

- While catching a ball, a cricket player lowers his hand to increase the time of impact. As $F = \frac{\Delta p}{\Delta t}$, smaller is the force and vice-versa. However, the change in momentum or impulse is same in both cases.
- A person falling on a cemented floor from a certain height gets more injury than when he is falling on sand because on the cemented floor the time of impact will be less and greater force acts on him.
- China wares, glass wares etc. are wrapped in a paper or straw before packing to increase the time of jerks during transportation. This decreases the possibility of action of greater force and subsequent damage to them.

Newton's First Law of motion [Law of Inertia]

Statement: "Everybody continues in its state of rest or uniform motion in a straight line unless it is acted on by an external resultant force to change that state"

- The first law gives the definition of force. Force is an external agency that changes or tends to change the state of rest or the state of the motion of the body.
- The first law gives the qualitative definition of force. (Significance of first law)
- The first law is also called the law of Inertia.
- According to this law, every object has a tendency to preserve its state of rest or uniform motion unless acted by an unbalanced external force. This tendency of the body is called inertia. Thus, the First law of motion is sometimes called as law of inertia.
- Inertia is an inherent characteristic of a material due to which it is unable to change its state.
- Inertia depends upon mass. So, lighter objects require less force to change their state of rest or motion in comparison with heavier ones. The lighter object has small inertia and the heavier has large inertia. So inertia in linear motion is equal to mass. Hence mass is the measurement of inertia.

Types of Inertia:

1. ***Inertia of rest:*** The inability of a body at rest to change its state of rest to a state of motion by itself is called inertia of rest. For e.g.
 - When a bus suddenly starts moving, the passengers fall backwards.
 - On the shaking branch of a tree, the fruits fall down.
 - A coin placed on a cardboard over a glass falls into the glass if the cardboard is suddenly removed.
2. ***Inertia of motion:*** The inability of a moving body to change its state of motion to a state of rest by itself is called inertia of motion. For e.g.
 - When the moving bus suddenly stops, the passengers fall forward.
 - An athlete runs before a long jump.
 - The rotating fan takes some time to come to rest after the switch is off.
3. ***Inertia of direction:*** The inability of a moving body to change its direction of motion by itself is called inertia of direction. For e.g.
 - When the vehicle takes a sharp turn, the passengers are thrown away.
 - The mud sticking to the wheel of the vehicle flies off tangentially.
 - A stone tied to a string is whirling in a horizontal circle, if the string breaks, the stone flies off tangentially.

Newton's second Law of motion:

Statement: The net external force acting on a body is directly proportional to time rate of change of its momentum.