Collisions

Perfectly Elastic One Dimensional Collision

- When mass of two colliding bodies are equal, then $v_1 = u_2$ and $v_2 = u_1$
- If second body of same mass is at rest, then after collision, then, $v_1 = 0$ and $v_2 = u_1$
- If $m_1 \ll m_2$ and m_2 is at rest, then, $v_1 = -u_1$ and $v_2 = 0$
- If $m_1 \gg m_2$ and m_2 is at rest, then, $v_1 = u_1$ and $v_2 = 2u_1$

$$v_1 = \frac{(m_1 - m_2)u_1 + 2m_2u_2}{(m_1 + m_2)}; \quad v_2 = \frac{(m_2 - m_1)u_2 + 2m_1u_1}{(m_1 + m_2)}$$

Two Dimensional / Oblique Collision

From law of conservation of momentum,

$$m_1u = m_1v_1 \cos\alpha + m_2v_2 \cos\beta;$$
$$0 = m_1v_1 \sin\alpha - m_2v_2 \sin\beta$$

Also, $$\frac{1}{2}m_1u^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$$

Inelastic Collision

e = coefficient of restitution

(In perfectly inelastic one dimensional collision e = 0)

Loss of kinetic energy

$$\Delta KE = \frac{m_1m_2}{2(m_1 + m_2)}(u_1 - u_2)^2(1 - e^2)$$

Coefficient of Restitution or Resilience (e).

For perfectly elastic collision, $e = 1$	For perfectly inelastic collision, $e = 0$

For all other collisions, $0 < e < 1$