PROB. 14-43

$W_A = 60^{LB}$, $W_B = 40^{LB}$, $L = 6^{ft}$, $v_{A0} = v_{B0} = 0$,

FIND v_A AND v_B WHEN $\theta = 0°$

IMPULSE - MOMENTUM PRINCIPLE:

$$\Sigma \cancel{m\vec{v}_1}^{\,0} + \Sigma \overrightarrow{IMP}_{1-2} = \Sigma m \vec{v}_2$$

$$\Sigma \overrightarrow{IMP}_{1-2} = (-W_A t)\hat{j} + (-W_B t)\hat{j} + (R_A t)\hat{j}$$

X-DIRECTION: $0 = m_A v_A + m_B v_B$

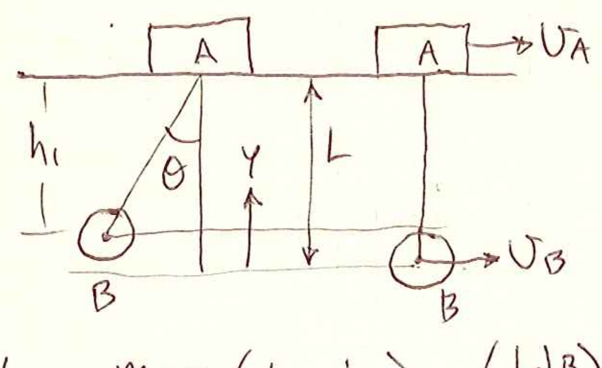
$$0 = \left(\frac{W_A}{g}\right) v_A + \left(\frac{W_B}{g}\right) v_B$$

$$\boxed{v_A = -\left(\frac{W_B}{W_A}\right) v_B}$$

CONSERVE ENERGY: NO FRICTION

$$\cancel{T_1}^{\,0} + V_1 = T_2 + V_2$$

$$\cancel{V_{1A}} + V_{1B} = T_{2A} + T_{2B} + \cancel{V_{2A}} + V_{2B}$$



SINCE h_A DOES NOT CHANGE, $V_{1A} = V_{2A}$

$$V_{1B} = m_B g (L - h_1) = \left(\frac{W_B}{g}\right) g (L - L\cos\theta) = W_B L (1 - \cos\theta)$$

$$T_{2A} = \frac{1}{2} m_A v_A^2 = \frac{1}{2}\left(\frac{W_A}{g}\right) v_A^2$$

$$T_{2B} = \frac{1}{2} m_B v_B^2 = \frac{1}{2}\left(\frac{W_B}{g}\right) v_B^2$$

PROB. 14-43 CONT.

$$W_B L(1-\cos\theta) = \left(\frac{W_A}{2g}\right)v_A^2 + \left(\frac{W_B}{2g}\right)v_B^2$$

$$W_B L(1-\cos\theta) = \left(\frac{W_A}{2g}\right)\left[-\left(\frac{W_B}{W_A}\right)v_B\right]^2 + \left(\frac{W_B}{2g}\right)v_B^2$$

$$W_B L(1-\cos\theta) = \frac{v_B^2}{2g}\left(\frac{W_B^2}{W_A} + W_B\right)$$

$$\cancel{W_B} L(1-\cos\theta) = \cancel{W_B}\left(\frac{v_B^2}{2g}\right)\left(\frac{W_B}{W_A} + 1\right)$$

$$L = (1-\cos\theta) = \left(\frac{W_A + W_B}{2g W_A}\right)v_B^2$$

$$v_B = \sqrt{\frac{2gLW_A(1-\cos\theta)}{(W_A + W_B)}}$$

$$v_B = \sqrt{\frac{2\left(32.2\ \frac{ft}{s^2}\right)(6\ ft)(60\ LB)(1-\cos 25^\circ)}{(60+40)\ LB}}$$

$$\boxed{v_B = 4.661\ \frac{ft}{s} \longrightarrow}$$

$$v_A = -\left(\frac{40}{60}\right)(4.661)\ \boxed{= -3.107\ \frac{ft}{s} \longleftarrow}$$