40. First, we find the speed v of the ball of mass m_1 right before the collision (just as it reaches its lowest point of swing). Mechanical energy conservation (with $h = 0.700$ m) leads to

$$m_1 gh = \frac{1}{2} m_1 v^2 \implies v = \sqrt{2gh} = 3.7 \text{ m/s} .$$

(a) We now treat the elastic collision (with SI units) using Eq. 10-30:

$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v = \frac{0.5 - 2.5}{0.5 + 2.5}(3.7) = -2.47$$

which means the final speed of the ball is 2.47 m/s.

(b) Finally, we use Eq. 10-31 to find the final speed of the block:

$$v_{2f} = \frac{2m_1}{m_1 + m_2} v = \frac{2(0.5)}{0.5 + 2.5}(3.7) = 1.23 \text{ m/s} .$$