6. A cricket player catches a ball of mass 100 g moving with a speed of 25 ms^{-1}. If the ball is caught in 0.1 s, average force of the blow exerted on the hands of the player is

(1) 4 N
(2) 25 N
(3) 40 N
(4) 250 N

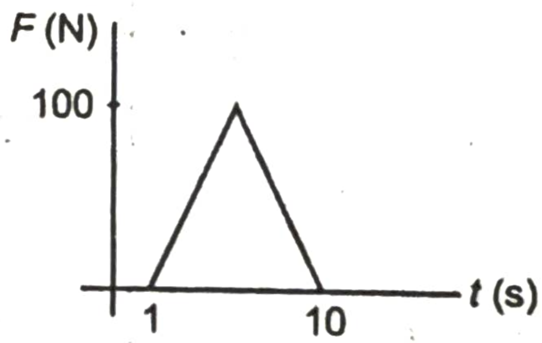
7. The linear momentum P of a particle varies with time as follows, $P = \alpha + \beta t^2$, where α and β are consta The net force acting on the particle is

(1) Proportional to t
(2) Proportional to t^2
(3) Zero
(4) Constant

8. A machine gun fires n bullets per second and the mass of each bullet is m. If v is the speed of each bullet, then average force exerted on the machine gun is

(1) mng
(2) mnv
(3) $mnvg$
(4) $(mnv)/g$

9. What is the impulse of force shown in the following figure?



(1) 225 Ns
(2) 450 Ns
(3) 900 Ns
(4) 1000 Ns

10. A body of mass 2 kg moves with acceleration 3 ms^{-2}. The change in momentum in one second is

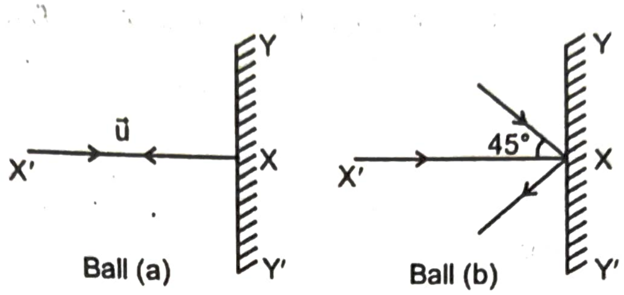
(1) $\frac{2}{3}$ kg ms^{-1}

(2) $\frac{3}{2}$ kg ms^{-1}

(3) 6 kg ms^{-1}

(4) None of these

11. Two billiard balls of equal mass 30 g strike a rigid wall with same speed of 108 kmph (as shown) but at different angles. If the balls get reflected with the same speed then the ratio of the magnitude of impulses imparted to ball 'a' and ball 'b' by the wall along 'X' direction is:



(1) $\sqrt{2}:1$

(2) $1:\sqrt{2}$

(3) 2 : 1

(4) 1 : 1

12. A force $\vec{F} = (40\hat{i} + 10\hat{j})$ N acts on a body of mass 5 kg. If the body start from rest, its position vector $\vec{r}$ at time t = 10 s, will be

(1) $(400\hat{i} + 400\hat{j})$ m

(2) $(400\hat{i} + 100\hat{j})$ m

(3) $(100\hat{i} + 400\hat{j})$ m

(4) $(100\hat{i} + 100\hat{j})$ m

13. A particle of mass M originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation

$$F = F_0\left[1 - \left(\frac{t - T}{T}\right)^2\right]$$

Where F_0 and T are constants. The force acts only for the time interval 2T. The velocity v of the particle after time 2T is :

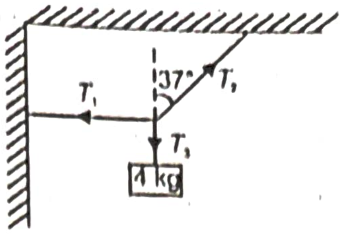
(1) $\frac{F_0T}{3M}$

(2) $\frac{F_0T}{2M}$

(3) $\frac{2F_0T}{M}$

(4) $\frac{4F_0T}{3M}$

16. Calculate the tensions T_1, T_2 and T_3 in the three threads shown in the following figure. (All threads are massless) ($g = 10$ m/s²)



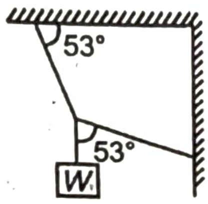
(1) 30 N, 40 N, 50 N

(2) 50 N, 30 N, 40 N

(3) 35 N, 45 N, 40 N

(4) 30 N, 50 N, 40 N

17. For the equilibrium situation shown. The strings are strong enough to with stand a maximum tension of 100 N. What is the largest value of W (in N) that they can support as shown?



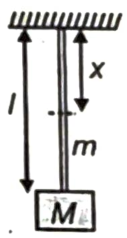
(1) 30 N

(2) 25 N

(3) 35 N

(4) 40 N

18. A heavy block of mass M hangs in equilibrium at the end of a rope of mass m and length l connected to a ceiling. Determine the tension in the rope at a distance x from the ceiling.



(1) $Mg + mg\left(\frac{l-x}{x}\right)$

(2) $Mg + mg\left(\frac{l-x}{l}\right)$

(3) $mg + Mg\left(\frac{l-x}{l}\right)$

(4) $mg + Mg\left(\frac{l-x}{x}\right)$

19. A block of mass M is pulled along a smooth horizontal surface with a rope of mass m by applying a force F. The acceleration of the block will be

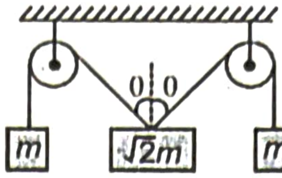
(1) $\frac{F}{M}$

(2) $\frac{F}{m}$

(3) $\frac{F}{M+m}$

(4) $\frac{F}{M-m}$

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



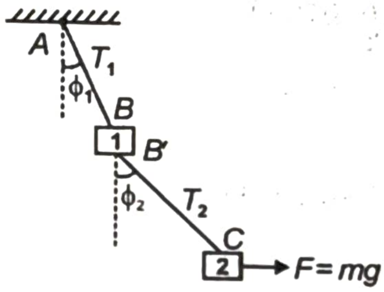
(1) 0°

(2) 30°

(3) 45°

(4) 60°

28. The blocks 1 and 2 in the arrangement have mass m each. The strings AB and BC are light, having tensi T_1 and T_2 respectively. The system is in equilibrium with a constant horizontal force mg acting on C. Then



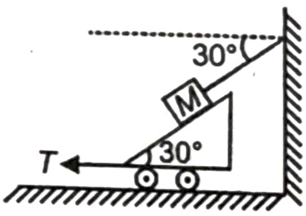
(1) $\tan\phi_1 = \frac{1}{2}$

(2) $\tan\phi_2 = 1$

(3) $T_1 = \sqrt{5}\,mg$

(4) $T_2 = \sqrt{2}mg$

29. Find the tension T needed to hold the cart in equilibrium, if there is no friction.



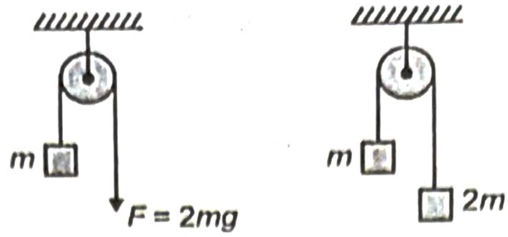
(1) $\frac{\sqrt{3}}{10}Mg$

(2) $\frac{Mg}{9}$

(3) $\frac{Mg}{2}$

(4) $\frac{\sqrt{3}}{4}Mg$

34. The magnitude of difference in accelerations of blocks of mass m in both the cases shown below is



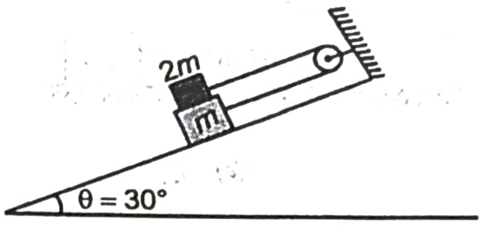
(1) g

(2) $\frac{2g}{3}$

(3) Zero

(4) $\frac{g}{3}$

35. Figure shows a block of mass $2m$ sliding on a block of mass m. Find the acceleration of each block. surface are smooth)



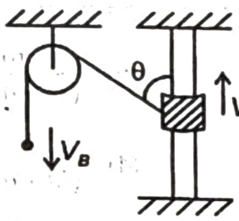
(1) $\frac{40}{3}$ m/s^2

(2) $\frac{20}{3}$ m/s^2

(3) $\frac{5}{3}$ m/s^2

(4) $\frac{10}{3}$ m/s^2

36. Two masses A and B are connected with an inextensible string. Their speeds are V_A and V_B at the moment show The correct constraint relationship is



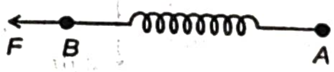
(1) $V_A \cos\theta = V_B$

(2) $V_B \cos\theta = V_A$

(3) $V_A \tan\theta = V_B$

(4) $V_A = V_B$

37. Two masses A and B, each of mass M are fixed together by a massless spring. A force acts on the mass as shown in figure. If the mass A starts moving away from mass B with acceleration 'a', then the acceleratio of mass B will be



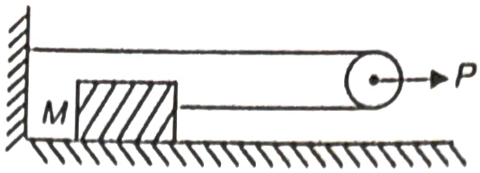
(1) $\frac{Ma - F}{M}$

(2) $\frac{MF}{F + Ma}$

(3) $\frac{F - Ma}{M}$

(4) $\frac{F + Ma}{M}$

40. In the following diagram a massless pulley is pulled by a constant force of magnitude P. There is no fr... between the block and the floor. The acceleration produced in the block of mass m is



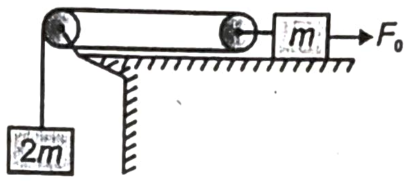
(1) $\frac{P}{m}$

(2) $\frac{P}{2m}$

(3) $\frac{P}{3m}$

(4) $\frac{P}{4m}$

41. A block of mass m on a smooth horizontal surface is connected to a second mass $2m$ by a light cord o... light frictionless pulley as shown. (Neglect the mass of the cord and of the pulley). A force of magnitude ... applied to mass m as shown. Neglect any friction. Find the value of force F_0 for which the system will b... equilibrium.



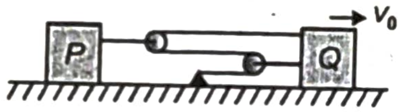
(1) mg

(2) $2mg$

(3) $3mg$

(4) $4mg$

42. The block Q moves to the right with a constant velocity v_0 as shown in figure. The relative velocity of bloc... P with respect to Q is (assume all pulleys and strings are ideal)



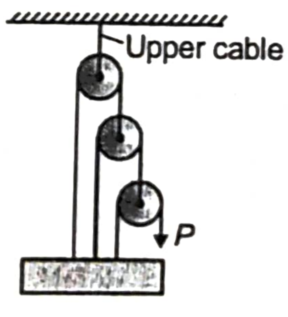
(1) $\frac{1}{2}v_0$ towards left

(2) $\frac{3}{2}v_0$ towards right

(3) $\frac{1}{2}v_0$ towards right

(4) $\frac{3}{2}v_0$ towards left

43. The pull P is just sufficient to keep the 14 N block in equilibrium as shown. Pulleys are ideal. Find the tension (in N) in the upper cable connected with ceiling.



(1) 4 N

(2) 8 N

(3) 12 N

(4) 16 N

52. A bus starts from rest and travels a distance s along a straight horizontal road. The coefficients of static and kinetic friction between the road and the tyres are μ_s and μ_k respectively. The minimum time of travel is proportional to

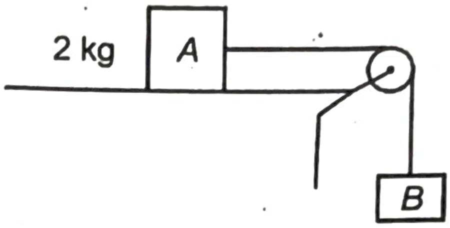
(1) $\sqrt{\mu_k}$

(2) $\frac{1}{\sqrt{\mu_s}}$

(3) μ_s

(4) $\frac{1}{\mu_k}$

53. The coefficient of static friction, μ_s between block A of mass 2 kg and the table as shown in figure is ... What should be the maximum mass of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless, (g = 10 m/s²).



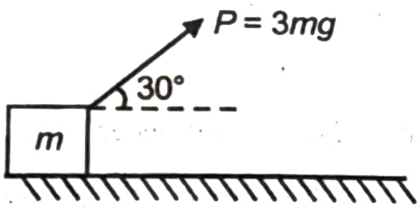
(1) 0.2 kg

(2) 0.4 kg

(3) 2.0 kg

(4) 4.0 kg

54. A force $P = 3mg$ acts on a block of mass m at an angle of 30° with horizontal. The friction force between the block and ground (assuming μ = coefficient of friction between the contacting surface) is



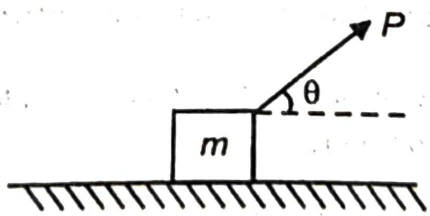
(1) Zero

(2) $2\ \mu mg$

(3) $\frac{3\sqrt{3}mg}{2}$

(4) None of these

55. A block is placed on a rough horizontal surface. The minimum force required to slide the block is



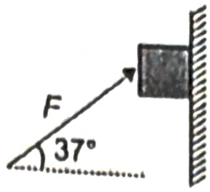
(1) $P\cos\theta$

(2) μmg

(3) $\frac{\mu mg}{\sqrt{1+\mu^2}}$

(4) All of these

66. A 1 kg block is being pushed against a wall by a force $F = 75$ N as shown in the figure. The coefficient of friction is 0.25. The magnitude of acceleration of the block is



(1) 10 m/s²
(2) 20 m/s²
(3) 5 m/s²
(4) None of these

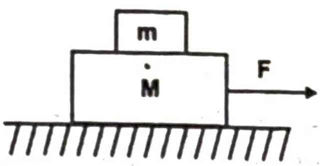
67. A block of mass 2 kg lies on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is ________.

(1) 7 N
(2) 10 N
(3) $7\sqrt{3}$ N
(4) None of these

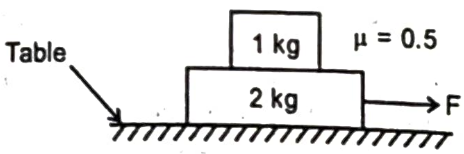
68. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is (take $g = 10$ m/s²)

(1) 2.0
(2) 4.0
(3) 1.6
(4) 2.5

69. Two block (m = 0.5 kg and M = 4.5 kg) are arranged on a horizontal frictionless table as shown in figure. The coefficient of static friction between the two blocks is $\frac{3}{7}$. Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is ________N. (Round off to the Nearest Integer) [Take g as 9.8 ms⁻²]



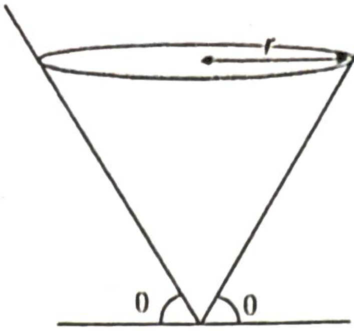
70. The coefficient of static friction between two blocks is 0.5 and the table is smooth. The maximum horizontal force that can be applied to move the blocks together is ____ N. (take g = 10 ms⁻²)



71. A body of mass 1 kg rests on a horizontal floor with which it has a coefficient of static friction $\frac{1}{\sqrt{3}}$. It is desired to make the body move by applying the minimum possible force F N. The value of F will be________. (Round off to the Nearest Integer)

[Take g = 10 ms⁻²]

85. A ball of mass 'm' is rotating in a circle of radius 'r' with speed v inside a smooth cone as shown in figure. Let N be the normal reaction on the ball by the cone, then choose the wrong option.



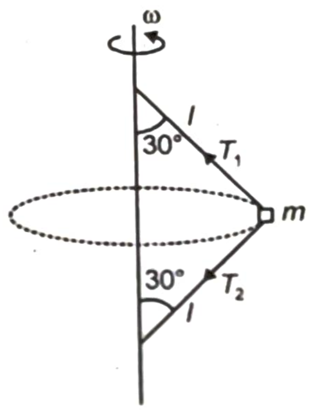
(1) $N = mg\cos\theta$

(2) $g\sin\theta = \frac{v^2}{r}\cos\theta$

(3) $N\sin\theta - \frac{mv^2}{r} = 0$

(4) None of these

86. A particle of mass m is whirled in horizontal circle with the help of two threads of length l each as shown in figure. Angular velocity equals ω, then



(1) $T_1 = T_2$

(2) $T_1 > T_2$

(3) $T_1 < T_2$

(4) Data insufficient

87. In Q.86, T_1 equals

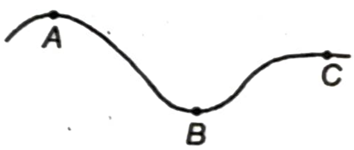
(1) $\frac{mg}{\sqrt{3}} + \frac{m\omega^2 l}{2}$

(2) $\frac{mg}{\sqrt{3}} - \frac{m\omega^2 l}{2}$

(3) $\frac{m\omega^2 l}{2}$

(4) $\frac{mg}{\sqrt{3}}$

88. A car moves on a straight road with uniform speed. Normal reaction at A, B and C are N_A, N_B and N_C respectively, then



(1) $N_A > N_B$

(2) $N_A > N_C$

(3) $N_B = N_C$

(4) $N_B > N_C > N_A$

There is only one correct option for every multiple choice question (MCQ).

1. Which of the following is CGS unit of force?

(1) Joules
(2) Ergs
(3) Dynes
(4) Newton

2. Passengers sitting in a car are thrown forward when it is stopped suddenly. It is explained by

(1) Newton's first law of motion
(2) Newton's second law of motion
(3) Newton's third law of motion
(4) Principle of conservation of momentum

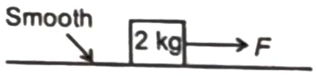
3. Body A of mass 5 kg and body B of mass 10 kg are exerted upon by a net force of magnitude F, each separately. If body A experiences an acceleration of 4 m/s² then the acceleration of body B will be

(1) 2 m/s²
(2) 3 m/s²
(3) 1 m/s²
(4) 8 m/s

4. A gun of mass 5 kg fires a bullet of mass 10 grams at 800 m/s. If no external force is acting on the system of gun and bullet then recoil speed of gun is equal to

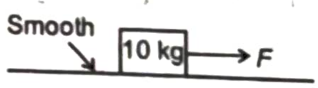
(1) 18 m/s
(2) 4 m/s
(3) 16 m/s
(4) 2 m/s

5. The force F required to produce an acceleration of 2 m/s² in the mass of 2 kg lying on a smooth surfaces is equal to

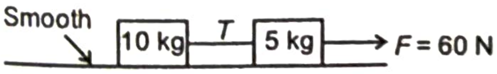


(1) 14 N
(2) 24 N
(3) 4 N
(4) 12 N

6. A force F = 40 N is applied of block of 10 kg horizontally. The value of reaction force on the block from the ground is : (g = 10 m/s²)



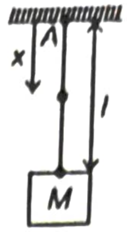
(1) 100 N
(2) 140 N
(3) 10 N
(4) $\sqrt{11600}$ N

7. 

The value of tension T in the given arrangement is :

(1) 4 N
(2) 14 N
(3) 40 N
(4) 30 N

8. A block of mass M hangs from a fixed ceiling by a massive rope of mass m.



The tension in the rope at a point, x unit length away from point A is equal to :

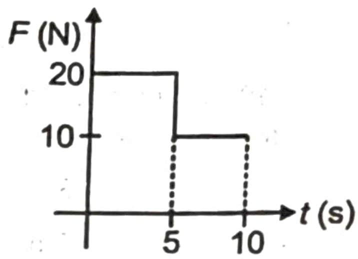
(1) $(M + m)g$

(2) $(M+m)g - mg\left(\frac{x}{l}\right)$

(3) $Mg + mg\frac{x}{l}$

(4) $(M+m)g + mg\left(\frac{x}{l}\right)$

9. Force is applied on an object of mass 2 kg at rest on a frictionless horizontal surface as shown in the graph. The speed of object at t = 1 s will be



(1) 7.5 m/s

(2) 12.5 m/s

(3) 10 m/s

(4) 25 m/s

10. A block of mass 2 kg rests on the floor of an elevator, which is moving down with an acceleration 'g', then the apparent weight of the block is [take g = 10 m/s^2]

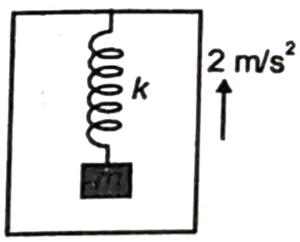
(1) 20 N

(2) 12 N

(3) 16 N

(4) Zero

11. A block of mass m = 2 kg is suspended with a light spring of spring constant k = 1000 N/m. If the lift is moving vertically upward with acceleration of 2 m/s^2 then equilibrium elongation in the spring is (g = 10 m/s^2)



(1) 3.2 cm

(2) 2.4 cm

(3) 1.2 cm

(4) 2.0 cm

17. Find the ratio of the extension in upper spring to lower spring at equilibrium

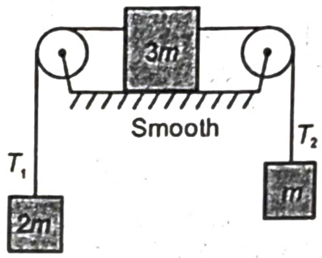
(1) $\frac{m_1k_1}{m_2k_2}$

(2) $\frac{m_2k_1}{m_1k_2}$

(3) $\frac{(m_1+m_2)k_2}{m_1k_1}$

(4) $\frac{(m_1+m_2)k_2}{m_2k_1}$

18. In the given arrangement, friction is absent and strings, pulleys are ideal. The difference of tension $(T_1 - T_2)$ is



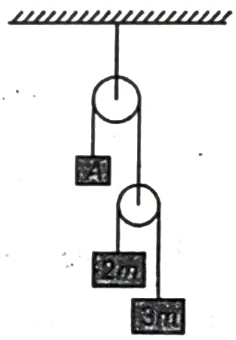
(1) mg

(2) $\frac{mg}{2}$

(3) $\frac{3mg}{2}$

(4) $2mg$

19. In the given arrangement strings and pulley are light and smooth, what should be mass of block *A* so that it could remain at rest?



(1) $5m$

(2) $\frac{27}{7}m$

(3) $\frac{24}{5}m$

(4) $\frac{18}{5}m$

20. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of

(1) $\frac{2}{3}k$

(2) $\frac{3}{2}k$

(3) $3k$

(4) $6k$

21. A man slides down a rope which can take maximum tension equal to half of the weight of the man. The minimum acceleration with which the man can slide down without breaking the rope is

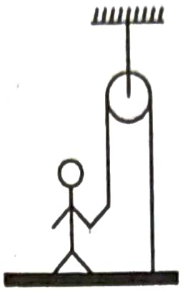
(1) g

(2) $\frac{g}{3}$

(3) $\frac{g}{2}$

(4) $\frac{g}{4}$

22. A man of mass m is standing on a light platform with the help of a setup of light and ideal pulley and strings, as shown what force should the man apply on string to remain at rest on platform ?



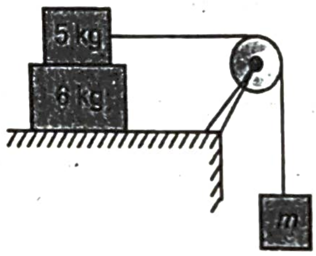
(1) mg

(2) $2mg$

(3) $\frac{mg}{2}$

(4) $\frac{3mg}{4}$

23. An arrangement of three blocks is shown in figure. The string and pulley are ideal. There is no friction between 6 kg block and ground. There is friction between 5 kg and 6 kg block (μ = 0.8). The maximum value of mass m, such that the two blocks (5 kg and 6 kg) will move together, is [Take g = 10 m/s^2]



(1) 44 kg

(2) 22 kg

(3) 40 kg

(4) 4 kg

24. What is the angle of friction between two surfaces in contact, if coefficient of friction is $\frac{1}{\sqrt{3}}$? (Assume two surfaces are slipping on each other)

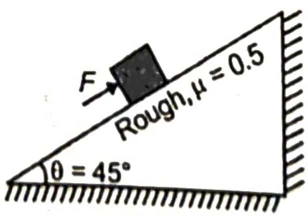
(1) 15°

(2) 30°

(3) 45°

(4) 60°

25. A block of mass 4 kg is placed on a rough fixed inclined plane as shown. The minimum force F which is parallel to inclined to keep the block at rest is (g = 10 m/s^2)



(1) $20\sqrt{2}$ N

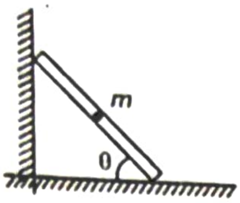
(2) Zero

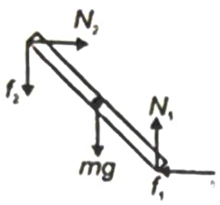
(3) 20 N

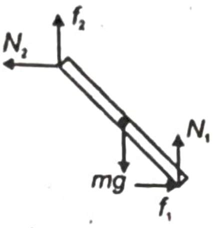
(4) $10\sqrt{2}$ N

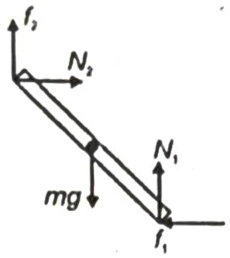
Objective Type Questions (One option is correct)

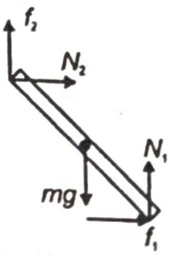
1. A uniform rod is held at rest against a rough wall and a rough floor. Which of the following represents correct free body diagram of rod? (All standard symbols used)



(1) 

(2) 

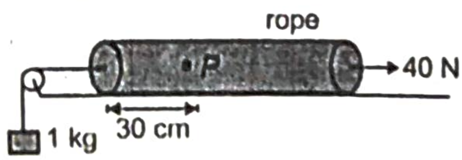
(3) 

(4) 

2. When a lift is moving upward with acceleration of 5 m/s^2 then percentage change in the weight of the person in the lift is x%. If the lift is moving down with acceleration 5 m/s^2 then percentage change in the weight of same person is y%. Then the ratio $\frac{x}{y}$ is (g = 10 m/s^2)

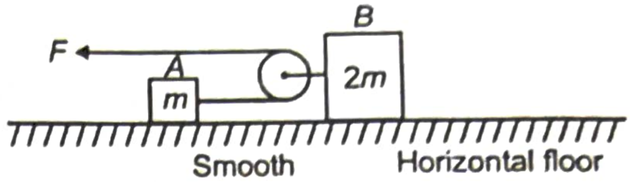
(1) 1 : 1
(2) 3 : 1
(3) 1 : 3
(4) 3 : 4

3. A rope of mass 2 kg and length 1 m is pulled along the smooth horizontal floor by the horizontal force of 40 N as shown. The tension at point P is (g = 10 m/s^2, strings and pulley is light and frictionless)



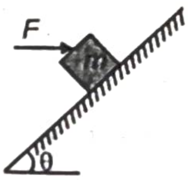
(1) 32 N
(2) 26 N
(3) 18 N
(4) 22 N

4. The magnitude of relative acceleration of A w.r.t. B is (Assuming pulley and string are light and massless)



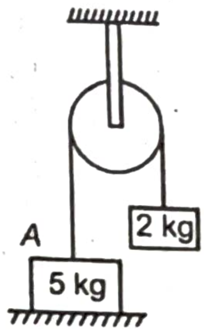
(1) $\frac{2F}{m}$
(2) $\frac{3F}{2m}$
(3) $\frac{4F}{3m}$
(4) $\frac{F}{2m}$

5. A block is placed on a smooth inclined plane as shown. For what value of horizontal force F, the block will remain at rest?



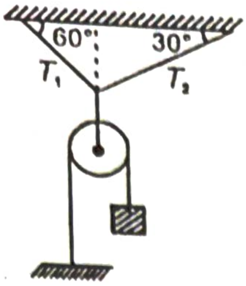
(1) $mg \tan \theta$
(2) $mg \sin \theta$
(3) $mg \cos \theta$
(4) $mg \cot \theta$

6. In the arrangement shown, what is the normal reaction between the block A (mass = 5 kg) and ground?



(1) 50 N
(2) 20 N
(3) 30 N
(4) Zero

7. If pulley and all strings as shown are massless, then tension T_2 = 100 N. Calculate weight of the block (g = 10 m/s²)

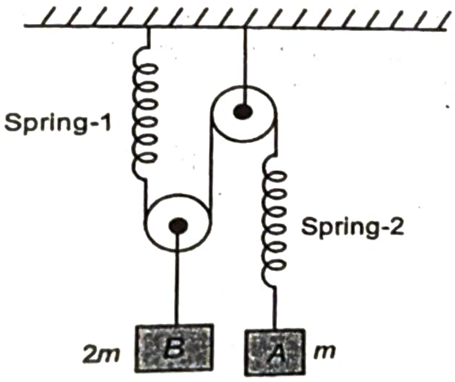


(1) 50 N
(2) 100 N
(3) $50\sqrt{3}$ N
(4) $100\sqrt{3}$ N

8. The system shown below is in equilibrium. Find the acceleration of block m_1, immediately after spring k_2 is cut.

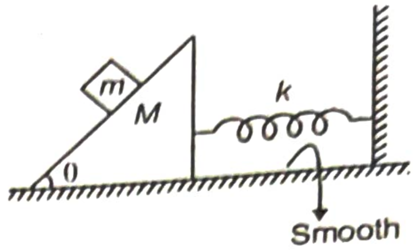
(1) Zero
(2) g
(3) $\frac{m_1 g}{m_2}$
(4) $\frac{m_2 g}{m_1}$

9. Blocks A and B are initially in equilibrium. The springs and strings are ideal. The accelerations of the blocks A and B, just after the spring-2 is cut, are respectively



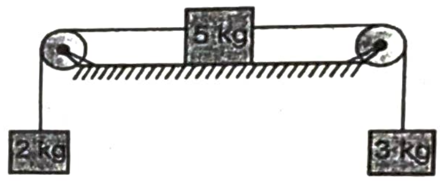
(1) g, 0
(2) g, $\frac{g}{2}$
(3) g, g
(4) 0, g

10. Find the compression in the spring if the system shown below is in equilibrium.



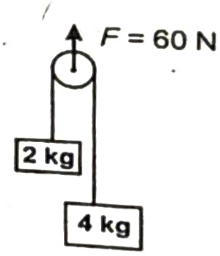
(1) $\frac{(mg\cos^2\theta)}{k}$
(2) $\frac{mg\sin\theta\cos\theta}{k}$
(3) $\frac{mg}{k}$
(4) Zero

11. A block of mass 5 kg is placed on a smooth table and tied from both ends by two masses 3 kg and 2 kg by means of light, inextensible strings passing through pulleys as shown. The tension in the string connecting 5 kg and 3 kg is (g = 10 m/s²)



(1) 22 N
(2) 27 N
(3) 33 N
(4) 30 N

12. The magnitude of accelerations of blocks of mass 2 kg and 4 kg are respectively (Pulleys and threads are massless) (g = 10 m/s²)



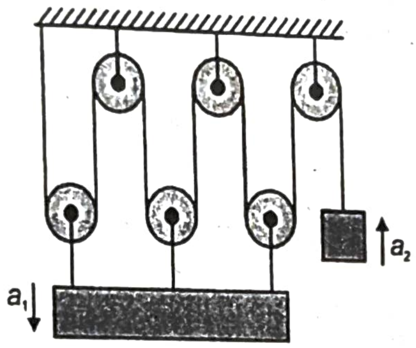
(1) a_1 = 5 m/s²; a_2 = 2.5 m/s²
(2) $a_1 = a_2 = 0$
(3) $a_1 = a_2 = \frac{20}{6}$ m/s²
(4) a_1 = 20 m/s²; a_2 = 5 m/s²

13. At a certain moment of time, acceleration of the block A is 2 m/s^2 upward and acceleration of block B is 3 m/s^2 upward. The acceleration of block C is (masses of pulleys and string are negligible)

(1) 5 m/s^2 upward (2) 7 m/s^2 upward

(3) 8 m/s^2 downward (4) 7 m/s^2 downward

14. Figure shows an arrangement of blocks, pulley and strings. Strings and pulley are massless and frictionless. The relation between acceleration of the blocks as shown in the figure is

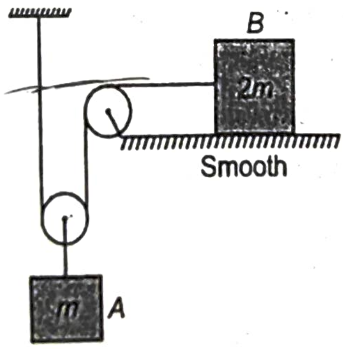


(1) $a_2 = 6a_1$ (2) $a_1 = 6a_2$

(3) $a_1 = 3a_2$ (4) $a_2 = 3a_1$

15. The acceleration of block B is

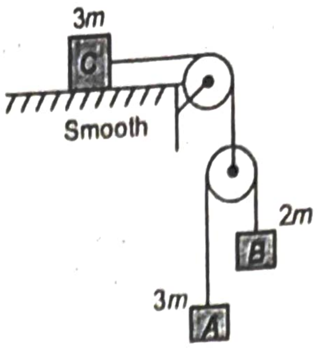
(Assuming pulley and strings are light and frictionless)



(1) $\frac{g}{9}$ (2) $\frac{2g}{9}$

(3) $\frac{g}{5}$ (4) $\frac{2g}{5}$

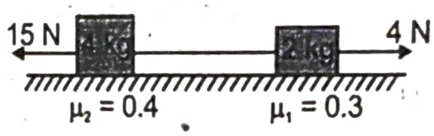
16. The acceleration of block C is



(1) $\frac{5g}{8}$ (2) $\frac{3g}{7}$

(3) $\frac{8g}{13}$ (4) $\frac{3g}{5}$

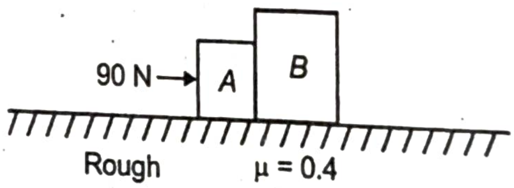
17. In the figure shown, two blocks of masses 2 kg and 4 kg are connected by a massless string which is just taut (*i.e.*, tension is zero at this moment). Now two forces 4 N and 15 N are applied on blocks. The tension in the string is (coefficient of static and kinetic friction are same). [g = 10 m/s^2]



(1) 2 N (2) Zero

(3) 6 N (4) 1 N

18. Two blocks A and B of masses 5 kg and 10 kg respectively are pushed on rough surface. The contact force between the blocks is (g = 10 m/s^2)



(1) 20 N (2) 40 N

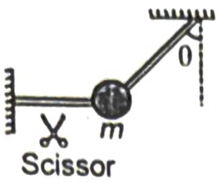
(3) 60 N (4) 70 N

19. A block of mass 10 kg is placed on a rough horizontal surface of coefficient of friction 0.5. The minimum force required to move the block is (g = 10 m/s^2)

(1) $20\sqrt{3}$ N (2) $50\sqrt{3}$ N

(3) 50 N (4) $20\sqrt{5}$ N

33. Figure shows a small ball of mass m held at rest by means of two light and inextensible strings. The tensions in the inclined string at the instant shown and just after cutting the horizontal string are respectively



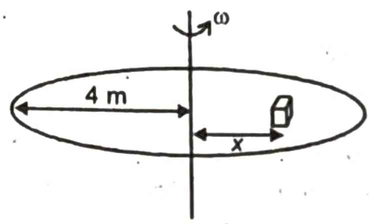
(1) $mg\cos\theta$, $mg\cos\theta$

(2) $mg\cos\theta, \dfrac{mg}{\cos\theta}$

(3) $\dfrac{mg}{\cos\theta}, mg\cos\theta$

(4) $\dfrac{mg}{\cos\theta}, \dfrac{mg}{\cos\theta}$

34. A disc of radius 4 m is rotating about its fixed centre with a constant angular velocity ω = 2 rad/ s (in the horizontal plane). A block is also rotating with the disc without slipping. If coefficient of friction between the block and the disc is 0.4, then the maximum distance at which the block can rotate without slipping is (g = 10 m/s^2)



(1) 1 m (2) 2 m

(3) 3 m (4) 4 m

35. A particle of mass m is moving on a circular path of radius r with uniform speed v, rate of change of linear momentum is

(1) Zero

(2) Independent of speed

(3) Proportional to radius r

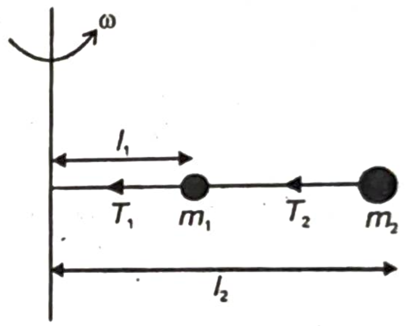
(4) Proportional to v^2

36. Figure shows a small bob of mass m suspended from a point on a thin rod by a light inextensible string of length l. The rod is rigidly fixed on a circular platform. The platform is set into rotation. The minimum angular speed ω, for which the bob loses contact with the vertical rod, is

(1) $\sqrt{\dfrac{g}{l}}$ (2) $\sqrt{\dfrac{2g}{l}}$

(3) $\sqrt{\dfrac{g}{2l}}$ (4) $\sqrt{\dfrac{g}{4l}}$

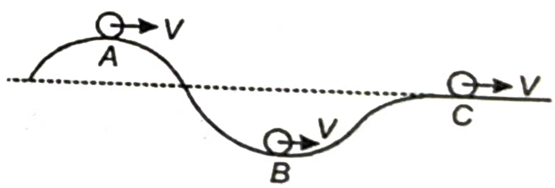
37. The whole set up shown in the figure is rotating with constant angular velocity ω on a horizontal frictionless table. The ratio of tensions $\dfrac{T_1}{T_2}$ is $\left(\text{Given, } \dfrac{l_2}{l_1} = \dfrac{2}{1}\right)$



(1) $\dfrac{m_1}{m_2}$ (2) $\dfrac{(m_1 + 2m_2)}{2m_2}$

(3) $\dfrac{m_2}{m_1}$ (4) $\dfrac{(m_2 + m_1)}{m_2}$

38. A body of mass 'm' is moving with constant speed V on a track shown in figure. At point A & point B radius of curvature is R. N_A, N_B & N_C represents normal reactions at A, B & C. Which of the following options is correct ?



(1) $N_A = mg - \dfrac{mV^2}{R}$ (2) $N_B = mg + \dfrac{mV^2}{R}$

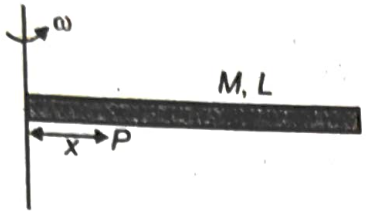
(3) $N_C = mg$ (4) All of these

39. A road is 8 m wide. Its radius of curvature is 40 m. The outer edge is above the lower edge by a distance of 1.2 m. This road is most suited for a velocity of

(1) 5.7 m/s (2) 7.7 m/s

(3) 36.1 m/s (4) 9.7 m/s

40. A uniform rod of mass M and length L is rotated in horizontal plane about a vertical axis with constant angular velocity ω as shown in figure. The tension in the rod at point P is



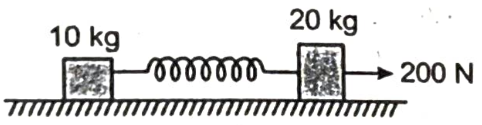
(1) $\frac{M\omega^2(L^2 - x^2)}{L}$ (2) $M\omega^2(L - x)$

(3) $\frac{M\omega^2(L^2 - x^2)}{2L}$ (4) $\frac{M\omega^2(L + x)}{2}$

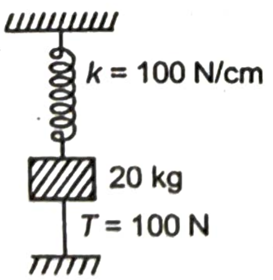
Numerical Value Based Questions

41. A block of mass 4 kg is pulled with a rope of mass 500 g on a frictionless surface. If a force 9 N is applied at free end of the rope, force exerted (in N) by the rope on block would be ______.

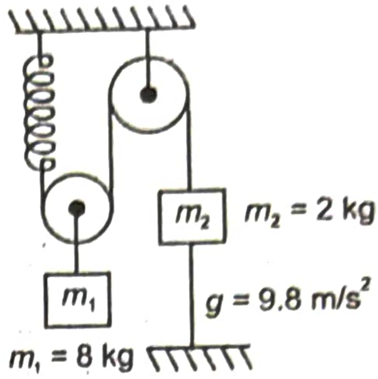
42. Two blocks of masses 10 kg and 20 kg are connected by a massless spring of spring constant 2000 N/m as shown in figure. A constant force of 200 N acts on 20 kg block. When the 10 kg block has acceleration of 12 m/s², the acceleration of 20 kg block in m/s² is equal to ______.



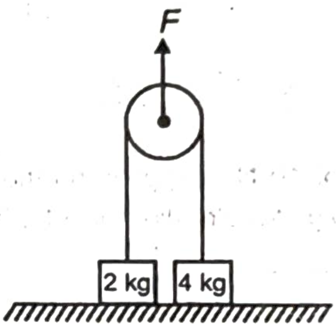
43. If hanging block is in equilibrium, then elongation in the spring in c.m. is equal to ________.



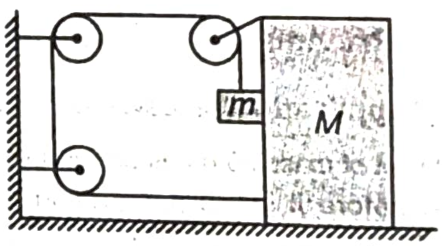
44. In figure shown, pulleys and string are ideal initially the system is in equilibrium and string connecting m_2 to rigid support below is cut. Find the initial acceleration of m_2 in m/s².



45. In the arrangement shown in figure the string and pulley are light. Value of F (in N) for which 4 kg block will move with 1 m/s² acceleration in the upward direction is ________.



46. In figure shown, if the magnitude of acceleration of m, is $2\sqrt{N}$ m/s², given that the string is inextensible and the acceleration of M is 2 m/s² towards left, then find N.



47. In the arrangement shown in figure, the string and pulley are light. The car starts moving on the horizontal road with constant velocity 5 m/s towards left. Speed of 2 kg block in m/s when $\theta = 60°$ is ________.