

VII. Impulse & Momentum

(A) Impulse = $\int F \cdot dt = F \Delta t = J$

(B) Units are $\text{kg} \cdot \frac{\text{m}}{\text{s}} = \text{N} \cdot \text{s}$

(C) momentum: $p = m \cdot v$

(D) Impulse/Momentum Theorem:

$$\int F dt = \Delta p$$

(E) Conservation of momentum

1. $p_i = p_f$: t.i.m. = t.f.m.

When $\sum F_{\text{ext}} = 0$

2. Elastic : $\Delta K = 0$

3. Inelastic : $\Delta K \neq 0$

(a) perfectly inelastic \Rightarrow stick together

4. Use for collisions/separations

(F) Center of mass

$$x_{\text{cm}} = \frac{\sum x_i m_i}{\sum m_i}$$



2. Laws of motion describe motion of center of mass.



3. Distributed mass

$$\lambda = \alpha x$$



$$x_{\text{cm}} = \frac{\int x dm}{M}$$

$$\lambda = \frac{dm}{dx}$$

$$x_{\text{cm}} = \frac{1}{M} \int_0^L x (\lambda dx)$$

4. Center of gravity vs. center of mass

