

UBC Engineering

A m_A kg box labelled (A) has an initial velocity of v_A , m/s before it slides down the smooth h m tall ramp. At the bottom of the ramp, it impacts a m_B kg stationary box labelled (B). If the coefficient of restitution between the boxes is e , what is the velocity of B after the collision?

given

m_A, v_{A1}, h, m_B, e

find

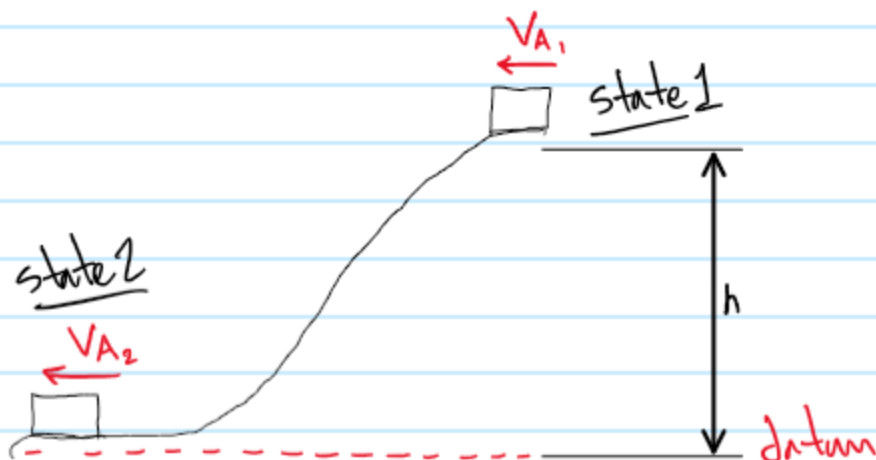
v_{B3}

Conservation of Energy

$$T_1 + V_1 = T_2 + V_2$$

$$\frac{1}{2} m_A v_{A1}^2 + m_A g h = \frac{1}{2} m_A v_{A2}^2 + 0$$

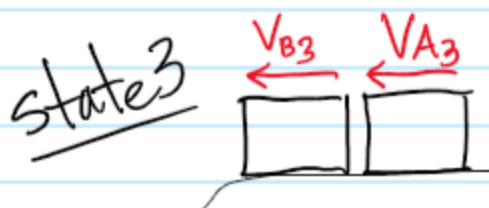
$$v_{A2} = \sqrt{v_{A1}^2 + 2gh}$$



Conservation of Momentum

$$m_A v_{A2} + m_B v_{B2} = m_A v_{A3} + m_B v_{B3}$$

$$m_A v_{A2} = m_A v_{A3} + m_B v_{B3}$$



$$e = \frac{v_{B3} - v_{A3}}{v_{A2} - v_{B2}}$$

$$\textcircled{1} \quad v_{A3} = \frac{m_A v_{A2} - m_B v_{B3}}{m_A}$$

$$\textcircled{2} \quad v_{A3} = v_{B3} - e(v_{A2})$$

$$\textcircled{1} \rightarrow \textcircled{2} \quad \frac{m_A v_{A2} - m_B v_{B3}}{m_A} = v_{B3} - e(v_{A2})$$

$$m_A v_{A2} - m_B v_{B3} = m_A v_{B3} - m_A e v_{A2}$$

$$v_{B3} = \frac{m_A v_{A2} + m_A e v_{A2}}{m_A + m_B}$$