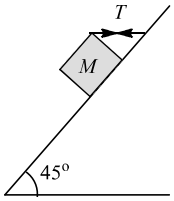
GPLUS EDUCATION

Date :
Time : **PHYSICS**
Marks :

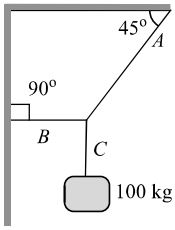
LAWS OF MOTION

Single Correct Answer Type

1. An ice cart of mass 60 kg rests on a horizontal snow patch with coefficient of static friction $\frac{1}{3}$. Assuming that there is no vertical acceleration, find the magnitude of the maximum horizontal force required to move the ice cart ($g = 9.8\ \text{ms}^{-2}$)
   a) 100 N b) 110 N c) 209 N d) 196 N
2. A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope ($g = 10\ m/s^2$)
   a) 10 m/s^2 b) 25 m/s^2 c) 2.5 m/s^2 d) 5 m/s^2
3. A player kicks a football of mass 0.5 kg and the football begins to move with a velocity of 10 m/s. If the contact between the leg and the football lasts for
   $\frac{1}{50}$ s,
   then the force on the ball should be
   a) 2500 N b) 1250 N c) 250 N d) 625 N
4. An 80 kg person is parachuting and is experiencing a downward acceleration of 2.8ms^{-2}. The mass of the parachute is 5 kg. The upward force on the open parachute is (Take $g = 9.8\text{ms}^{-2}$)
   a) 595 N b) 675 N c) 456 N d) 925 N
5. A block of mass 15 kg is resting on a rough inclined plane as shown in figure. The block is tied by a horizontal string which has a tension of 50 N. The coefficient of friction between the surfaces of contact is ($g = 10\ \text{ms}^{-2}$)



   a) 1/2 b) 3/4 c) 2/3 d) 1/4
6. The rate of the mass of the gas emitted from rear of a rocket is initially 0.1kgs^{-1}. If the speed of the gas relative to the rocket is 50 ms^{-1} and mass of the rocket is 2 kg, then the acceleration of the rocket (in ms^{-2}) is
   a) 5 b) 5.2 c) 2.5 d) 25
7. A 100 kg block is suspended with the help of three string A, B and C. The tension in the string C is



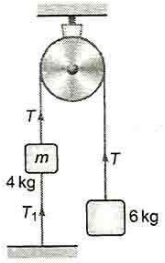
   a) 50 gN b) 100 gN c) 20 gN d) 20 gN
8. If the resultant of all the external forces acting on a system of particles is zero, then form an inertial frame, one can surely say that

a) Linear momentum of the system does not change in time
b) Kinetic energy of the system does not change in time
c) Angular momentum of the system does not change in time
d) Potential energy of the system does not change in time

9. Which of the following quantities measured from different inertial reference frames are same
a) Force b) Velocity c) Displacement d) Kinetic energy

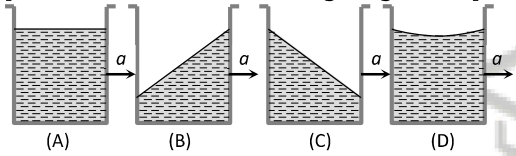
10. Maximum value of static friction is called
a) Limiting friction b) Rolling friction c) Normal reaction d) Coefficient of friction

11. Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is attached to the table by another string. The tension in this string T_1 is



a) 19.6 N b) 25 N c) 10.6 N d) 10 N

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

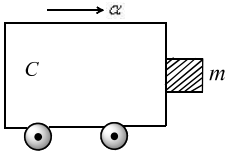


a) A b) B c) C d) D

13. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10s. Then the coefficient of friction is
a) 0.01 b) 0.02 c) 0.03 d) 0.06

14. Which of the following is the correct order of forces
a) Weak < gravitational forces < strong forces (nuclear) < electrostatic
b) Gravitational < Weak < (electrostatic) < strong force
c) Gravitational < electrostatic < Weak < strong force
d) Weak < gravitational < electrostatic < strong forces

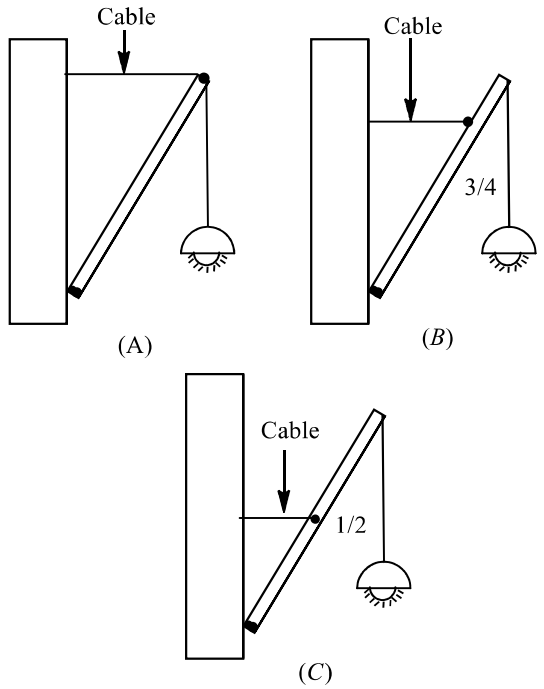
15. A block of mass m is in contact with the cart C as shown in the figure



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 satisfies
a) $\alpha < \frac{g}{\mu}$ b) $\alpha > \frac{mg}{\mu}$ c) $\alpha > \frac{g}{\mu m}$ d) $\alpha \geq \frac{g}{\mu}$

16. A block of mass m_1 reacts on a horizontal table. A string tied to the block is passed on a frictionless pulley fixed at the end of the table and to the other end of string is hung another block of mass m_2. The acceleration of the system is
a) $\frac{m_2 g}{(m_1 + m_2)}$ b) $\frac{m_1 g}{(m_1 + m_2)}$ c) g d) $\frac{m_2 g}{m_1}$

17. If a street light of mass M is suspended from the end of a uniform rod of length L in different possible patterns as shown in figure, then

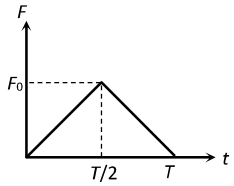


a) Pattern A is more sturdy
b) Pattern B is more sturdy
c) Pattern C is more sturdy
d) All will have same sturdiness

18. If a ladder weighing 250 N is placed against a smooth vertical wall having coefficient of friction between it and floor is 0.3, then what is the maximum force of friction available at the point of contact between the ladder and the floor

a) 75 N b) 50 N c) 35 N d) 25 N

19. A particle of mass m moving with velocity u makes an elastic one dimensional collision with a stationary particle of mass m. They are in contact for a very short time T. Their force of interaction increases from zero to F_0 linearly in time $T/2$, and decreases linearly to zero in further time $T/2$. The magnitude of F_0 is



a) mu/T b) $2mu/T$ c) $mu/2T$ d) None of these

20. Pulling force making an angle θ to the horizontal is applied on a block of weight W placed on a horizontal table. If the angle of friction is α, then the magnitude of force required to move the body is equal to

a) $\frac{W \sin\alpha}{g \tan(\theta-\alpha)}$ b) $\frac{W \cos\alpha}{\cos(\theta-\alpha)}$ c) $\frac{W \sin\alpha}{\cos(\theta-\alpha)}$ d) $\frac{W \tan\alpha}{\sin(\theta-\alpha)}$

21. Two blocks of masses $m_1 = 4$ kg and $m_2 = 2$ kg are connected to the ends of a string which passes over a massless, frictionless pulley. The total downwards thrust on the pulley is nearly

a) 27 N b) 54 N c) 0.8 N d) Zero

22. Consider the following statement. When jumping from some height, you should bend your knees as you come to rest instead of keeping your legs stiff. Which of the following relations can be useful in explaining the statement?

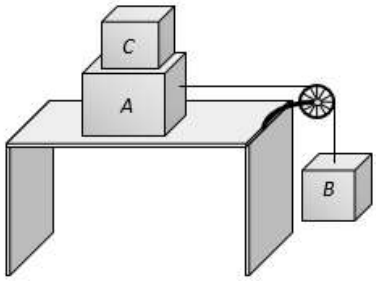
a) $\Delta\mathbf{p}_1 = -\Delta\mathbf{p}_2$
b) $\Delta E = -\Delta(\text{PE} + \text{KE}) = 0$
c) $\mathbf{F}\,\Delta t = m\Delta\mathbf{v}$
d) $\Delta\mathbf{x} \propto \Delta\mathbf{F}$

Where symbols have their usual meaning

23. At a certain instant of time the mass of rocket going up vertically is 100 kg. If it is ejecting 5 kg of gas per second at a speed of 400 m/s, the acceleration of the rocket would be (Taking $g = 10$ m/s^2)

a) $20\ \text{m/s}^2$ b) $10\ \text{m/s}^2$ c) $2\ \text{m/s}^2$ d) $1\ \text{m/s}^2$

24. Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown. The coefficient of static friction of A with table is 0.2. The minimum mass of C that may be placed on A to prevent it from moving is

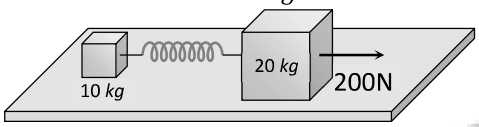


a) 15 kg b) 10 kg c) 5 kg d) 12 kg

25. A bullet of mass 5 g is shot from a gun of mass 5 kg. The muzzle velocity of the bullet is 5000 ms^{-1}. The recoil velocity of the gun is

a) 0.5 ms^{-1} b) 0.25 ms^{-1} c) 1 ms^{-1} d) Data is insufficient

26. The masses of 10 kg and 20 kg respectively are connected by a massless spring as shown in figure. A force of 200 N acts on the 20 kg mass. At the instant shown, the 10 kg mass has acceleration 12 m/sec^2. What is the acceleration of 20 kg mass



a) 12 m/sec^2 b) 4 m/sec^2 c) 10 m/sec^2 d) Zero

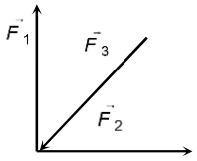
27. A steel wire can withstand a load up to 2940 N. A load of 150 kg is suspended from a rigid support. The maximum angle through which the wire can be displaced from the mean position, so that the wire does not break when the load passes through the position of equilibrium, is

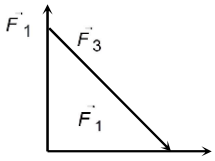
a) 30° b) 60° c) 80° d) 85°

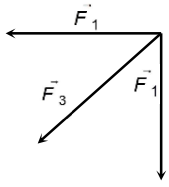
28. The upper half of an inclined plane of inclination θ is perfectly smooth while the lower half is rough. A body starting from the rest at top comes back to rest at the bottom if the coefficient of friction for the lower half is given by

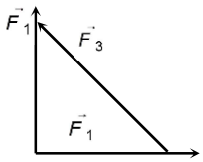
a) $\mu = \sin\theta$ b) $\mu = \cot\theta$ c) $\mu = 2\cos\theta$ d) $\mu = 2\tan\theta$

29. Which of the four arrangements in the figure correctly shows the vector addition of two forces $\overrightarrow{F_1}$ and $\overrightarrow{F_2}$ to yield the third force $\overrightarrow{F_3}$

a) 

b) 

c) 

d) 

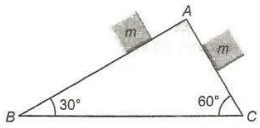
30. A particle moves in the $x-y$ plane under the influence of a force such that its linear momentum is $\vec{p}(t) = A[\hat{\imath}\cos(kt) - \hat{\jmath}\sin(kt)]$
Where A and k are constants. The angle between the force and momentum is

a) 0° b) 30° c) 45° d) 90°

31. The spring balance inside a lift suspends an object. As the lift begins to ascent, the reading indicated by the spring balance will

a) Increase b) Decrease
c) Remain unchanged d) Depend on the speed of ascend

32. Two blocks of equal masses m are released from the top of a smooth fixed wedge as shown in the figure.



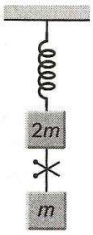
The acceleration of the centre of mass of the two blocks is

a) g b) $\frac{g}{2}$ c) $\frac{3g}{4}$ d) $\frac{g}{\sqrt{2}}$

33. A brick of mass 2 kg begins to slide down on a plane inclined at an angle of 45° with the horizontal. The force of friction will be

a) $19.6 \sin 45°$ b) $19.6 \cos 45°$ c) $9.8 \sin 45°$ d) $9.8 \cos 45°$

34. System shown in figure is in equilibrium and at rest. The spring and string are massless, now the string is



cut. The acceleration of mass 2 m and m just after the string is cut will be

a) $g/2$ upward, g downward b) g upward, $g/2$ downward

c) g upward, $2g$ downward d) $2g$ upward, g downward

35. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if

a) $r \geq \frac{\mu g}{\omega^2}$ b) $r = \mu g \omega^2$ c) $r < \frac{\omega^2}{\mu g}$ d) $r \leq \frac{\mu g}{\omega^2}$

36. A body sitting on the topmost berth in the compartment of a train which is just going to stop on a railway station, drops an apple aiming at the open hand of his brother sitting vertically below his hands at a distance of about 2 m. The apple will fall

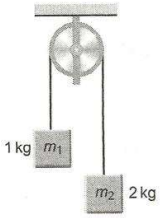
a) Precisely on the hand of his brother

b) Slightly away from the hand of his brother in the direction of motion of the train

c) Slightly away from the hand of his brother in the direction opposite to the direction of motion of the train

d) None of the above

37. Two masses $m_1 = 1\text{kg}$ and $m_2 = 2\text{kg}$ are connected by a light inextensible string and suspended by means of a weightless pulley as shown in figure.



Assuming that both the masses start from rest, the distance travelled by the centre of mass in 2 s is (take $g = 10\text{m/s}^2$)

a) $\frac{20}{9}\text{m}$ b) $\frac{40}{9}\text{m}$ c) $\frac{2}{3}\text{m}$ d) $\frac{1}{3}\text{m}$

38. For ordinary terrestrial experiments, the observer is an inertial frame in the following cases is

a) A child revolving in a giant wheel

b) A driver in a sports car moving with a constant high speed of 200 kmh^{-1} on a straight rod

c) The pilot of an aeroplane which is taking off

d) A cyclist negotiating a sharp curve

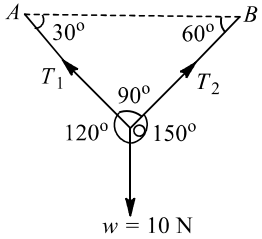
39. A large force is acting on a body for a short time. The impulse imparted is equal to the change in

a) Acceleration b) Momentum c) Energy d) Velocity

40. A block is kept on an inclined plane of inclination θ of length l. The velocity of particle at the bottom of inclined plane is (the coefficient of friction is μ)

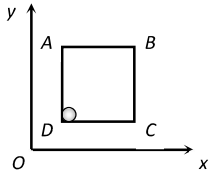
a) $\sqrt{2gl(\mu\cos\theta - \sin\theta)}$ b) $\sqrt{2gl(\sin\theta - \mu\cos\theta)}$ c) $\sqrt{2gl(\sin\theta + \mu\cos\theta)}$ d) $\sqrt{2gl(\cos\theta + \mu\sin\theta)}$

41. A ball of mass 1 kg hangs in equilibrium from two strings OA and OB as shown in figure. What are the tensions in strings OA and OB? (Take g $= 10$ ms^{-2})



a) 5 N, zero b) Zero, N c) 5 N, $5\sqrt{3}$ N d) $5\sqrt{3}$ N, 5 N

42. A solid sphere of mass 2 kg is resting inside a cube as shown in the figure. The cube is moving with a velocity $v = (5t\hat{\imath} + 2t\hat{\jmath})m/s$. Here t is the time in second. All surface are smooth. The sphere is at rest with respect to the cube. What is the total force exerted by the sphere on the cube. (Take $g = 10\ m/s^2$)



a) $\sqrt{29}N$ b) 29 N c) 26 N d) $\sqrt{89}\ N$

43. In the given arrangement, n number of equal masses are connected by strings of negligible masses. The tension in the string connected to nth mass is

a) $\dfrac{mMg}{nm + M}$ b) $\dfrac{mMg}{nmM}$ c) mg d) mng

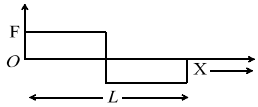
44. A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be

a) $mg\cos\theta$ b) $mg\sin\theta$ c) mg d) $mg/\cos\theta$

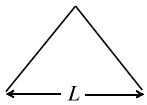
45. A body is imparted motion from rest to move in a straight line. If it is then obstructed by an opposite force, then

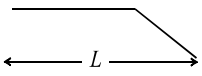
a) The body may necessarily change direction
b) The body is sure to slow down
c) The body will necessarily continue to move in the same direction at the same speed
d) None of these

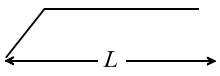
46. A person used force (F), shown in figure to move a load with constant velocity on given surface

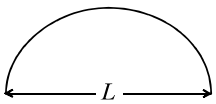


Identify the correct surface profile

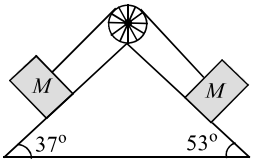
a) 

b) 

c) 

d) 

47. The acceleration of system of two bodies over the wedge as shown in figure is



a) $1ms^{-1}$ b) $2ms^{-2}$ c) $0.52ms^{-2}$ d) $10ms^{-2}$

48. A body of mass 6 kg moves in a straight line according to the equation $x = t^3 - 75t$,
Where x denotes the distance in metre and t the time in second. The force on the body at $t = 4$ s is
a) 64 N b) 72 N c) 144 N d) 36 N

49. An object is subjected to a force in the north-east direction. To balance this force, a second force should be applied in the direction
a) North-East b) South c) South-west d) West

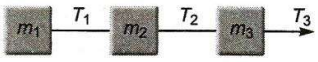
50. A body of mass 0.05 kg is observed to fall with an acceleration of 9.5 ms^{-2}. The opposing force of air on the body is ($g = 9.8\ ms^{-2}$)
a) 0.015 N b) 0.15 N c) 0.030 N d) Zero

51. Diwali rockets are ejecting 50 g of gases per second at a velocity of 400 ms^{-1}. The accelerating force on the rocket will be
a) 22 dyne b) 20 N c) 20 dyne d) 100 N

52. Which of the following statements is not true
a) The coefficient of friction between two surfaces increases as the surface in contact are made rough
b) The force of friction acts in a direction opposite to the applied force
c) Rolling friction is greater than sliding friction
d) The coefficient of friction between wood and wood is less than 1

53. A truck is moving on a frictionless surface with uniform velocity of 10 ms^{-1}. A leak occurs in the water tank of the truck at the rate of 2 kgs^{-1}. What is the speed of truck after 50 s if the mass of truck is 100 kg and mass of water in truck initially was 100 kg?
a) 20 ms^{-1} b) 10 ms^{-1} c) 5 ms^{-1} d) None of these

54. A body of mass 1000 kg is moving horizontally with a velocity 50 ms^{-1}. A mass of 250 kg is added. Find the final velocity
a) 40 ms^{-1} b) 23 ms^{-1} c) 12 ms^{-1} d) 32.5 ms^{-1}

55. 

In the figure shown, $m_1 = 10$ kg, $m_2 = 6$ kg, $m_3 = 4$ kg. If $T_3 = 40$ N, $T_2 =$?
a) 13 N b) 32 N c) 25 N d) 35 N

56. A body takes time t to reach the bottom of an inclined plane of angle θ with the horizontal. If the plane is made rough, time taken now is $2t$. The coefficient of the friction of the rough surface is
a) $\frac{3}{4}\tan\theta$ b) $\frac{2}{3}\tan\theta$ c) $\frac{1}{4}\tan\theta$ d) $\frac{1}{2}\tan\theta$

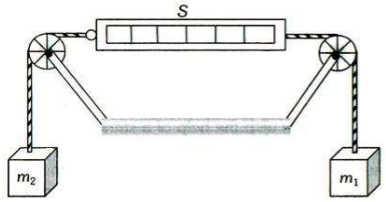
57. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an initial upward acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be ($g = 10\ ms^{-2}$)
a) 127.5 kgs^{-1} b) 187.5 kgs^{-1} c) 185.5 kgs^{-1} d) 137.5 kgs^{-1}

58. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. Force P is applied at one end of the rope. The force which the rope exerts on the block is
a) $\frac{P}{M(m+M)}$ b) $\frac{P}{M-m}$ c) $\frac{Pm}{M-m}$ d) $\frac{PM}{m+M}$

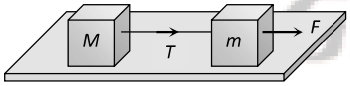
59. A body of mass M is kept on a rough horizontal surface (friction coefficient μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on the body is F, where
a) $F = Mg$ b) $F = \mu Mgf$

c) $Mg \leq F \leq Mg\sqrt{1+\mu^2}$ d) $Mg \geq F \geq Mg\sqrt{1+\mu^2}$

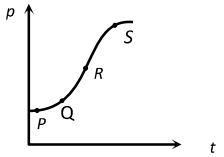
60. Three concurrent co-planar forces 1 N, 2 N and 3 N acting along different directions on a body
    a) Can keep the body in equilibrium if 2 N and 3 N act at right angle
    b) Can keep the body in equilibrium if 1 N and 2 N act at right angle
    c) Cannot keep the body in equilibrium
    d) Can keep the body in equilibrium if 1 N and 3 N act at an acute angle
61. A car turns a corner on a slippery road at a constant speed of 10 m/s. If the coefficient of friction is 0.5, the minimum radius of the arc in meter in which the car turns is
    a) 20 b) 10 c) 5 d) 4
62. In the arrangement shown, the pulleys are fixed and ideal, the strings are light, $m_1 > m_2$ and S is a spring balance which is itself massless. The reading of S (in unit of mass) is



    a) $m_1 - m_2$ b) $\frac{1}{2}(m_1 + m_2)$ c) $\frac{m_1 m_2}{m_1 + m_2}$ d) $\frac{2m_1 m_2}{m_1 + m_2}$
63. Which activity is not based upon friction
    a) Writing b) Speaking c) Hearing d) Walking
64. A rope of mass 0.1 kg is connected at the same height of two opposite walls. It is allowed to hang under its own weight. At the contact point between the rope and the wall, the rope makes an angle $\theta = 10°$ with respect to the horizontal. The tension in the rope at its midpoint between the wall is
    a) 2.78 N b) 2.56 N c) 2.82 N d) 2.71 N
65. Two masses M and m are connected by a weightless string. They are pulled by a force F on a frictionless horizontal surface. The tension in the string will be



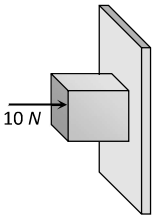
    a) $\frac{FM}{m+M}$ b) $\frac{F}{M+m}$ c) $\frac{FM}{m}$ d) $\frac{Fm}{M+m}$
66. The variation of momentum with time of one of the body in a two body collision is shown in fig. The instantaneous force is maximum corresponding to point



    a) P b) Q c) R d) S
67. A motorcyclist of mass m is to negotiate a curve of radius r with a speed v. The minimum value of the coefficient of friction so that this negotiation may take place safely, is
    a) $v^2 rg$ b) $\frac{v^2}{gr}$ c) $\frac{gr}{v^2}$ d) $\frac{g}{v^2 r}$
68. If a body of mass m is carried by a lift moving with an upward acceleration a, then the forces acting on the body are (i) the reaction R on the floor of the lift upwards (ii) the weight mg of the body acting vertically downwards. The equation of motion will be given by
    a) $R = mg - ma$ b) $R = mg + ma$ c) $R = ma - mg$ d) $R = mg \times ma$
69. A packet of weight w is dropped with the help of a parachute and on striking the ground comes to rest with retardation equal to twice the acceleration due to gravity. What is the force exerted on the ground?
    a) w b) 2 w c) 3 w d) 4 w

70. Two forces are such that the sum of their magnitudes is 18 N and their resultant is perpendicular to the smaller force and magnitude of resultant is 12 N. Then the magnitudes of the forces are
a) 12 N, 6 N b) 13 N, 5 N c) 10 N, 8 N d) 16 N, 2 N

71. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is



a) 2 N b) 20 N c) 50 N d) 100 N

72. A car is moving with uniform velocity on a rough horizontal road. Therefore, according to Newton's first law of motion
a) No force is being applied by its engine
b) A force is surely being applied by its engine
c) An acceleration is being produced in the car
d) The kinetic energy of the car is increasing

73. A 2 kg block is lying on a smooth table which is connected by a body of mass 1 kg by a string which passes through a pulley. The 1 kg mass is hanging vertically. The acceleration of block and tension in the string will be
a) $3.27 m/s^2$, 6.54 N b) $4.38 m/s^2$, 6.54 N c) $3.27 m/s^2$, 9.86 N d) $4.38 m/s^2$, 9.86 N

74. A machine gun mounted on a 2000 kg car on a horizontal frictionless surface fires 10 bullets per second. If 10 g be the mass of each bullet and 500 ms^{-1}, the velocity of each bullet, then the acceleration of the car will be
a) $\frac{1}{10} ms^{-2}$ b) $\frac{1}{20} ms^{-2}$ c) $\frac{1}{40} ms^{-2}$ d) $\frac{1}{60} ms^{-2}$

75. A rocket of mass 100 kg burns 0.1 kg of fuel per second. If velocity of exhaust gas is 1 kms^{-1}, then it lifts with an acceleration of
a) 1000 ms^{-2} b) 100 ms^{-2} c) 10 ms^{-2} d) 1 ms^{-2}

76. A boy of mass 0.25 kg is projected with muzzle velocity 100 ms^{-1} from a tank of mass 100 kg. What is the recoil velocity of the tank
a) 5 ms^{-1} b) 25 ms^{-1} c) 0.5 ms^{-1} d) 0.25 ms^{-1}

77. A force vector applied on a mass is represented as $\vec{F} = 6\hat{\imath} - 8\hat{\jmath} + 10\hat{k}$ and accelerates with 1 m/s^2. What will be the mass of the body
a) $10\sqrt{2}\ kg$ b) $2\sqrt{10}\ kg$ c) 10 kg d) 20 kg

78. A rope of length L is pulled by a constant force F. What is the tension in the rope at distance x from the end when the force is applied?
a) $\frac{F(L-x)}{L}$ b) $\frac{FL}{L-x}$ c) $\frac{FL}{x}$ d) $\frac{Fx}{L-x}$

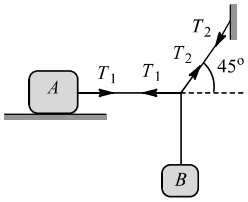
79. A person is sitting in a left accelerating upwards. Measured weight of person will be
a) Less than actual weight b) Equal to actual weight
c) More than actual weight d) None of the above

80. A block of mass m is pushed with a velocity u towards a movable wedge of mass nm and height h, figure. All the surfaces are smooth. The minimum value of u for which the block will reach the top of wedge is
a) $\sqrt{2gh\left(1-\frac{1}{n}\right)}$ b) $\sqrt{2gh\left(1+\frac{1}{n}\right)}$ c) $\sqrt{3gh}$ d) $\sqrt{2gh}$

81. A block of mass 10 kg is placed on an inclined plane. When the angle of inclination is 30°, the block just begin to slide down the plane. The force of static friction is

a) 10 $kg\ wt$ b) 89 $kg\ wt$ c) 49 $kg\ wt$ d) 5 $kg\ wt$

82. The block A in figure weight 100 N. The coefficient of static friction between the block and the table is 0.25. The weight of the block B is maximum for the system to be in equilibrium. The value of T_1 is



a) 0.25 N b) 25 N c) 100 N d) 100.25 N

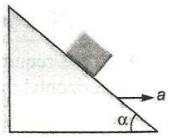
83. A body of 10 kg is acted by a force of 129.4 N if $g = 9.8\ m/s^2$. The acceleration of the block is 10 m/s^2. What is the coefficient of kinetic friction

a) 0.03 b) 0.01 c) 0.30 d) 0.25

84. A lift of mass 1000 kg is moving with an acceleration of 1 m/s^2 in upward direction. Tension developed in the string, which is connected to the lift is ($g = 9.8\ m/s^2$)

a) 9,800 N b) 10,000 N c) $10,800\ N$ d) $11,000\ N$

85. A block is kept on a frictionless inclined surface with angle of inclination α. The incline is given an acceleration a to keep the block stationary. Then a is equal to



a) $g/\tan\alpha$ b) g cosec α c) g d) $g\tan\alpha$

86. A coin of mass 10 g is placed over a book of length 50 cm. the coin is on the verge of sliding when one end of the book is lifted to 10 cm up. The coefficient of static friction between the book and the coin is

a) 1.0 b) 0.4 c) 0.3 d) 0.2

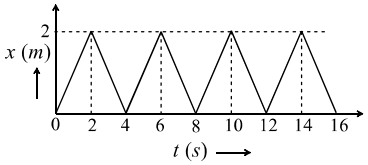
87. A uniform rope of length l lies on a table. If the coefficient of friction is μ, then the maximum length l_1 of the part of this rope which can overhang from the edge of the table without sliding down is

a) $\frac{1}{\mu}$ b) $\frac{1}{\mu + l}$ c) $\frac{\mu l}{1+\mu}$ d) $\frac{\mu l}{\mu - 1}$

88. A boy of mass 100 g is sliding from an inclined plane of inclination 30°. What is the frictional force experienced if $\mu = 1.7$

a) $1.7 \times \sqrt{2} \times \frac{1}{\sqrt{3}} N$ b) $1.7 \times \sqrt{3} \times \frac{1}{2} N$ c) $1.7 \times \sqrt{3} N$ d) $1.7 \times \sqrt{2} \times \frac{1}{3} N$

89. The figure shows the position – time $(x - t)$ graph of one-dimensional motion of a body of mass 0.4 kg . The magnitude of each impulse is



a) 0.2 Ns b) 0.4 Ns c) 0.8 Ns d) 1.6 Ns

90. A person is measuring his weight by standing on a weighing machine inside a lift. When the lift is at rest, the machine shows his weight to be 55 kg. In between the floor when the lift is moving up with a constant speed of 10 km/hr, he again measures his weight, which is

a) 55 kg b) 65 kg c) 50 kg d) 45 kg

91. A cricket ball of mass 150 g collides straight with a bat with a velocity of 10 ms^{-1} . Batsman hits it straight back with a velocity of 20 ms^{-1}. If ball remains in contact with bat for 0. 1s, then average force exerted by the bat on the ball is

a) 15 N b) 45 N c) 150 N d) 4.5 N

92. A satellite in force-free space sweeps stationary interplanetary dust at rate

$\frac{dM}{dt} = \alpha\, v,$

where M is the mass, v is the velocity of satellite and α is a constant

What is the deceleration of the satellite?

a) $\frac{-2\alpha v^2}{M}$ b) $-\alpha v^2/M$ c) $-\alpha v^2$ d) $\frac{\alpha\, v^2}{M}$

93. A rocket with a lift-off mass 3.5×10^4 kg is blasted upward with an initial acceleration of 10 ms^{-2}. Then the initial thrust of the blast is

a) 3.5×10^5 N b) 7.0×10^5 N c) 14.0×10^5 N d) 1.75×10^5N

94. The tension in the spring is

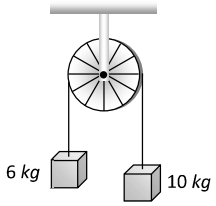
a) Zero b) 2.5 N c) 5 N d) 10 N

95. A motor cycle and a car are moving on a horizontal road with the same velocity. If they are brought to rest by the application of brakes, which provided equal retardation, then

a) Motor cycle will stop at shorter distance b) Car will stop at a shorter distance

c) Both will stop at the same distance d) Nothing can be predicted

96. A light string passes over a frictionless pulley. To one of its ends a mass of 6 kg is attached. To its other end a mass of 10 kg is attached. The tension in the thread will be

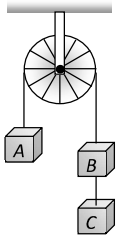


a) 24.5 N b) 2.45 N c) 79 N d) 73.5 N

97. A flat plate moves normally with a speed v_1 towards a horizontal jet of water of uniform area of cross-section. The jet discharges water at the rate of volume V per second at a speed of v_2. The density of water is ρ. Assume that water splashes along the surface of the plate at right angles to the original motion. The magnitude of the force acting on the plate due to the jet of water is

a) $\rho V v_1$ b) $\rho V(v_1 + v_2)$ c) $\frac{\rho V}{v_1 + v_2} v_1^2$ d) $\rho \left[\frac{V}{v_2}\right](v_1 + v_2)^2$

98. Three equal weights A, B and C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in the figure. The tension in the string connecting weights B and C is



a) Zero b) 13 N c) 3.3 N d) 19.6 N

99. A student attempts to pull himself up by tugging on his hair. He will not succeed

a) As the force exerted in small

b) The frictional force while gripping, is small

c) Newton's law of inertia is not applicable to living beings

d) As the force applied is internal to the system

100. The force required just to move a body up an inclined plane is double the force required just to prevent the body sliding down. If the coefficient of friction is 0.25, the angle of inclination of the plane is

a) 36.8° b) 45° c) 30° d) 42.6°

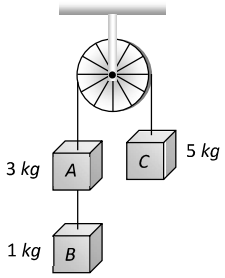
101. An aircraft is moving with velocity of 300 ms^{-1}. If all the forces acting on it are balanced, then

a) It still moves with the same velocity
b) It will be just floating at the same point in space
c) It will fall down instantaneously
d) It will lose its velocity gradually

102. 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 $g = 10\ m/s^2$)

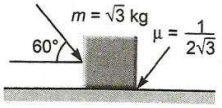
a) 2.0 b) 4.0 c) 1.6 d) 2.5

103. Three weight A, B and C are connected by string as shown in the figure. The system moves over a frictionless pulley. The tension in the string connecting A and B is (where g is acceleration due to gravity)



a) g b) $\frac{g}{9}$ c) $\frac{8g}{9}$ d) $\frac{10g}{9}$

104. What is the maximum value of the force F such that the block shown in the arrangement, does not move?



a) 20 N b) 10 N c) 12 N d) 15 N

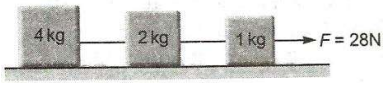
105. A frictionless inclined plane of length l having inclination θ is placed inside a lift which is accelerating downward with an acceleration $a(<$ g). If a block is allowed to move, down the inclined plane, from rest, then the time taken by the block to slide from top of the inclined plane to the bottom of the inclined plane is

a) $\sqrt{\frac{2l}{g}}$ b) $\sqrt{\frac{2l}{g-a}}$ c) $\sqrt{\frac{2l}{g+a}}$ d) $\sqrt{\frac{2l}{(g-a)\sin\theta}}$

106. A spacecraft of mss M moving with velocity v in free space explodes and breaks into two pieces. After the explosion, a mass m of the space craft is left stationary. The velocity of the other part is

a) $\frac{mv}{M-m}$ b) $\frac{Mv}{M-m}$ c) $\frac{M+m}{M}$ d) $\frac{Mv}{M}$

107. In the arrangement shown in figure, the strings are light and inextensible. The surface over which blocks are placed is smooth. What is the acceleration of each block?

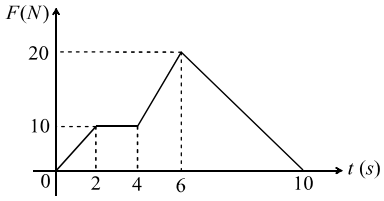


a) 8 ms^{-2} b) 4 ms^{-2} c) 2 ms^{-2} d) 14 ms^{-2}

108. A car having a mass of 1000 kg is moving at a speed of 30 $metres/sec$. Brakes are applied to bring the car to rest. If the frictional force between the tyres and the road surface is 5000 $newtons$, the car will come to rest in

a) 5 $seconds$ b) 10 $seconds$ c) 12 $seconds$ d) 6 $seconds$

109. A particle of mass 2 kg is initially at rest. A force acts on it whose magnitude changes with time. The force time graph is shown below



The velocity of the particle after 10 s is

a) 20 ms^{-1} b) 10 ms^{-1} c) 75 ms^{-1} d) 50 ms^{-1}

110. A student unable to answer a question on Newton's law of motion attempts to pull himself up by tugging on his hair. He will not succeed
   a) As the force exerted is small
   b) The frictional force while gripping, is small
   c) Newton's law of inertia is not applicable to living beings
   d) As the force applied is internal to the system

111. A block moves down a smooth inclined plane of inclination θ. Its velocity on reaching the bottom is v. If it slides down a rough inclined plane of same inclination, its velocity on reaching the bottom is v/n, where n is a number greater than 1. The coefficient of friction is given by

   a) $\mu = \tan\theta\left(1-\frac{1}{n^2}\right)$ b) $\mu = \cot\theta\left(1-\frac{1}{n^2}\right)$

   c) $\mu = \tan\theta\left(1-\frac{1}{n^2}\right)^{1/2}$ d) $\mu = \cot\theta\left(1-\frac{1}{n^2}\right)^{1/2}$

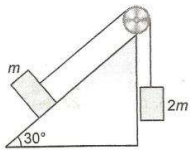
112. A pendulum bob of mass 50 gm is suspended from the ceiling of an elevator. The tension in the string if the elevator goes up with uniform velocity is approximately

   a) 0.30 N b) 0.40 N c) 0.42 N d) 0.50 N

113. A uniform metal chain is placed on a rough table such that one end of chain hangs down over the edge of the table. When one-third of its length hangs over the edge, the chain starts sliding. Then, the coefficient of static friction is

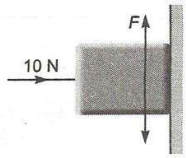
   a) $\frac{3}{4}$ b) $\frac{1}{4}$ c) $\frac{2}{3}$ d) $\frac{1}{2}$

114. Two blocks of masses m and $2m$ are connected by a light string passing over a frictionless pulley. As shown in the figure, the mass m is placed on a smooth inclined plane of inclination 30° and $2m$ hangs vertically. If the system is released, the blocks move with an acceleration equal to



   a) $\frac{g}{4}$ b) $\frac{g}{3}$ c) $\frac{g}{2}$ d) g

115. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is



   a) 20 N b) 50 N c) 100 N d) 2 N

116. A Bullet of mass 10 gm is fired from a gun of mass 1 kg. If the recoil velocity is 5 m/s, the velocity of the muzzle is

   a) 0.05 m/s b) 5 m/s c) 50 m/s d) 500 m/s

117. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain that can hang over one edge of the table is

a) 20% b) 25% c) 35% d) 15%

118. The maximum speed of a car on a road turn of radius 30 m; if the coefficient of friction between the tyres and the road is 0.4; will be

a) 9.84 m/s b) 10.84 m/s c) 7.84 m/s d) 5.84 m/s

119. The sum of the magnitudes of two forces acting at a point is 18 N and the magnitude of their resultant is 12 N. If the resultant is at 90° with the smaller force, the magnitude of the forces in N are

a) 6,12 b) 11,7 c) 5,13 d) 14,4

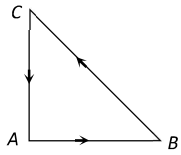
120. A block of mass M placed on a frictionless horizontal table is pulled by an other block of mass m hanging vertically by a massless string passing over a frictionless pulley. The tension in the string is

a) $\frac{m}{M+m}g$ b) $\frac{M}{M+m}g$ c) $\frac{M+m}{Mm}g$ d) $\frac{Mm}{M+m}g$

121. The engine of a jet aircraft applies a thrust force of $10^5 N$ during take off and causes the plane to attain a velocity of 1 km/sec in 10 sec. The mass of the plane is

a) $10^2\ kg$ b) $10^3\ kg$ c) $10^4 kg$ d) $10^5 kg$

122. Three forces starts 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



a) $\vec{v}$ remaining unchanged b) Less than $\vec{v}$

c) Greater than $\vec{v}$ d) $\vec{v}$ in the direction of the largest force BC

123. A wagon weighing 1000 kg is moving with a velocity 50 km/h on smooth horizontal rails. A mass of 250 kg is dropped into it. The velocity with which it moves now is

a) 2.5 $km/hour$ b) 20 $km/hour$ c) 40 $km/hour$ d) 50 $km/hour$

124. The mass of man when standing on lift is 60 kg. What is the weight when he is standing on lift which is moving upwards with acceleration 4.9 ms^{-2} ?

a) 882 kg b) 600 N c) 306 N d) Zero

125. A cricket ball of mass 250 g collides with a bat with velocity 10 m/s and returns with the same velocity within 0.01 second . The force acted on bat is

a) 25 N b) 50 N c) 250 N d) 500 N

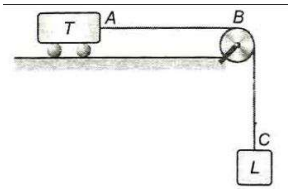
126. A block of mass 5 kg is on a rough horizontal surface and is at rest. Now a force of 24 N is imparted to it with negligible impulse. If the coefficient of kinetic friction is 0.4 and $g = 9.8\ m/s^2$, then the acceleration of the block is

a) 0.26 m/s^2 b) 0.39 m/s^2 c) 0.69 m/s^2 d) 0.88 m/s^2

127. A smooth block is released at rest on a 45° incline and then slides a distance d. The time taken to slide is n times as much to slide on rough incline than on a smooth incline. The coefficient of friction is

a) $\mu_k = 1 - \frac{1}{n^2}$ b) $\mu_k = \sqrt{1 - \frac{1}{n^2}}$ c) $\mu_s = 1 - \frac{1}{n^2}$ d) $\mu_s = \sqrt{1 - \frac{1}{n^2}}$

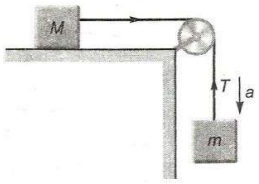
128. A plate of mass M is placed on a horizontal frictionless surface (see figure), and a body of mass m is placed on this plate. The coefficient of dynamics friction between this body and the plate is μ. If a force $2\mu mg$ is applied to the body of mass m along the horizontal, the acceleration of the plate will be



a) $\frac{\mu m}{M}$g b) $\frac{\mu m}{(M+m)}$g c) $\frac{2\mu m}{M}$g d) $\frac{2\mu m}{(M+m)}$g

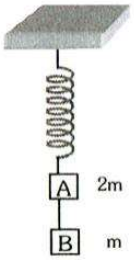
129. A 60 kg man stands on a spring scale in a lift. At some instant he finds that the scale reading has changed from 60 kg to 50 kg for a while and then comes again to 60 kg mark. What should he conclude?
a) The lift was in constant motion upwards
b) The lift was in constant motion downwards
c) The lift while in motion suddenly stopped
d) The lift while in motion upwards suddenly stopped

130. Two blocks of masses M and m are connected by a string passing over a pulley as shown in



the figure. The downward acceleration of the block with mass m is
a) $M/(m+M)g$ b) $mg/(m+M)$ c) $(m+M)/mg$ d) $(n+M)/Mg$

131. Two blocks A and B of masses $2m$ and m, respectively, are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in the figure. The magnitudes of acceleration of A and B , immediately after the spring is cut, are respectively



a) $g, g/2$ b) $g/2, g$ c) g, g d) $g/2, g/2$

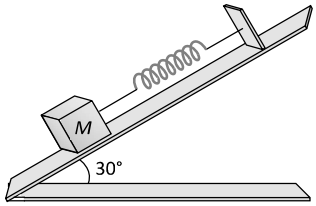
132. A false balance has equal arms. An object weigh X when placed in one pan and Y when placed in other pan, then the weight W of the object is equal to
a) $\sqrt{XY}$ b) $\frac{X+Y}{2}$ c) $\frac{X^2+Y^2}{2}$ d) $\frac{2}{\sqrt{X^2+Y^2}}$

133. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an initial upward acceleration of 20 ms^{-2} the amount of gas ejected per second to supply the needed thrust will be ($g = 10\ ms^{-2}$)
a) 127.5 $kg\ s^{-1}$ b) 187.5 $kg\ s^{-1}$ c) 185.5 $kg\ s^{-1}$ d) 137.5 $kg\ s^{-1}$

134. An object at rest in space suddenly explodes into three parts of same mass. The momentum of the two parts are $2p\hat{\mathbf{i}}$ and $p\hat{\mathbf{j}}$. The momentum of the third part
a) Will have a magnitude $p\sqrt{3}$
b) Will have a magnitude $p\sqrt{5}$
c) Will have a magnitude p
d) Will have a magnitude $2p$

135. A rifle of 20 kg mass can fire 4 bullets per second. The mass of each bullet is 35×10^{-3} kg and its final velocity 400 ms^{-1}. Then what force must be applied on the rifle so that it does not move backwards while firing the bullets?
a) 80 N b) 28 N c) -112 N d) -56 N

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



a) 50 N b) 25 N c) 500 N d) 10 N

137. A vehicle of mass 120 kg is moving with a uniform velocity of 108 kmh^{-1}. The force required to step the vehicle in 10 s is

a) 90 N b) 180 N c) 360 N d) 720 N

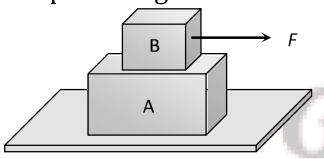
138. A man is standing at the centre of frictionless pond of ice. How can he get himself to the shore

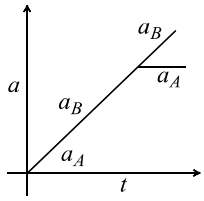
a) By throwing his shirt in vertically upward direction
b) By spitting horizontally
c) He will wait for the ice to melt in pond
d) Unable to get at the shore

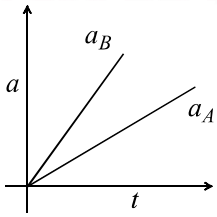
139. A block of mass M is attached to the lower end of a vertical rope of mass. An upward force P acts on the upper end of the rope. The system is free to move. The force exerted by the rope on the block is $\frac{PM}{M+m}$

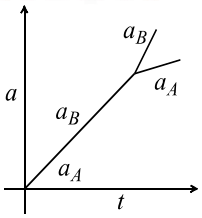
a) In all cases
b) Only if the rope is uniform
c) In gravity-free space only
d) Only if $P > (M + m)g$

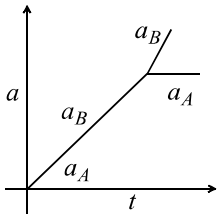
140. A block B is placed on block A. The mass of block B is less that the mass of block A. Friction exists between the blocks, whereas the ground on which the block A is placed is taken to be smooth. A horizontal force F, increasing linearly with time begins to act on B. The acceleration a_A and a_B of blocks A and B respectively are plotted against t. The correctly plotted graph is



a) 

b) 

c) 

d) 

141. A plumb line is suspended from a ceiling of a car moving with horizontal acceleration of a. What will be the angle of inclination with vertical

a) $\tan^{-1}(a/g)$ b) $\tan^{-1}(g/a)$ c) $\cos^{-1}(a/g)$ d) $\cos^{-1}(g/a)$

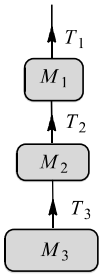
142. A machine gun fires a bullet of mass 40 g with a velocity 1200ms^{-1}. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fired per second at the most?

a) Only one
b) Three
c) Can fire any number of bullets
d) 144 × 48

143. A 10 kg stone is suspended with a rope of breaking strength 30 kg wt. The minimum time in which the stone can be raised through a height 10 m starting from rest is (taking $g = 10\ N/kg$)

a) 0.5 $seconds$ b) 1.0 $seconds$ c) $\sqrt{\frac{2}{3}}\ seconds$ d) 2.0 $seconds$

144. The masses M_1, M_2 and M_3 are 5,2 and 3 kg respectively. These have been joined using massless, inextensible pieces of strings as shown in figure. If whole system is going upward with an acceleration of 2 ms^{-2}, then the value of tensions T_1, T_2 and T_3 respectively are



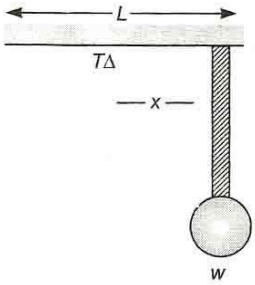
a) 29.4 N, 98 N, 98 N b) 98 N, 49 N, 29.4 N c) 118 N, 59 N, 35.4 N d) 35.4 N, 118 N, 59 N

145. A boy having a mass equal to 40 $kilograms$ is standing in an elevator. The force felt by the feet of the boy will be greatest when the elevator
($g = 9.8\ metres/\sec^2$)
a) Stands still
b) Moves downward at a constant velocity of 4 $metres/sec$
c) Accelerates downward with an acceleration equal to 4 $metres/\sec^2$
d) Accelerates upward with an acceleration equal to 4 $metres/\sec^2$

146. A person is standing in an elevator. In which situation he finds his weight less than actual weight
a) The elevator moves upward with constant acceleration
b) The elevator moves downward with constant acceleration
c) The elevator moves upward with uniform velocity
d) The elevator moves downward with uniform velocity

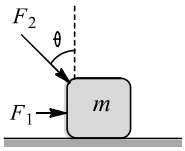
147. A man slides down on a telegraphic pole with acceleration equal to one-fourth of acceleration due to gravity. The frictional force between man and pole is equal to in terms of man's weight w
a) $\frac{w}{4}$ b) $\frac{w}{2}$ c) $\frac{3w}{4}$ d) w

148. A rod of length L and weight W is kept horizontally. A small weight w is hung at one end. If the system balances on a fulcrum placed at T then



a) $x = \frac{L}{2}$ b) $x = \frac{wL}{2(W+w)}$ c) $x = \frac{wL}{W}$ d) None of these

149. A block of mass m on a rough horizontal surface is acted upon by two forces as shown in figure. For equilibrium of block, the coefficient of friction between block and surface is



a) $\frac{F_1 + F_2 \sin\theta}{mg + F_2 \cos\theta}$ b) $\frac{F_1 \sin\theta + F_2}{mg + F_2 \sin\theta}$ c) $\frac{F_1 + F_2 \cos\theta}{mg + F_2 \sin\theta}$ d) $\frac{F_1 \sin\theta - F_2}{mg - F_2 \cos\theta}$

150. A body of mass 10 kg is lying on a rough plane inclined at an angle of 30° to the horizontal and the coefficient of friction is 0.5. the minimum force required to pull the body up the plane is
a) 914 N b) 91.4 N c) 9.14 N d) 0.914 N

151. A block of mass 10 kg is placed on a rough horizontal surface having coefficient of friction $\mu = 0.5$. If a horizontal force of 100 N is acting on it, then acceleration of the block will be

a) $0.5\ m/s^2$ b) $5\ m/s^2$ c) $10\ m/s^2$ d) $15\ m/s^2$

152. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be

a) $1\ Mg/k$ b) $2Mg/k$ c) $4\ Mg/k$ d) $Mg/2k$

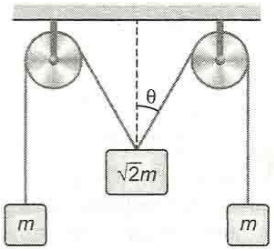
153. A bullet of mass 10 g moving with 300 ms^{-1} hits a block of ice of mass 5 kg and drops dead. The velocity of ice is

a) 50 cm/s b) 60 cm/s c) 40 cm/s d) 200 cm/s

154. A lift accelerated downward with acceleration 'a'. A man in the lift throws a ball upward with acceleration $a_0 (a_0 < a)$. Then acceleration of ball observed by observer, which is on earth, is

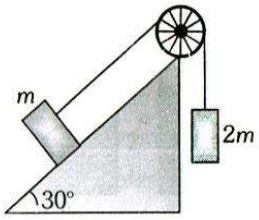
a) $(a + a_0)$ upward b) $(a - a_0)$ upward c) $(a + a_0)$ downward d) $(a - a_0)$ downward

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



a) 0° b) 30° c) 45° d) 60°

156. Two blocks of masses m and $2m$ are connected by a light string passing over a frictionless pulley. As shown in the figure, the mass m is placed on a smooth inclined plane of inclination 30° and $2m$ hangs vertically. If the system is released, the blocks move with an acceleration equal to



a) $g/4$ b) $g/3$ c) $g/2$ d) g

157. If a body of mass m is moving on a rough horizontal surface of coefficient of kinetic friction μ, the net electromagnetic force exerted by surface on the body is

a) $mg\sqrt{1+\mu^2}$ b) $\mu\ mg$ c) mg d) $mg\sqrt{1-\mu^2}$

158. A block moving on a surface with velocity 20 ms^{-1} comes to rest because of surface friction over a distance of 40 m. taking $g = 10\ ms^{-2}$, the coefficient of dynamic friction is

a) 0.5 b) 0.3 c) 0.2 d) 0.1

159. A man weighing 60 kg is standing on a trolley weighing 240 kg. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley with a velocity of 1 ms^{-1}, then after 4 s, his displacement relative to the ground is

a) 6 m b) 4.8 m c) 3.2 m d) 2.4 m

160. When the speed of a moving body is doubled

a) Its acceleration is doubled b) Its momentum is doubled

c) Its kinetic energy is doubled d) Its potential energy is doubled

161. A boy B lies on a smooth horizontal table and another body A is placed on B. The coefficient of friction between A and B is μ. What acceleration given to B will cause slipping to occur between A and B

a) μg b) g/μ c) μ/g d) $\sqrt{\mu g}$

162. Impulse is

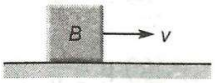
a) A scalar

b) Equal to change in the momentum of a body
c) Equal to rate of change of momentum of a body
d) A force

163. A body of mass 40 kg resting on a rough horizontal surface is subjected to a force P which is just enough to start the motion of the body. If $\mu_s = 0.5, \mu_k = 0.4, \text{g} = 10\ \text{ms}^{-2}$ and the force P is continuously applied on the body, then the acceleration of the body is
a) Zero b) $1\ \text{ms}^{-2}$ c) $2\ \text{ms}^{-2}$ d) $2.4\ \text{ms}^{-2}$

164. The coefficient of limiting friction μ is defined as
a) $\mu = \frac{\text{R}}{\text{F}}$ b) $\mu = \sqrt{\frac{\text{F}}{\text{R}}}$ c) $\mu = \frac{\text{F}}{\text{R}}$ d) $\mu = \sqrt{\frac{\text{R}}{\text{F}}}$

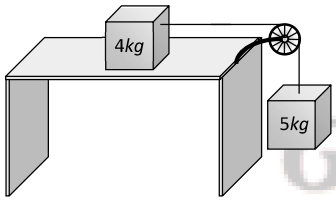
165. A block B is pushed momentarily along a horizontal surface with an initial velocity v. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



a) $\frac{v}{g\mu}$ b) $\frac{g\mu}{v}$ c) $\frac{g}{v}$ d) $\frac{v}{g}$

166. A body of mass 10 kg slides along a rough horizontal surface. The coefficient of friction is $1/\sqrt{3}$. Taking $g = 10\ m/s^2$, the least force which acts an angle of 30° to the horizontal is
a) 25 N b) 100 N c) 50 N d) $\frac{50}{\sqrt{3}}\ N$

167. Two masses of 4 kg and 5 kg are connected by a string passing through a frictionless pulley and are kept on a frictionless table as soon as shown in the figure. The acceleration of 5 kg mass is

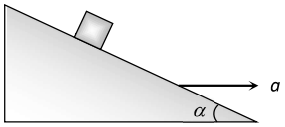


a) $49\ m/s^2$ b) $5.44\ m/s^2$ c) $19.5\ m/s^2$ d) $2.72\ m/s^2$

168. The motion of a rocket is based on the principle of conservation of
a) Mass b) Kinetic energy c) Linear momentum d) Angular momentum

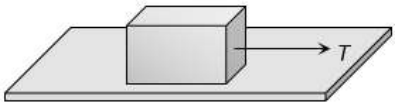
169. 10000 small balls, each weighing 1 g, strike one square centimeter of area per second with a velocity $100\ \text{ms}^{-1}$ in a normal direction and rebound with the same velocity. The value of pressure on the surface will be
a) $2 \times 10^3\ \text{Nm}^{-2}$ b) $2 \times 10^5\ \text{Nm}^{-2}$ c) $10^7\ \text{Nm}^{-2}$ d) $2 \times 10^7\ \text{Nm}^{-2}$

170. A block is kept on a frictionless inclined surface with angle of inclination 'α'. The incline is given an acceleration 'a' to keep the block stationary. Then a is equal to



a) g b) $g \tan\alpha$ c) $g/\tan\alpha$ d) $g\ \text{cosec}\ \alpha$

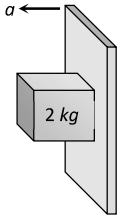
171. In the figure shown, a block of weight 10 N is resting on a horizontal surface. The coefficient of static friction between the block and the surface $\mu_s = 0.4$. A force of 3.5 N will keep the block in uniform motion, once it has been set in motion. A horizontal force of 3N is applied to the block then the block will



a) Move over the surface with constant velocity

b) Move having accelerated motion over the surface
c) Not move
d) First it will move with a constant velocity for some time and then will have accelerated motion

172. A rough vertical board has an acceleration $'a'$ so that a 2 kg block pressing against it does not fall. The coefficient of friction between the block and the board should be

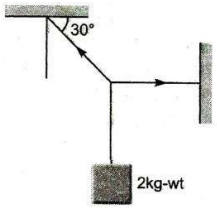


a) $> g/a$ b) $< g/a$ c) $= g/a$ d) $> a/g$

173. A light spring balance hangs from the hook of the other light spring balance and a block of mass M kg hangs from the former one. Then the true statement about the scale reading is
a) Both the scales read $M/2$ kg each
b) Both the scales read M Kg each
c) The scale of the lower one reads M kg and of the upper one zero
d) The reading of the two scales can be anything but the sum of the reading will be M kg

174. While waiting in a car at a stoplight, and 80 kg man and his car are suddenly accelerated to a speed of 5 ms^{-1} as a result or rear end colllison. If the time of impact is 0.4 s, find the average force on the man
a) 100 N b) 200 N c) 500 N d) 1000 N

175. A body of weight 2 kg is suspended as shown in figure. The tension T_1 in the horizontal string (in kg-wt) is

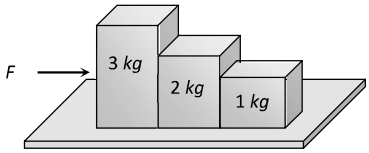


a) $2/\sqrt{3}$ b) $\sqrt{3}/2$ c) $2\sqrt{3}$ d) 2

176. Rocket engines lift a rocket from the earth surface because hot gas with high velocity
a) Push against the earth b) Push against the air
c) React against the rocket and push it up d) Heat up the air which lifts the rocket

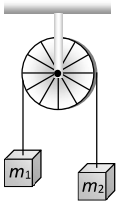
177. A force of 98 N is required to just start moving a body of mass 100 kg over ice. The coefficient of static friction is
a) 0.6 b) 0.4 c) 0.2 d) 0.1

178. Consider the following statements about the blocks shown in the diagram that are being pushed by a constant force on a frictionless table



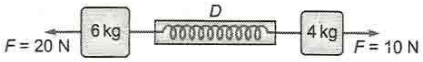
A. All blocks move with the same acceleration
B. The net force on each block is the same
Which of these statements are/is correct
a) A only b) B only c) Both A and B d) Neither A nor B

179. Two masses $m_1 = 5\ kg$ and $m_2 = 4.8\ kg$ tied to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when they are free to move ($g = 9.8\ m/s^2$)



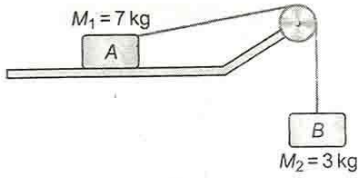
a) $0.2\ m/s^2$ b) $9.8\ m/s^2$ c) $5\ m/s^2$ d) $4.8\ m/s^2$

180. A dynamometer D is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10 N are applied on the blocks as shown in figure. The dynamometer reads



a) 10 N b) 20 N c) 6 N d) 14 N

181. A block A of mass 7 kg is placed on a frictionless table. A thread tied to it passes over a frictionless pulley and carries a body B of mass 3 kg at the other end, as in figure. The acceleration of the system is (given g = $10\ ms^{-2}$)



a) $100\ ms^{-2}$ b) $3\ ms^{-2}$ c) $10\ ms^{-2}$ d) $30\ ms^{-2}$

182. Which one of the following is not a force

a) Impulse b) Tension c) Thrust d) Air resistance

183. A second's pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket

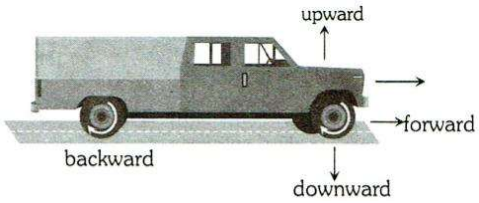
a) Comes down with uniform acceleration

b) Moves round the earth in a geostationary orbit

c) Moves up with a uniform velocity

d) Moves up with uniform acceleration

184.



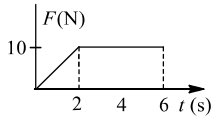
Direction of frictional force between wheel of the car and road is

a) Upward b) Forward c) Backward d) Downward

185. A man drags a block through $10m$ on rough surface ($\mu = 0.5$). A force of $\sqrt{3}kN$ acting at 30° to the horizontal. The work done by applied force is

a) Zero b) 15 kJ c) 5 kJ d) 10 kJ

186. A body of mass 3 kg is acted on by a force which varies as shown in the graph below. The momentum acquired is given by



a) Zero b) 5 N-s c) 30 N-s d) 50 N-s

187. A motor car has a width 1.1 m between wheels. Its centre of gravity is 0.62 m above the ground and the coefficient of friction between the wheels and the road is 0.8. What is the maximum possible speed, if the centre of gravity inscribes a circle of radius 15 m? (Road surface is horizontal)

a) $7.64\ m/s$ b) $6.28\ m/s$ c) $10.84\ m/s$ d) $11.23\ m/s$

188. **Statement I** A cloth covers a table. Some dishes are kept on it. The cloth can be pulled out without dislodging the dishes from the table.
Statement II For every action there is an equal and opposite reaction.
a) Statement I is true, statement II is true; statement II is a correct explanation for statement I
b) Statement I is true, statement II is true; statement II is not a correct explanation for statement I
c) Statement I is true, statement II is false
d) Statement I is false, statement II is true

189. A mass m hangs with a help of a string wrapped around a pulley on a frictionless bearing. The pulley has mass m and radius R. Assuming pulley to be a perfect uniform circular disc, the acceleration of the mass m, if the string does not slip on the pulley, is
a) $\frac{3}{2}\ g$ b) g c) $\frac{2}{3}\ g$ d) $\frac{g}{3}$

190. A force of 50 $dynes$ is acted on a body of mass 5 g which is at rest for an interval of 3 seconds, then impulse is
a) $0.15\ \times 10^{-3}\ N-s$ b) $0.98\ \times 10^{-3}\ N-s$ c) $1.5\ \times 10^{-3}\ N-s$ d) $2.5\ \times 10^{-3}\ N-s$

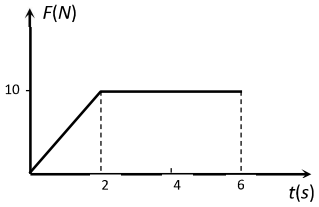
191. A ball of mass 0.5 kg moving with a velocity of 2 m/sec strikes a wall normally and bounces back with the same speed. If the time of contact between the ball and the wall is one millisecond, the average force exerted by the wall on the ball is
a) 2000 N b) 1000 N c) 5000 N d) 125 N

192. A hockey player receives a corner shot at a speed of 15 ms^{-1} at an angle of 30° with the y-axis and then shoots the ball of mass 100 g along the negative x-axis with a speed of 30 ms^{-1}. If it remains in contact with the hockey stick for 0.01 s, the force imparted to the ball in the x-direction is
a) 281.25 N b) 187.5 N c) 562.5 N d) 375 N

193. The mass of a body measured by a physical balance in a lift at rest is found to be m. If the lift is going up with an acceleration a, its mass will be measured as
a) $m\left(1-\frac{a}{g}\right)$ b) $m\left(1+\frac{a}{g}\right)$ c) m d) Zero

194. Same force acts on two bodies of different masses 3 kg and 5 kg initially at rest. The ratio of times required to acquire same final velocity is
a) 5: 3 b) 25: 9 c) 9: 25 d) 3: 5

195. A body of mass $3kg$ is acted on by a force which varies as shown in the graph below. The momentum acquired is given by



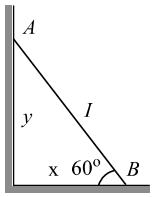
a) Zero b) 5 N-s c) 30 N-s d) 50 N-s

196. In the above Question, if the string C is stretched slowly, then
a) The portion AB of the string will break b) The portion BC of the string will break
c) None of the strings will break d) None of the above

197. Which one of the following is not a contact force
a) Viscous force b) Air resistance c) Friction d) Magnetic force

198. Figure represents a painter in a crate which hangs along the side of a building. When the painter of mass 100 kg pulls the rope, the force exerted by him on the floor of the crate is 450 N. If the crate weighs 125 kg, then the acceleration in the rope is (Given g = 10 ms^{-2})
a) 1 ms^{-2} b) 2 ms^{-2} c) 3 ms^{-2} d) 4 ms^{-2}

199. A rod length AB is moving with ends remaining in contact with frictionless wall and floor. If at the instant shown, the velocity of end B is 3 ms^{-1} towards negative x-direction, then magnitude of velocity of end A will be

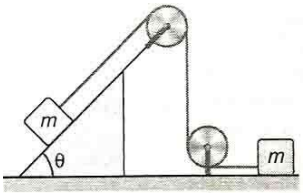


a) 3 ms^{-1} b) $\sqrt{3}$ ms^{-1} c) 1.5 ms^{-1} d) 2 ms^{-1}

200. An iron block of mass 5 kg is kept on a trolley. If the trolley is being pushed with an acceleration of 5 m/s^2, What will be the force of friction between the block and the trolley surface? (Take the coefficient of static friction between the block and the surface to be 0.8)

a) Zero b) 5 N c) 4 N d) 25 N

201. For the system shown in figure, the pulleys are light and frictionless. The tension in the string will be



a) $\frac{2}{3}mg\sin\theta$ b) $\frac{3}{2}mg\sin\theta$ c) $\frac{1}{2}mg\sin\theta$ d) $2mg\sin\theta$

202. A body of mass 4 kg is accelerated upon by a constant force, travels a distance of 5 m in the first second and a distance of 2 m in the third second. The force acting on the body is

a) $6N$ b) 8 N c) 2 N d) 4 N

203. 10,000 small balls, each weighing 1 gm, strike one square cm of area per second with a velocity 100 m/s in a normal direction and rebound with the same velocity. The value of pressure on the surface will be

a) 2×10^3 N/m^2 b) 2×10^5 N/m^2 c) 10^7 N/m^2 d) 2×10^7 N/m^2

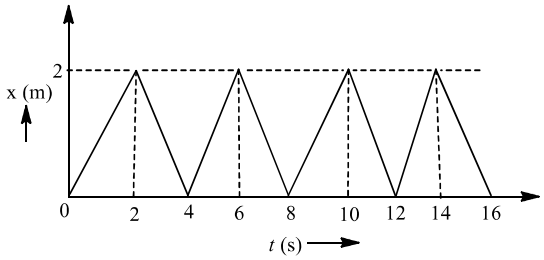
204. A bob of mass 0.450 kg hangs from the massless string of a long simple pendulum. A bullet of mass 0.50 kg is fired vertically from below into the bob. The bullet gets embedded into the bob and the combination rises vertically through a height of 1.8 m. If g = 10 ms^{-2}, then the velocity of the bullet is

a) 6 ms^{-1} b) 60 ms^{-1} c) 600 ms^{-1} d) 6000 ms^{-1}

205. Force of 4 N is applied on a body of mass 20 kg. The work done in 3rd second is

a) 2 J b) 4 J c) 16 J d) 1.2 J

206. The figure shows the position-time $(x - t)$ graph of one-dimensional motion of a body of mass 0.4 kg. The magnitude of each impulse is



a) 0.4 Ns b) 0.8 Ns c) 1.6 Ns d) 0.2 Ns

207. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is

a) $\frac{Pm}{M+m}$ b) $\frac{Pm}{M-m}$ c) P d) $\frac{PM}{M+m}$

208. An army vehicle of mass 1000 kg is moving with a velocity of 10 m/s and is acted upon by a forward force of 1000 N due to the engine and a retarding force of 500 N due to friction. What will be its velocity after 10 s

a) 5 m/s b) 10 m/s c) 15 m/s d) 20 m/s

209. A train is moving with velocity 20 m/s on this dust is falling at the rate 50kg/min. The extra force requested to move this train with a constant velocity will be

a) 16.66 N b) 1200 N c) 1000 N d) 166.6 N

210. The resultant of two forces, one double the other in magnitude, is perpendicular to the smaller of the two forces. The angle between the two forces is

a) 60° b) 120° c) 150° d) 90°

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

a) $\frac{a}{gk}$ b) $\frac{a}{2gk}$ c) $\frac{2a}{gk}$ d) $\frac{a}{4gk}$

212. Two bodies of masses m_1 and m_2 are connected by a light, inextensible string which passes over a frictionless pulley. If the pulley is moving upward with uniform acceleration g, then the tension in the string is

a) $\frac{4m_1m_2}{m_1+m_2}$g b) $\frac{m_1m_2}{4m_1m_2}$g c) $\frac{m_1m_2}{m_1+m_2}$g d) $\frac{m_1-m_2}{m_1+m_2}$g^2

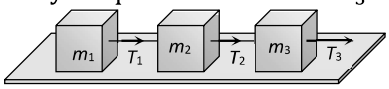
213. A block of mass m is resting on a smooth horizontal surface. One end of a uniform rope of mass $\left(\frac{m}{3}\right)$ is fixed to the block, which is pulled in the horizontal direction by applying force F at the other end. The tension in the middle of the rope is

a) $\frac{8}{6}F$ b) $\frac{1}{7}F$ c) $\frac{1}{8}F$ d) $\frac{7}{8}F$

214. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force. Consider $g = 10\ m/s^2$

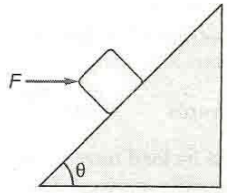
a) 16 N b) 20 N c) 22 N d) 4 N

215. Three blocks of masses m_1, m_2 and m_3 are connected by massless strings as shown on a frictionless table. They are pulled with a force $T_3 = 40\ N$. If $m_1 = 10\ kg, m_2 = 6\ kg$ and $m_3 = 4\ kg$, the tension T_2 will be



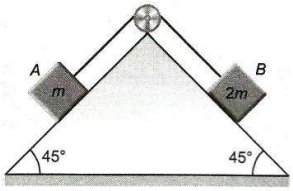
a) 20 N b) 40 N c) 10 N d) 32 N

216. A horizontal force F is applied on a block mass m placed on a rough inclined plane of inclination θ. The normal reaction N is



a) $mg\cos\theta$ b) $mg\sin\theta$ c) $mg\cos\theta - F\cos\theta$ d) $mg\cos\theta + F\sin\theta$

217. Block A of mass m and block B of mass $2m$ are placed on a fixed triangular wedge by means of a massless, inextensible string and a frictionless pulley as shown in figure. The wedge is inclined at 45° to the horizontal on both the sides. The coefficient of friction between the block A and the wedge is 2/3 and that between the block B and the wedge is 1/3 and both the blocks A and B are released from rest, the acceleration of A will be

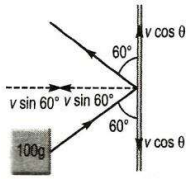


a) -1 b) 1.2 c) 0.2 d) Zero

218. When a bullet is fired at a target, its velocity decreases by half after penetrating 30 cm into it. The additional thickness it will penetrate before coming to rest is

a) 30 cm b) 40 cm c) 10 cm d) 50 cm

219. A mass of 100 g strikes the wall with speed 5 ms^{-1} at an angle as shown in figure and it rebounds with the same speed. If the contact time is 2×10^{-3} s, what is the force applied?



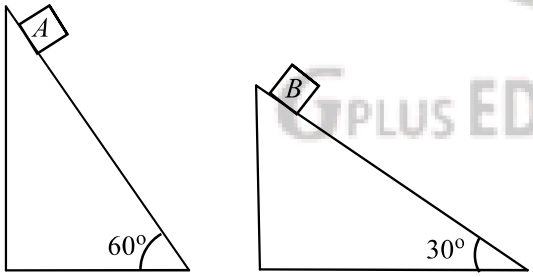
a) $250\sqrt{3}$ N to right b) 250 N to right c) $250\sqrt{3}$ N to left d) 250 N to left

220. The linear momentum ρ of a body moving in one dimension varies with time according to the equation $\rho = a + bt^2$ where a and b are positive constants. The net force acting on the body is

a) A constant b) Proportional to t^2

c) Inversely proportional to t d) Proportional to t

221. Two fixed frictionless in inclined plane making an angle 30° and 60° with the vertical are shown in the figure. Two blocks A and B are placed on the two planes. What is the relative vertical acceleration of A with respect to B?



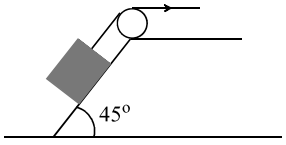
a) 4.9 ms^{-2} in horizontal direction b) 9.8 ms^{-2} in vertical direction

c) Zero d) 4.9 ms^{-2} in vertical direction

222. A rocket is propelled by a gas which is initially at a temperature of 4000 K. The temperature of the gas falls to 1000 K as it leaves the exhaust nozzle. The gas which will acquire the largest momentum while leaving the nozzle, is

a) Hydrogen b) Helium c) Nitrogen d) Argon

223. A block of mass 200 kg is being pulled up by men on an inclined plane at angle of 45° as shown. The coefficient of static friction is 0.5. Each man can only apply a maximum force of 500 N. Calculate the number of men required for the block to just start moving up the plane

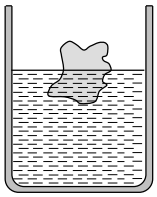


a) 10 b) 15 c) 5 d) 3

224. A man of 50 kg is standing at one end on a boat of length 25 m and mass 200 kg. If he starts running and when he reaches the other end, he has a velocity 2 ms^{-1} with respect to the boat. The final velocity of the boat is (in ms^{-1})

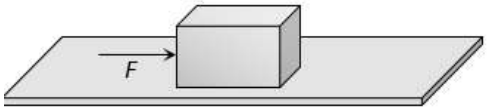
a) $\frac{2}{5}$ b) $\frac{2}{3}$ c) $\frac{8}{5}$ d) $\frac{8}{3}$

225. A body floats in a liquid contained in a beaker. If the whole system as shown in figure falls freely under gravity, then the upthrust on the body due to liquid is



a) Zero
b) Equal to the weight of liquid displaced
c) Equal to the weight of the body in air
d) None of these

226. A block of mass 2 kg is kept on the floor. The coefficient of static friction is 0.4. If a force F of 2.5 $Newtons$ is applied on the block as shown in the figure, the frictional force between the block and the floor will be

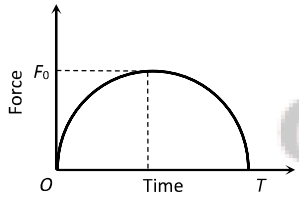


a) 2.5 N b) 5 N c) 7.84 N d) 10 N

227. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$ then the ratio of the masses is

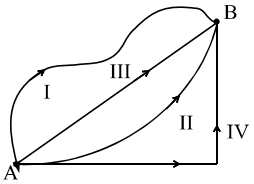
a) 8 : 1 b) 9 : 7 c) 4 : 3 d) 5 : 3

228. A particle of mass m, initially at rest, is acted upon by a variable force F for a brief interval of time T. It begins to move with a velocity u after the force stops acting. F is shown in the graph as a function of time. The curve is semicircle



a) $u = \frac{\pi F_0^2}{2m}$ b) $u = \frac{\pi T^2}{8m}$ c) $u = \frac{\pi F_0 T}{4m}$ d) $u = \frac{F_0 T}{2m}$

229. In a gravitational force field a particle is taken from A to B along different paths as shown in figure. Then



a) Work done along path I will be maximum
b) Work done along path III will be minimum
c) Work done along path IV will be minimum
d) Work done along all the paths will be the same

230. A 100 g iron ball having velocity 10 m/s collides with a wall at an angle 30° and rebounds with the same angle. If the period of contact between the ball and wall is 0.1 $second$, then the force experienced by the wall is

a) 10 N b) 100 N c) 1.0 N d) 0.1 N

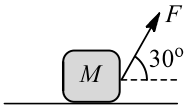
231. A force of 100 dyne acts a mass of 5 gram for 10 s. The velocity produced is

a) 2000 cms^{-1} b) 200 cms^{-1} c) 20 cms^{-1} d) 2 cms^{-1}

232. An astronaut of weight Mg is in a rocket accelerating upward with an acceleration of 4g. The apparent weight of the astronaut will be

a) $5\,Mg$ b) $4\,Mg$ c) Mg d) Zero

233. A block mass 10 kg is kept on a horizontal surface. A force F is acted on the block as shown in figure. For what minimum value of F, the block will be lifter up?



a) 98 N b) 49 N c) 200 N d) None of these

234. A machine gun fires a bullet of mass 40 g with a velocity 1200 ms^{-1} . The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most

a) One b) Four c) Two d) Three

235. The velocity of a body of mass 20 kg decreases from 20 m/s to 5 m/s in a distance of 100 m. Force on the body is

a) $-27.5\ N$ b) $-47.5\ N$ c) $-37.5\ N$ d) $-67.5\ N$

236. Two masses 8 kg and 12 kg are connected at the two ends of a string that goes over a frictionless pulley. Calculate the acceleration of the masses and the tension in the string. (Take $g = 10\ \mathrm{m/s^2}$)

a) $8\ \mathrm{m/s^2}$, 144 N b) $4\ \mathrm{m/s^2}$, 112 N c) $6\ \mathrm{m/s^2}$, 128 N d) $2\ \mathrm{m/s^2}$, 96 N

237. A body of mass 2 kg is being dragged with uniform velocity of 2 m/s on a rough horizontal plane. The coefficient of friction between the body and the surface is 0.20. The amount of heart generated in 5 sec is ($J = 4.2\ joule/cal$ and $g = 9.8\ m/s^2$)

a) 9.33 cal b) 10.21 cal c) 12.67 cal d) 13.34 cal

238. The minimum velocity (in $\mathrm{ms^{-1}}$) with which a car driver must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is

a) $60\ \mathrm{ms^{-1}}$ b) $30\ \mathrm{ms^{-1}}$ c) $15\ \mathrm{ms^{-1}}$ d) $25\ \mathrm{ms^{-1}}$

239. A pendulum bob of mass 50 g is suspended from the ceiling of an elevator. The tension in the string if the elevator goes up with uniform velocity is approximately

a) 0.30 N b) 0.40 N c) 0.42 N d) 0.50 N

240. A block of mass 4 kg is kept on a rough horizontal surface. The coefficient of static friction is 0.8. If a force of 19 N is applied on the block parallel to the floor, then the force of friction between the block and floor is

a) 32 N b) 18 N c) 19 N d) 9.8 N

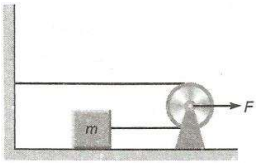
241. A ball falls from 20 m height on floor and rebounds to 5 m. Time of contact is 0.02 s. Find acceleration during impact.

a) $1200\ \mathrm{ms^{-2}}$ b) $1000\ \mathrm{ms^{-2}}$ c) $2000\ \mathrm{ms^{-2}}$ d) $1500\ \mathrm{ms^{-2}}$

242. In an elevator moving vertically up with an acceleration g, the force exerted on the floor by a passenger of mass M is

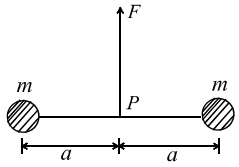
a) Mg b) $\frac{1}{2}\,Mg$ c) Zero d) $2\,Mg$

243. In the given figure the pulley is assumed massless and frictionless. If the friction force on the object of mass m is f, then its acceleration in terms of the force F will be equal to



a) $(F-f)/m$ b) $\left(\frac{F}{2}-f\right)/m$ c) F/m d) None of these

244. The two particles of mass m each are tied at the ends of a light string of length $2a$. The whole system is kept on a frictionless horizontal surface with the string held tight so that each mass is at a distance 'a' from the center P (as shown in the figure). Now, the mid-point of the string is pulled vertically upwards with a small but constant force F. As a result, the particles move towards each other on the surface. The magnitude of acceleration, when the separation between them becomes $2x$, is

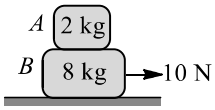


a) $\frac{F}{2m}\frac{a}{\sqrt{a^2-x^2}}$ b) $\frac{F}{2m}\frac{x}{\sqrt{a^2-x^2}}$ c) $\frac{F}{2m}\frac{x}{a}$ d) $\frac{F}{2m}\frac{\sqrt{a^2-x^2}}{x}$

245. A body weight 8 g when placed in one pan and 18 g when placed on the other pan of a false balance. If the beam is horizontal when both the pans are empty. The true weight of the body is

a) 13 g b) 12 g c) 15.5 g d) 15 g

246. Block A of mass 2 kg is placed over a block B of mass 8 kg. The combination is placed on a rough horizontal surface. If g $= 10\text{ms}^{-2}$, coefficient of friction between B and floor $=0.5$, coefficient of friction between A and $B = 0.4$ and a horizontal force of 10 N is applied on 8 kg block, then the force of friction between A and B is



a) 100 N b) 50 N c) 40 N d) None of these

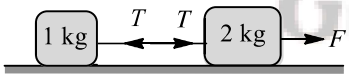
247. A man of mass 60 kg and a boy mass 30 kg are standing together on frictionless ice surface. If they push each other apart, man moves away with a speed of 0.4 ms^1 relative to ice after 5 s. They will be away from each other at a distance of

a) 9.0 m b) 3.0 m c) 6.0 m d) 30 m

248. A player kicks a football of mass 0.5 kg and the football begins to move with a velocity of 10 m/s. If the contact between the leg and the football lasts for $\frac{1}{50}$ sec, then the force acted on the football should be

a) 2500 N b) 1250 N c) 250 N d) 625 N

249. Two blocks masses 1 kg and 2 kg rest on a smooth horizontal table. When the 2 kg block is pulled by a certain force F, the tension T in the string is 1.5 N. The value of F is



a) 1.5 N b) 2.5 N c) 3.5 N d) 4.5 N

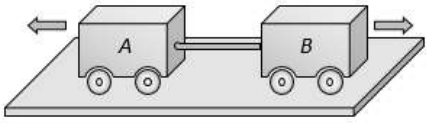
250. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is (Take $g = 10\text{ ms}^{-2}$)

a) 2.0 b) 4.0 c) 1.6 d) 2.5

251. A bag of sand of mass m is suspended by a rope. A bullet of mass $\frac{m}{20}$ is fired at it with a velocity v and gets embedded into it. The velocity of the bag finally is

a) $\frac{v}{20}\times 21$ b) $\frac{20v}{21}$ c) $\frac{v}{20}$ d) $\frac{v}{21}$

252. Two carts of masses 200 kg and 300 kg on horizontal rails are pushed apart. Suppose the coefficient of friction between the carts and the rails are same. If the 200 kg cart travels a distance of 36 m and stops, then the distance travelled by the cart weighing 300 kg is



a) 32 m b) 24 m c) 16 m d) 12 m

253. If a block slides down a plane inclined at 30° with horizontal, then the coefficient of friction between the block and inclined plane is

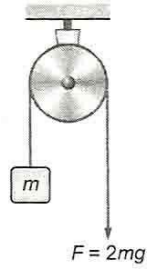
a) 0.5 b) $\frac{1}{3}$ c) $\frac{1}{\sqrt{2}}$ d) $\frac{1}{\sqrt{3}}$

254. A cylinder roll up an inclined plane, reaches some height and then rolls down (without slipping throughout these motions). The directions of frictional force acting on the cylinder are
a) Up the inclined while ascending and down the incline while descending
b) Up the incline while ascending as well as descending
c) Down the incline while ascending and up the incline while descending
d) Down the incline while ascending as well as descending

255. A machine gun fires n bullets per second, each of mass m. If the speed of each bullet is u, then the force of recoil is

a) mng b) mnv c) $mnvg$ d) $\frac{mnv}{g}$

256. In the arrangement shown in figure, if a force 2 mg is applied at the free end of the rope, the mass m will ascend with an acceleration of

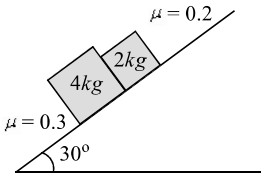


a) $\frac{g}{3}$ b) $\frac{g}{2}$ c) g d) 2 g

257. A partly hanging uniform chain of length chain of length L is resting on a rough horizontal table. l is the maximum possible length that can hang in equilibrium. The coefficient of friction between the chain and table is

a) $\frac{l}{L-l}$ b) $\frac{L}{l}$ c) $\frac{l}{L}$ d) $\frac{lL}{L+l}$

258. Two blocks, 4 kg and 2 kg are sliding down an incline plane as shown in figure. The acceleration of 2 kg block is



a) 1.66 m/s^2 b) 2.66 m/s^2 c) 3.66 m/s^2 d) 4.66 m/s^2

259. A block of mass m is connected to another block of mass M by a spring (massless) of spring constant k. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force F starts acting on the block of mass M to pull it. Find the force on the block of mass m

a) $\frac{mF}{M}$ b) $\frac{(M+m)F}{m}$ c) $\frac{mF}{(m+M)}$ d) $\frac{MF}{(m+M)}$

260. Which of the following quantities measured from different inertial reference frames are same?
a) Force b) Velocity c) Displacement d) Kinetic energy

261. A solid disc of mass M is just held in air horizontally by throwing 40 stones per sec vertically upwards to strike the disc each with a velocity 6 ms^{-1}. If the mass of each stone is 0.05 kg what is the mass of the disc ($g = 10ms^{-2}$)

a) 1.2 kg b) 0.5 kg c) 20 kg d) 3 kg

262. If a person with a spring balance and a body hanging from it goes up and up in an aeroplane, then the reading of the weight of the body as indicated by the spring balance will

a) Go on increasing
b) Go on decreasing
c) First increase and then decrease
d) Remain the same

263. A vehicle of mass m is moving on a rough horizontal road with momentum P. If the coefficient of friction between the tyres and the road be μ, then the stopping distance is

a) $\frac{P}{2\mu mg}$ b) $\frac{P^2}{2\mu mg}$ c) $\frac{P}{2\mu m^2 g}$ d) $\frac{P^2}{2\mu m^2 g}$

264. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient kinetic friction between the tyres and the road is 0.5, the shortest distance in which the car can be stopped is [$g = 10\ ms^{-2}$]

a) 30 m b) 40 m c) 72 m d) 20 m

265. The velocity of a body at time $t = 0$ is $10\sqrt{2}\ m/s$ in the north-east direction and it is moving with an acceleration of $2\ m/s^2$ directed towards the south. The magnitude and direction of the velocity of the body after 5 sec will be

a) 10 m/s, towards east
b) 10 m/s, towards north
c) 10 m/s, towards south
d) 10 m/s, towards north-east

266. A block of mass 5 kg, resting on a horizontal surface, is connected by a cord, passing over a light frictionless pulley to a hanging block of mass 5 kg. The coefficient of kinetic friction between the block and the surface is 0.5. Tension in the cord is [Take $g = 9.8\ ms^{-2}$]

a) 49 N b) 36 N c) 36.75 N d) 2.45 N

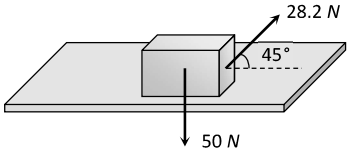
267. The backside of a truck is open and a box of 40 kg is placed 5m away from the rear end. The coefficient of friction of the box with the surface of the truck is 0.15. The truck starts from rest with 2 m/s^2 acceleration. Calculate the distance covered by the truck when the box falls off

a) 20 m b) 30 m c) 40 m d) 50 m

268. An object of mass 5 kg is attached to the hook of a spring balance and the balance is suspended vertically from the roof of a lift. The reading on the spring balance when the lift is going up with an acceleration of $0.25 ms^{-2}$ is ($g = 10 ms^{-2}$)

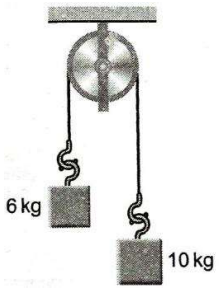
a) 51.25 N b) 48.75 N c) 52.75 N d) 47.25 N

269. A body of weight 50 N placed on a horizontal surface is just moved by a force of 28.2 N. The frictional force and the normal reaction are



a) 10 N, 15 N b) 20 N, 30 N c) 2 N, 3 N d) 5 N, 6 N

270. The tension in the string in the pulley system shown in the figure is



a) 75 N b) 80 N c) 7.5 N d) 30 N

271. A block of mass 50 kg slides over a horizontal distance of 1m. If the coefficient of friction between their surface is 0.2, then work done against friction is

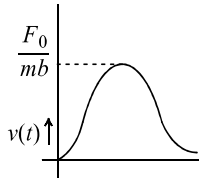
a) 98 J b) 72 J c) 56 J d) 34 J

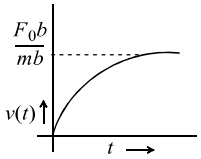
272. If in a stationary lift, a man is standing with a bucket full of water, having a hole at its bottom. The rate of flow of water through this hole is R_0. If the lift starts to move up and down with same acceleration and then that rates of flow of water are R_u and R_d, then
a) $R_0 > R_u > R_d$ b) $R_u > R_0 > R_d$ c) $R_d > R_0 > R_u$ d) $R_u > R_d > R_0$

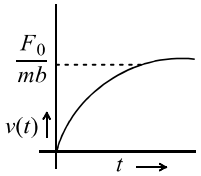
273. For ordinary terrestrial experiments, the observer in an inertial frame in the following cases is
a) A child revolving in a giant wheel
b) A driver in a sport car moving with a constant high speed of 200km h^{-1} on a straight rod
c) The pilot of an aeroplane which is taking off
d) A cyclist negotiating a sharp curve

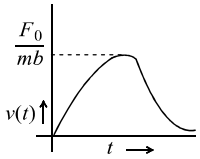
274. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of 5 ms^{-2}, the reading of the spring balance will be
a) 24 N b) 74 N c) 15 N d) 49 N

275. A particle of mass m is at rest at the origin at time $t = 0$. It is subjected to a force $F(t) = F_0 e^{-bt}$ in the x direction. Its speed $v(t)$ is depicted by which of the following curves

a) 

b) 

c) 

d) 

276. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off in two mutually perpendicular directions, one with velocity of $3\,\hat{\mathbf{i}}$ ms^{-1} and the other with a velocity of $4\,\hat{\mathbf{j}}$ ms^{-1}. If the explosion occurs in 10^{-4} s, the force acting on the third piece in newtons is
a) $(3\,\hat{\mathbf{i}} + 4\,\hat{\mathbf{j}}) \times 10^{-4}$ b) $(3\,\hat{\mathbf{i}} - 4\,\hat{\mathbf{j}}) \times 10^{-4}$ c) $(3\,\hat{\mathbf{i}} + 4\,\hat{\mathbf{j}}) \times 10^{4}$ d) $-(3\,\hat{\mathbf{i}} + 4\,\hat{\mathbf{j}}) \times 10^{4}$

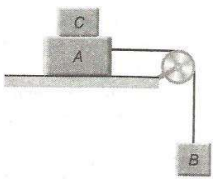
277. A body of mass 5 kg starts from the origin with an initial velocity $\mathbf{u} = (30\hat{\mathbf{i}} + 40\hat{\mathbf{j}})$ ms^{-1}. If a constant force $(-6\hat{\mathbf{i}} - 5\hat{\mathbf{j}})$N acts on the body, the time in which the y component of the velocity becomes zero is
a) 5 s b) 20 s c) 40 s d) 80 s

278. A player caught a cricket ball of mass 150 g moving at the rate of 20 ms^{-1}. If the catching process be completed in 0.1 s, the force of blow exerted by the ball on the hands of the player is
a) 0.3 N b) 30 N c) 300 N d) 3000 N

279. In an air collision between an aeroplane and a bird, the force experienced by the bird as compared to that of the aeroplane is
a) Very high b) Equal c) Less d) Zero

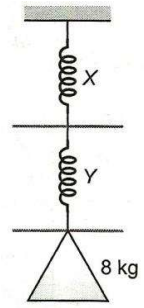
280. A mass of 5 kg is suspended by a rope of length 2 m from a ceiling. A force of 50 N in the horizontal direction is applied at the mid-point of the rope. The angle made by rope with the vertical, in equilibrium is
a) 50° b) 60° c) 30° d) 45°

281. Two masses A and B of 15 kg and 10 kg are connected with a string passing over a frictionless pulley fixed at the corner of a table (as shown in figure). The coefficient of friction between the table and block is 0.4. The minimum mass of C, that may be placed on A to prevent it from moving is



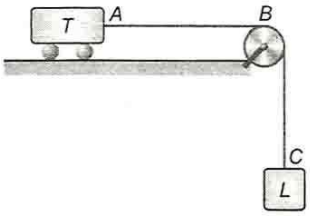
a) 10 kg b) 5 kg c) Zero d) 15 kg

282. A body of mass 8 kg is suspended through two light springs X and Y connected in series as shown in figure. The reading is X and Y respectively are



a) 8 kg, zero b) Zero, 8 kg c) 6 kg, 2 kg d) 8 kg, 8 kg

283. A trolley T (mass 5 kg) on a horizontal smooth surface is pulled by a load L (2 kg) through a uniform rope ABC of length 2 m and mass 1kg. As the load falls from $BC = 0$ to $BC = 2$ m, its acceleration (in ms^{-2}) changes from (Take $g = 10 ms^{-2}$)



a) 20/6 to 20/5 b) 20/8 to 30/8 c) 20/5 to 30/6 d) None of these

284. A uniform metal chain is placed on a rough table such that one end of it hangs down over the edge of the table. When one-third of its length hangs over the edge, the chain starts sliding. Then, the coefficient of static friction is

a) 3/4 b) 1/4 c) 2/3 d) 1/2

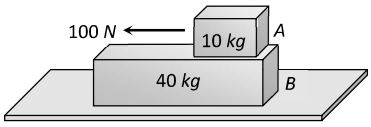
285. In which of the following cases forces may not be required to keep the

a) Particle going in a circle b) Particle going along a straight line
c) The momentum of the particle constant d) Acceleration of the particle constant

286. A stationary bomb explodes into three pieces. One piece of 2 kg mass moves with a velocity of 8 ms^{-1}at right angles to the other pieces of mass 1 kg moving with a velocity of 12 ms^{-1}. If the mass of the third piece is 0.5 kg, then its velocity is

a) 10 ms^{-1} b) 20 ms^{-1} c) 30 ms^{-1} d) 40 ms^{-1}

287. A 40 kg slab rests on a frictionless floor as shown in the figure. A 10 Kg block rests on the top of the slab. The static coefficient of friction between the block and slab is 0.60 while the kinetic friction is 0.40. The 10 kg block is acted upon by a horizontal force 100 N. If $g = 9.8\ m/s^2$, the resultant acceleration of the slab will be



a) 0.98 m/s^2 b) 1.47 m/s^2 c) 1.52 m/s^2 d) 6.1 m/s^2

288. The normal reaction on a body placed in a lift moving up with constant acceleration 2 ms^{-1} is 120 N. Mass of body is (Take $g = 10\ ms^{-2}$)

a) 10 kg b) 15 kg c) 12 kg d) 5 kg

289. A rope of length 5 m is kept on frictionless surface and a force of 5N is applied to one of its end. Find tension in the rope at 1 m from this end

a) 1 N b) 3 N c) 4 N d) 5 N

290. A balloon has 5 g of air. A small hole is pierced into it. The air escapes at a uniform rate with a velocity of 4 cms^{-1}. If the balloon shrinks completely in 2.5 s the average force acting on the balloon is

a) 2 dyne b) 50 dyne c) 8 dyne d) 8 N

291. A car starts from rest to cover a distance s. The coefficient of friction between the road and the tyres is μ. The minimum time in which the car can cover the distance is proportional to

a) μ b) $\sqrt{\mu}$ c) $1/\mu$ d) $1/\sqrt{\mu}$

292. One day on a spacecraft corresponds to 2 days on the earth. The speed of the spacecraft relative to the earth is

a) $1.5 \times 10^8\ ms^{-1}$ b) $2.1 \times 10^8\ ms^{-1}$ c) $2.6 \times 10^8\ ms^{-1}$ d) $5.2 \times 10^8\ ms^{-1}$

293. 100 g of an iron ball having velocity 10 ms^{-1} collides with wall at an angle 30° and rebounds with the same angle. If the period of contact between the ball and wall is 0.1 s, then the average force experienced by the wall is

a) 10 N b) 100 N c) 1.0 N d) 0.1 N

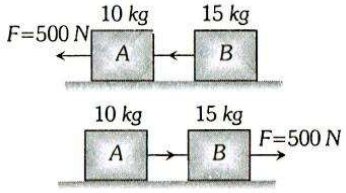
294. A body, whose momentum is constant, must have constant

a) Force b) Velocity c) Acceleration d) All of these

295. A force of 50 $dynes$ is acted on a body of mass 5 g which is at rest for an interval of 3 seconds, then impulse is

a) $0.15 \times 10^{-3}\ Ns$ b) $0.98 \times 10^{-3}\ Ns$ c) $1.5 \times 10^{-3} Ns$ d) $2.5 \times 10^{-3}\ Ns$

296. 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 spring when a horizontal force $F = 500\ N$ is applied to A (as shown in figure 1) and T′′ be the tension when it is applied to B (figure 2), then which of the following is true



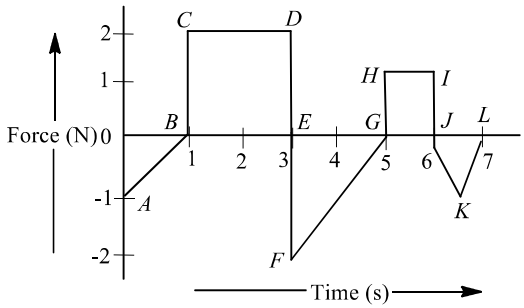
a) $T = T' = 500\ N$ b) $T = T' = 250\ N$

c) $T = 200\ N, T' = 300\ N$ d) $T = 300N, T' = 200\ N$

297. A block of mass m is placed on a smooth inclined plane of inclination θ with the horizontal. The force exerted by the plane on the block has a magnitude

a) mg b) $\frac{mg}{\cos\theta}$ c) $mg\cos\theta$ d) $mg\tan\theta$

298. A force-time graph for a linear motion of a body is shown in the figure. The change in linear momentum between 0 and 7 s is



a) 2 Ns b) 3 Ns c) 4 Ns d) 5 NS

299. A stone is accelerated upwards by a cord whose breaking strength is three times the weight of the stone. The maximum acceleration with which the stone can be moved up without breaking the cord is

a) g b) 2 g c) 3 g d) 4 g

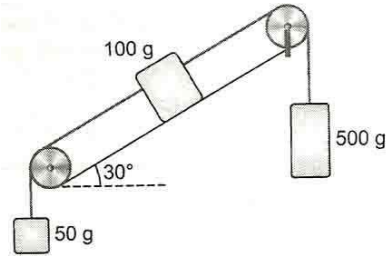
300. An ice cube is kept on an inclined plane of angle 30°. Coefficient of kinetic friction between block and incline plane is $1/\sqrt{3}$. What is acceleration of block

a) Zero b) $2\ m/s^2$ c) $1.5\ m/s^2$ d) $5\ m/s^2$

301. A body of mass 1000 kg is moving horizontally with a velocity 50 m/s. A mass of 250 kg is added. Find the final velocity

a) 40 m/s b) 20 m/s c) $30\sqrt{2}\ m/s$ d) 50 m/s

302. The acceleration of the 500 g block in figure is



a) $\frac{6g}{13}$ downwards b) $\frac{7g}{13}$ downwards c) $\frac{8g}{13}$ downwards d) $\frac{9g}{13}$ upwards

303. A force of 20N is applied on a body of mass 5 kg resting on a horizontal plane. The body gains a kinetic energy of 10 $joule$ after it moves a distance 2 m. The frictional force is

a) 10 N b) 15 N c) 20 N d) 30 N

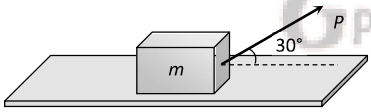
304. An object is kept on a smooth inclined plane of 1 in l. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the inclined is

a) $g\sqrt{l^2-1}$ b) $g(l^2-1)$ c) $\frac{g}{\sqrt{l^2-1}}$ d) $\frac{g}{l^2-1}$

305. A block at rest slides down a smooth inclined plane which makes an angle 60° with the vertical and it reaches the ground in t_1 second. Another block is dropped vertically from the same point and reaches the ground in t_2 second. Then the ratio of $t_1 : t_2$ is

a) 1:2 b) 2:1 c) 1:3 d) $1:\sqrt{2}$

306. A body of mass m rests on horizontal surface. The coefficient of friction between the body and the surface is μ. If the mass is pulled by a force P as shown in the figure, the limiting friction between body and surface will be



a) μmg b) $\mu\left[mg+\left(\frac{P}{2}\right)\right]$ c) $\mu\left[mg-\left(\frac{P}{2}\right)\right]$ d) $\mu\left[mg-\left(\frac{\sqrt{3}P}{2}\right)\right]$

307. When force 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

a) F_1/m b) F_2F_3/mF_1 c) $(F_2-F_3)/m$ d) F_2/m

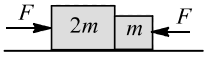
308. A ball of mass 0.2 kg is thrown vertically upward by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes up to 2 m height further, find the magnitude of the force. Consider $g = 10\text{ms}^{-2}$

a) 4 N b) 16 N c) 20 N d) 22 N

309. A block of mass 1 kg slides down on a rough inclined plane of inclination 60° starting from its top. If the coefficient of kinetic friction is 0.5 and length of the plane is 1 m, then work done against friction is (Take $g = 9.8\ m/s^2$)

a) 9.82 J b) 4.94 J c) 2.45 J d) 1.96 J

310. Two blocks are in contact on a frictionless table. One has mass m and other $2m$. A force f is applied on $2m$ as shown in figure. Next the same force F is applied from the right on m. In the two cases respectively, the force of contact between the two blocks will be



a) 2 : 1 b) 1 : 3 c) 1 : 2 d) 3 : 1

311. A body of mass $m = 3.513\ kg$ is moving along the x-axis with a speed of $5.00\ ms^{-1}$. The magnitude of its momentum is recorded as
a) $17.565\ kg\ ms^{-1}$ b) $17.56\ kg\ ms^{-1}$ c) $17.57\ kg\ ms^{-1}$ d) $17.6\ kg\ ms^{-1}$

312. A block of mass M placed on a frictionless horizontal table is pulled by another block of mass m hanging vertically by a massless string passing over a frictionless pully. The tension in the string is
a) $\frac{m}{M+m}g$ b) $\frac{M}{M+m}g$ c) $\frac{M+m}{Mm}g$ d) $\frac{Mm}{M+m}g$

313. In the motion of a racket, physical quantity which is conserved is
a) Angular momentum b) Linear momentum c) Force d) Work

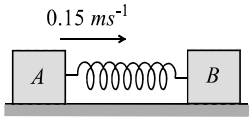
314. A body of mass $2\ kg$ is moving on the ground comes to rest after some time. The coefficient of kinetic friction between the body and the ground is 0.2. The retardation in the body is
a) $9.8\ m/s^2$ b) $4.73\ m/s^2$ c) $2.16\ m/s^2$ d) $1.96\ m/s^2$

315. A body is coming with a velocity of 72 kmh^{-1} on a rough horizontal surface of coefficient of friction 0.5. If the acceleration due to gravity is 10 ms^{-2}, find the minimum distance it can be stopped
a) 400 m b) 40 m c) 0.40 m d) 4 m

316. A particle moves in the X-Y plane under the influence of a force such that its linear momentum is $\mathbf{p}(t) = A[\hat{\mathbf{i}}\cos(kt) - \hat{\mathbf{j}}\sin(kt)]$ where A and k are constant. The angle between the force and the momentum is
a) 0° b) 30° c) 45° d) 90°

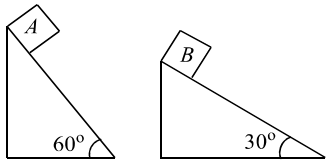
317. A bullet of mass 0.05 kg moving with a speed of 80 ms^{-1} enters a wooden block and is stopped after a distance of 0.40 m. The average resistive force exerted by the block on the bullet is
a) 300 N b) 20 N c) 400 N d) 40 N

318. Two rectangular blocks A and B of masses 2 kg and 3 kg respectively are connected by a spring of spring constant $10.8\ Nm^{-1}$ and are placed on a frictionless horizontal surface. The block A was given an initial velocity of $0.15\ ms^{-1}$ in the direction shown in the figure. The maximum compression of the spring during the motion is



a) $0.01\ m$ b) $0.02\ m$ c) $0.05\ m$ d) $0.03\ m$

319. The fixed frictionless inclined planes making an angle 30° and 60° with the vertical are shown in the figure. Two blocks A and B are placed on the two planes. What is the relative vertical acceleration of A with respect to B



a) $4.9\ ms^{-2}$ in vertical direction b) $4.9\ ms^{-2}$ in horizontal direction
c) $9.8\ ms^{-2}$ in vertical direction d) Zero

320. Newton's third law of motion leads to the law of conservation of
a) Angular momentum b) Energy c) Mass d) Momentum

321. A 500 kg horse pulls a cart of mass 1500 kg along a level road with an acceleration of $1\ ms^{-2}$. If the coefficient of sliding friction is 0.2, then the force exerted by the horse in forward direction is
a) $3000\ N$ b) $4000\ N$ c) $5000\ N$ d) $6000\ N$

322. Three weights W, $2W$ and $3W$ are connected to identical springs suspended from a rigid horizontal rod. The assembly of the rod and the weights fall freely. The positions of the weights from the rod are such that
a) $3W$ will be farthest b) W will be farthest
c) All will be at the same distance d) $2W$ will be farthest

323. A shell is fired from cannon with a velocity v ms^{-1} at an angle of θ with the horizontal direction. At the highest point in its path, it explodes into 2 pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other piece immediately after the explosion is
a) $\sqrt{3/2}\, v\cos\theta$ b) $v\cos\theta$ c) $2v\cos\theta$ d) $3v\cos\theta$

324. When a horse pulls a wagon, the force that causes the horse to move forward is the force
a) The ground exerts on it b) It exerts on the ground
c) The wagon exerts on it d) It exerts on the wagon

325. To avoid slipping while walking on ice, one should take smaller steps because of the
a) Friction of ice is large b) Larger normal reaction
c) Friction of ice is small d) Smaller normal reaction

326. Three guns are aimed at the centre of a circle. They are mounted on the circle, 120° apart. They fire in a timed sequence, such that the three bullets collide at the centre and mash into a stationary lump. Two of the bullets have identical masses of 4.5 g and speed of v_1 and v_2. The third bullet has a mass of 2.50 g and a speed of 575 ms^{-1}
Find the unknown speeds.
a) 200 ms^{-1} each b) 145 ms^{-1} and 256 ms^{-1}
c) 536 ms^{-1} and 320 ms^{-1} d) None of the above

327. A child weighing 25 kg slides down a rope hanging from the branch of a tall tree. If the force of friction acting against him is 2 N, what is the acceleration of the child (Take $g = 9.8\ m/s^2$)
a) 22.5 m/s^2 b) 8 m/s^2 c) 5 m/s^2 d) 9.72 m/s^2

328. A 2 kg mass starts from rest on an inclined smooth surface with inclination 30° and length 2 m. How much will it travel before coming to rest on a frictional surface with frictional coefficient of 0.25
a) 4 m b) 6 m c) 8 m d) 2 m

329. Starting from rest, the time taken by a body sliding down on a rough inclined plane at 45° with the horizontal is twice the time taken to travel on a smooth plane of same inclination and same distance. Then the coefficient of kinetic friction is
a) 0.25 b) 0.33 c) 0.50 d) 0.75

330. A jet engine works on the principle of
a) Conservation of mass b) Conservation of energy
c) Conservation of linear momentum d) Conservation of angular momentum

331. A box of mass m kg is placed on the rear side of an open truck accelerating at t ms^{-2}. The coefficient of friction between the box and the surface below it is 0.4. The net acceleration of the box with respect to the truck is zero. The value of m is [Given g = 10 ms^{-2}]
a) 4 kg b) 8 kg c) 9.78 kg d) It could be any value

332. Two balls of masses m_1 and m_2 are separated from each other by a powder charge placed between them. The whole system is at rest on the ground. Suddenly the powder charge explodes and masses are pushed apart. The mass m_1 travels a distance s_1 and stops. If the coefficients of friction between the balls and ground are same, the mass m_2 stops after traveling the distance
a) $s_2 = \frac{m_1}{m_2}s_1$ b) $s_2 = \frac{m_2}{m_1}s_1$ c) $s_2 = \frac{m_1^2}{m_2^2}s_1$ d) $s_2 = \frac{m_2^2}{m_1^2}s_1$

333. In the above question, the acceleration of mass m is
a) $\frac{F}{m}$ b) $\frac{F-T}{m}$ c) $\frac{F+T}{m}$ d) $\frac{F}{M}$

334. A block is at rest on an inclined plane making an angle α with the horizontal. As the angle α of the incline is increased, the block starts slipping when the angle of inclination becomes θ. The coefficient of static friction between the block and the surface of the incline plane is or A body starts sliding down at an angle θ to horizontal. Then coefficient of friction equal to
a) $\sin\theta$ b) $\cos\theta$ c) $\tan\theta$ d) Independent of θ

335. A given object takes n times more time to slide down a 45° rough inclined plane as it takes so slide down a perfectly smooth 45° incline. The coefficient of kinetic friction between the object and the incline is

a) $\frac{1}{1-n^2}$ b) $1-\frac{1}{n^2}$ c) $\sqrt{1-\frac{1}{n^2}}$ d) $\sqrt{\frac{1}{1-n^2}}$

336. An iron nail is dropped from a height h from the level of a sand bed. If it penetrates through a distance x in the sand before coming to rest, then average force exerted by the sand on nail is

a) $mg\left(\frac{h}{x}+1\right)$ b) $mg\left(\frac{x}{h}+1\right)$ c) $mg\left(\frac{h}{x}-1\right)$ d) $mg\left(\frac{x}{h}-1\right)$

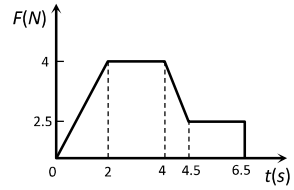
337. A block compartment containing gas is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is

a) Same everywhere b) Lower in front side c) Lower in rear side d) Lower in upper side

338. The average resisting force that must act on a 5 kg mass to reduce its speed from 65 cm/s to 15 cm/s in 0.2s is

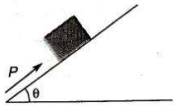
a) 12.5 N b) 25 N c) 50 N d) 100 N

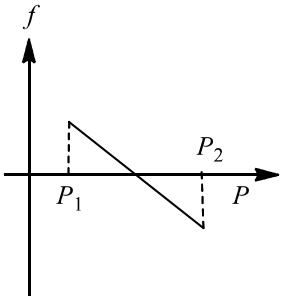
339. A body of 2 kg has an initial speed 5 ms^{-1}. A force acts on it for some time in the direction of motion. The force time graph is shown in figure. The final speed of the body

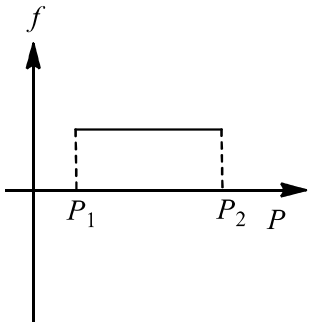


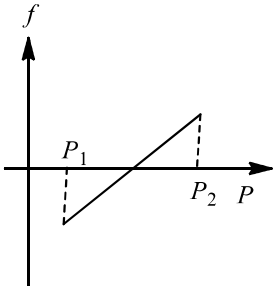
a) 9.25 ms^{-1} b) 5 ms^{-1} c) 14.25 ms^{-1} d) 4.25 ms^{-1}

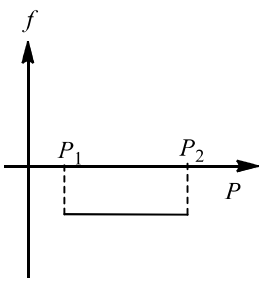
340. A block of mass m is on an inclined plane of angle θ. The coefficient of friction between the block and the plane is μ and $\tan\theta > \mu$. The block is held stationary by applying a force E parallel to the plane. The direction of force pointing up the plane is taken to be positive. As P is varied from $P_1 = mg(\sin\theta - \mu\cos\theta)$ to $P_2 = mg(\sin\theta + \mu\cos\theta)$, the frictional force f *versus* P graph will look like



a)


b)


c)


d)


341. A body is moving along a rough horizontal surface with an initial velocity 6 m/s. If the body comes to rest after travelling $9m$, then the coefficient of sliding friction will be
a) 0.4 b) 0.2 c) 0.6 d) 0.8

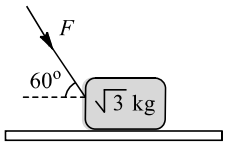
342. In the above ques., the height to which the lift takes the passenger is
a) 3.6 $meters$ b) 8 $meters$ c) 1.8 $meters$ d) 36 $meters$

343. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of $v\ m/s$ will be
a) $\frac{Mv}{2}$ newton b) Zero c) Mv newton d) 2 Mv newton

344. 300 $joule$ of work is done in sliding up a 2 kg block on an inclined plane to a height of 10 $metres$. Taking value of acceleration due to gravity 'g' to be 10 m/s^2, work done against friction is
a) 100 J b) 200 J c) 300 J d) Zero

345. A mass of 10 kg is suspended from a string balance. It is pulled aside by a horizontal string so that it makes an angle of 60° with the vertical. The new reading of the balance is
a) 20 kg-wt b) 10 kg-wt c) $10\sqrt{3}$ kg-wt d) $20\sqrt{3}$ kg-wt

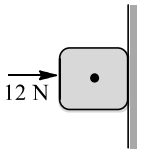
346. A block of mass $\sqrt{3}$ kg resting on a horizontal surface. A force F is applied on the block as shown in figure. If coefficient of friction between the block be $\frac{1}{2\sqrt{3}}$, what can be the maximum value of force F so that block does not start moving? (Take g = 10 ms^{-2})



a) 20 N b) 10 N c) 12N d) 15 N

347. A force of 1200 N acts on a 0.5 kg steel ball as result of collision lasting 25 ms. If the force is in a direction opposite to the initial velocity of 14 ms^{-1} then the final speed of the steel ball would be
a) 24 ms^{-1} b) 35 ms^{-1} c) 12 ms^{-1} d) 46 ms^{-1}

348. A block of weight 5N is pushed against a vertical wall by a force 12N. The coefficient of friction between the wall and block is 0.6. The magnitude of the force exerted by the wall on the block is



a) 12 N b) 5 N c) 7.2 N d) 13 N

349. The 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 not true
a) The force on the 6^{th} (counted from the bottom) due to all the coins on its top is equal to 4 mg (downwards)
b) The force on the 6^{th} coin due to 7^{th} coin is $4mg$ (downwards)
c) The reaction of the 6^{th} coin on the 7^{th} coin is 4 mg (upwards)
d) The total force on the 10^{th} coin is 9 mg (downwards)

350. A stationary bomb explodes into three pieces. One piece of 2 kg mass moves with a velocity of 8 ms^{-1} at right angles to the other piece of mass 1 kg moving with a velocity of 12 ms^{-1}. If the mass of the third piece is 0.5 kg, then its velocity is
a) 10 ms^{-1} b) 20 ms^{-1} c) 30 ms^{-1} d) 40 ms^{-1}

351. Newton's second and third laws of motion lead to the conservation of
a) Linear momentum b) Angular momentum c) Potential energy d) Kinetic energy

352. A chain lies on a rough horizontal table. It starts sliding when one-fourth of its length hangs over the edge of the table. The coefficient of static friction between the chain and the surface of the table is

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{5}$

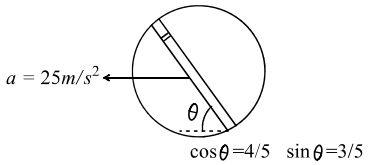
353. The minimum force required to start pushing a body up a rough (frictional coefficient μ) inclined plane is F_1 while the minimum force needed to prevent it from sliding down is F_2. If the inclined plane makes an angle θ from the horizontal such that $\tan\theta = 2\mu$, then the ratio $\frac{F_1}{F_2}$ is

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

354. A body of mass 2 kg is kept by pressing to a vertical wall by a force of 100 N. The coefficient of friction between wall and body is 0.3. Then the frictional force is equal to

a) 6 N b) 20 N c) 600 N d) 700 N

355. A circular disc with a groove along its diameter is placed horizontally. A block of mass $1kg$ is placed as shown. The co-efficient of friction between the block and all surfaces of groove in contact is $\mu = 2/5$. The disc has an acceleration of 25 m/s^2. Find the acceleration of the block with respect to disc

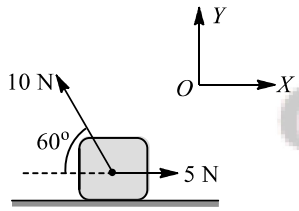


a) 10 m/s^2 b) 5 m/s^2 c) 20 m/s^2 d) 1 m/s^2

356. A solid disc of mass M is just held in air horizontal by throwing 40 stones per sec vertically upwards to strike the disc each with a velocity 6 ms^{-1}. If the mass of each stone is 0.05 kg. What is the mass of the disc (g = 10 ms^{-2})

a) 1.2 kg b) 0.5 kg c) 20 kg d) 3 kg

357. A block of mass $\sqrt{3}$ kg rests on a horizontal frictionless XY plane. What would be the acceleration of the block if it is subjected to two forces as shown in figure?



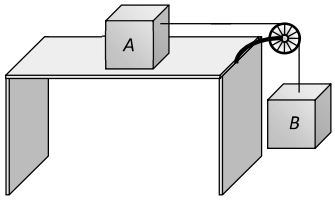
a) 2.5 ms^{-2} b) 5 ms^{-2} along Y-axis

c) 10 ms^{-2} along X-axis d) 15 ms^{-2} along Y-axis

358. Two forces of magnitude F have a resultant of the same magnitude F. The angle between the two forces is

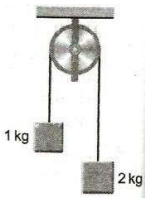
a) 45° b) 120° c) 150° d) 60°

359. A block A of mass 7 kg is placed on a frictionless table. A thread tied to it passes over a frictionless pulley and carries a body B of mass 3 kg at the other end. The acceleration of the system is (given $g = 10\ ms^{-2}$)



a) 100 ms^{-2} b) 3 ms^{-2} c) 10 ms^{-2} d) 30 ms^{-2}

360. Two blocks of masses 1 kg and 2 kg are connected by a metal wire going over a smooth pulley as shown in figure. The breaking stress of the metal is 2×10^9 Nm^{-2}. What should be the minimum radius of the wire used if it is not to break? Take $g = 10$ ms^{-2}



a) 4.6×10^{-5} m b) 4.6×10^{-6} m c) 2.5×10^{-6} m d) 2.5×10^{-5} m

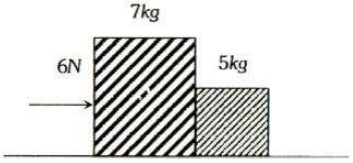
361. When forces F_1, F_2, F_3 are acting on a particle of mass m such that F_2 and F_3 are naturally perpendicular, then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is

a) F_1/m b) F_2F_3/mF_1 c) $(F_2 - F_3)/m$ d) F_2/m

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

a) 60° b) 45° c) 30° d) 15°

363. Two block of masses 7 kg and 5 kg are placed in contact with each other on a smooth surface. If a force of 6 N is applied on the heavier mass, the force on the lighter mass is

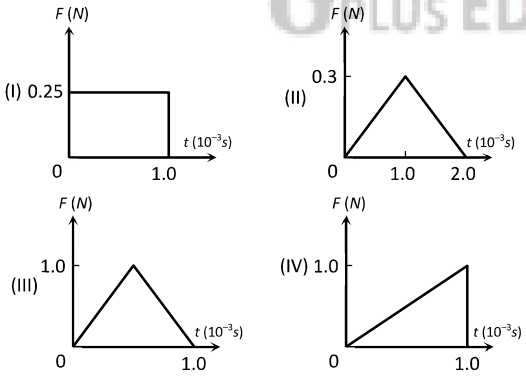


a) 3.5 N b) 2.5 N c) 7 N d) 5 N

364. A particle moves in a circular path with decreasing speed. Choose the correct statement

a) Angular momentum remains constant
b) Acceleration $\vec{a}$ is towards the centre
c) Particle moves in a spiral path with decreasing radius
d) The direction of angular momentum remains constant

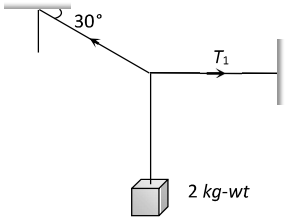
365. Figures I, II, III and IV depict variation of force with time



The impulse is highest in the case of situations depicted. Figure

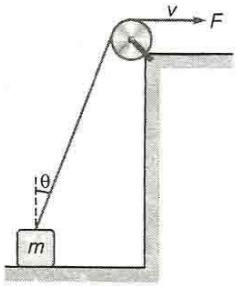
a) I and II b) III and I c) III and IV d) IV only

366. A body of weight 2 kg is suspended as shown in the figure. The tension T_1 in the horizontal string (in $kg\ wt$) is



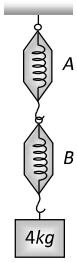
a) $2/\sqrt{3}$ b) $\sqrt{3}/2$ c) $2\sqrt{3}$ d) 2

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



a) v b) $v \sin\theta$ c) $\frac{v}{\sin\theta}$ d) $\frac{v}{\cos\theta}$

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



a) 4 kg and zero kg b) Zero kg and 4 kg c) 4 kg and 4 kg d) 2 kg and 2 kg

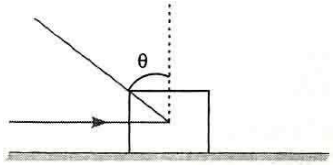
369. A cold soft drink is kept on the balance. When the cap is open, then the weight
a) Increases b) Decreases
c) First increases then decreases d) Remains same

370. An ice tube is kept on an inclined plane of angle 30°. Coefficient of kinetic friction between block and inclined plane is $\frac{1}{\sqrt{3}}$. What is the acceleration of block?
a) Zero b) 2 ms^{-2} c) 1.5 ms^{-2} d) 5 ms^{-2}

371. A man weighs 80 kg. He stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of $5m/s^2$. What would be the reading on the scale. ($g = 10\ m/s^2$)
a) 400 N b) 800 N c) 1200 N d) Zero

372. A 20 kg block is initially at rest on a rough horizontal surface. A horizontal force of 75 N is required set the block in motion. After it is in motion, a horizontal force of 60 N is required to keep the block moving with constant speed. The coefficient of static friction is
a) 0.38 b) 0.44 c) 0.52 d) 0.60

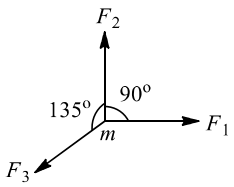
373. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is



a) $\frac{P + Q\sin\theta}{mg + Q\cos\theta}$ b) $\frac{P\cos\theta + Q}{mg - Q\sin\theta}$ c) $\frac{P + Q\cos\theta}{mg + Q\sin\theta}$ d) $\frac{P\sin\theta - Q}{mg - Q\cos\theta}$

374. The mass of ship is $2 \times 10^7\ kg$. On applying a force of $25 \times 10^5\ N$, it is displaced through 25 m. After the displacement, the velocity acquired by the ship will be
a) 12.5 m/s b) 5 m/s c) 3.7 m/s d) 2.5 m/s

375. When a force F acts on a body of mass m, the acceleration produced in the body is a. If three equal forces $F_1 = F_2 = F_3 = F$ act on the same body as shown in figure, the acceleration produced is



a) $(\sqrt{2}-1)a$ b) $(\sqrt{2}+1)a$ c) $\sqrt{2}a$ d) a

376. A block of 1 kg is stopped against a wall by applying a force F perpendicular to the wall. If $\mu = 0.2$ then minimum value of F will be

a) 980 N b) 49 N c) 98 N d) 490 N

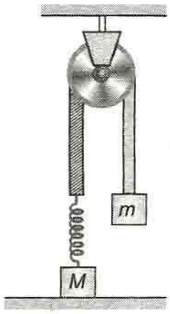
377. A train is moving with velocity 20 m/sec. On this dust is falling at the rate of 50 $kg/minute$. The extra force required to move this train with constant velocity will be

a) 16.66 N b) 1000 N c) 166.6 N d) 1200 N

378. Two masses $m_1 = 5$ kg and $m_2 = 4.8$ kg tried to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when lift is free to move? ($g = 9.8$ ms^{-2})

a) 0.2 ms^{-2} b) 9.8 ms^{-2} c) 5 ms^{-2} d) 4.8 ms^{-2}

379. In the figure, the ball A is released from rest when the spring is at its natural length. For the block B of mass M to leave contact with the ground at same stage, the minimum mass of A must be



a) $2M$
b) M
c) $\frac{M}{2}$
d) A function of M and the force constant of the spring

380. A 1000 kg lift is supported by a cable that can support 2000 kg. The shortest distance in which the lift can be stopped when it is descending with a speed of 2.5 ms^{-1} is [Take g = 10 ms^{-2}]

a) 1 m b) 2 m c) $\frac{5}{32}$ m d) $\frac{5}{16}$ m

381. A box is placed on an inclined plane and has to be pushed down. The angle of inclination is

a) Equal to angle of friction b) More than angle of friction
c) Equal to angle of repose d) Less than angle of repose

382. A rocket with a lift-off mass 10^5 kg is blasted upward with an initial acceleration of 5 ms^{-2}. If g = 10 ms^{-2}, then the initial thrust of the blast is

a) 1.5×10^2 N b) 1.5×10^3 N c) 1.5×10^5 N d) 1.5×10^6 N

383. The maximum speed that can be achieved without skidding by a car on a circular unbanked road of radius R and coefficient of static friction μ, is

a) μRg b) $Rg\sqrt{\mu}$ c) $\mu\sqrt{Rg}$ d) $\sqrt{\mu Rg}$

384. A force of 5 N acts on a body of weight 9.8 N. What is the acceleration produced in $m/\sec^2$
a) 49.00 b) 5.00 c) 1.46 d) 0.51

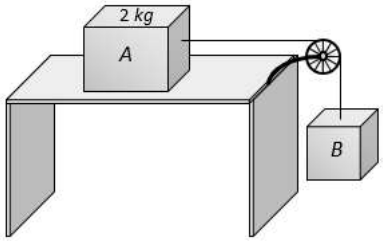
385. A player caught a cricket ball of mass 150 gm moving at the rate of 20 m/sec. If the catching process be completed in 0.1 sec the force of the blow exerted by the ball on the hands of player is
a) 0.3 N b) 30 N c) 300 N d) 3000 N

386. A disc of mass 10 g is kept floating horizontally in air by firing bullets, each of mass 5g , with the same velocity at the same rate of 10 bullets per second. The bullets rebound with the same speed in positive direction. The velocity of each bullet at the time of impact is
a) 196 cms^{-1} b) 98 cms^{-1} c) 49 cms^{-1} d) 392 cms^{-1}

387. A bullet of mass 10 g moving with 300 m/s hits a block of ice of mass 5 kg and drops dead. The velocity of ice is
a) 50 cm/s b) 60 cm/s c) 40 cm/s d) 30 cm/s

388. A particle is moving with a constant speed along a straight line path. A force is not required to
a) Increase its speed b) Decrease the momentum
c) Change in direction d) Keep it moving with uniform velocity

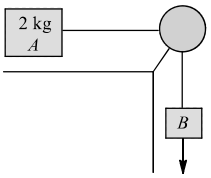
389. The coefficient of static friction, μ_s, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless ($g = 10\ m/s^2$)



a) 2.0 kg b) 4.0 kg c) 0.2 kg d) 0.4 kg

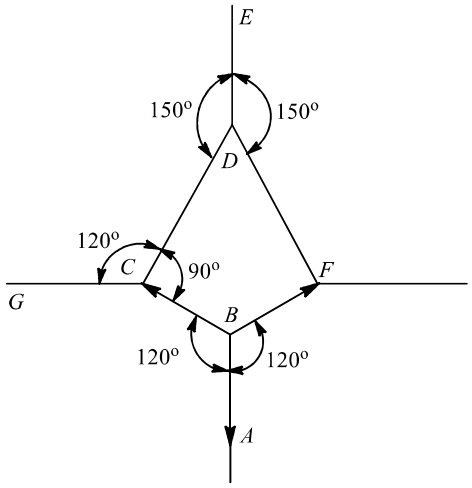
390. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time
a) At the mean position of the platform b) For an amplitude of g/ω^2
c) For an amplitude of g^2/ω^2 d) At the highest position of the platform

391. The coefficient of static friction μ_s between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pully are assumed to be smooth and massless ($\text{g} = 10\ \text{ms}^{-2}$)



a) 2.0 kg b) 4.0 kg c) 0.2 kg d) 0.4 kg

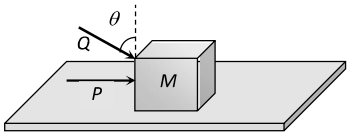
392. The adjacent figure is the part of a horizontally stretched net. Section AB is stretched with a force of 10 N. The tension in the section BC and BF are



a) 10 N, 11N
b) 10 N, 6 N
c) 10 N, 10 N
d) Can't be calculated due to insufficient data

393. A stick of 1 m is moving with velocity of $2.7 \times 10^8\ ms^{-1}$. What is the apparent length of the stick ($c = 3 \times 10^8\ ms^{-1}$)
a) 10 m b) 0.22 m c) 0.44 m d) 2.4 m

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



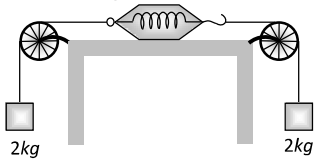
a) $\frac{(P + Q\sin\theta)}{(mg + Q\cos\theta)}$ b) $\frac{(P\cos\theta + Q)}{(mg - Q\sin\theta)}$ c) $\frac{(P + Q\cos\theta)}{(mg + Q\sin\theta)}$ d) $\frac{(P\sin\theta - Q)}{(mg - Q\cos\theta)}$

395. The time in which a force of 2 N produces a change in momentum of 0.4 $kg - ms^{-1}$ in the body is
a) 0.2 s b) 0.02 s c) 0.5 s d) 0.05 s

396. A ball of mass 0.2 kg is thrown normally against a wall with a speed of 15 ms^{-1}. The impulse of the force by the ball on the wall is
a) 0.35 Ns b) 0.7 Ns c) 7 Ns d) 70 Ns

397. The linear momentum of a particle varies with time t as $p = a + bt + ct^2$
Which of the following statements is correct?
a) Force varies with time in a quadratic manner
b) Force is time-dependent
c) The velocity of the particle is proportional to time
d) The displacement of the particle is proportional to t

398. As shown in the figure, two equal masses each of 2 kg are suspended from a spring balance. The reading of the spring balance will be



a) Zero
b) 2 kg
c) 4 kg
d) Between zero and 2 kg

399. Physical independence of force is consequence of
a) Third law of motion b) Second law of motion c) First law of motion d) All of the above

400. A conveyor belt is moving at a constant speed of 2 m/s. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it, taking $g = 10\ ms^{-2}$, is

a) Zero b) 0.4 m c) 1.2 m d) 0.6 m

401. Steady rain, giving 5 mm an hour, turns suddenly into a downpour giving 20 mm an hour and the speed of the rain drops falling vertically on to a flat roof simultaneously doubles. The pressure exerted by the falling rain on the roof is raised by a factor of

a) 4 b) 8 c) 16 d) 32

402. A body of mass 4 kg is accelerated upon by a constant force, travel a distance of 5 m in the first second and a distance of 2 m in the third second. The force acting on the body is

a) 2 N b) 4 N c) 6 N d) 8 N

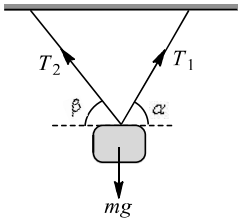
403. Two particle of equal mass are connected to a rope AB of negligible mass, such that one is at end A and the other dividing the length of the rope in the ratio 1:2 from B. The rope is rotated about end B in a horizontal plane. Ratio of the tension in the smaller part to the other is (ignore effect of gravity)

a) 4:3 b) 1:4 c) 1:2 d) 1:3

404. An open carriage in a goods train is moving with a uniform velocity of 10 ms^{-1}. If the rain adds water with zero velocity at the rate of 5 kgs^{-1}, then the additional force applied by the engine to maintain the same velocity of the train is

a) 0.5 N b) 2.0 N c) 50 N d) 25 N

405. A body of mass m is suspended by two strings making angle α and β with the horizontal as shown in figure. Tensions in the two strings are



a) $T_1 = \dfrac{mg\cos\beta}{\sin(\alpha+\beta)} = T_2$ b) $T_1 = \dfrac{mg\sin\beta}{\sin(\alpha+\beta)} = T_2$

c) $T_1 = \dfrac{mg\cos\beta}{\sin(\alpha+\beta)}; T_2 = \dfrac{mg\cos\alpha}{\sin(\alpha+\beta)}$ d) None of the above

406. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button one control panel. The lift starts moving upwards with an acceleration 1.0 m/s^2. If $g = 10\ ms^{-2}$, the tension in the supporting cable is

a) 1200 N b) 8600 N c) 9680 N d) 11000 N

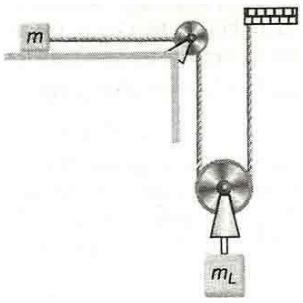
407. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off in two mutually perpendicular directions, one with a velocity of $3\hat{\imath}\ ms^{-1}$ and the other with a velocity of $4\hat{\jmath}\ ms^{-1}$. If the explosion occurs in $10^{-4}\ s$, the average force acting on the third piece in newton is

a) $(3\hat{\imath}+4\hat{\jmath})\times10^{-4}$ b) $(3\hat{\imath}-4\hat{\jmath})\times10^{-4}$ c) $(3\hat{\imath}+4\hat{\jmath})\times10^{4}$ d) $-(3\hat{\imath}+4\hat{\jmath})\times10^{4}$

408. Three solids of masses m_1, m_2 and m_3 are connected with weightless string in succession and are placed on a frictionless table. If the mass m_3 is dragged with a force T, the tension in the string between m_2 and m_3 is

a) $\dfrac{m_2}{m_1+m_2+m_3}T$ b) $\dfrac{m_3}{m_1+m_2+m_3}T$ c) $\dfrac{m_1+m_2}{m_1+m_2+m_3}T$ d) $\dfrac{m_2+m_3}{m_1+m_2+m_3}T$

409. If the surface is smooth, the acceleration of the block m_2 will be



a) $\frac{m_2 g}{4m_1 + m_2}$ b) $\frac{2m_2 g}{4m_1 + m_2}$ c) $\frac{2m_1 g}{m_1 + 4m_2}$ d) $\frac{2m_1 g}{m_1 + m_2}$

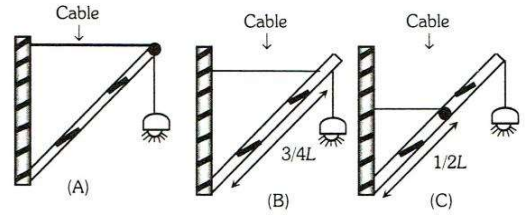
410. A block of mass 2 kg is placed on the floor. The coefficient of static friction is 0.4. If a force of 2.8 N is applied on the block parallel to floor, the force of friction between the block and floor (Taking g = $10\ ms^{-2}$) is

a) 2.8 N b) 8 N c) 2 N d) Zero

411. A point mass m is moving along inclined plane with acceleration a with respect to smooth triangular block. The triangular block is moving horizontally with acceleration a_0. The value of a is

a) $g \sin\theta + a_0 \cos\theta$ b) $g \sin\theta - a_0 \cos\theta$ c) $g \cos\theta - a_0 \sin\theta$ d) None of these

412. If a street light of mass M is suspended from the end of a uniform rod of length L in different possible patterns as shown in figure, then



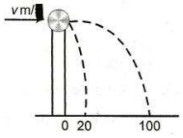
a) Pattern A is sturdier b) Pattern B is sturdier

c) Pattern C is sturdier d) All will have same sturdiness

413. A body of mass $5kg$ rests on a rough horizontal surface of coefficient of friction 0.2. The body is pulled through a distance of $10m$ by a horizontal force of 25 N. The kinetic energy acquired by it is ($g = 10\ ms^2$)

a) 330 J b) 150 J c) 100 J d) 50 J

414. A ball of mass 0.2 kg rests on a vertical post of height 5 m. A bullet of mass 0.01 kg, travelling with a velocity v m/s in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of 20 m and the bullet at ball hits the ground at a distance of 100 m from the foot of the post. The initial velocity v of the bullet is



a) 250 m/s b) $250\sqrt{2}$ m/s c) 400 m/s d) 500 m/s

415. A block of mass 5 kg is moving horizontally at a speed of 1.5 m/s. A perpendicular force of $5N$ acts on it for 4 sec. What will be the distance of the block from the point where the force started acting

a) 10 m b) 8 m c) 6 m d) 2 m

416. A spring balance and a physical balance are kept in a lift. In these balances equal masses are placed. If now the lift starts moving upwards with constant acceleration, then

a) The reading of spring balance will increase and the equilibrium position of the physical balance will disturb

b) The reading of spring balance will remain unchanged and physical balance will remain in equilibrium

c) The reading of spring balance will decrease and physical balance will remain in equilibrium

d) The reading of spring balance will increase and the physical balance will remain in equilibrium

417. A wooden box of mass 8 kg slides down an inclined plane of inclination 30° to the horizontal with a constant acceleration of 0.4 ms^{-2}. What is the force of friction between the box and inclined plane? [g = 10 ms^{-2}]
a) 36.8 N b) 76.8 N c) 65.6 N d) 97.8 N

418. A 60 kg weight is dragged on a horizontal surface by a rope upto 2 $metres$. If coefficient of friction is $\mu = 0.5$, the angle of rope with the surface is 60° and $g = 9.8m/sec^2$, then work done is
a) 294 $joules$ b) 315 $joules$ c) 588 $joules$ d) 197 $joules$

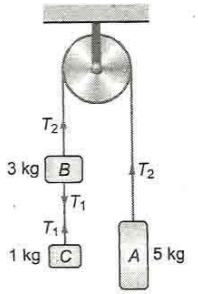
419. A block of base 10 $cm \times 10$ cm and height 15 cm is kept on an inclined plane. The coefficient of friction between them is $\sqrt{3}$. The inclination θ of this inclined plane from the horizontal plane is gradually increased from 0°. Then
a) At $\theta = 30°$, the block will start sliding down the plane
b) The block will remain at rest on the plane up to certain θ and then it will topple
c) At $\theta = 60°$, the block will start sliding down the plane and continue to do so at higher angles
d) At $\theta = 60°$, the block will start sliding down the plane and on further increasing θ, it will topple at certain θ

420. A monkey climbs up and another monkey climbs down a rope hanging from a tree with same uniform acceleration separately. If the respective masses of monkeys are in the ratio 2 : 3, the common acceleration must be
a) $g/5$ b) $6g$ c) $g/2$ d) g

421. The resultant of two forces acting at an angle of 120° is 10 kg-wt and is perpendicular to one of the forces. That force is
a) $\frac{10}{\sqrt{3}}$ kg– wt b) 10 kg-wt c) $20\sqrt{3}$ kg-wt d) $10\sqrt{3}$ kg-wt

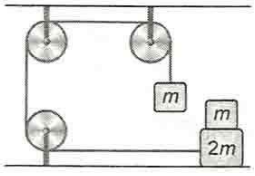
422. A shell of rest at the origin explodes into three fragments of masses 1 kg, 2 kg and m kg. The 1 kg and 2 kg pieces fly off with speed of 5 ms^{-1} along x-axis and 6 ms^{-1} along y-axis respectively. If the m kg piece flies off with speed of 6.5 ms^{-1}, the total mass of the shell must be
a) 4 kg b) 5 kg c) 3.5 kg d) 4.5 kg

423. Refer to the system shown in figure. The acceleration of the masses is



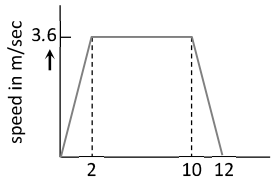
a) $\frac{g}{3}$ b) $\frac{g}{6}$ c) $\frac{g}{9}$ d) $\frac{g}{12}$

424. Mass of 3 kg descending vertically downward supports a mass of 2 kg by means the end of 5 s, the string breaks. How much higher the 2 kg mass will go further?



a) 4.9 m b) 9.8 m c) 19.6 m d) 2.45 m

425. A lift is going up. The total mass of the lift and the passenger is 1500 kg the variation in the speed of the lift is as given in the graph. The tension in the rope pulling the lift at $t = 11^{th} sec$ will be



a) 17400 N b) 14700 N c) 12000 N d) Zero

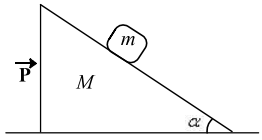
426. A wooden block of mass 1 kg is attached to the hook of a spring balance. The spring balance is then raised with an acceleration of 9.8 ms^{-2}. The apparent weight of the body is

a) 1 kg-wt b) 2 kg-wt c) 3 kg-wt d) 4 kg-wt

427. The engine of a car produces an acceleration of 6ms^{-2} in the car. If this car pulls another car of the same mass, then the acceleration would be

a) 6ms^{-2} b) 12ms^{-2} c) 3ms^{-2} d) 1.5ms^{-2}

428. A wooden wedge of mass M and inclination angle α rests on a smooth floor. A block of mass m is kept on wedge. A force $\vec{\mathbf{P}}$ is applied on the wedge as shown in figure, such that a block remains stationary with respect to wedge. The magnitude of force $\vec{\mathbf{P}}$ is



a) $(M+m)$g tan α b) g tan α c) $mg\cos\alpha$ d) $(M+m)$g cosec α

429. A bird is sitting in a large closed cage which is placed on a spring balance. It records a weight of 25 N. The bird (mass $m = 0.5\ kg$) files upward in the cage with an acceleration of 2 m/s^2. The spring balance will now record a weight of

a) 24 N b) 25 N c) 26 N d) 27 N

430. The ratio of the weight of a man in a stationary lift and when it is moving downward with uniform acceleration 'a' is 3: 2,. The value of 'a' is (g- Acceleration due to gravity of the earth)

a) $\frac{3}{2}g$ b) $\frac{g}{3}$ c) $\frac{2}{3}g$ d) g

431. On the horizontal surface of a truck ($\mu = 0.6$), a block of mass 1 kg is placed. If the truck is accelerating at the rate of $5m/sec^2$ then frictional force on the block will be

a) 5 N b) 6 N c) 5.88 N d) 8 N

432. A body of mass M at rest explodes into three pieces, two of which of mass $M/4$ each are thrown off in perpendicular directions with velocities of 3 m/s and 4 m/s respectively. The third piece will be thrown off with a velocity of

a) 1.5 m/s b) 2.0 m/s c) 2.5 m/s d) 3.0 m/s

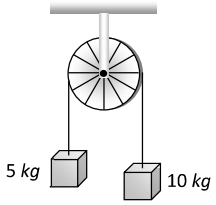
433. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is (g/8), then the ratio of masses is

a) 8 : 1 b) 9 : 7 c) 4 : 3 d) 5 : 3

434. A gun fires N bullets per second, each of mass m with velocity v. The force exerted by the bullets on the gun is

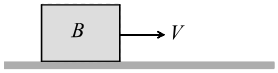
a) vNm b) $\frac{mv}{N}$ c) mvN^2 d) $\frac{mv^2}{N}$

435. Two masses of 5 kg and 10 kg are connected to a pulley as shown. What will be the acceleration of the system (g = acceleration due to gravity)



a) g b) $\frac{g}{2}$ c) $\frac{g}{3}$ d) $\frac{g}{4}$

436. A block B is pushed momentarily along a horizontal surface with an initial velocity V. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time

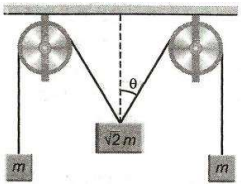


a) $V/(g\mu)$ b) $g\mu/V$ c) g/V d) V/g

437. A vehicle of 100 kg is moving with a velocity of 5 m/sec. To stop it in $\frac{1}{10}$ sec, the required force in opposite direction is

a) 5000 N b) 500 N c) 50 N d) 1000 N

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



a) 0° b) 30° c) 45° d) 60°

439. A gun fires N bullets per second, each of mass m with velocity v. The force exerted by the bullets on the gun is

a) $vN\ m$ b) $\frac{mv}{N}$ c) mvN^2 d) $\frac{mv^2}{N}$

440. A block of mass 1 kg is at rest on a horizontal table. The coefficient of static friction between the block and the table is 0.5. If g $= 10\text{ms}^{-2}$, then the magnitude of the force acting upwards at an angle of 60° from the horizontal that will just start the block moving is

a) 5 N b) 5.36 N c) 74.6 N d) 10 N

441. A mass 1 kg is suspended by a thread. It is (i) lifted up with an acceleration 4.9 m/s^2 (ii) lowered with an acceleration 4.9 m/s^2
The ratio of the tension is

a) 3:1 b) 1:3 c) 1:2 d) 2:1

442. A satellite in force-free space sweeps stationary interplanetary dust at a rate $dM/dt = \alpha v$ where M is the mass, v is the velocity of the satellite and α is a constant. What is the deacceleration of the satellite

a) $-2\alpha v^2/M$ b) $-\alpha v^2/M$ c) $+\alpha v^2/M$ d) $-\alpha v^2$

443. A nucleus disintegrates into two nuclear parts which have their velocities in the ratio 2 : 1. The ratio of their nuclear sizes will be

a) $2^{1/3}:1$ b) $1:3^{1/2}$ c) $3^{1/2}:1$ d) $1:2^{1/3}$

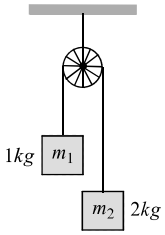
444. A body moves along a circular path of radius $10m$ and the coefficient of friction is 0.5. What should be its angular speed in rad/s if it is not to slip from the surface ($g = 9.8\ m/s^2$)

a) 5 b) 10 c) 0.1 d) 0.7

445. A sphere is accelerated upwards by a cord whose braking strength is four times its weight. The maximum acceleration with which the sphere can move up without breaking the cord is

a) g b) $3g$ c) $2g$ d) $4g$

446. Two masses $m_1 = 1\ kg$ and $m_2 = 2kg$ are connected by a light inextensible string and suspended by means of a weightless pulley as shown in the figure. Assuming that both the masses start from rest, the distance travelled by the centre of mass in two seconds is (Take $g = 10ms^{-2}$)



a) $\frac{20}{9}\ m$ b) $\frac{40}{9}\ m$ c) $\frac{2}{3}\ m$ d) $\frac{1}{3}\ m$

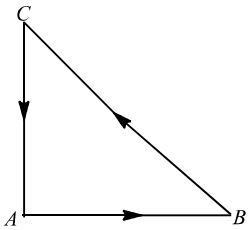
447. A shell of mass 10 kg is moving with a velocity of 10 ms^{-1} when it blasts and forms two parts of mass 9 kg and 1 kg respectively. If the 1st mass is stationary, the velocity of the 2nd is
a) 1 ms^{-1} b) 10 ms^{-1} c) 100 ms^{-1} d) 1000 ms^{-1}

448. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is
a) 30 ms^{-2} downwards b) 4 ms^{-2} upwards c) 4 ms^{-2} downwards d) 14 ms^{-2} upwards

449. When a bus suddenly takes a turn, the passengers are thrown outwards because of
a) Inertia of direction b) Acceleration of motion
c) Speed of motion d) Both (b) and (c)

450. A shell initially at rest explodes into two pieces of equal mass, the two pieces will
a) Move with different velocities in different directions
b) Move with the same velocity in opposite directions
c) Move with the same velocity in the same directions
d) Be at rest

451. Three forces start acting simultaneously on a particle moving with velocity **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



a) Less than **v** b) Greater than **v**
c) v in the direction of largest force BC d) **v** remaining unchanged

452. A man wants to slide down a rope. The breaking load for the rope $\frac{2}{3}$rd of the weight of the man. With what minimum acceleration should fireman slide down?
a) $\frac{g}{4}$ b) $\frac{g}{3}$ c) $\frac{2g}{3}$ d) $\frac{g}{6}$

453. A blumb bob is hung from the ceiling of a train compartment. The train moves on an inclined track of inclination 30° with horizontal. Acceleration of train up the plane is $a = 9/2$. The angle which the string supporting the bob makes with normal to the ceiling in equilibrium is
a) 30° b) $\tan^{-1}\left(\frac{2}{\sqrt{3}}\right)$ c) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ d) $\tan^{-1}(2)$

454. A lift is moving upwards with a uniform velocity v in which a block of mass m is lying. The frictional force offered by the block, when coefficient of the frictional is μ, will be
a) Zero b) mg c) μmg d) $2\mu mg$

455. A shell of mass 10 kg is moving with a velocity of 10 ms^{-1} when it blasts and forms two parts of mass 9 kg and 1 kg respectively. If the 1^{st} mass is stationary, the velocity of the 2^{nd} is
a) 1 m/s b) 10 m/s c) 100 m/s d) 1000 m/s

456. The rate of mass of the gas emitted from rear of a rocket is initially 0.1 kg/sec. If the speed of the gas relative to the rocket is 50 m/sec and mass of the rocket is 2 kg, then the acceleration of the rocket in m/sec^2 is
a) 5 b) 5.2 c) 2.5 d) 25

457. A machine gun fires 20 bullets per second into a target. Each bullet weighs 150 gms and has a speed of 800 m/sec. Find the force necessary to hold the gun in position
a) 800 N b) 1000 N c) 1200 N d) 2400 N

458. Force required to move a mass of 1 kg at rest on a horizontal rough plane ($\mu = 0.1$ and $g = 9.8\ ms^{-2}$) is
a) 0.98 N b) 0.49 N c) 9.8 N d) 4.9 N

459. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg first part moving with a velocity of 12 ms^{-1} and 2 kg second part moving with a velocity of 8 ms^{-1}. If the third part files off with a velocity of 4 ms^{-1}, its mass would be
a) 5 kg b) 7 kg c) 17 kg d) 3 kg

460. A block of base 10 cm × 10 cm and height 15 cm is kept on an inclined plane. The coefficient of friction between them is $\sqrt{3}$. The inclination θ of this inclined plane from the horizontal plane is gradually increased from 0°. Then,
a) at $0 = 30°$, the block will start sliding down the plane
b) The block will remain at the rest on the plane up to certain θ and then it will topple
c) At $\theta = 60°$, the block will start sliding down the plane and continue to do so at higher angles
d) At $\theta = 60°$, the block will start sliding down the plane and on further increasing θ, it will topple at certain θ

461. A block of mass m is resting on a smooth horizontal surface. One end of a uniform rope of mass $(m/3)$ is fixed to the block, which is pulled in the horizontal direction by applying a force F at the other end. The tension in the middle of the rope is
a) $\frac{8}{7}F$ b) $\frac{1}{7}F$ c) $\frac{1}{8}F$ d) $\frac{7}{8}F$

462. Two masses m_1 and m_2 $(m_1 > m_2)$ are connected by massless flexible and inextensible string passed over massless and frictionless pulley. The acceleration of centre of mass is
a) $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2 g$ b) $\frac{m_1 - m_2}{m_1 + m_2} g$ c) $\frac{m_1 + m_2}{m_1 - m_2} g$ d) Zero

463. The resultant of two forces $3P$ and $2P$ is R. If the first force is doubled then the resultant is also doubled. The angle between the two forces is
a) 60° b) 120° c) 70° d) 180°

464. A rocket standing vertically on a launch pad has to start moving up with practically zero velocity. If the initial mass of the rocket is 5×10^5 kg, then the rate of burning of the fuel should be [Take $g = 10\ ms^{-2}$ and velocity of exhaust gases $= 10\ kms^{-1}$]
a) 10 kgs^{-1} b) 50 kgs^{-1} c) 500 kgs^{-1} d) 5000 kgs^{-1}

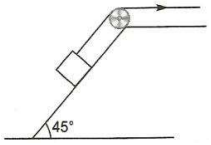
465. The momentum is most closely related to
a) Force b) Impulse c) Power d) K.E.

466. A block weighing W is held against a vertical wall by applying a horizontal force F. The minimum value of F needed to hold the block is
a) Less than W b) Equal to W c) Greater than W d) Data is insufficient

467. A block is lying static on the floor. The maximum value of static frictional force on the block is $10N$. If a horizontal force of 8 N is applied to the block, what will be the frictional force on the block
a) 2 N b) 18 N c) 8 N d) 10 N

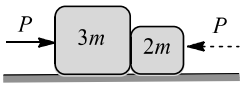
468. Force required to move a mass of 1 kg at rest on a horizontal rough plane ($\mu = 0.1$ and $g = 9.8\ m/s^2$) is
a) 0.98 N b) 0.49 N c) 9.8 N d) 4.9 N

469. A block of mass 200 kg is being pulled up by men on an inclined plane at angle of 45° as shown in the figure. The coefficient of static friction is 0.5. Each man can only apply a maximum force of 500 N. Calculate the number of men required for the block to just start moving up the plane.



a) 10 b) 15 c) 5 d) 3

470. Two blocks of masses 3 m and 2 m are in contact on a smooth table. A force P is first applied horizontally on block of mass 3 m and then on mass 2 m. The contact forces between the two blocks in the two cases are in the ratio



a) 1 : 2 b) 2 : 3 c) 3 : 2 d) 5 : 3

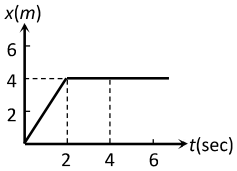
471. If a force of 250 N act on body, the momentum acquired is 125 kg-m/s. What is the period for which force acts on the body

a) 0.5 sec b) 0.2 sec c) 0.4 sec d) 0.25 sec

472. The average force necessary to stop a bullet of mass 20 g moving with a speed of 250 m/s, as it penetrates into the wood for a distance of 12 cm is

a) 2.2×10^3 N b) 3.2×10^3 N c) 4.2×10^3 N d) 5.2×10^3 N

473. 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



a) 0.2 $kg\ m\ \sec^{-1}$ b) $-0.2\ kg\ m\ \sec^{-1}$ c) 0.1 $kg\ m\ \sec^{-1}$ d) $-0.4\ kg\ m\ \sec^{-1}$

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

a) $\frac{4w_1w_2}{w_1+w_2}$ b) $\frac{2w_1w_2}{w_1+w_2}$ c) $\frac{w_1-w_2}{w_1+w_2}$ d) $\frac{w_1w_2}{2(w_1+w_2)}$

475. The engine of a car produces acceleration 4 m/s^2 in the car. If this car pulls another car of same mass, what will be the acceleration produced

a) 8 m/s^2 b) 2 m/s^2 c) 4 m/s^2 d) 1/2 m/s^2

476. Two small balls of same size and masses m_1 and m_2 $(m_1 > m_2)$ are tied by a thin weightless thread and dropped from a certain height. Training upward buoyancy force F into account, the tension T of the thread during the flight after the motion of the ball becomes uniform will be

a) $(m_1 - m_2)$g b) $(m_1 - m_2)$g/2 c) $(m_1 + m_2)$g d) $(m_1 + m_2)$g/2

477. A coin of mass 10 kg is placed over a book of length 50 cm. The coin is on the verge of sliding when one end of the book is lifted 10 cm up. The coefficient of static friction between the book and the coin is

a) 1.0 b) 0.4 c) 0.3 d) 0.2

478. If coefficient of friction between an inset and bowl is μ and radius of the bowl is r, the maximum height to which the insect can crawl in the bowl is

a) $r\left[1 - \frac{1}{\sqrt{1+\mu^2}}\right]$ b) $\frac{r}{\sqrt{1+\mu^2}}$ c) $r\sqrt{1+\mu^2}$ d) $r[\sqrt{1+\mu^2} - 1]$

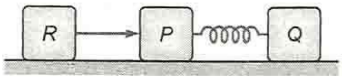
479. Consider the following two statements :

I. Linear momentum of a system of particles is zero.

II. Kinetic energy of a system of particles is zero. Then

a) I does not imply II and II does not imply I
b) I implies II but II does not imply I
c) I does not imply II but II implies I
d) I implies II and II implies I

480. Two elastic blocks P and Q of equal masses m and connected by a massless spring rest on a smooth horizontal surface, as in figure. A third block R of the same mass M strikes the block P. After the collision, P and Q will



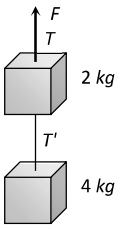
a) Always move in same direction
b) Sometimes move in same direction and sometime move in opposite directions
c) Always move in opposite directions
d) Be at rest with respect to each other

481. A man is standing on a balance and his weight is measured. If he takes a step in the left side, then weight
a) Will decrease
b) Will increase
c) Remains same
d) First decreases then increases

482. The coefficient of kinetic friction between a 20 kg box and the floor is 0.40. How much work does a pulling force do on the box in pulling it 8.0 m across the floor at constant speed? The pulling force is directed 37° above the horizontal
a) 343 J
b) 482 J
c) 14.4 J
d) None of these

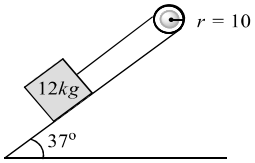
483. Work done by a frictional force is
a) Negative
b) Positive
c) Zero
d) All of the above

484. Two blocks are connected by a string as shown in the diagram. The upper block is hung by another string. A force F applied on the upper string produces an acceleration of 2 m/s^2 in the upward direction in both the blocks. If T and T' be the tensions in the two parts of the string, then ($g = 9.8\ m/s^2$)



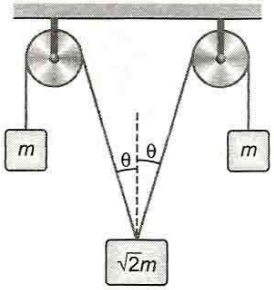
a) $T = 70.8\ N$ and $T' = 47.2\ N$
b) $T = 58.8\ N$ and $T' = 47.2\ N$
c) $T = 70.8\ N$ and $T' = 58.8\ N$
d) $T = 70.8\ N$ and $T' = 0$

485. A body shown in figure is accelerating downward with acceleration 2 m/s^2. The tension in the string is



a) 48 N
b) 50 N
c) 30 N
d) 42 N

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



a) 0°
b) 30°
c) 45°
d) 60°

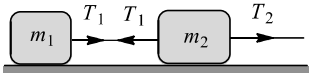
487. A car is moving along a straight horizontal road with a speed v_0. If the coefficient of friction between the tyres and the road is μ, the shortest distance in which the car can be stopped is

a) $\frac{v_0^2}{2\mu g}$ b) $\frac{v_0}{\mu g}$ c) $\left(\frac{v_0}{\mu g}\right)^2$ d) $\frac{v_0}{\mu}$

488. An elevator and its load have a total mass of 800 kg. The elevator is originally moving downwards at 10 ms^{-1}, it slows down to stop with constant acceleration in a distance of 25 m. Find the tension T in the supporting cable while the elevator is being brought to rest. (Take g = 10 ms^{-2})

a) 8000 N b) 1600 N c) 9600 N d) 6400 N

489. Refer to the system shown in figure. The ratio of tension T_1 and T_2 is

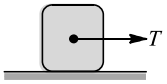


a) $\frac{m_1}{m_1+m_2}$ b) $\frac{m_2}{m_1+m_2}$ c) $\frac{m_1}{m_2}$ d) $\frac{m_2}{m_1}$

490. A force of 750 N is applied to a block of mass 102 kg to prevent it from sliding on a plane with an inclination angle 30° with the horizontal. If the coefficients of static friction and kinetic friction between the block and the plane are 0.4 and 0.3 respectively, then the frictional force acting on the block is

a) 750 N b) 500 N c) 345 N d) 250 N

491. In figure a block of weight 10 N is shown resting on a horizontal surface. The coefficient of static friction between the block and surface is $\mu_s = 0.4$. A force of 3.5 N will keep the block in uniform motion, once it has been in motion. A horizontal force of 3 N is applied to the block. The block will there



a) Move over the surface with a constant velocity
b) Moves having accelerated motion over the surface
c) Not move
d) First move with a constant velocity for sometime and then will have accelerated motion

492. Two weights ω_1 and ω_2 are suspended from the ends of a light string passing over a smooth fixed pulley. If the pulley is pulled up at an acceleration g, the tension in the string will be

a) $\frac{4\omega_1\omega_2}{\omega_1+\omega_2}$ b) $\frac{2\omega_1\omega_2}{\omega_1+\omega_2}$ c) $\frac{\omega_1\omega_2}{\omega_1+\omega_2}$ d) $\frac{\omega_1\omega_2}{2(\omega_1+\omega_2)}$

493. A smooth inclined plane of length L having inclination θ with the horizontal is inside a lift which is moving down with retardation a. The time taken by α body to slide down the inclined plane, from rest, will be

a) $\sqrt{\frac{2L}{(g+a)\sin\theta}}$ b) $\sqrt{\frac{2L}{(g-a)\sin\theta}}$ c) $\sqrt{\frac{2L}{g\sin\theta}}$ d) $\sqrt{\frac{2L}{\alpha\sin\theta}}$

494. The backside of a truck is open and a box of 40 kg is placed 5 m away from the rear end. The coefficient of friction of the box with the surface of the truck is 0.15. The truck starts from rest with 2 m/s^2 acceleration. Calculate the distance covered by the truck when the box falls off.

a) 20 m b) 30 m c) 40 m d) 50 m

495. A block of mass 2 kg rests on horizontal surface. If a horizontal force of 5 N is applied on the block, the frictional force on, it is ($\mu_k = 0.4, \mu_s = 0.5$)

a) 5 N b) 10 N c) 8 N d) Zero

496. A block of mass 2 kg is at rest on a floor. The coefficient of static friction between block and the floor is 0.54. A horizontal force of 2.8 N is applied to the block. What should be the frictional force between the block and the floor? (Take $g = 10\ m/s^2$)

a) 8.8 N b) 5.8 N c) 2.8 N d) 10.8 N

497. A small block slides without friction down an inclined plane starting from rest. Let s_n be the distance travelled from time $t = n - 1$ to $t = n$. Then

$\frac{s_n}{s_n+1}$ is

a) $\frac{2n-1}{2n}$ b) $\frac{2n+1}{2n-1}$ c) $\frac{2n-1}{2n+1}$ d) $\frac{2n}{2n+1}$

498. A person is sitting in a travelling train and facing the engine. He tosses up a coin and the coin falls behind him. It can be concluded that the train is

a) Moving forward and gaining speed b) Moving forward and losing speed

c) Moving forward with uniform speed d) Moving backward with uniform speed

499. A block is gently placed on a conveyor belt moving horizontally with constant speed. After 4s the velocity of the block becomes equal to the velocity of belt. If the coefficient of friction between the block and the belt is 0.2, then velocity of the conveyor belt is

a) 2 ms^{-1} b) 4 ms^{-1} c) 6 ms^{-1} d) 8 ms^{-1}

500. Two bodies of mass 3 kg and 4 kg are suspended at the ends of massless string passing over a frictionless pulley. The acceleration of the system is ($g = 9.8\ m/s^2$)

a) 4.9 m/s^2 b) 2.45 m/s^2 c) 1.4 m/s^2 d) 9.5 m/s^2

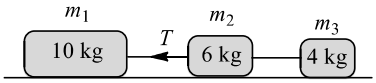
501. A force of 100 dynes acts on a mass of 5 $gram$ for 10 sec. The velocity produces is

a) 2000 cm/sec b) 200 cm/sec c) 20 cm/sec d) 2 cm/sec

502. A ball of mass m moves with speed v and it strikes normally with a wall and reflected back normally, if its time of contact with wall is t then find force exerted by ball on wall

a) $\frac{2mv}{t}$ b) $\frac{mv}{l}$ c) mvt d) $\frac{mv}{2t}$

503. Three blocks of masses m_1, m_2 and m_3 are placed on a horizontal frictionless surface. A force of 40 N pulls the system then calculate the value of T, if $m_1 = 10$ kg, $m_2 = 6$ kg, $m_3 = 4$ kg



a) 40 N b) 20 N c) 10 N d) 5 N

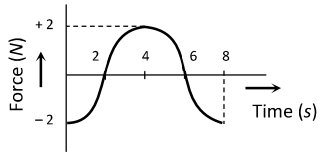
504. Consider car moving on a straight road with a speed of 100 m/s. The distance at which car can be stopped is [$\mu_k = 0.5$]

a) 100 m b) 400 m c) 800 m d) 1000 m

505. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of 5 m/s^2, the reading of the spring balance will be

a) 49 N b) 24 N c) 74 N d) 15 N

506. The force-time ($F - t$) curve of a particle executing linear motion is as shown in the figure. The momentum acquired by the particle in time interval from zero to 8 $second$ will be



a) -2 N-s b) $+4$ N-s c) 6 N-s d) Zero

507. A body of mass 2 kg is kept by pressing to a vertical wall by a force of 100 N. The friction between wall and body is 0.3. Then the frictional force is equal to

a) 6 N b) 20 N c) 600 N d) 700 N

508. Newton's first law of motion describes the following

a) Energy b) Work c) Inertia d) Moment of inertia

509. If two forces of 5 N each are acting along X and Y axes, then the magnitude and direction of resultant is

a) $5\sqrt{2}, \pi/3$ b) $5\sqrt{2}, \pi/4$ c) $-5\sqrt{2}, \pi/3$ d) $-5\sqrt{2}, \pi/4$

510. A block is kept on an inclined plane of inclination θ and length l. The velocity of particle at the bottom of incline is (the coefficient of friction is μ)

a) $\sqrt{2gl(\mu\cos\theta - \sin\theta)}$ b) $\sqrt{2gl(\sin\theta - \mu\cos\theta)}$

c) $\sqrt{2gl(\sin\theta + \mu\cos\theta)}$ d) $\sqrt{2gl(\cos\theta - \mu\ \sin\theta)}$

511. Newton's Second law gives the measure of

a) Acceleration b) Force c) Momentum d) Angular momentum

512. The upper half of an inclined plane with inclination ϕ is perfectly smooth, while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if coefficient of friction for the lower half is given by

a) $2\sin\phi$ b) $2\cos\phi$ c) $2\tan\phi$ d) $\tan\phi$

513. A gun fires bullet each of mass 1 g with velocity of 10 ms^{-1} by exerting a constant force of 5 g weight. Then the number of bullets fired per second is
(Take $g = 10\ ms^{-2}$)

a) 50 b) 5 c) 10 d) 25

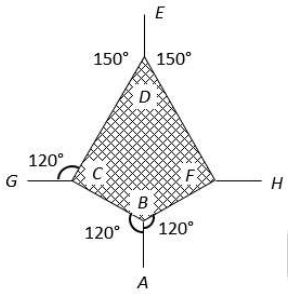
514. If force on a rocket having exhaust velocity of 300 m/sec is 2010 N, then rate of combustion of the fuel is

a) 0.7 kg/s b) 1.4 kg/s c) 0.07 kg/s d) 10.7 kg/s

515. A force of 19.6 N when applied parallel to the surface just moves a body of mass 10 kg kept on a horizontal surface. If a 5 kg mass is kept on a horizontal surface. If a 5 kg mass is kept on the first mass, the force applied parallel to the surface to just move the combined body is

a) 29.4 N b) 39.2 N c) 18.6 N d) 42.6 N

516. The adjacent figure is the part of a horizontally stretched net. Section AB is stretched with a force of 10 N. The tensions in the section BC and BF are



a) 10 N, 11 N

b) 10 N, 6 N

c) 10 N, 10 N

d) Can't calculate due to insufficient data

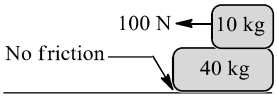
517. A block at rest slides down a smooth inclined plane which makes an angle 60° with the vertical and it reaches the ground in t_1 seconds. Another block is dropped vertically from the same point and reaches the ground in t_2 seconds.
Then the ratio of $t_1 : t_2$ is

a) 1:2 b) 2:1 c) 1:3 d) $1:\sqrt{2}$

518. A block of mass 'm' is connected to another block of mass 'M' by a spring (massless) of spring constant 'K'. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force 'F' starts acting on the block of mass 'M' to pull it. Find the force on the block of mass 'm'

a) $\frac{mF}{M}$ b) $\frac{(M+mF)}{m}$ c) $\frac{mF}{(m+M)}$ d) $\frac{MF}{(m+M)}$

519. A 40 kg slab rests on a frictionless floor. A 10 kg block rests on top of the slab. The static coefficient of friction between the block and the slab is 0.60 while the kinetic coefficient of friction is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. If g = 9.8 ms^{-2}, the resulting acceleration of the slab will be



a) 1.47 ms^{-2} b) 1.69 ms^{-2} c) 9.8 ms^{-2} d) 0.98 ms^{-2}

520. A light spring balance hangs from the hook of the other light spring balance and a block of mass M kg hangs from the former one. Then the true statement about the scale reading is
   a) Both the scales read M kg each
   b) The scale of the lower one reads M kg and of the upper one zero
   c) The reading of the two scales can be anything but the sum of reading will be M kg
   d) Both the scales read $M/2$ kg

521. A man getting down a running bus falls forward because
   a) Due to inertia of rest, road is left behind and man reaches forward
   b) Due to inertia of motion upper part of body continues to be in motion in forward direction while feet come to rest as soon as they touch the road
   c) He leans forward as a matter of habit
   d) Of the combined effect of all the three factors stated in (a), (b) and (c)

522. Two masses of 3 kg and 5 kg are suspended from the ends of an unstreachable massless cord passing over a frictionless pulley. When the masses are released, the pressure on the pulley is
   a) 2 kgf b) 7.5 kgf c) 8 kgf d) 15 kgf

523. A block can slide on a smooth inclined plane of inclination θ kept on the floor of a lift. When the lift is descending with a retardation a, the acceleration of the block relative to the incline is
   a) $(g + a)\sin\theta$ b) $(g - a)$ c) $g\sin\theta$ d) $(g - a)\sin\theta$

524. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively
   a) g, g b) g − a, g − a c) g − a, g d) a, g

525. An object is kept on a smooth inclined plane of 1 in l. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the inclined is
   a) $g\sqrt{l^2 - 1}$ b) $g(l^2 - 1)$ c) $\frac{g}{\sqrt{l^2 - 1}}$ d) $\frac{g}{l^2 - 1}$

526. If the coefficient of static friction between the tyres and road is 0.5, what is the shortest distance in which an automobile can be stopped when travelling at 72 kmh^{-1} ?
   a) 50 m b) 60 m c) 40.8 m d) 80.16 m

527. A man is standing at a spring platform. Reading of spring balance is 60 $kg\ wt$. If man jumps outside platform, then reading of spring balance
   a) First increases then decreases to zero b) Decreases
   c) Increases d) Remains same

528. A particle moves in x-y plane under the action of force **F** and the value of its linear momentum **p** at a given time t is $p_x = 2\cos t$, $p_y = 2\sin t$. Then the angle θ between **F** and **p** at a given time t is
   a) θ = 30° b) θ = 180° c) θ = 0° d) θ = 90°

529. If the normal force is doubled, the coefficient of friction is
   a) Not changed b) Halved c) Doubled d) Tripled

530. When two surfaces are coated with a lubricant, then they
   a) Stick to each other b) Slide upon each other c) Roll upon each other d) None of these

531. A rope of length L is pulled by a constant force F. What is the tension in the rope at a distance x from the end where the force is applied
   a) $\frac{FL}{x}$ b) $\frac{F(L - x)}{L}$ c) $\frac{FL}{L - x}$ d) $\frac{Fx}{L - x}$

532. Observer O_1 is in a lift going upwards and O_2 is on the ground. Both apply Newton's law, and measure normal reaction on the body
   a) Both measure the same value b) Both measure zero

c) Both measure different value d) No sufficient data

533. A ball of mass $150g$ starts moving with an acceleration of 20 m/s^2. When hit by a force, which acts on it for 0.1 sec the impulsive force is

a) 0.5 N-s b) 0.1 N-s c) 0.3 N-s d) 1.2 N-s

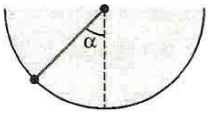
534. If a bullet of mass 5 gm moving with velocity 100 m/sec, penetrates the wooden block upto 6 cm. Then the average force imposed by the bullet on the block is

a) 8300 N b) 417 N c) 830 N d) Zero

535. In the first second of its flight, rocket ejects 1/60 of its mass with a velocity of 2400 ms^{-1}. The acceleration of the rocket is

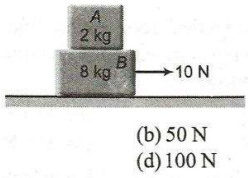
a) 19.6 ms^{-2} b) 30.2 ms^{-2} c) 40 ms^{-2} d) 49.8 ms^{-2}

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



a) $\cot\alpha = 3$ b) $\sec\alpha = 3$ c) $\text{cosec}\,\alpha = 3$ d) None of these

537. Block A of mass 2 kg is placed over block B of mass 8 kg. The combination is placed over a rough horizontal surface. Coefficient of friction between B and the floor is 0.5. Coefficient of friction between A and B is 0.4. A horizontal force of 10 N is applied on block B. The force of friction between A and B is

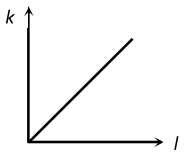


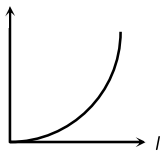
a) Zero b) 50 N c) 40 N d) 100 N

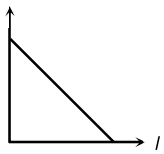
538. A body is under the action of two mutually perpendicular forces of 3 N and 4 N. The resultant force acting on the body is

a) 7 N b) 1 N c) 5 N d) Zero

539. Which of the following graph depicts spring constant k versus length l of the spring correctly

a) 

b) 

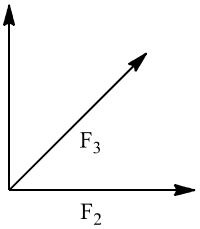
c) 

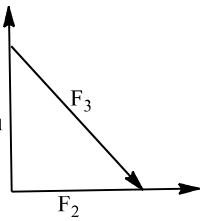
d) 

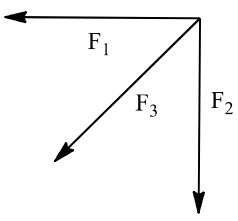
540. A fireman of mass 60 kg slides down a pole. He is pressing the pole with a force of 600 N. The coefficient of friction between the hands and the pole is 0.5, with what acceleration will the fireman slide down ($g = 10\ m/s^2$)

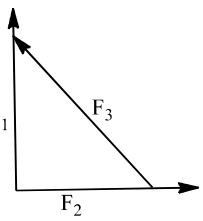
a) 1 m/s^2 b) 2.5 m/s^2 c) 10 m/s^2 d) 5 m/s^2

541. Which of the four arrangements in the figure correctly shows the vector addition of two forces F_1 and F_2 to yield the third force F_3?

a) 

b) 

c) 

d) 

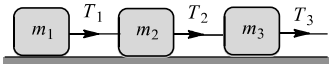
542. A book is lying on the table. What is the angle between the action of the book on the table and the reaction of the table on the book

a) 0° b) 30° c) 45° d) 180°

543. A shell at rest at the origin explodes into three fragments of masses 1 kg, 2kg and m kg. The 1 kg and 2 kg pieces fly off with speeds off 5ms^{-1} along x-axis and 6ms^{-1} along y-axis respectively. If the m kg piece files off with a speed of 6.5 ms^{-1}, the total mass of the shell must be

a) 4 kg b) 5 kg c) 3.5 kg d) 4.5 kg

544. Three blocks of masses m_1, m_2 and m_3 are connected by massless strings as shown on a frictionless table in figure. They are pulled with a force $T_3 = 40$ N. If $m_1 = 10$ kg, $m_2 = 6$ kg and $m_3 = 4$ kg, the tension T_2 will be



a) 20 N b) 40 N c) 10 N d) 32 N

545. A particle of mass 0.3 kg is subjected to a force $F = -kx$ with $k = 15$ N/m. What will be its initial acceleration if it is released from a point 20 cm away from the origin

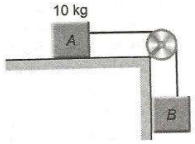
a) 5 m/s^2 b) 10 m/s^2 c) 3 m/s^2 d) 15 m/s^2

546. A person sitting in an open car moving at constant velocity throws a ball vertically up into air. The ball falls

a) Outside the car b) In the car ahead of the person

c) In the car to the side of the person d) Exactly in the hand which threw it up

547. If the mass of $A = 10$ kg, coefficient of static friction = 0.22, coefficient of kinetic friction = 0.2, then minimum mass of B to start motion is



a) 2 kg b) 2.2 kg c) 4.8 kg d) 3.4 kg

548. Which one of the following is not used to reduce friction

a) Oil b) Ball bearings c) Sand d) Graphite

549. Rocket propulsion is associated with

a) The conservation of angular momentum b) The conservation of mass

c) The conservation of mechanical energy d) Newton's III law of motion

550. Consider the following statement: When jumping from some height, you should bend your knees as you come to rest, instead of keeping your legs stiff. Which of the following relations can be useful in explaining the statement

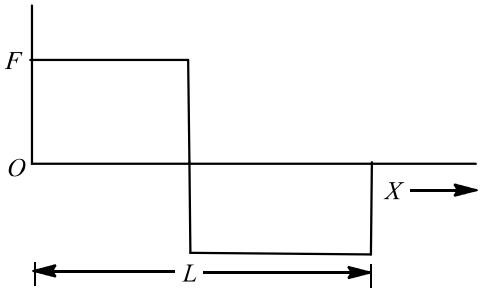
a) $\Delta\overrightarrow{P_1} = -\Delta\overrightarrow{P_2}$ b) $\Delta E = -\Delta(PE + KE) = 0$

c) $\vec{F}\Delta t = m\Delta\vec{v}$ d) $\Delta\vec{x} \propto \Delta\vec{F}$

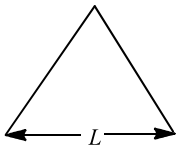
551. A body presses a book against the front wall such that the book does not move. The force of friction between the wall and the book is

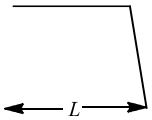
a) Towards right b) Towards left c) Downwards d) Upwards

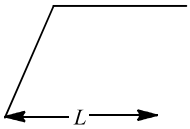
552. A person used force (F), shown in figure move a load with constant velocity on give surface.

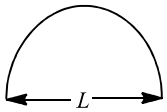


Identify the correct surface profile

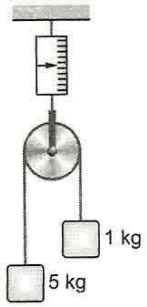
a) 

b) 

c) 

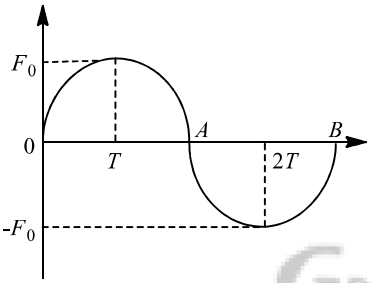
d) 

553. In the figure a smooth pulley of negligible weight is suspended by a spring balance. Weights of 1 kg and 5 kg are attached to the opposite ends of a string passing over the pulley and move with acceleration because of gravity. During their motion, the spring balance reads a weight of



a) 6 kg
b) Less than 6 kg
c) More than 6 kg
d) May be more or less than 6 kg

554. A unidirectional force F varying with time t as shown in the figure acts on a body initially at rest for a short duration $2T$. Then the velocity acquired by the body is



a) $\frac{\pi F_0 T}{4m}$
b) $\frac{\pi F_0 T}{2m}$
c) $\frac{F_0 T}{4m}$
d) Zero

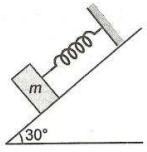
555. A diwali rocket is ejecting 0.05 kg of gases per second at a velocity of 400 m/sec. The accelerating force on the rocket is

a) 20 $dynes$
b) 20 N
c) 22 $dynes$
d) 1000 N

556. In relativity which is constant between two frames of reference

a) Acceleration
b) Conservation of mass
c) Space interval
d) Velocity

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

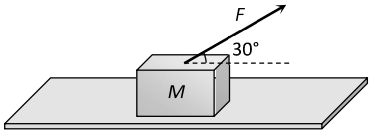


a) 50 N
b) 25 N
c) 500 N
d) 10 N

558. Impulse is

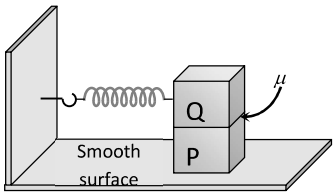
a) A scalar
b) Equal to change in the momentum of a body
c) Equal to rate of change of momentum of a body
d) A force

559. A block of mass $M = 5\ kg$ is resting on a rough horizontal surface for which the coefficient of friction is 0.2. When a force $F = 40\ N$ is applied, the acceleration of the block will be ($g = 10\ ms^2$)



a) $5.73\ m/sec^2$ b) $8.0\ m/sec^2$ c) $3.17\ m/sec^2$ d) $10.0\ m/sec^2$

560. A block P of mass m is placed on a frictionless horizontal surface. Another block Q of same mass is kept on $P$and connected to the wall with the help of a spring of spring constant k as shown in the figure. μ_s is the coefficient of friction between P and Q. The blocks move together performing SHM of amplitude A. The maximum value of the friction force between P and Q is



a) kA b) $\frac{kA}{2}$ c) Zero d) $\mu_s mg$

561. A pulley fixed to the ceiling carries a string with blocks of mass m and $3m$ attached to its ends. The masses of string and pulley are negligible. When the system is released, its centre of mass moves with what acceleration

a) 0 b) $g/4$ c) $g/2$ d) $-g/2$

562. The monkey B shown in figure is holding on to the tail of the monkey A which is climbing up a rope. The masses of the monkeys A and B are 5 kg and 2 kg respectively. If A can tolerate a tension of 30 N in its tail, what force should it apply on the rope in order to carry the monkey B with it? (Take $g = 10\ ms^{-2}$)

a) 105 N b) 108 N c) 10.5 N d) 100 N

563. A body of mass 5 kg starts from the origin an initial velocity $\vec{u} = 30\hat{\imath} + 40\hat{\jmath}\ ms^{-1}$. If a constant force $\vec{F} = -(\hat{\imath} + 5\hat{\jmath})N$ acts on the body, the time in which the $y-$component of the velocity becomes zero is

a) 5 $seconds$ b) 20 $seconds$ c) 40 $seconds$ d) 80 $seconds$

564. A mass of 6 kg is suspended by a rope of length 2 m from a ceiling. A force of 50 N is applied in the horizontal direction at the mid-point of the rope. The angel made by the rope, with the vertical, in equilibrium position will be (take $g = 10\ ms^{-2}$, neglect the mass of the rope)

a) 90° b) 60° c) 50° d) 40°

565. A bird weighs 2 kg and is inside a closed cage of 1 kg. If it starts flying, then what is the weight of the bird and cage assembly

a) 1.5 kg b) 2.5 kg c) 3 kg d) 4 kg

566. A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is

a) same everywhere b) lower in front side c) lower in rear side d) lower in upper side

567. A 24 kg block resting on a floor has a rope tied to its top. The maximum tension, the rope can withstand without breaking is 310 N. The minimum time in which the block can be lifted a vertical distance of 4.6 m by pulling on the rope is

a) 1.2 s b) 1.3 s c) 1.7 s d) 2.3 s

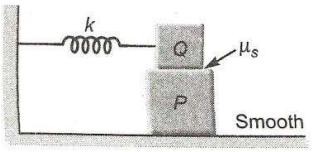
568. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5 t$, where F is in *newtons* and t in seconds. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet

a) 9 Ns b) Zero c) 0.9 Ns d) 1.8 Ns

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

a) $\left(1 - \frac{1}{n^2}\right)$ b) $\frac{1}{1-n^2}$ c) $\sqrt{\left(1 - \frac{1}{n^2}\right)}$ d) $\sqrt{\frac{1}{1-n^2}}$

570. A block P of mass m is placed on a horizontal surface. Another block Q of same mass is kept on P and connected to the wall with the help of a spring of spring constant k as shown in the figure. μ_s is the coefficient of friction between P and Q. The blocks move together performing SHM of amplitude A. The maximum value of the friction force between P and Q is



a) kA b) $\frac{kA}{2}$ c) Zero d) $\mu_s\, mg$

571. A cricket ball of mass 0.25 kg with speed 10 m/s collides with a bat and returns with same speed with in 0.01 s. The force acted on bat is

a) 25 N b) 50 N c) 250 N d) 500 N

572. A rocket of mass 1000 kg is exhaust gases at a rate of 4 kgs^{-1} with a velocity 3000 ms^{-1}. The thrust developed on the rocket is

a) 12000 N b) 120 N c) 800 N d) 200 N

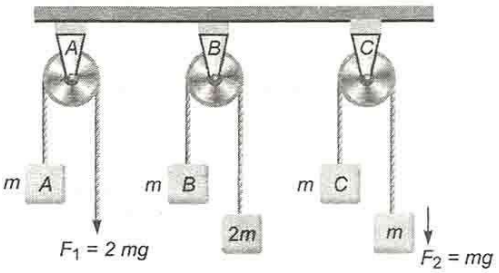
573. A 1.5 kg ball drops vertically on a floor hitting with a speed of $25ms^{-1}$. It rebounds with an initial speed of 15 ms^{-1}. If the ball was in contact for only 0.03 seconds, the force exerted on the floor by the ball is

a) 2000 N b) 3000 N c) 3500 N d) 4000 N

574. Starting from rest, a body slides down a 45° inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined plane is

a) 0.33 b) 0.25 c) 0.75 d) 0.80

575. In figure, the blocks A, B and C each of mass m have acceleration a_1, a_2 and a_3 respectively. F_1 and F_2 are external forces of magnitude 2 mg and mg respectively.
Then



a) $a_1 = a_2 = a_3$ b) $a_1 > a_3 > a_2$ c) $a_1 = a_2, a_2 = a_3$ d) $a_1 = a_2, a_1 = a_3$

576. Human heart is pumping blood with constant velocity v m s^{-1} at the rate of M kg s^{-1}. The force required for this is (in N)

a) M b) Mv c) $\frac{M}{v}$ d) $v\frac{dM}{dt}$

577. An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20 m. If the car is going twice at fast, $i.e.$ 120 km/h, the stopping distance will be
a) 20 m b) 40 m c) 60 m d) 80 m

578. A body of mass 1.0 kg is falling with an acceleration of 10 $m/\sec^2$. Its apparent weight will be ($g = 10\ m/\sec^2$)
a) 1.0 $kg\ wt$ b) 2.0 $kg\ wt$ c) 0.5 kg/wt d) Zero

579. A passenger is travelling in a train moving at 72 kmh^{-1}. His suitcase is kept on the berth. The driver of the train applies brakes such that the speed of the train decreases at a constant rate of 36 kmh^{-1} in 5 s. What should be the minimum coefficient of friction between the suitcase and the berth if the suitcase is not the slide during retardation of the train?
a) $\frac{10}{49}$ b) $\frac{10}{98}$ c) $\frac{28}{49}$ d) $\frac{30}{98}$

580. A man fires a bullet of mass 200 g at a speed of 5 m/s . The gun is of one kg mass. By what velocity the gun rebounds backwards
a) 0.1 m/s b) 10 m/s c) 1 m/s d) 0.01 m/s

581. When the speed of a moving body is doubled
a) Its acceleration is doubled b) Its momentum is doubled
c) Its kinetic energy is doubled d) Its potential energy is doubled

582. A marble block of mass 2 kg lying on ice when given a velocity of 6 ms^{-1} is stopped by friction in 10 s. Then the coefficient of friction is
a) 0.02 b) 0.03 c) 0.06 d) 0.01

583. A 5 kg stationary bomb is exploded in three parts having mass 1: 1: 3 respectively. Parts having same mass move in perpendicular directions with velocity 39 ms^{-1}, then the velocity of bigger part will be
a) $10\sqrt{2}\ \text{ms}^{-1}$ b) $\frac{10}{\sqrt{2}}\ \text{ms}^{-1}$ c) $13\sqrt{2}\ \text{ms}^{-1}$ d) $\frac{15}{\sqrt{2}}\ \text{ms}^{-1}$

584. Which of the following groups of forces could be in equilibrium
a) 3 N, 4 N, 5N b) 4 N, 5 N, 10 N c) 30 N, 40 N, 80 N d) 1 N, 3 N, 5 N

585. Formula for true force is
a) $F = ma$ b) $F = \frac{mdv}{dt}$ c) $F = \frac{dmv}{dt}$ d) $F = \frac{md^2x}{dt^2}$

586. If rope of lift breaks suddenly, the tension exerted by the surface of lift (a = acceleration of lift)
a) mg b) $m(g + a)$ c) $m(g - a)$ d) 0

587. A body of weight 64 N is pushed with just enough force to start it moving across a horizontal floor and the same force continues to act afterwards. If the coefficients of static and dynamic friction are 0.6 and 0.4 respectively, the acceleration of the body will be (Acceleration due to gravity = g)
a) $\frac{g}{6.4}$ b) 0.64 g c) $\frac{g}{32}$ d) 0.2 g

588. In the above question, if the lift is moving upwards with a uniform velocity, then the frictional resistance offered by the body is
a) Mg b) μMg c) $2\mu Mg$ d) Zero

589. A block of mass 0.1 kg is held against a wall by applying a horizontal force of 5 N on the block. If the coefficient of friction between the block and the wall is 0.5, the magnitude of the frictional force acting on the block is
a) 2.5 N b) 0.98 N c) 4.9 N d) 0.49 N

590. If the resultant of all the external forces acting on a system of particles is zero, then from an inertial frame, one can surely say that
a) Liner momentum of the system does not change in time
b) Kinetic energy of the system does not change in time
c) Angular momentum of the system does not change in time

d) Potential energy of the system does not change in time

591. A stone weighing 1 kg and sliding on ice with a velocity of 2 m/s is stopped by friction in 10 sec.The force of friction (assuming it to be constant) will be

a) $-20\ N$ b) $-0.2\ N$ c) $0.2\ N$ d) $20\ N$

592. With what minimum acceleration can a fireman slide down a rope while breaking strength of the rope is $\frac{2}{3}$ of the weight?

a) $\frac{2}{3}g$ b) g c) $\frac{1}{3}g$ d) Zero

593. A lift is moving downwards with an acceleration equal to acceleration due to gravity. A body of mass m kept on the floor of the lift is pulled horizontally. If the coefficient of friction is μ, then the frictional resistance offered by the body is

a) mg b) μmg c) $2\mu mg$ d) Zero

594. The resultant force of 5 N and 10 N can not be

a) 12 N b) 8 N c) 4 N d) 5 N

595. A boy of mass 40 kg is climbing a vertical pole at a constant speed. If the coefficient of friction between his palms and the pole is 0.8 and $g = 10\ m/s^2$, the horizontal force that he is applying on the pole is

a) 300 N b) 400 N c) 500 N d) 600 N

596. When a body is moving on a surface, the force of friction is called

a) Static friction b) Dynamic friction c) Limiting friction d) Rolling friction

597. It is easier to roll a barrel than pull it along the road. This statement is

a) False b) True c) Uncertain d) Not possible

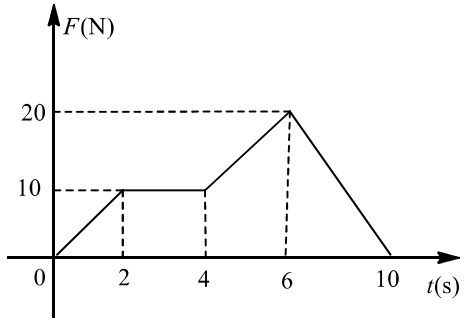
598. A body of mass m collides against a wall with a velocity v and rebounds with the same speed. Its change of momentum is

a) $2\ mv$ b) mv c) $-mv$ d) Zero

599. Two iron blocks of equal mass but with double area slide down an inclined plane with friction coefficient μ. If the first block with surface area A experience a frictional force f, then the second block with surface area $2A$ will experience a frictional force

a) $f/2$ b) f c) $2f$ d) $4f$

600. A particle of mass 2 kg is initially at rest. A force acts on it whose magnitude changes with time. The force-time graph is shown below



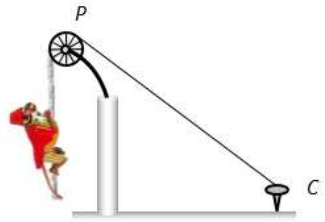
The velocity of the particle after 10 s is

a) 20 ms^{-1} b) 10 ms^{-1} c) 75 ms^{-1} d) 50 ms^{-1}

601. There is a simple pendulum hanging from the ceiling of a lift. When the lift is stand still, the time period of the pendulum is T. If the resultant acceleration becomes $g/4$, then the new time period of the pendulum is

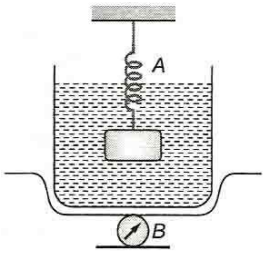
a) 0.8 T b) 0.25 T c) 2 T d) 4 T

602. One end of a massless rope, which passes over a massless and frictionless pulley P is tied to a hook C while the other end is free. Maximum tension that the rope can bear is 360 N. with what value of minimum safe acceleration (in ms^{-2}) can a monkey of 60 kg move down on the rope



a) 16 b) 6 c) 4 d) 8

603. A spring balance, A reads 2 kg with a block m suspended from it. A balance B reads 5 kg when a breaker filled with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging mass is inside the liquid as shown in figure. In this situation



a) The balance A will read more than 2 kg
b) The balance B will read more than 5 kg
c) The balance A will read less than 2 kg and B will read more than 5 kg
d) The balance A and B will read 2 kg and 5 kg

604. A body of mass 10 kg is acted upon by two forces each of magnitude 10 N making an angle of 60° with each other. Find the net acceleration of the body

a) $2\sqrt{3}\text{ms}^{-2}$ b) $\sqrt{3}\text{ms}^{-2}$ c) $3\sqrt{3}\text{ms}^{-2}$ d) $4\sqrt{3}\text{ms}^{-2}$

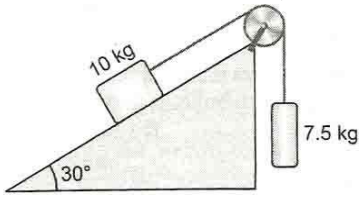
605. A motorcycle is travelling on a curved track of radius 500 m. If the coefficient of between road and tyres is 0.5, the speed avoiding skidding will be

a) 50 m/s b) 75 m/s c) 25 m/s d) 35 m/s

606. A passenger train is running on a railways track with a speed v_1. While driving, the driver discovers that another goods train is travelling in front of the passenger train with a speed $v_2(v_1 > v_2)$. Its retardation after applying brakes is a. The least distance the passenger train must travel to avoid collision with goods train is

a) $\frac{v_1^2 - v_2^2}{2a}$ b) $\frac{v_2 - v_1}{a}$ c) $\frac{v_2 + v_1}{2a}$ d) $\frac{v_2^2 + v_1^2}{2a}$

607. The acceleration of the system shown in figure is

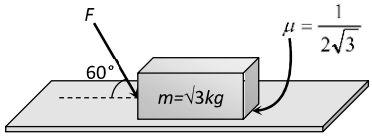


a) $\frac{3.5}{17.5}$g b) $\frac{7.5}{17.5}$g c) $\frac{14.5}{17.5}$g d) $\frac{\text{g}}{7}$

608. If μ_s, μ_k and μ_r are coefficients of static friction, sliding friction and rolling friction, then

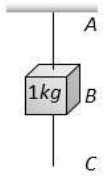
a) $\mu_s < \mu_k < \mu_r$ b) $\mu_k < \mu_r < \mu_s$ c) $\mu_r < \mu_k < \mu_s$ d) $\mu_r < \mu_k < \mu_s$

609. What is the maximum value of the force F such that the block shown in the arrangement, does not move



a) 20 N b) 10 N c) 12 N d) 15 N

610. A mass of 1 kg is suspended by a string A. Another string C is connected to its lower end (see figure). If a sudden jerk is given to C, then

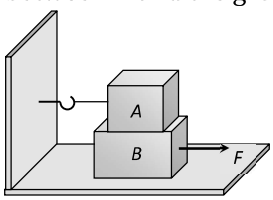


a) The portion AB of the string will break
b) The portion BC of the string will break
c) None of the strings will break
d) The mass will start rotating

611. The engine of a car produces an acceleration of 6 ms^{-2} in the car. If this car pulls another car of the same mass, then the acceleration would be

a) 6 ms^{-2} b) 12 ms^{-2} c) 3 ms^{-2} d) 1.5 ms^{-2}

612. A block A with mass 100 kg is resting on another block B of mass 200 kg. As shown in figure a horizontal rope tied to a wall holds it. The coefficient of friction between A and B is 0.2 while coefficient of friction between B and the ground is 0.3. The minimum required force F to start moving B will be



a) 900 N b) 100 N c) 1100 N d) 1200 N

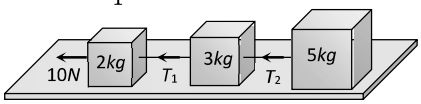
613. Swimming is possible on account of

a) First law of motion
b) Second law of motion
c) Third law of motion
d) Newton's law of gravitation

614. A block is moving up an inclined plane of inclination 60° with velocity of 20 ms^{-1} and stops after 2.00 s. If g = 10ms^{-2} then the approximate value of coefficient of friction is

a) 3 b) 3.3 c) 0.27 d) 0.33

615. Three blocks of masses 2 kg, 3 kg and 5 kg are connected to each other with light string and are then placed on a frictionless surface as shown in the figure. The system is pulled by a force $F = 10\ N$, then tension $T_1 =$



a) 1 N b) 5 N c) 8 N d) 10 N

616. Two persons are holding a rope of negligible weight tightly at its ends so that it is horizontal. A 15 kg weight is attached to rope at the mid-point which now no more remains horizontal. The minimum tension required to completely straighten the rope is

a) 15 kg b) 15/2 kg c) 5 kg d) Infinitely large

617. A block of mass 50 kg can slide on a rough horizontal surface. The coefficient of friction between the block and the surface is 0.6. The least force of pull acting at an angle of 30° to the upward drawn vertical which causes the block to just slide is

a) 29.43 N b) 219.6 N c) 21.96 N d) 294.3 N

618. A particle moves in the xy- plane under the action of a force $\boldsymbol{F}$ such that the components of its linear momentum $\boldsymbol{p}$ at any time t are $p_x = 2\cos\ t\ , p_y = 2\sin t$. The angle between $\boldsymbol{F}$ and $\boldsymbol{p}$ at time t is

a) 90° b) 0° c) 180° d) 30°

619. A body of 5 kg weight kept on a rough inclined plane of angle 30° starts sliding with a constant velocity. Then the coefficient of friction is (assume $g = 10\ m/s^2$)

a) $1/\sqrt{3}$ b) $2/\sqrt{3}$ c) $\sqrt{3}$ d) $2\sqrt{3}$

620. A force of 10 Newton acts on a body of mass 20 kg for 10 seconds. Change in its momentum is

a) $5\ kg\ m/s$ b) $100\ kg\ m/s$ c) $200\ kg\ m/s$ d) $1000\ kg\ m/s$

621. In a rocket of mass 1000 kg fuel is consumed at a rate of 40 kg/s. The velocity of the gases ejected from the rocket is $5 \times 10^4\ m/s$. The thrust on the rocket is

a) $2 \times 10^3\ N$ b) $5 \times 10^4 N$ c) $2 \times 10^6\ N$ d) $2 \times 10^9\ N$

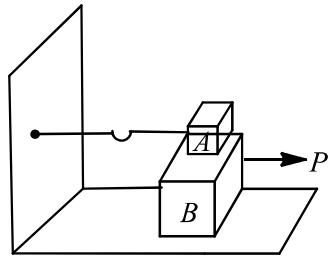
622. The time period of a simple pendulum measured inside a stationary lift is found to be T. If the lift starts accelerating upwards with an acceleration $g/3$, the time period is

a) $T\sqrt{3}$ b) $T\sqrt{3}/2$ c) $T/\sqrt{3}$ d) $T/3$

623. A rocket with a lift-off mass $3.5 \times 10^4\ kg$ is blasted upwards with an initial acceleration of 10 m/s^2. Then the initial thrust of the blast is

a) $1.75 \times 10^5\ N$ b) $3.5\ \times 10^5 N$ c) $7.0\ \times 10^5\ N$ d) $14.0\ \times 10^5\ N$

624. A block A weighing 100 kg rests on a block B and is tied with a horizontal string to the wall at C. Block B weighs 200kg. The coefficient of friction between A and B is 0.25 and between B and the surface is $\frac{1}{3}$. The horizontal force P necessary to move the block B should be $\left(g = 10\frac{\text{m}}{\text{s}^2}\right)$



a) 1150 N b) 1250 N c) 1300 N d) 1420 N

625. A ball of mass 400 gm is dropped from a height of $5m$. A boy on the ground hits the ball vertically upwards with a bat with an average force of 100 $newton$ so that it attains a vertical height of 20 m. The time for which the ball remains in contact with the bat is $[g = 10\ m/s^2]$

a) 0.12 s b) 0.08 s c) 0.04 s d) 12 s

626. When a train stops suddenly, passengers in the running train feel an instant jerk in the forward direction because

a) The back of seat suddenly pushes the passengers forward
b) Inertia of rest stops the train and takes the body forward
c) Upper part of the body continues to be in the state of motion whereas the lower part of the body in contact with seat remains at rest
d) Nothing can be said due to insufficient data

627. Which of the following is correct, when a person walks on a rough surface

a) The frictional force exerted by the surface keeps him moving
b) The force which the man exerts on the floor keeps him moving
c) The reaction of the force which the man exerts on floor keeps him moving
d) None of the above

628. The spring balance inside a lift suspends an object. As the lift begins to ascend, the reading indicated by the spring balance will

a) Increase b) Decrease
c) Remain unchanged d) Depend on the speed of ascend

629. A cork is submerged in water by a spring attached to the bottom of a pail. When the pail is kept in a elevator moving with an acceleration downwards, the spring length

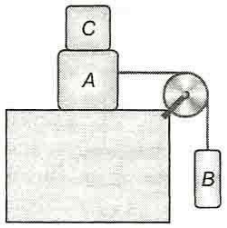
a) Increases b) Decreases c) Remains unchanged d) Data insufficient

630. A ball of mass m moves with speed v and it strikes normally with a wall and reflected back normally. If its time of contact with wall is t, then find force exerted by ball on the wall

a) $\frac{2mv}{t}$ b) $\frac{mv}{t}$ c) mvt d) $\frac{mv}{2t}$

631. A 60 kg man stands on a spring scale in the lift. At some instant he finds, scale reading has changed from 60 kg to 50 kg for a while and then comes back to the original mark. What should we conclude
    a) The lift was in constant motion upwards
    b) The lift was in constant motion downwards
    c) The lift while in constant motion upwards, is stopped suddenly
    d) The lift while in constant motion downwards, is suddenly stopped
632. A body is sliding down an inclined plane having coefficient of friction 0.5. If the normal reaction is twice that of the resultant downward force along the incline, the angle between the inclined plane and the horizontal is
    a) 15° b) 30° c) 45° d) 60°
633. Two masses of M and $4M$ are moving with equal kinetic energy. The ratio of their linear momentum is
    a) 1:8 b) 1:4 c) 1:2 d) 4:1
634. Two masses M and $M/2$ are joined together by means of light inextensible string passed over a frictionless pulley as shown in the figure. When the bigger mass is released, the small one will ascend with an acceleration of

    a) $\frac{g}{3}$ b) $\frac{3g}{2}$ c) $\frac{g}{2}$ d) g
635. When a body is stationary
    a) There is no force acting on it
    b) The force acting on it is not in contact with it
    c) The combination of forces acting on it balances each other
    d) The body is in vacuum
636. Three forces F_1, F_2 and F_3 together keep a body in equilibrium. If $F_1 = 3\ N$ along the positive x-axis, $F_2 = 4N$ along the positive y-axis, then the third force F_3 is
    a) 5 N making an angle $\theta = \tan^{-1}\left(\frac{3}{4}\right)$ with negative y-axis
    b) 5 N making an angle $\theta = \tan^{-1}\left(\frac{4}{3}\right)$ with negative y axis
    c) 7 N making an angle $\theta = \tan^{-1}\left(\frac{3}{4}\right)$ with negative y axis
    d) 7 N making an angle $\theta = \tan^{-1}\left(\frac{4}{3}\right)$ with negative y axis
637. A rocket of mass 100 kg burns 0.1 kg of fuel per sec. If velocity of exhaust gas is 1 km/sec, then it lifts with an acceleration of
    a) 1000 ms^{-2} b) 100 ms^{-2} c) 10 ms^{-2} d) 1 ms^{-2}
638. If two particles collide at constant temperature then which of the following is conserved?
    a) Kinetic energy b) Momentum c) Temperature d) Velocity
639. A box is lying on an inclined plane what is the coefficient if static friction if the box starts sliding when an angle of inclination is 60°
    a) 1.173 b) 1.732 c) 2.732 d) 1.677
640. A man of weight mg is moving up in a rocket with acceleration 4g. the apparent weight of the man in the rocket is
    a) Zero b) 4 mg c) 5 mg d) mg
641. Two masses A and B of 10 kg and 5 kg respectively, are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown in figure. The coefficient of friction of A with the table is 0.2. The minimum mass of C that may be placed on A to prevent it front moving is



a) 15 kg b) 5 kg c) 10 kg d) Zero

642. The coefficient of friction between a body and the surface of an inclined plane at 45° is 0.5. If $g = 9.8\ m/s^2$, the acceleration of the body downwards in m/s^2 is

a) $\frac{4.9}{\sqrt{2}}$ b) $4.9\sqrt{2}$ c) $19.6\sqrt{2}$ d) 4.9

643. The mass of a body measured by a physical balance in the lift at rest is found to be m. If the lift is going up with an acceleration a, its mass will be measured as

a) $m\left(1-\frac{a}{g}\right)$ b) $m\left(1+\frac{a}{g}\right)$ c) m d) Zero

644. An object placed on an inclined plane starts sliding when the angle of incline becomes 30°. The coefficient of static friction between the object and the plane is

a) $\frac{1}{\sqrt{3}}$ b) $\sqrt{3}$ c) $\frac{1}{2}$ d) $\frac{\sqrt{3}}{2}$

645. A rider on horse back falls when horse starts running all of a sudden because

a) Rider is taken back
b) Rider is suddenly afraid of falling
c) Inertia of rest keeps the upper part of body at rest whereas lower part of the body moves forward with the horse
d) None of the above

646. A gardner waters the plants by a pipe of diameter 1mm. The water comes out at the rate or 10 cm^3/sec. The reactionary force exerted on the hand of the gardner is

a) Zero b) $1.27 \times 10^{-2}\ N$ c) $1.27 \times 10^{-4}\ N$ d) $0.127\ N$

647. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5 t$ where F is in newton and t in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average in pulse imparated to the bullet?

a) 9 Ns b) 1.8 ns c) 0.9 Ns d) 0.3 Ns

648. A gun of mass 10 kg fires 4 bullets per second. The mass of each bullet is 20 g and the velocity of the bullet when it leaves the gun is 300 ms^{-1}. The force required to hold the gum while firing is

a) 6 N b) 8 N c) 24 N d) 240 N

649. A shell is fired from a cannon with velocity v ms^{-1} at an angle θ with the horizontal direction. At the highest point in its path it explodes into two pieces of equal mass. One of the pieces retraces its path to the cannon and the speed in m/s of the piece immediately after the explosion is

a) $3v\cos\theta$ b) $2v\cos\theta$ c) $\frac{3v}{2}\cos\theta$ d) $\frac{\sqrt{3}v\cos\theta}{2}$