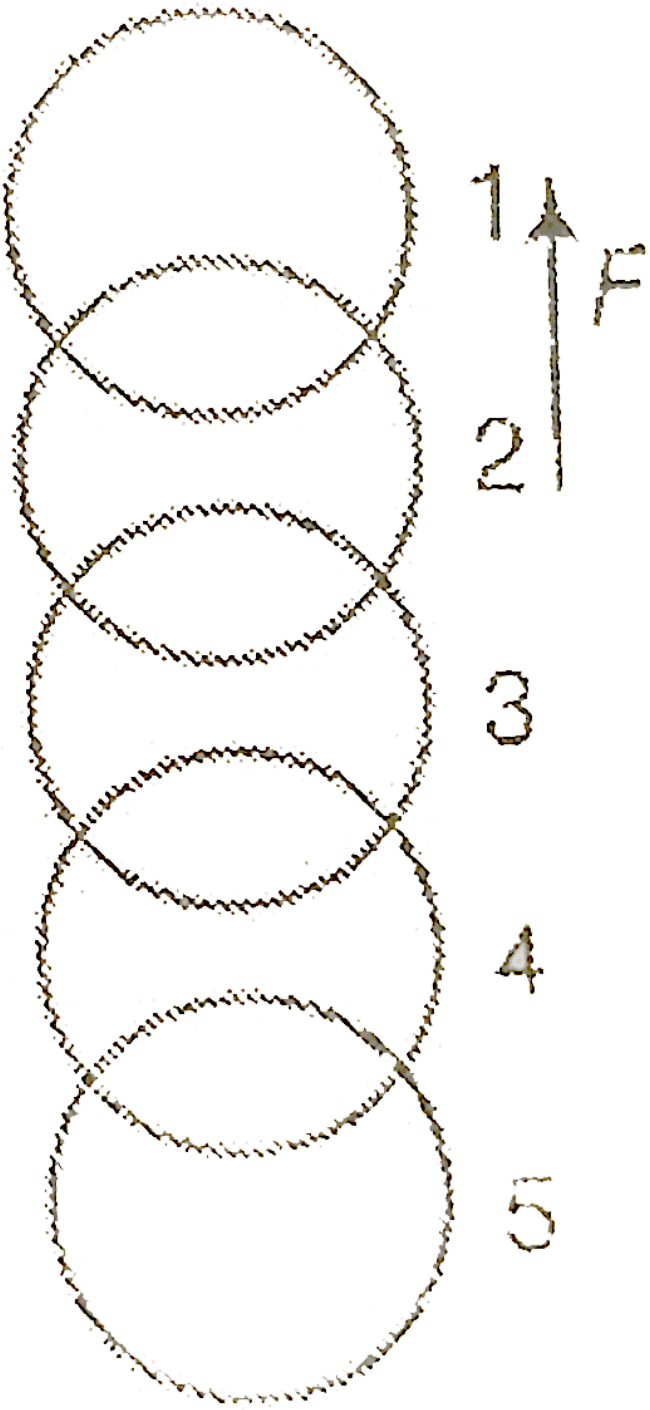
22. A chain consisting of 5 links each of mass 0.1 kg is lifted vertically with a constant acceleration of $2.5m/s^2$ as shown in the figure. The force of interaction between the top link and the link

immediately below it, will be



A. 6.15 N

B. 4.92 N

C. 3.69 N

D. 2046 N

Answer: B

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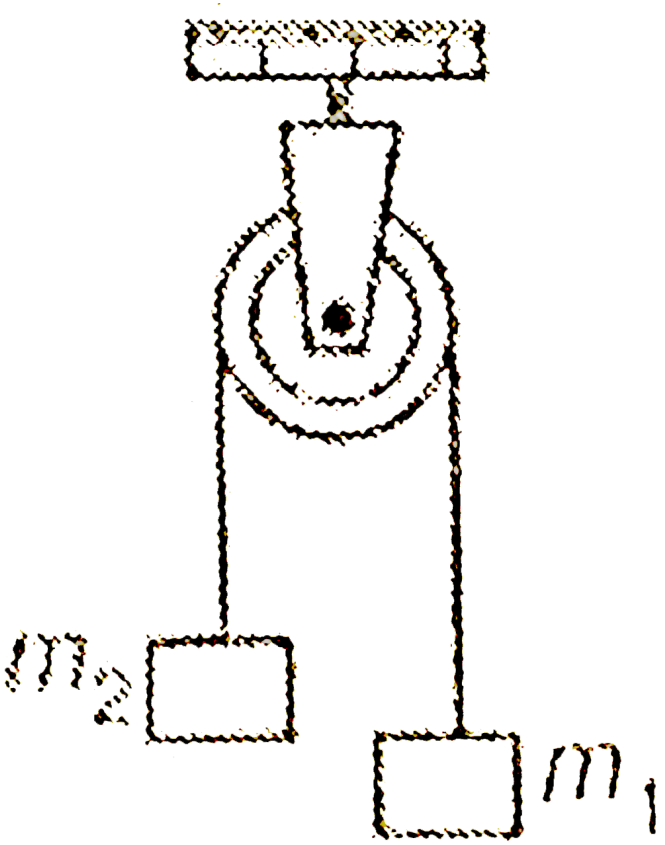
23. In the given figure,



A. acceleration of m_1 and m_2 are same

B. the magnitude of relative acceleration of m_1 with respect to m_2 is twice the magnitude of

acceleration of m_1

C. the velocities of m_1 and m_2 are same

D. the speed of m_1 and m_2 are not same

Answer: B

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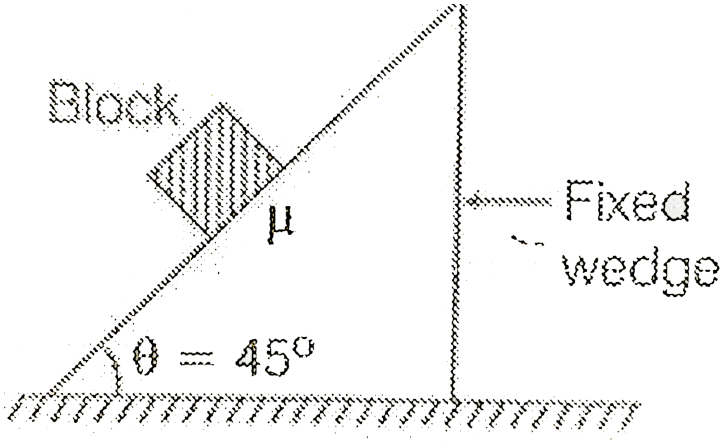
24. A block of mass 1 kg is placed on a wedge shown in figure. Find out minimum coefficient of friction

between wedge and block to stop the block on it.



A. 0.6

B. 0.9

C. 1

D. 0.2

Answer: C

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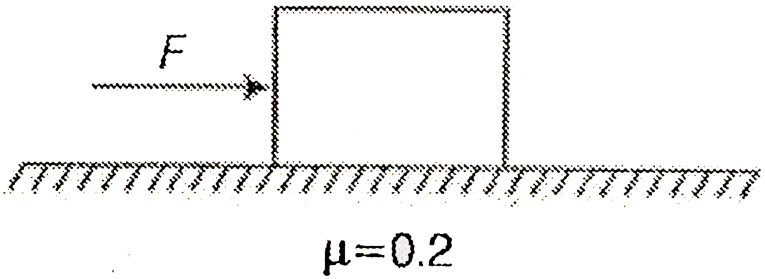
25. A body of mass 2 kg is placed on rough horizontal plane. The coefficient of friction between body and plane is 0.2 Then,



A. body will move in forward direction if F = 5 N

B. body will be move in backward direction with acceleration $0.5m/s^2$ if force F = 3N

C. if F = 3N, then body will be in rest condition

D. Both a and c are correct

Answer: D

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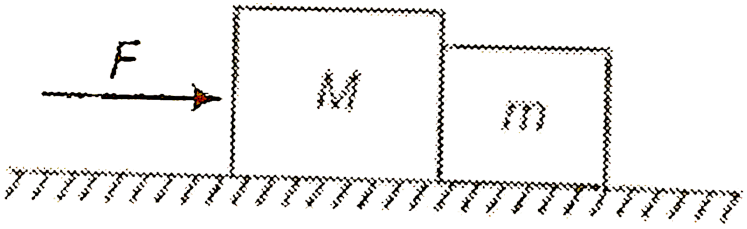
26. Two blocks of masses M = 3 kg and m = 2 kg are in contact on a horizontal table. A constant horizontal force F = 5 N is applied to block M as shown. There is a constant frictional force of 2 N between the table and the block m but no frictional force between the table and the first block M, then acceleration of the two blocks is



A. $0.4ms^{-2}$

B. $0.6ms^{-2}$

C. $0.8ms^{-2}$

D. $1ms^{-2}$

Answer: B

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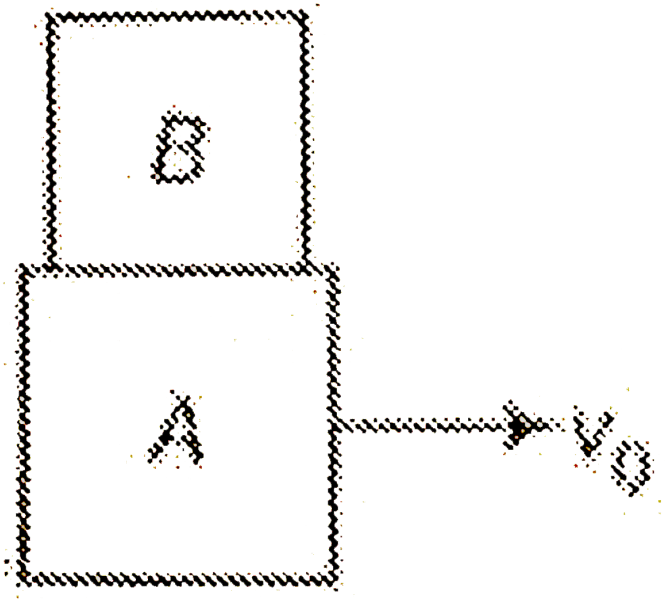
27. The coefficient of static friction between the bodies A and B is 0.30. Determine minimum stopping distance that the body A can have from a speed of 70 km/h with constant deceleration if the body B is

not to slip forward



A. 3 m

B. 30.3 m

C. 70 km

D. 63 m

Answer: D

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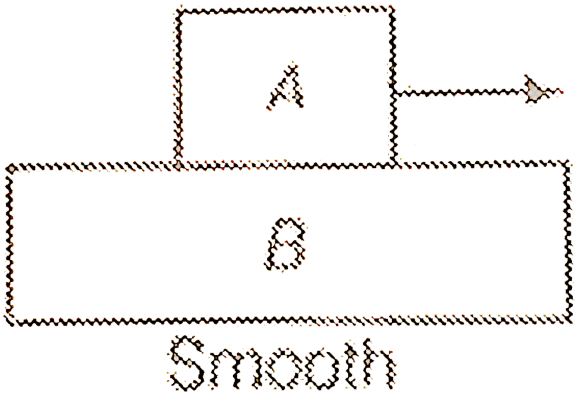
28. In the given figure, force of friction on body is



A. towards left

B. towards right

C. either left or right

D. no sufficient data

Answer: B

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29. A piece of ice slides down a rough inclined plane at 45° inclination in twice the time that it takes to slide down an identical but frictionless inclined plane. What is the coefficient of friction between ice and incline ?

A. $\frac{3}{7\cot\theta}$

B. $\frac{4}{7\cot\theta}$

C. $\frac{3}{4\cot\theta}$

D. $\frac{7}{9\cot\theta}$

Answer: C

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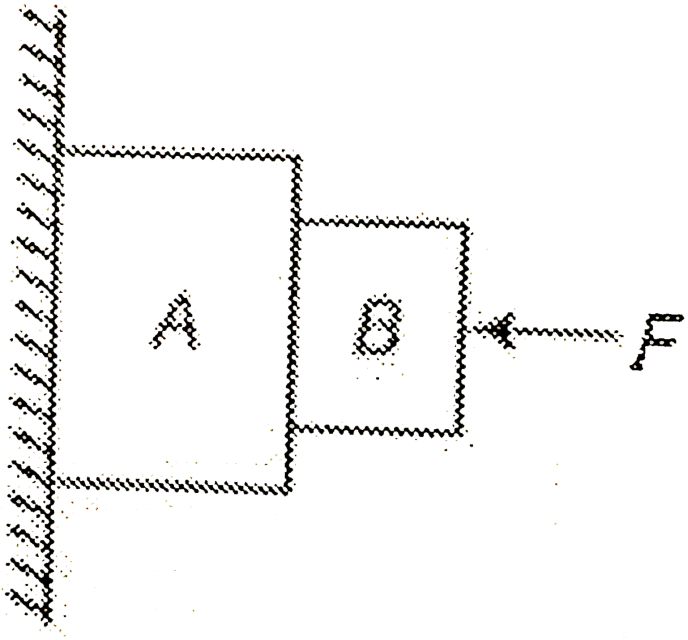
30. Consider the situation shown in the figure. The wall is smooth but the surfaces of A and B in contact

are rough. Then,



A. system may remain in equilibrium

B. both bodies must move together

C. the system cannot remain in equilibrium

D. None of the above

Answer: C

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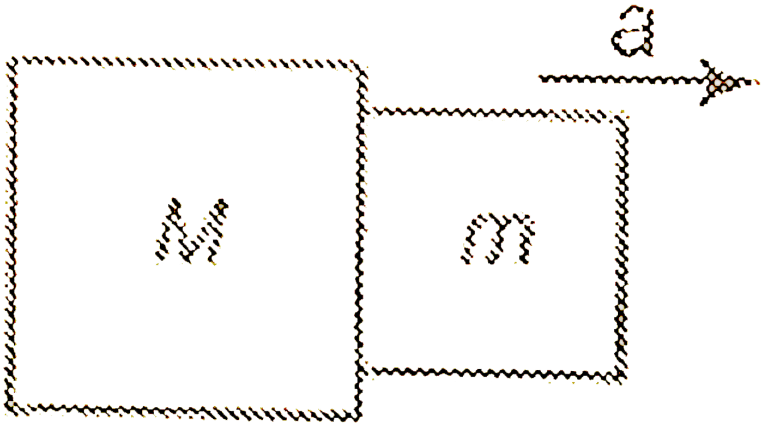
31. The coefficient of static friction between the two blocks is 0.363. What is the acceleration of block 1 so that block 2 does not fall ?



A. $6ms^{-2}$

B. $12ms^{-2}$

C. $18ms^{-2}$

D. $27ms^{-2}$

Answer: D

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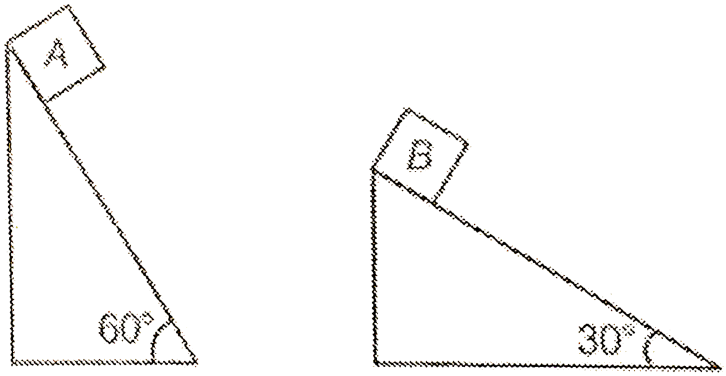
32. Two fixed frictionless inclined plane making angles 30° and 60° with the vertical are shown in the figure. Two blocks A and B are placed on the two planes What is the relative vertical acceleration of A

with respect to B ?



A. $4.9ms^{-2}$ in horizontal direction

B. $9.8ms^{-2}$ in vertical direction

C. Zero

D. $4.9ms^{-2}$ in vertical direction

Answer: D

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33. A body is in equilibrium on a rough inclined plane undr its own weight. If the angle of inclination of the inclined plane is α and the angle of friction is λ, then

A. $\alpha > \lambda$

B. $\alpha > \frac{\lambda}{2}$

C. $\alpha = \lambda$

D. $\alpha \geq \lambda$

Answer: C

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34. For the equilibrium of a body on an inclined plane of inclination 45°, the coefficient of static friction will be

A. greater than one

B. less than one

C. zero

D. less than zero

Answer: A

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1. A block of mass 0.18 kg is attached to a spring of force constant 2N/m. The coefficient of friction between the block and the floor is 0.1. Initially, the block is at rest and the spring is unstretched. An impulse is given to the block.

The block slides a distance of 0.06 m and comes to rest for the first time. The initial velocity of the block in m/s is v=N/10. Then, N is

A. 2

B. 3

C. 4

D. 6

Answer: D

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2. The sum of the magnitudes of two forces acting at a point is 16 N. The resultant of these forces is perpendicular to the smaller force which has a magnitude of 8 N. If the magnitude of smaller force is x, then the value of x is

A. 2 N

B. 4 N

C. 6 N

D. 7 N

Answer: C

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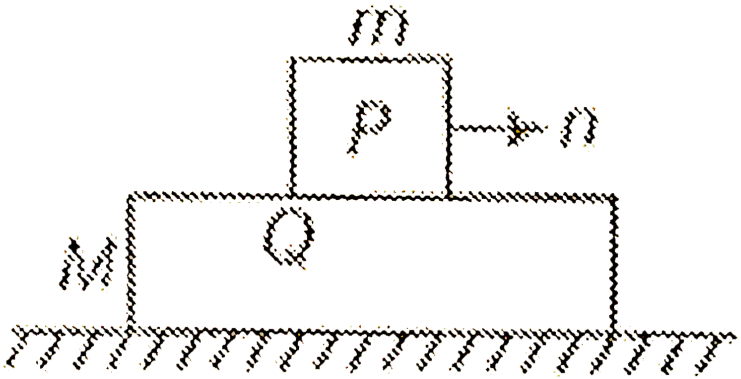
3. A block of mass m = 1 kg is placed over a plank Q of mass M = 6 kg, placed over a smooth horizontal surface as shown in figure. Block P is given a velocity $v = 2m/s^2$ to the right. If the coefficient of friction between P and Q is $\mu = 0.3$. Find the acceleration of

Q relative to P.



A. $4m/s^2$

B. $3.5m/s^2$

C. $2m/s^2$

D. $10.0m/s^2$

Answer: B

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4. A bomb at rest explodes into three parts of the same mass. The linear momentum of two parts are $-2p\hat{i}$ and $p\hat{j}$. The magnitude of momentum of third part is $p\sqrt{x}$. Find x.

A. p

B. $\sqrt{5}p$

C. $2p$

D. $10p$

Answer: B

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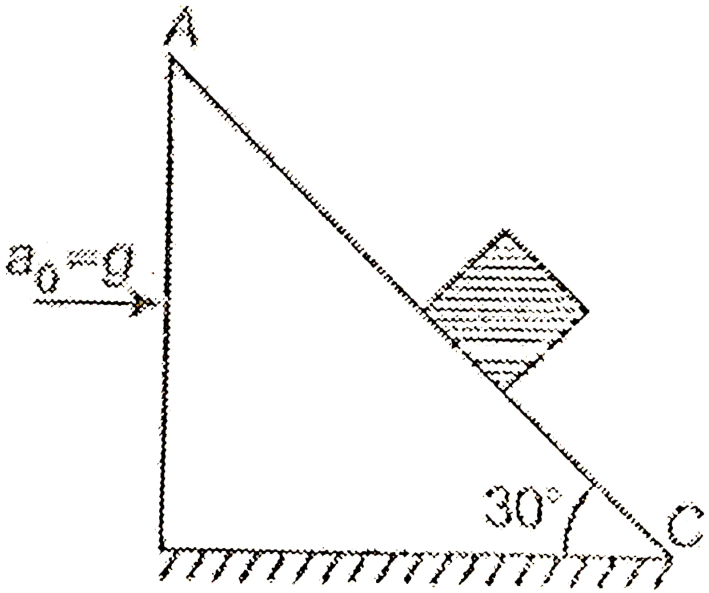
5. A block is placed on an inclined plane. The block is moving towards right horizontal with an acceleration $a_0 = g$. The length of the inclined plane (AC) is equal to 1 m. Whole the situation are shown in the figure. Assume that all the surfaces are frictionless. The time taken by the block to reach from C to A is (Take,$g = 10m/s^2$)



A. 0.74 s

B. 0.9 s

C. 0.52 s

D. 1.24 s

Answer: A

6. Pseudo force is

A. electromagnetic in nature

B. a nuclear force

C. a gravitational force

D. None of the above

Answer: D

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7. A body is moved in straight line by constant power of machine. What will be the relation between the travelling distance and time?

A. $s^2 \propto t^3$

B. $s^4 \propto t^3$

C. $s^3 \propto t^2$

D. $s \propto t^3$

Answer: A

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8. A 10 kg stone is suspended with a rope of breaking strength 30 kg-wt. The minimum time in which the stone can be raised through a height 10 m starting from rest is (Take, $g = 10Nkg^{-1}$).

A. 0.5 s

B. 1.0 s

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

D. 2.0 s

Answer: B

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

A. 60°

B. 45°

C. 30°

D. 15°

Answer: C

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10. Natural length of a spring is 60 cm and its spring constant is 4000 N/m. A mass of 20 kg is hung from it. The extension produced in the spring is (Take, $g = 9.8m/s^2$)

A. 4.9 cm

B. 0.49 cm

C. 9.4 cm

D. 0.94 cm

Answer: A

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

A. a constant

B. proportional to t^2

C. inversely proportional to t

D. proportional to t

Answer: D

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12. A block of mass 5 kg is placed on a rough inclined plane. The inclination of the plane is gradually increased till the block just begins to slide down. The inclination of the plane is than 3 in 5. The coefficient

of friction between the block and the plane is (Take, $g = 10m/s^2$)

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

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

C. $\frac{4}{5}$

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

Answer: B

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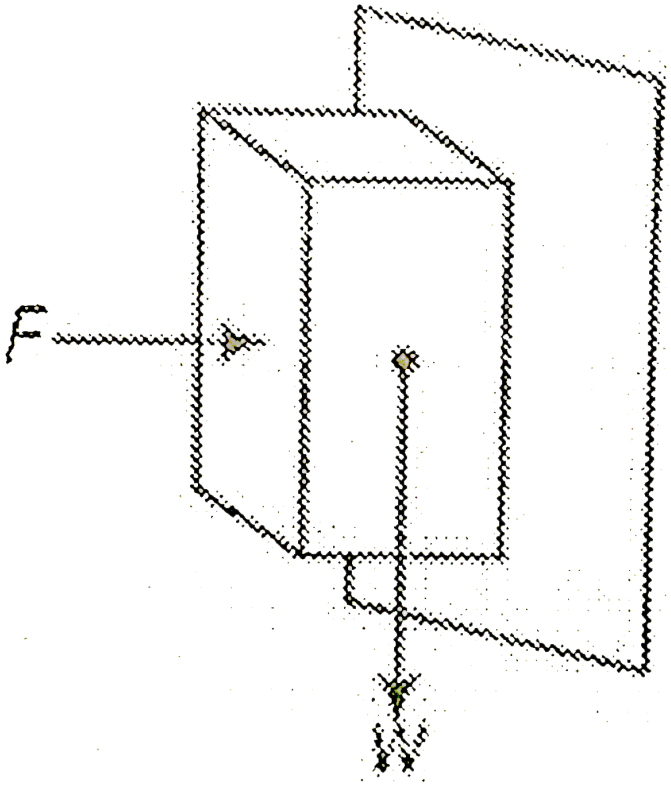
13. A block weighing w is held against a vertical wall be pressing horizontally with a force F. Then, F

needed to hold the block is



A. equal to w

B. equal to $\frac{w}{\mu}$ only

C. greater than $\frac{w}{\mu}$ only

D. greater than or equal to $\frac{w}{\mu}$

Answer: B

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14. A body of mass 2 kg is placed on a horizontal surface having coefficient of kinetic friction 0.4 and limiting coefficient of static friction 0.5. If a horizontal force 2.5 N is applied on the body, the frictional force acting on the body will be (Take, $g = 10ms^2$)

A. 8 N

B. 10 N

C. 20 N

D. 2.5 N

Answer: D

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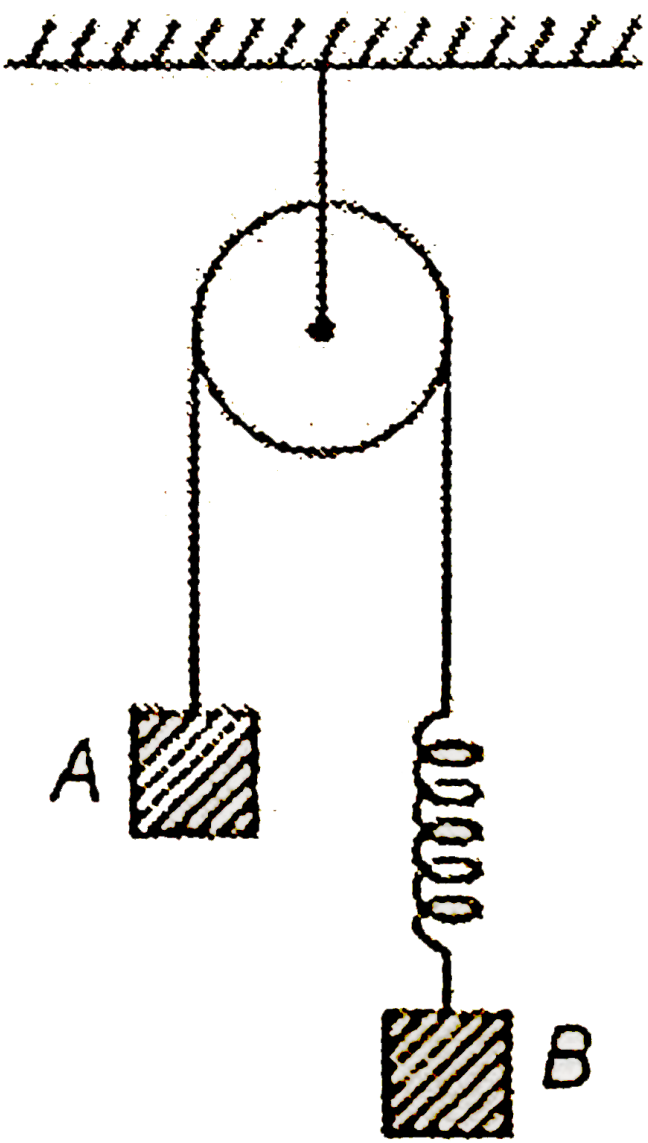
15. In figure, block A is released from rest, when spring is at its natural unstretched length. For block B of mass M to leave contact with the ground at

some stage, the minimum mass of A must be



A. 3M

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

C. M

D. cannot say

Answer: B

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16. A 600 kg rocket is set for a vertical fliring. If the exhaust speed is $100 m / s$, the mass of the gas ejected per second to supply the thrust needed to overcome the weight of rocket is

A. $117.6 kgs^{-1}$

B. $58.6kgs^{-1}$

C. $6kgs^{-1}$

D. $46.4kgs^{-1}$

Answer: C

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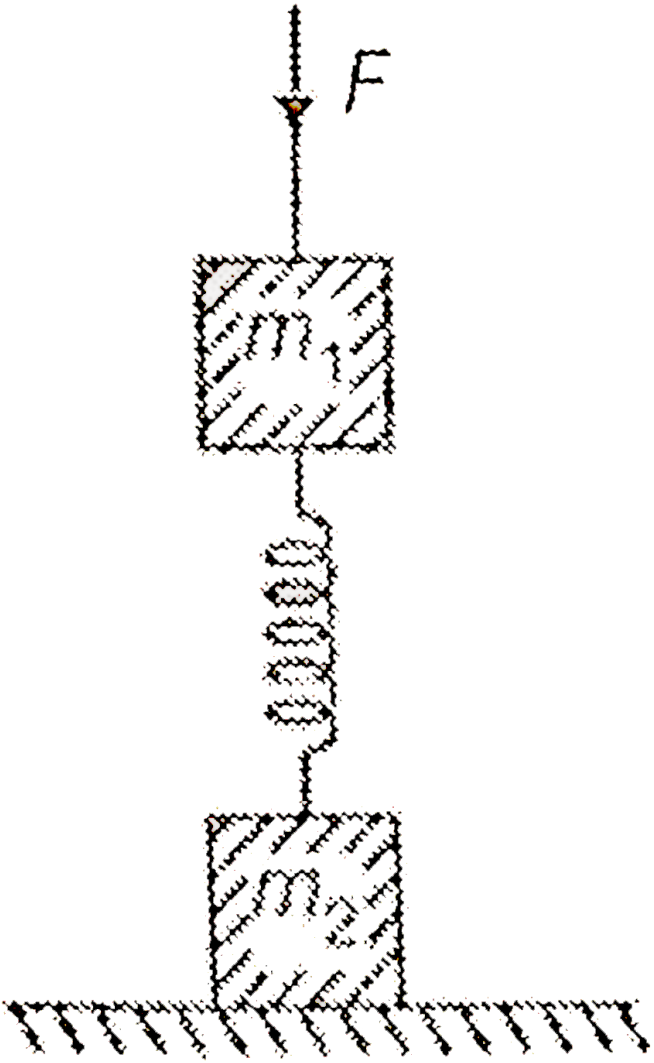
17. A system consists of two cubes of mass m_1, and m_2 respectively connected by a spring of force constant k. force (F) that should be applied to the upper cube for which the lower one just lifts after

the force is removed, is



A. mg

B. $m_2 g$

C. $(m_1 + m_2)g$

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

Answer: C

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

A. 0.25

B. 0.33

C. 0.5

D. 0.75

Answer: D

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19. Three weights w, 2w and 3w are connected to identical spring suspended from a rigid horizontal rod. The assembly of the rod and the weights fall freely. The positions of the weight from the rod are such that

A. 3w will be farthest

B. w will be farthest

C. all will be at the same distance

D. 2w will be farthest

Answer: C

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20. Consider the following statement. When jumping from some height, you should bend your knees as you come to rest instead of keeping your legs stiff.

Which of the following relations can be useful in explaining the statement?

A. $\Delta p_1 = -\Delta p_2$

B. $\Delta E = -\Delta(PE + KE) = 0$

C. $F\Delta t = m\Delta v$

D. $\Delta x \propto \Delta F$

Answer: C

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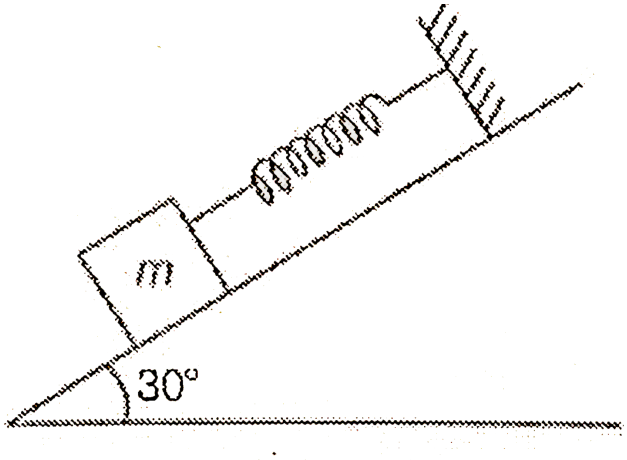
21. A body of mass 5 kg is suspended by a spring balance on an inclined plane as shown in figure. The

spring balance measure



A. 50 N

B. 25 N

C. 500 N

D. 10 N

Answer: B

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22. Under the action of a force F = Cx, the position of a body changes from 0 to x. The work done is

A. $\frac{1}{2}Cx^2$

B. Cx^2

C. Cx

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

Answer: a

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23. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on her hair. He will not succeed.

A. as the force exerted small

B. the frictional force while gripping is small

C. Newton's law of inertia is not applicable to living beings

D. as the force applied in internal to the system

Answer: D

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