An airline employee tosses two suitcases in rapid succession, with a horizontal velocity of 7.2 ft/s, onto a 50-lb baggage carrier which is initially at rest. (*a*) Knowing that the final velocity of the baggage carrier is 3.6 ft/s and that the first suitcase the employee tosses onto the carrier has a weight of 30 lb, determine the weight of the other suitcase. (*b*) What would be the final velocity of the carrier if the employee reverses the order in which he tosses the suitcases?

$$L = L'$$

$$L_A + L_B + \cancel{L_C} = L'_A + L'_B + L'_C$$

$$0$$

$$V'_A = V'_B = V'_C$$

$$m_A v_A + m_B v_B = m_A v'_A + m_B v'_B + m_C v'_C$$

$$= (m_A + m_B + m_C) v'_C$$

$$30 \cdot 7.6 + m_B 7.6 = (30 + m_B + 50) 3.6$$

$$= (30+50) 3.6 + m_B 3.6$$

$$(7.6 - 3.6) m_B = (30+50) 3.6 - 30 \cdot 7.6$$

$$m_B = \frac{(30+50) 3.6 - 30 \cdot 7.6}{7.6 - 3.6} = \boxed{15 \text{ lb}}$$

Energy for a system of particles

$$T = \frac{1}{2}\sum_{i=1}^{n} m_i v_i^2$$

$$v_i = \bar{v} + v_i' \qquad T = \frac{1}{2} m \bar{v}^2 + \frac{1}{2}\sum_{i=1}^{n} m_i v_i'^2$$

$$T_1 + U_{1\to 2} = T_2$$

$$T_1 + V_1 = T_2 + V_2$$

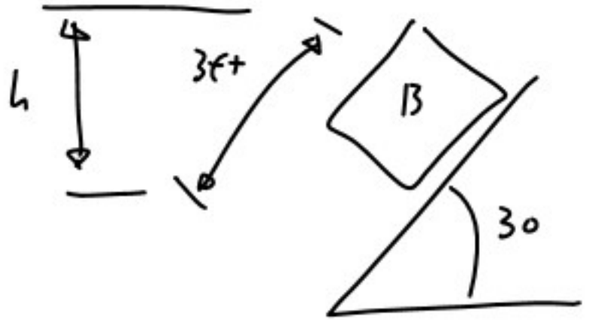
Impulse in a system

$$\vec{L}_1 + \sum_{i=1}^{n} \int_{t_1}^{t_2} \vec{F}_i \, dt = \vec{L}_2$$

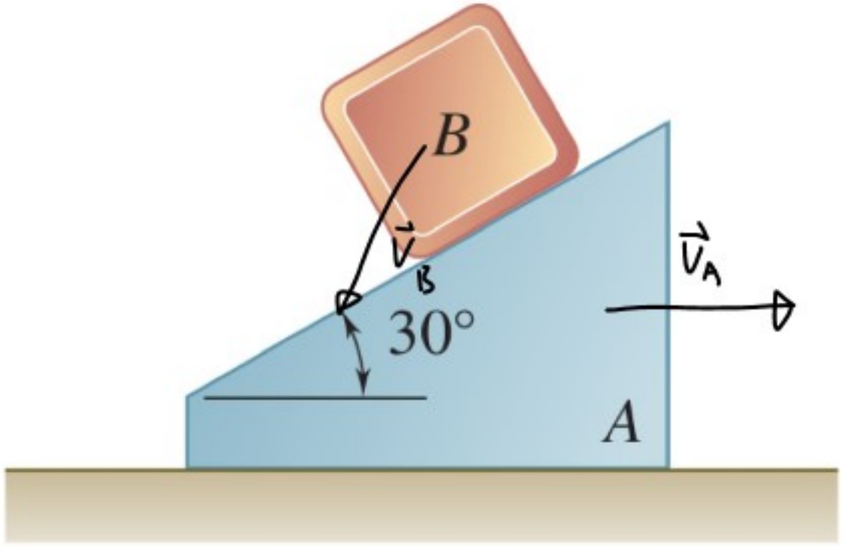
$$\vec{L}_1 + \sum_{i=1}^{n} (\overrightarrow{Imp_i})_{1 \to 2} = \vec{L}_2$$

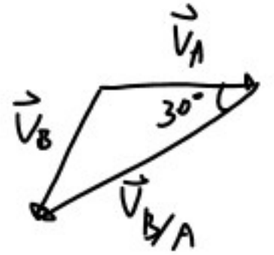
$$(\vec{H}_o)_1 + \sum_{i=1}^{n} \int_{t_1}^{t_2} (M_o)_i \, dt = (\vec{H}_o)_2$$

A 15-lb block B starts from rest and slides on the 25-lb wedge A, which is supported by a horizontal surface. Neglecting friction, determine (*a*) the velocity of B relative to A after it has slid 3 ft down the inclined surface of the wedge, (*b*) the corresponding velocity of A.



$h = 3 \sin 30$





$V_{Bx} = V_A - V_{B/A} \cos 30$

$V_B^2 = V_A^2 + V_{B/A}^2 - 2 V_A V_{B/A} \cos 30$

$\vec{L}_1 = \vec{L}_2$

$0 = \vec{L}_A + \vec{L}_B = m_A \vec{V}_A + m_B \vec{V}_B$

$m_A V_{AX} + m_B V_{BX} = 0$

$m_A V_A + m_B V_{BX} = 0$

$m_A V_A + m_B (V_A - V_{B/A}(0530) = 0$

$25 V_A + 15 (V_A - 0.866 V_{B/A}) = 0$

$25 V_A + 15 V_A - 13 V_{B/A} = 0$

$40 V_A = 13 V_{B/A}$

$V_A = 0.32 V_{B/A}$

$T_1 + V_1 = T_2 + V_2$

$T_{A1} + V_{B1} = T_{A2} + T_{B2} + V_{A2} + V_{B2}$

$m_B g h = \frac{1}{2} m_A V_A^2 + \frac{1}{2} m_B V_B^2$

$W_B h = \frac{1}{2} m_A (0.32 V_{B/A})^2 + \frac{1}{2} m_B (V_A^2 + V_{B/A}^2 - 2 V_A V_{B/A} \cos 30)$

$(15) 3 \sin 30 = \frac{1}{2} \frac{25}{32.2} (0.32 V_{B/A})^2 + \frac{1}{2} \frac{15}{32.2} ((0.32 V_{B/A})^2 + V_{B/A}^2 - 2(0.32 V_{B/A}) V_{B/A} \cos 30)$

$22.5 = 0.167 V_{B/A}^2$

$V_{B/A}^2 = 139$

$V_{B/A} = 11.6$ ft/s

$V_A = 0.32 V_{B/A} = 3.7$ ft/s

A 40-lb block B is suspended from a 6-ft cord attached to a 60-lb cart A, which may roll freely on a frictionless, horizontal track. If the system is released from rest in the position shown, determine the velocities of A and B as B passes directly under A.