NEWTON'S 2nd & 3rd Law of Motion

Inertial frame :- Frame which is at rest. Any frame which moves with a const. velocity w.r.t. an inertial frame is also inertial.

Newton's 2nd Law :-

$$\vec{p} = m\vec{v}$$

2nd Law relates net force acting on the body to its rate of change of momentum.

Rate of change of momentum of a particle is directly proportional to the applied force on the particle and the change of momentum, takes place in the direction in which force acts.

$$\vec{F} = \frac{d\vec{p}}{dt} = m\frac{d\vec{v}}{dt} = m\vec{a}$$

$m \rightarrow kg$

$a \rightarrow m/s^2$

$\vec{F} \rightarrow$ Newton, $1N = 1\ kg\ m/s^2$

★ $\vec{F}, \vec{p}$ & $\vec{a}$ are vectors $\Rightarrow$

$$F_x = \frac{dp_x}{dt} = ma_x$$

$$F_y = \frac{dp_y}{dt} = ma_y$$

$$F_z = \frac{dp_z}{dt} = ma_z$$

★ $\vec{F} = \frac{d\vec{p}}{dt}$

$$\int_{t_1}^{t_2} \vec{F}.dt = \int d\vec{p} = \vec{p}_{t_2} - \vec{p}_{t_1}$$

Impulse of a force acting on a particle from t_1 to t_2 = change of momentum of particle during this time interval.

If $\vec{F}$ is constant $\Rightarrow \int \vec{F}.dt = \vec{F}\,\Delta t$

$$\boxed{\vec{I} = \vec{F}_{av.}\,\Delta t}$$

Newton's Third Law :-

When 2 bodies interact, then $\vec{F}_{AB}$, force that body B exerts on body A, is equal & opposite to $\vec{F}_{BA}$, which is the force that body A exerts on body B.

"To every action there is an equal & opposite rxn."

★ Summary :-

Ist Law → Statics

IInd Law → $\vec{F} = m\vec{a}$

IIIrd Law → mutually, forces b/w particle cancel out.