Unit 8 – Impulse and Momentum

Derive Impulse Momentum from Newton's 2nd Law

Newton's 2nd Law $\Sigma F = ma$

Replace $a = \frac{\Delta v}{\Delta t}$ $\Sigma F = m\frac{\Delta v}{\Delta t}$

Move Δt **over to other side of equation** $\Delta t * \Sigma F = m\frac{\Delta v}{\cancel{\Delta t}} * \cancel{\Delta t}$

Impulse (*J*) – Momentum (*Δp*) Theorem $\Sigma F * \Delta t = m\Delta v$

$$J = \Sigma F * \Delta t = \Delta p = m\Delta v$$

$$J = \mathrm{N} * s = \Delta p = kg * \frac{m}{s}$$

Conservation of Momentum true for isolated systems.

($p_i = p_f$) or ($p_o = p$)

(Conserve means remains the same before and after)

$$m_1 * v_{o_1} + m_2 * v_{o_2} = m_1 * v_1 + m_2 * v_2$$

Elastic collision conserve momentum AND kinetic energy.

Elastic collisions the objects bounce off of each other.

Inelastic collision conserve momentum *BUT NOT* kinetic energy.

Inelastic collisions the objects stick to each other.

Conservation of Momentum for Inelastic Collisions

$$m_1 * v_{o_1} + m_2 * v_{o_2} = m_1 * v_1 + m_2 * v_2$$

Since they stick together with same final velocity we can rewrite the equation.

$$m_1 * v_{o_1} + m_2 * v_{o_2} = (m_1 + m_2) * v$$

After collision they have a common final velocity.

EXPLOSIONS

It's an Inelastic Collision but stuck together at the start and then separates.

Conservation of Momentum for Explosions!!

$$m_1 * v_{o_1} + m_2 * v_{o_2} = m_1 * v_1 + m_2 * v_2$$

Since they stick together before we can rewrite the equation.

$$(m_1 + m_2) * v_o = m_1 * v_1 + m_2 * v_2$$

Before the explosion (collision) they have a common initial velocity.