Conservation of Momentum (1-D)

In an isolated system (i.e. no external forces)

$$\Delta\vec{P}_{total} = \vec{0}$$

$$\vec{P}_{total,i} = \vec{P}_{total,f}$$

Total Momentum Before = Total Momentum After

$$\sum_{k=1}^{n} m_k\vec{v}_{ki} = \sum_{k=1}^{n} m_k\vec{v}_{kf}$$

$$m_1\vec{v}_{1i} + m_2\vec{v}_{2i} + \cdots + m_n\vec{v}_{ni} = m_1\vec{v}_{1f} + m_2\vec{v}_{2f} + \cdots + m_n\vec{v}_{nf}$$

- For **Elastic Collisions**
  (Momentum and Kinetic Energy are conserved)
- For **Inelastic Collisions** (Momentum is conserved, but kinetic energy is not conserved – the energy dissipates into sound, heat, deformation of the objects, etc.)

Example (Inelastic):

Steve (m_m=57kg) runs with a speed of 4 m/s and collides with Lukas (m_c=100kg) who is stationary. If Steve wraps his arms around Lukas during the tackle, what is their final combined speed?