# Collision Types

| Collision | Momentum conserved? | Energy conserved? |
|---|---|---|
| Elastic | Yes | Yes |
| Perfectly Inelastic | Yes | No |
| Inelastic | No | No |

# Energy and Momentum in Collisions

p. 216 #1)

a) object 1 → arrow

$m_1 = 0.25\ kg$

$v_{1i} = 12\ m/s$ west

object 2 → target

$m_2 = 6.8\ kg$

$v_{2i} = 0\ m/s$

final object → arrow + target

$m_1 + m_2 = 7.05\ kg$

$v_f = ?$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$v_f = \frac{m_1 v_{1i}}{m_1 + m_2}$$

$$= 0.43\ m/s$$

b) $$E_{lost} = K_f - K_i$$

$$= \frac{1}{2}(m_1 + m_2) v_f^2 - \frac{1}{2} m_1 v_{1i}^2$$

$$= 0.65\ J - 18\ J$$

$$= -17.35\ J$$

p. 219 #2) → +

a) [2] → ← [1] ⇒ ← [2] [1] →

raft canoe

1 → $m_1 = 16\,kg$, $v_{1i} = -12.5\,m/s$, $v_{1f} = ?$

2 → $m_2 = 14\,kg$, $v_{2i} = 16\,m/s$, $v_{2f} = -14.4\,m/s$

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

$$v_{1f} = \frac{1}{m_1}\left[m_1 v_{1i} + m_2 v_{2i} - m_2 v_{2f}\right]$$

$$= \frac{1}{16\,kg}\left[(-200\,kg\cdot m/s) + (224\,kg\cdot m/s) - (-201.6\,kg\cdot m/s)\right]$$

$$= \frac{1}{16\,kg}(225.6\,kg\cdot m/s)$$

$$= 14.1\,m/s$$

b) $K_i = \frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2$

$= 1250\,J + 1792\,J$

$= 3042\,J$

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

$= 1590.5\,J + 1451.5\,J$

$= 3042\,J$