

## Competitive Exams: Questions on Laws of Motion

1. Why we beat a carpet with a stick to remove dust particles?
2. A stone thrown on a windowpane smashes it into pieces, while a bullet fired against it makes a clean hole through it.
3. An athlete runs some distance before taking a jump. Explain?
4. If a fast running horse stops, the rider is thrown forward over the horse head.
5. On firing a bullet, the rifle always gives backward kick.
6. A cricket player lowers his hands while catching a ball.
7. It is difficult to drive a nail into wooden block without supporting it.
8. When an object falls to the earth, the earth also moves up to meet it but earth's motion is not noticeable. Explain
9. Why a person falling on a pucca floor receives more severe injuries than when falling on a heap of sand.
10. Establish a general relation between P and kinetic energy  $E_k$ .
11. A force acts for 10 sec on a body of mass 10g. After it ceases to act, the body describes 50cm in the next 5sec. Find the magnitude of the force.
12. A force of 2000 dyne acts upon a body of mass 1 kg. As a result, the velocity of the body changes from 20 cm/s to 5 cm/s in passing through a certain distance. Find that distance.
13. A force of 100N acting on a body for 5sec gives it a velocity of 20 m/s. Calculate the mass of the body.
14. A force of 72 dyne is inclined to the horizontal at an angle of  $60^\circ$  Find the acceleration it produces in a mass of 9g which moves in a horizontal direction.
15. The force on a particle of mass 10g is? if it starts from rest, what would be its position at time  $t = 5$  sec?
16. A bullet of mass 0.04 kg moving with a speed of 90m/s enters a heavy wooden block and is stopped after a distance of 60cm. What is the average resistive force exerted by the block on the bullet?
17. A ball moving with a momentum of 5 kg m/s strikes against a wall at an angle of  $45^\circ$  and is reflected at the same angle. Calculate the change in momentum (in magnitude).

18. A player in 0.05 sec brings a cricket ball of mass 200g moving with a velocity of 15m/s to rest. What is the impulse of the ball and the average force applied by the player?
19. a rubber ball of mass 50g falls from a height of 1m and rebounds to a height of 50cm. Calculate the impulse and the average force between the ball and the ground, if the time during which they are in contact was 0.1 sec.
20. Two blocks of masses 3kg and 2kg are placed in contact with each other on a frictionless table. Find then force on the common cross-sectional area of contact if a force of 5N is applied on
  - i. bigger block
  - ii. smaller block.
21. Three bodies are connected to each other with strings. The masses of bodies are  $m$ ,  $3m$ , and  $5m$  respectively. These bodies are being pulled with a horizontal force  $F$  on a frictional horizontal surface. The tension  $P$  in the first string is 16N. Calculate
  - i. acceleration of the bodies
  - ii. tension  $Q$  in the second string
  - iii. the force.
22. A passenger of mass 72.2 kg is riding in an elevator while standing on a platform scale. What does the scale read when the elevator cab is
  - a. descending with constant velocity
  - b. ascending with acceleration  $3.20 \text{ m/s}^2$ ?
23. A machine gun has a mass of 20kg. It fires 35g bullets at the rate of 4 bullets per sec, with a speed of 400 m/s. What force must be applied to the gun to keep it in position?
24. A bag of sand of mass  $M$  is hanging from a rope. A bullet of mass  $xm$  is fired at it with a velocity  $v$ . The bullet gets embedded into the bag. What is the velocity of the bag after the bullet gets embedded into it?
25. A bomb is thrown in a horizontal direction with a velocity of 50m/s. It explodes into two parts of masses 6kg and 3kg. The heavier fragment continues to move in the horizontal direction with a velocity of 80 m/s. Calculates the velocity of the lighter fragment.
26. What is the difference between absolute and gravitational units of force?
27. Two blocks of masses  $m_1$  and  $m_2$  are connected by a light spring on a smooth horizontal surface. The two masses are pulled apart and then released. Prove that the ratios of the accelerations are inversely proportional to their masses.

28. A block slides down a rough inclined plane of inclination  $i$  with constant velocity. If this block projected up the plane with a velocity  $V_0$ , then at what distance along the inclined plane block will come to rest?
29. Why does a heavy rifle not kick strongly as a light rifle using same bullet?
30. Why is it difficult to walk on a slippery ground?
31. Is it correct to say that banking of road reduces the wear and tear of automobile? If yes explain.
32. The linear velocity of a particle moving on a circumference of a circle is equal to the velocity acquired by a freely falling body through a distance equal to  $1/4$ th the diameter of the circle. What is the centripetal acceleration of the particle moving along the circle?
33. A body A is  $n$  times heavier than body B they are dropped from the same height. What is the ratio of their momentum just before they hit the ground?
34. An aeroplane requires for take off a speed of 80 km/h, the run on the ground being 100m. the mass of the plane is 10, 000 kg and coefficient of friction between the plane and the ground is 0.2. Assume that the plane accelerates uniformly during takeoff. What is minimum force required by the engine of the plane for takeoff?
35. The driver of a truck travelling with speed  $V$  suddenly notices a broad wall in front of him at a distance  $r$ . Is it better for him to apply brakes or makes a circular turn without applying brakes in order to just avoid crashing into a wall?
36. A uniform rope of length  $L$  is pulled by a constant force  $F$ . What is the tension in the rope at a distance  $l$  from the end, where it is applied?
37. How can proper inflation of tyres save fuel?
38. Carts with rubber tyres are easier to ply than those with iron tyres. Why?
39. Smoother the surface, lesser is friction. Comment.
40. Automobiles tyres have generally irregular projections over their surfaces. Why?
41. Polishing a surface beyond a certain limit may increase friction. Why?
42. A smooth block is released at rest on a  $45^\circ$  incline and then slides a distance  $d$ . If time taken to slide on rough incline is  $n$  times large as that to slide on a smooth incline, find the coefficient of friction.
43. Why do we slip on a muddy road?
44. A uniform rope of length  $L$  is pulled by a constant force  $F$ . What is the tension in the rope at a distance  $l$  from the end where it is applied?
45. A body of mass  $5 \times 10^{-3}$  kg is launched up on a rough inclined plane making an

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angle of  $30^\circ$  with the horizontal. Obtain the coefficient of friction between the body and the plane if the time of ascent is half of time of decent.

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