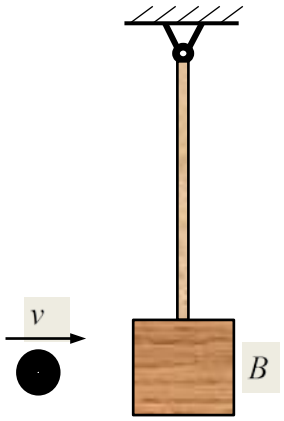
4-11. The 1-kg ball is thrown at the suspended 5-kg block with a normally distributed velocity $v_0 \sim N(10, 1^2)$ m/s. The coefficient of restitution between the ball and the block is $e = 0.8$. Determine the velocity of the block just after the impact.



$$m_A(v_A)_1 + m_B(v_B)_1 = m_A(v_A)_2 + m_B(v_B)_2$$

$$m_A v_0 + 0 = m_A(v_A)_2 + m_B(v_B)_2$$

$$(v_A)_2 = v_0 - \frac{m_B}{m_A}(v_B)_2$$

$$e = \frac{(v_B)_2 - (v_A)_2}{(v_A)_1 - (v_B)_1} = \frac{(v_B)_2 - (v_A)_2}{v_0}$$

$$(v_B)_2 = ev_0 + (v_A)_2 = ev_0 + v_0 - \frac{m_B}{m_A}(v_B)_2$$

$$(v_B)_2 = \frac{(1+e)m_A v_0}{m_A + m_B}$$

$$\mu_{(v_B)_2} = \frac{(1+e)m_A \mu_{v_0}}{m_A + m_B} = \frac{(1+0.8)(1)(10)}{1+5} = 3 \text{ m/s}$$

$$\sigma_{(v_B)_2} = \frac{(1+e)m_A \sigma_{v_0}}{m_A + m_B} = \frac{(1+0.8)(1)(1)}{1+5} = 0.3 \text{ m/s}$$

Therefore, $(v_B)_2 \sim N(3, 0.3^2)$ m/s. **Ans.**