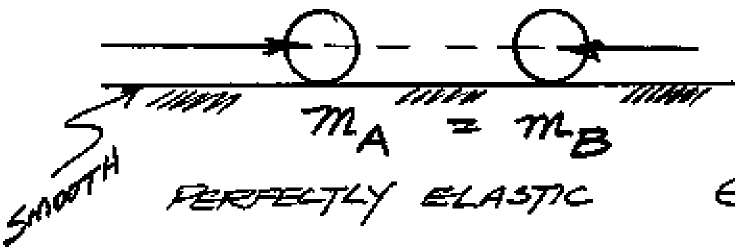
# HIBBELER — IMPACT

**15-59**




$m_A = m_B$

DIRECT CENTRAL HIT.

PERFECTLY ELASTIC $\quad e = 1$

PROVE $\quad KE_{BEFORE} = KE_{AFTER}$

$$m_A V_A)_i + m_B V_B)_i = m_A V_A)_f + m_B V_B)_f$$

$$m_A [V_{Ai} - V_{Af}] = m_B [V_{Bf} - V_{Bi}] \quad (1)$$

BY DEFINITION

$$e = \frac{(V_{Bf} - V_{Af})}{V_{Ai} - V_{Bi}} = 1 \quad (2)$$

$$\therefore\ V_{Bf} - V_{Af} = V_{Ai} - V_{Bi} \quad (3)$$

set $(1) = \cancel{(2)} = 1 = (4)$ $\quad$ or $(V_{Bf} + V_{Bi}) = (V_{Ai} + V_{Af})\ (4)$

$$\frac{m_A [V_{Ai} - V_{Af}]}{m_B [V_{Bf} - V_{Bi}]} = 1 = \frac{(V_{Bf} \cancel{-} V_{Af})}{(V_{Ai} \cancel{-} V_{Bi})} = \frac{(V_{Bf} + V_{Bi})}{(V_{Ai} + V_{Af})}$$

CROSS MULTIPLY:

$$m_A [V_{Ai} - V_{Af}](V_{Ai} + V_{Af}) = m_B [V_{Bf} - V_{Bi}](V_{Bf} + V_{Bi})$$

$$m_A [V_{Ai}^2 - V_{Af}^2] = m_B [V_{Bf}^2 - V_{Bi}^2] \quad \times \frac{1}{2}$$

$$\underbrace{\frac{1}{2} m_A V_{Ai}^2 + \frac{1}{2} m_B V_{Bi}^2}_{KE_i} = \underbrace{\frac{1}{2} m_B V_{Bf}^2 + \frac{1}{2} m_A V_{Af}^2}_{KE_f}$$