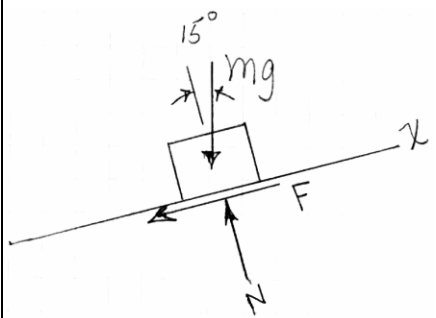


**Chapter 13, Solution 123.**



$W = 20,000 \text{ lb}$

$m = \frac{20,000}{32.2} = 621.118 \text{ lb}\cdot\text{s}^2/\text{ft}$

Momentum in the  $x$  direction

$$x: mv_0 - (F + mg \sin 15^\circ) t = mv_1$$

$$621.118(108) - (F + mg \sin 15^\circ) 6 = (621.118)(36)$$

$$F + mg \sin 15^\circ = 7453.4$$

(a)  $F = 7453.4 - 20,000 \sin 15^\circ = 2277 \text{ lb}$

$F = 2280 \text{ lb} \blacktriangleleft$

(b)  $mv_0 - (F + mg \sin 15^\circ) t = 0 \quad t = \text{total time}$

$$621.118(108) - 7453.4 t = 0; \quad t = 9.00 \text{ s}$$

**Additional time = 9 - 6 = 3 s ◀**

**Chapter 13, Solution 140.**

$$m = 2 \text{ oz} \left( \frac{1 \text{ lb}}{16 \text{ oz}} \right) \left( \frac{1}{32.2 \text{ ft/s}^2} \right) = 0.003882 \text{ lb} \cdot \text{s}^2/\text{ft}$$

Conservation of energy (before impact)

$$\frac{1}{2} m v_1^2 + mgh_1 = \frac{1}{2} m (v_1^2 + v_{Ay}^2)$$

$$\frac{1}{2} m (54)^2 + m (32.2) (4.5) = \frac{1}{2} m (54^2 + v_{Ay}^2)$$

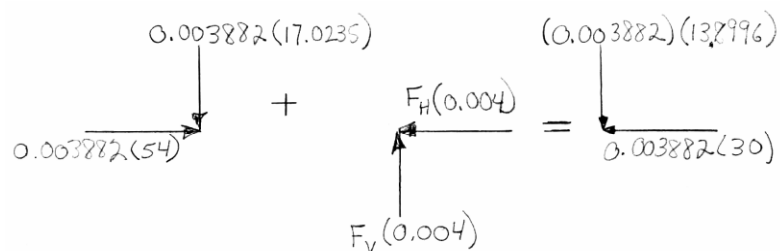
$$v_{Ay} = 17.0235 \text{ ft/s (Just before impact)}$$

Conservation of energy (after impact)

$$\frac{1}{2} m (v_{Ay}'^2 + v_2^2) = \frac{1}{2} m (v_2)^2 + mg h_2$$

$$\frac{1}{2} m [v_{Ay}'^2 + (30)^2] = \frac{1}{2} m (30)^2 + m (32.2)(3)$$

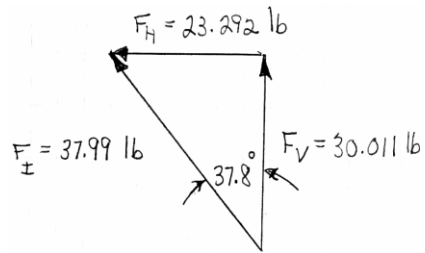
$$v_{Ay}' = 13.8996 \text{ ft/s (Just after impact)}$$



$$+\rightarrow x : 0.003882(54) - F_H(0.004) = 0.003882(30), F_H = 23.292 \text{ lb}$$

$$+\uparrow y : -0.003882(17.0235) + F_V(0.004) = 0.003882(13.8996), F_V = 30.011 \text{ lb}$$

$F_I = \text{impulsive force}$



$$F_I = 38.0 \text{ lb} \quad \nearrow 52.2^\circ \quad \blacktriangleleft$$

**Chapter 13, Solution 148.**

$$\mathbf{v}_A = \mathbf{v}_{A/B} + \mathbf{v}_B : \mathbf{v}_A = \frac{30^\circ}{3.59 \text{ m/s}} + \leftarrow \mathbf{v}_B$$

$$\rightarrow m_A v_{Ax} + m_B v_{Bx} = 0 \quad 2[3.59 \cos 30^\circ - v_B] + 10(-v_B) = 0$$

$$v_B = 0.518 \text{ m/s Just before impact } \leftarrow$$

After impact,  $v_A = v_B = 0$

(a)  $\therefore F \Delta t = -m_A v_A = -2 \left[ \begin{array}{c} 3.59 \\ \swarrow 30^\circ \end{array} + \begin{array}{c} 0.5182 \\ \leftarrow \end{array} \right] = \begin{array}{c} \uparrow 3.59 \\ \leftarrow 5.1817 \end{array}$

$F \Delta t = 6.30 \text{ N}\cdot\text{s}$   $\swarrow 34.7^\circ$  ◀

(b) Loss = T, just before impact =  $\frac{1}{2} (2 v_A^2) + \frac{1}{2} (10 v_B^2)$

$$T = \left[ \frac{6.3038}{2} \right]^2 + 5 (0.51817)^2 = 11.28 \text{ J } \blacktriangleleft$$