Daily Practice Problem

PHYSICS

LAWS OF MOTION

1. Which one of the following statement is incorrect?
(a) The state of rest or uniform linear motion both imply zero acceleration.
(b) A net force is needed to keep a body in uniform motion.
(c) Inertia means resistance to change.
(d) The rate of change of momentum is proportional to the applied force.
(e) Momentum is a vector quantity.

2. On a conveyor belt moving with a speed u, sand falls at a constant rate $\left(\frac{dm}{dt}\right)$, where m is the mass of sand. The extra force required to maintain the speed of the belt is
(a) $m\left(\frac{du}{dt}\right)$ (b) mu
(c) $\left(\dfrac{dm}{dt}\right)/u$ (d) $u\left(\dfrac{dm}{dt}\right)$
(e) $\frac{1}{m}\left(\frac{du}{dt}\right)$

3. Area under the force-time graph gives the change in
(a) velocity
(b) acceleration
(c) linear momentum
(d) angular momentum
(e) impulsive force

4. Choose the correct statement.
(a) Second law of motion is a vector equation.
(b) Second law of motion is applicable to a particle and not to the system of particles.
(c) Force is always in the direction of motion.
(d) If external force on a body is zero, it does not mean the acceleration is zero.
(e) Acceleration at an instant depends on the history of the motion of the particle.

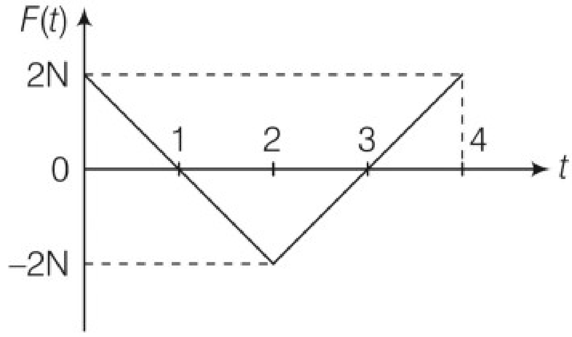
5. A ship of mass 2×10^7 kg initially at rest is pulled by a force of 5×10^5 N through a distance of 2 m. Assuming that the resistance due to water is negligible, the speed of the ship is
(a) 2 ms^{-1} (b) 0.01 ms^{-1}
(c) 0.316 ms^{-1} (d) 1 ms^{-1}
(e) 5 ms^{-1}

6. A force of $(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}})$N acts on a body of mass 1 kg which is at rest initially. The acceleration of the body is
(a) $(4\hat{i} + 6\hat{j})\text{ms}^{-2}$
(b) $(2\hat{i} + 3\hat{j})\text{ms}^{-2}$
(c) $(3\hat{i} + 5\hat{j})\text{ms}^{-2}$
(d) $(6\hat{i} + 2\hat{j})\text{ms}^{-2}$
(e) $(\hat{i} + \hat{j})\text{ms}^{-2}$

7. A vehicle moving at 36 km/h is to be stopped by applying brakes in the next 5 m. If the vehicle weight 2000 kg, determine the average force that must be applied on it

(a) 10^4 N (b) 2×10^4 N
(c) 3×10^4 N (d) 5×10^3 N
(e) 10^3 N

8. A block of mass 1 kg is free to move along the X-axis. It is at rest and from time $t = 0$ onwards it is subjected to a time-dependent force $F(t)$ in the x-direction. The force $F(t)$ varies with t as shown in figure. The kinetic energy of the block at $t = 4$ s is



(a) 1 J (b) 2 J
(c) 3 J (d) 0 J
(e) 4 J

9. A body of mass $m = 1$ kg is moving in a medium and experiences a fractions force $F = -kv$, where v is the speed of the body. The initial speed is $v_0 = 10\ \text{ms}^{-1}$ and after 10 s, its energy becomes half of initial energy. Then, the value of k is
(a) $10 \ln \sqrt{2}$ (b) $\ln \sqrt{2}$
(c) $\dfrac{\ln 2}{20}$ (d) $10 \ln 2$
(e) $\ln 2$

10. The one which does not represent a force in any context is
(a) friction (b) impulse
(c) tension (d) weight
(e) viscous drag

11. The net force acting is not zero on
(a) a retarding train
(b) a ball falling with terminal velocity
(c) a kite held stationary
(d) a truck moving with constant velocity
(e) a book placed on a table

12. If n bullets each of mass m are fired with a velocity v per second from a machine gun, the force required to hold the gun in position is
(a) $(n+1)mv$ (b) $\dfrac{mv}{n^2}$
(c) $\dfrac{mv}{n}$ (d) n^2mv
(e) mnv

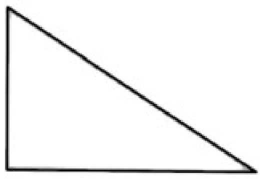
13. A ball of mass 10 g moving perpendicular to the plane of the wall strikes it and rebounds in the same line with the same velocity. If the impulse experienced by the wall is 0.54Ns, the velocity of the ball is
(a) $27\ \text{ms}^{-1}$ (b) $3.7\ \text{ms}^{-1}$
(c) $54\ \text{ms}^{-1}$ (d) $37\ \text{ms}^{-1}$
(e) $5.4\ \text{ms}^{-1}$

14. A constant force F acts on a particle of mass 1 kg moving with a velocity v, for one second. The distance moved in that time is
(a) 0 (b) $\dfrac{F}{2}$
(c) $2F$ (d) $\dfrac{v}{2}$
(e) $v + \dfrac{F}{2}$

15. A block of weight 4 kg is resting on a smooth horizontal plane. If it is struck by a jet of water at the rate of 2kgs^{-1} and at the speed of $10\ \text{ms}^{-1}$, then the initial acceleration of the block is

(a) 15 ms^{-2}
(b) 10 ms^{-2}
(c) 2.5 ms^{-2}
(d) 1 ms^{-2}
(e) 5 ms^{-2}

16. 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

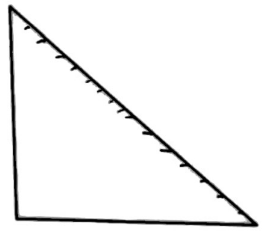


(a) 1 : 2
(b) 2 : 1
(c) 1 : 3
(d) 1 : $\sqrt{2}$
(e) 3 : 1

17. A passenger getting down from a moving bus, falls in the direction of the motion of the bus. This is an example for
(a) moment of inertia
(b) second law of motion
(c) third law of motion
(d) inertia of rest
(e) inertia of motion

18. Which one of the following is not a contact force?
(a) Viscous force
(b) Air resistance
(c) Friction
(d) Buoyant force
(e) Magnetic force

19. A mass of 1 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is 60°. The minimum force necessarv to pull the mass up the inclined plane ($g = 10$ ms^{-2}) is

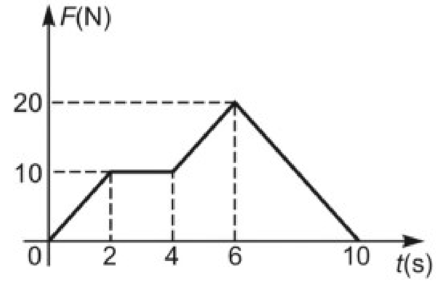


(a) 14.14 N
(b) 17.32 N
(c) 10 N
(d) 16.66 N
(e) 0.866 N

20. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg-wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is
(a) $\frac{1}{2}$
(b) 2
(c) $\frac{2}{5}$
(d) $\frac{5}{6}$
(e) $\frac{1}{5}$

21. 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 bellow is
(a) 300 N
(b) 20 N
(c) 400 N
(d) 40 N
(e) 200 N

22. 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) 26 ms^{-1}
(e) 50 ms^{-1}

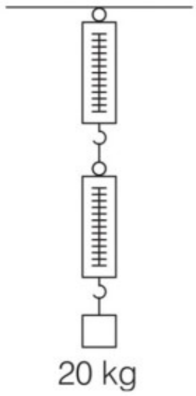
23. The momentum of a body is increased by 25%. The kinetic energy is increased by about :

(a) 25% (b) 5%
(c) 56% (d) 38%
(e) 65%

24. A boy is standing on a weighing machine inside a lift. When the lift goes upwards with acceleration $\frac{g}{4}$, the machine shows the reading 50 kg-wt When the lift goes downward with acceleration $\frac{g}{4}$, the reading of the machine in kg-wt would be

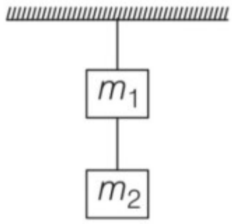
(a) 50 (b) 30
(c) 45.5 (d) 62.5
(e) 14

25. A block of mass 20 kg is suspended through two spring balances with negligible mass as shown in figure. What will be the readings in the upper and lower balance respectively?



(a) 0 kg, 20 kg (b) 10 kg, 20 kg
(c) 20 kg, 10 kg (d) 10 kg, 10 kg
(e) 20 kg, 20 kg

26. Two masses connected in series with two massless strings are hanging from a support as shown in the figure. Find the tension in the upper string



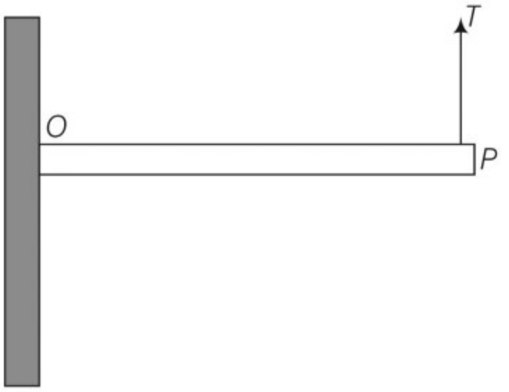
(a) $m_1 g$
(b) $(m_1 - m_2)\, g$
(c) $m_2 g$
(d) $(m_1 + m_2)\, g$
(e) $(m_1 \times m_2)\, g$

27. A man of mass 60 kg climbed down using an elevator.The elevator had an acceleration 4 ms^{-2}. If the acceleration due to gravity is 10 ms^{-2}, the man's apparent weight on his way down is

(a) 60 N (b) 240 N
(c) 360 N (d) 840 N
(d) 3600 N

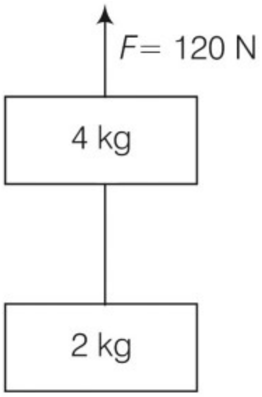
28. A uniform rod of length of 1 m and mass of 2 kg is attached to a side support at O

as shown in the figure. The rod is at equilibrium due to upward force T acting at P. Assume the acceleration due to gravity as 10 m/s^2. The value of T is



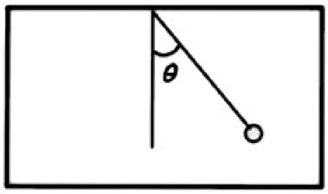
(a) 0 (b) 2 N
(c) 5 N (d) 10 N
(e) 20 N

29. Two blocks of masses 2 kg and 4 kg are attached by an inextensible light string as shown in the figure. If a force of 120 N pulls the blocks vertically upward, the tension in the string is (take $g = 10 \text{ ms}^{-2}$)



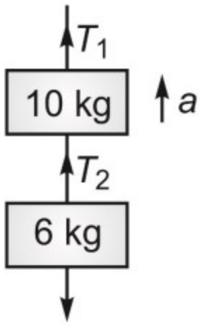
(a) 20 N (b) 15 N
(c) 35 N (d) 40 N
(e) 30 N

30. A ball is hung by a string from the ceiling of a car moving on a straight and smooth road. If the string is inclined towards the front side of the car making a small constant angle with the vertical, then the car is moving with



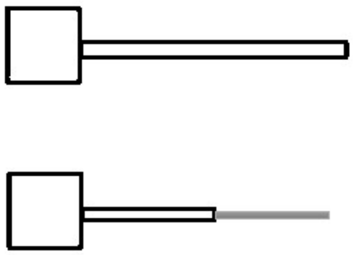
(a) constant velocity
(b) constant acceleration
(c) constant retardation
(d) increasing acceleration
(e) decreasing retardation

31. A body of mass 6 kg is hanging from another body of mass 10 kg as shown in figure. This combination is being pulled up by a string with an acceleration of 2 ms^{-2}. The tension T_1 is, ($g = 10 \text{ ms}^{-2}$)



(a) 240 N (b) 150 N
(c) 220 N (d) 192 N
(e) 178 N

32. 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) $\frac{1}{5}F$

(e) $\frac{7}{8}F$

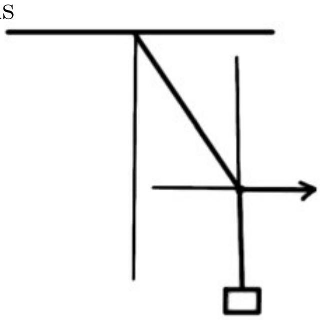
33. An object of mass 5 kg is attached to the hook of a spring balance and the balance is suspended vertically from the roof of a lift. The reading on the spring balance when the lift is going up with an acceleration of $0.25\ \text{ms}^{-2}$ is ($g = 10\ \text{ms}^{-2}$)

(a) 51.25 N (b) 48.75 N

(c) 52.75 N (d) 47.25 N

(e) 55 N

34. A mass of 6 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 the rope with the vertical, in equilibrium is

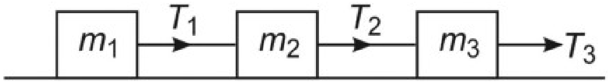


(a) 50° (b) 60°

(c) 30° (d) 40°

(e) 45°

35. Three blocks of masses m_1, m_2 and m_3 are connected by massless string as shown kept 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

(e) 16 N

36. 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

(e) $g/3$

37. A spacecraft of mass 100 kg breaks into two when its velocity is $10^4\ \text{ms}^{-1}$. After the break, a mass of 10 kg of the spacecraft is left stationary. The velocity of the remaining part is

(a) $10^3\ \text{ms}^{-1}$

(b) $11.11 \times 10^3\ \text{ms}^{-1}$

(c) $11.11 \times 10^2\ \text{ms}^{-1}$

(d) $10^4\ \text{ms}^{-1}$

(e) $1100\ \text{ms}^{-1}$

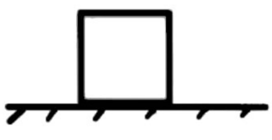
38. A stationary bomb explodes into three pieces. One piece of 2 kg mass moves with a velocity of $8\ \text{ms}^{-1}$ at right angles to the other piece of mass 1 kg moving with a velocity of $12\ \text{ms}^{-1}$. If the mass of the third piece of 0.5 kg, then its velocity is

(a) 10 ms^{-1} (b) 20 ms^{-1}
(c) 30 ms^{-1} (d) 40 ms^{-1}
(e) 50 ms^{-1}

39. 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 $3\hat{\imath}\text{ms}^{-1}$ and the other with a velocity of $4j\ \hat{m}s^{-1}$. If the explosion occurs in 10^{-4} s, the average force acting on the third piece in newton 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) $-(3\hat{\mathbf{i}} + 4\hat{\mathbf{j}}) \times 10^{4}$
(e) $(4\hat{\mathbf{i}} - 3\hat{\mathbf{j}}) \times 10^{4}$

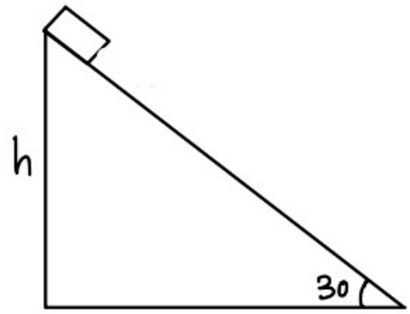
40. A shell at rest at the origin explodes into three fragments of masses 1 kg, 2 kg and m kg. The 1 kg and 2 kg pieces fly off with speeds of 5 ms^{-1} along x-axis and 6 ms^{-1} along y-axis respectively. If the m kg piece flies off with a speed of 6.5 ms^{-1}, the total mass of the shell must be
(a) 4 kg (b) 5 kg
(c) 3.5 kg (d) 4.5 kg
(e) 5.5 kg

41. A wooden block of mass 10 kg is moving with an acceleration of 3 ms^{-2} on a rough floor. If the coefficient of friction is 0.3, then the applied force on it is ($g = 10\ \text{ms}^{-2}$)



(a) 10 N (b) 30 N
(c) 80 N (d) 60 N
(e) 65 N

42. A brick of mass 2 kg slides down an incline of height 5 m and angle 30°. If the coefficient of friction of the incline is $\frac{1}{2\sqrt{3}}$, the velocity of the block at the bottom of the incline is (Assume the acceleration due to gravity is 10 m/s^2)



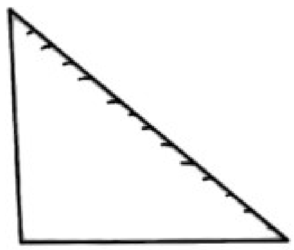
(a) 5 m/s (b) 50 m/s
(c) 7 m/s (d) 0
(e) 10 m/s

43. A car moves at a speed of 20 ms^{-1} on a banked track and describes an arc of a circle of radius $40\sqrt{3}$. The angle of banking is (take, $g = 10\ \text{ms}^{-2}$)
(a) 25° (b) 60°
(c) 45° (d) 30°
(e) 40°

44. A cyclist bends while taking turn in order to
(a) reduce friction
(b) provide required centripetal force
(c) reduce apparent weight
(d) reduce speed
(e) sit comfortably

45. A mass of 1 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is 60°. The mini-

mum force necessarv to pull the mass up the inclined plane ($g = 10$ ms^{-2}) is



(a) 14.14 N (b) 17.32 N
(c) 10 N (d) 16.66 N
(e) 0.866 N

46. If the road is unbanked and the coefficient of friction between the road and the tyres is 0.8, then the maximum speed with which an automobile can move around a curve of 84.5 m radius without slipping ($g = 10$ ms^{-2}) is
(a) 26 ms^{-1} (b) 67.6 ms^{-1}
(c) 13 ms^{-1} (d) 36.7 ms^{-1}
(e) 8.2 ms^{-1}

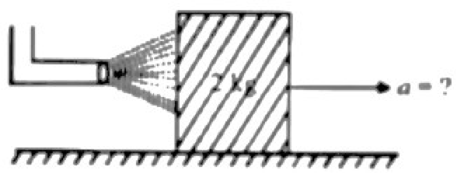
47. A car of mass 1000 kg moves on a circular track of radius 20 m. If the coefficient of friction is 0.64, then the maximum velocity with which the car can move is :
(a) 15 m/s (b) 11.2 m/s
(c) 20 m/s (d) 18 m/s
(e) 22.4 m/s

48. In two different experiments, an object of mass 5 kg moving with a speed of 25 ms^{-1} hits two different walls and comes to rest within (i) 3 second, (ii) 5 seconds, respectively.
Choose the correct option out of the following :
(a) Impulse and average force acting on the object will be same for both the cases.
(b) Impulse will be same for both the cases but the average force will be different.
(c) Average force will be same for both the cases but the impulse will be different.
(d) Average force and impulse will be different for both the cases.
(e) None of these

49. A balloon has mass of 10 g in air. The air escapes from the balloon at a uniform rate with velocity 4.5 cm/s. If the balloon shrinks in 5 s completely. Then, the average force acting on that balloon will be (in dyne).
(a) 3 (b) 9
(c) 12 (d) 18
(e) 25

50. A ball of mass 0.15 kg hits the wall with its initial speed of 12 ms^{-1} and bounces back without changing its initial speed. If the force applied by the wall on the ball during the contact is 100 N. Calculate the time duration of the contact of ball with the wall.
(a) 0.018 s (b) 0.036s
(c) 0.009 s (d) 0.072 s
(e) 0.048 s

51. A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of 1kgs^{-1} and at a speed of 10 ms^{-1}. Then, the initial acceleration of the block, in ms^{-2}, will be:



(a) 3 (b) 6
(c) 5 (d) 4
(e) 8

52. A man of 60 kg is running on the road and suddenly jumps into a stationary trolly car of mass 120 kg. Then the trolly car starts moving with velocity 2 ms^{-1}. The velocity of the running man was .... ms^{-1}. When he jumps into the car.
(a) 3 (b) 6
(c) 5 (d) 4
(e) 8

53. A batsman hits back a ball of mass 0.4 kg straight in the direction of the bowler without changing its initial speed of 15 ms^{-1}. The impulse imparted to the ball is ...... Ns
(a) 12 (b) 6
(c) 15 (d) 0
(e) 24

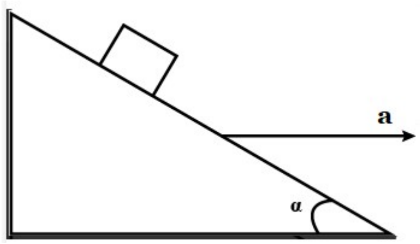
54. A force $\vec{F} = (40\hat{i} + 10\hat{\jmath})N$ acts on a body of mass 5 kg. If the body starts from rest, its position vector $\vec{r}$ at time $t = 10$ s, will be :
(a) $(100\hat{\imath} + 400\hat{\jmath})m$ (b) $(100\hat{\imath} + 100\hat{\jmath})m$
(c) $(400\hat{\imath} + 100\hat{\jmath})m$ (d) $(400\hat{\imath} + 400\hat{\jmath})m$
(e) $(400\hat{\imath} + 200\hat{\jmath})m$

55. A boy pushes a box of mass 2 kg with a force $\vec{F} = (20\overrightarrow{\text{i}} + 10\vec{\jmath})$N on a frictionless surface. If the box was initially at rest, then .... m is displacement along the x-axis after 10 s.
(a) 1000 (b) 100
(c) 200 (d) 500
(e) 750

56. A particle of mass m is moving in a straight line with momentum p. Starting at time t = 0, a force F = kt acts in the same direction on the moving particle during time interval T so that its momentum changes from p to 3p. Here k is a constant. The value of T is :
(a) $2\sqrt{\frac{k}{p}}$ (b) $2\sqrt{\frac{\text{p}}{k}}$
(c) $\sqrt{\frac{2k}{p}}$ (d) $\sqrt{\frac{2p}{\text{k}}}$
(e) $\sqrt{\frac{3p}{\text{k}}}$

57. A body of mass 5 kg under the action of constant force $\vec{F} = F_x\hat{i} + F_y\hat{\jmath}$ has velocity at $t = 0s$ as $\vec{v} = (6\hat{i} - 2\hat{\jmath})$m/s and at t = 10 s as $\overrightarrow{\text{v}} = +6\text{j}\hat{\text{m}}$/s. The force $\overrightarrow{\text{F}}$ is:
(a) $(-3\hat{\imath} + 4\hat{\jmath})N$ (b) $\left(-\frac{3}{5}\hat{\imath} + \frac{4}{5}\hat{\jmath}\right)N$
(c) $(3\hat{\imath} - 4\hat{\jmath})N$ (d) $\left(\frac{3}{5}\hat{\imath} - \frac{4}{5}\hat{\jmath}\right)N$
(e) $\left(\frac{-3}{5}\hat{\imath} - \frac{4}{5}\hat{\jmath}\right)N$

58. 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) $g \operatorname{cosec} \alpha$ (b) $g/\tan\alpha$
(c) $g\tan\alpha$ (d) g
(e) $g/\sec\alpha$

59. A rocket with a lift-off mass 3.5×10^4 kg is blasted upwards with an initial acceleration of 10 m/s^2. Then the initial thrust

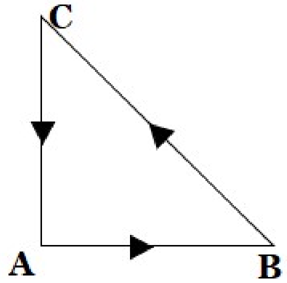
of the blast is

(a) 3.5×10^5 N (b) 7.0×10^5 N

(c) 14.0×10^5 N (d) 1.75×10^5 N

(e) 4.75×10^5 N

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



(a) less than $\vec{v}$

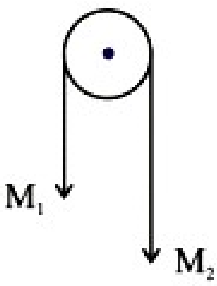
(b) greater than $\vec{v}$

(c) $|\vec{v}|$ in the direction of the largest force BC

(d) $\vec{v}$, remaining unchanged

(e) not able to predict

61. Two masses M_1 and M_2 are tied together at the two ends of a light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1 the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1. The acceleration of the system is a_2. The ratio $\frac{a_1}{a_2}$ will be:



(a) $\frac{1}{3}$ (b) $\frac{2}{3}$

(c) $\frac{3}{2}$ (d) $\frac{1}{2}$

(e) $\frac{1}{6}$

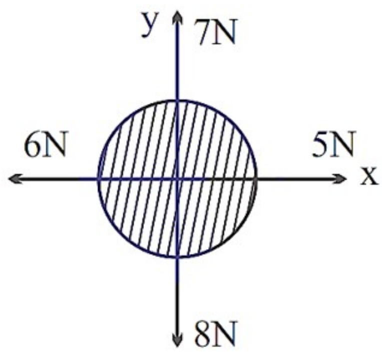
62. A block of mass M placed inside a box descends vertically with acceleration ' a '. The block exerts a force equal to one-fourth of its weight on the floor of the box. The value of ' a ' will be :

(a) $\frac{g}{4}$ (b) $\frac{g}{2}$

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

(e) $\frac{g}{6}$

63. For a free body diagram shown in the figure, the four forces are applied in the ' x ' and ' y ' directions. What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero?



(a) $\sqrt{2}N, 45°$ (b) $\sqrt{2}N, 135°$

(c) $\frac{2}{\sqrt{3}}N, 30°$ (d) 2 N, 45°

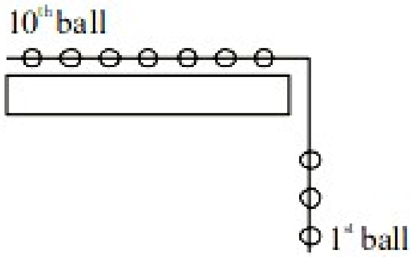
(e) 2 N, 215°

64. A person is standing in an elevator. In which situation, he experiences weight loss ?

(a) When the elevator moves upward with constant acceleration
(b) When the elevator moves downward with constant acceleration
(c) When the elevator moves upward with uniform velocity
(d) When the elevator moves downward with uniform velocity
(e) When the elevator is stationary

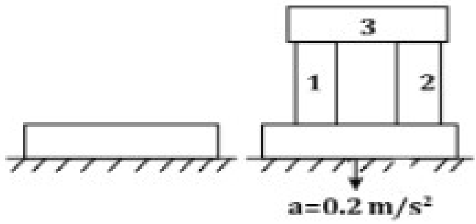
65. A mass of 10 kg is suspended by a rope of length 4 m, from the ceiling. A force F is applied horizontally at the mid-point of the rope such that the top half of the rope makes an angle of 45° with the vertical. Then F equals: (Take $g = 10$ ms^{-2} and the rope to be massless)
(a) 100 N (b) 90 N
(c) 70 N (d) 75 N
(e) 50 N

66. A system of 10 balls each of mass 2 kg are connected via massless and stretchable string. The system is allowed to slip over the edge of a smooth table as shown in figure. Tension on the string between the 7$^{\text{th}}$ and 8$^{\text{th}}$ ball is ..... N when 6$^{\text{th}}$ ball just leaves the table. (use $g = 10$ m/s^2)



(a) 18 N (b) 9 N
(c) 10 N (d) 20 N
(e) 36 N

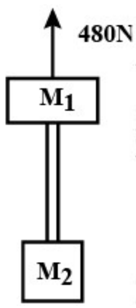
67. A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration 0.2 m/s^2. The normal reaction R_2 by the floor if mass of the iron cylinders are equal and of 20 kg each, is ..... N (Take g = 10 m/s^2]



(a) 716 (b) 686
(c) 714 (d) 684
(e) 674

68. 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) $\dfrac{Pm}{M+m}$ (b) $\dfrac{Pm}{M-m}$
(c) P (d) $\dfrac{PM}{M+m}$
(e) $\dfrac{P}{M+m}$

69. Two blocks of mass $M_1 = 20$ kg and $M_2 = 12$ kg are connected by a metal rod of mass 8 kg. The system is pulled vertically up by applying a force of 480 N as shown. The tension at the mid-point of the rod is :



(a) 144 N (b) 96 N

(c) 240 N (d) 192 N
(e) 225 N

70. A person standing on a spring balance inside a stationary lift measures 60 kg. The weight of that person if the lift descends with uniform downward acceleration of 1.8 m/s^2 will be .... N. [g = 10 m/s^2]
(a) 600 N (b) 480 N
(c) 240 N (d) 720 N
(e) 492 N

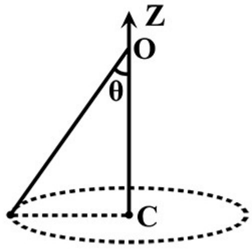
71. A block of mass M slides down on a rough inclined plane with constant velocity. The angle made by the incline plane with horizontal is θ. The magnitude of the contact force will be:
(a) Mg (b) $Mg\cos\theta$
(c) $\sqrt{Mg\sin\theta + Mg\cos\theta}$
(d) Mgsin $\theta\sqrt{1+\mu}$
(e) $Mg\sin\theta$

72. A disc with a flat small bottom beaker placed on it at a distance R from its center is revolving about an axis passing through the center and perpendicular to its plane with an angular velocity ω. The coefficient of static friction between the bottom of the beaker and the surface of the disc is μ. The breaker will revolve with the disc if :
(a) $R \leq \frac{\mu g}{2\omega^2}$ (b) $R \leq \frac{\mu g}{\omega^2}$
(c) $R \geq \frac{\mu g}{2\omega^2}$ (d) $R \geq \frac{\mu g}{\omega^2}$
(e) $R \geq \frac{\mu g}{4\omega^2}$

73. 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 the coefficient of friction for the lower half is given by
(a) $2\cos\phi$ (b) $2\sin\phi$
(c) $\tan\phi$ (d) $2\tan\phi$
(e) $2\cot\phi$

74. A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r such that r = $\frac{L}{\sqrt{2}}$. The speed of particle will be:
(a) $\sqrt{rg}$ (b) $\sqrt{2rg}$
(c) $2\sqrt{rg}$ (d) $\sqrt{\frac{rg}{2}}$
(e) $\sqrt{\frac{rg}{3}}$

75. A conical pendulum of length 1 m makes an angle $\theta = 45°$ w.r.t. Z-axis and moves in a circle in the XY plane.The radius of the circle is 0.4 m and its centre is vertically below 0 . The speed of the pendulum, in its circular path, will be : Take g = 10 ms^{-2})



(a) 0.4 m/s (b) 4 m/s
(c) 0.2 m/s (d) 2 m/s
(e) 8 m/s