

Chapter 9 - Force and Laws of Motion

Short Answer Type Questions

1. There are three solids made up of aluminium, steel and wood, of the same shape and same volume. Which of them would have highest inertia?
2. Two balls of the same size but of different materials, rubber and iron are kept on the smooth floor of a moving train. The brakes are applied suddenly to stop the train. Will the balls start rolling? If so, in which direction? Will they move with the same speed? Give reasons for your answer.
3. Two identical bullets are fired one by a light rifle and another by a heavy rifle with the same force. Which rifle will hurt the shoulder more and why?
4. A horse continues to apply a force in order to move a cart with a constant speed. Explain why?
5. Suppose a ball of mass m is thrown vertically upward with an initial speed v , its speed decreases continuously till it becomes zero. Thereafter, the ball begins to fall downward and attains the speed v again before striking the ground. It implies that the magnitude of initial and final momentums of the ball are same. Yet, it is not an example of conservation of momentum. Explain why ?
6. Velocity versus time graph of a ball of mass 50 g rolling on a concrete floor is shown in Fig. 9.1. Calculate the acceleration and frictional force of the floor on the ball.

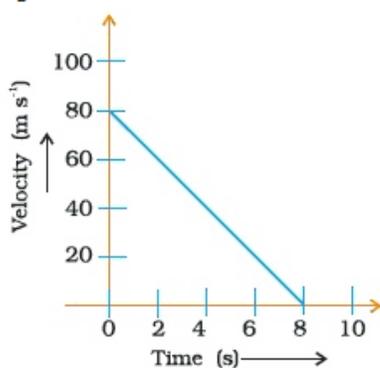


Fig. 9.1

7. A truck of mass M is moved under a force F . If the truck is then loaded with an object equal to the mass of the truck and the driving force is halved, then how does the acceleration change?
8. Two friends on roller-skates are standing 5 m apart facing each other. One of them throws a ball of 2 kg towards the other, who catches it, How will this activity affect the position of the two? Explain your answer.
9. Water sprinkler used for grass lawns begins to rotate as soon as the water is supplied. Explain the principle on which it works.

Long Answer Type Questions

1. Using second law of motion, derive the relation between force and acceleration. A bullet of 10 g strikes a sand-bag at a speed of 10^3 m s^{-1} and gets embedded after travelling 5 cm. Calculate
 - (i) the resistive force exerted by the sand on the bullet
 - (ii) the time taken by the bullet to come to rest.
2. Derive the unit of force using the second law of motion. A force of 5 N produces an acceleration of 8 m s^{-2} on a mass m_1 and an acceleration of 24 m s^{-2} on a mass m_2 . What acceleration would the same force provide if both the masses are tied together?
3. What is momentum? Write its SI unit. Interpret force in terms of momentum. Represent the following graphically
 - (a) momentum versus velocity when mass is fixed.
 - (b) momentum versus mass when velocity is constant.