

# Laws of Motion

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1. Explain the following:
  - a. When a train suddenly moves forward, the passenger standing in the compartment tends to fall backwards.
  - b. When a corridor train suddenly starts, the sliding doors of some compartments may open.
  - c. People often shake branches of a tree for getting down the fruits.
  - d. After a lightning from a moving bus, one has to run for some distance in the direction of bus in order to avoid falling.
  - e. Dust particles are removed from a carpet by beating it.
2. Two balls A and B of masses  $m$  and  $2m$  are in motion with velocities  $2v$  and  $v$  respectively. Compare:
  - a. Their inertia,
  - b. Their momentum, and
  - c. The force needed to stop them in the same time.
3. Why does a glass vessel break when it falls on a hard floor, but it does not break when it falls on a carpet?
4. A body of mass  $5\text{ kg}$  is moving with velocity  $2\text{ m/s}$ . Calculate its linear momentum.
5. The linear momentum of a ball of mass  $50\text{ g}$  is  $0.5\text{ kg m/s}$ . Find its velocity.
6. A force of  $15\text{ N}$  acts on a body of mass  $2\text{ kg}$ . Calculate the acceleration produced.
7. A force of  $10\text{ N}$  acts on a body of mass  $2\text{ kg}$  for  $3\text{ s}$ , initially at rest. Calculate:
  - a. The velocity acquired by the body, and
  - b. Change in momentum of the body.
8. A force acts for  $0.1\text{ s}$  on a body of mass  $2\text{ kg}$  initially at rest. The force is then withdrawn and the body moves with a velocity of  $2\text{ m/s}$ . Find the magnitude of force.

9. A car of mass 480 kg moving at a speed of 54 km per hour, is stopped in 10 s. Calculate the force applied by the brakes.
10. A bullet of mass 50 g moving with an initial velocity of 100 m/s, strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate:
- Initial momentum of the bullet,
  - Final momentum of the bullet,
  - Retardation caused by the wooden block.
  - Resistive force exerted by the wooden block
11. A force causes an acceleration of  $10 \text{ m/s}^2$  in a body of mass 500 g. What acceleration will be caused by the same force in a body of mass 5 kg?
12. A car is moving with a uniform velocity 30 m/s. It is stopped in 2 s by applying a force of 1500 N through its brakes. Calculate :
- The change in momentum of car,
  - The retardation produced in the car, and
  - The mass of the car.