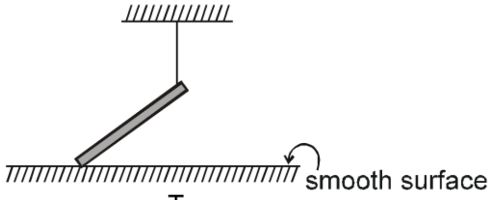
# Exercise-1

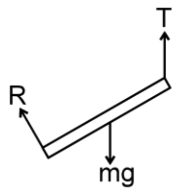
## PART-I : ONLY ONE OPTION CORRECT TYPE

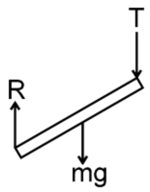
### SECTION (A) :TYPE OF FORCES, NEWTON’S THIRD LAW, FREE BODY DIAGRAM

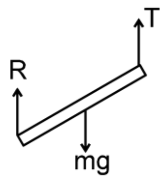
**1.** Let E,G and N represents the magnitude of electromagnetic, gravitational and nuclear forces between two protons at a given separation (1 fermi meter) . Then
(1) $N < E < G$ (2) $E > N > G$ (3) $G > N > E$ (4) $N > E > G$

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




(1) 

(2) 

(3) 

(4) None of these

**3.** In a tug of war each of the two teams apply 1000 Newton force at the ends of a rope, which is found to be in equilibrium, the tension in the rope is-
(1) 2000 newton (2) 1000 newton (3) 500 newton (4) zero

**4.** As an inclined plane is made slowly horizontal by reducing the value of angle θ with horizontal, the component of weight parallel to the plane of a block resting on the inclined plane-
(1) decreases (2) remains same
(3) increases (4) increases if the plane is smooth

**5.** When a body is stationary-
(1) There is no force acting on it
(2) The force acting on it not in contact with it
(3) The combination of forces acting on it balances each other
(4) The body is in vaccum

**6.** Essential characteristic of translational equilibrium is-
(1) its momentum is equal to zero (2) its acceleration is equal to zero
(3) its kinetic energy equal to zero (4) a single force acts on it

**7.** Newton's Third law is equivalent to the-
(1) law of conservation of linear momentum (2) law of conservation of angular momentum
(3) law of conservation of energy (4) law of conservation of energy and mass

**8.** A cannon after firing recoils due to-
(1) Conservation of energy (2) Backward thrust of gases produced
(3) Newton's third law of motion (4) Newton's first law of motion

**9.** An object will continue accelerating until :
(1) resultant force on it begins to decrease
(2) its velocity changes direction
(3) the resultant force on it is zero
(4) the resultant force is at right angles to its direction of motion

**10.** In the case of horse pulling a cart, the force that causes the horse to move forward is the force that :
(1) the horse exerts on the ground (2) the horse exerts on the cart
(3) the ground exerts on the horse (4) the cart exerts on the horse

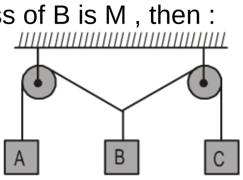
**11.** A rider on horse falls back when horse starts running, all of a sudden because-
(1) rider is taken back
(2) rider is suddenly afraid of falling
(3) inertia of rest keeps the upper part of body at rest while lower part of the body moves forward with the horse
(4) none of the above

**12.** A particle is moving with a constant speed along a straight line path. A force is not required to
(1) Increase its speed
(2) Decrease the momentum
(3) Change the direction
(4) Keep it moving with uniform velocity

**13.** The momentum of a system is conserved
(1) Always
(2) Never
(3) In the absence of an external force on the system
(4) None of the above

**14.** A particle is moving with a constant speed along a straight line path. A force is not required to :
(1) increase its speed
(2) decrease its momentum
(3) change the direction
(4) keep it moving with uniform velocity

**15.** Three blocks A , B and C are suspended as shown in the figure. Mass of each block A and C is m. If system is in equilibrium and mass of B is M , then :



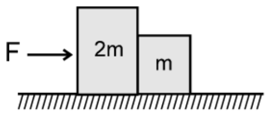

(1) M = 2m (2) M < 2m (3) M > 2m (4) M = m

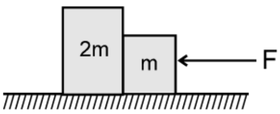
**16.** We can derive newton's-
(1) second and third laws from the first law
(2) first and second laws from the third law
(3) third and first laws from the second law
(4) all the three laws are independent of each others.

**17.** A man getting down a running bus, falls forward because-
(1) due to inertia of rest, road is left behind and man reaches forward
(2) 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
(3) he leans forward as a matter of habit
(4) of the combined effect of all the three factors stated in (1), (2) and (3)

## SECTION (B) : CALCULATION OF NORMAL REACTION

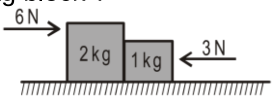
**1.** Two blocks are in contact on a frictionless table. One has mass m and the other 2m. A force F is applied on 2m as shown in the figure. Now the same force F is applied from the right on m. In the two cases respectively, the ratio of force of contact between the two blocks will be :




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

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




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

**3.** A force of 6N acts on a body at rest of mass 1 kg. During this time, the body attains a velocity of 30 m/s. The time for which the force acts on the body is-
(1) 10 seconds (2) 8 seconds (3) 7 seconds (4) 5 seconds

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

**5.** A bird weighing 1 kg sitting on the base of a wire mesh cage weighing 1.5 kg. The bird starts flying in the cage. The weight of the bird cage assembly will be
(1) 1250 g (2) 1500 g (3) 1750 g (4) None of these

**6.** 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
(1) mg (2) mg/cos θ (3) mgcos θ (4) mgtan θ

**7.** The mass of a body measured by a physical balance in a lift at rest if found to be m. If the lift is going up with an acceleration a, its mass will be measured as -
(1) $m\left(1-\frac{a}{g}\right)$ (2) $m\left(1+\frac{a}{g}\right)$ (3) m (4) zero

**8.** 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 metre/sec$^2$)-
(1) Stands still
(2) Moves downwards at a constant velocity of 4 metre/sec.
(3) Accelerates downward with an acceleration equal to 4 metres/sec$^2$
(4) Acelerates upward with an acceleration equal to 4 metres/sec$^2$

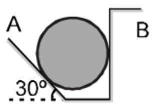
**9.** A man weighs 80 kg. He stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of 5 m/s$^2$. What would be the reading on the scale ? (g = 10 m/s$^2$)
(1) 800 N (2) 1200 N (3) Zero (4) 400 N

**10.** A body of mass 10 kg is placed in a lift moving upward with an acceleration of 2m/s$^2$. The apparent weight of body is (g = 9.8 m/s$^2$)
(1) 118 N (2) 78 N (3) 98 N (4) 198 N

**11.** A boy of 50 kg is standing in a lift moving down with an acceleration 9.8 m/s$^2$. The apparent weight of the boy is :
(1) $\frac{50}{9.8}$ N (2) 50 × 9.8 N (3) 50 N (4) zero

**12.** 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
(1) $m\left(1-\frac{a}{g}\right)$ (2) $m\left(1+\frac{a}{g}\right)$ (3) m (4) Zero

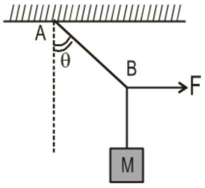
**13.** The 50 kg homogeneous smooth sphere rests on the 30º incline A and bears against the smooth vertical wall B. The contact forces at A and B.




(1) $N_A = \frac{1000}{\sqrt{3}}$ N, $N_B = \frac{500}{\sqrt{3}}$ N (2) $N_A = \frac{1000}{\sqrt{3}}$ N, $N_B = \frac{1000}{\sqrt{3}}$ N
(3) $N_A = \frac{500}{\sqrt{3}}$ N, $N_B = \frac{500}{\sqrt{3}}$ N (4) $N_A = \frac{500}{\sqrt{3}}$ N, $N_B = \frac{400}{\sqrt{3}}$ N

## SECTION (C) : CALCULATION OF TENSION

**1.** A mass M is suspended by a rope from a rigid support at A as shown in figure. Another rope is tied at the end B, and it is pulled horizontally with a force F. If the rope AB makes an angle θ with the vertical in equilibrium, then the tension in the string AB is :

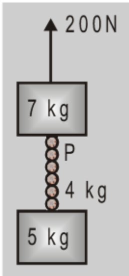



(1) F sin θ (2) F/sin θ (3) F cos θ (4) F/cos θ

**2.** A uniform thick rope of length 5m is kept on frictionless surface and a force of 5N is applied to one of its end. Find tension in the rope at 1m from this end-
(1) 1N (2) 3N (3) 4N (4) 5N

**3.** An elevator weighing 6000 kg is pulled upward by a cable with an acceleration of 5 $m/s^2$. Taking g to be $10m/s^2$. Then the tension in the cable is-
(1) 6000 N (2) 9000 N (3) 60000 N (4) 90000 N

**4.** Two blocks of 7 kg and 5 kg are connected by a heavy rope of mass 4 kg. An upward force of 200N is applied as shown in the diagram. The tension at the top of heavy rope at point P is- (g = 10 $m/s^2$)




(1) 2.27 N (2) 112.5 N (3) 87.5 N (4) 360 N

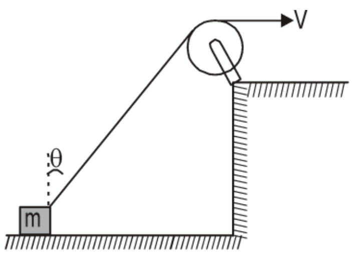
**5.** If the tension in the cable of 1000 kg elevator is 1000 kg weight, the elevator
(1) is accelerating, upwards (2) is accelerting downwards
(3) may be at rest or accelerating (4) may be at rest or in uniform motion

**6.** A block of mass 0.2 kg is suspended from the ceiling by a light string. A second block of mass 0.3 kg is suspended from the first block through another string. The tensions in the two strings : Take g = 10 $m/s^2$.
(1) $T_1$ = 5 N, $T_2$ = 3N (2) $T_1$ = 4 N, $T_2$ = 3N (3) $T_1$ = 5 N, $T_2$ = 5N (4) $T_1$ = 3 N, $T_2$ = 3N

**7.** 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 the rope at the mid point which now no longer remains horizontal. The minimum tension required to completely straighten the rope is :
(1) 15 kg (2) $\frac{15}{2}$ kg (3) 5 kg (4) Infinitely large

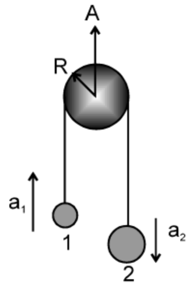
## Section (D) : Constrained motion :

**1.** A block is dragged on smooth plane with the help of a rope which moves with velocity v. The horizontal velocity of the block is :



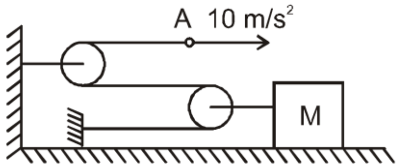

(1) v (2) $\frac{v}{\sin\theta}$ (3) v sin θ (4) $\frac{v}{\cos\theta}$

**2.** Two masses are connected by a string which passes over a pulley accelerating upward at a rate A as shown. If $a_1$ and $a_2$ be the acceleration of bodies 1 and 2 respectively then :



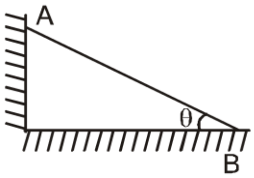

(1) A = $a_1 - a_2$ (2) A = $a_1 + a_2$ (3) A = $\frac{a_1 - a_2}{2}$ (4) A = $\frac{a_1 + a_2}{2}$.

**3.** In the shown figure acceleration of mass M is



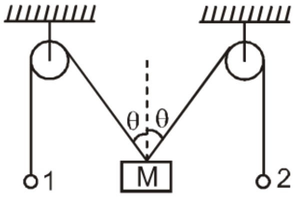

(1) 20 $m/s^2$ leftward (2) 5 $m/s^2$ leftward (3) 10 $m/s^2$ rightward (4) 5 $m/s^2$ rightward

**4.** A rod AB is slipping on a frictionless surface as shown. It acceleration of A is 10 $m/s^2$ downward, the acceleration of B will be :



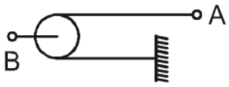

(1) 10 cot θ (2) 10 tan θ (3) 10 sin θ (4) 10 cos θ

**5.** If points 1 and 2 both are acceleration with acceleration a downward, mass M will move with



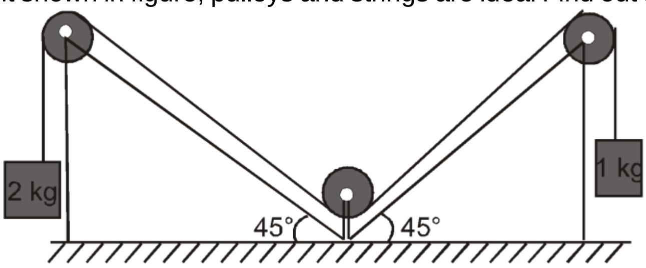

(1) a cos θ (2) 2a cos θ (3) a sec θ (4) 2 a sec θ

**6.** The ratio of magnitudes of acceleration of A and B is



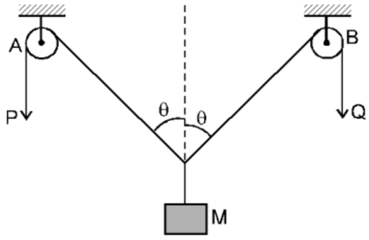

(1) 1 (2) 2 (3) 1/2 (4) 1/3

**7.** For the arraangement shown in figure, pulleys and strings are ideal Find out the acceleration of 2 kg block



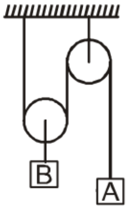

(1) $\frac{g}{3}$ (2) $\frac{g\sqrt{2}}{3}$ (3) $\frac{2g}{3}$ (4) $\frac{2g}{\sqrt{2}}$

**8.** In the arrangement shown in fig. the ends P and Q of an unstretchable string move downwards with uniform speed U. Pulleys A and B are fixed. Mass M moves upwards with a speed.



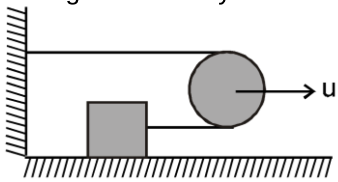

(1) 2 U cos θ (2) U cos θ (3) 2 U/cos θ (4) U/cos θ

**9.** The ration of magnitudes of acceleration of A and B is :



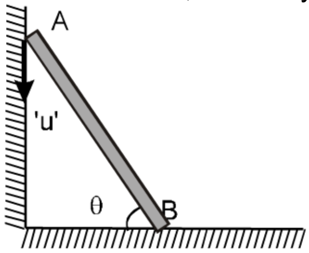

(1) 2 (2) 1 (3) 1/2 (4) 3

**10.** In the figure shown, the pulley is moving with velocity u. The velocity of the block attached with string:



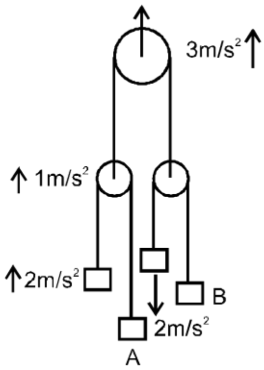

(1) 4u (2) 3u (3) u (4) 2u

**11.** The velocity of end 'A' of rigid rod placed between two smooth vertical walls moves with velocity 'u' along vertical direction. The velocity of end 'B' of that rod, rod always remains in contact with the vertical walls.



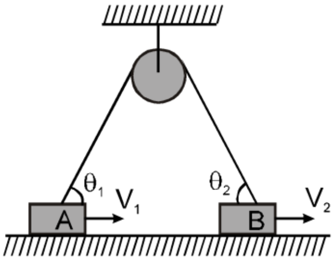

(1) u cot θ (2) u tan θ (3) u sin θ (4) u cos θ

**12.** Acceleration of pulleys and blocks are as shown in the figure. All pulleys & strings are massless & frictionless magnitude of $a_A$ and $a_B$ are :




(1) $a_A = 0, a_B = 7$ (2) $a_A = 0, a_B = 5$ (3) $a_A = 0, a_B = 12$ (4) $a_A = 5, a_B = 7$

**13.** In the figure shown, blocks A and B move with velocities $v_1$ and $v_2$ along horizontal direction. The ratio of $\frac{v_1}{v_2}$ :




(1) $\frac{\sin\theta_2}{\sin\theta_1}$ (2) $\frac{\sin\theta_1}{\sin\theta_2}$ (3) $\frac{\cos\theta_2}{\cos\theta_1}$ (4) $\frac{\cos\theta_1}{\cos\theta_2}$

## SECTION (E) : CALCULATION OF FORCE & ACCELERTION

**1.** The linear momentum P of a body varies with time and is given by the equation $P = x + yt^2$ where x and y are constants. The net force acting on the body for a one dimensional motion is proportional to-

(1) $t^2$ (2) a constant (3) $\frac{1}{t}$ (4) t

**2.** In which of the following cases forces must not be required to keep the-

(1) Particle going in a circle (2) Particle going along a straight line

(3) The momentum of the particle constant (4) Acceleration of the particle constant

**3.** Newton's second law gives a measure of-

(1) acceleration (2) force (3) momentum (4) angular momentum

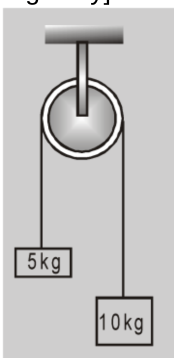
**4.** The average force necessary to stop a hammer having momentum 25 N-s in 0.05 second is-

(1) 25 N (2) 50 N (3) 1.25 N (4) 500 N

**5.** When a constant force is applied to a body, it moves with uniform :

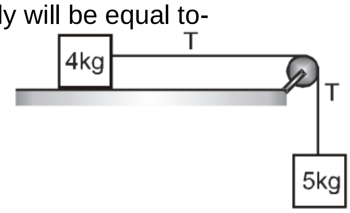
(1) acceleration (2) velocity (3) speed (4) momentum

**6.** Two masses of 5 kg and 10 kg are connected to a pulley as shown. What will be the acceleration if the pulley is set free? [g = acceleration due to gravity]




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

**7.** Two bodies of 5 kg and 4 kg are tied to a string as shown in the fig. If the table and pulley both are smooth, acceleration of 5 kg body will be equal to-




(1) g (2) $\frac{g}{4}$ (3) $\frac{4g}{9}$ (4) $\frac{5g}{9}$

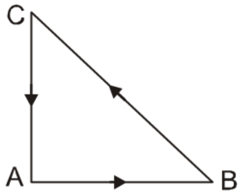
**8.** The mass of ship is $2 \times 10^7$ kg. On applying a fore of $25 \times 10^5$ N, it is displaced through 25m. After the displacement. The speed aquired by the ship will be:

(1) 12.5 m/s (2) 5 m/s (3) 3.7 m/s (4) 2.5 m/s

**9.** A body of mass 0.1 kg attains a velocity of 10 $ms^{-1}$ in 0.1 s. The force acting on the body is :

(1) 10 N (2) 0.01 N (3) 0.1 N (4) 100 N

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




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

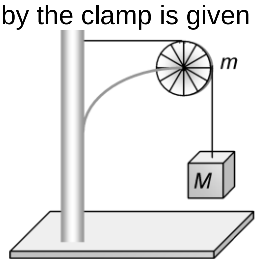
**11.** 250 g ball striks at the bat with velocity of 10 m/s and remains in contact upto 0.01 second after then it return with same speed then find out force exerted by ball on bat:
(1) 25 N (2) 50 N (3) 250 N (4) 500 N

**12.** 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
(1) 8300 N (2) 417 N (3) 830 N (4) Zero

**13.** 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
(1) 20 dynes (2) 20 N (3) 22 dynes (4) 1000 N

**14.** Gravels are dropped on a conveyor belt at the rate of 0.5 kg/sec. The extra force required in newtons to keep the belt moving at 2 m/sec is
(1) 1 (2) 2 (3) 4 (4) 0.5

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



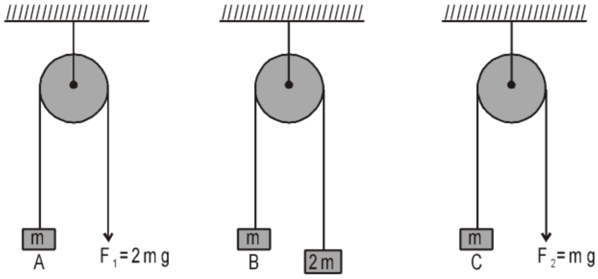

(1) $\sqrt{2}Mg$ (2) $\sqrt{2}mg$ (3) $\sqrt{(M+m)^2+m^2}g$ (4) $\sqrt{(M+m)^2+M^2}g$

**16.** A ball weighing 10 gm hits a hard surface vertically with a speed of 5m/s and rebounds with the same speed. The ball remain in contact with the surface for 0.01 sec. The average force exerted by the surface on the ball is :
(1) 100 N (2) 10 N (3) 1 N (4) 150 N

**17.** A 10 kg wagon is pushed with a force of 7N for 1.5 second, then with a force of 5 N for 1.7 seconds, and then with a force of 10 N for 3 second in the same direction. What is the change in velocity brought about ?
(1) 9.8 m/s (2) 19.6 m/s (3) 4.9 m/s (4) 10 m/s

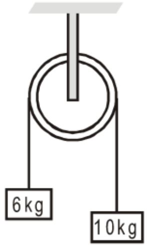
**18.** A 1 kg particle strikes a wall with velocity 1 m/s at an angle of 30° with the normal to the wall and reflects at the same angle. If it remain in contact with wall for 0.1 s, then the force is-
(1) 0 (2) $10\sqrt{3}$ N (3) $30\sqrt{3}$ N (4) $40\sqrt{3}$ N

**19.** In the figure, the blocks A , B and C of mass m each have acceleration $a_1$ , $a_2$ and $a_3$ respectively. $F_1$ and $F_2$ are external forces of magnitudes 2 mg and mg respectively .




(1) $a_1 = a_2 = a_3$ (2) $a_1 > a_2 > a_3$ (3) $a_1 = a_2$ , $a_2 > a_3$ (4) $a_1 > a_2$ , $a_2 = a_3$

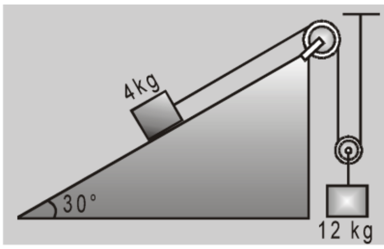
**20.** A light string passes over a frictionless pulley. To one of its ends a mass of 6 kg is attached and to its other end a mass of 10 kg is attached. The tension in the string will be -




(1) 50 N (2) 75 N (3) 100 N (4) 150 N

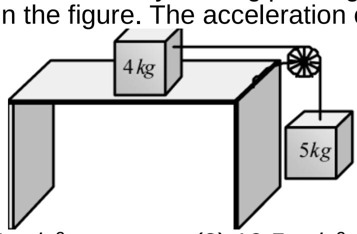
**21.** A ship of mass $3 \times 10^7$ kg initially at rest, is pulled by a force of $5 \times 10^4$ N through a distance of 3 m. Assuming that the resistance due to water is negligible, the speed of the ship is :
(1) 1.5 m/s (2) 60 m/s (3) 0.1 m/s (4) 5 m/s

**22.** Calculate the acceleration of the mass 12 kg shown in the set up of fig. Also calculate the tension in the string connecting the 12 kg mass. The string are weightless and inextensible, the pulleys are weightless and frictionless-




(1) $\frac{9}{10}, \frac{56g}{5}$ N (2) $\frac{2g}{7}, \frac{60g}{7}$ N (3) $\frac{10}{g}, \frac{5}{56g}$ N (4) $\frac{9}{14}, \frac{5}{56g}$ N

**23.** 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 shown in the figure. The acceleration of 5 *kg* mass is




(1) 49 m/s$^2$ (2) 5.44 m/s$^2$ (3) 19.5 m/s$^2$ (4) 2.72 m/s$^2$

**24.** A player takes 0.1 s in catching a ball of mass 150 g moving with velocity of 20 m/s. The force imparted by the ball on the hands of the player is :
(1) 0.3 N (2) 3 N (3) 30 N (4) 300 N

**25.** An object of mass 3 kg is at rest. If a force $\vec{F} = (6t^2\,\hat{i} + 4t\,\hat{j})$ N is applied on the object, then the velocity of the object at t = 3 s is :
(1) $18\,\hat{i} + 3\,\hat{j}$ (2) $18\,\hat{i} + 6\,\hat{j}$ (3) $3\,\hat{i} + 18\,\hat{j}$ (4) $18\,\hat{i} + 4\,\hat{j}$

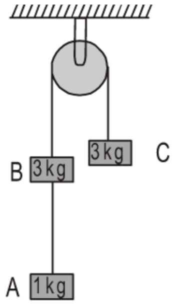
**26.** A lift of mass 1000 kg is moving upwards with an acceleration of 1 m/s$^2$. The tension developed in the string, which is connected to lift is : (g = 9.8 m/s$^2$)
(1) 9800 N (2) 10800 N (3) 11000 N (4) 10000 N

**27.** A sphere is accelerated upwards by a cord whose breaking strength is four times its weight. The maximum acceleration with which the sphere can move up without breaking the cord is :
(1) g (2) 3g (3) 2g (4) 4g

**28.** A body of mass 0.1 kg attains a velocity of 10 $ms^{-1}$. in 0.1 s. The force acting on the body is :
(1) 10 N (2) 0.01 N (3) 0.1 N (4) 100 N

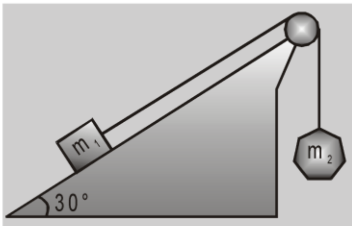
**29.** A light string passing over a smooth light pulley connects two blocks of masses $m_1$ and $m_2$ (vertically). If the acceleration of the system is g/8, then the ratio of the masses is :
(1) 8 : 1 (2) 9 : 7 (3) 4 : 3 (4) 5 : 3

**30.** In the system shown in the figure, the acceleration of the 1 kg mass and the tension in the string connecting between A and B is :



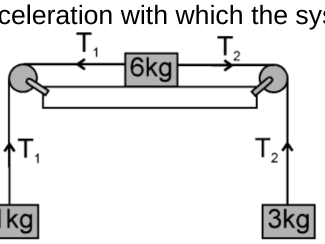

(1) $\frac{g}{4}$ downwards , $\frac{8g}{7}$ (2) $\frac{g}{4}$ upwards, $\frac{g}{7}$ (3) $\frac{g}{7}$ downwards , $\frac{6}{7}$g (4) $\frac{g}{2}$ upwards, g

**31.** A block of mass $m_1 = 2$ kg on a smooth inclined plane at angle 30° is connected to a second block of mass $m_2 = 3$ kg by a cord passing over a frictionless pulley as shown in fig. The acceleration of each block is- (assume g = 10 m/$sec^2$)




(1) 2 m/$sec^2$ (2) 4 m/$sec^2$ (3) 6 m/$sec^2$ (4) 8 m/$sec^2$

**32.** Three masses of 1 kg , 6 kg and 3 kg are connected to each other with threads and are placed on table as shown in figure. What is the acceleration with which the system is moving ? Take g = 10m $s^{-2}$.




(1) Zero (2) 1 m $s^{-2}$ (3) 2 m $s^{-2}$ (4) 3 m $s^{-2}$

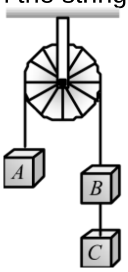
**33.** An elevator weighing 3000 kg is pulled upwards by a cable with an acceleration of 5 $ms^{-2}$ . Taking 'g' to be 10 $ms^{-2}$. Then the tension in the cable is -
(1) 6000 N (2) 9000 N (3) 60000 N (4) 45000 N

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

**35.** The mass of a lift is 500 kg. What will be the tension in its cable when it is going up with an acceleration of 2.0 m/$s^2$-
(1) 5000 N (2) 5600 N (3) 5900 N (4) 6200 N

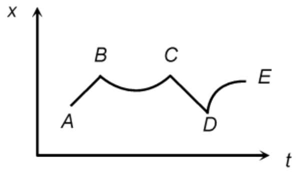
**36.** A balloon of gross weight w newton is falling vertically downward with a constant acceleration a(<g). The magnitude of the air resistance is :
(1) w (2) $w\left(1+\frac{a}{g}\right)$ (3) $w\left(1-\frac{a}{g}\right)$ (4) $w\frac{a}{g}$

**37.** 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



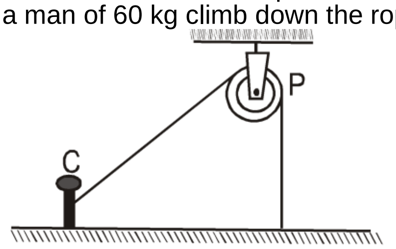

(1) Zero (2) $\frac{40}{3}$N (3) 3.3 *N* (4)19.6 *N*

**38.** Figure shows the displacement of a particle going along the X-axis as a function of time. The force acting on the particle is zero in the region




(1) AB (2) BC (3) CD (4) DE

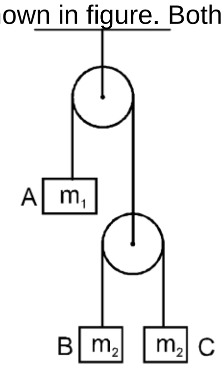
**39.** One end of massless rope, which passes over a massless and frictionless pulley P is tied to a hook C while the other end is free. Maximum tension that the rope can bear is 360 N. With what value of minimum safe acceleration (in $ms^{-2}$) can a man of 60 kg climb down the rope ?




(1) 16 (2) 6 (3) 4 (4) 8

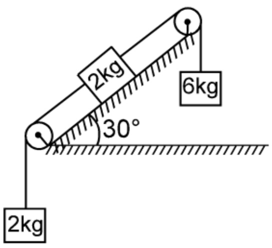
**40.** A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope ? (g = 10 $m/s^2$)
(1) 25 $m/s^2$ (2) 2.5 $m/s^2$ (3) 5 $m/s^2$ (4) 10 $m/s^2$

**41.** Consider the system of 2 pullies as shown in figure. Both the pulleys are smooth and strings are light.



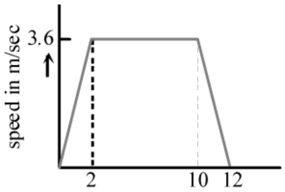

If acceleration of $m_1$ was 5 $m/sec^2$ downward then find the value of $\frac{m_1}{m_2}$ (Take g = 10 $m/s^2$)
(1) 3 (2) 4 (3) 5 (4) 6

**42.** Find the acceleration of the 6 Kg block in the figure. All the surfaces and pulleys are smooth. Also the strings are inextensible and light. [Take g = 10 $m/s^2$]



(1) 3 m/$s^2$ (2) 5 m/$s^2$ (3) 7 m/$s^2$ (4) 9 m/$s^2$

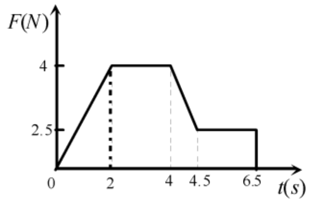
**43.** A lift is going up. The total mass of the lift and the passenger is 1500 *kg*. The variation in the speed of the lift is as given in the graph. The tension in the rope pulling the lift at $t$ = 11th *sec* will be




(1) 17400 *N* (2) 14700 *N* (3) 12000 *N* (4) Zero

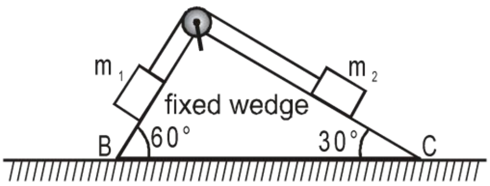
**44.** In the above ques., the height to which the lift takes the passenger is
(1) 3.6 *meters* (2) 8 *meters* (3) 1.8 *meters* (4) 36 *meters*

**45.** 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.



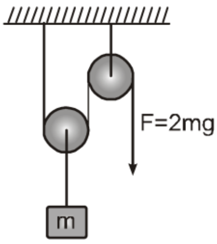

(1) 9.25 $ms^{-1}$ (2) 5 $ms^{-1}$ (3) 14.25 $ms^{-1}$ (4) 4.25 $ms^{-1}$

**46.** Two small masses $m_1$ and $m_2$ are at rest on a frictionless, fixed triangular wedge whose angles are 30° and 60° as shown. They are connected by a light inextensible string. The side BC of wedge is horizontal and both the masses are 1 metre vertically above the horizontal side BC of wedge. There is no friction between the wedge and both the masses. If the string is cut, which mass reaches the bottom of the wedge first? (Take g = 10m/$s^2$)



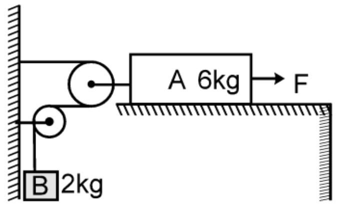

(1) Mass $m_1$ reaches the bottom of the wedge first.
(2) Mass $m_2$ reaches the bottom of the wedge first.
(3) Both reach the bottom of the wedge at the same time.
(4) It's impossible to determine from the given information.

**47.** In the shown mass pulley system, pulleys and string are massless. The one end of the string is pulled by the force F = 2mg. The acceleration of the block will be



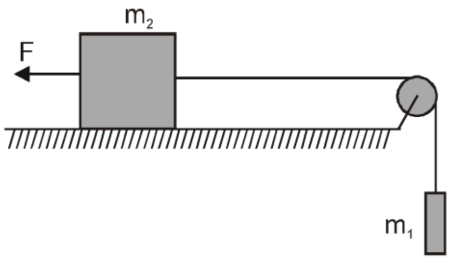

(1) g/2 (2) 0 (3) g (4) 3g

**48.** The system starts from rest and A attains a velocity of 5 m/s after it has moved 5 m towards right. Assuming the arrangement to be frictionless every where and pulley & strings to be light, if the constant force F applied on A then find the value of $\frac{F}{15}$.




(1) 1 (2) 3 (3) 5 (4) 7

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



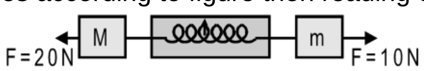

(1) $\frac{m_1 g}{2(m_1+m_2)}$ (2) $\frac{m_2 g}{2(m_1+m_2)}$ (3) $\frac{m_1}{2(m_1+m_2)}$ (4) $\frac{m_2}{2(m_1+m_2)}$

## SECTION (F) : WEIGHING MACHINE, SPRING RELATED PROBLEMS AND SPRING BALANCE :

**1.** A spring toy weighing 1 kg on a spring balance suddenly jumps upward. A boy standing near the toy notices that the scale of the balance reads 1.05 kg. In this process the maximum acceleration of the toy is- (g = 10m $sec^{-2}$)

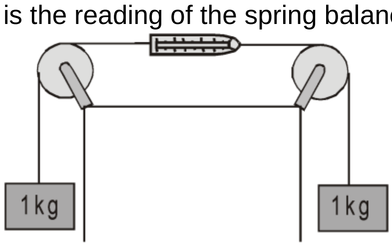
(1) 0.05 m $sec^{-2}$ (2) 0.5 m $sec^{-2}$ (3) 1.05 m $sec^{-2}$ (4) 1 m $sec^{-2}$

**2.** A dynamometer D, is connected with to bodies of mass M = 6 kg and m = 4kg. If two forces F = 20 N & F = 10 N are applied on masses according to figure then reading of the dynamometer will be –




(1) 10 N (2) 20 N (3) 6 N (4) 14 N

**3.** In the given figure, what is the reading of the spring balance ?




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

**4.** 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

(1) both the scales read M kg each

(2) the scale of the lower one reads M kg and of the upper one zero

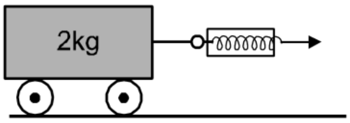
(3) the reading of the two scales can be anything but the sum of the readings will be M kg

(4) both the scales read M / 2kg

**5.** Two spring of spring constants $k_1$ and $k_2$ are joined in series. The effective spring constant of the combination is given by :

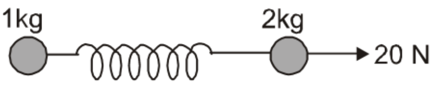
(1) $\sqrt{k_1k_2}$ (2) $(k_1 + k_2)/2$ (3) $k_1 + k_2$ (4) $k_1k_2/(k_1 + k_2)$

**6.** A massless spring balance is attached to 2 kg trolley and is used to pull the trolley along a flat surface as shown in the fig. The reading on the spring balance remains at 10 kg during the motion. The acceleration of the trolley is (Use g = 9.8 $ms^{-2}$)



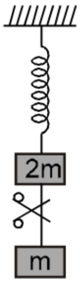

(1) 4.9 $ms^{-2}$ (2) 9.8 $ms^{-2}$ (3) 49 $ms^{-2}$ (4) 98 $ms^{-2}$

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




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

**8.** 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 2m and m just after the string is cut will be :



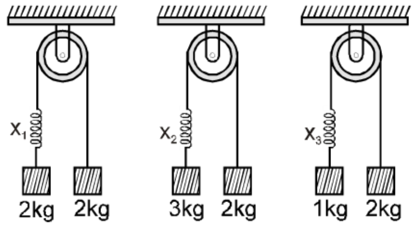

(1) g/2 upwards , g downwards (2) g upwards, g/ 2 downwards
(3) g upwards , 2g downwards (4) 2g upwards , g downwards

**9.** A cold soft drink is kept on the balance. When the cap is open, then the weight -
(1) increases (2) decreases
(3) first increases then decreases (4) remains same

**10.** 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-
(1) First increases then decreases to zero (2) decreases
(3) increases (4) remains same

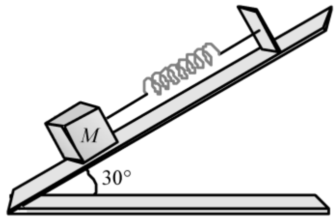
**11.** A light spring balance hangs from the hook of the other light spring balance and a block of mass M kg hangs from the former one. Then the true statement about the scale reading is :
(1) Both the scale read M kg each
(2) The scale of the lower one reads M kg and of the upper one zero
(3) The reading of the two scales can be anything but the sum of the reading will be M kg
(4) Both the scales read M/2 kg

**12.** Same spring is attached with 2 kg, 3 kg and 1 kg blocks in three different cases as shown in figure. If $x_1$, $x_2$ and $x_3$ be the extensions in the spring in these cases then (Assume all the blocks to move with uniform acceleration)




(1) $x_1 = 0$, $x_3 > x_2$ (2) $x_2 > x_1 > x_3$ (3) $x_3 > x_1 > x_2$ (4) $x_1 > x_2 > x_3$

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




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

**14.** The force exerted by the floor of an elevator on the foot for a person standing there. is more than the weight of the person if the elevator is

A**.** Going up with increasing speed

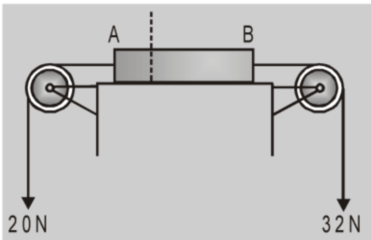
B. Going down with decrasing speed .

(1) A is true but B is false (2) A is false but B is ture

(3) Both A and B are ture (4) Both A and B are false

## SECTION (G) : NEWTON'S LAW FOR A SYSTEM :

**1.** Figure shows a uniform rod of mass 3 kg and of length 30 cm. The strings shown in figure are pulled by constant forces of 20 N and 32 N. The acceleration of the rod is-

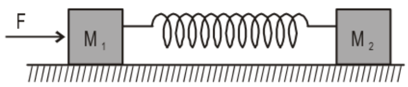



(1) 2 m/s² (2) 3m/s² (3) 4m/s² (4) 6m/s²

**2.** In the above question tension in rod at a distance 10cm from end A is-

(1) 18N (2) 20N (3) 24N (4) 36N

**3.** Two blocks of masses $M_1$ and $M_2$ are connected to each other through a light spring as shown in figure. If we push mass $M_1$ with force F and cause acceleration $a_1$ in mass $M_1$, what will be the magnitude of acceleration in $M_2$?




(1) $F/M_2$ (2) $F/(M_1 + M_2)$ (3) $a_1$ (4) $(F - M_1a_1)/M_2$

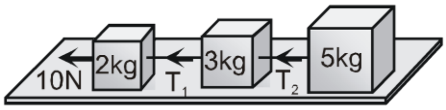
**4.** A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is

(1) $\frac{P\ m}{M+m}$ (2) $\frac{P\ m}{M-m}$ (3) P (4) $\frac{P\ M}{M+m}$

**5.** 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 -

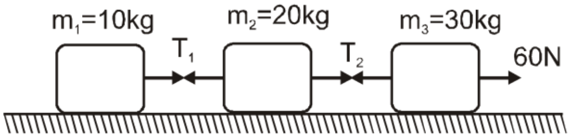
(1) $1\ m/s_2$ (2) $1.5\ m/s_2$ (3) $2\ m/s_2$ (4) $4\ m/s_2$

**6.** 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 $T_1$ =




(1) 1*N* (2) 5 *N* (3) 8 *N* (4) 10 *N*

**7.** Three masses connected by massless string as shown in figure, are placed on a horizontal frictionless surface. Find tensions $T_1$ and $T_2$.

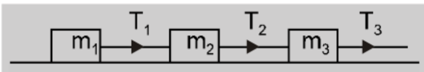



(1) 10, 30 (2) 15, 30 (3) 20, 30 (4) 10, 40

**8.** A block of mass m is connected to another block of mass M by a string (massless). The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest. 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

(1) $\frac{mF}{m}$ (2) $\frac{(M+m)\ F}{m}$ (3) $\frac{mF}{(m+M)}$ (4) $\frac{MF}{(m+M)}$

**9.** 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-




(1) 20 N (2) 40 N (3) 10 N (4) 32 N

**10.** A man stands on a weighing machine kept inside a lift. Initially the lift is ascending with the acceleration ‘a’ due to which the reading is W. Now the lift decends with the same accleration and reading is 10 % of initial. Find the acceleration of lift ?

(1) $\frac{g}{19}$ m/$sec^2$ (2) $\frac{9g}{11}$ m/$sec^2$ (3) 0 m/$sec^2$ (4) g m/$sec^2$

## SECTION (H) : PSEUDO FORCE

**1.** The ratio of the weight of a man in a stationary lift & when it is moving downward with uniform acceleration 'a' is 3 : 2 . The value of 'a' is : (g = acceleration. due to gravity)

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

**2.** A body of mass 2 kg is hung on a spring balance mounted vertically in a lift. If the lift descends with an acceleration equal to the acceleration due to gravity 'g' the reading on the spring balance will be-

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

**3.** 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

(1) 24 N (2) 74 N (3) 15 N (4) 49 N

**4.** An object of mass 2 kg moving with constant velocity $10\hat{i}$ m/s is seen in a frame moving with constant velocity $10\hat{i}$ m/s. The value of ‘pseudo force’ acting on object in this frame will be :

(1) 20 N (2) 0 (3) 10 N (4) 2 N

**5.** 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 has a magnitude.

(1) mg (2) mg/cos θ (3) mgcos θ (4) mgtan θ

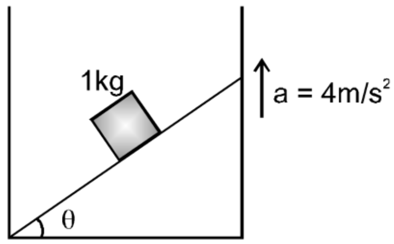
**6.** A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be :

(1) mg cos θ (2) mg sin θ (3) mg (4) mg/cos θ

**7.** 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. The a is equal to

(1) g (2) g tan α (3) g/tanα (4) g cosec α

**8.** A wedge is moving with an acceleration a = 4m/s$^2$ vertically up as shown in figure. What is acceleration of block of mass 1 kg w.r.t. wedge & normal reaction by wedge on block respectively. All surfaces are smooth. Choose correct pair : (g = 10 m/s$^2$)



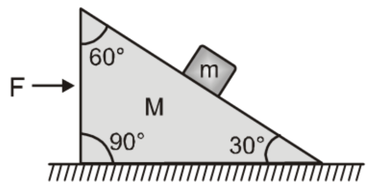

(1) 7 m/s$^2$ , $7\sqrt{3}$ N (2) 5 m/s$^2$, $5\sqrt{3}$ N (3) 4.9 m/s$^2$ , $4.9\sqrt{3}$ N (4) 10 m/s$^2$ , $10\sqrt{3}$ N

## Exercise-2

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

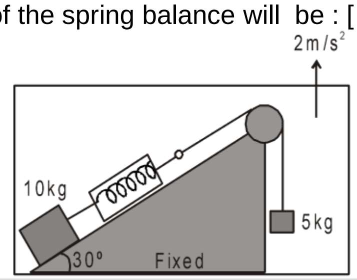
(1) 20 N (2) 22 N (3) 4 N (4) 16 N

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



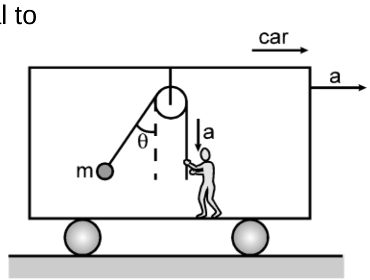

(1) Mg tan 30° (2) mg tan 30° (3) (M+m)g tan 30° (4) (M+m)g cos 30°

**3.** According to figure the reading of the spring balance will be : [ g = 10 m/s$^2$ ]



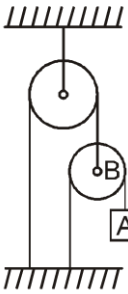
(1) 6 kg f (2) 5 kg f (3) 600 N (4) 60 kg f

**4.** A bob is hanging over a pulley inside a car through a string. The second end of the string is in the hand of a person standing in the car. The car is moving with constant acceleration 'a' directed horizontally as shown in figure. Other end of the string is pulled with constant acceleration 'a' (relative to car) vertically. The tension in the string is equal to



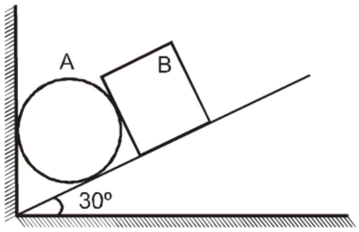

(1) $m\sqrt{g^2+a^2}$ (2) $m\sqrt{g^2+a^2}$ – ma (3) $m\sqrt{g^2+a^2}$ + ma (4) m(g + a)

**5.** The ratio of acceleration of A and B is



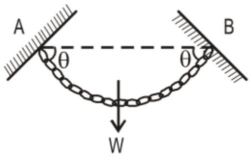

(1) 2 (2) 1 (3) 4 (4) Not defined

**6.** A perfect smooth sphere A of mass 2kg is in contact with a rectangular block B of mass 4kg and vertical wall as shown in the figure. All surfaces are smooth. Find normal reaction by vertcial wall on sphere A.



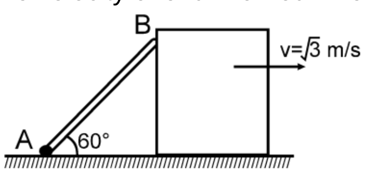

(1) 20 N (2) 25 N (3) 30 N (4) 40 N

**7.** A flexible chain of weight W hangs between two fixed points A and B at the same level. The inclination of the chain with the horizontal at the two points of support is θ. What is the tension of the chain at the endpoint.



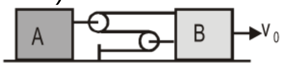

(1) $\frac{W}{2}$ cosec θ (2) $\frac{W}{2}$ sec θ (3) W cos θ (4) $\frac{W}{3}$ sin θ

**8.** A rod AB is shown in figure. End A of the rod is fixed on the ground. Block is moving with velocity $\sqrt{3}$ m/s towards right. The velocity of end B of rod when rod makes an angle of 60º with the ground is:



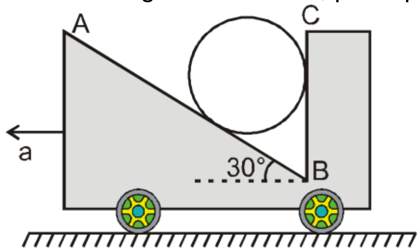

(1) $\sqrt{3}$ m/s (2) 2 m/s (3) $2\sqrt{3}$ m/s (4) 3 m/s

**9.** Block B is moving towards right with constant velocity $v_0$. Velocity of block A with respect to block B is-
(Assume all pulleys and strings are ideal)



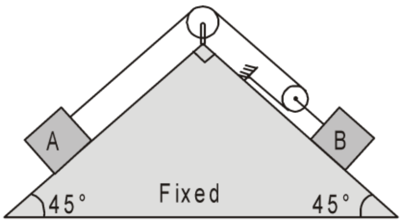

(1) $v_0/2$ left (2) $v_0/2$ right (3) $3/2v_0$ right (4) $3/2v_0$ left

**10.** A cylinder rests in a supporting carriage as shown. The side AB of carriage makes an angle $30_o$ with the horizontal and side BC is vertical. The carriage lies on a fixed horizontal surface and is being pulled towards left with an horizontal acceleration 'a'. The magnitude of normal reactions exerted by sides AB and BC of carriage on the cylinder be $N_{AB}$ and $N_{BC}$ respectively. Neglect friction everywhere. Then as the magnitude of acceleration 'a ' of the carriage is increased, pick up the correct statement:



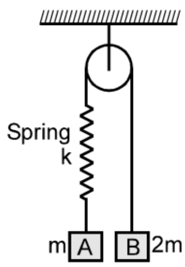

(1) $N_{AB}$ increases and $N_{BC}$ decreases.
(2) Both $N_{AB}$ and $N_{BC}$ increase.
(3) $N_{AB}$ remains constant and $N_{BC}$ increases.
(4) $N_{AB}$ increases and $N_{BC}$ remains constant.

**11.** Two blocks A and B of mass 10 kg and 40 kg are connected by an ideal string as shown in the figure. Neglect the masses of the pulleys and effect of friction. ($g = 10\ m/s^2$)



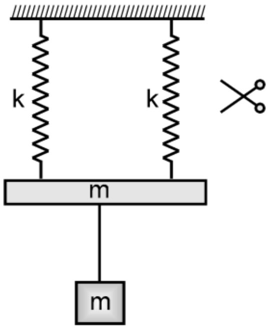

(1) The acceleration of block A is $\frac{5}{\sqrt{2}}$ $ms^{-2}$
(2) The acceleration of block B is $\frac{50}{2\sqrt{2}}$ $ms^{-2}$
(3) The tension in the string is $\frac{125}{\sqrt{2}}$ N
(4) The tension in the string is $\frac{1500}{\sqrt{2}}$ N

**12.** Two blocks A and B of masses m & 2m respectively are held at rest such that the spring is in natural length. Find out the accelerations of blocks A and B respectively just after release (pulley, string and spring are massless).




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

**13.** System shown in figure is in equilibrium. The magnitude of change in tension in the string just before and just after, when one of the spring is cut. Mass of both the blocks is same and equal to m and spring constant of both springs is k. (Neglect any effect of rotation)




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

# Exercise-3

## PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS )

**1.** A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 $ms^{-2}$. The mass of this body must be **[CBSE-AIPMT screening (Med.) 2009]**

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

**2.** A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by : **[AIPMT (Mains)-2012]**

(1) 68% (2) 41% (3) 200% (4) 100%

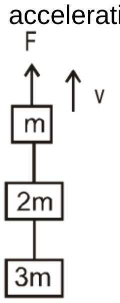
**3.** The mass of a lift is 2000 kg. When the tension in the supporitng cable is 28000 N, then its acceleration is **[AIPMT SCREENING 2009]**

(1) 30 $ms^{-2}$ downwards (2) 4 $ms^{-2}$ upwards (3) 4 $ms^{-2}$ downwards (4) 14 $ms^{-2}$ upwards

**4.** A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on 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 : **[AIPMT Screening-2011]**

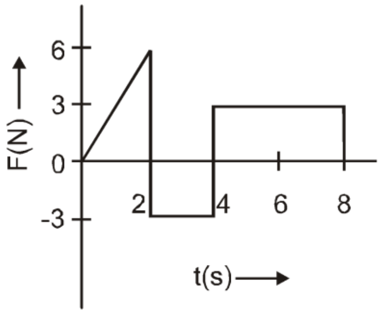
(1) 8600 N (2) 9680 N (3) 11000 N (4) 1200 N

**5.** Three blocks with masses m, 2 m and 3m are connected by strings as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m? (g is the acceleration due to gravity) **[NEET-2013, 4/180, –1]**




(1) 2mg (2) 3 mg (3) 6 mg (4) zero

**6.** The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is : **[AIPMT-2014]**




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

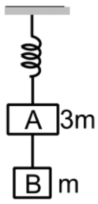
**7.** A balloon with mass 'm' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that is starts moving up with an acceleration 'a' ? **[AIPMT-2014]**

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

**8.** Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block then the contact force between A and B is : **[AIPMT-2015]**


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

**9.** Two blocks A and B of masses 3m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively : **[NEET 2017]**

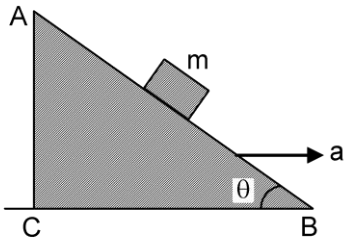



(1) g, $\frac{g}{3}$ (2) $\frac{g}{3}$, g (3) g, g (4) $\frac{g}{3}$, $\frac{g}{3}$

**10.** A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constnt is k'. Then they are connected in parallel and force constant is k''. Then k' : k'' is : **[NEET 2017]**

(1) 1 : 6 (2) 1 : 9 (3) 1 : 11 (4) 1 : 14

**11.** A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration 'a' towards the right. The relation between a and θ for the block to remain stationary on the wedge is **[NEET 2018]**

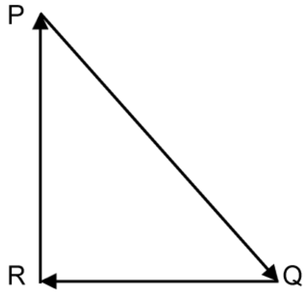



(1) $a = \frac{g}{\operatorname{cosec}\theta}$ (2) $a = g\tan\theta$ (3) $a = g\cos\theta$ (4) $a = \frac{g}{\sin\theta}$

**12.** When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60º with horizontal, it can travel a distance $x_1$ along the plane. But when the inclination is decreased to 30º and the same object is shot with the same velocity, it can travel $x_2$ distance. Then $x_1 : x_2$ will be : **[NEET-2019-I]**

(1) $1:2\sqrt{3}$ (2) $1:\sqrt{2}$ (3) $\sqrt{2}:1$ (4) $1:\sqrt{3}$

**13.** A particle moving with velocity $\vec{V}$ is acted by the three forces shown by the vector triangle PQR. The velocity of the particle will : **[NEET-2019-I]**




(1) change according to the smallest force $\overrightarrow{QR}$
(2) increase (3) decrease (4) remain constant

**14.** A truck is stationary and has a bob suspended by a light string, in a frame attached to the truck. The truck, suddenly moves to the right with an acceleration of a. The pendulum will tilt **[NEET_2019-II]**

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

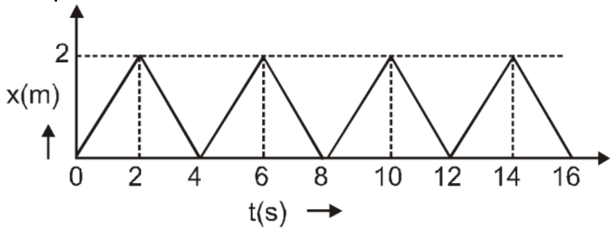
(2) to the left and angle of inclination of the pendulum with the vertical is $\tan^{-1}\left(\frac{a}{g}\right)$

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

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

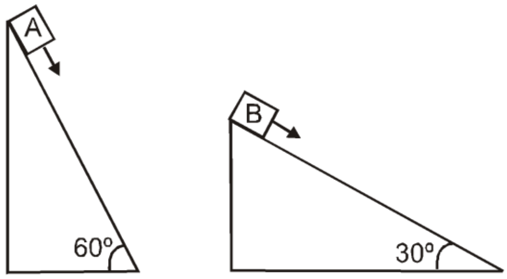
# PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

**1.** 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 **[AIEEE 2010]**




(1) 0.4 Ns (2) 0.8 Ns (3) 1.6 Ns (4) 0.2 Ns

**2.** Two fixed frictionless inclined planes making an angle 30º and 60º 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? **[AIEEE 2010]**

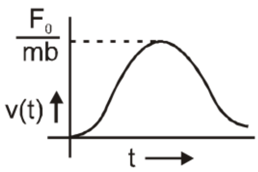


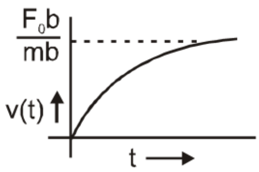

(1) 4.9 $ms^{-2}$ in horizontal direction (2) 9.8 $ms^{-2}$ in vertical direction
(3) Zero (4) 4.9 $ms^{-2}$ in vertical direction

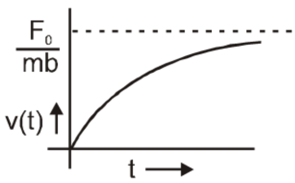
**3.** At time t = 0s a particle starts moving along the x-axis. If its kinetic energy increases uniformly with time 't', the net force acting on it must be proportional to : **[AIEEE 2011; 4, –1]**

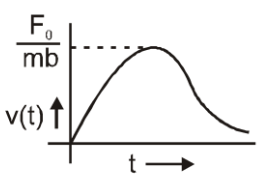
(1) constant (2) t (3) $\frac{1}{\sqrt{t}}$ (4) $\sqrt{t}$

**4.** A particle of mass m is at rest at the origin at time t = 0. It is subjected to a force $F(t) = F_0e^{-bt}$ in the x direction. Its speed v(t) is depicted by which of the following curves ? **[AIEEE 2012 ; 4/120, –1]**

(1) 


(2) 


(3) 


(4) 


**5.** A mass of 10 kg is suspended vertically by a rope form the roof. When a horizontal force is applied on the rope at some point, the rope deviated at an angle of 45º at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied is (g = 10 $ms^{-2}$) **[Mains-2019]**

(1) 200 N (2) 100 N (3) 140 N (4) 70 N

**6.** 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: **[Mains- 2019]**

(1) $\sqrt{\frac{2k}{p}}$ (2) $2\sqrt{\frac{k}{p}}$ (3) $2\sqrt{\frac{p}{k}}$ (4) $\sqrt{\frac{2p}{k}}$

# Answers

## EXERCISE - 1

**SECTION (A) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (3) | **3.** | (2) | **4.** | (1) | **5.** | (3) | **6.** | (2) | **7.** | (1) |
| **8.** | (3) | **9.** | (3) | **10.** | (3) | **11.** | (3) | **12.** | (4) | **13.** | (3) | **14.** | (4) |
| **15.** | (2) | **16.** | (4) | **17.** | (2) | | | | | | | | |

**SECTION (B) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (3) | **3.** | (4) | **4.** | (1) | **5.** | (2) | **6.** | (3) | **7.** | (3) |
| **8.** | (4) | **9.** | (2) | **10.** | (1) | **11.** | (4) | **12.** | (3) | **13.** | (1) | | |

**SECTION (C) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (3) | **3.** | (4) | **4.** | (2) | **5.** | (4) | **6.** | (1) | **7.** | (4) |

**SECTION (D) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (3) | **3.** | (2) | **4.** | (2) | **5.** | (3) | **6.** | (2) | **7.** | (1) |
| **8.** | (4) | **9.** | (1) | **10.** | (4) | **11.** | (2) | **12.** | (3) | **13.** | (3) | | |

**SECTION (E) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (3) | **3.** | (2) | **4.** | (4) | **5.** | (1) | **6.** | (3) | **7.** | (4) |
| **8.** | (4) | **9.** | (1) | **10.** | (4) | **11.** | (4) | **12.** | (2) | **13.** | (2) | **14.** | (1) |
| **15.** | (4) | **16.** | (2) | **17.** | (3) | **18.** | (2) | **19.** | (2) | **20.** | (2) | **21.** | (3) |
| **22.** | (2) | **23.** | (2) | **24.** | (3) | **25.** | (2) | **26.** | (2) | **27.** | (2) | **28.** | (1) |
| **29.** | (2) | **30.** | (3) | **31.** | (2) | **32.** | (3) | **33.** | (4) | **34.** | (1) | **35.** | (3) |
| **36.** | (3) | **37.** | (2) | **38.** | (1) | **39.** | (3) | **40.** | (2) | **41.** | (4) | **42.** | (1) |
| **43.** | (3) | **44.** | (4) | **45.** | (3) | **46.** | (1) | **47.** | (4) | **48.** | (3) | **49.** | (1) |

**SECTION (F) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (4) | **3.** | (1) | **4.** | (1) | **5.** | (4) | **6.** | (3) | **7.** | (2) |
| **8.** | (1) | **9.** | (3) | **10.** | (1) | **11.** | (1) | **12.** | (2) | **13.** | (2) | **14.** | (3) |

**SECTION (G) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (3) | **2.** | (3) | **3.** | (4) | **4.** | (4) | **5.** | (3) | **6.** | (3) | **7.** | (1) |
| **8.** | (3) | **9.** | (4) | **10.** | (2) | | | | | | | | |

**SECTION (H) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (4) | **3.** | (1) | **4.** | (2) | **5.** | (2) | **6.** | (4) | **7.** | (2) |
| **8.** | (1) | | | | | | | | | | | | |

## EXERCISE # 2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (3) | **3.** | (1) | **4.** | (3) | **5.** | (4) | **6.** | (3) | **7.** | (1) |
| **8.** | (2) | **9.** | (2) | **10.** | (3) | **11.** | (1) | **12.** | (1) | **13.** | (1) | | |

## EXERCISE # 3

### PART – I

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (2) | **3.** | (2) | **4.** | (3) | **5.** | (4) | **6.** | (3) | **7.** | (1) |
| **8.** | (1) | **9.** | (2) | **10.** | (3) | **11.** | (2) | **12.** | (4) | **13.** | (4) | **14.** | (2) |

### PART – II

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (4) | **3.** | (3) | **4.** | (3) | **5.** | (2) | **6.** | (3) |