

## 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

$$m_1 = 0.25 \text{ kg}$$

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

object 2 → target

$$m_2 = 6.8 \text{ kg}$$

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

final object → arrow + target

$$m_1 + m_2 = 7.05 \text{ kg}$$

$$v_f = ?$$

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

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

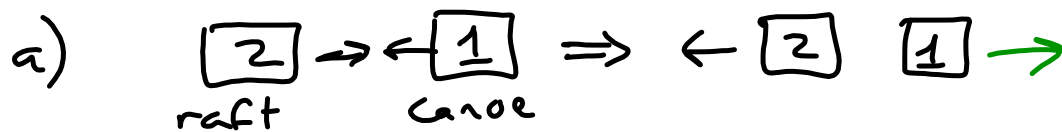
$$= 0.43 \text{ m/s}$$

$$b) \quad E_{\text{lost}} = K_f - K_i$$

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

$$= 0.65 \text{ J} - 18 \text{ J}$$

$$= -17.35 \text{ J}$$

p. 219 #2)  $\rightarrow +$ 

$$\begin{array}{ll} \underline{1} \rightarrow m_1 = 16 \text{ kg} & \underline{2} \rightarrow m_2 = 14 \text{ kg} \\ v_{1i} = -12.5 \text{ m/s} & v_{2i} = 16 \text{ m/s} \\ v_{1f} = ? & v_{2f} = -14.4 \text{ m/s} \end{array}$$

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

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

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

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

$$= 14.1 \text{ m/s}$$

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

$$= 1250 \text{ J} + 1792 \text{ J}$$

$$= 3042 \text{ J}$$

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

$$= 1590.5 \text{ J} + 1451.5 \text{ J}$$

$$= 3042 \text{ J}$$