Problem 8-39

(a) Linear momentum is conserved (as in Exercise 8-21).

$$\therefore m_H v_{Hx} + m_B v_{Bx} = m_H v_{Hx}' + m_B v_{Bx}'$$

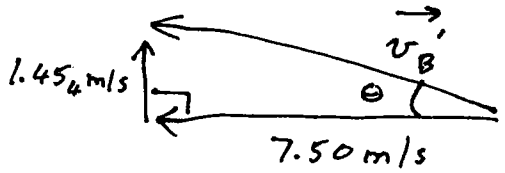
$$\therefore 100(0) + (90.0)(-15.0 \sin 30.0^\circ) = 100(0) + 90.0\, v_{Bx}'$$

$$\therefore v_{Bx}' = -15.0 \sin 30.0^\circ = -7.50 \text{ m/s}$$

In y-direction: $m_H v_{Hy} + m_B v_{By} = m_H v_{Hy}' + m_B v_{By}'$

$$\therefore 100(10.0) + (90.0)(-15.0 \cos 30.0^\circ) = 100(-3.00) + 90.0\, v_{By}'$$

$$\therefore v_{By}' = 1.45_4 \text{ m/s}$$



$\Rightarrow v_B' = 7.64 \text{ m/s} \quad (7.64_0 \text{ m/s})$

$\theta = 11.0^\circ$

(b) $$\Delta KE = \left(\tfrac{1}{2} m_H v_H'^2 + \tfrac{1}{2} m_B v_B'^2\right) - \left(\tfrac{1}{2} m_H v_H^2 + \tfrac{1}{2} m_B v_B^2\right)$$

$$= \tfrac{1}{2}\left[m_H (v_H'^2 - v_H^2) + m_B (v_B'^2 - v_B^2)\right]$$

$$= \tfrac{1}{2}\left[100\left((3.00)^2 - (10.00)^2\right) + 90.0\left((7.64_0)^2 - (15.0)^2\right)\right]$$

$$= -1.20 \times 10^4 \text{ J}$$