→ Only conservative forces work in elastic collisions.

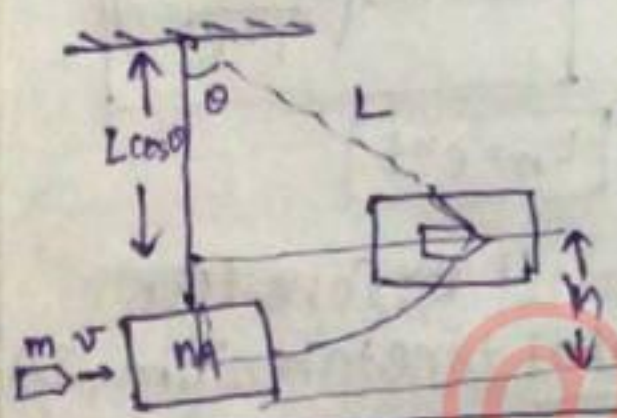
④ Different masses, collision inelastic

$$\text{Loss in KE} = \frac{1}{2}\frac{m_1 m_2}{(m_1+m_2)}(1-e^2)(\vec{v}_1-\vec{u}_2)^2$$

Law of conservation of linear momentum doesnot ~~change with time~~ depend on FOR but linear momentum depends on FOR.

Block-Bullet System

ⓐ When bullet remains embedded in the block



Speed of bullet:

$$v = \frac{m+M\sqrt{2gh}}{m}$$

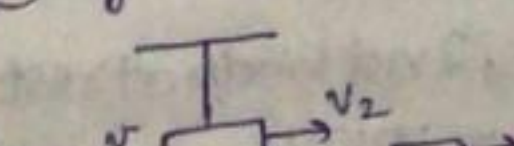
Velocity of block:

$$V = \frac{mv}{M+m}$$

$$h = \frac{V^2}{2g} = \frac{m^2v^2}{2g(m+M)^2}$$

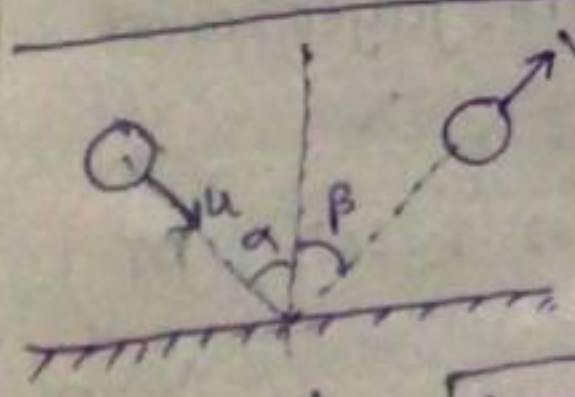
$$\theta = \cos^{-1}\left(1-\frac{h}{L}\right)$$

ⓑ If bullet emerges out of block.



$$v_2 = \sqrt{2gh}$$

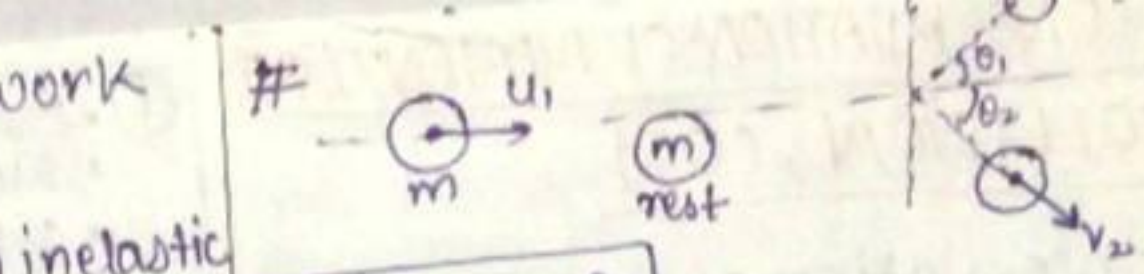
$$h = \frac{m^2(v-v_1)^2}{2gM^2}$$



$$\frac{\tan\alpha}{e} = \tan\beta$$

- For elastic: $\tan\alpha = \tan\beta$
- Perfectly inelastic: $\tan\beta = 90°$

#



$$\theta_1+\theta_2 = 90°$$

condition:
1) Mass same
2) Oblique
3) 2nd at rest
4) elastic

Perfectly inelastic;

$$KE_{loss} = \frac{1}{2}\frac{m_1m_2}{m_1+m_2}(\vec{v}_1-\vec{v}_2)^2$$

Energy transfered in fraction

$$KE = \frac{4m_1m_2}{(m_1+m)^2}$$

condition
1) Elastic
2) 2nd at rest

Centre of mass

$$\vec{r}_{cm} = \frac{m_1\vec{r}_1+m_2\vec{r}_2+m_3\vec{r}_3+\dots}{m_1+m_2+m_3+\dots}$$

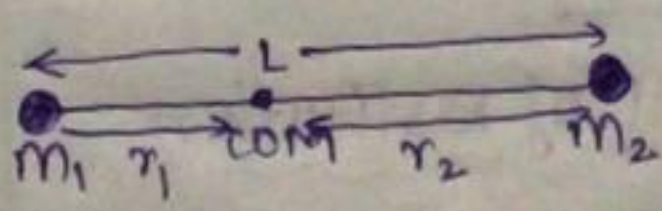
→ Position vector of com

$$x_{cm} = \frac{m_1x_1+m_2x_2+\dots}{m_1+m_2+\dots}$$

$$y_{cm} = \frac{m_1y_1+m_2y_2+\dots}{m_1+m_2+\dots}$$

$$z_{cm} = \frac{m_1z_1+m_2z_2+\dots}{m_1+m_2+\dots}$$

COM of 2 particle system:



From M_1:

$$r_1 = \frac{M_2L}{m_1+m_2}$$

From M_2:

$$r_2 = \frac{m_1L}{m_1+m_2}$$

- Linear mass density (λ) = mass/length
- Surface density (σ) = mass/Area
- Volume density (ρ) = mass/volume

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