LAWS OF MOTION

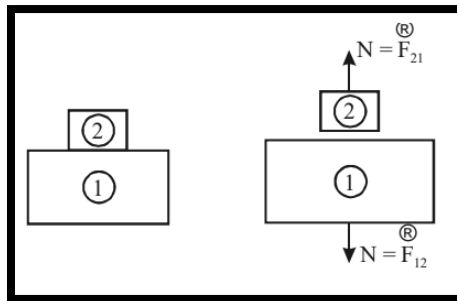## NEWTON'S THIRD LAW OF MOTION

THIRD LAW OF MOTION

According to this law, 'Every action has its equal and opposite reaction"

When two bodies A and B exert force on each other, the force (action) of A on B

$(\vec{F}_{BA})$ is always equal and opposite to the force of B on A $(\vec{F}_{AB})$

Thus

$$\vec{F}_{AB} = -\vec{F}_{BA}$$

1)   This law expresses the nature of force.

2)   Action and reaction always acts on different bodies

$$\vec{F}_{12} = -\vec{F}_{21}$$

Impulse :

If a force acts on a body for a short duration Δt, then impulse is defined as product of force and its time of action

Impulse = Force × Duration

$$\Delta \vec{p} = \vec{F} \times \Delta t$$

By Newton's second law

$$\vec{F} = \frac{\Delta \vec{p}}{\Delta t}$$

$$\vec{F}\Delta t = \Delta \vec{p} = \vec{p}_f - \vec{p}_i$$

Thus impulse of force $= \vec{F}\Delta t = \Delta \vec{p} = \vec{p}_f - \vec{p}_i$

Ex.   A man fires the bullets of mass m each with the velocity v with the help of machine
gun, if he fires n bullets every sec, the reaction force per second on the man will be –

(1) $\frac{m}{v}n$ (2) mnv

(3) $\frac{mv}{n}$ (4) $\frac{vn}{m}$

Sol.   (2) $F = \frac{dp}{dt}$

$Fdt = dp = p_2 - p_1$

$F \times 1 = mnv - 0$

$F = mnv$

(Total mass of the bullets fired in 1 sec = mn) Hence correct answer is (2)