



Force and Laws of Motion

Force : A push or pull experienced by an object is called force. Its S.I Unit is 'Newton'. It is a vector quantity.

Types of Forces

Balanced force : • A force where two forces of equal size act on a body, in opposite directions is known as balanced forces.

• Net force = 0



Unbalanced force : A force where two forces acting in opposite directions on a body, are not in equal magnitude, is known as an unbalanced force.

• Net force $\neq 0$



First law of Motion : An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force.

Inertia : The tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia.

Types of inertia

① Inertia of rest :- tendency of an object to stay at rest.
eg: a person falls backwards when bus driver suddenly starts bus.



② Inertia of motion : tendency of an object to resist any change in its state of motion.
eg:- a person falls forwards when bus driver suddenly applies brakes.

③ Inertia of direction : tendency of an object to resist any change in its state of direction of motion.
eg:- a person moves sideways when bus driver takes a turn.

Momentum : • The quantity of motion of a moving body measured as a product of mass and velocity is called momentum.

- $p = \text{mass} \times \text{velocity}$
- Its S.I Unit is kgm/s
- It is a vector quantity.

Second law of motion : According to second law of motion, the force applied on an object is directly proportional to rate of change of momentum

$$F \propto \frac{\text{change in momentum}}{\text{time}}$$

$$F \propto \frac{mv - mu}{t}$$

$$F \propto m \frac{(v-u)}{t}$$

$$F \propto ma$$

$$F = kma$$

$$\text{where, } k=1$$

$$\therefore \boxed{F = ma}$$



Applications of Second law of motion

- ① A fielder moves his hands backward while catching a ball.
- ② In a high jump athletic event, the athletes are made to fall either on a cushioned bed or on a sand bed.

Third Law of Motion

Third law of motion states that for every action there is an equal and opposite direction.

- These two forces are equal in magnitude but opposite in direction.
- These forces act on different objects and never on the same object.

eg:- You push the road below backwards. The road exerts equal and opposite force on your feet to make you move forward.