

1-D Collision (Elastic)



1) No external forces \rightarrow Conservation of $\rightarrow \vec{p}_i = \vec{p}_f$
Momentum

2) Elastic \rightarrow Conservation of $\rightarrow KE_i = KE_f$
Energy

$$\vec{p}_i = \vec{p}_f$$

$$1) \quad m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$$30 - 20 = v_{1f} + v_{2f}$$

$$\boxed{v_{2f} = 10 - v_{1f}}$$

$$2) \quad KE_i = KE_f$$

$$\frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$$

$$\boxed{30^2 + 20^2 = v_{1f}^2 + v_{2f}^2}$$

$$\textcircled{1} \rightarrow \textcircled{2} \quad 1300 = v_{1f}^2 + 100 + v_{1f}^2 - 20v_{1f}$$

$$v_{1f}^2 - 10v_{1f} - 600 = 0$$

$$(v_{1f} - 30)(v_{1f} + 20) = 0$$

$$v_{1f} = 30 \text{ or } -20$$

Must choose $v_{1f} = -20$ if we know a collision occurred

$$\text{thus } \boxed{v_{1f} = -20 \frac{\text{cm}}{\text{s}} \quad v_{2f} = 30 \frac{\text{cm}}{\text{s}}}$$