

27. No external forces with horizontal components act on the man-stone system and the vertical forces sum to zero, so the total momentum of the system is conserved. Since the man and the stone are initially at rest, the total momentum is zero both before and after the stone is kicked. Let m_s be the mass of the stone and v_s be its velocity after it is kicked; let m_m be the mass of the man and v_m be his velocity after he kicks the stone. Then $m_s v_s + m_m v_m = 0 \rightarrow v_m = -m_s v_s / m_m$. We take the axis to be positive in the direction of motion of the stone. Then

$$v_m = - \frac{(0.068 \text{ kg})(4.0 \text{ m/s})}{91 \text{ kg}} = -3.0 \times 10^{-3} \text{ m/s} .$$

The negative sign indicates that the man moves in the direction opposite to the direction of motion of the stone.