Exercise - I (Conceptual Questions) Build Up Your Understanding

BASIC QUESTION RELATED TO CONCEPT OF FORCE AND NEWTON'S LAWS OF MOTION

1. A particle is in a straight line motion with uniform velocity. A force is not required :-
(1) To increase the speed
(2) To decrease the speed
(3) To maintain the same speed
(4) To change the direction
PLM001

2. Essential characteristic of equilibrium is :-
(1) Momentum equals zero
(2) Acceleration equals zero
(3) K.E. equals zero
(4) Velocity equals zero
PLM002

3. When a constant force is applied to a body, it moves with uniform :-
(1) Acceleration (2) Velocity
(3) Speed (4) Momentum
PLM003

4. A 10 kg mass is accelerated from rest to 30 m/s in 2 s. What force acts on it : -
(1) 300 N (2) 150 N
(3) 75 N (4) 600 N
PLM004

5. A body of mass 80 g is moving with a constant velocity of 4 cm/s on a horizontal frictionless table. The force on the body (in dynes) is :-
(1) Zero (2) 39200
(3) 78400 (4) 8000
PLM005

6. A body of mass 6 kg moving on a horizontal surface with an initial velocity of 8 m/s comes to rest after 3 s. If one wants to keep this body moving on the same surface with a velocity of 8 m/s, the force required is :-
(1) 8 N (2) 16 N (3) Zero (4) 6 N
PLM006

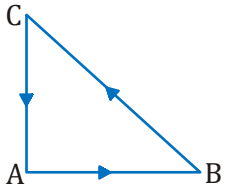
7. An object with a mass 5 kg moves at a constant velocity of 8 m/s. A constant force then acts for 6 seconds on the object giving it a speed of 4 m/s in opposite direction. The acceleration produced is :-
(1) 1.5 m/s^2 (2) –2 m/s^2
(3) 0.67 m/s^2 (4) –0.5 m/s^2
PLM007

8. 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^0 (3) $\frac{1}{\sqrt{m}}$ (4) m
PLM008

9. A ship of mass 5×10^7 kg initially at rest is pulled by a force of 25×10^4 N through a distance of 100m. Neglecting friction, the speed of the ship at this moment is :
(1) 3.0 m/s (2) 1.5 m/s
(3) 1 m/s (4) 2 m/s
PLM009

10. A body of mass 40 gm is moving with a constant velocity of 2cm/sec on a horizontal frictionless table. The force on the table by the body is :-
(1) 39200 dyne (2) 160 dyne
(3) 80 dyne (4) zero
PLM010

11. Three forces start acting simultaneously on a particle moving with velocity $\vec{v}$. These forces are represented in magnitude and direction by the three sides of a triangle ABC (as shown). The particle will now move with velocity



(1) less than $\vec{v}$
(2) greater than $\vec{v}$
(3) $\vec{v}$, in the direction of largest force BC
(4) $\vec{v}$ remains unchanged
PLM011

12. A body with mass 5 kg is acted upon by a force $\vec{F}=(-3\hat{i}+4\hat{j})N$. If its initial velocity at t = 0 is $\vec{u}=(6\hat{i}-12\hat{j})ms^{-1}$, the time at which it will just have a velocity along the Y-axis is :-
(1) never (2) 10 s (3) 2 s (4) 15 s
PLM012

13. When forces F_1 , F_2 , F_3 are acting on a particle of mass m such that F_2 and F_3 are mutually perpendicular then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is :-
(1) F_1/m (2) F_2F_3/mF_1
(3) $(F_2 - F_3)/m$ (4) F_2/m
PLM013

14. A stone of mass 1 kg is lying on the floor of a train which is accelerating with 1 ms^{-2}. The net force acting on the stone is :-
(1) zero (2) 1 N (3) 5 N (4) 10 N
PLM014

15. A car accelerates on a horizontal road due to the force exerted by :-
(1) the engine of the car
(2) the driver of the car
(3) the car on earth
(4) the road on the car
PLM015

MOMENTUM, IMPULSE, RATE OF CHANGE OF MOMENTUM AND AVERAGE FORCE RELATED PROBLEMS

16. Newton's II law of motion connects :
(1) Momentum and acceleration
(2) Change of momentum and velocity
(3) Rate of change of momentum and external force
PLM016
(4) Rate of change of force and momentum

17. When we kick a stone, we get hurt. Due to which of the following properties of stone does it happens ?
(1) Inertia (2) Velocity
(3) Reaction (4) Momentum
PLM017

18. A force of 20 N acts on a body of mass 10 kg for 20 seconds. The change in its momentum is
(1) 40 kg-m/s (2) 100 kg-m/s
(3) 400 kg-m/s (4) 200 kg-m/s
PLM018

19. A player catches a ball of 100 g moving with a speed of 5 m/s. If the time taken to complete the catch is 0.25 s, the force exerted on the player's hand is :-
(1) 8 N (2) 4 N (3) 2 N (4) 0 N
PLM019

20. A football of mass 0.5 kg coming towards player with a velocity of 10 m/s. Player hit straight back the football with velocity 15 m/s. If the contact time is 0.02 second then the average force involved is:-
(1) 250 N (2) 1250 N
(3) 500 N (4) 625 N
PLM020

21. A 100 g tennis ball coming at a speed of 20 m/s is hit straight back by a bat to speed of 40 m/s. The magnitude of the average force F on the ball, when it is in contact for 5 ms with the bat is:-
(1) 1200 N (2) 6000 N
(3) 2400 N (4) 1000 N
PLM021

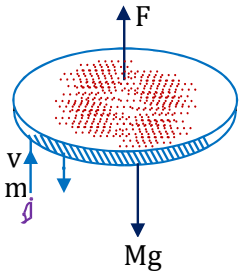
22. A ball weighing 50 g hits a hard surface vertically with a speed of 25 m/s and rebounds with the same speed. The ball remains in contact with the surface for 0.05 s. The average force exerted by the surface on the ball is :-
(1) 100 N (2) 25 N (3) 50 N (4) 5 N
PLM022

23. A tennis ball is dropped on the floor from a height of 10 m. It rebounds to a height of 5 m. The ball was in contact with the floor for 0.01 s. What was its average acceleration during the contact ? ($g=10m/s^2$)
(1) 800 m/s^2 (2) 200 m/s^2
(3) 1600 m/s^2 (4) 2400 m/s^2
PLM023

24. A 150 g ball, in horizontal flight with a speed of 40 m/s, is struck by a bat. After leaving the bat, the ball travels in the opposite direction with speed 40 m/s. If the impact time for the ball-bat collision is 1.20 ms, what average force acts on the ball ?
(1) 1500 N (2) 1000 N
(3) 10000 N (4) 9800 N
PLM024

25. n bullet strike per second elastically on a wall with speed v and rebound. What will be the force exerted on the wall by bullets if mass of each bullet is m :-
(1) mnv (2) 4mnv
(3) 2mnv (4) $\frac{mnv}{2}$
PLM025

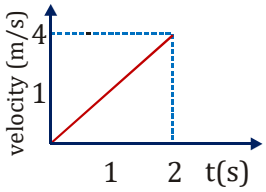
26. A disc of mass 2 kg is kept floating horizontally in air by firing bullets of mass 0.1 kg each vertically at it, at the rate of 5 per second. If the bullets rebound with the same speed, the speed with which these are fired will be–



(1) 1·96 m/s (2) 0·98 m/s
(3) 9·8 m/s (4) 19.6 m/s

PLM026

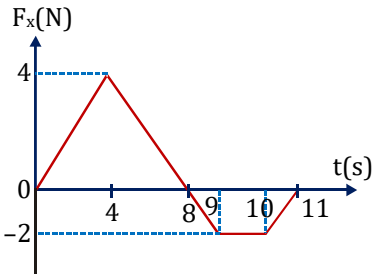
27. For a body of 25 kg mass, the velocity-time graph is shown in figure. The force acting on the body is :



(1) 25 N (2) 50 N
(3) 12.5 N (4) 100 N

PLM027

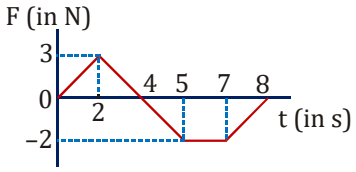
28. A 2 kg toy car starts from rest (i.e. at t = 0, v = 0) can move along x-axis. Graph shows force F_x, acting on the car. The velocity of the car at t = 10 s is :-



(1) 2 m/s (2) 6 m/s
(3) 6.5 m/s (4) 5 m/s

PLM028

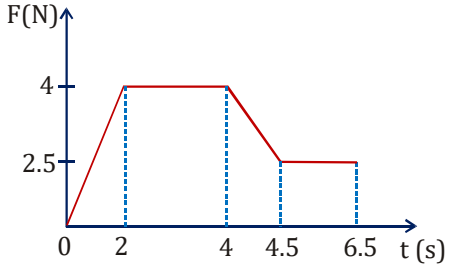
29. Force-time graph for the motion of a body is shown in fig. Change in linear momentum between 0 to 8 s is :-



(1) Zero (2) 4 N-s (3) 8 N-s (4) 6 N-s

PLM029

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



(1) 9.25 ms^{-1} (2) 5 ms^{-1}
(3) 14.3 ms^{-1} (4) 4.25 ms^{-1}

PLM030

31. Which one of the following statements is not true?

(1) The same force for the same time causes the same change in momentum for different bodies.
(2) The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction in which the force acts.
(3) A greater opposing force is needed to stop a heavy body than a light body in the same time, if they are moving with the same speed.
(4) The greater the change in the momentum in a given time, the lesser is the force that needs to be applied.

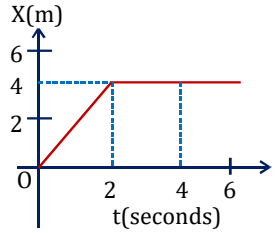
PLM031

32. If force F = 50 – 20t, then impulse in interval [0, t] :-

(1) $50t - 10t^2$ (2) 50t – 10
(3) $50 - t^2$ (4) $25t^2$

PLM032

33. In the figure given below, the position–time graph of a particle of mass 0·1 kg is shown. The impulse at t=2 sec is –



(1) 0·2 kg-m/s (2) –0·2 kg-m/s
(3) 0·1 kg-m/s (4) –0·4 kg-m/s

PLM033

34. Gravel is dropped onto a conveyer belt at a rate of 1.5 kg/s. The extra force required in newton to keep the belt moving at 3 m/s is :-
(1) 1.5 N (2) 2 N (3) 4 N (4) 4.5 N

PLM034

35. A block of metal weighing 1.5 kg is resting on a frictionless plane. It is struck by a jet releasing water at a rate of 3 kg/s with a speed of 10 m/s. The initial acceleration of the block will be :-
(1) 20 m/s^2 (2) 5 m/s^2
(3) 10 m/s^2 (4) 15 m/s^2

PLM035

36. A block of metal weighing 2 kg is resting on a frictionless plane. It is struck by a jet releasing water at a rate of 1 kg/s and a speed of 5 m/s. The initial acceleration of the block will be :-
(1) 2.5 m/s^2 (2) 5 m/s^2
(3) 10 m/s^2 (4) 20 m/s^2

PLM036

37. If the force on a rocket moving in force free space with an exhaust velocity of gases 400 m/sec is 300N, then the rate of combustion of the fuel, is :-
(1) 1.3 kg/s (2) 0.75 kg/s
(3) 2.7 kg/s (4) 0.3 kg/s

PLM037

38. A satellite in force free space sweeps stationary interplanetary dust at a rate $(dM/dt) = + \alpha v^2$. Here v is the velocity. The acceleration of satellite of mass M is :-
(1) $-2\alpha v^2/M$ (2) $-3\alpha v^2/M$
(3) $-\alpha v^3/M$ (4) $-\alpha v^2$

PLM038

39. A rocket of mass 60 kg. is fired in a gravity free space is ejecting gases with velocity 300 m/s at the rate of 2 kg/s. What will be the initial acceleration of the rocket ?
(1) 30 m/s^2 (2) 5 m/s^2
(3) 10 m/s^2 (4) 15 m/s^2

PLM039

40. For a Rocket propulsion velocity of exhaust gases relative to rocket is 1.6 km/s. If mass of rocket system is 800 kg, then the rate of fuel consumption for a rocket to rise up with an acceleration 4.2 m/s^2 will be :-
(1) 12.25 kg/s (2) 17.5 kg/s
(3) 7 kg/s (4) 5.2 kg/s

PLM040

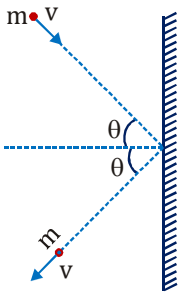
41. The force on a rocket, moving in gravity free space is 210 N. If the gases ejects from the rocket with speed 300 m/s (w.r.t. rocket) then the rate of combustion of the fuel is :-
(1) 0.07 kg s^{-1} (2) 1.4 kg s^{-1}
(3) 0.7 kg s^{-1} (4) 10.7 kg s^{-1}

PLM041

42. A rocket of mass 800 kg is to be projected vertically upwards. The gases are exhausted vertically downwards with velocity 40 m/s with respect to the rocket. What is the minimum rate of burning fuel, so as to just lift the rocket upwards against the gravitational attraction ? (Take g = 10 m/s^2)
(1) 80 kg/s (2) 400 kg/s
(3) 200 kg/s (4) 800 kg/s

PLM042

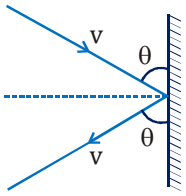
43. A ball is moving towards the wall as shown in diagram then the momentum of the ball is conserved



(1) along the wall
(2) along the normal of the wall
(3) along any direction
(4) Both (1) and (2)

PLM043

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

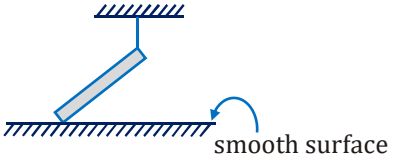


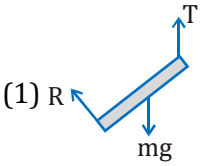
(1) $2av^2d\cos\theta$ (2) $2av^2d\sin\theta$
(3) $2avd\cos\theta$ (4) $avd\cos\theta$

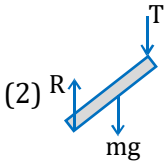
PLM044

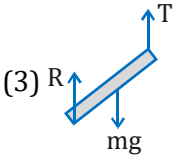
FREE BODY DIAGRAM, NEWTON'S THIRD LAW

45. Which figure represents the correct F.B.D. of rod of mass m as shown in figure :-



(1) 

(2) 

(3) 

(4) None of these

PLM045

46. Working of rocket or jet is based on :-
(1) Newton's I law (2) Newton's II law
(3) Newton's III law (4) All the three laws

PLM046

47. 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

PLM047

48. A man is at rest in the middle of a pond on perfectly smooth ice. He can get himself to the shore by making use of Newton's :-
(1) First law
(2) Second law
(3) Third law
(4) Law of gravitation

PLM048

49. A material body A of mass m exerts a force on another material body B of mass 2m. If the acceleration of B be a, the magnitude of the acceleration of A is :-
(1) Zero (2) a
(3) 2a (4) a/2

PLM049

50. If the force of gravity suddenly increase, then :-
(1) The mass of all bodies will increase
(2) The weight of all bodies will increase
(3) Both mass and weight of all bodies will increase
(4) Neither mass nor weight of all bodies will increase

PLM050

51. Two bodies of masses 5 kg and 8 kg are acted upon by the same force. If the acceleration of lighter body is 2 m/s^2, then the acceleration of the heavier body is :-
(1) 4 m/s^2 (2) 2.5 m/s^2
(3) 6.25 m/s^2 (4) 1.25 m/s^2

PLM051

52. Action and reaction :- (For a given system)
(a) Act on the same object
(b) Have same direction
(c) Have different magnitudes
(d) Have non-zero resultant
(1) a, b, c
(2) b, c, d
(3) All of the above
(4) None of the above

PLM052

53. Weight is defined as :-
(1) Force of attraction exerted by the earth
(2) Mass of a body
(3) Nature of a body
(4) None of these

PLM053

54. A rider on horse falls back when horse starts running, all of a sudden because :-
(1) rider is taken back
(2) rider is suddenly afraid of falling
(3) inertia of rest keeps the upper part of body at rest while lower part of the body moves forward with the horse.
(4) none of the these

PLM054

55. The force exerted by the floor of an elevator on the foot for a person standing there, is more than the weight of the person, if the elevator is
A. Going up with increasing speed
B. Going down with decreasing speed
(1) A is true but B is false
(2) A is false but B is true
(3) Both A and B are true
(4) Both A and B are false

PLM055

56. A cork of mass 10 g is floating on water. The net force acting on the cork is :-
(1) 10 N (2) 10^{-3} N (3) 10^{-2} N (4) zero

PLM056

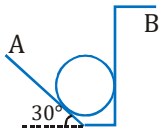
57. Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m. Which of the following statements is true ? (counted from the bottom)
(1) The force on the 3rd coin due to all the coins on its top is equal to 3mg (downwards).
(2) The force on the 6th coin due to the 7th coin is 4mg (downwards)
(3) The reaction of the 6th coin on the 7th coin is 3mg (upwards).
(4) The total force on the 10th coin is 9mg (downwards)

PLM057

58. Ten one rupees coins are put on top of each other on a table. Each coin has a mass 'm' kg., then the force on the 3rd coin (counted from the bottom) due to all the coins on its top :-
(1) 3 mg (2) 7 mg (3) 2 mg (4) 5 mg

PLM058

59. The 50 kg homogeneous smooth sphere rests on the 30° incline A and bears against the smooth vertical wall B. The contact forces at A and B are:-



(1) $N_A = \frac{1000}{\sqrt{3}}N, N_B = \frac{500}{\sqrt{3}}N$

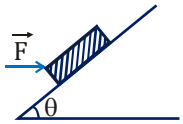
(2) $N_A = \frac{1000}{\sqrt{3}}N, N_B = \frac{1000}{\sqrt{3}}N$

(3) $N_A = \frac{500}{\sqrt{3}}N, N_B = \frac{500}{\sqrt{3}}N$

(4) $N_A = \frac{500}{\sqrt{3}}N, N_B = \frac{400}{\sqrt{3}}N$

PLM059

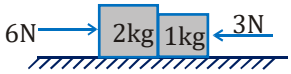
60. The figure shows a horizontal force $\vec{F}$ acting on a block of mass m placed on an inclined plane (angle θ). What is the normal reaction on the block?



(1) mgsinθ + Fcosθ (2) mgsinθ – Fcosθ
(3) mgcosθ – Fsinθ (4) mgcosθ + Fsinθ

PLM060

61. Two forces of 6N and 3N are acting on the two blocks of 2kg and 1kg kept on frictionless floor. What is the force exerted on 2kg block by 1kg block?



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

PLM061

62. Two blocks of masses 2 kg and 1 kg are in contact with each other on a frictionless table. When a horizontal force of 3.0 N is applied to the block of mass 1 kg the value of the force of contact between the two blocks is -
(1) 2 N (2) 3 N (3) 5 N (4) 1 N

PLM062

63. A person is standing in an elevator. In which situation he finds his weight more ?
(1) when the elevator moves downward with constant velocity
(2) when the elevator moves downward with constant acceleration
(3) when the elevator moves upward with uniform velocity
(4) when the elevator moves downward with decreasing velocity

PLM063

64. A man weighs 80 kg. He stands on a weighing scale in a lift which is moving downwards with a uniform acceleration of 5m/s². What would be the reading on the scale ? (g = 10 m/s²)
(1) Zero (2) 400 N
(3) 800 N (4)1200 N

PLM064

65. A man, of mass 60 kg, is riding in a lift. The ratio of the apparent weights of the man when the lift is accelerating upwards and downwards at 2 m/s² is:-
(Taking g = 10 m/s²)
(1) 2 : 3 (2) 1 : 1
(3) 3 : 2 (4) none of these

PLM065

EQUILIBRIUM FORCES OR CONSTANT FORCES – LAMI THEOREM

66. Two persons hold a rope of negligible weight tightly at its ends so that it is horizontal. A 15 kg weight is attached to the rope at the mid point which is now no longer remains horizontal. The minimum tension required to completely straighten the top is

(1) 15 kg (2) 15/2 kg
(3) 5 kg (4) Infinitely large

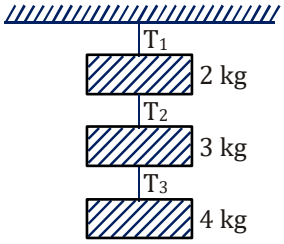
PLM066

67. A boy of mass 40 kg is hanging from a horizontal branch of a tree. The tension in his arms is minimum when the angle between the arms is :-

(1) 0° (2) 90° (3) 120° (4) 180°

PLM067

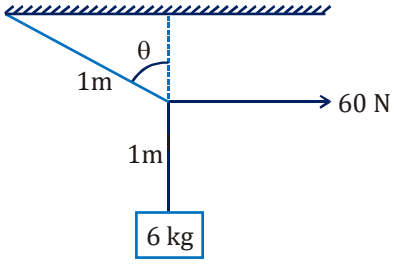
68. Find the ratio T_1/T_3 for the system shown in fig.



(1) 2 : 1 (2) 1 : 4 (3) 9 : 4 (4) 3 : 1

PLM068

69. A mass of 6 kg is suspended by a rope of length 2 m from a ceiling. A force of 60 N is applied in horizontal direction at the mid point of the rope. What is the angle between the rope and the vertical in equilibrium :-

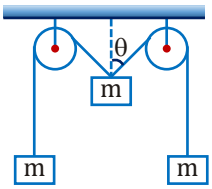


(1) $\tan^{-1}\left(\frac{4}{5}\right)$ (2) $\tan^{-1}\left(\frac{5}{4}\right)$

(3) $\tan^{-1}\left(\frac{5}{6}\right)$ (4) 45°

PLM069

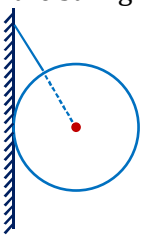
70. The pulleys and strings shown in the fig. are smooth and are of negligible mass. For the system to remain in equilibrium, the angle θ should be



(1) 0° (2) 30° (3) 45° (4) 60°

PLM070

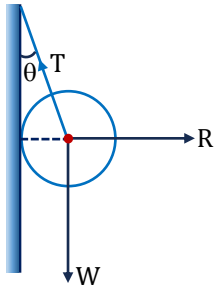
71. A uniform sphere of weight W and radius 3 m is being held by a string of length 2m attached to a frictionless wall as shown in the figure. The tension in the string will be :-



(1) 5 W/4 (2) 15 W/4
(3) 15 W/16 (4) none of these

PLM071

72. 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 not correct ?

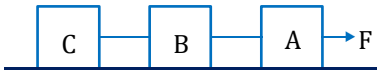


(a) $\vec{R}+\vec{T}+\vec{W}=0$ (b) $T^2 = R^2 + W^2$
(c) T = R + W (d) R = W tan θ
(1) a (2) b (3) c (4) d

PLM072

MOTION OF BODIES IN CONTACT OR CONNECTED BY STRINGS, PULLEY SYSTEM

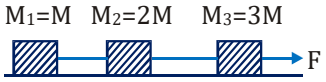
73. Three identical blocks of mass m = 2kg are drawn by a force of 10.2 N on frictionless surface. The tension (in N) in the string between the blocks B and C is :-



(1) 9.2 (2) 8 (3) 3.4 (4) 9.8

PLM073

74. Three masses M_1, M_2 and M_3 are lying on a frictionless table. The masses are connected by massless threads as shown. The mass M_3 is pulled by a constant force F as shown. The tension in the thread between masses M_2 and M_3 is



(1) $\frac{F}{2}$ (2) $\frac{F}{3}$ (3) $\frac{F}{4}$ (4) $\frac{F}{6}$

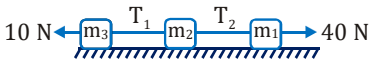
PLM074

75. Three blocks are connected as shown in fig. on a horizontal frictionless table. If M_1 = 1 kg, M_2 = 8 kg, M_3 = 27 kg and F = 36N, Then T' will be :-

(1) 18 N (2) 8 N
(3) 35 N (4) 27 N

PLM075

76. Three blocks of masses m_1, m_2 and m_3 are connected by massless strings as shown in the figure on a frictionless table. Forces of 10 N and 40 N are applied on them as shown in diagram. If m_1 = 10kg, m_2 = 6 kg and m_3 = 4 kg, then tension T_2 will be:-



(1) 10 N (2) 20 N
(3) 25 N (4) 35 N

PLM076

77. Two bodies A and B of masses 10 kg and 15 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light string. If T represents the tension in the string when a horizontal force F = 500 N is applied to A (as shown in figure 1) and T' be the tension when F = 750 N is applied to B (figure2), then which of the following is true?

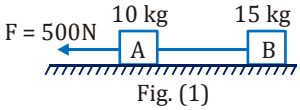


Fig. (1)

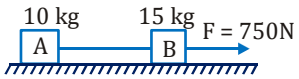
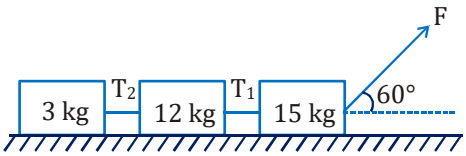


Fig. (2)

(1) T = T' = 500 N
(2) T = T' = 250 N
(3) T = 300 N, T' = 200 N
(4) T = 300 N, T' = 300 N

PLM077

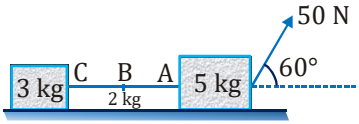
78. The surface shown in diagram is frictionless and T_1 is 30 N, then the value of F is :-



(1) 30 N (2) 60 N
(3) 120 N (4) 69.36 N

PLM078

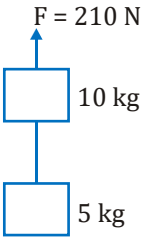
79. Two blocks of masses 5 kg and 3 kg connected by a rope of mass 2 kg are resting on a frictionless floor as shown in the following figure. If a constant force of 50 N is applied to 5 kg block, then the tension in the rope at points A, B and C are respectively given by:



(1) 7.5N, 10N, 12.5N (2) 12.5N, 10N, 7.5N
(3) 20N, 20N, 20N (4) 50N, 50N, 50N

PLM079

80. Two blocks of masses 10 kg and 5 kg are connected from a massless string as shown in figure. The system is pulled up with a force of 210 N, then the acceleration of the system is :-



(1) 14 m/s² (2) 11 m/s²
(3) 4 m/s² (4) zero

PLM080

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

(1) 80 N (2) 40 N

(3) $40\sqrt{3}$ N (4) $\frac{40}{\sqrt{3}}$ N

PLM081

82. A monkey of mass 15 kg is holding a vertical rope. The rope will not break when a mass of 30 kg is suspended from it but will break if the mass exceeds 30 kg what is the maximum acceleration with which the monkey can climb up along the rope ? (g = 10 m/s^2)

(1) 15 m/s^2 (2) 10 m/s^2

(3) 25 m/s^2 (4) 20 m/s^2

PLM082

83. A uniform rope of length L resting on a frictionless horizontal surface is pulled at one end by a force F. What is the tension in the rope at a distance ℓ from the end where the force is applied.

(1) F (2) F(1+ℓ/L)

(3) F/2 (4) F(1–ℓ/L)

PLM083

84. A string of length L and mass M is lying on a horizontal table. A force F is applied at one of its ends. Tension in the string at a distance x from the end other than at which force is applied is

(1) Zero (2) Fx/L

(3) F(L – x)/L (4) F(L – x)/M

PLM084

85. A block of mass m is pulled along a horizontal frictionless surface by a rope of mass m. If a force F is applied at one end of the rope, the tension at the mid-point of the rope is :-

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

PLM085

86. Two particles of masses m and 2M (M > m) are connected by a cord that passes over a massless and frictionless pulley. The tension T in the string and the acceleration a of the particles is :-

(1) $T=\frac{2mM}{(M-m)}g;\ a=\left(\frac{M-m}{M+m}\right)g$

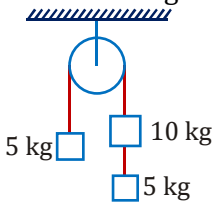
(2) $T=\frac{4mM}{(2M+m)}g;a=\left(\frac{2M-m}{2M+m}\right)g$

(3) $T=\left(\frac{2M-m}{2M+m}\right)g;\ a=\left(\frac{4mM}{M+m}\right)g$

(4) $T=\left(\frac{2Mm}{2M+m}\right)g;\ a=\left(\frac{4mM}{2M+m}\right)g$

PLM086

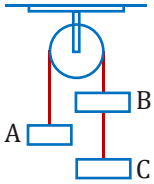
87. What will be the acceleration of the blocks if they are set free to move?
(g = acceleration due to gravity)



(1) g (2) g/2 (3) g/3 (4) g/4

PLM087

88. Three blocks each of mass 5 kg are hanging on a string passing over a fixed pulley as shown in fig. What is the tension in the string connecting blocks A and B.

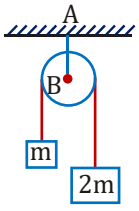


(1) Zero (2) 33.3 N

(3) 66.67 N (4) 50 N

PLM088

89. In the arrangement shown in the figure, the pulley has a mass 3m. Neglecting friction on the contact surface, the force exerted by the supporting rope AB on the ceiling is :-

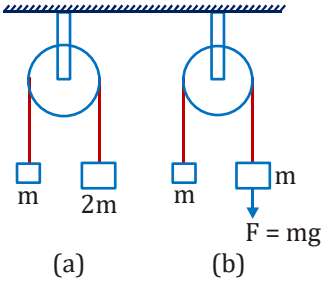


(1) 5.67mg (2) 3mg

(3) 4mg (4) 2.67mg

PLM089

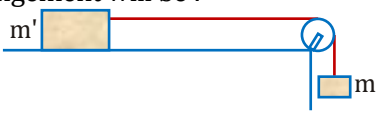
90. The pulley arrangements shown in the figure are ideal, the mass of the rope being negligible. In case (a) mass m is lifted by attaching a mass of 2m to the other end of the rope. In case (b) the mass m is connected with an another mass m which is pulling by a rope with a constant downward force F = mg, 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)

PLM090

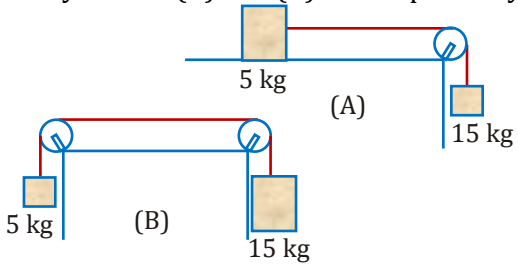
91. In the fig. given below masses m and m' are tied with a thread passing over a pulley, m' is on a frictionless horizontal surface. If acceleration due to gravity is g, the acceleration of m in this arrangement will be :-



(1) g
(2) m'g/(m + m')
(3) mg/(m + m')
(4) mg/(m – m')

PLM091

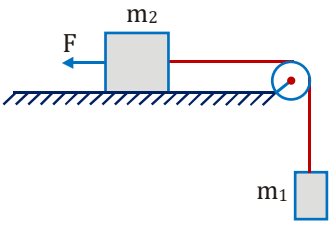
92. Two bodies of masses 15 kg and 5 kg are arranged in two different ways as shown in fig. (A) and (B). If the pulleys and the table are perfectly smooth, the acceleration of the 5 kg body in case (A) and (B) are respectively :-



(1) 3g/4 and g/2
(2) g/5 and g/2
(3) g/2 and 3g/4
(4) 15g/2 and g/5

PLM092

93. A constant force F = $m_1g/2$ is applied on the block of mass m_2 as shown in figure. The string and the pulley are light and the surface of the table is smooth. Find the acceleration of m_2



(1) $\frac{m_2g}{m_1+m_2}$
(2) $\frac{m_1g}{m_1+m_2}$
(3) $\frac{m_1g}{2(m_1+m_2)}$
(4) $\frac{m_2g}{2(m_1+m_2)}$

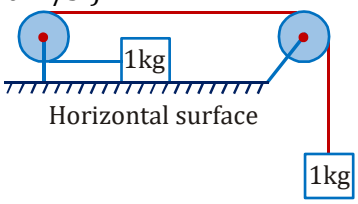
PLM093

94. Two bodies A (20 kg) and B (30 kg) tied with a light string are placed on a frictionless table. A force F acting at B pulls this system with an acceleration of $3ms^{-2}$. The tension in the string is:

(1) 60 N
(2) 120 N
(3) 90 N
(4) 140 N

PLM094

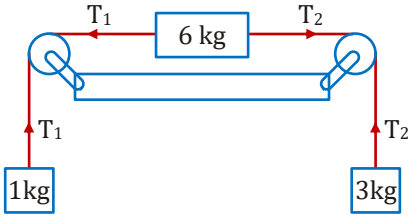
95. Consider the system as shown in the figure. The pulley and the string are light and all the surfaces are frictionless. The tension in the string is
($g = 10\ m/s^2$)



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

PLM095

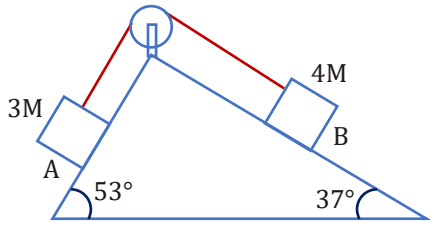
96. Three masses of 1 kg, 6 kg and 3 kg are connected to each other with threads and are placed on a table as shown in figure. The ratio $\frac{T_1}{T_2}$ is :- (Take $g = 10\ m/s^2$)



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

PLM096

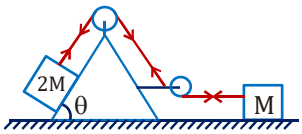
97. Two blocks of mass 3M and 4M are resting on a frictionless inclined planes as shown in fig. then



(1) The block A moves down the plane
(2) The block B moves down the plane
(3) Both the blocks remain at rest
(4) Both the blocks move down the plane.

PLM097

98. The acceleration of the block shown in figure :-

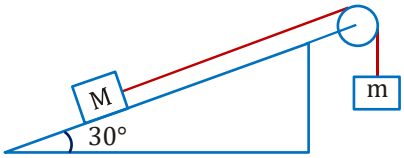


(1) 0 (2) $\frac{g\sin\theta}{2}$

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

PLM098

99. In the fig. mass m = 10 kg then in order to keep it at rest, the value of mass M will be:



(1) 10 kg (2) 5 kg
(3) 20 kg (4) 40 kg

PLM099

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

(1) 4 kg and zero kg (2) zero kg and 4 kg
(3) 4 kg and 4 kg (4) 2 kg and 2 kg

PLM100

101. Two masses m_1 and m_2 are joined by a spring as shown. The system is dropped to the ground 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.

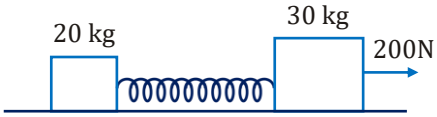
PLM101

102. Two masses of 1 kg and 2 kg respectively are connected by a massless spring as shown in figure. A force of 20 N acts on the 2 kg mass at the instant when the 1 kg mass has an acceleration of 10 ms^{-2} towards right, the acceleration of the 2 kg mass is:-

(1) 2 ms^{-2} (2) 5 ms^{-2}
(3) 10 ms^{-2} (4) 20 ms^{-2}

PLM102

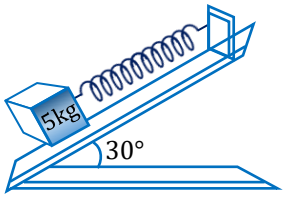
103. Two masses of 20 kg and 30 kg respectively are connected by a massless spring as shown in the figure. A force of 200 N acts on the 30 kg mass. At the instant shown the 20 kg mass has an acceleration 2 m/s^2 rightwards. What is the acceleration of 30 kg mass ?



(1) Zero (2) 5.3 m/s^2
(3) 4 m/s^2 (4) 8 m/s^2

PLM103

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



(1) 50 N (2) 25 N (3) 500 N (4) 10 N

PLM104

105. A man is standing at a spring platform. Reading of spring balance is 60 kg-wt. If the man jumps off from the platform, then reading of spring balance

(1) First increases then decreases to zero
(2) Decreases
(3) Increases
(4) Remains same

PLM105

FRAME OF REFERENCE - INTERTIAL OR NON INERTIAL FRAME, PSEUDO FORCE, MECHANICAL ADVANTAGE

106. In Newton's second Law $\vec{F}=m\vec{a}$ (for constant mass m), $\vec{a}$ is the acceleration of the mass m with respect to
(1) any observer
(2) any inertial observer
(3) an observer at rest only
(4) an observer moving with uniform speed only

PLM106

107. A frame will be inertial, if it moves with respect to another inertial frame with a constant :-
(1) Linear velocity
(2) Angular velocity
(3) Linear acceleration
(4) All of the above

PLM107

108. A small sphere of mass m is suspended by a string from the ceiling of a car. If the car begins to move with a constant acceleration $\frac{g}{2}$, then the tension in the string is :-

(1) mg (2) $\frac{3}{2}$mg
(3) $\frac{\sqrt{5}}{2}$mg (4) $\frac{mg}{2}$

PLM108

109. A boy sitting on the upper berth in the compartment of an accelerated train, which is just left the railway station, drops an apple aiming at the open hand of his brother vertically below his hands at a distance of about 2 m. The apple will fall :-
(1) In the hand of his brother
(2) Slightly away from the hands of his brother in the direction of motion of the train
(3) Slightly away from the hands of his brother in the direction opposite to the direction of motion of the train
(4) None of the above

PLM109

110. The force exerted by a person on the floor of an elevator is less than the weight of the person if the elevator is :-
(a) Going up and slowing down
(b) Going up and speeding up
(c) Going down and slowing down
(d) Going down and speeding up
(1) a, c (2) b, c (3) a, d (4) b, d

PLM110

111. Two equal masses are kept on the pans of a simple balance in a lift accelerating upward. Then
(1) Pans will remain at the same level.
(2) Nothing can be said as data is incomplete
(3) Left side pan will lower down.
(4) Right side pan will lower down.

PLM111

112. The ratio of weights of a man in a lift moving with acceleration 'a' in upward direction and moving with acceleration 'a' in downward direction is 3 : 1. Then the value of a is :-

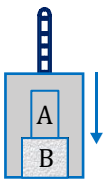
(1) $\frac{g}{3}$ (2) $\frac{g}{2}$ (3) $\frac{g}{5}$ (4) $\frac{4}{3}$g

PLM112

113. A man weighing 100 kg carries a load of 10 kg on his head. He jumps from a tower with the load on his head. What will be the weight of the load as experienced by the man ?
(1) zero
(2) 10 kg
(3) slightly more than 10 kg
(4) 110 kg

PLM113

114. The elevator shown in figure is descending, with a retardation of 2 m/s^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

PLM114

115. Drums of oil are carried in a moving truck. Suddenly breaks are applied on the truck then the surface of the oil in the drum will -
(1) Remain unaffected
(2) Rise in the forward direction
(3) Rise in the backward direction
(4) Nothing is certain

PLM115

116. A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be :–
(1) mg sinθ (2) mg
(3) mg/cosθ (4) mg cosθ

PLM116

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

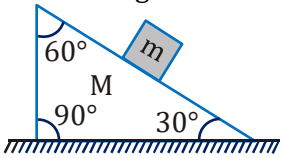
(3) $\frac{gx}{\sqrt{x^2-1}}$ (4) $\frac{g}{\sqrt{x^2-1}}$

PLM117

118. An object of mass 2 kg moving with constant velocity $10\hat{i}$ m/s is seen in a frame moving with constant velocity $10\hat{i}$ m/s. The value of 'pseudo force' acting on object in this frame will be :-
(1) 20 N (2) 0 N (3) 10 N (4) 2 N

PLM118

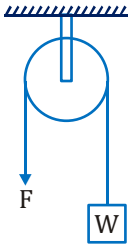
119. A triangular wedge of mass M rests on a smooth surface as shown in figure. A cubical block of mass m rests on the inclined surface of wedge. If all surfaces are frictionless, the horizontal force that must be applied to the wedge so as to keep the block stationary relative to the wedge is :-



(1) Mg tan30° (2) mg tan30°
(3) (M+m)g tan30° (4) (M+m)g cos30°

PLM119

120. What is the mechanical advantage of single fixed pulley ?



(1) 1 (2) 2 (3) 0.5 (4) 4

PLM120

121. The force required to lift a 400 kg wt is 80 kg wt then the mechanical advantage is :-
(1) 8 (2) 10 (3) 5 (4) 4

PLM121

FRICTION

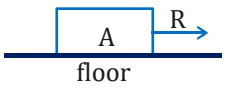
122. The coefficient of static friction between two surfaces depend on
(1) the normal reaction on the surface
(2) the shape of the surface in contact
(3) the area of contact
(4) None of the above

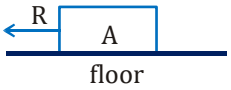
PLM122

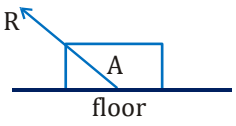
123. A girl horizontally press her physics text book against a rough vertical wall with her hand. The direction of the frictional force on the book exerted by the wall is :-
(1) downwards (2) upwards
(3) out from the wall (4) into the wall

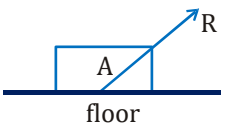
PLM123

124. A box 'A' is lying on the horizontal floor of the compartment of a train running along horizontal rails from left to right. At time 't', it retards. Then the reaction R by the floor on the box is given best by:-

(1) 

(2) 

(3) 

(4) 

PLM124

125. A horizontal force F acts on the block of mass m and the block remains stationary, the value of friction force on the block is :-
(1) μmg (2) μmg – F
(3) F (4) zero
PLM125

126. A block of mass 4 kg is placed on the floor. The coefficient of static friction is 0.4. Force of 8 N is applied on the block. The force of friction between the block and the floor is
(1) 16 N (2) 8.0 N (3) 2.0 N (4) zero
PLM126

127. A block of mass 3 kg is placed on a rough horizontal surface (μ_s = 0.4). A horizontal force of 8.7 N is applied on the block. The force of friction between the block and floor is :-
(1) 8.7 N (2) 12N (3) 10N (4) zero
PLM127

128. The frictional force of the air on a body of mass 0.5 kg, falling with an acceleration of 9.0 m/s^2, will be (g = 10 m/sec^2) :
(1) 4.9 N (2) 0.5 N
(3) 4.5 N (4) 5 N
PLM128

129. Consider a car moving on a straight road with a speed of 100 m/s. The distance at which car can be stopped is [μ_k = 0.5]
(1) 1000 m (2) 800 m
(3) 400 m (4) 100 m
PLM129

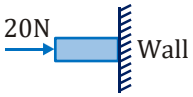
130. A block of mass 10 kg is placed on a long trolley. The coefficient of friction between the block and trolley is 0.2. The trolley accelerates from rest with 0.5 m/s^2 for 20 s. then what is the friction force ?
(1) 20 N (2) 100 N (3) 5 N (4) 10 N
PLM130

131. A 20 kg block is initially at rest. A 75 N force is required to set the block in motion. After the motion start, a force of 60 N is applied to keep the block moving with constant speed. The coefficient of static friction is :-
(1) 0.6 (2) 0.52
(3) 0.44 (4) 0.375
PLM131

132. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 5 m/s^2, the frictional force acting on the block is :-
(1) 5N (2) 6N (3) 10N (4) 15N
PLM132

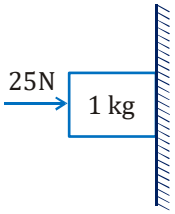
133. A body of mass 10 kg lies on a rough horizontal surface. When a horizontal force of F newton acts on it, it gets an acceleration of 5m/s^2, and when the horizontal force is doubled, it gets an acceleration of 18m/s^2. The coefficient of friction between the body and the horizontal surface is :-
(1) 0.2 (2) 0.4 (3) 0.6 (4) 0.8
PLM133

134. A horizontal force of 20 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and wall is 0.15. The weight of the block is :-



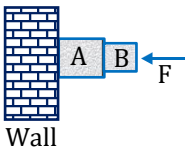
(1) 20 N (2) 3 N
(3) 30 N (4) 0.3 N
PLM134

135. A block of mass 1 kg. is pressed against a wall with a horizontal force of 25 N as shown in the figure. If the coefficient of friction between the wall and the block is 0.5 then the frictional force acting on the block will be (g = 9.8 m/s^2) :-



(1) 9.8 N (2) 2.5 N
(3) 12.5 N (4) 4.9 N
PLM135

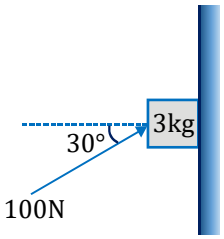
136. Adjoining figure shows two blocks A and B pushed against the wall with a force F. The wall is smooth but the surfaces in contact of A and B are rough. Which of the following is true for the system of blocks to be at rest against the wall ?



(1) F should be 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

PLM136

137. A force of 100N is applied on a block of mass 3 kg as shown in the figure. The coefficient of friction between the surface and the block is $\mu = \frac{1}{\sqrt{3}}$. The frictional force acting on the block is :-



(1) 15 N downwards
(2) 25 N upwards
(3) 20 N downwards
(4) 30 N upwards

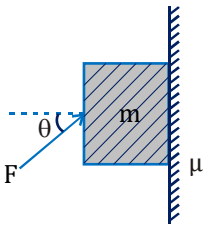
PLM137

138. In previous problem the acceleration of block is :-

(1) zero
(2) 10 m/s² upwards
(3) 10 m/s² downwards
(4) none of these

PLM138

139. The minimum value of force F required to keep the block stationary is :-



(1) $\frac{mg}{\mu\cos\theta}$ (2) $\frac{mg}{\sin\theta+\mu\cos\theta}$

(3) $\frac{mg}{\sin\theta-\mu\cos\theta}$ (4) $\frac{mg}{\mu\tan\theta}$

PLM139

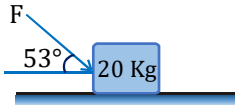
140. In previous question the value of F for which friction force between the block and the wall is zero.

(1) mg (2) $\frac{mg}{\sin\theta}$

(3) $\frac{mg}{\cos\theta}$ (4) $\frac{mg}{\tan\theta}$

PLM140

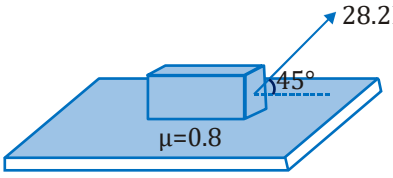
141. A block of mass 20 kg is acted upon by a force F = 30 N at an angle 53° with the horizontal in downward direction as shown in diagram. The coefficient of friction between the block and the horizontal surface is 0.2. The friction force acting on the block by the ground is ($g = 10\ m/s^2$)



(1) 40.0 N (2) 30.0 N
(3) 18.0 N (4) 44.8 N

PLM141

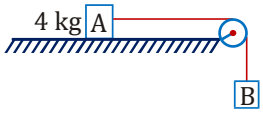
142. A body of weight 50 N is placed on a horizontal surface. A force of 28.2 N is applied on it as shown in diagram. The frictional force and normal reaction on the body are



(1) 2N, 3N (2) 5N, 6N
(3) 10N, 15N (4) 20N, 30N

PLM142

143. The coefficient of static friction, μ_s, between block A of mass 4 kg and the table as shown in the figure is 0.3. What would be the maximum mass value of block B so that the two blocks do not move ? The string and the pulley are assumed to be smooth and massless.
($g = 10\ m/s^2$)



(1) 12 kg (2) 0.2 kg
(3) 0.12 kg (4) 1.2 kg

PLM143

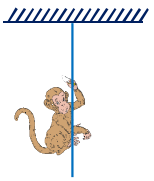
144. A rope lies on a table such that a part of it hangs down the table. When the length of hanging part is 1/5 of entire length the rope just begins to slide. The coefficient of friction between the rope and the table is :-
(1) 1/4 (2) 1/6 (3) 1/5 (4) 3/4

PLM144

145. A block of mass m = 2 kg is placed at rest with respect to moving plank accelerating with acceleration a = 1 m/s^2. If coefficient of friction between plank and block is $\mu = 0.2$. The frictional force acting on the block is :-
(1) 2 N (2) 4 N
(3) 3 N (4) none of these

PLM145

146. In the given figure a monkey of mass m is climbing up a rope hanging from the roof with acceleration a. The coefficient of static friction between the body of the monkey and the rope is μ. value of friction force on the monkey is :-



(1) mg (2) m(g + a)
(3) μ mg (4) m(g – a)

PLM146

147. A block has been placed on an inclined plane with the slope angle θ, the block slides down the plane at constant speed. The coefficient of kinetic friction is equal to :-
(1) $\sin\theta$ (2) $\cos\theta$ (3) g (4) $\tan\theta$

PLM147

148. A car is moving along a straight horizontal road with a speed $2v_0$. If the coefficient of friction between tyres and the road is μ. The shortest distance in which the car can be stopped is :

(1) $\frac{v_0^2}{2\mu g}$ (2) $\frac{v_0^2}{\mu g}$
(3) $\left(\frac{v_0}{\mu g}\right)^2$ (4) $\frac{2v_0^2}{\mu g}$

PLM148

149. A body of mass 2 kg is placed on a inclined plane with an inclination of 30^0. What is the frictional force experienced, if coefficient of friction is 0.8 ? (Take $g = 10\ m/s^2$)
(1) 8.5 N (2) 13.6 N (3) 10 N (4) 8 N

PLM149

150. The force required to just move a body up an inclined plane is 3 times the force required to just prevent the body from sliding down the plane. The coefficient of friction is μ. The inclination θ of the plane is :-
(1) $\tan^{-1}(\mu)$ (2) $\tan^{-1}(\mu/2)$
(3) $\tan^{-1}(2\mu)$ (4) $\tan^{-1}(3\mu)$

PLM150

151. A body is sliding down an inclined plane (angle of inclination 45°). If the coefficient of friction is 0.25 and $g = 10\ m/s^2$. then the approximate downward acceleration of the body in m/s^2 is :-
(1) 7 (2) 14 (3) 3.5 (4) 5.4

PLM151

152. A block of mass m is lying on an inclined plane. The coefficient of friction between the plane and the block is μ. The force (F_1) required to move the block up the inclined plane will be:-
(1) $mg\sin\theta + \mu mg\cos\theta$
(2) $mg\cos\theta - \mu mg\sin\theta$
(3) $mg\sin\theta - \mu mg\cos\theta$
(4) $mg\cos\theta + \mu mg\sin\theta$

PLM152

153. A block slides with constant velocity on a plane inclined at an angle θ. The same block is projected 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) $\frac{v_0^2\sin^2\theta}{4g}$

PLM153

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

PLM154

155. A body is placed on an inclined plane and has to be pushed down in order to make it move. The angle made by the normal reaction with the vertical will be :-

(1) Equal to angle of repose

(2) Equal to the angle of friction

(3) Less than the angle of repose

(4) More than the angle of friction

PLM155

156. A block 'A' kept on an inclined surface just begins to slide if the inclination is 30° with the horizontal. The block is replaced by another block 'B' and it is found that it just begins to slide if the inclination is 40° with the horizontal :-

(1) mass of A > mass of B

(2) mass of A < mass of B

(3) mass of A = mass of B

(4) all the three are possible

PLM156

157. If the coefficient of friction of a surface is $\sqrt{3}$, then the angle of inclination of this surface from the horizontal to make a body on it just to slide, is :-

(1) 30° (2) 45° (3) 60° (4) 75°

PLM157

158. A block is placed on a rough floor and a horizontal force F is applied on it. The force of friction f by the floor on the block is measured for different values of F and a graph is plotted between them ($\mu_k < \mu_s$):-

(a) The graph is a straight line of slope 45°

(b) The graph is straight line parallel to the F-axis

(c) The graph is a straight line of slope 45° for small F and a straight line parallel to the F-axis for large F.

(d) There is small kink on the graph.

(1) c, d (2) a, d (3) a, b (4) a, c

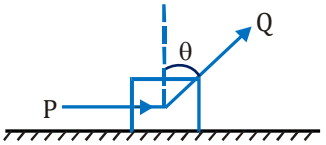
PLM158

159. A block of mass 4 kg rests on an inclined plane. The inclination of the plane is gradually increased. it is found that when the inclination is 3 in 5, the block just begins to slide down the plane. The coefficient of friction between the block and the plane is :-

(1) 0.4 (2) 0.6 (3) 0.8 (4) 0.75

PLM159

160. 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 :-

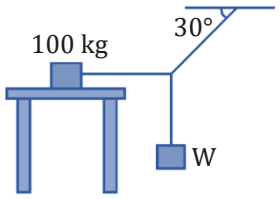


(1) $\frac{P+Q\sin\theta}{mg+Q\cos\theta}$ (2) $\frac{P\cos\theta+Q}{mg-Q\sin\theta}$

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

PLM160

161. The system shown in the figure is in equilibrium. The maximum value of W, so that the maximum value of static frictional force on 100 kg body is 346 N, will be :-



(1) 100 N (2) 250 N

(3) 200 N (4) 1000 N

PLM161

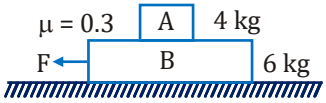
TWO BLOCK SYSTEMS

162. A 8 kg block (A) is placed on 2 kg block (B) which rests on a table. Coefficient of friction between (A) and (B) is 0.5 and between (B) and table is 0.2. A 60 N horizontal force is applied on the block (A), then the friction force between the blocks (A) and (B) is :-

(1) Zero (2) 2.5 N
(3) 28 N (4) 40 N

PLM162

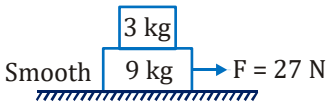
163. Two blocks (A) 4 kg and (B) 6 kg rest one over the other on a smooth horizontal plane. The coefficient of static and dynamic friction between (A) and (B) is the same and equal to 0.3. The maximum horizontal force F that can be applied to (B) in order that both (A) and (B) do not have any relative motion is :



(1) 30 N (2) 30 kgf
(3) 12 kgf (4) 12 N

PLM163

164. In the arrangement coefficient of friction between the two blocks is $\mu = \frac{1}{3}$. The force of friction acting between the two blocks is :-



(1) 10 N (2) 6.75 N
(3) 40 N (4) 13.5 N

PLM164

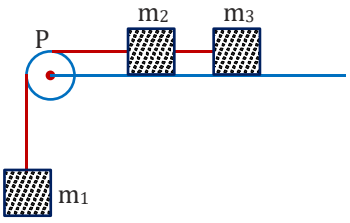
EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	2	1	2	1	2	2	3	3	1	4	2	1	2	4
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	1	3	3	4	1	3	4	3	3	4	2	3	1	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	4	1	2	4	1	1	2	3	3	3	3	3	1	2	3
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	3	3	3	2	4	4	1	3	3	4	2	2	1	4
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	3	1	4	2	3	4	1	3	4	4	1	3	3	1	3
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	3	4	3	2	3	1	2	4	2	2	2	2	3	1	3
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	3	1	3	1	4	3	3	3	3	4	4	2	2	2	1
Question	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Answer	2	1	3	3	3	1	2	1	3	2	3	4	2	3	1
Question	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Answer	3	4	2	3	3	2	1	2	1	3	4	1	4	2	1
Question	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Answer	4	3	1	2	2	3	4	4	1	1	2	4	4	3	3
Question	151	152	153	154	155	156	157	158	159	160	161	162	163	164	
Answer	4	1	2	1	3	4	3	1	4	4	3	3	1	2	

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

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

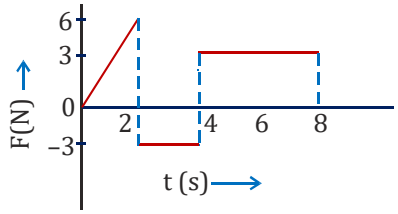


(1) $\frac{g(1-2\mu)}{9}$ (2) $\frac{2g\mu}{3}$

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

PLM171

2. 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 8 s is :-



(1) 24 Ns (2) 20 Ns (3) 12 Ns (4) 6 Ns

PLM172

3. A balloon with mass 'm' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration 'a' ? (Assume that it's volume does not change)

(1) $\frac{2ma}{g+a}$ (2) $\frac{2ma}{g-a}$ (3) $\frac{ma}{g+a}$ (4) $\frac{ma}{g-a}$

PLM173

AIPMT 2015

4. 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) $\frac{m_1m_2(1+\mu_k)g}{(m_1+m_2)}$

(3) $\frac{m_1m_2(1-\mu_k)g}{(m_1+m_2)}$ (4) $\frac{(m_2+\mu_k m_1)g}{(m_1+m_2)}$

PLM174

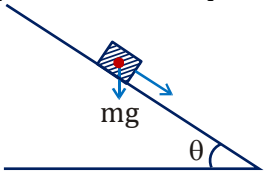
5. Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is :

(1) 6 N (2) 8 N (3) 18 N (4) 2 N

PLM175

Re-AIPMT 2015

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



(1) 0.4 and 0.3 (2) 0.6 and 0.6
(3) 0.6 and 0.5 (4) 0.5 and 0.6

PLM176

NEET-II 2016

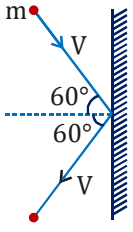
7. A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure below. The value of impulse imparted by the wall on the ball will be :-

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

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

(3) mV

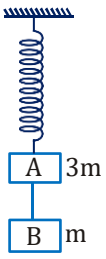
(4) 2mV



PLM177

NEET(UG) 2017

8. Two blocks A and B of masses 3 m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively :-



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

PLM178

NEET(UG) 2018

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

(1) Rolling friction is smaller than sliding friction

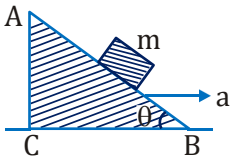
(2) Limiting value of static friction is directly proportional to normal reactions

(3) Frictional force opposes the relative motion

(4) Coefficient of sliding friction has dimensions of length

PLM179

10. 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 = g cos θ (4) a = g tan θ

PLM180

NEET(UG) 2019 (Odisha)

11. A truck is stationary and has a bob suspended by a light string, in a frame attached to the truck. The truck, suddenly moves to the right with an acceleration of a. The pendulum will tilt :-

(1) to the left and angle of inclination of the pendulum with the vertical is $\sin^{-1}(g/a)$

(2) to the left and angle of inclination of the pendulum with the vertical is $\tan^{-1}(a/g)$

(3) to the left and angle of inclination of the pendulum with the vertical is $\sin^{-1}(a/g)$

(4) to the left and angle of inclination of the pendulum with the vertical is $\tan^{-1}(g/a)$

PLM181

12. A body of mass m is kept on a rough horizontal surface (coefficient of friction = μ) A horizontal force is applied on the body, but it does not move. The resultant of normal reaction and the frictional force acting on the object is given by F, where F is :

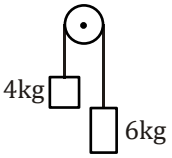
(1) $|\vec{F}| = mg + \mu mg$ (2) $|\vec{F}| = \mu mg$

(3) $|\vec{F}| \le mg\sqrt{1+\mu^2}$ (4) $|\vec{F}| = mg$

PLM182

NEET(UG) 2020

13. Two bodies of mass 4kg and 6kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is :

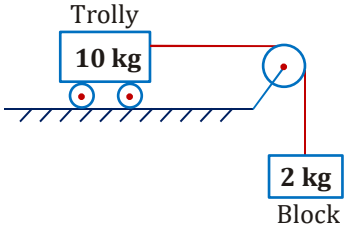


(1) g/10 (2) g (3) g/2 (4) g/5

PLM183

NEET(UG) 2020 (COVID-19)

14. Calculate the acceleration of the block and trolly system shown in the figure. The coefficient of kinetic friction between the trolly and the surface is 0.05. (g = 10 m/s², mass of the string is negligible and no other friction exists).



(1) 1.25 m/s² (2) 1.50 m/s²

(3) 1.66 m/s² (4) 1.00 m/s²

PLM184

NEET(UG) 2021

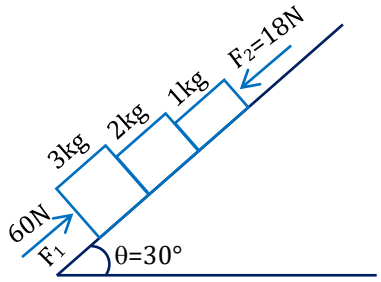
15. A ball of mass 0.15 kg is dropped from a height 10 m, strikes the ground and rebounds to the same height. The magnitude of impulse imparted to the ball is ($g = 10\ m/s^2$) nearly :

(1) 0 kg m/s (2) 4.2 kg m/s
(3) 2.1 kg m/s (4) 1.4 kg m/s

PLM185

RE-NEET(UG) 2022

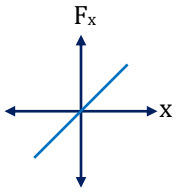
16. 22. In the diagram shown, the normal reaction force between 2 kg and 1 kg is (Consider the surface, to be smooth):
Given $g = 10\ ms^{-2}$

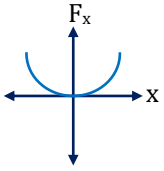


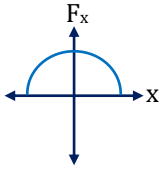
(1) 25 N (2) 39 N (3) 6 N (4) 10 N

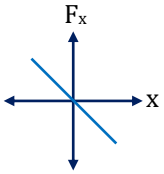
PLM186

17. The restoring force of a spring with a block attached to the free end of the spring is represented by :

(1) 

(2) 

(3) 

(4) 

PLM187

18. The distance covered by a body of mass 5 g having linear momentum 0.3 kg m/s in 5 s is:

(1) 300 m (2) 30 m (3) 3 m (4)0.3 m

PLM188

NEET(UG) 2023

19. A football player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is :

(1) along northward (2) along north-east
(3) along south-west (4) along eastward

PLM202

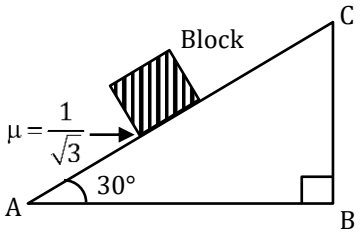
20. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10\ m\ s^{-2}$).

(1) 150 m s^{-2} (2) 1.5 m s^{-2}
(3) 50 m s^{-2} (4) 1.2 m s^{-2}

PLM203

RE-NEET(UG) 2023

21. A block of mass 2 kg is placed on inclined rough surface AC (as shown in figure) of coefficient of friction μ. If $g = 10\ m\ s^{-2}$, the net force (in N) on the block will be :



(1) $10\sqrt{3}$ (2) zero
(3) 10 (4) 20

PLM204

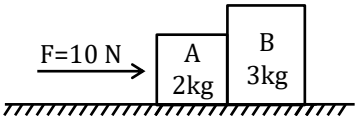
22. A 1 kg object strikes a wall with velocity 1 m s^{-1} at an angle of 60° with the wall and reflects at the same angle. If it remains in contact with wall for 0.1 s, then the force exerted on the wall is :-

(1) $30\sqrt{3}$ N (2) Zero
(3) $10\sqrt{3}$ N (4) $20\sqrt{3}$ N

PLM205

NEET(UG) 2024

23. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is :



(1) zero (2) 4 N
(3) 6 N (4) 10 N

PLM206

RE-NEET(UG) 2024

24. A box of mass 5 kg is pulled by a cord, up along a frictionless plane inclined at 30° with the horizontal. The tension in the cord is 30 N. The acceleration of the box is
(Take g = 10 m s^{-2})
(1) 2 m s^{-2} (2) zero
(3) 0.1 m s^{-2} (4) 1 m s^{-2}

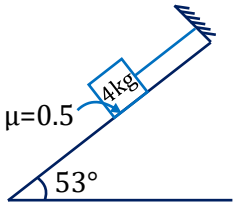
PLM207

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	3	1	2	1	3	3	1	4	4	2	3	4	1	2
Question	16	17	18	19	20	21	22	23	24						
Answer	1	4	1	2	2	2	3	3	4						

Exercise - III (Analytical Questions) Master Your Understanding

1. For the given figure, match column-I to column-II

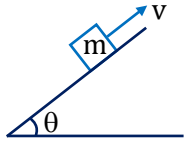


Column-I		Column-II	
(a)	Tension in the string	(P)	24 N
(b)	Normal on the block	(Q)	20 N
(c)	Contact force between block and inclined plane	(R)	12 N
(d)	Friction on the block	(S)	27 N

(1) (a) – Q, (b) – P, (c) – S, (d) – R
(2) (a) – P, (b) – Q, (c) – S, (d) – R
(3) (a) – P, (b) – Q, (c) – R, (d) – S
(4) (a) – Q, (b) – P, (c) – R, (d) – S

PLM190

2. A block of mass m is thrown upwards with some initial velocity as shown. On the block



Column-I		Column-II	
(a)	Net force in horizontal direction	(P)	zero
(b)	Net force in vertical direction	(Q)	$m(g\sin\theta+\mu g\cos\theta)$
(c)	Net force along the plane	(R)	$m(g\sin\theta\cos\theta+\mu g\cos^2\theta)$
(d)	Net force perpendicular to plane	(S)	$m(g\sin^2\theta+\mu g\sin\theta\cos\theta)$
		(T)	None

(1) (a) – P (b) – R (c) – Q (d) – P
(2) (a) – R (b) – S (c) – Q (d) – P
(3) (a) – P (b) – S (c) – Q (d) – P
(4) (a) – Q (b) – R (c) – P (d) – R

PLM191

3. If the net force acting on a system is represented by $\vec{F}$ and its momentum is $\vec{P}$. Then match the entries of column I with the entries of Column II.

Column-I		Column-II	
(a)	If $\vec{F}$ is constant	(P)	$\vec{P}$ may change its direction
(b)	If $\vec{F}$ is changing in magnitude only	(Q)	$\vec{P}$ must change its magnitude
(c)	If $\vec{F}$ is changing in direction only	(R)	$\vec{P}$ may not change its direction
(d)	If $\vec{F}$ is zero	(S)	$\vec{P}$ may be constant in magnitude

(1) (a) – P,Q,R (b) – P,Q,R (c) – P,S (d) – S
(2) (a) – P,R (b) – P,Q (c) – P,R (d) – S
(3) (a) – P,Q (b) – Q,R (c) – P,R (d) –S
(4) (a) – P,R (b) – P,Q,R (c) – P (d) – S

PLM192

4. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : When a block is placed in a lift which is accelerating upwards then the body experiences the following three forces :
(a) Weight (mg)
(b) Normal reaction (N) and
(c) Pseudo force (ma) if 'a' is acceleration of lift

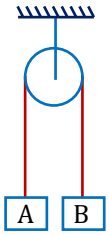
Reason (R) : Pseudo force is applied on a body only when body is seen from an accelerated observer.

In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PLM194

5. Equilibrium means zero acceleration while rest means zero velocity.
(1) True (2) False
(3) Partially true (4) None of the above
PLM195

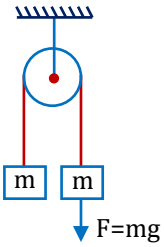
6. Two blocks of mass 2 kg and 3 kg are arranged as shown and released from rest. Assuming string and pulley to be ideal. Find the separation between them after 1 sec. [g =10 m/s²]



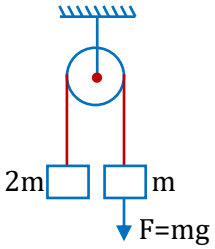
(1) 1 m (2) 2 m
(3) 4 m (4) None
PLM198

7. Match the situations in column I to the accelerations of blocks in the column II (acceleration due to gravity is g and F is an additional force applied to one of the blocks ?

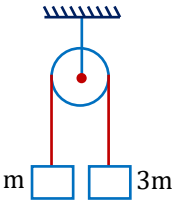
Column I **Column II**

(A)


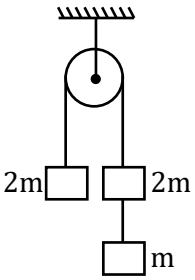
(P) $\frac{g}{5}$

(B)


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

(C)


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

(D)


(S) 0

Options :-
(1) A → R, B → S, C → R, D → P
(2) A → R, B → S, C → Q, D → P
(3) A → Q, B → P, C → R, D → S
(4) A → P, B → Q, C → R, D → S
PLM199

8. If a body is placed on a rough inclined plane, the nature of forces acting on the body is(are)
(A) gravitational (B) electromagnetic
(C) nuclear (D) weak
(1) Only A (2) A and D
(3) A, B, C, D (4) A and B
PLM200

9. **Statement-I** : When a cloth with a lot of dirt in it, is jerked the dirt gets away from it.
Statement-II : When an object applies force on another object the other object also applies an equal force but opposite in direction.
(1) Statement–1 is True, Statement–2 is True ; Statement–2 is a correct explanation for Statement–1.
(2) Statement–1 is True, Statement–2 is True ; Statement–2 is not a correct explanation for Statement–1.
(3) Statement–1 is True, Statement–2 is False.
(4) Statement–1 is False, Statement–2 is True.
PLM201

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9
Answer	1	2	1	4	1	2	1	4	2