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

(1) He exerts on the wagon
(2) The wagon exerts on him
(3) The ground exerts on him
(4) He exerts on the ground

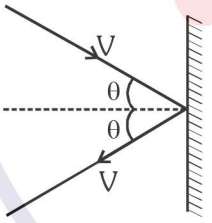
2. If the force of gravity suddenly disappears :-

(1) The mass of all bodies will become zero
(2) The weight of all bodies will become zero
(3) Both mass and weight of all bodies will become zero
(4) Neither mass nor weight of all bodies will become zero

3. The velocity acquired by a mass m in travelling a certain distance d starting from rest under the action of a constant force is directly proportional to :-

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

4. A water jet, whose cross sectional are is 'a' strikes a wall making an angle 'θ' with the normal and rebounds elastically. The velocity of water of density 'd' is v. Force exerted on wall is :-



(1) $2av^2d\cos\theta$ (2) $av^2d\sin\theta$
(3) $2avd\cos\theta$ (4) $avd\cos\theta$

5. Three forces act on a particle that moves with unchanging velocity $\vec{v} = (3\hat{i} - 4\hat{j})$ m/s. Two of the forces are $\vec{F}_1 = (3\hat{i} + 2\hat{j} - 4\hat{k})N$ and $\vec{F}_2 = (-5\hat{i} + 8\hat{j} - 3\hat{k})N$. The third force is :-

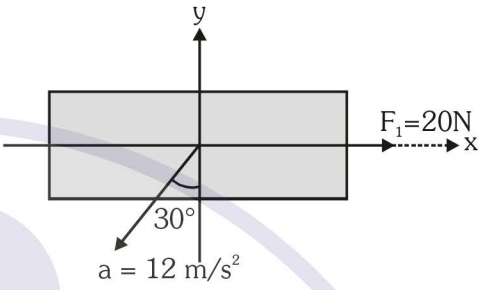
(1) $(-2\hat{i} + 10\hat{j} - 7\hat{k})N$

(2) $(2\hat{i} - 10\hat{j} + 7\hat{k})N$

(3) $(7\hat{i} - 2k + 10\hat{j})N$

(4) none of these

6. There are two forces on the 2.0 kg box in the overhead view of figure but only one is shown. The figure also shows the acceleration of the box. The second force is nearly :-



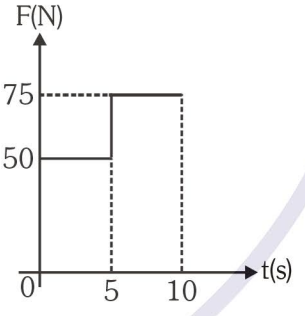
(1) $-20\hat{j}N$

(2) $(-20\hat{i}N + 20\hat{j})N$

(3) $(-32\hat{i} - 21\hat{j})N$

(4) $(-21\hat{i} - 16\hat{j})N$

7. A force represented as show in figure acts on a body having a mass of 16 kg. The velocity of the body at t = 10 s, if the body starts from rest :-



(1) 100 m/s (2) 50 m/s
(3) 49 m/s (4) 39 m/s

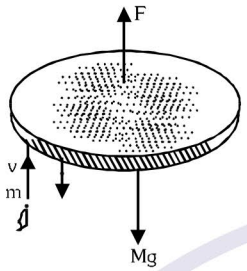
8. A player catches a ball of 200 g moving with a speed of 20 m/s. If the time taken to complete the catch is 0.5 s, the force exerted on the player's hand is :-

(1) 8 N (2) 4 N (3) 2 N (4) 0

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

(1) 2.5 m/s^2 (2) 5.0 m/s^2
(3) 10 m/s^2 (4) None of the above

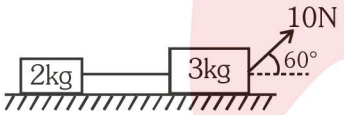
10. A disc of mass 1·0 kg is kept floating horizontally in air by firing bullets of mass 0·05 kg each vertically at it, at the rate of 10 per second. If the bullets rebound with the same speed, the speed with which these are fired will be–



(1) 0·098 m/s (2) 0·98 m/s
(3) 9·8 m/s (4) 98·0 m/s

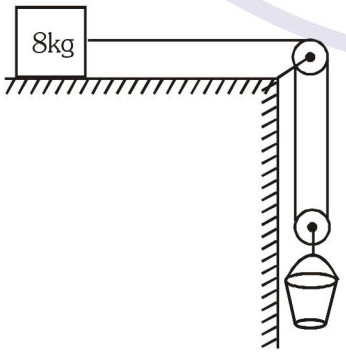
11. If force F = 500 – 100t, then impulse as a function of time will be :-
(1) $500t - 50t^2$ (2) $50t - 10$
(3) $50 - t^2$ (4) $100t^2$

12. Find the tension in the string which connected the blocks as shown in the following figure :-



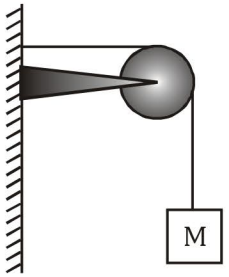
(1) 2 N (2) 3 N (3) 5 N (4) 10 N

13. A block of mass M = 8 kg is connected to an empty bucket of mass 1 kg by a massless cord running over an ideal pulley . The coefficients of static and kientic friction between table top and block are 0.5 and 0.4 respectively. Sand is gradually added to the bucket until the block just begin to slide. The mass of sand added is : (g = 10 m/s²)



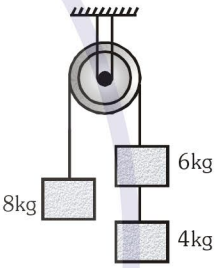
(1) 5 kg (2) 6 kg (3) 7 kg (4) 10 kg

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

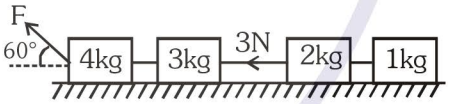


(1) $\sqrt{2}$ Mg (2) $\sqrt{2}$ mg
(3) $\left(\sqrt{(M+m)^2+m^2}\right)g$ (4) $\left(\sqrt{(M+m)^2+M^2}\right)g$

15. Three blocks of masses 4 kg, 6 kg and 8 kg are banging over a fixed pulley as shown. The tension in the the string connecting 4 kg and 6 kg block is :-
(g = 10 m/s²)
(1) 4 N
(2) 6 N
(3) $\frac{320}{9}$N
(4) $\frac{40}{9}$N

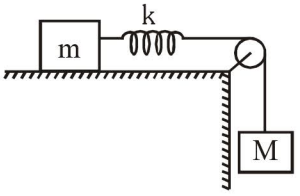


16. Figure shows four blocks that are being pulled along a smooth horizontal surface. The masses of the blocks and tension in one cord are given. The pulling force F is :-



(1) 5 N (2) 10 N (3) 12.5 N (4) 20 N

17. Two masses, M and m are connected together by a pulley two strings and a stretched spring of force constant k as shown. Assume that string, pulley and spring all are massless and surface below m is smooth. The amount by which the spring is stretched:-



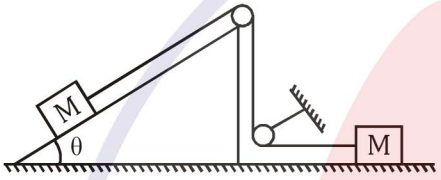
(1) $\frac{mMg}{k(m+M)}$ (2) $\frac{2mMg}{k(m+M)}$
(3) $\frac{Mg}{k}$ (4) $\frac{(m+M)g}{2k}$

18. A block of mass M is pulled along a horizontal smooth surface by a rope of mass m. Force P is applied at one end of the rope. The force which the rope exert on the block is :-

(1) $\frac{P}{(M-m)}$ (2) $\frac{PM}{(M+m)}$

(3) $\frac{Pm}{(M+m)}$ (4) $P\frac{m}{M}$

19. Two blocks, each having a mass M, rest on frictionless surface as shown in the figure. If the pulleys are light and frictionless, and M on the incline is allowed to move down, then the tension in the string will be :-



(1) 2.3 Mg sin θ (2) 1.3 Mg sin θ

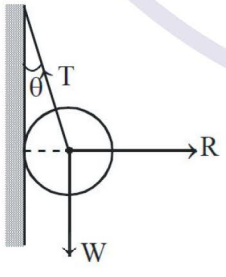
(3) $\frac{Mg}{2}\sin\theta$ (4) 2 Mg sin θ

20. With what minimum acceleration can a firemman slide down a rope whose breaking strength is 3/4th of his weight.

(1) $\frac{g}{4}m/s^2$ (2) g m/s^2

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

21. A metal sphere is hung by a string fixed to a wall. The forces acting on the sphere are shown in fig. Which of the following statements is correct ?



(a) $\vec{R}+\vec{T}+\vec{W}=0$ (b) $T^2 = R^2 + W^2$

(c) T = R + W (d) R = W tan θ

(1) a, b, c (2) b, c, d

(3) a, b, d (4) a, b, c, d

22. Two masses m_1 and m_2 are joined by a spring as shown. The system is dropped to the gorund from a certain height. The spring will be :-

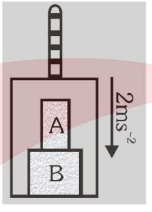
(1) Stretched when $m_2 > m_1$

(2) compressed when $m_2 < m_1$

(3) neither compressed nor stretched only when $m_1 = m_2$

(4) neither compressed nor stretched regardless of the values of m_1 and m_2.

23. The elevator shown in figure is descending, with an acceleration of 2 ms^{-2}. The mass of the block A is 0.5 kg. The force exerted by the block A on the block B is :



(1) 2 N (2) 4 N (3) 6 N (4) 8 N

24. A body kept on a smooth inclined plane of inclination 1 in x will remain stationary relative to the inclined plane if the plane is given a horizontal acceleration equal to :-

(1) $\sqrt{x^2-1}g$ (2) $\frac{\sqrt{x^2-1}}{x}g$

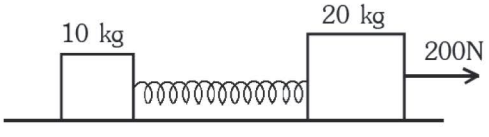
(3) $\frac{gx}{\sqrt{x^2-1}}$ (4) $\frac{g}{\sqrt{x^2-1}}$

25. If a parrot starts flying upwards with an acceleration in an air tight cage, then the boy will feel the weight of the cage:

(1) Unchanged (2) Reduced

(3) Increased (4) Nothing can be said

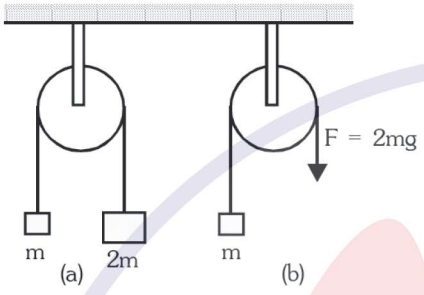
26. Two masses of 10 kg and 20 kg respectively are connected by a massless spring as shown in the figure. A force of 200 N acts on the 20 kg mass. At the instant shown the 10 kg mass has an acceleration 4 m/s^2 rightwards. What is the acceleration of 20 kg mass ?



(1) Zero (2) 10 m/s^2

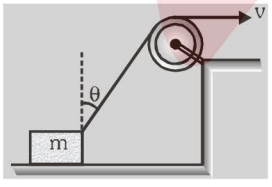
(3) 4 m/s^2 (4) 8 m/s^2

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



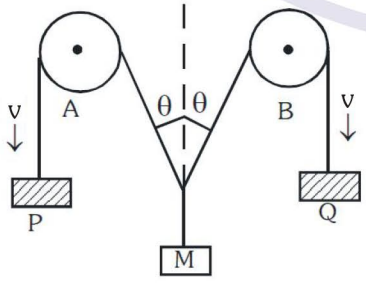
(1) Zero
(2) More than that in case (b)
(3) Less than that in case (b)
(4) Equal to that in case (b)

28. A block is dragged on a smooth plane with the help of a rope which moves with a velocity v as shown in figure. The horizontal velocity of the block is :



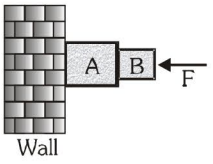
(1) v (2) $\frac{v}{\sin\theta}$ (3) v sinθ (4) $\frac{v}{\cos\theta}$

29. In the fig., the ends P and Q of an unstrechable string move downward with uniform speed v. Mass M moves upwards with speed.



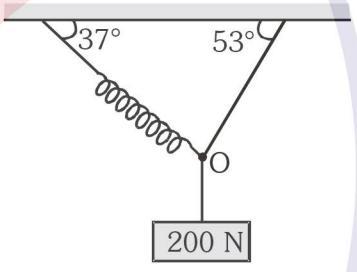
(1) v cosθ (2) v/cosθ
(3) 2v cosθ (4) 2/v cosθ

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



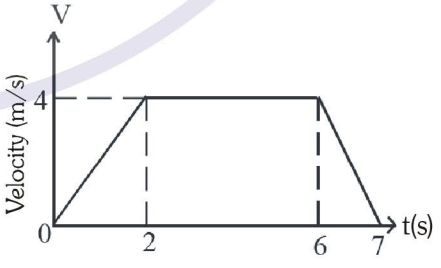
(1) F should be be more than the weight of A and B
(2) F should be equal to the weight of A and B
(3) F should be less than the weight of A and B
(4) system cannot be in equilibrium

31. In the set-up shown, a 200 N block is supported in equilibrium with the help of strings and a spring. all knotted at ponit O. Extension in the spring is 4 cm. Force constant of the spring is closest to [g = 10 m/s^2]



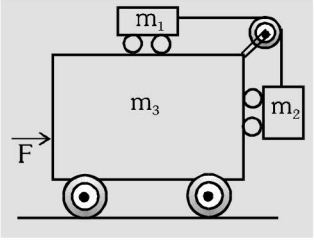
(1) 30 N/m (2) 2500 N/m
(3) 3000 N/m (4) 4000 N/m

32. A lift of mass 100 kg starts moving from rests in the upward direction. Fig shows the variation if speed of the lift, T_1, T_2 and T_3 stand for tension in the rope form zero to two seconds, two to six seconds, six to seven seconds respectively then :-



(1) $T_1 : T_2 : T_3 :: 1 : 1 : 1$
(2) $T_1 : T_2 : T_3 :: 6 : 5 : 3$
(3) $T_1 : T_2 : T_3 :: 3 : 5 : 6$
(4) $T_1 : T_2 : T_3 :: 6 : 5 : 6$

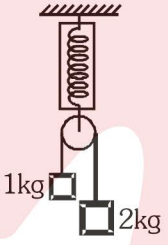
33. All surfaces are assumed to be frictionless. Calculate the horizontal force F that must be applied so that m_1 and m_2 do not move relative to m_3 is :–



(1) $(m_1 + m_2 + m_3)\dfrac{m_2 g}{m_1}$ (2) $(m_1 + m_2)\dfrac{m_2 g}{m_1}$

(3) $(m_2 + m_3)\dfrac{m_1 g}{m_2}$ (4) $(m_1 + m_3)\dfrac{m_1 g}{m_2}$

34. Two masses of 1 kg and 2 kg are attached to the ends of a massless string passing over a pulley of negligible weight. The pulley itself is attached to a light spring balance as shown in figure. The masses start moving; during this interval the reading of spring balance will be:-



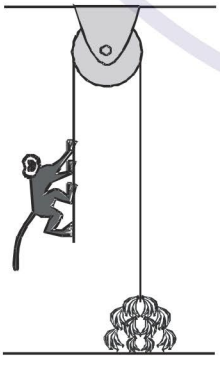
(1) More than 3 kg.

(2) Less than 3 kg.

(3) Equal to 3 kg.

(4) None of the above

35. As shown in figure a monkey of 20 kg mass is holding a light rope that passes over a frictionless pulley. A bunch of bananas of the same mass 20 kg is tied to the other end of the rope. In order to get access to the bananas the monkey starts climbing the rope. The distance between the monkey and the bananas :-



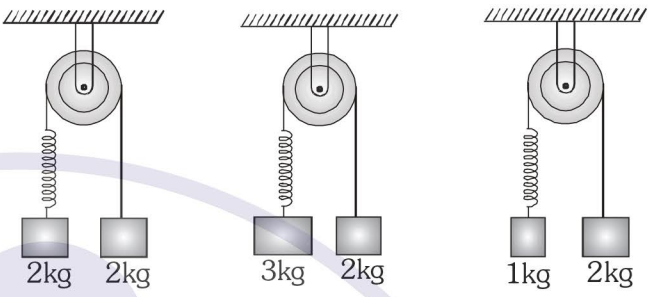
(1) Decreases

(2) Increases

(3) remains unchanged

(4) Nothing can be stated

36. Same spring is attached with 2 kg, 3 kg and 1 kg blocks in three different cases as shown in figure. If x_1, x_2 and x_3 be the respective extensions in the spring in these three cases, then :-



(1) $x_1 = 0,\ x_3 > x_2$

(2) $x_2 > x_1 > x_3$

(3) $x_3 > x_1 > x_2$

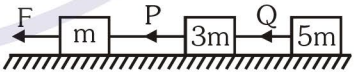
(4) $x_1 > x_2 > x_3$

37. Two weights w_1 and w_2 are connected by a light thread which passes over a light smooth pulley. If the pulley is raised upwards with an acceleration equal to g, then the tension in the thread will be :-

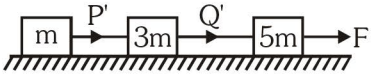
(1) $\dfrac{2w_1w_2}{w_1 + w_2}$ (2) $\dfrac{w_1w_2}{w_1 + w_2}$

(3) $\dfrac{4w_1w_2}{w_1 + w_2}$ (4) $\dfrac{4w_1w_2}{w_1 - w_2}$

38. Three blocks of masses m, 3m and 5m are connected by massless strings and pulled by a force F on a frictionless surface as shown in the figure below. The tension P in the first string is 16N.



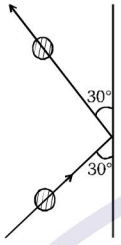
If the point of application of F is changed as given below, the values of P' and Q' shall be :-



(1) 16N, 10N (2) 10N, 16N

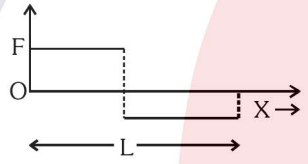
(3) 8 N, 2N (4) None of these

39. A 0.5 kg ball moving with a speed of 48 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.5 seconds, the average force acting on the wall is :-

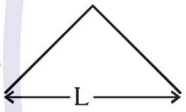


(1) 24 N (2) 48 N (3) 72 N (4) 96 N

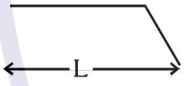
40. A person used force (F), shown in figure to move a load with constant velocity on a given surface. Identify the correct surface profile :-



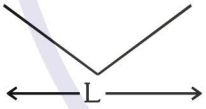
(1)



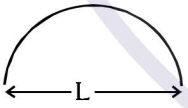
(2)



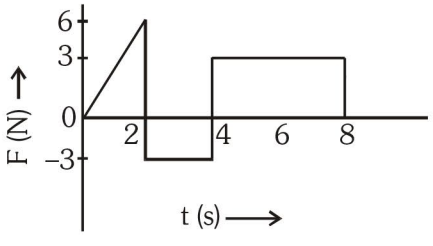
(3)



(4)

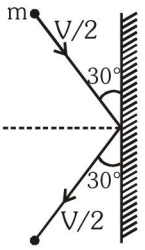


41. The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 6 s is :-



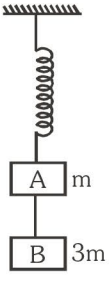
(1) 24 Ns (2) 12 Ns
(3) 6 Ns (4) 3 Ns

42. A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure below. The value of impulse imparted by the wall on the ball will be :-



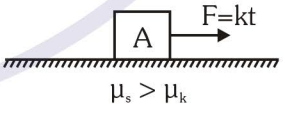
(1) 2mV (2) mV (3) $\frac{mV}{2}$ (4) $\frac{mV}{3}$

43. Two blocks A and B of masses m and 3m 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 respectively :-

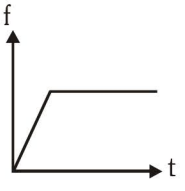


(1) 3g, g (2) g,g (3) 3g, 3g (4) g $\frac{g}{3}$

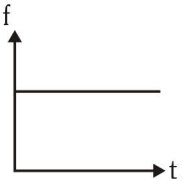
44. A force F = kt is applied to a block A as shown in figure, where t is time in second. The force is applied at t = 0, when the system was at rest. Which of the following graphs correctly gives the frictional force on block A as a function of time ?



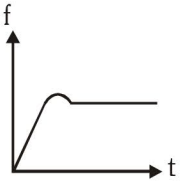
(1)



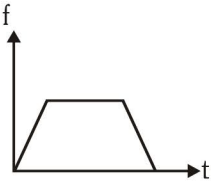
(2)



(3)



(4)

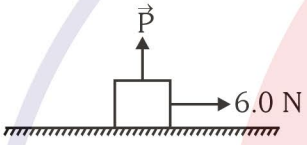


45. A 20 kg body is pushed with just enough force to start it moving across a floor and the same force continues to act afterwards. The coefficient of static and kinetic friction are 0.6 and 0.2 respectively. The acceleration of the body is :- ($g = 10\ m/s^2$)

(1) $1\ m/s^2$ (2) $2\ m/s^2$

(3) $3\ m/s^2$ (4) $4\ m/s^2$

46. A 2.5 kg block is initially at rest on a horizontal surface. A 6.0 N horizontal force and a vertical force $\vec{P}$ are applied to the block as shown in figure. The coefficient of friction for the block and surface is 0.4. The magnitude of friction force when P = 9N ($g = 10\ m/s^2$)

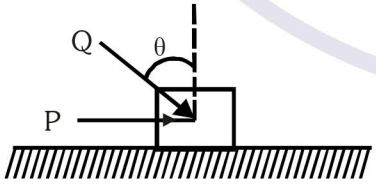


(1) 6.0 N (2) 6.4 N (3) 9.0 N (4) zero

47. 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 $g = 10\ m/s^2$) :-

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

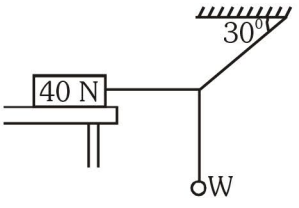
48. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is :-



(1) $\frac{P+Q\sin\theta}{mg+Q\cos\theta}$ (2) $\frac{P\cos\theta+Q}{mg-Q\sin\theta}$

(3) $\frac{P+Q\cos\theta}{mg+Q\sin\theta}$ (4) $\frac{P\sin\theta+Q}{mg-Q\cos\theta}$

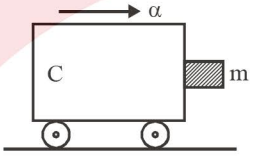
49. In the figure given, the system is in equilibrium. What is the maximum value W can have if the friction force on the 40 N block cannot exceed 12.0 N ?



(1) 3.45 N (2) 6.92 N

(3) 10.35 N (4) 12.32 N

50. A block of mass m is in contact with the cart C as shown in the figure. The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling statisfies :-



(1) $\alpha < \frac{g}{\mu}$ (2) $\alpha > \frac{mg}{\mu}$

(3) $\alpha > \frac{g}{\mu m}$ (4) $\alpha \geq \frac{g}{\mu}$

51. Which one of the following statements is ***incorrect***?

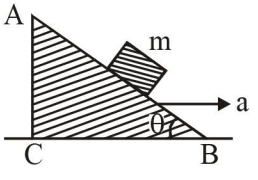
(1) Rolling friction is smaller than sliding friction

(2) Limiting value of static friction is directly proportional to normal reactions

(3) Frictional force opposes the relative motion

(4) Coefficient of sliding friction has dimensions of force

52. A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration 'a' towards the right. The relation between a and θ for the block to remain stationary on the wedge is :-



(1) $a = \frac{g}{\text{cosec}\,\theta}$ (2) $a = \frac{g}{\sin\theta}$

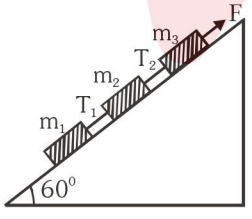
(3) $a = \frac{g}{\tan\theta}$ (4) $a = \frac{g}{\cot\theta}$

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

(1) $\frac{(m_2 - \mu_k m_1)g}{(m_1 + m_2)}$ (2) $\frac{m_1 m_2(1+\mu_k)g}{(m_1 + m_2)}$

(3) $\frac{m_1 m_2(1-\mu_k)g}{(m_1 + m_2)}$ (4) $\frac{(m_2 + \mu_k m_1)g}{(m_1 + m_2)}$

54. Three blocks, of masses $m_1 = 2.0$, $m_2 = 4.0$ and $m_3 = 6.0$ kg are connected by strings on a frictionless inclined plane of 60^0, as shown in the figure. A force F = 120 N is applied upwards along the incline to the uppermost block, causing an upward movement of the blocks. The connecting cords are light. The values of tensions T_1 and T_2 in the cords are



(1) T_1 = 20 N, T_2 = 60 N

(2) T_1 = 60 N, T_2 = 60 N

(3) T_1 = 30 N, T_2 = 50 N

(4) T_1 = 20 N, T_2 = 1 00 N

55. A given object takes n times as much time to slide down a 45^0 rough incline as it takes to slide down a perfectly smooth 45^0 incline. The coefficient of kinetic friction between the object and the incline is given by :

(1) $\left(1 - \frac{1}{n^2}\right)$ (2) $\left(\frac{1}{1-n^2}\right)$

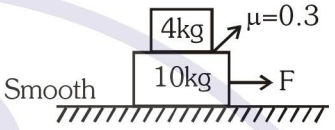
(3) $\sqrt{\left(1 - \frac{1}{n^2}\right)}$ (4) $\sqrt{\left(\frac{1}{1-n^2}\right)}$

56. A block slides with constant velocity on a plane inclined at an angle θ. The same block is pushed up the plane with an initial velocity v_0. The distance covered by the block before coming to rest is :-

(1) $\frac{v_0^2}{2g\sin\theta}$ (2) $\frac{v_0^2}{4g\sin\theta}$

(3) $\frac{v_0^2 \sin^2\theta}{2g}$ (4) $\frac{v_0^2 \sin^2\theta}{4g}$

57.

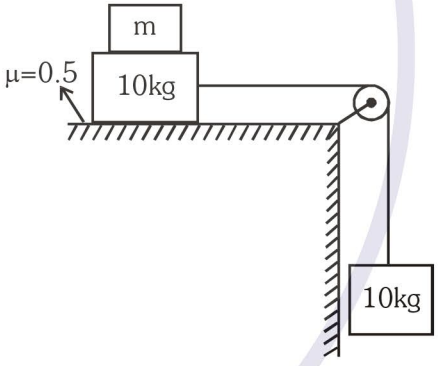


Find maximum force for which both the block will move with same acceleration.

(1) 12N (2) 24N

(3) 36N (4) 42N

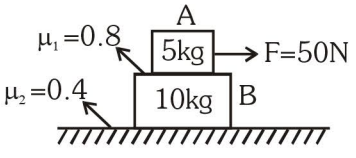
58. Find the minimum value of m that should placed on 10kg. So that system remain at rest.



(1) 5kg (2) 10kg

(3) 15kg (4) 20kg

59. Find acceleration of block A and B. If $\mu_1 = 0.8$ and $\mu_2 = 0.4$



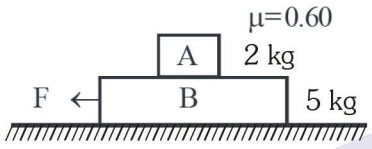
(1) 0 m/s² and 0 m/s²

(2) 1 m/s² and 1/2 m/s²

(3) 2 m/s² and 0 m/s²

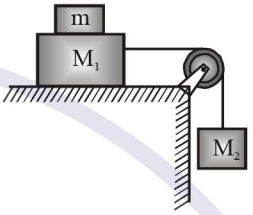
(4) 1/2m/s² and 1/4 m/s²

60. Two blocks (A) 2 kg and (B) 5 kg rest one over the other on a smooth horizontal plane. The coefficient of static and dynamic friction between (A) and (B) is the same and equal to 0.60. The maximum horizontal force F that can be applied to (B) in order that both (A) and (B) do not have any relative motion is :



(1) 42 N (2) 42 kgf
(3) 5.4 kgf (4) 1.2 N

61. Two blocks of masses M_1 = 4 kg and M_2 = 6 kg are connected by a string of negligible mass passing over a frictionless pulley as shown in the figure below. The coefficient of friction betwen the block M_1 and the horizontal surface is 0.4. When the system is released, the masses M_1 and M_2 start accelerating. What additional mass m should be placed over M_1 so that the masses (M_1 + m) slide with a uniform speed ?



(1) 12 kg (2) 11 kg (3) 10 kg (4) 9 kg

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**2**	**3**	**1**	**2**	**3**	**4**	**1**	**1**	**3**	**1**	**1**	**3**	**4**	**3**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**4**	**1**	**2**	**3**	**1**	**3**	**4**	**2**	**4**	**3**	**4**	**3**	**2**	**2**	**4**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**4**	**2**	**1**	**3**	**3**	**1**	**3**	**4**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**1**	**1**	**1**	**2**	**4**	**4**	**4**	**2**	**1**	**1**	**2**	**4**	**2**	**3**	**1**
Que.	61														
Ans.	**2**														