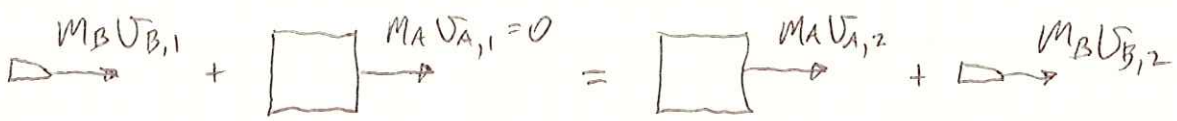
PROB. 13-148

$W_B = (0.5\,oz)\left(\frac{lb}{16\,oz}\right) = 0.03125\,lb$, $W_A = W_C = 3\,lb$

$\mu_K = 0.25$, $v_{B,1} = v_0$, $v_{A,1} = v_{C,1} = 0$, $\Delta x_A = \frac{1}{2}\,ft$

$\Delta x_C = \frac{1}{3}\,ft$, FIND v_0

BULLET STRIKES BLOCK A:



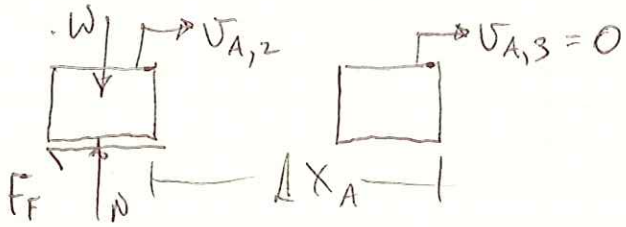
$\sum m\vec{v}_1 + \sum \int \vec{F}\,dt = \sum m\vec{v}_2$ NO EXTERNAL IMPULSES

$0 + m_B v_0 = m_A v_{A,2} + m_B v_{B,2}$

$v_0 = \left(\frac{m_A}{m_B}\right) v_{A,2} + v_{B,2} = \left(\frac{W_A}{W_B}\right) v_{A,2} + v_{B,2}$

BLOCK A SLIDES TO A STOP: PRINCIPLE OF WORK + ENERGY

$T_1 + U_{1-2} = T_2$



$T_1 = \frac{1}{2} m_A v_{A,2}^2 = \frac{1}{2}\left(\frac{W_A}{g}\right) v_{A,2}^2$, $U_{1-2} = -F_F \cdot \Delta x_A = -\mu_K W_A \cdot \Delta x_A$

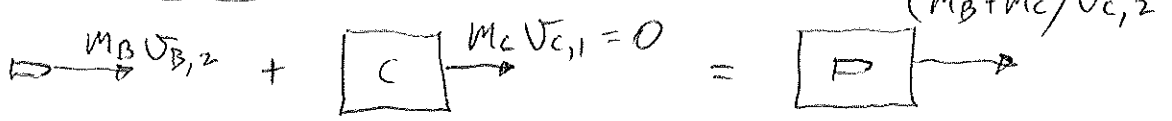
$T_2 = \frac{1}{2} m_A v_{A,3}^2 = 0$

$\frac{1}{2}\left(\frac{W_A}{g}\right) v_{A,2}^2 - \mu_K W_A \cdot \Delta x_A = 0$

$v_{A,2} = \sqrt{2g\mu_K \cdot \Delta x_A} = \sqrt{2\left(32.2\,\frac{ft}{s^2}\right)(0.25)\left(\frac{1}{2}\,ft\right)} = 2.837\,\frac{ft}{s}$

BULLET STRIKES BLOCK C:

PROB. 13-148 CONT.



$\sum m\vec{v}_1 + \sum \int \vec{F}\,dt = \sum m\vec{v}_2$ NO EXTERNAL IMPULSES

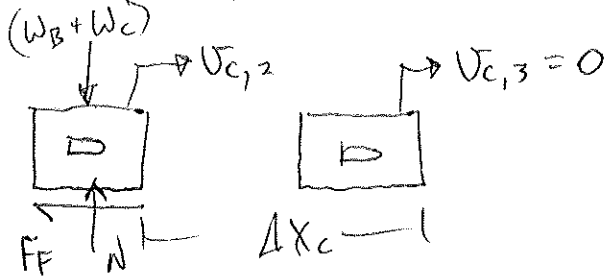
$m_B v_{B,2} + 0 = (m_B + m_C) v_{C,2}$

$\left(\frac{W_B}{g}\right) v_{B,2} = \frac{1}{g}(W_B + W_C) v_{C,2}$

$v_{B,2} = \left(1 + \frac{W_C}{W_B}\right) v_{C,2}$

BLOCK C AND BULLET B SLIDE TO A STOP: W + E

$T_1 + U_{1-2} = T_2$



$T_1 = \frac{1}{2}(m_B + m_C) v_{C,2}^2 = \frac{1}{2g}(W_B + W_C) v_{C,2}^2$

$U_{1-2} = -F_F \cdot \Delta x_C = -\mu_K (W_B + W_C) \cdot \Delta x_C$, $T_2 = \frac{1}{2}(m_B + m_C) v_{C,3}^2 = 0$

$\frac{1}{2g}(W_B + W_C) v_{C,2}^2 - \mu_K (W_B + W_C) \cdot \Delta x_C = 0$

$v_{C,2} = \sqrt{2g\mu_K \cdot \Delta x_C} = \sqrt{2\left(32.2 \frac{ft}{s^2}\right)(0.25)\left(\frac{1}{3} ft\right)} = 2.317 \frac{ft}{s}$

$v_{B,2} = \left[1 + \frac{(3^{LB})}{(0.03125^{LB})}\right]\left(2.317 \frac{ft}{s}\right) = 224.7 \frac{ft}{s}$

$v_0 = \left(\frac{3^{LB}}{0.03125^{LB}}\right) \cdot \left(2.837 \frac{ft}{s}\right) + \left(224.7 \frac{ft}{s}\right) = 497.1 \frac{ft}{s}$