64. (a) We choose a coordinate system with $+x$ downriver and $+y$ in the initial direction of motion of the second barge. The velocities in component forms are $\vec{v}_{1i} = (6.2\,\mathrm{m/s})\hat{\mathrm{i}}$ and $\vec{v}_{2i} = (4.3\,\mathrm{m/s})\hat{\mathrm{j}}$ before collision. After the collision, barge 2 has velocity

$$\vec{v}_{2f} = (5.1\,\mathrm{m/s})\left((\sin 18^\circ)\hat{\mathrm{i}} + (\cos 18^\circ)\hat{\mathrm{j}}\right) .$$

Writing $\vec{v}_{1f} = v_{1f}\left((\cos\theta)\hat{\mathrm{i}} + (\sin\theta)\hat{\mathrm{j}}\right)$, with θ we express the component form of the conservation of momentum:

$$\begin{aligned} m_1 v_{1i} &= m_1 v_{1f}\cos\theta + m_2 v_{2f}\sin 18^\circ \\ m_2 v_{2i} &= m_1 v_{1f}\sin\theta + m_2 v_{2f}\cos 18^\circ . \end{aligned}$$

Substituting $v_{1i} = 6.2\,\mathrm{m/s}$, $v_{2i} = 4.3\,\mathrm{m/s}$, and $v_{2f} = 5.1\,\mathrm{m/s}$, we find: $v_{1f} = 3.4\,\mathrm{m/s}$, $\theta = 17^\circ$ (from the point of view of someone on that barge, this deflection is toward the left).

(b) The loss of kinetic energy is

$$K_i - K_f = \left(\frac{1}{2}m_1 v_{1i}^2 + \frac{1}{2}m_2 v_{2i}^2\right) - \left(\frac{1}{2}m_1 v_{1f}^2 + \frac{1}{2}m_2 v_{2f}^2\right)$$

which yields 9.5×10^5 J.