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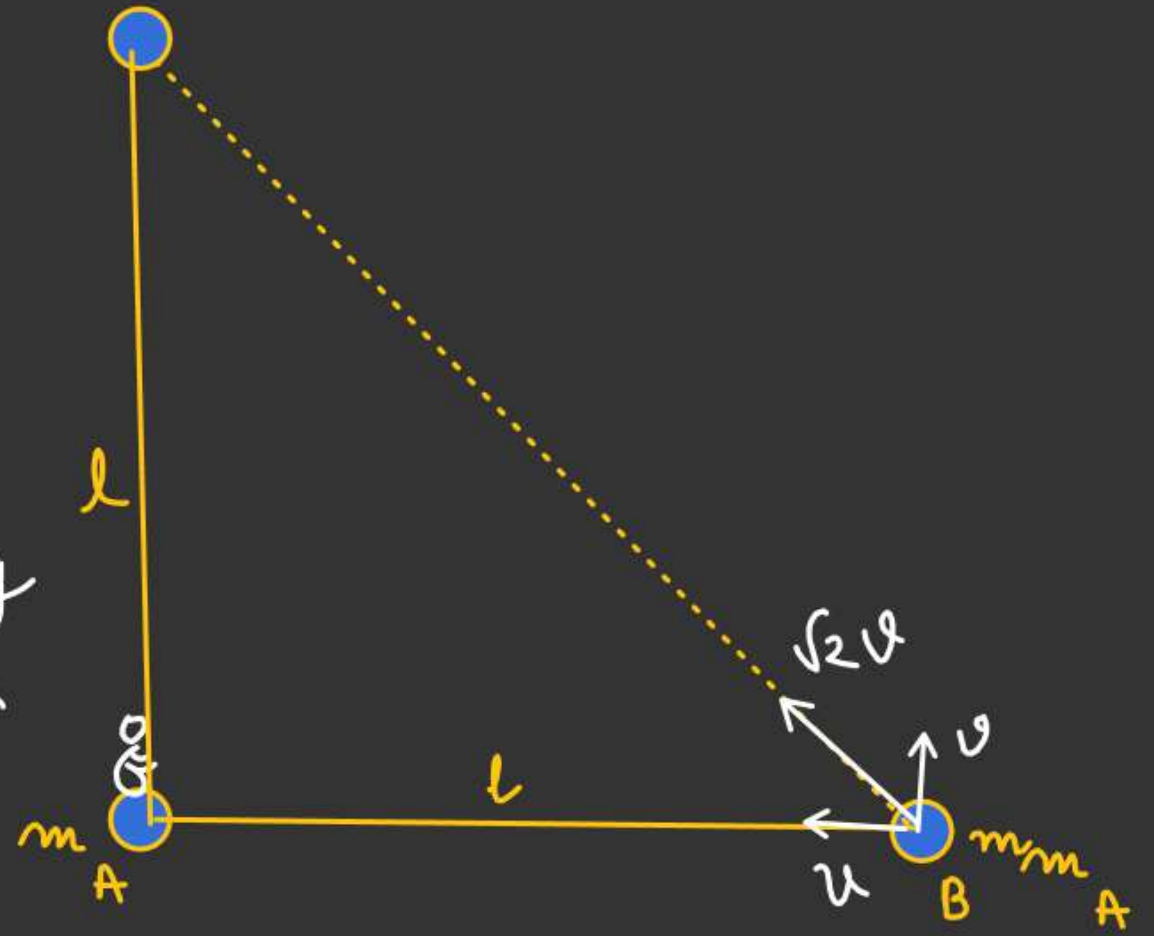
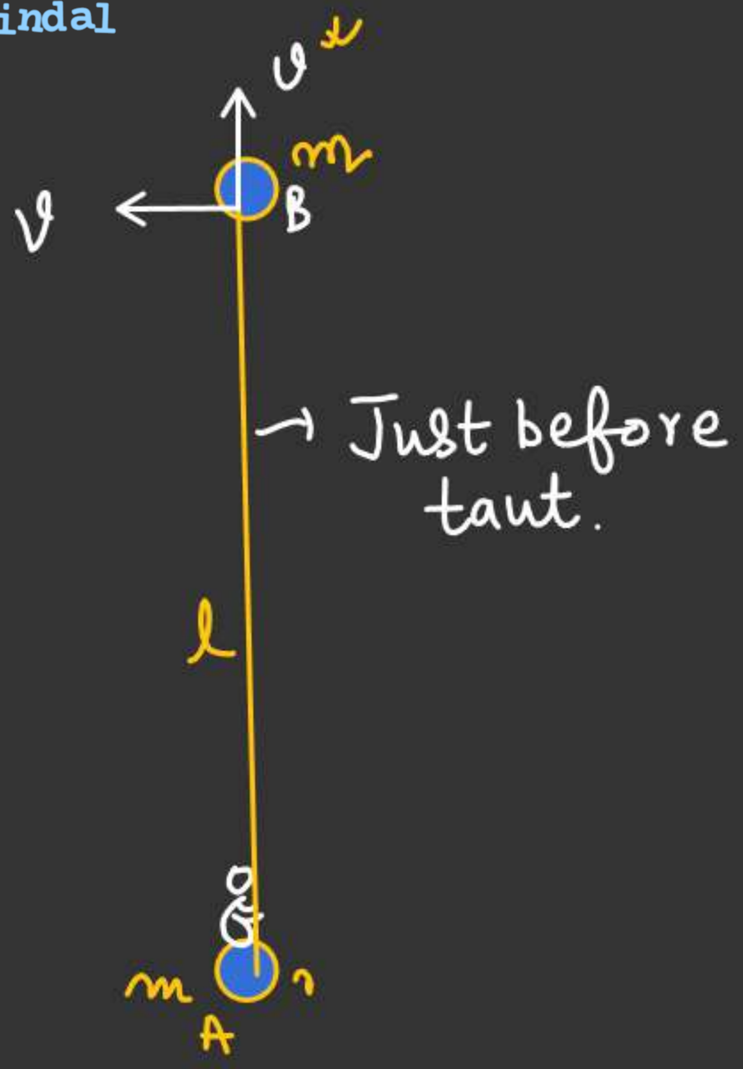
Two balls A and B Connected With a String of length l.
The whole System is kept on a horizontal table.

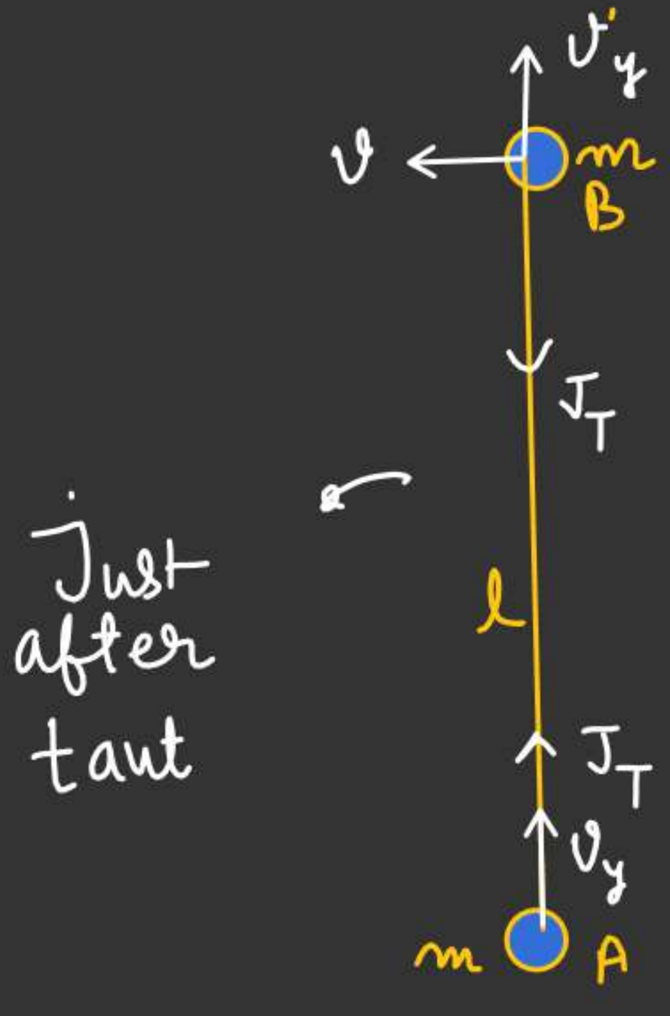
Both the balls given velocity in mutually perpendicular direction.

Find Speed of ball A and B when String again attained its length l.

Sol^n:- When relative distance b/w two ball be 'l' then string attained its orginal length







L.M.C Along the String.

$$mv = 2m v_y$$

$$v_y = \left(\frac{v}{2}\right)$$

Speed of A $= v_y = \frac{v}{2}$ m/s.

$$\text{Speed of B} = \sqrt{v_y^2 + v^2}$$

$$= \sqrt{\frac{v^2}{4} + v^2}$$

$$= \left(\frac{\sqrt{5}\,v}{2}\right).$$

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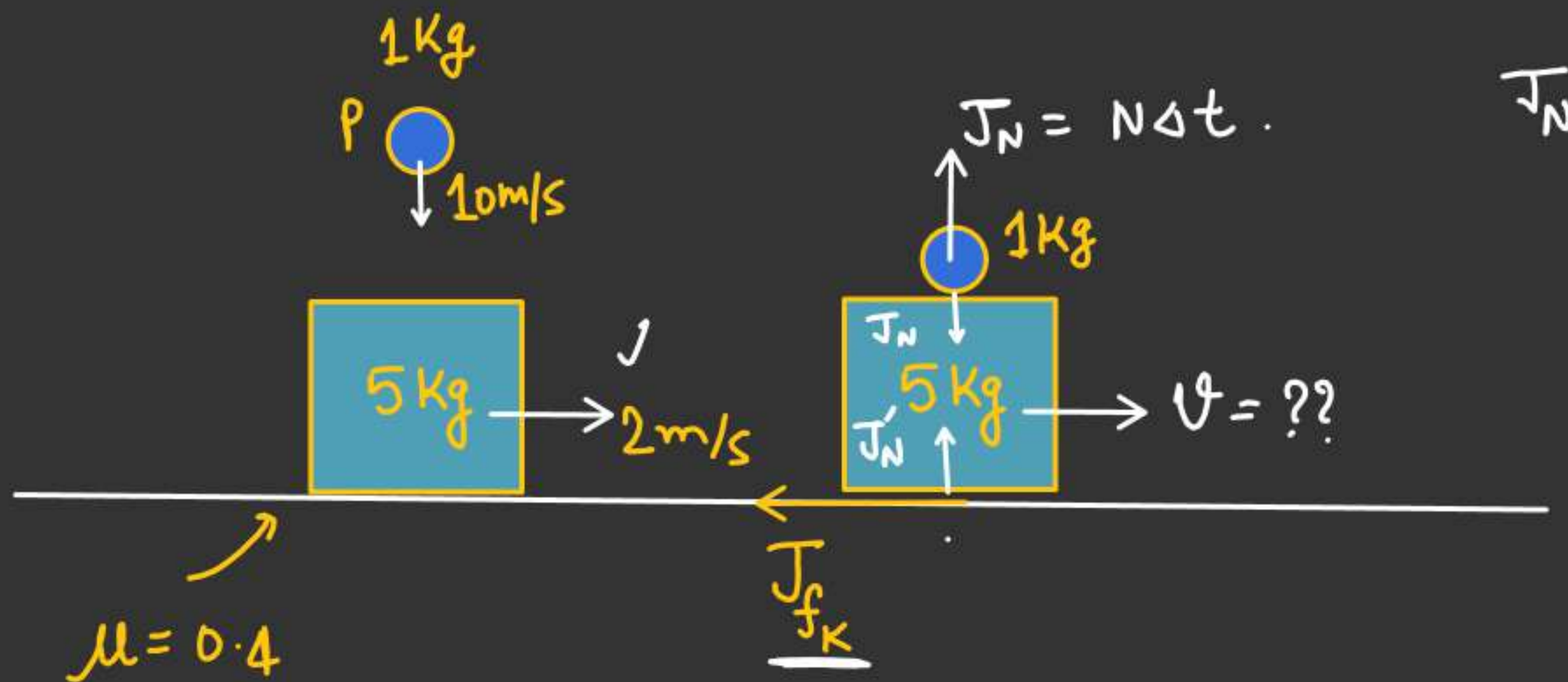


Particle 'P' Collide and stick to block. Find velocity of block just after the particle Collide with the block

J_N' = Due to ground on the block

$J_N' = (N_g \cdot \Delta t)$

$f_K = \mu N_g$.

$f_K \cdot \Delta t = \mu N_g \cdot \Delta t$.

$\Downarrow$

$J_{f_K} = \mu J_N'$

$\left(J_{f_K} = \mu J_N\right)$.

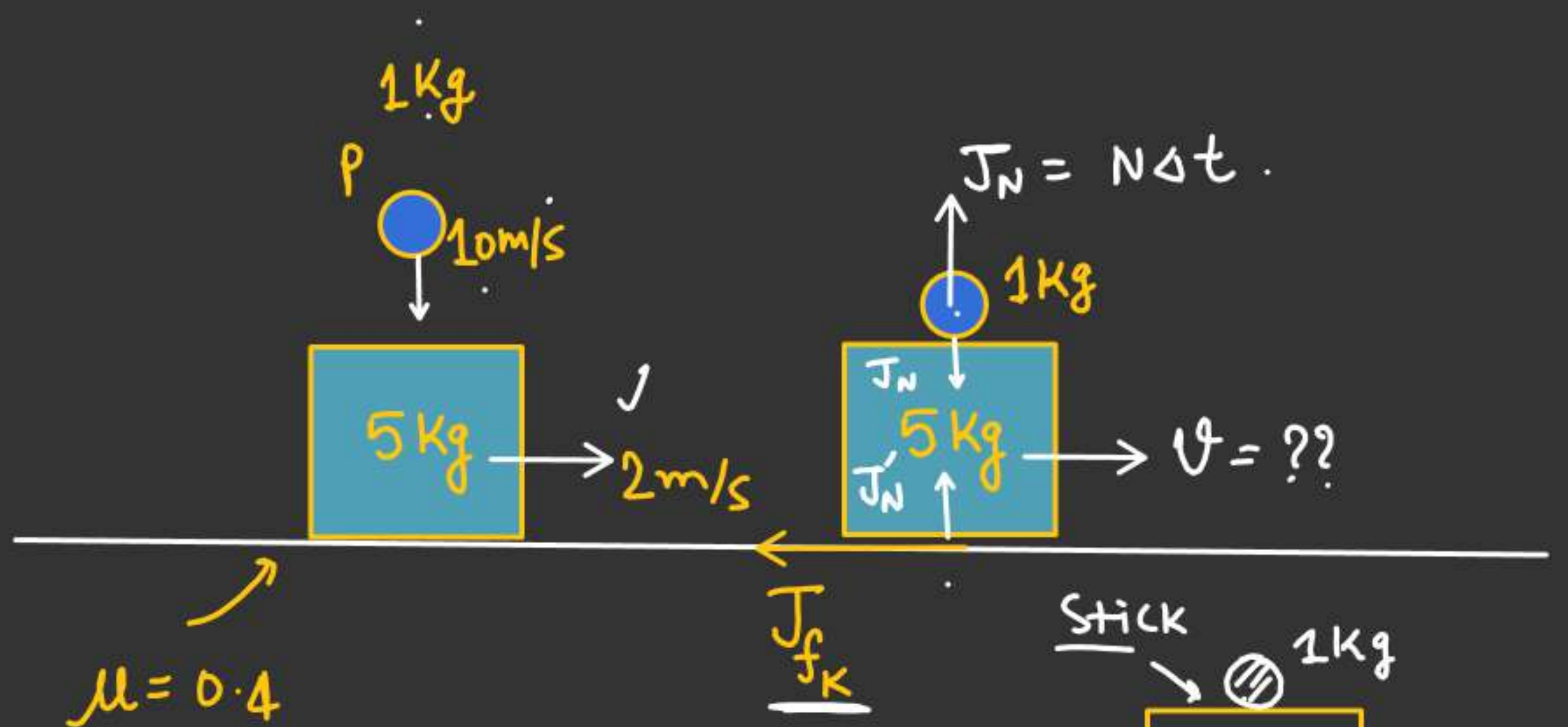
Net linear Momentum of block in y-direction is zero

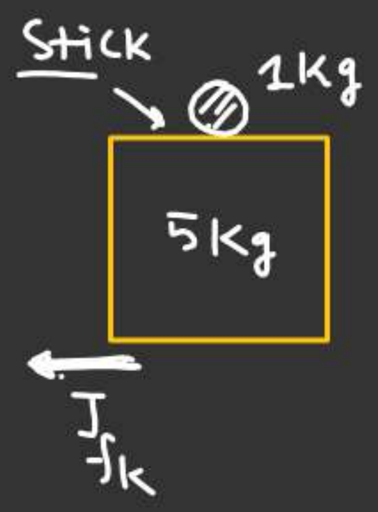
$J_{N'} - J_N = 0$

$J_{N'} = J_N$.

$\vec{J}_{f_K} = (\overrightarrow{\Delta p})_{\text{block in } x\text{-direction}}$

$-(J_{f_K})\hat{i} = (6V - 10)\hat{i}$





for particle

$$\vec{J_N} = (\vec{\Delta p})_{particle}.$$

$$\vec{J_N} = \vec{p_f} - \vec{p_i}$$

$$\vec{J_N} = 0 - (-10 \times 1)\hat{j}$$

$$\vec{J_N} = 10\hat{j}$$

$$J_N = 10$$

$$J_{f_K} = \mu J_N$$

$$= 0.4 \times 10$$

$$= 4.$$

$$-J_{f_K} = 6v - 10.$$

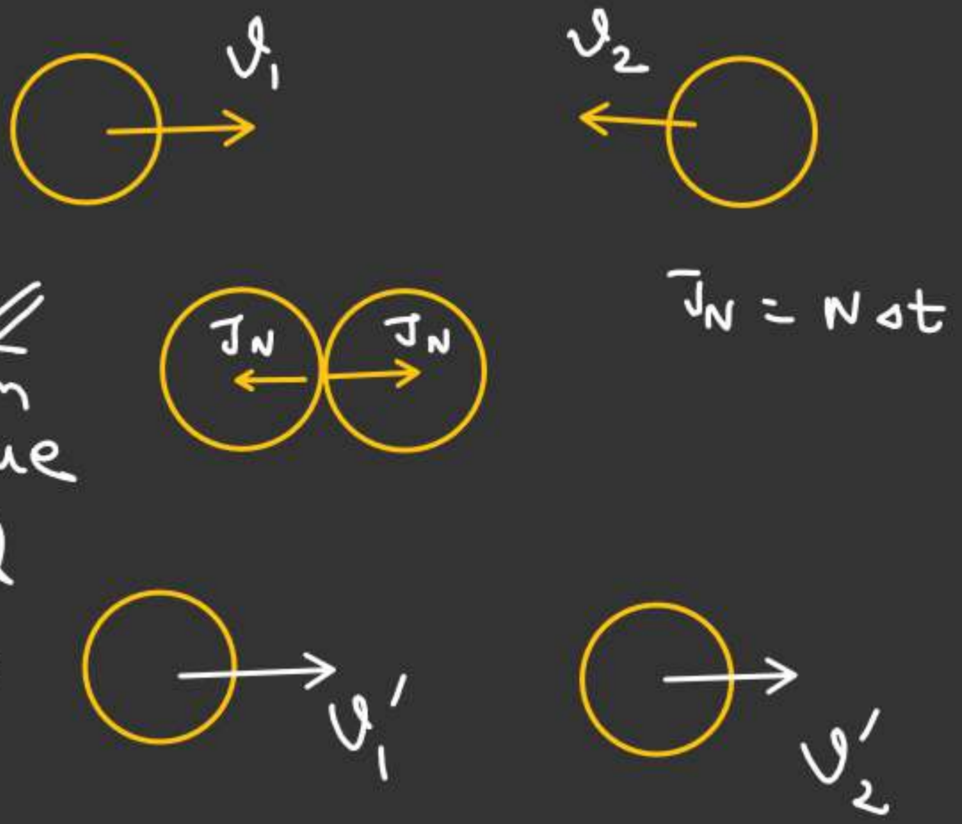
$$-4 = 6V - 10$$

$$6 = 6V$$

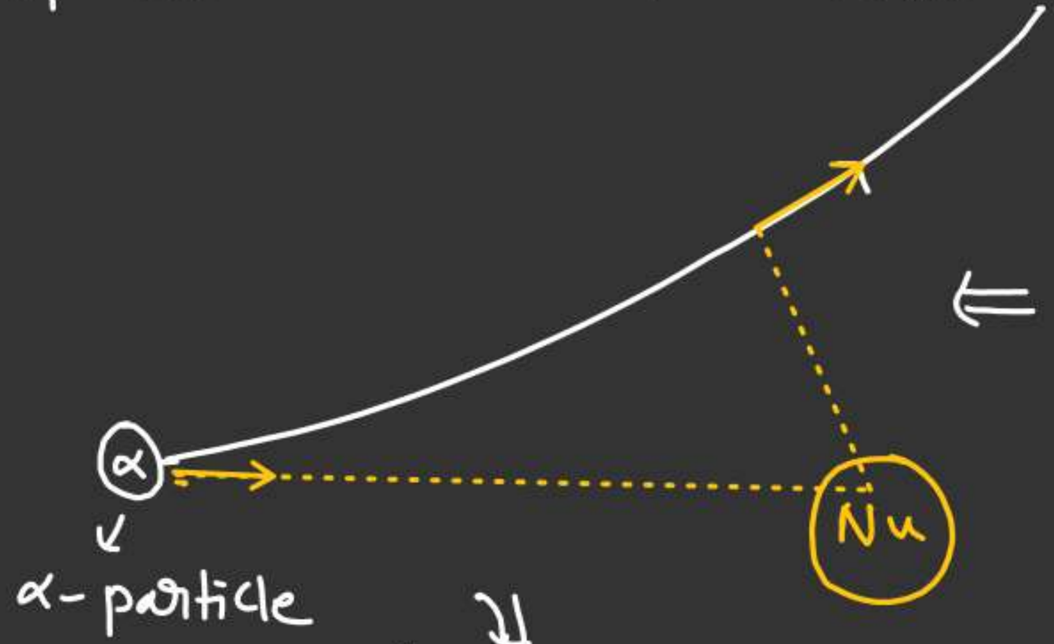
$$V = 1\,m/s$$ ✓

COLLISION

Def^n:- Two or more than two bodies are said to be collide if their velocities or their linear momentum changes either by actually in contact with each other or without in contact with each other.



[Momentum change due to actual contact ⇙]



⇐ Collision.

⇓

[Without actual contact.
Momentum of α-particle changes.]

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Type of Collision

(*) On the basis of line of action of Colliding bodies.

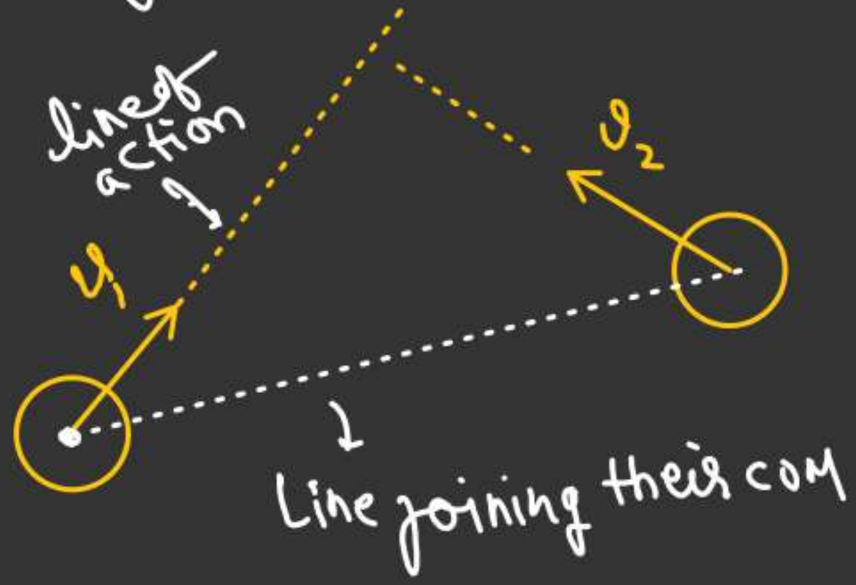
1. Head on Collision.
2. Oblique Collision

Head on- Collision

The line of action of Colliding bodies. along the line joining their center of mass

Oblique Collision

The line of action of Colliding bodies not along the line joining their COM.



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On the basis of Nature of Colliding bodies.

1. Elastic Collision

- Body have tendency to regain their Shape completely.
- Linear Momentum Conservation.
- kinetic energy of Colliding bodies. Conserved.

2. In Elastic Collision

- Body doesn't regain their Shape Completely.
- In inelastic Collision some part of kinetic energy of Colliding bodies stored in the body in the form of deformation so kinetic energy not Conserved.
- Linear Momentum conserved.

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Perfectly Inelastic Collision

- Colliding bodies doesn't reform i.e after collision bodies stick together and move with common velocity.

- Linear Momentum Conservation

- Kinetic Energy of colliding bodies not conserved

In general Energy conservation Equation for Inelasic collision

$$\boxed{(K.E_i) = (K.E)_f + \underbrace{(P.E)}}$$

$(K.E_i)$ ⇓ K.E before collision

$(K.E)_f$ ⇓ K.E after collision

$(P.E)$ ↳ Energy stored in the form of deformation within the body

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Coffⁿ of Restitution [e]

$$e = \left(\frac{\text{Impulse of Reformation}}{\text{Impulse of deformation}}\right)$$

Reformation just after collision
deformation just before
Collision.

$$\boxed{e = \frac{\text{Relative Speed of Seperation}}{\text{Relative Speed of approach}}}$$

$e = 1 \Rightarrow$ Perfectly Elastic collision

$0 < e < 1 \Rightarrow$ Inelastic Collision

$e = 0 \Rightarrow$ Perfectly inelastic