

Laws of Motion

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1. An object of mass 5 kg is attached to the hook of a spring balance and the balance is suspended vertically from the roof of a lift. The reading on the spring balance when the lift is going up with an acceleration of 0.25 ms^{-2} is ($g = 10 \text{ ms}^{-2}$) (a) 51.25 N (b) 48.75 N (c) 52.75 N (d) 47.25 N (e) 55 N
2. A bullet of mass 0.05 kg moving with a speed of 80 ms^{-1} enters a wooden block and is stopped after a distance of 0.4 m. The average resistance force exerted by the block on the bullet is (a) 300 N (b) 20N (c) 400 N (d) 40 N (e) 200 N
3. A shell at rest at the origin explodes into three fragments of masses 1 kg, 2 kg and 'm' kg. The 1 kg and 2 kg pieces fly off with speeds of 5 ms^{-1} along the X- axis and 6 ms^{-1} along the Y-axis respectively. If the m kg piece flies off with speed 6.5 ms^{-1} , the total mass of the shell must be (a) 4 kg (b) 5 kg (c) 3.5 kg (d) 4.5 kg (e) 5.5 kg
4. A uniform rope of length 'L' is resting on a smooth horizontal surface. If it is pulled at one end by applying a horizontal force 'F' parallel to its length, what will be the tension in the rope at a distance 'd' from the other end? (a) F (b) F/d (c) FL/d (d) Fd (e) Fd/L
5. A shell is fired from a canon with a velocity v at an angle θ with horizontal. At the highest point of its path it explodes into two pieces of equal mass. One of the pieces retraces its path to the point of projection and the speed of the second piece immediately after the explosion is (a) $3v\cos\theta$ (b) $2v\cos\theta$ (c) $v\cos\theta$ (d) $(2/3)v\cos\theta$
6. An elastic ball falls from the height 100m. It losses 20% energy due to impact. The ball will again rise to the height of (a) 80m (b) 98m (c) 60m (d) 40m
7. A particle moving with a velocity v in +X direction collides elastically with a wall moving in opposite direction with velocity V. If coefficient of restitution is e then for velocity of the particle remaining the same after collision the value of V will be (a) $\frac{1-e}{1+e} v$ (b) $\frac{1-e}{1+2e} v$ (c) $\frac{1-2e}{1+e} v$ (d) $\frac{1-2e}{1+2e} v$
8. Two masses m and 2m respectively are connected with a light spring of force constant k. The whole system is now moving with velocity v towards a wall with mass 2m towards the wall. If the system collides with the wall elastically then the maximum compression of the spring immediately after impact will be (a) $v\sqrt{\frac{m}{k}}$ (b) $2v\sqrt{\frac{m}{k}}$ (c) $2v\sqrt{\frac{2m}{3k}}$ (d) $2v\sqrt{\frac{m}{3k}}$
9. The angle for which the maximum height and the range of a projectile are the same is (a) 32° (b) 48° (c) 76° (d) 84°

10. A block of mass M is pulled along a smooth surface by a rope of mass m . Force P is applied at one end of the rope. The force which the rope exerts on the block is
a) $P/[M(m+M)]$ b) $P/(M-m)$ c) $Pm/(M-m)$ d) $PM/(m+M)$
11. Two masses m and M are hanged on a pulley. Both masses moves 0.6 m in 4 sec. The ratio m/M is a) 55/57 b) 113/117 c) 57/55 d) 397/403
12. A body of mass 1 kg is accelerated by a constant force and travels 5m in 1st second and 2m in 3rd second. The force acting on the body is a) 2N b) 4N c) 6N d) 8N.
13. A simple pendulum of bob mass m is oscillating with angular amplitude 40° . When the angular displacement is 20° the tension of the string will be a) $mg \cos 20^\circ$ b) $mg \sin 20^\circ$ c) $> mg \cos 20^\circ$ d) $> mg \sin 20^\circ$
14. A particle of mass m is made to move with a uniform speed v along the perimeter of a regular hexagon. Magnitude of impulse applied at each corner of the hexagon is a) mv b) $mv\sqrt{3}$ c) $mv/2$ d) 0
15. A ball of mass M falls from a height h on a floor for which the coefficient of restitution is e . The height attained by the ball after two rebounds is a) e^2h b) eh^2 c) e^4h d) h/e^4
16. A ship of mass $3 \times 10^7 \text{ kg}$ initially at rest is pulled by a force of $5 \times 10^4 \text{ N}$ through a distance of 3 m. Assume that the resistance due to water is negligible; the speed of the ship is (a) 1.5 ms^{-1} (b) 60 ms^{-1} (c) 0.1 ms^{-1} (d) 5 ms^{-1}
17. An open knife edge of mass 200 g is dropped from height 5 m on a cardboard. If the knife edge penetrates distance 2 m into the cardboard, the average resistance offered by the cardboard to the knife edge is (a) 7 N (b) 25 N (c) 35 N (d) None of these
18. A body with mass 5 kg is acted upon by a force $F = (-3\hat{i} + 4\hat{j})\text{N}$. If its initial velocity at $t = 0$ is $v = (6\hat{i} - 12\hat{j})\text{m/s}$. The time at which it will just have a velocity along the Y-axis is (a) never (b) 10 s (c) 2 s (d) 15 s
19. A block of mass m is moving on a wedge with the acceleration a_0 . The wedge is moving with the acceleration a_1 . The observer is situated on wedge. The magnitude of pseudo force on the block is (a) ma_0 (b) ma_1 (c) $m\sqrt{a_0^2 + a_1^2}$ (d) $m\left(\frac{a_1 + a_0}{2}\right)$
20. A machine gun fires 10 bullets/s, each of mass 10 g, the speed of each bullet is 20 cms^{-1} , then force of recoil is (a) 200 dyne (b) 2000 dyne (c) 20 dyne (d) None of these
21. A body, under the action of a force $F = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 s^{-2} . The mass of this body must be (a) $2\sqrt{10} \text{ kg}$ (b) 10 kg (c) 20 kg (d) $10\sqrt{2} \text{ kg}$