Chapter 03 -: Notes:-

"Dynamics"

The field of physics in which we Study about the motion as well it Cause (force)

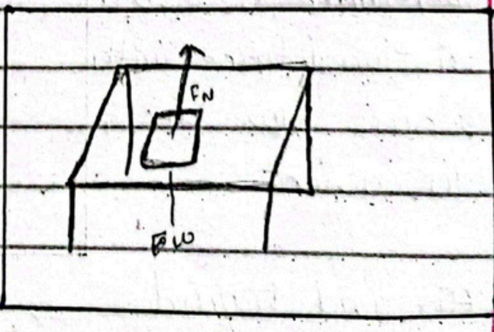
force:- force is a vector quantity which changes or tends to change state of body.

Types of forces:- forces are broadly Classified as Contact and non-Contact forces:

Contact forces:- A force acting b/w two objects that are in physical contact are termed as contact forces.
Example:- Batter hitting a cricket ball is a Contact force Since Since there is a Physical contact b/w the bat and the ball.

-: Examples:-

1. **Normal force:-**



A force that is perpendicular to the Contact Surface at the angle of 90°, that prevents the objects from passing through each other is called normal force And is represent as F_N.

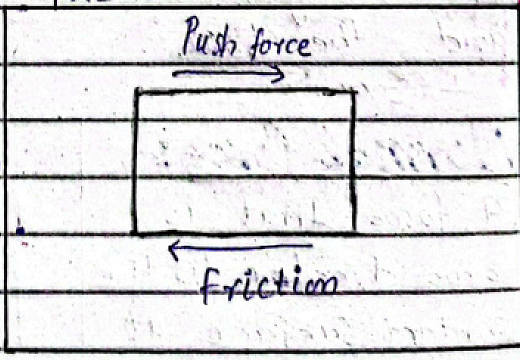
Example:- The book lying on a table the force perpendicular to the table is normal force.

2. **Thrust force:-** The force that propels a flying machine in the direction of motion is termed as Thrust.

Example:- Engine produce thrust, the thrust of engine of Car cause it to accelerate.

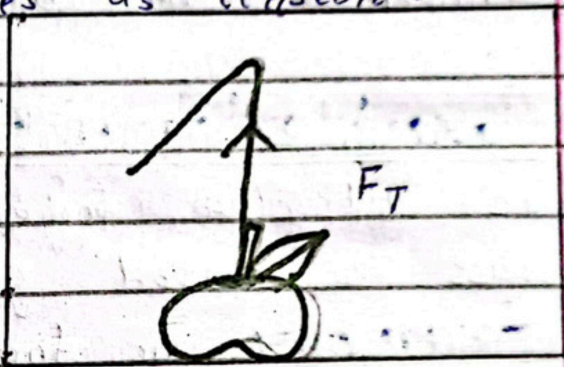
3. **Friction:-** force that opposes the direction of motion. force that resist the relative motion of solid surfaces, fluid surfaces/layers and material elements in contact and sliding against each other is called friction.

Example:- Air resistance is also a frictional force with occurs b/w air & an object.



Air and liquid → fluids

Tension:- The forces exerted by two or more physical objects that are in contact through string, rope, cable or Spring. we call such forces as tension.



Elastic forces:- The forces that an object exerts to resist a ~~st~~ change in its Shape are called elastic forces.

-: Non-Contact forces:-

"The force which acts at a distance, without any physical contact b/w bodies is termed as non-contact forces."

1. Gravitational force:-

The attractive force b/w two objects with mass is called gravitational force.

Example:- The force; The force experienced by moon because of earth.

2. Electrostatic force:-

An attractive or repulsive force experienced by charged objects is called electrostatic force.

Example:- Attractive force b/w a positively charged nucleus and negatively charged electron.

SLO Based Questions
Related to topic "Contact and non-Contact" forces

Q Differentiate b/w contact and non-contact forces.

Contact forces	non-Contact forces
Definition:-	
forces that require phyical contact between objects.	forces that donot require physical contact between objects
Characteristics:-	
• Require direct contact between objects.	• Donot require direct contact b/w objects.
• Act on the surface of objects	• Can act over long distance.
Example:-	
- friction force	- Nuclear forces
- Normal force	- Electromagnetic forces
- Tension force	- Gravitational forces

Q2 Why magnetic and electrostatic forces are placed in non contact forces?

Magnetic and electrostatic forces are classified as non-contact forces because they can act b/w objects without physical contact or direct touching.

Example:- "A magnet can attract and repel each other without physical contact". ② "A charge particle can exert an electrostatic force on another charge particle without touching."

Q How moon attracts the earth? what kind of force is b/w them describe its nature:

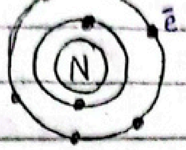
-: Attraction b/w Moon & Earth :-

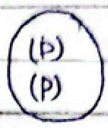
The moon attract the earth through gravitational force. Gravitational force is a type of non-contact force. This force is a result of the mutual attraction b/w two masses.

fundamental forces in Nature

Q Briefly Explain strong nuclear force.

Strong nuclear force :-





"force that bind positivively P=+
charged protons tightly packed P=+
in the nucleus of an atom"

Exchange particle :-

Exchange particle of strong nuclear force are called pions (Π).

Q Define Exchange particle.

Exchange particle :-

Exchange particles ~~transfer~~ trasmit the fundamental forces between particles.

Electromagnetic force :-

Electric force	Magnetic force
"force b/w two electric charges"	"force b/w magnetic poles (North & south)"

-: Scientific word of light is Photon :-

Photon :- is a mass less particle
"have both electric & magnetic force".
"dual nature".

* "Particles that have both electric & magnetic force is called photon."

$\boxed{\text{Electric force} + \text{Magnetic force} = \text{Photons}}$

Gravitational force :-

Gravitational force is the force of attraction that exist between two mass objects.

★ Universal Gravitation constant $= G = 6.673 \times 1$

Exchange particle :-

Exchange particle in Gravitational force is "graviton" not detected yet

weak nuclear force :-

★ Convet neutrons to proton and protons to neutron ~~to proton~~

★ emits or radiates unstable nucleus is weak nuclear force.

Exchange particle :-

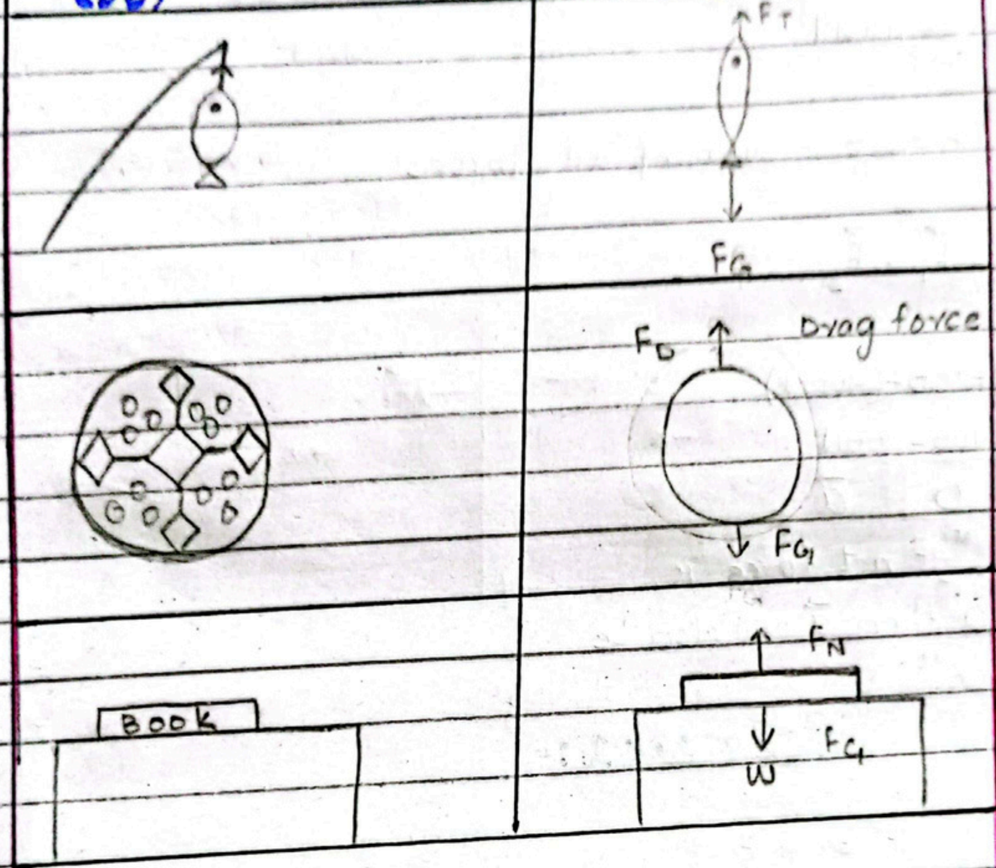
W^+, W^-, Z_0 (vector bosons)

★ when we break any proton or neutron the particles in it are called quark

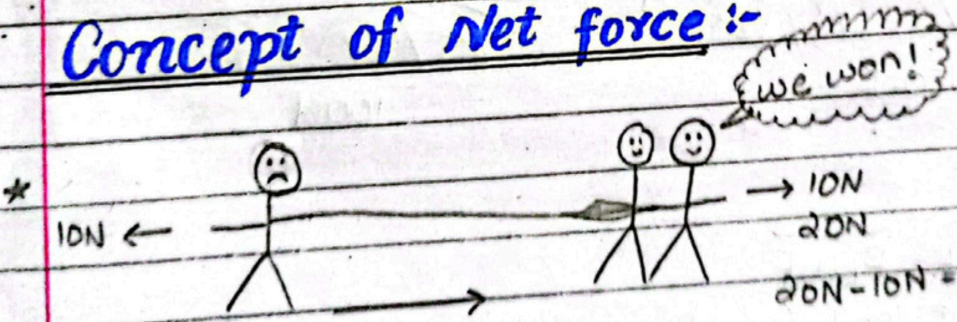
★ 3quarks = proton and neutron

force Diagrams :- If we critically analyze any System diagram is known as free diagram.

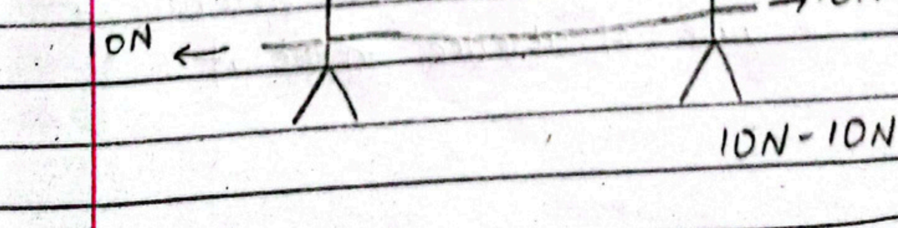
System Diagram (SD)	free body Diagram (FBD)



Concept of Net force :-

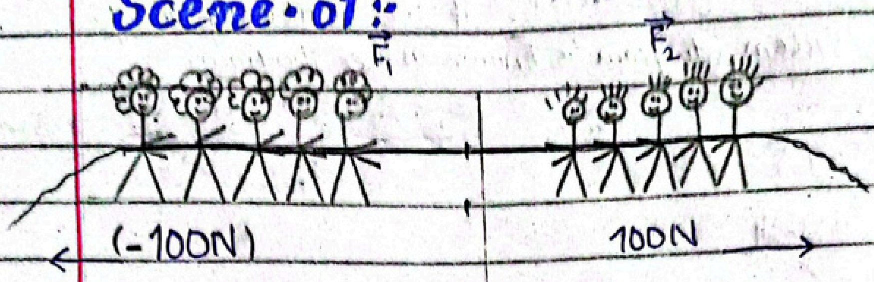


$20N - 10N = 10N$



$10N - 10N = 0$

Scene·01:-



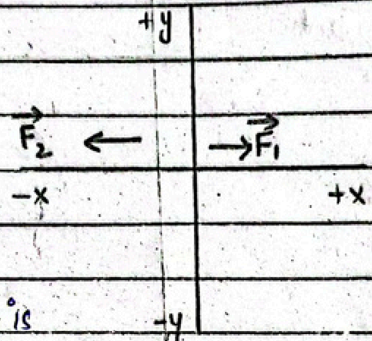
$\Rightarrow F_{net}$ = Sum of all forces

$\Rightarrow \vec{F}_{net} = \vec{F_1} + \vec{F_2}$

$= +100 + (-100N)$

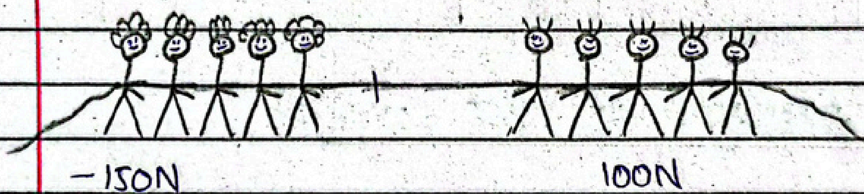
$= 100 - 100N$

$\vec{F}_{net} = \boxed{0}$ $\vec{a}$



"If net force is 0 then $\vec{a}$ will also be 0."

Scene·02:-



$\vec{F}_{net} = \vec{F_1} + \vec{F_2}$

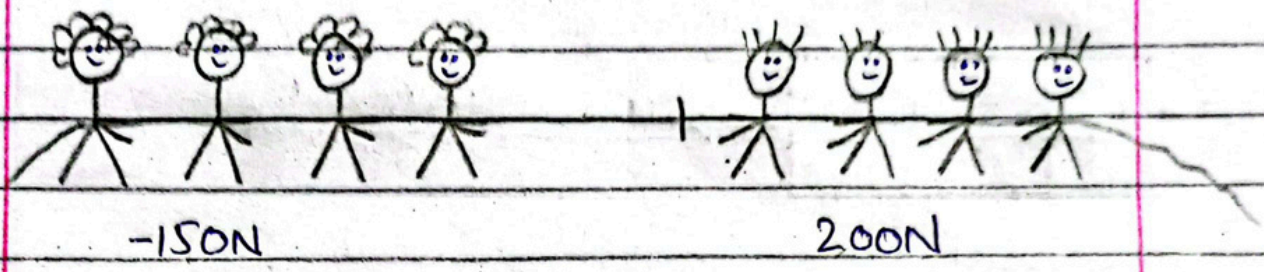
$= 100N + (-150N)$

$= 100N - 150N$

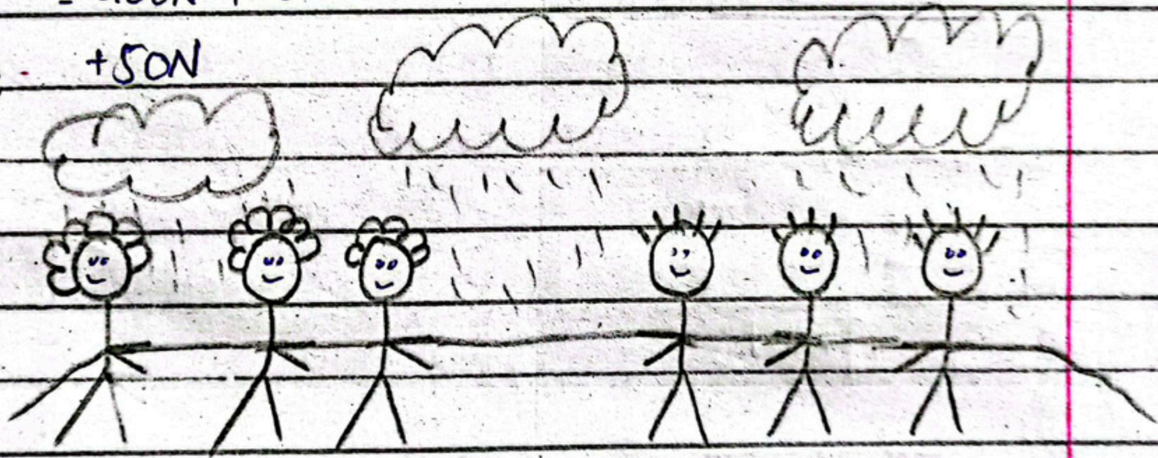
$\vec{F}_{net} = -50N$

"The value of $\vec{a}$ cannot be determined in this because of the absence ~~of the~~ of mass"

Scene 03:-



$$F_{net} = F_1 + F_2$$
$$= 200N + (-150N)$$
$$= 200N - 150N$$
$$\vec{F}_{net} \cdot +50N$$



"Match has been posponded
Due to Rain" ☺

Newton's first law of motion :-

$\boxed{\vec{a} = 0}$ → At rest
→ At motion (uniform velocity)

$\vec{F}_{net} = m\vec{a} \Rightarrow F_{net} = m \times 0$
$\Rightarrow \boxed{\vec{F}_{net} = 0.}$

$\Delta\vec{V} = \vec{V}_f - \vec{V}_i = \cancel{5} m/s - \cancel{5} m/s$
$\Delta\vec{V} = \boxed{0 \, m/s}$

When will be the newton's first law of motion will valid?
Newton's first law of motion is only valid when object is at rest or moves with Constant / uniform velocity and in that case the change in velocity is zero and in the same way the value of acceleration is also zero
Thus, we conclude that when $\vec{a}$ is zero than the net force is also zero.

Since, $\Delta\vec{V} = 0 \Rightarrow \vec{a} \Rightarrow \frac{\Delta\vec{V}}{\Delta t} \Rightarrow \vec{a} = \frac{0}{\Delta t} \Rightarrow \boxed{\vec{a} = 0}$

Since, $\vec{F}_{net} = ma \Rightarrow \vec{f}_{net} = m \times 0 \Rightarrow \vec{f}_{net} \boxed{= 0}$

Q why passenger move outside when we take turn?
Since passenger are not directly attached to the vehicle, they tend to continue moving in their original direction (straight line) due to intrtia

Q Where the newtons first law of motion is valid ?

Newton's first law describe the natural tendency of objects to resist changes in Their motion, Making it a Universal principle applicable everywhere in the Universe.

Newton's Second law of Motion :-

Q State and Derive newton's second law of motion.

:: Diagram :-

$\downarrow\uparrow$ Net force $\propto$ Acceleration $\uparrow\downarrow$

$$\Rightarrow \vec{a} \propto \vec{F}_{net} \rightarrow (i)$$

$$\Rightarrow \vec{a} \propto \frac{1}{m} \rightarrow (ii)$$

By Combining eq (i) and (ii) Then

$$\Rightarrow \vec{a} \propto \frac{\vec{F}}{m}$$

$$\Rightarrow m\vec{a} \propto F$$

$$\Rightarrow \vec{F} \propto m\vec{a}$$

$$\Rightarrow \vec{F} = (\text{constant})\, m\vec{a}$$

$$\Rightarrow \vec{F} = k\, m\, \vec{a} \qquad \because k = 1$$

$$\Rightarrow \vec{F} = m\vec{a}$$

$$\Rightarrow \boxed{\vec{F} = m\vec{a}}$$

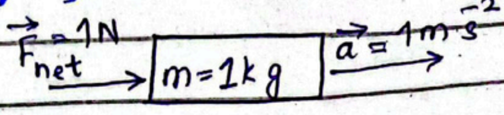
Define one N

Statement :- The acceleration of an object as produced by a ~~object~~ ~~as~~ net force is directly proportional to the magnitude of the net force and inversely proportional to the mass of an object

Define one newton ?

SI Unit of force :-

Since, $F = ma$



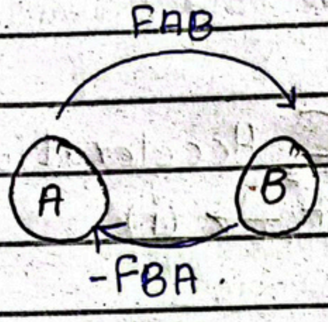
$$1N = 1kg \times 1ms^{-2}$$

$$1N = 1kg\,ms^{-2}$$

Newton's Third law of motion

Statement:-

To every action there is always but opposite reaction that will be equal in magnitude

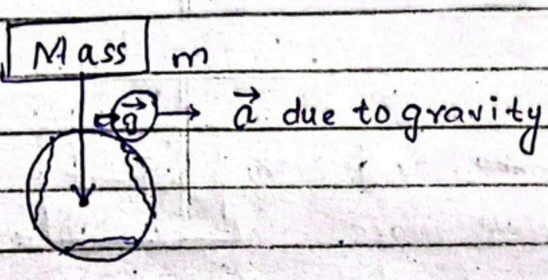


Action = Reaction

$F_{AB} = -F_{BA}$

direction of force is opposite

Mass	weight
-: Definition :-	
The quantity of matter possesed by a body is called mass.	The gravitational pull ($\vec{g}$) on a body is called a weight (or) the force of gravity acting on a body
-: Quantity :-	
It is Scalar quantity	It is a vector quantity
-: Nature :-	
Mass have Scalar Nature	Weight have vector nature
-: Dependence :-	
Mass is independent of Gravity	Weight is dependend on the value of gravity
Unit	
SI Unit of Mass is (kg)	SI Unit of weight is Newton (N)
Variation	
The value of mass doesn't vary by varying the value of altitude or height	The value of weight varies by varying the value of altitude height A, the value of $\vec{g}$ varies at different height.
-: Symbolic Representation :-	
Mass is symbolically represented by "m"	weight is symbolically represented by "$\vec{w}$"



Weight :-

-: Derivation :-

Since from Newton's secon law of motion

$\Rightarrow \vec{F} = m\vec{a}$

If $\vec{a} = \vec{g}$ then $\vec{F} = \vec{w}$

$\Rightarrow \boxed{\vec{w} = m\vec{g}}$

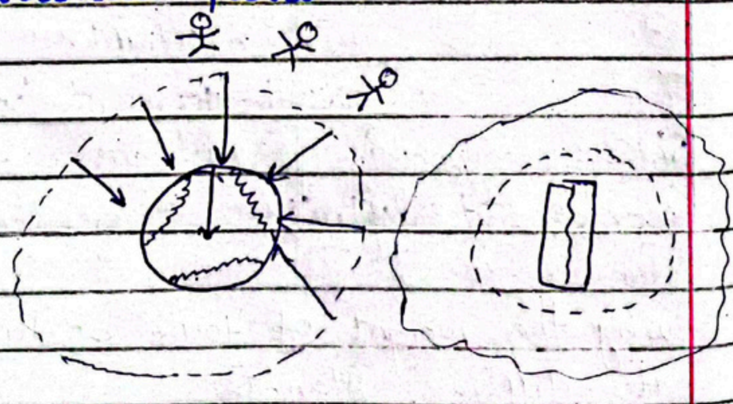
MAK's Special tip :-

weight is a special case of force when the acceleration is equal to the ~~ms~~ value of gravity.

* when we put gravitational acceleration instead of acceleration then force would be defined as weight

Gravitational field :-

The region around earth



The region around the ~~g~~earth where force of the attraction exerts on another object. this field is known as gravitational fie

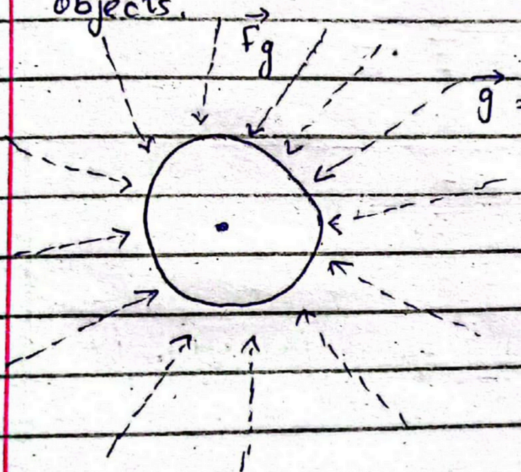
$\frac{F_g}{m}$ = Gravitational field strength

$$\Rightarrow \frac{F_g}{m} = g \Rightarrow \boxed{\vec{g} = \frac{\vec{F_g}}{m}}$$

$\vec{F_g}$ → Newton, m → kg

It is defined as:-
" Force acting on unit mass"

Gravitation field strength is is gravitational force exerted by earth on massive objects.



$\vec{g} = 9.8 m/s^2$
$\vec{g}$ = N/kg

Gravitational field strength or Gravitation is same

Main points:-

1) Gravity / Gravitational field strength / Gravitational acceleration are the same thing.
2) Both units m/s^2 & N/kg are used for $(\vec{g})$
) $(\vec{g})$ is a vector quantity and it has direction towards the centre of earth.
) The value of $\vec{g}$ varies by varying the heights

Momentum:-

"The product of mass "m" and velocity "$\vec{v}$" is known as momentum ($\vec{P}$)"

Mathematical formula:-

$$\vec{P} = m\vec{v} \quad kg\,m\,s^{-1}$$

der-standing ← **Physical definition:-** The quantity that is related with the mass objects during their motion($\vec{v}$) the the quantity is called as momentum.

Q1:- On which factors the value of momentum depends?

Momentum depend on two factors

1. Mass:- (higher mass higer momentum) (~~higher~~ lower mass lower Momentum)
2. Velocity:- (higher $\vec{v}$ higher momentum) (lower $\vec{v}$ lower momentum)

Q2:- Derive the relation b/w force and momentum?

Relation b/w force and momentum.

According to Newton's 2nd law of motion

$\Rightarrow \vec{F}_{net} = m\vec{a}$ $\qquad \because \vec{a} = \dfrac{\vec{v}_f - \vec{v}_i}{\Delta t}$

$\Rightarrow \vec{F}_{net} = m\left(\dfrac{\vec{v}_f - \vec{v}_i}{\Delta t}\right)$ $\qquad \because P = m\vec{v}$

$\Rightarrow \vec{F}_{net} = \dfrac{m\vec{v}_f - m\vec{v}_i}{\Delta t}$ $\qquad \because P_i = m\vec{v}_i$, $\because P_f = m\vec{v}_f$

$\Rightarrow \vec{F}_{net} = \dfrac{\vec{P}_f - \vec{P}_i}{\Delta t}$

$\Rightarrow \boxed{\vec{F}_{net} = \dfrac{\Delta\vec{P}}{\Delta t}}$ $\qquad \because \Delta\vec{P} = \vec{P}_f - \vec{P}_i$

Conclusion:- Thus we can conclude the relation of force and momentum that the rate of change in momentum is equal to force

$\vec{F}_{net} = \frac{\Delta P}{\Delta t} = \Delta\vec{P} = \vec{F}_{net} \times \Delta t$

$\Delta\vec{P} = N \times S$

SI unit of = NS
Momentum:

Impulse and Change in Momentum:-

$\vec{F}_{net} = \frac{\Delta\vec{P}}{\Delta t}$

body pe jo lage Fnet se to momentum Chang hota hai.

$\vec{F}_{net} \times \Delta t = \Delta\vec{P} \rightarrow$ Impule (J)

$\boxed{\vec{J} = \vec{F}_{net} \times \Delta t} \rightarrow$ formula of Impulse

Mathematical Definition :-

It is defined as the Product of $\vec{F}_{net}$ net force and change in time it called impulse

Physical definition describes the actual object which exist in the real world, while the mathematical definition is the mathematical description of the physical model

Read
rig
$\vec{F}_{net}$
read
let
rig
$\vec{F}_{net}$

Explain
Q. when will the moment is Conserve

Newton's ~~Second~~ law of motion and Law of Conservation of Momentum :-

In isolated System the $\vec{F}_{net}$ is equal too

$$\vec{F}_{net} = 0 \rightarrow i$$

and since, from the ~~Realation~~ ~~of~~ Net force and change in Momentum we have :-

$$\vec{F}_{net} = \frac{\Delta\vec{P}}{\Delta t} \longrightarrow ii$$

Putting eq (i) in eq ii then

$$\Rightarrow 0 = \frac{\Delta\vec{P}}{\Delta t} \Rightarrow 0 = \Delta\vec{P}$$

$$\Rightarrow \Delta\vec{P} = 0$$

$$\Rightarrow \vec{P}_f - \vec{P}_i = 0 \Rightarrow \boxed{\vec{P}_f = \vec{P}_i} \text{ or } \boxed{m\vec{v}_f = m\vec{v}_i}$$

Q:- When will the Momentum ~~with~~ of a System is conserved

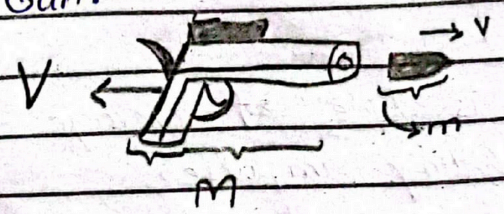
Q:- Explain law of conservation of momentum with the help of example

Law of Conservation of momentum:- It is defi
The momentum of an isolated System remains Constant

$\Rightarrow$ Initial Momentum = final Momentum

$$\vec{P}_f = \vec{P}_i \Rightarrow \boxed{m\vec{v}_f = mv_i}$$

Recoiling of Gun:-



Now, Applying law of conservation of momentum :-

$\Rightarrow$ Initial momentum Before the gun fire = Final momentum After gun fire

$\Rightarrow$ 0 = {momentum of Gun + Momentum of Bullet}

$\Rightarrow$ $0 = MV + mv \Rightarrow -\cancel{MV}^{mv} = -MV$

$\Rightarrow MV = -mv$

$= \boxed{V = -\left(\frac{m}{M}\right) v}$