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DEPARTMENT OF EDUCATION (S)
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CLASS IX
PHYSICS
CHAPTER 7 – FORCE AND LAWS OF MOTION

NOTES

- **Force** is the cause which produces the change in the state of rest or uniform motion of the body on which it acts.

- A force or a set of forces can

  - ❖ change the shape of the body,

  - ❖ change the direction of motion of the body, and

  - ❖ change the shape of deformable bodies.

- If forces acting on a body produce no acceleration in it, the forces are said to be balanced. If, on the other hand they produced a non-zero acceleration, the force is said to be unbalanced.

- The natural tendency of object resisting a change in their state of rest or uniform motion is called inertia. The mass of a body is a measure of its inertia and its SI unit is Kilogram (kg).

- **Newton's laws of motion:**

  First law of motion: It states that "everybody continues in its states of rest or of uniform motion in a straight line unless compelled to change that state by an external applied force."

  Second law of motion: It states that the rate of change of momentum of a body is proportional to the applied unbalanced force in the direction of force.

  Third law of motion: It states that when one body exerts a force on another body, the other body also exerts a force on the first body. These forces are always equal in magnitude but opposite in direction.

➤ **Momentum (p):** The momentum of a body is the product of its mass and velocity, *i.e.*,

$$p = mv, \tag{7.1}$$

where m is the mass of the body and v is its velocity. The direction of momentum is the same as that of velocity. Its SI unit is $kgms^{-1}$.

➤ **Mathematical form of Newton's second law of motion:** The applied force on a body is

$$F = ma, \tag{7.2}$$

where m is the mass of the body and a is the acceleration of the body.

➤ The SI unit of force is **$kgms^{-2}$ or newton (N).** A force of 1 N produces an acceleration equal to 1 ms^{-2} on a body of mass 1kg.

➤ The change in momentum of body is equal to the impulse of the applied force.

➤ **Impulse**: It is defined as

$$I = Ft, \tag{7.3}$$

where F is the force applied on the body for a time interval t. The SI unit of impulse is newton-second (Ns).

➤ **Principle of conservation of momentum**: The total momentum of a system remains constant if no net external unbalanced force acts on the system.

➤ Total momentum before collision = total momentum after collision

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \tag{7.4}$$

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