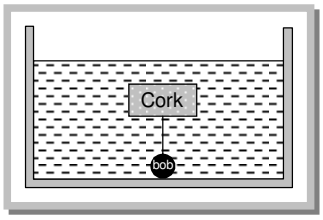
Newton Law of Motion Assignment

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

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

2. A cork and a metal bob are connected by a string as shown in the figure. If the beaker is given an acceleration towards left then the cork will be thrown towards



(a) Right (b) Left (c) Upwards (d) Downwards

3. A machine gun is mounted on a 2 quintal vehicle on a horizontal smooth road. (Friction negligible). The gun fires 10 bullets per second with a velocity of $500\ ms^{-1}$. If the mass of each bullet be 10 *g*, what is the acceleration produced in the vehicle

(a) $25\ cm\ s^{-2}$ (b) $25\ ms^{-2}$ (c) $50\ cm\ s^{-2}$ (d) $50\ m\ s^{-2}$

4. In a tug-of-war contest, two men pull on a horizontal rope from opposite sides. The winner will be the man who

(a) Exerts greater force on the rope

(b) Exerts greater force on the ground

(c) Exerts a force on the rope which is greater than the tension in the rope

(d) Makes a smaller angle with the vertical

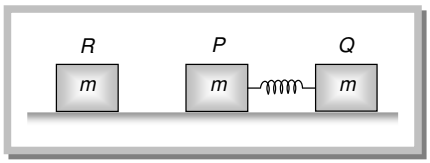
5. A man weighing 80 *kg* is standing in a trolley weighing 320 *kg*. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley with a speed of 1 *m*/*s*, then after 4 *sec* his displacement relative to the ground will be

(a) 5 *m* (b) 4.8 *m* (c) 3.2 *m* (d) 3.0 *m*

6. A body of mass 1 *kg* initially at rest, explodes and breaks into three fragments of masses in the ratio 1 : 1 : 3. The two pieces of equal mass fly off perpendicular to each other, with a speed of 30 *m*/*s* each. What is the velocity of the heavier fragment

(a) 10 *m*/*s* (b) 20 *m*/*s* (c) $10\sqrt{2}\ m/s$ (d) $30\sqrt{2}\ m/s$

7. Two elastic blocks *P* and *Q* of equal mass *m* are connected by a massless spring rest on a smooth horizontal surface. A third block *R* of the same mass *m* strikes the block *P* after this collision *P* and *Q* will



(a) Always move in opposite direction

(b)Sometimes move in the same direction and sometimes move in opposite direction

(c) Always move in the same direction

(d) Be at rest with respect to each other

8. A shell is fired from a cannon with a velocity *v* at an angle θ with the horizontal direction. At the highest point in its path it explodes into two pieces of equal mass. One of the pieces retraces its path to the cannon and the speed of the other piece immediately after the explosion is

(a) $3v\cos\theta$ (b) $2v\cos\theta$ (c) $\frac{3}{2}v\cos\theta$ (d) $\frac{\sqrt{3}}{2}v\cos\theta$

9. A body of mass 5 *kg* explodes at rest into three fragments with masses in the ration 1 : 1 : 3. The fragment with equal masses fly in mutually perpendicular directions with speeds of 21 *metres per sec*. The velocity of the heaviest fragments will be **[CBSE 1991]**

(a) 11.5 *metres per sec* (b) 14.0 *metres per sec* (c) 7.0 *metres per sec* (d) 9.87 *metres per sec*

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

(a) $127.5\ kg\ s^{-1}$ (b) $187.5\ kg\ s^{-1}$ (c) $185.5\ kg\ s^{-1}$ (d) $137.5\ kg\ s^{-1}$

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

(a) $R_0 > R_u > R_d$ (b) $R_u > R_0 > R_d$ (c) $R_d > R_0 > R_u$ (d) $R_u > R_d > R_0$

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

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

13. A 60 *kg* man stands on a spring scale in the lift. At some instant he finds, scale reading has changed from 60 *kg* to 50 *kg* for a while and then comes back to the original mark. What should we conclude

(a) The lift was in constant motion upwards

(b) The lift was in constant motion downwards

(c) The lift while in constant motion upwards, is stopped suddenly

(d) The lift while in constant motion downwards, is suddenly stopped

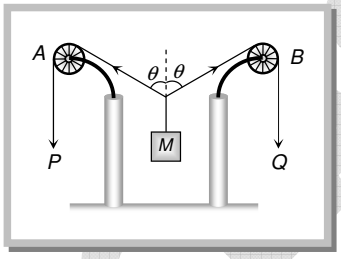
14. The mass of a body measured by a physical balance in a lift at rest is found to be *m*. If the lift is going up with an acceleration *a*, its mass will be measured as

(a) $m\left(1-\frac{a}{g}\right)$ (b) $m\left(1+\frac{a}{g}\right)$ (c) m (d) Zero

15. A pulley fixed to the ceilling carries a string with blocks of mass *m* and 3 *m* attached to its ends. The masses of string and pulley are negligible. When the system is released, its centre of mass moves with what acceleration

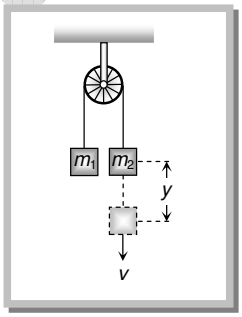
(a) 0 (b) $g/4$ (c) $g/2$ (d) $-g/2$

16. In the arrangement shown to figure the ends *P* and *Q* of an unstretchable string move down wards with uniform speed *U*. Pulleys *A* and *B* are fixed. Mass *M* moves upwards with a speed



(a) $2U\cos\theta$ (b) $U\cos\theta$ (c) $\frac{2U}{\cos\theta}$ (d) $\frac{U}{\cos\theta}$

17. Two bodies of mass m_1 and m_2 $(m_1 < m_2)$ are connected by a light string. The string passes over a frictionless pulley. The speed of the heavier body, when it has covered a distance *y*, will be

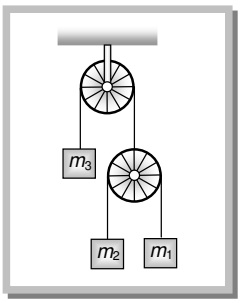


(a) $\sqrt{\frac{m_2-m_1}{m_1+m_2}gy}$ (b) $\sqrt{\frac{m_1m_2}{m_1+m_2}gy}$ (c) $\sqrt{\frac{2(m_2-m_1)}{m_2+m_1}gy}$ (d) None of them

18. Two masses m_1 and m_2 are connected by a light string passing over a smooth pulley. When set free, m_1 moves downwards by 1.4 *m* in 2*s*. The ratio m_1/m_2 is $(g=9.8\ m/s^2)$

(a) $\frac{9}{7}$ (b) $\frac{11}{9}$ (c) $\frac{13}{11}$ (d) $\frac{15}{13}$

19. Three masses m_1, m_2 and m_3 are attached to a string pulley system as shown. All three masses are held at rest and then released. To keep m_3 at rest, the condition is

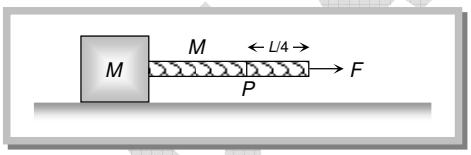


(a) $\frac{1}{m_3}=\frac{1}{m_1}+\frac{1}{m_3}$ (b) $m_1+m_2=m_3$ (c) $\frac{4}{m_3}=\frac{1}{m_1}+\frac{1}{m_2}$ (d) $\frac{1}{m_1}+\frac{2}{m_2}=\frac{3}{m_3}$

20. Two balls of mass 1 *kg* and 2 *kg* respectively are connected to the two ends of the spring. The two balls are pressed together and placed on a smooth table. When released, the lighter ball moves with an acceleration of $2\ ms^{-2}$. The acceleration of the heavier ball will be

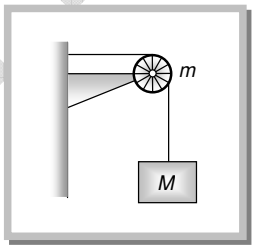
(a) $4\ ms^{-2}$ (b) $2\ ms^{-2}$ (c) $1\ ms^{-2}$ (d) $0.5\ ms^{-2}$

21. A block of mass *M* is pulled by a uniform chain of mass *M* tied to it by applying a force *F* at the other end of the chain. The tension at a point distant quarter of the length of the chain from free end will be



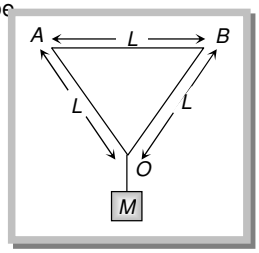
(a) $\frac{7F}{8}$ (b) $\frac{4F}{5}$ (c) $\frac{3F}{4}$ (d) $\frac{6F}{7}$

22. 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



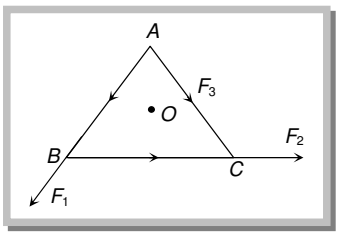
(a) $\sqrt{2}Mg$ (b) $\sqrt{2}mg$ (c) $\sqrt{(M+m)^2+m^2}\,g$ (d) $\sqrt{(M+m)^2+M^2}\,g$

23. In the following figure, the length of the rod *AB* is *L*. A weight of 1000 *Kg.* is suspended from its two ends with the help of two strings of length *L*. The tension in the rod will be



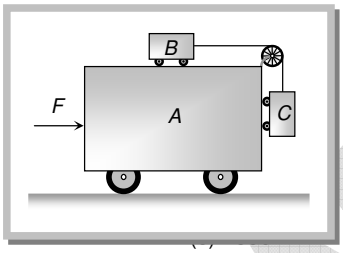
(a) $\frac{5\times10^3}{\sqrt{3}}N$ (b) $5\times10^3\ N$ (c) $5\times10^3\times\sqrt{3}\ N$ (d) Zero

24. *O* is the centre of an equilateral triangle *ABC*. F_1, F_2 and F_3 are three forces acting along the sides *AB*, *BC* and *AC* as shown here. What should be the magnitude of F_3, so that the total torque about *O* is zero



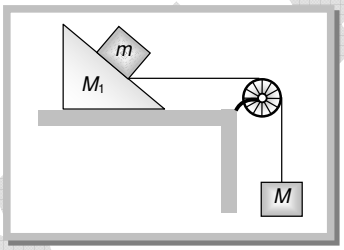
(a) $(F_1 + F_2)/2$ (b) $2(F_1 + F_2)$ (c) $(F_1 + F_2)$ (d) $(F_1 - F_2)$

25. A frictionless cart *A* of mass 100 *kg* carries other two frictionless carts *B* and *C* having masses 8 *kg* and 4 *kg* respectively connected by a string passing over a pulley as shown in the figure. What horizontal force *F* must be applied on the cart so that smaller cart do not move relative to it



(a) 150 *N* (b) 340 *N* (d) 630 *N*

26. Find the mass *M* of the hanging block shown in figure. Which will prevent the smaller block from slipping over the triangular block. All the surfaces are friction less and the strings and the pulleys are light



(a) $\frac{m + M_1}{(\sin\theta - 1)}$ (b) $\frac{m + M_1}{(\cos\theta - 1)}$ (c) $\frac{m + M_1}{(\tan\theta - 1)}$ (d) $\frac{m + M_1}{(\cot\theta - 1)}$

27. A bird is resting on the floor of an air tight box suspended from a spring balance. If the bird starts flying, how will the reading of spring balance change

(a) It cannot be predicted (b) It will remain unchanged (c) It will be less then earlier (d) It will be more than earlier

28. 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*. Assume that the resistance due to water is negligible, the speed of the ship is

(a) 1.5 *m/s* (b) 60 *m/s* (c) 0.1 *m/s* (d) 5 *m/s*

29. A body kept on a smooth inclined plane having inclination 1 in *x* will remain stationary relative to the inclined plane if the plane is given a horizontal acceleration equal to

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

30. A satellite in force-free space sweeps stationary interplanetary dust at a rate $\frac{dM}{dt} = \alpha v$, where *M* is the mass and *v* is the velocity of the satellite and α is a constant. The deceleration of the satellite is

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

31. A force of $(\hat{i} + \hat{j})N$ acts on a particle of mass 0.1 *kg*. If it starts from rest, its position at *t* = 1*s* will be

(a) $(5\hat{i} + 6\hat{j})m$ (b) $(\hat{i} + 5\hat{j})m$ (c) $(5\hat{i} + 5\hat{j})$ (d) $(\hat{i} + \hat{j})m$

32. A block slides down an inclined plane of slope angle θ with constant velocity, it is then projected up on the same plane with an initial velocity V_0. How far up the incline will it move before coming to rest

(a) $\frac{4g\sin\theta}{V_0^2}$ (b) $\frac{4V_0^2}{g\sin\theta}$ (c) $\frac{V_0^2}{4g\sin\theta}$ (d) $\frac{V_0^2 g}{4\sin\theta}$

33. Which of the following sets of concurrent forces may be in equilibrium

(a) $F_1 = 3N,\ F_2 = 5N,\ F_3 = 9N$ (b) $F_1 = 3N,\ F_2 = 5N,\ F_3 = 1N$

(c) $F_1 = 3N, F_2 = 5N, F_3 = 15N$ (d) $F_1 = 3N,\ F_2 = 5N,\ F_3 = 6N$

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

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

35. An object will continue accelerating until

(a) The resultant force acting on it begins to decrease

(b) The resultant force on it is zero

(c) The resultant force is at right angle to its rotation

(d) The resultant force on it is increased continuously

36. A body is in equilibrium under the action of three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$. Which of the following statements is wrong

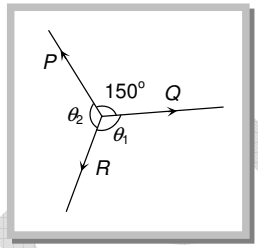
(a) $\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$

(b) $\vec{F}_1, \vec{F}_2, \vec{F}_3$ can be represented by the three sides of a triangle taken in order

(c) $F_1 + F_2 + F_3 = 0$

(d) None of the above

37. *P*, *Q* and *R* are three coplanar forces acting at a point and are in equilibrium. Given *P* = 1.9318 *kg* wt, $\sin\theta_1 = 0.9659$, the value of *R* in (in *kg* wt)



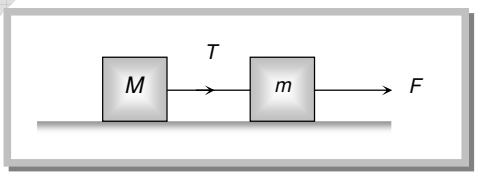
(a) 0.9659 (b) 2 (c) 1 (d) $\frac{1}{2}$

38. Three concurrent forces of the same magnitude are in equilibrium. What is the angle between the forces. Also name the triangle formed by the forces as sides

(a) 60° equilateral triangle (b) 120° equilateral triangle

(c) 120°, 30°, 30° an isosceles triangle (d) 120° an obtuse angled triangle

39. Two masses *M* and *m* are connected by a weight less string. They are pulled by a force *F* on a frictionless horizontal surface. The tension in the string will be



(a) $\frac{FM}{m+M}$ (b) $\frac{F}{M+m}$ (c) $\frac{FM}{m}$ (d) $\frac{Fm}{M+m}$

40. In the above problem (65), the acceleration of mass *m* is

(a) $\frac{F}{m}$ (b) $\frac{F-T}{m}$ (c) $\frac{F+T}{m}$ (d) $\frac{F}{M}$

41. A body of mass 4 *kg* weighs 4.8 *kg* when suspended in a moving lift. The acceleration of the lift is

(a) $9.80\ ms^{-2}$ downwards (b) $9.80\ ms^{-2}$ upwards (c) $1.96\ ms^{-2}$ downwards (d) $1.96\ ms^{-2}$ upwards

42. A boy having a mass equal to 40 *kilograms* is standing in an elevator. The force felt by the feet of the boy will be greatest when the elevator $(g = 9.8\ metres/\sec^2)$

(a) Stand still

(b) Moves downward at a constant velocity of $4\ metres/\sec$

(c) Accelerates downward with an acceleration equal to $4\ metres/\sec^2$

(d) Accelerates upward with an acceleration equal to $4\ metres/\sec^2$

43. If a body of mass *m* is carried by a lift moving with an upward acceleration *a*, then the forces acting on the body are (i) the reaction *R* on the floor of the lift upwards (ii) the weight *mg* of the body acting vertically downwards. The equation of motion will be given by

(a) $R = mg - ma$ (b) $R = mg + ma$ (c) $R = ma - mg$ (d) $R = mg \times ma$

44. An 80 *kg* man stands on a spring balance in an elevator. When it starts to move, the scale reads 700 *N*. What is the acceleration of the elevator $(g = 10\ m/s^2)$

(a) $1.25\ m/s^2$ downwards (b) $2.0\ m/s^2$ upwards (c) $2.0\ m/s^2$ downwards (d) $1.25\ m/s^2$ upwards

45. A gun of mass 1 *kg* fires a bullet of mass 1 *g* with a velocity of $1\,ms^{-1}$. The recoil velocity of the gun is

(a) $1\ ms^{-1}$ (b) $0.1\ ms^{-1}$ (c) $0.01\ ms^{-1}$ (d) $0.001\ ms^{-1}$

46. A proton is moving with velocity $7 \times 10^6\ m/s$ towards right and neutron (mass nearly equal to that of proton) is moving with velocity $4 \times 10^6\ m/s$ towards left. They collide and a deuteron is formed. The deuteron will move with a velocity

(a) $1.5 \times 10^6\ m/s$ towards left (b) $1.5 \times 10^6\ m/s$ towards right

(c) $3 \times 10^6\ m/s$ towards right (d) $3 \times 10^6\ m/s$ towards left

47. A lead ball and a rubber ball both having the same mass, strike normally on a smooth vertical wall with the same velocity. The lead ball falls down after striking but the rubber ball bounces back. Check the correct statement

(a) The momentum of the lead ball is more than that of the rubber ball

(b) The momentum of the rubber ball is more than that of the lead ball

(c) The rubber ball suffers a greater change in momentum as compared to the lead ball

(d) Both the balls suffer an equal change of momentum

48. A bomb at rest explodes into a large number of tiny fragments. The total momentum of all the fragments

(a) Is zero (b) Depends on the total mass of all the fragments

(c) Depends on the speeds of various fragments (d) Is infinity

49. A player caught a cricket ball of mass 150 *gm* moving at a rate of 20 *m/s*. If the catching process be completed in 0.1*s*, then the force of the blow exerted by the ball on the hands of the player is

(a) 0.3 *N* (b) 30 *N* (c) 300 *N* (d) 3000 *N*

50. 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

(a) 1 (b) 2 (c) 4 (d) 0.5