

Midterm

Thursday - Saturday

Everything through Assignment 7

Motion of the Mass Center

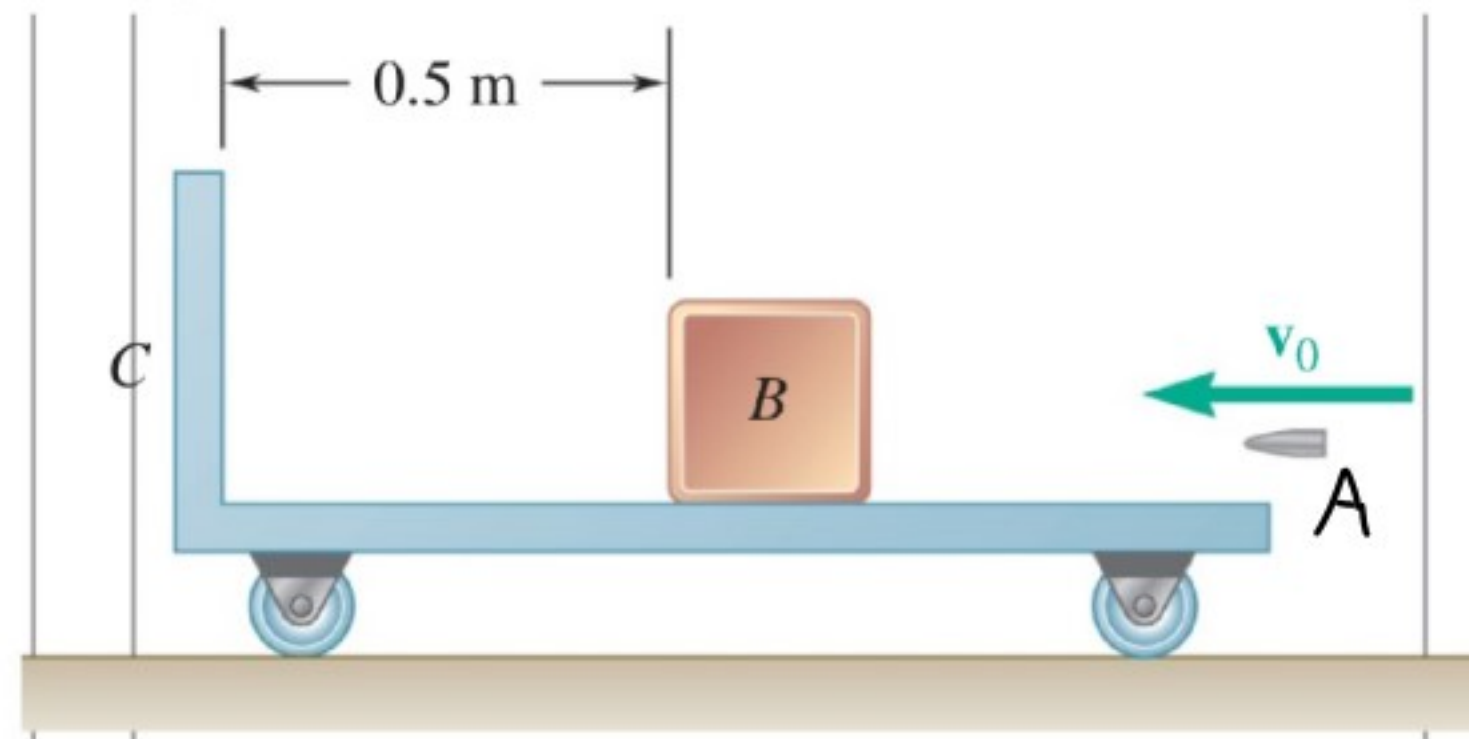
$$\sum \vec{M}_G = \dot{\vec{H}}_G$$

$$\vec{H}_G = \sum_{i=1}^n \vec{r}_i' \times m_i \vec{v}_i = \sum_{i=1}^n \vec{r}_i' \times m_i \vec{v}_i'$$

\vec{r}_i' Vector from center of mass to P_i

$$\vec{v}_i = \vec{v} + \vec{v}_i'$$

A 30-g bullet is fired with a horizontal velocity of 450 m/s and becomes embedded in block B , which has a mass of 3 kg. After the impact, block B slides on 30-kg carrier C until it impacts the end of the carrier. Knowing the impact between B and C is perfectly plastic and the coefficient of kinetic friction between B and C is 0.2, determine (a) the velocity of the bullet and B after the first impact, (b) the final velocity of the carrier.



$$L_A + L_B = L'_A + L'_B$$

$$V'_A = V'_B$$

$$m_A V_A = m_A V'_A + m_B V'_B = m_A V'_B + m_B V'_B = V'_B (m_A + m_B)$$

$$0.03(950) = V'_B (0.03 + 3)$$

$$V'_B = \frac{0.03(950)}{0.03 + 3} = \boxed{9.46 \text{ m/s}}$$

$$L_A + L_B + L_C = L'_A + L'_B + L'_C$$

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

$$\begin{aligned} m_A V_A &= m_A V'_A + m_B V'_B + m_C V'_C = m_A V'_C + m_B V'_C + m_C V'_C \\ &= V'_C (m_A + m_B + m_C) \end{aligned}$$

$$0.03(950) = V'_C (0.03 + 3 + 30)$$

$$V'_C = \frac{0.03(950)}{0.03 + 3 + 30} = \boxed{0.9 \text{ m/s}}$$

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?

