

Momentum

Momentum is the product of the mass and velocity.

- $p = m \times v$

Unit: $\text{kg}\cdot\text{m}\cdot\text{s}^{-1}$

Impulse

Impulse is the product of the net force acting on an object and the time it acts.

$$F_{\text{net}}\Delta t = m(v_f - v_i) = \Delta mv = \Delta p$$

Unit: $\text{N}\cdot\text{s}$

MOMENTUM AND IMPULSE

Newton II in terms of momentum

The net force that acts on an object is equal to the rate of change in the momentum of the object.

Closed system
A system where no external forces (non-conservative forces) act on it.

Elastic collisions
A collision is completely elastic if the total kinetic energy of the system just before the collision is the same as the total kinetic energy of the system after the collision.

Change in momentum

$$\begin{aligned} \Delta p &= p_{\text{after}} - p_{\text{before}} \\ &= \Delta mv \\ &= mv_f - mv_i \\ &= m(v_f - v_i) \end{aligned}$$

Remember to interpret the signs.

Unit: $\text{kg}\cdot\text{m}\cdot\text{s}^{-1}$

Conservation of linear momentum

In a closed system the vector sum of the linear momentum before a collision or explosion is equal to the vector sum of the linear momentum after the collision or explosion.

OR

The total momentum of a closed system remains constant.

$$\begin{aligned} \Sigma p_{\text{before}} &= \Sigma p_{\text{after}} \\ \Sigma p_i &= \Sigma p_f \\ m_1 v_i + m_2 v_i &= m_1 v_f + m_2 v_f \end{aligned}$$