46. (a) Conservation of linear momentum implies $m_A\vec{v}_A + m_B\vec{v}_B = m_A\vec{v}'_A + m_B\vec{v}'_B$. Since $m_A = m_B = m = 2.0\,\text{kg}$, the masses divide out and we obtain (in m/s)

$$\begin{aligned}\vec{v}'_B &= \vec{v}_A + \vec{v}_B - \vec{v}'_A \\ &= (15\hat{\text{i}} + 30\hat{\text{j}}) + (-10\hat{\text{i}} + 5\hat{\text{j}}) - (-5\hat{\text{i}} + 20\hat{\text{j}}) \\ &= 10\hat{\text{i}} + 15\hat{\text{j}}\ .\end{aligned}$$

(b) The final and initial kinetic energies are

$$\begin{aligned}K_f &= \frac{1}{2}mv'^2_A + \frac{1}{2}mv'^2_B = \frac{1}{2}(2.0)\left((-5)^2 + 20^2 + 10^2 + 15^2\right) = 8.0 \times 10^2\ \text{J} \\ K_i &= \frac{1}{2}mv^2_A + \frac{1}{2}mv^2_B = \frac{1}{2}(2.0)\left(15^2 + 30^2 + (-10)^2 + 5^2\right) = 1.3 \times 10^3\ \text{J}\ .\end{aligned}$$

The change kinetic energy is then $\Delta K = -5.0 \times 10^2\,\text{J}$ (that is, 500 J of the initial kinetic energy is lost).