## LAWS OF MOTION

**1.** A 600 kg rocket is set for a vertical firing. If the exhaust speed is 1000 $ms^{-1}$, the mass of the gas ejected per second to supply the thrust needed to overcome the weight of rocket is :

(a) 117.6 kg $s^{-1}$ (b) 58.6 kg $s^{-1}$

(c) 6 kg $s^{-1}$ (d) 76.4 kg $s^{-1}$

**2.** An impulse is supplied to a moving object with the force at an angle of $20^o$ with respect to velocity vector. The angle between the impulse vector and the change in momentum vector is :

(a) $0^o$ (b) $60^o$

(c) $120^o$ (d) $240^o$

**3.** A man of mass 90 kg is standing in an elevator whose cable broke suddenly. If the elevator falls, apparent weight of the man is:

(a) 90 N (b) 90 gN

(c) 0 N (d) any negative value

**4.** Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between the tyres and the road is 0.5, the shortest distance in which the car can be stopped is (taking g = 10 $m/s^2$) :

(a) 30 m (b) 40 m

(c) 72 m (d) 20 m

**5.** A stretching force of 10 N is applied at one end of a spring balance and an equal stretching force is applied at the other end at the same time. What will be the reading of the balance :

(a) 5 N (b) 10 N

(c) 20 N (d) 0

**6.** An open knife edge of mass M is dropped from a height h an a wooden floor. If the blade penetrates distance S into the wood, the average resistance offered by the wood to the blade is :

(a) Mg

(b) $Mg\left(1+\frac{h}{S}\right)$

(c) $Mg\left(\frac{1-h}{S}\right)$

(d) $Mg\left(1+\frac{h}{S}\right)^2$

**7.** A shell is fired from a cannon, it explodes in mid air, its total :

(a) momentum increases

(b) momentum decreases

(c) K.E. increases

(d) K.E. increases

**8.** A block at rest explodes into 3 parts of the same mass. The momentum of the 2 parts are $-2p\hat{i}$ and $p\hat{j}$. The momentum of the third part will have a magnitude

(a) p (b) $p\sqrt{3}$

(c) $\sqrt{5}$ (d) zero

**9.** A block A of mass 2 kg rests on another block B of mass 8 kg which rests on horizontal floor. The coefficient of friction between A and B is 0.2 while that between B and floor is 0.5. When a horizontal force of 25 N is applied on the block B, the force of friction between A and B is :

(a) zero (b) 3.9 N

(c) 5.0 N (d) 4.9 N

**10.** A monkey is descending from the branch of a tree with constant acceleration. If the breaking strength is 75% of the weight of the monkey, the minimum acceleration with which monkey can slide down without breaking the branch is

(a) g (b) $\frac{3g}{4}$

(c) $\frac{g}{4}$ (d) $\frac{g}{2}$

**11.** A ball weighing 10 g hits a hard surface vertically with a speed of 5 $ms^{-1}$ and rebounds with the same spee(d) The ball remains in contact with the surface for 0.01 s. The average force exerted by the surface on the ball is :

(a) 100 N (b) 10 N

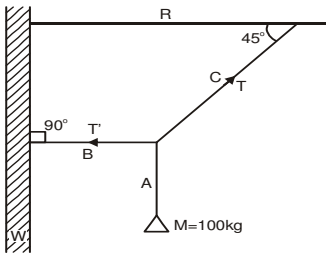
(c) 1 N (d) 0.1 N

**12.** A body of mass 60 kg is dragged with just enough force to start moving on a rough surface with coefficients of static and kinetic frictions 0.5 and 0.4 respectively. On applying the same force, what is the acceleration :

(a) 0.98 $m/s^2$ (b) 9.8 $m/s^2$

(c) 0.54 $m/s^2$ (d) 5.292 $m/s^2$

**13.** A mass M of 100 kg is suspended with use of strings A, B and C as shown in figure, where W is vertical wall and R is a rigid horizontal ro(d) The tension in string B is :




(a) 100 g N (b) 0

(c) $100\sqrt{2}$ g N (d) $\frac{100}{\sqrt{2}}$ g N

**14.** Two balls of masses $m_1$ and $m_2$ are separated from each other by a powder charge placed between them. the while system is at rest on the groun(d) Suddenly, the powder charge explodes and masses are pushed apart. The mass $m_1$ travels a distance $S_1$ and stops. If the coefficients of friction between balls and ground are same, mass $m_2$ stops after travelling the distance :

(a) $S_2 = \frac{m_1}{m_2} S_1$ (b) $S_2 = \frac{m_2}{m_1} S_1$

(c) $S_2 = \frac{m_1^2}{m_2^2} S_1$ (d) $S_2 = \frac{m_2^2}{m_1^2} S_1$

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

(a) 12.5 km/h (b) 20 km/h

(c) 40 km/h (d) 50 km/h

**16.** In a rocket of mass 1000 kg, fuel is consumed at a rate of 40 kg/s. The velocity of gases ejected from rocket is $5 \times 10^4$ m/s. The thrust on rocket is :

(a) $2 \times 10^3$ N (b) $5 \times 10^4$ N

(c) $2 \times 10^6$ N (d) $2 \times 10^8$ N

**17.** A person is sitting in a travelling train and facing engine. He tosses up a coin and coin falls behind him. It can be concluded that train is :

(a) moving forward and gaining speed

(b) moving forward and losing speed

(c) moving forward with uniform speed

(d) moving backward with uniform speed

**18.** A body is imparted motion from rest to move in a straight line. If it is then obstructed, by an opp. force, then :

(a) the body may necessarily change direction

(b) the body is sure to slow down

(c) the body will necessarily continue to move in same direction at same speed

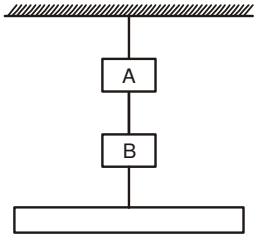
(d) None of the above

**19.** If a force of 250 N act on body, the momentum acquired is 125 kg m/s, what is the period for which force acts on the body:

(a) 0.5 sec (b) 0.2 sec

(c) 0.4 sec (d) 0.25 sec

**20.** A block of mass 4 kg is suspended thro' two light spring balances A and (B) Then A and B will read respectively :




(a) 4 kg and zero kg (b) zero and 4 kg

(c) 4 kg and 4 kg (d) 2 kg and 2 kg

**21.** A force vector applied on a mass is represented as $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ and accelerates with 1 m/s$^2$. What will be the mass of body :

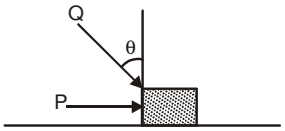
(a) $10\sqrt{2}$ kg

(b) $2\sqrt{10}$ kg

(c) 10 kg

(d) 20 kg

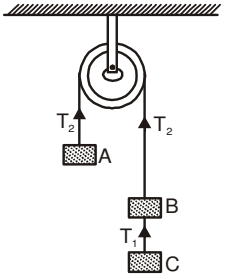
**22.** A block of mass m, lying on a rough horizontal plane, is acted upon by a horizontal force P and another force Q, inclined at an angle θ to vertical. The block will remain in equilibrium, if coefficient of friction between it and surface is :




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

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

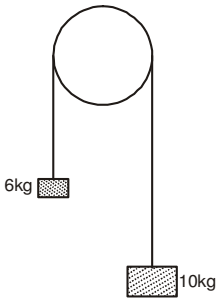
**23.** Three equal weights of mass 2 kg each are hanging on a string passing over a fixed pulley as shown in figure. What is tension in string connecting weights B and C :




(a) zero (b) 13.3 N

(c) 3.3 N (d) 19.6 N

**24.** A light string passes over a frictionless pulley. To one of its ends, a mass of 6 kg is attache(d) To its other end a mass of 10 kg is attached, shown in figure the tension in thread will be :




(a) 24.5 N (b) 2.45 N

(c) 79 N (d) 73.5 N

**25.** A particle is projected with 200 m/s at an angle 60$^o$. At highest pt, it explodes into three particles of equal masses. One goes vertically upward with velocity 100 m/s, second particle goes vertically downward with same velocity, then what is velocity of third one :

(a) 120 m/s with 60$^o$ angle

(b) 200 m/s with 30$^o$ angle

(c) 300 m/s

(d) 200 m/s

**26.** A ball of wt. 0.1 kg coming with speed 30 m/s strikes with a bat and returns in opp. direction with speed 40 m/s, then impulse is :

(a) $-0.1 \times (40) - 0.1 \times 30$

(b) $0.1 \times (40) - 0.1 \times (-30)$

(c) $0.1 \times (40) + 0.1 \times (-30)$

(d) $0.1 \times (40) - 0.1 \times 20$

**27.** A bird weights 2 kg and is inside a cage of 1 kg. If it starts flying then what is weight of bird and cage assembly :

(a) 1.5 kg (b) 2.5 kg

(c) 3 kg (d) 4 kg

**28.** A truck and a car are moving with equal velocity. On applying brake, both will stop after certain distance, then :

(a) truck will cover less distance before stopping

(b) car will cover less distance before stopping

(c) both will cover equal distance

(d) none of these

**29.** A bullet of mass m and velocity V is fired into a block of mass M and sticks to it. The final velocity would be :

(a) $\frac{M}{m+M}V$ (b) $\frac{M-m}{M}V$

(c) $\frac{m}{m+M}V$ (d) $\frac{m+M}{M}V$

**30.** A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5$ t. Where f is in N and t in se(c) The force on bullet becomes zero as soon as it leaves barrel. What is average impulse imparted to bullet :

(a) 9 Ns (b) zero

(c) 0.9 Ns (d) 1.8 Ns

**31.** A 5000 kg rocket is set for vertical firing. The exhaust speed is 300 m/s. To give an initial upward acceleration of 20 $m/s^2$, amount of gas ejected per second to supply needed thrust will be ($g = 10\ m/s^2$)

(a) 127.5 kg/s (b) 187.5 kg/s

(c) 185.5 kg/s (d) 137.5 kg/s

**32.** A body of mass 100 g is sliding from an inclined plane of inclination $30^o$. What is the frictional force experienced if $\mu = 1.7$ :

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

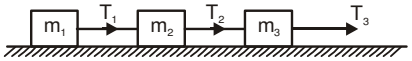
(c) $1.7 \times \sqrt{3}$ N (d) $1.7 \times \sqrt{2} \times \frac{1}{\sqrt{3}}$ N

**33.** In small balls each of mass 'm' impinge elastically each second on a surface with velocity u. The force experienced by surface will be :

(a) mnu (b) 2 mnu

(c) 4 mnu (d) $\frac{1}{2}$ mnu

**34.** Three blocks of masses $m_1$, $m_2$ and $m_3$ are connected by massless string as shown in figure 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

**35.** Consider two unequal masses $m_2 > m_1$ connected by a string which passes over a frictionless and massless pulley. The tension T in string is :

(a) $\vec{T} = \frac{2m_1 + m_2}{m_1 + m_2}\vec{g}$ (b) $\vec{T} = \frac{2m_1 m_2}{m_1 + m_2}\vec{g}$

(c) $\vec{T} = \frac{2(m_1 + m_2)}{m_1 + m_2}\vec{g}$ (d) $\vec{T} = 2(m_1 + m_2)\vec{g}$

**36.** A man of mass 60 kg records his wt. on a weighing machine placed inside a lift. The ratio of wts. of man recorded when lift is ascending up with a uniform speed of 2 m/s to when it is descending down with a uniform speed of 4 m/s will be :

(a) 0.5 (b) 1

(c) 2 (d) none

**37.** If the force on a rocket moving with a velocity of 300 m/s is 210 N, then the rate of combustion of fuel is :

(a) 0.7 kg/s (b) 1.4 kg/s

(c) 0.07 kg/s (d) 10.7 kg/s

**38.** A 20 kg block is initially at rest A 75 N force is required to set the block in motion. After the motion, a force of 60 N is applied to keep the block moving with constant spee(d) The coefficient of static friction is :

(a) 0.6 (b) 0.52

(c) 0.44 (d) 0.35

**39.** In an elevator moving vertically up with an acceleration 'g' the force exerted on the floor by a passenger of mass M is :

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

(c) zero (d) 2 Mg

**40.** A body of mass 5 kg is moving with a velocity of 20 m/s. If a force of 100 N is applied on it for 10 s in the same direction as its velocity, what will be the velocity of the body :

(a) 200 m/s (b) 220 m/s

(c) 240 m/s (d) 260 m/s

**41.** A bullet of mass a and velocity b is fired into a large block of mass c. The final velocity of the system is :

(a) $\frac{cb}{a+b}$ (b) $\frac{ab}{a+c}$

(c) $\frac{(a+b)a}{c}$ (d) $\frac{(a+c)b}{a}$

**42.** The power of a water pump is 2 kW. If g = 10 m/s$^2$, the amount of water it can raise in one minute to a height of 10 m is :

(a) 2000 litres (b) 1000 litres

(c) 100 litres (d) 1200 litres

**43.** A long spring is stretched by 2 cm. Its potential energy is V. If the spring is stretched by 10 cm, its potential energy would be :

(a) $\frac{V}{25}$ (b) $\frac{V}{5}$

(c) 5 V (d) 25 V

**44.** An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m (g = 10 m/s$^2$) :

(a) 4 s (b) 5 s

(c) 8 s (d) 10 s

**45.** A box is dragged across a floor by a rope which makes an angle of 45$^o$ with the horizontal. The tension in the rope is 100 N, while the box is dragged 10 m. The work done is :

(a) 607.1 J (b) 707.1 J

(c) 1414.2 J (d) 900 J

**46.** A particle moves along the x–axis from x = $x_1$ to x = $x_2$ under the influence of a force given by F = 2x. Work done in the process is :

(a) zero (b) $x_2^2 - x_1^2$

(c) $2x_2 (x_2 - x_1)$ (d) $2x_1 (x_1 - x_1)$

**47.** If K.E. of a body increases by 0.1%, the percent increase in its momentum will be :

(a) 0.05%

(b) 0.1%

(c) 1.0%

(d) 10%

**48.** Out of a pair of identical springs of spring constant 240 N/m, one is compressed by 10 cm and the other is extended by 10 cm. The difference of the stored potential energies of the two springs is :

(a) 12 J (b) 4 J

(c) 1.2 J (d) zero

**49.** A position dependent force $F = (7 - 2x + 3x^2)$ N acts on a small body of mass 2 kg and displaces it from x = 0 to x = 5 m. Work done in joule is :

(a) 35 (b) 70

(c) 135 (d) 270

**50.** The K.E. acquired by a mass m in travelling a certain distance d, starting from rest, under the action of a constant force is directly proportional to:

(a) m

(b) $\sqrt{m}$

(c) $\frac{1}{\sqrt{m}}$

(d) independent of m

**ANSWERS KEY**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | c | 2 | a | 3 | c | 4 | b | 5 | B |
| 6 | b | 7 | c | 8 | c | 9 | a | 10 | c |
| 11 | b | 12 | a | 13 | a | 14 | c | 15 | C |
| 16 | c | 17 | a | 18 | b | 19 | a | 20 | C |
| 21 | a | 22 | a | 23 | b | 24 | d | 25 | C |
| 26 | b | 27 | c | 28 | b | 29 | c | 30 | C |
| 31 | b | 32 | b | 33 | b | 34 | d | 35 | B |
| 36 | b | 37 | a | 38 | d | 39 | d | 40 | B |